Modelling transmission and control of *Toxoplasma gondii* in New Zealand farmland

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Toxoplasmosis impacts the health of humans, livestock and wildlife

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Toxoplasmosis wipes out $12k of lambs, bringing cat control issues to the fore

Catherine Hubbard • 15:33, Oct 25 2023

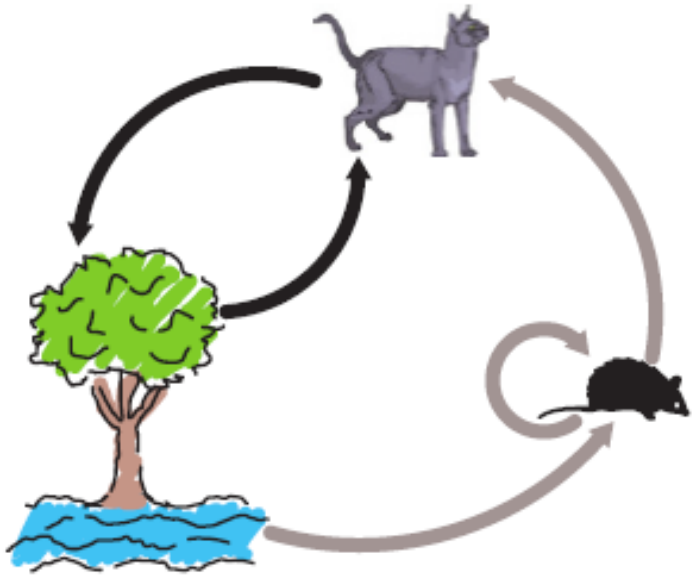
123RF/STUFF

Dolphin found on Auckland beach died of disease often spread by cats

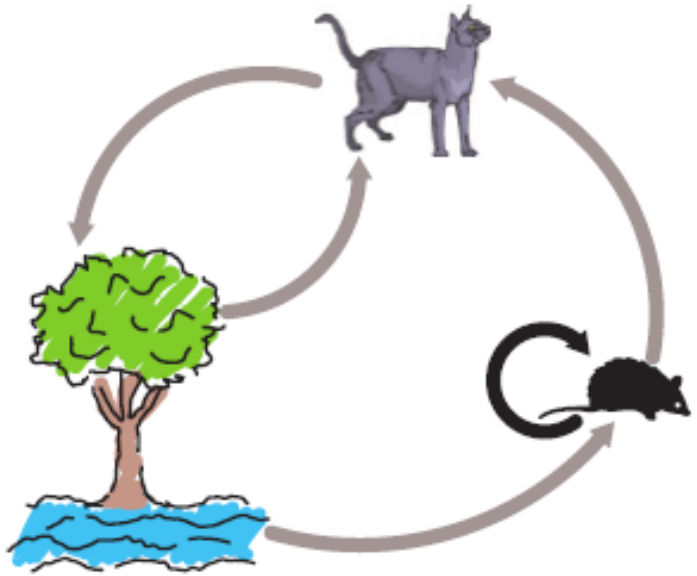
Emma Clark-Dow • 16:55, Apr 18 2023

MONIQUE FORD/STUFF

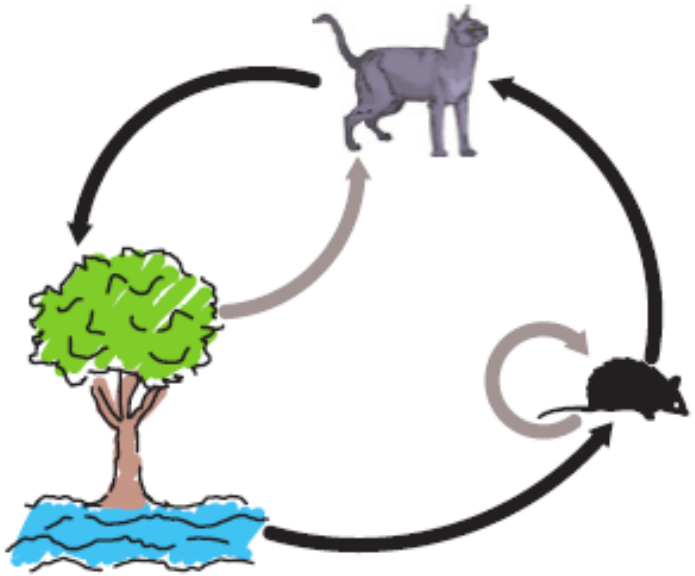
Life cycle of *Toxoplasma gondii*



(a) Environmental infection of cats.



(b) Vertical transmission in mice.



(c) The predator–prey cycle.

Turner et al. (2013)

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Toxoplasmosis management in NZ farmland

T. gondii transmits from feral cats to livestock and wildlife

House mice and ship rats are important prey of feral cats

Is predator control of feral cats and rodents a potential approach?

NZ Department of Conservation

jacqui-nz (iNaturalistNZ)

TrapWorks

Modelling management of toxoplasmosis

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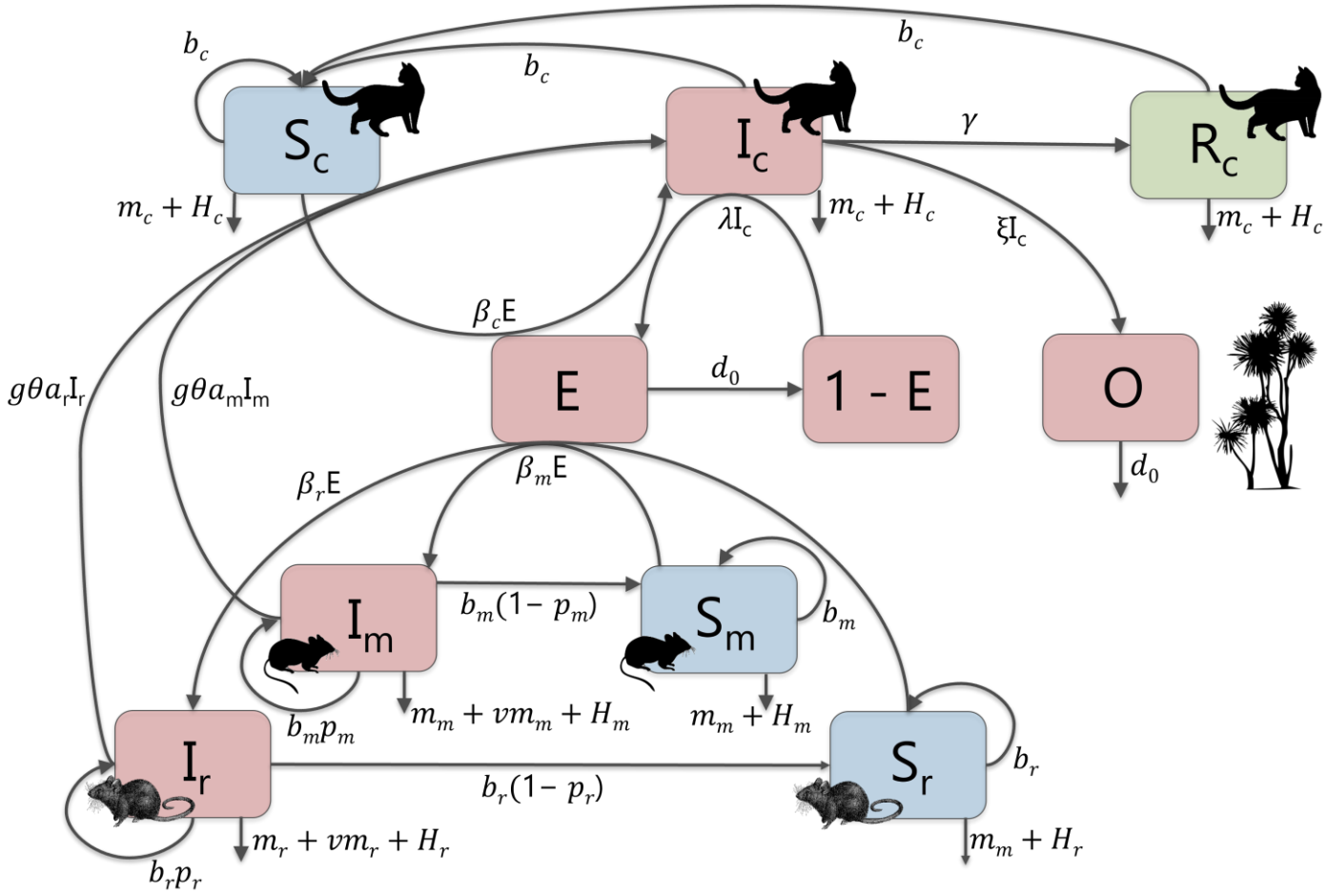
1) Could feral cat and rodent control be an effective approach for managing spread of *T. gondii* on farmland?

2) Which uncertain factors are a priority for field measurement?



Our model is an extension of previous models by Lelu et al. (2010) and Turner et al. (2013)

Modelling management of toxoplasmosis

Feral cat, ship rat and house mouse populations, and environment

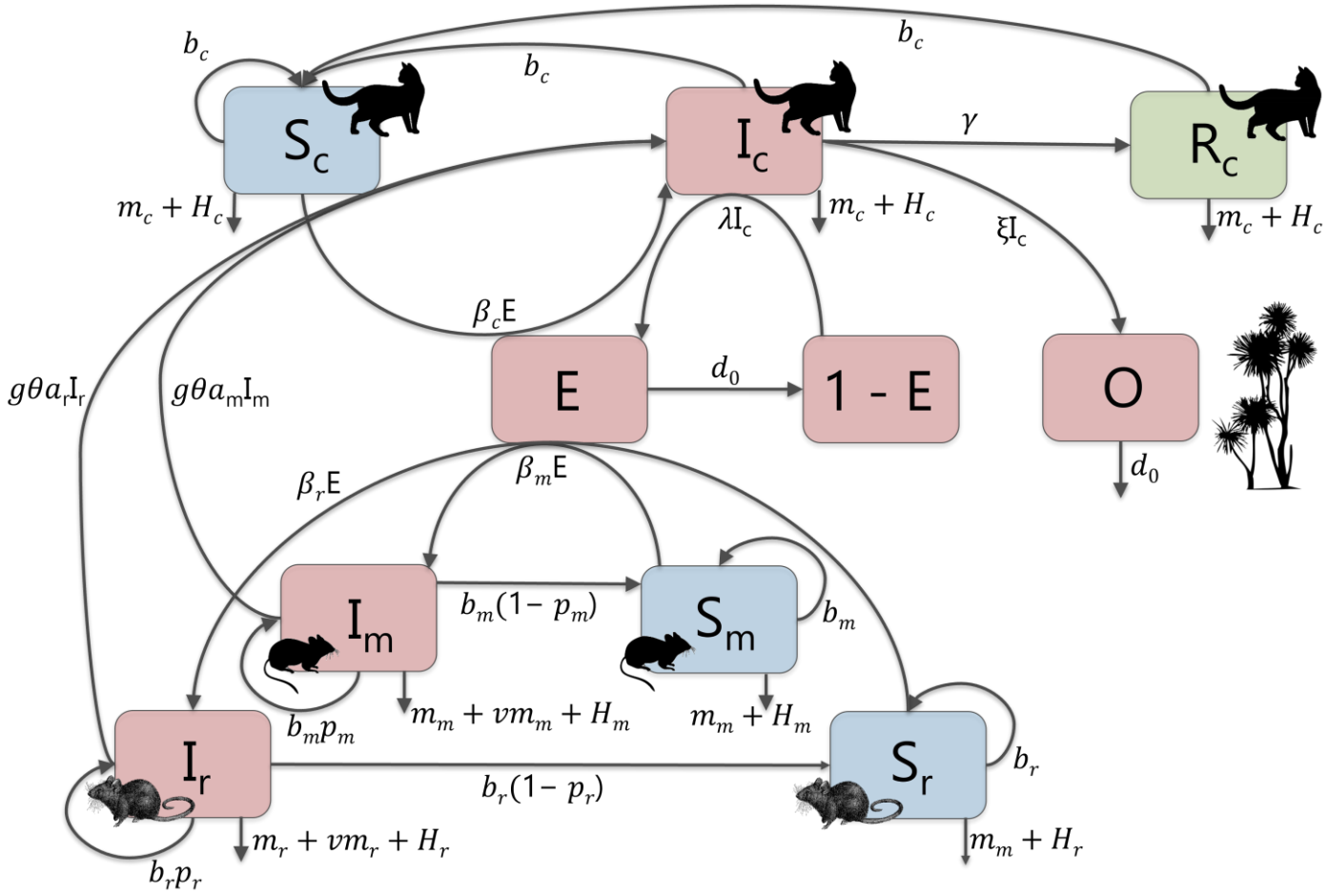
Environmental transmission

Predator-prey cycle

Vertical transmission in rodents

Infection-induced behavioural change in rodents

Predator control of cats and rodents



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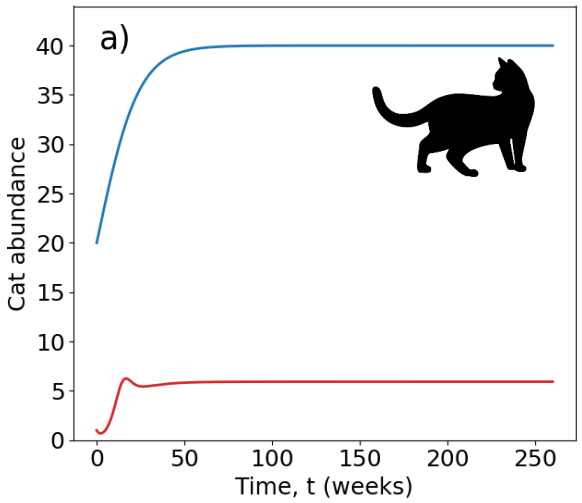
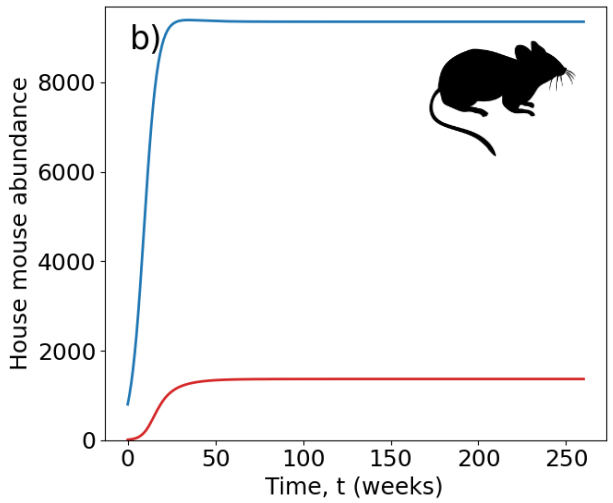
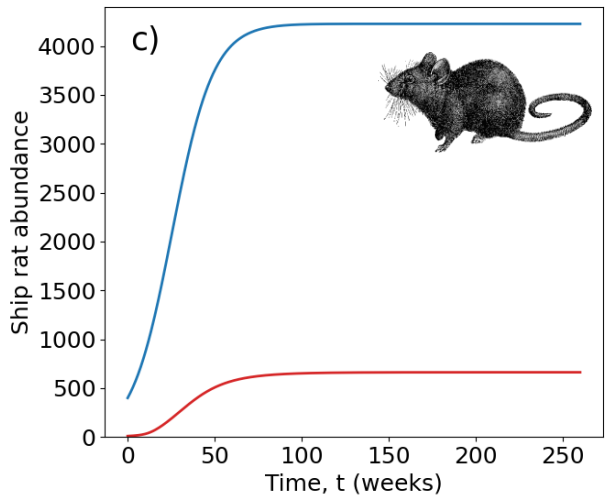
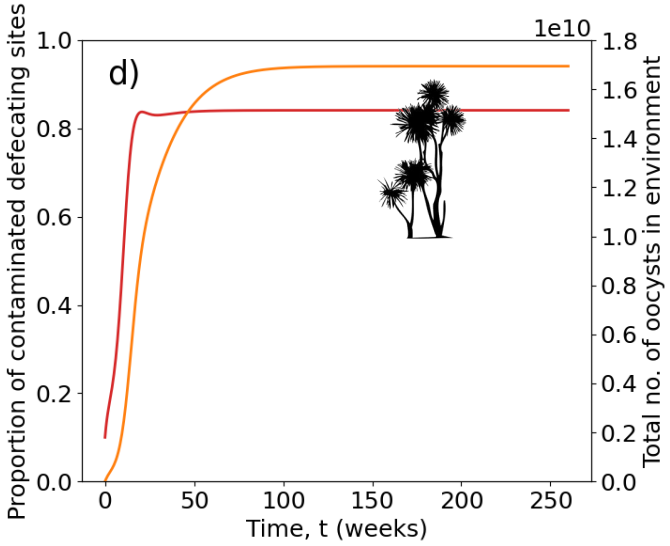
Model results: population dynamics







Population size
No. of infecteds



% contaminated environment
No. of oocysts

No control

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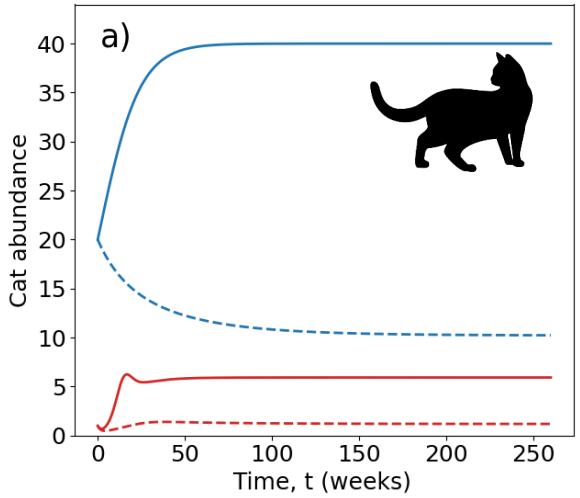
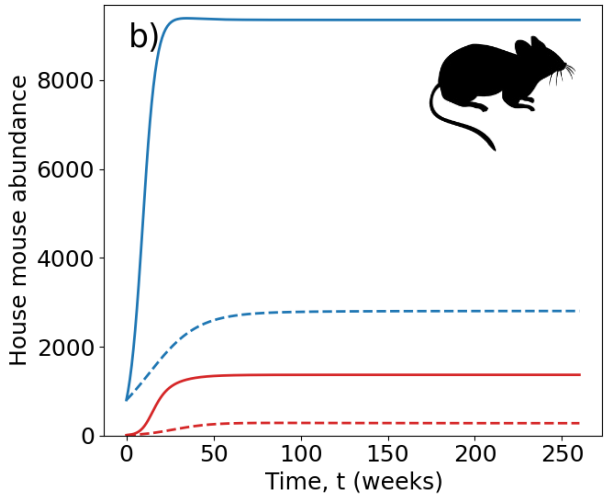
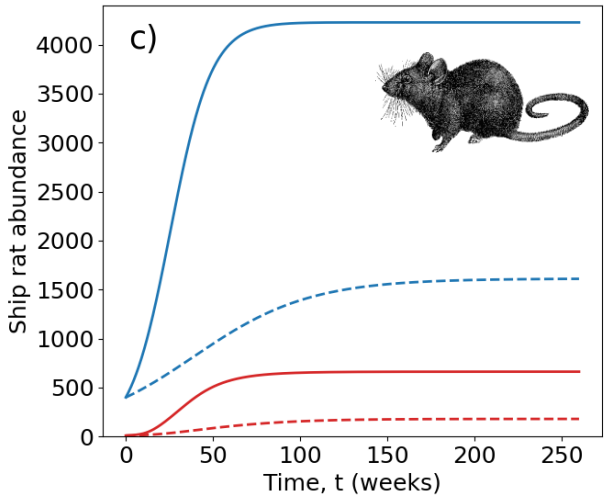
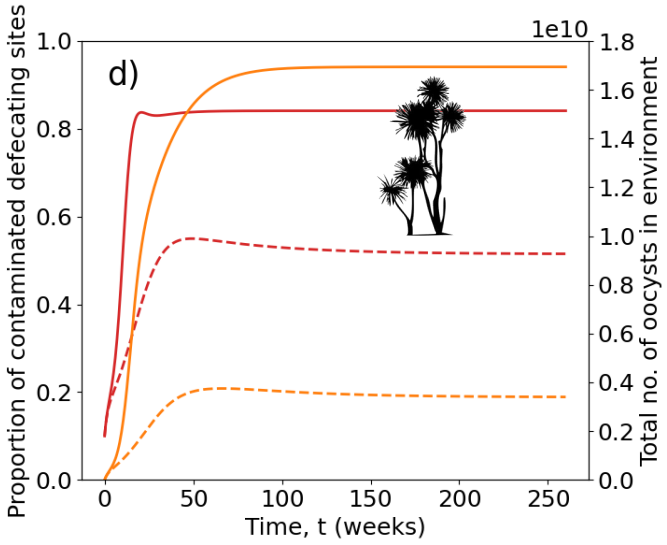
Model results: population dynamics







Population size
No. of infecteds



% contaminated environment
No. of oocysts

No control
Feral cat and rodent control

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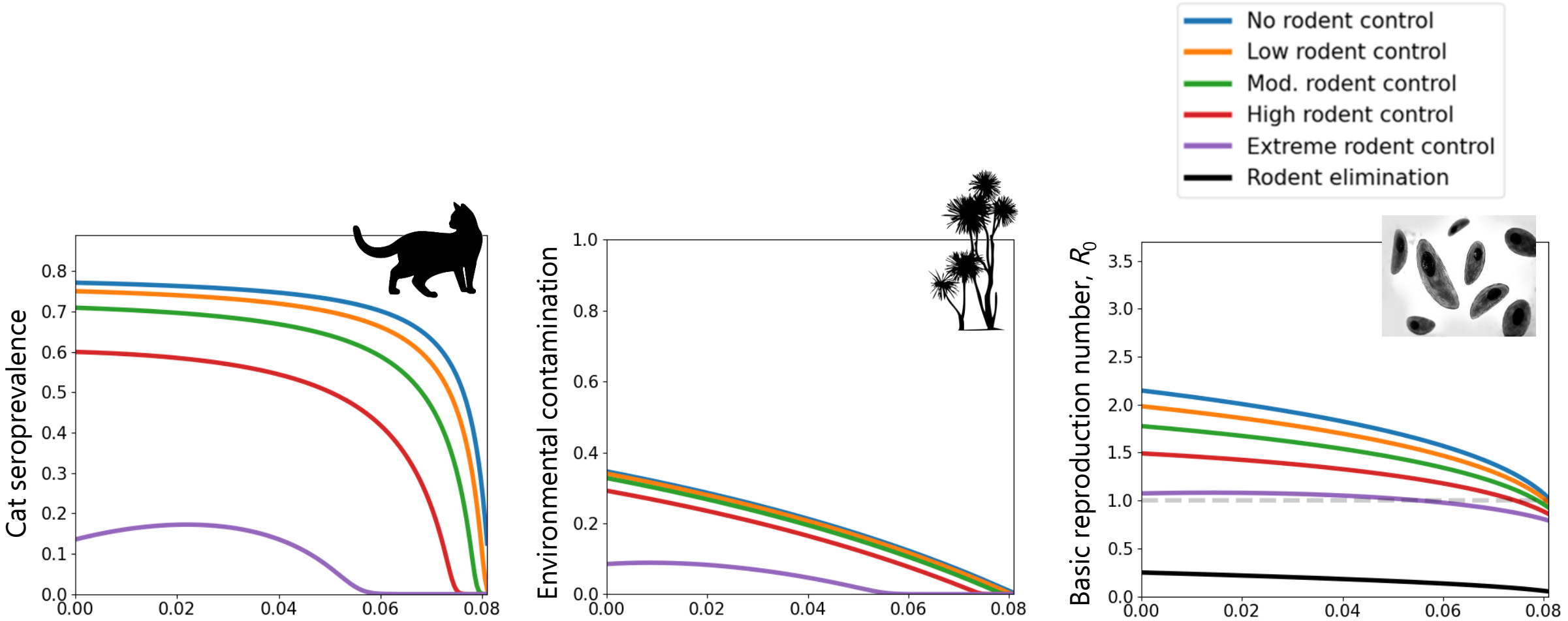
Model results: effectiveness of control



Cat control rates (proportion of population removed per week)

What should we measure?

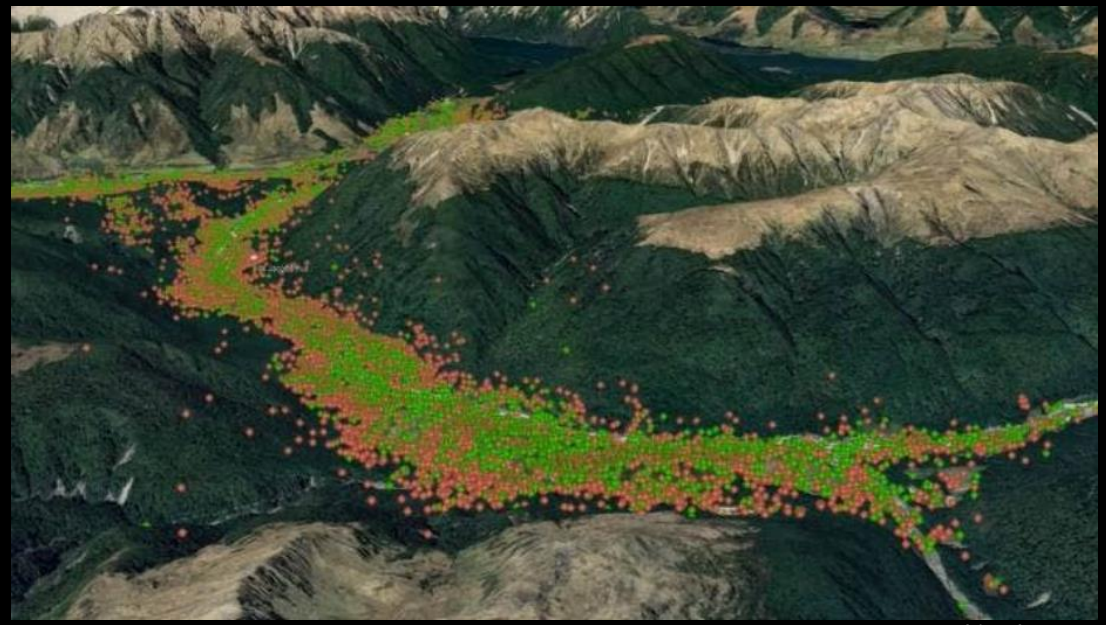
Transmission rates from environment to rodents:

- Infection prevalence and environmental contamination
- Contacts with contaminated sites

Rate of environmental contamination by cats:

- Infection prevalence
- Space use

ATSDR



Manaaki Whenua

Recommendations

- Predator control is a potentially-viable approach for on-farm toxoplasmosis management, but only if **high levels** of population control are **sustained**
- Manage rodents AND feral cats
- Likely feasible only for small cat populations, low contamination levels and/or low contact rates between rodents and contaminated environment
- Infection prevalence and environmental contamination are priorities for field measurement

Nga Manu

Te Ara

Questions?

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