Biodiversity outcomes from possum-focused pest control in New Zealand

Andrea Byrom, John Innes & Rachelle Binny

Biosecurity Bonanza

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Brushtail possum (*Trichosurus vulpeca*)

Vectors of bovine tuberculosis (TB) to farmed cattle

Economic losses to the primary sector

Predation on native fauna and browse damage on vegetation

Major threat to native biota

Possum-focused pest control in NZ
Possum-focused pest control in NZ

- Extensive pest control targeting possums to limit TB threat to livestock by reducing TB prevalence and containing spread
- Conducted by OSPRI (under the TBfree NZ programme)
- Likely to benefit native biodiversity but benefits haven’t been formally assessed
- Also control by DOC, local authorities and landowners
Biodiversity outcomes from possum-focused pest control in New Zealand

• Byrom AE, Innes J & Binny RN (2016). A review of biodiversity outcomes from possum-focused pest control in New Zealand. *Wildlife Research.* (Accepted for publication)

• Objectives:
  • Describe New Zealand’s major pest control “regimes”
  • Find published biodiversity outcome literature
  • Preliminary look at outcomes (much unpublished data still out there)
  • Start to quantify effects of control (meta-analysis)
Aerial vs. ground operations

- **OSPRI:**
  - Aerial 1080 approx. 0.5 million ha annually, return time 4-6 years
  - Ground control 3.5-4 million ha annually

- **DOC:**
  - Aerial 1080 approx. 0.135 million ha annually, return time 2-7 years
  - Diverse objectives

- Total area under sustained control in NZ = approx. 10 million ha
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<th>Regime</th>
<th>Outcome objective</th>
<th>Sites</th>
<th>Mammals targeted</th>
<th>Mammal control objective</th>
<th>Control method</th>
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<td>Ecosystem restoration – maximise indigenous dominance</td>
<td>Marine and lacustrine islands, ring-fenced sanctuaries</td>
<td>All (up to 14 species)</td>
<td>Eradicate all species</td>
<td>Aerial or ground application of brodifacoum, plus follow-up trapping, hunting, poisoning.</td>
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<td>Sustained (sometimes seasonal) control of several key pest species</td>
<td>Initial or repeated (2-3 years) aerial poisoning with 1080, and/or sustained (usually annual) ground poisoning and trapping</td>
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<td>Forests, shrublands, tussocklands</td>
<td>One or several of: stoats, possums, ship rats, cats, ferrets, weasels, Norway rats and mice</td>
<td>Sustained (sometimes seasonal) or pulsed low numbers of target taxa</td>
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Reviewing the literature

- 47 accounts (4 accounts by OSPRI, 30 others, 13 unknown), 1990-2014
- 60% aerial, 40% ground
- 51% replicated fully or partially in space or time
- 85% compared treatment vs. non-treatment

**Ecosystem bias**
- Podocarp-broadleaved forests (77%)
- Beech (15%)
- Exotic/other (8%)

**Taxonomic bias**
- Vegetation (47%)
- Birds (32%)
- Invertebrates (15%)
- Frogs (6%)
Vegetation

- Mean study time 6.2 yrs, max 25 yrs
- 17/20 (85%) studies reported increased canopy cover, reduced tree mortality, or reduced browse of susceptible species (e.g. mistletoes, kohekohe, kāmahi)
- Patchy browse and other environmental drivers: no simple relationship between possum density and browse damage
- 3 ground control studies on fruitfall: increased flowering success and fruit production (e.g. Hīnau, nikau palm)
Invertebrates

- 7 studies, monitoring up to 6 years
- Diverse, complex invertebrate communities
- 2/7 studies: Wētā population high for 2 years after control, then declined as rats increase
- Otherwise no coherent changes

Frogs

- 3 studies (ground control): mean 2.2yrs, max 4 yrs
- 2/3 studies: intensive possum and rat control increased frogs
- No long-term studies of frog responses to aerial 1080
Birds

- 15 accounts: mean post-op study time 2.2 yrs (aerial) and 3.4 yrs (ground), max 14 yrs
- 9/11 studies reported increased nesting success following pest control
- 5/6 studies reported increase in adult bird abundance
Meta-analysis

- 84 response measures from 35 out of 47 studies
- “Effect size”: measures the effect on a native population of conducting pest control, relative to the effect of not conducting pest control.
- Effect size > 0, positive response of native biota to pest control
- Effect size < 0, negative response to pest control
- Effect size ≈ 0, unaffected by pest control
Possum-focused pest control benefits native flora and fauna in NZ

Byrom AE, Innes J & Binny RN (2016)
Recommendations for future studies

- Standardised monitoring protocols and outcome measures for pests (e.g. Residual trap catch index) and native biota
- Non-treatment site (or pre-treatment data) for comparison
- Replicated studies
- Long-term studies
Summary

• Overall, results suggest pest control has benefits for native biodiversity

• Many studies report population-level outcomes. Community-level measures will give more insight into benefits for ecosystems as a whole

• Few published long-term studies of bats, frogs, lizards, seed/fruit production
What’s next?

- 2 yr Postdoctoral project
- Andrea Byrom, Roger Pech, John Innes (Landcare Research), Alex James (University of Canterbury)
- Project aims:
  - Compare the impacts of mammalian pest control on NZ’s native biodiversity, across different control regimes
  - Carry out national-scale analyses and modelling of biodiversity outcome and pest monitoring data (published and unpublished)
  - Measure community- and ecosystem-level outcomes
  - Compile data from marine islands, mainland islands, sanctuaries (fenced and unfenced), and regions where large-scale aerial or ground-based control is conducted
Acknowledgements

- This work was funded by OSPRI (who manage the TBfree NZ programme) and MBIE

- Data/help: Karen Vincent, Alastair Fairweather, Graeme Elliott, Hugh Robertson, Josh Kemp, Jerome Guillotel (DOC), Murray Hudson, Phil Dawson, Paul Livingstone, Bruce Warburton (OSPRI), Robbie Price, Wendy Ruscoe, Peter Bellingham, Frank Cross (Landcare Research).