Landcare Research
Manaaki Whenua

Research on ecological change in sanctuaries and proposed indicators of restoration success.

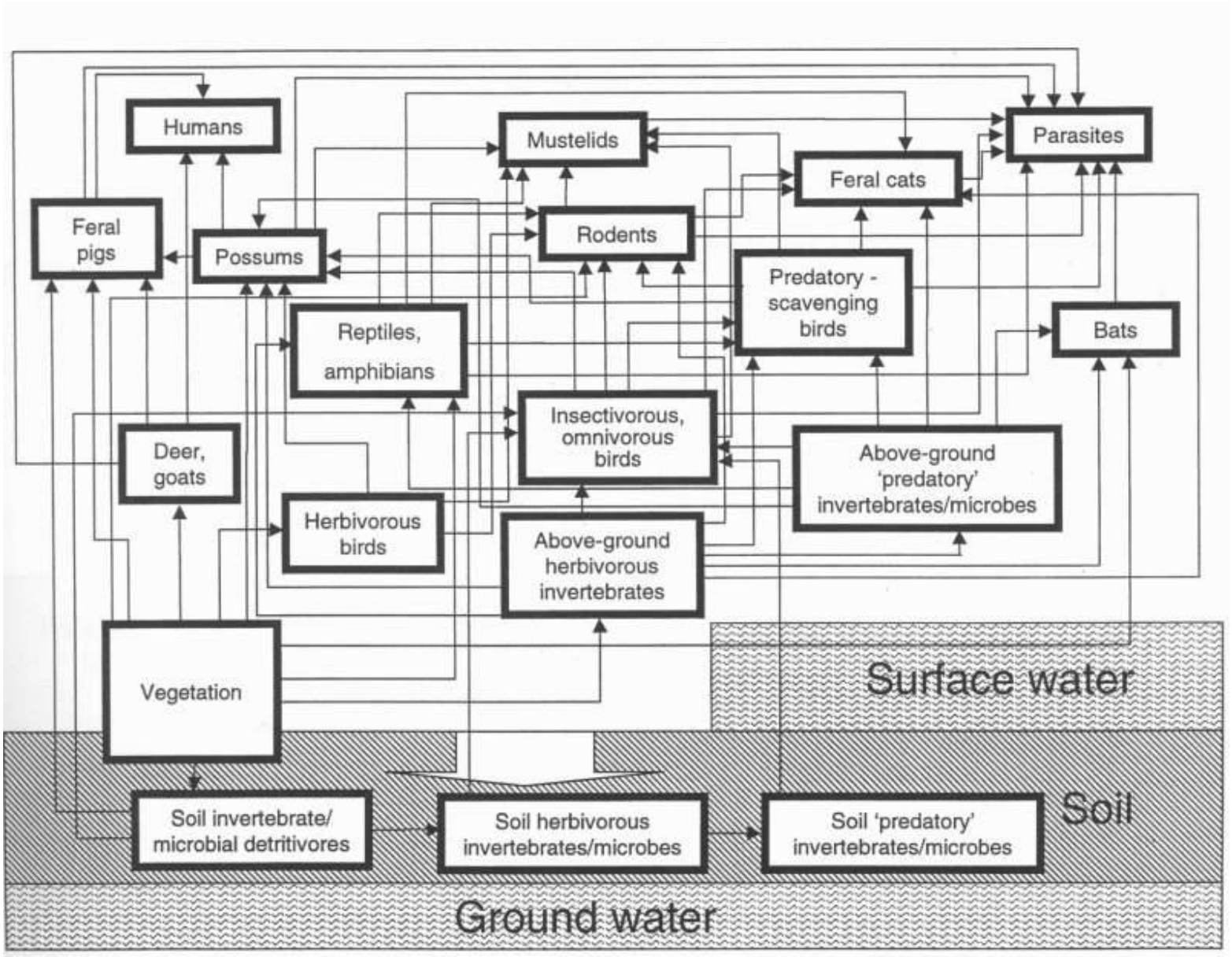
Bruce Burns

Two themes

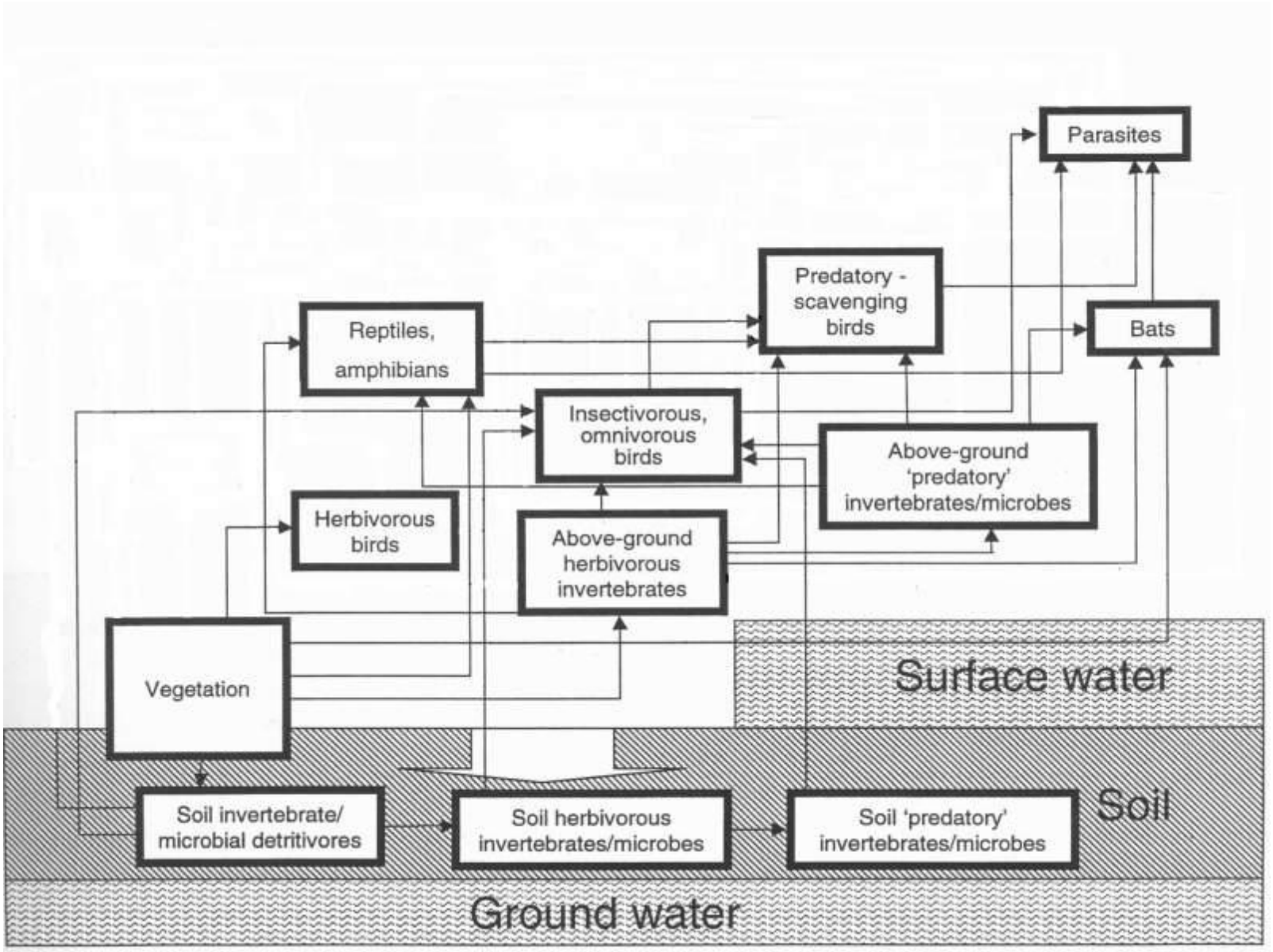
1. What ecological changes are occurring in sanctuaries as a result of the exclusion of mammalian pests?

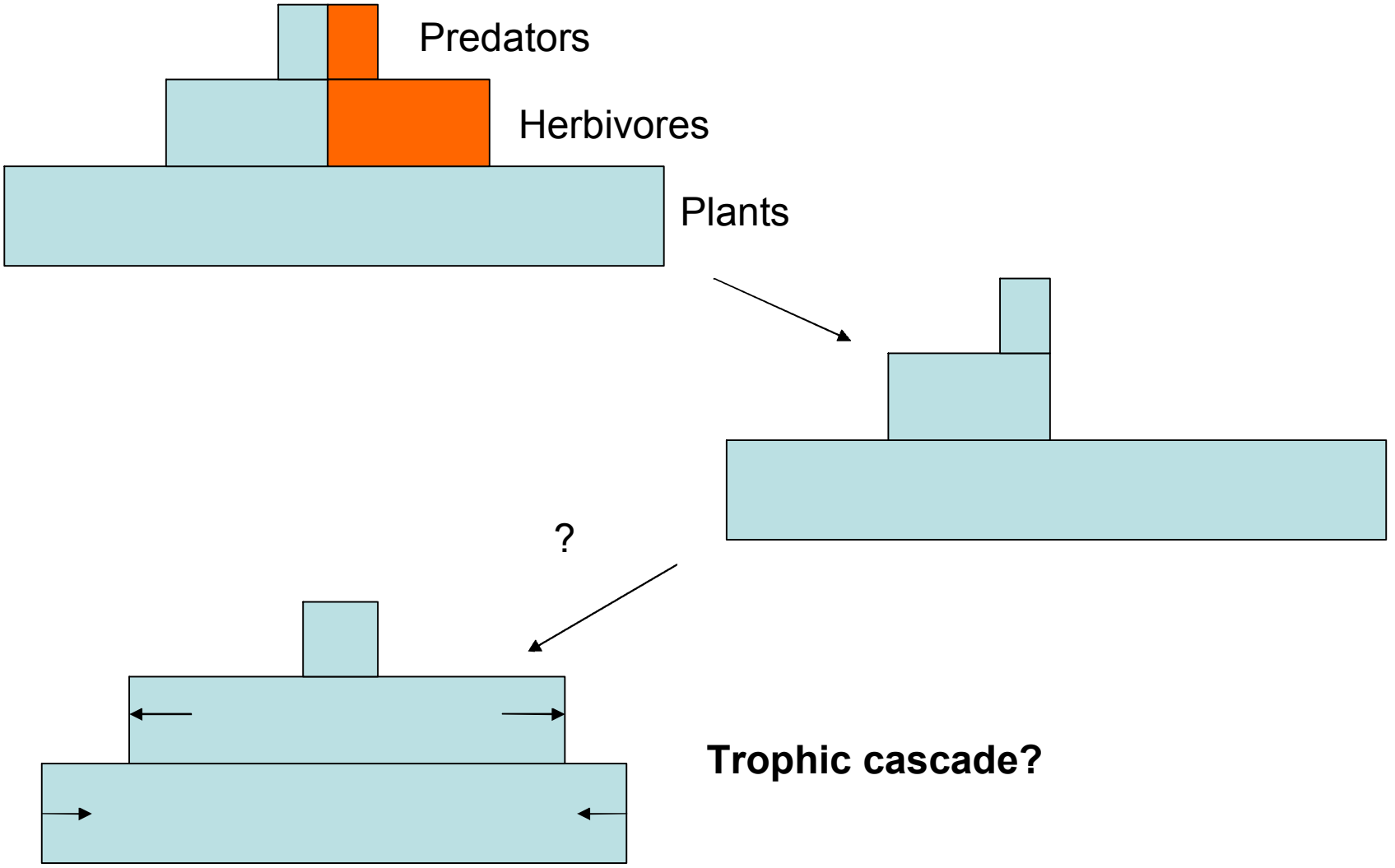
2. What can we measure to indicate successful ecological restoration?

Current situation

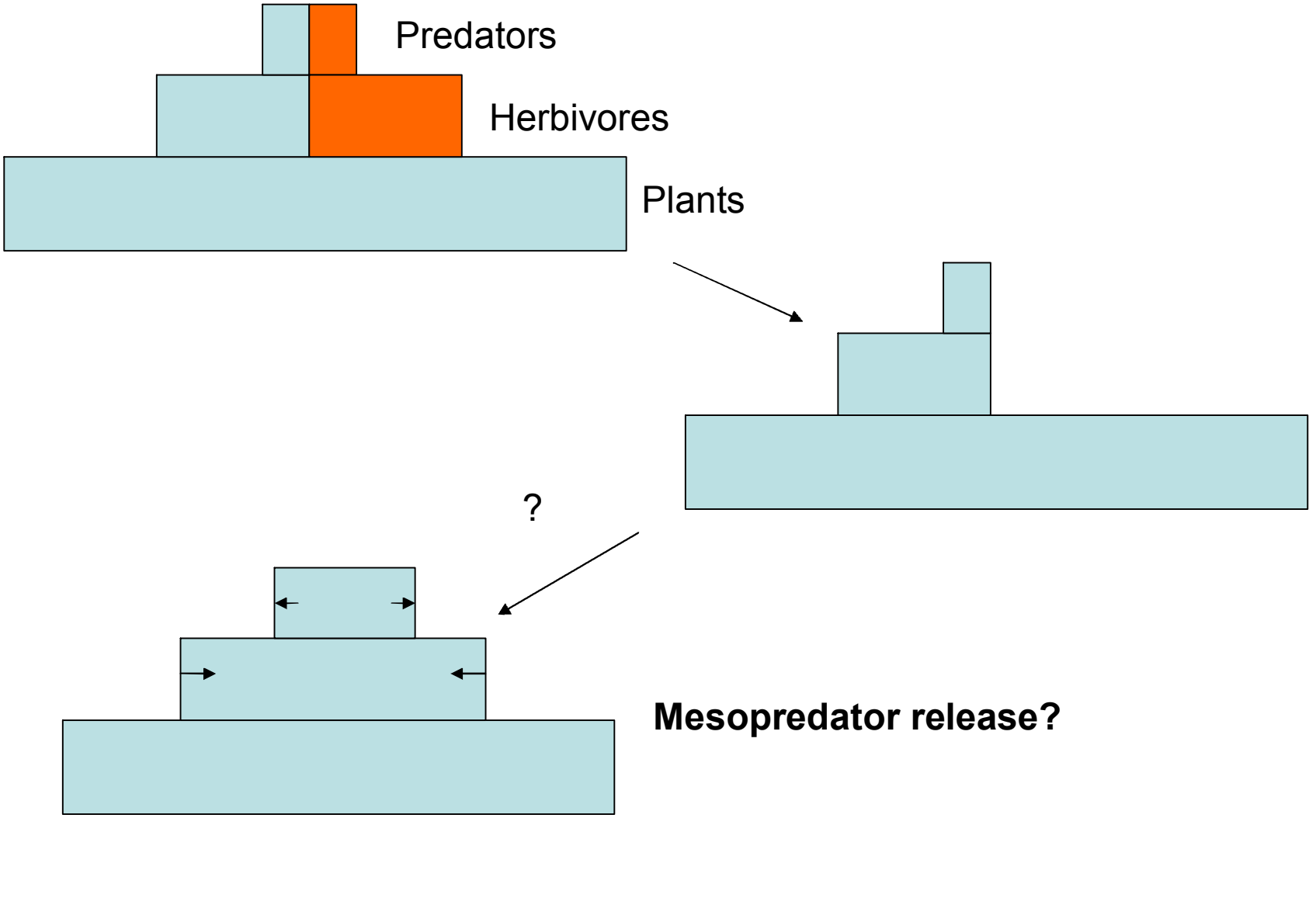


Ecological release!

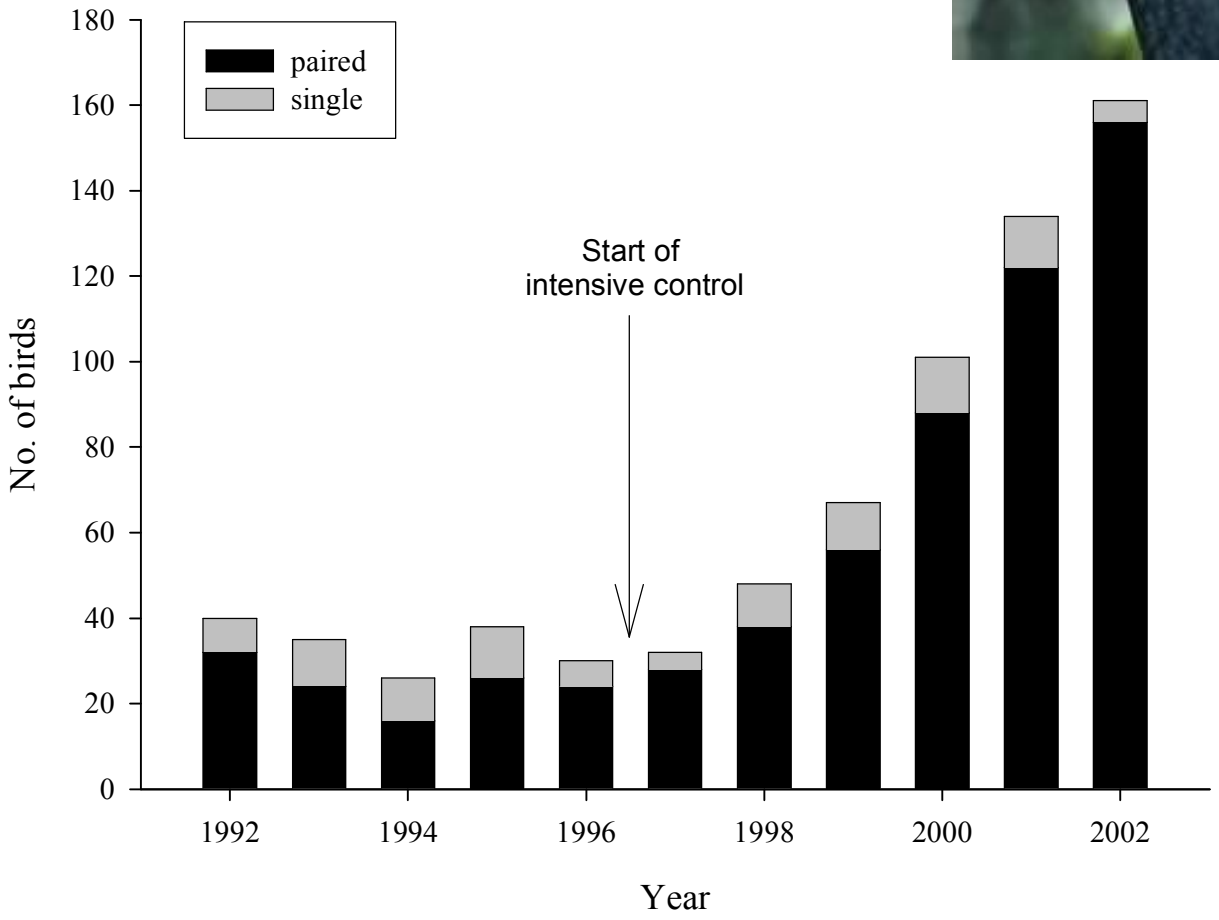


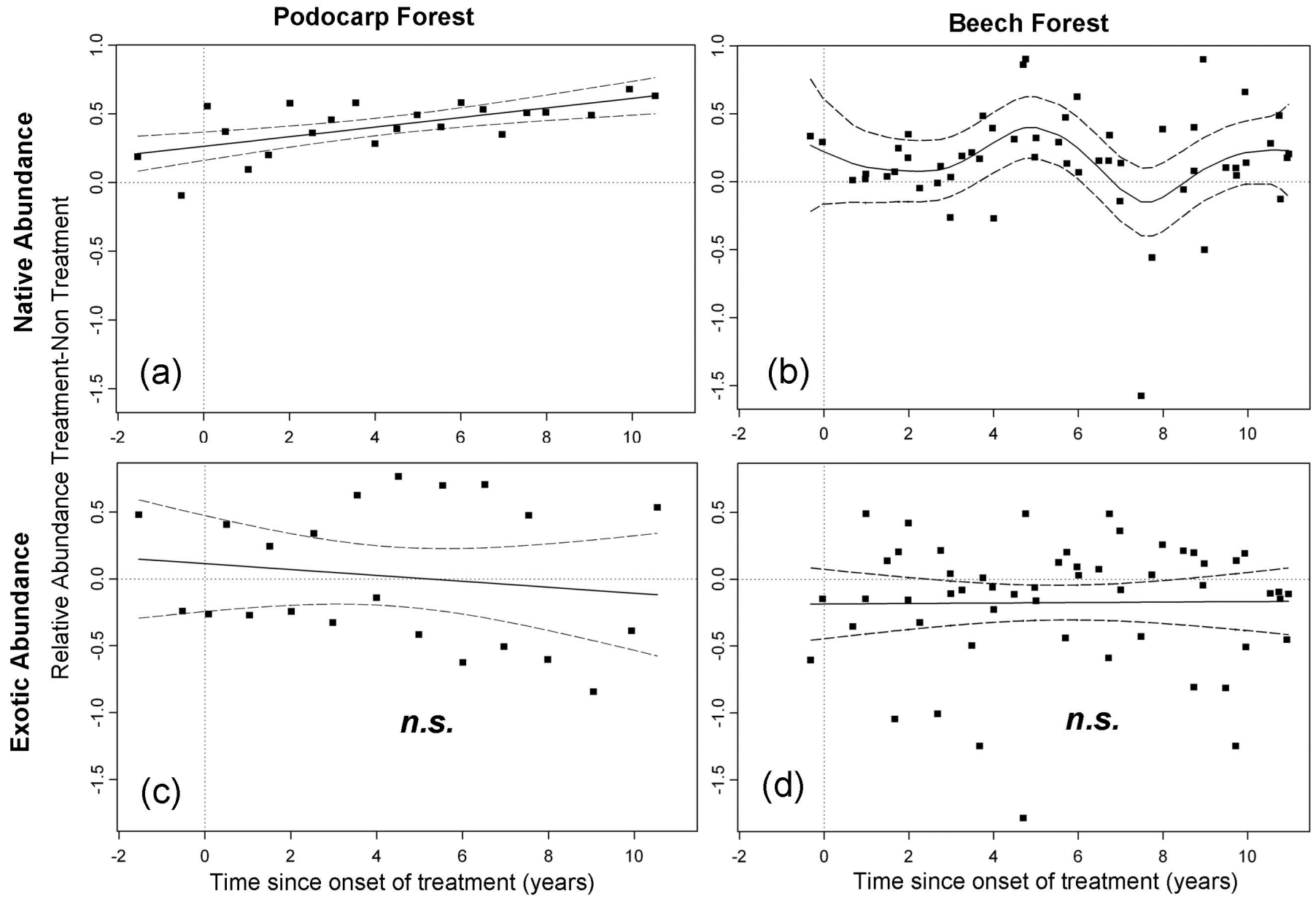


Trophic cascade?


Predators
Herbivores
Plants
?
Mesopredator release?

Kokako at Otamatuna (Te Urewera)




Podocarp Forest
Beech Forest
Native Abundance
Exotic Abundance
Relative Abundance Treatment-Non Treatment
(a)
(b)
(c)
(d)
n.s.
n.s.
Time since onset of treatment (years)
Time since onset of treatment (years)

Bird community changes

% differences with reference sites based on 5 minute bird counts

Species	Boundary Stream	Rotoiti	Tiritiri Matangi	Kapiti
Bellbird	169.7%	59.1%	89.5%	1503%
Whitehead	138.6%	-	Introduced	16,135%
Tui	8.0%	614.3%	9.5%	-41%
Kereru	59.3%	-	-	-39%
Fantail	107.7%	50.0%	-11.1%	-86%
Tomtit	56.8%	150.0%	-	-80%
Grey warbler	-47.9	Detected	-48.3	Not detected
Silvereye	-39.7	-38.8	-72.2%	-98%

>10% increase

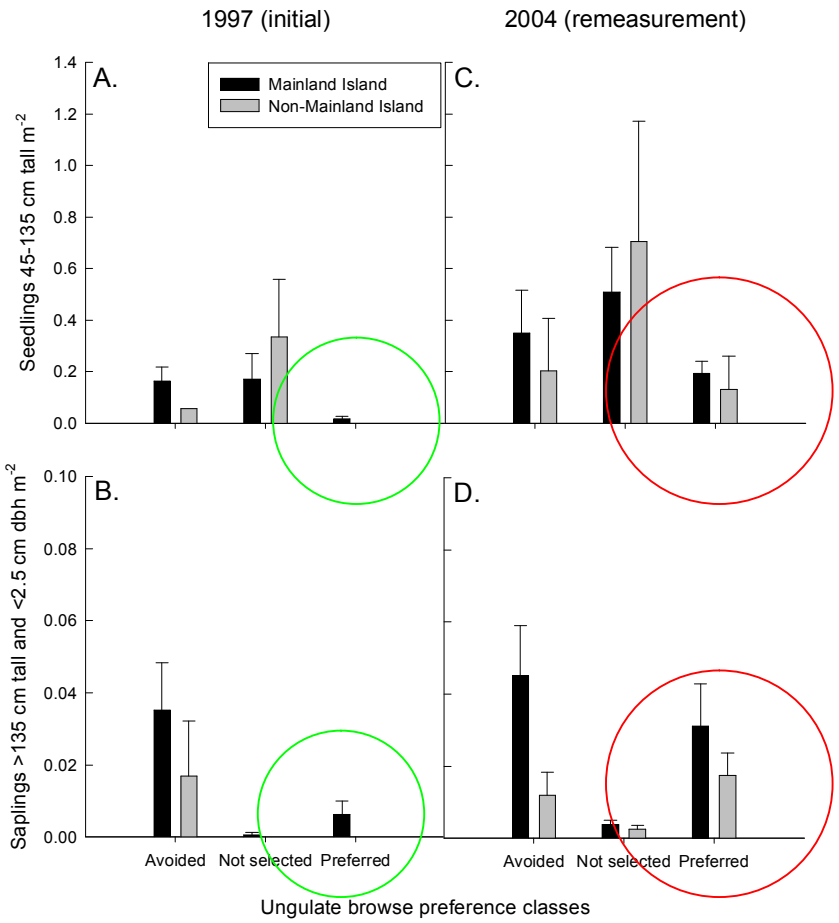
>10% decrease

Bellbird (*Anthornis melanura*)

What are characteristics of birds that increase in abundance compared to birds that decrease?

- ‘Old’ endemics vs natives
- Forest specialists vs habitat generalists

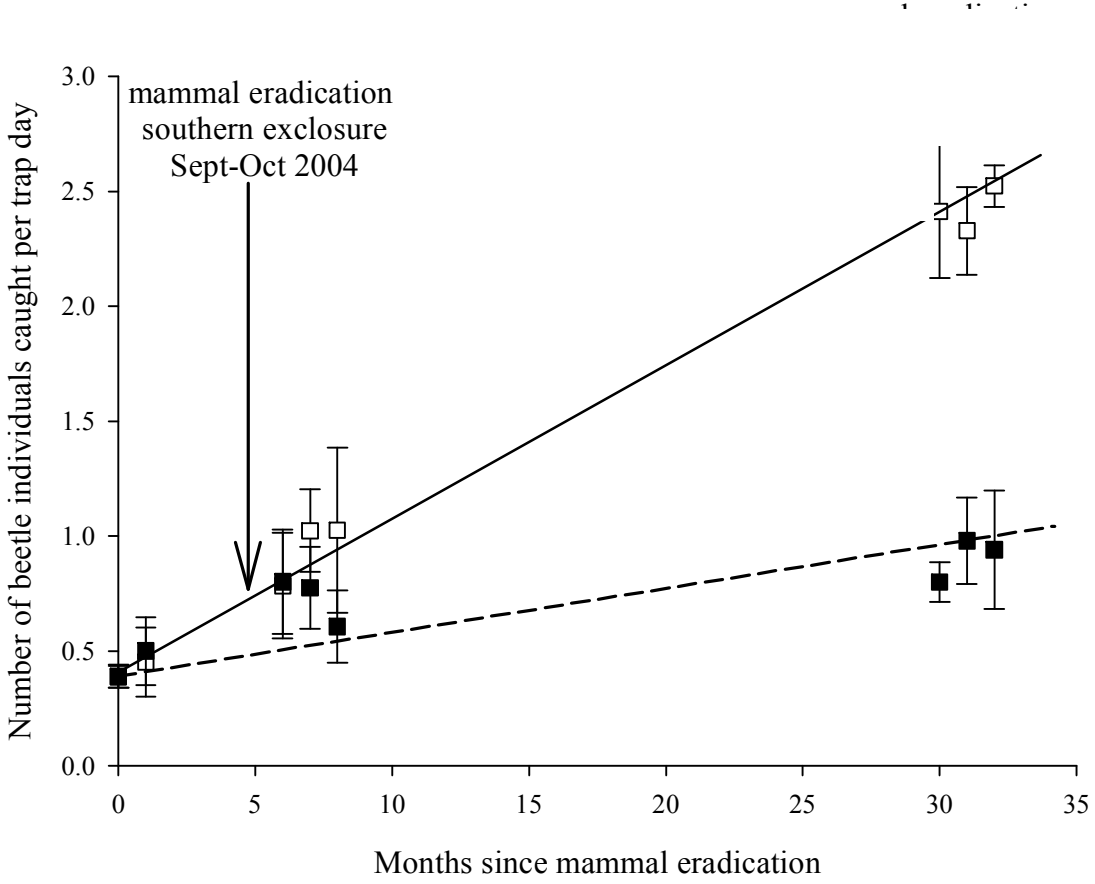
Seedling and sapling densities



Changes in densities of larger seedlings and saplings in plots at Boundary Stream mainland island by ungulate preference class (Bellingham 2006)

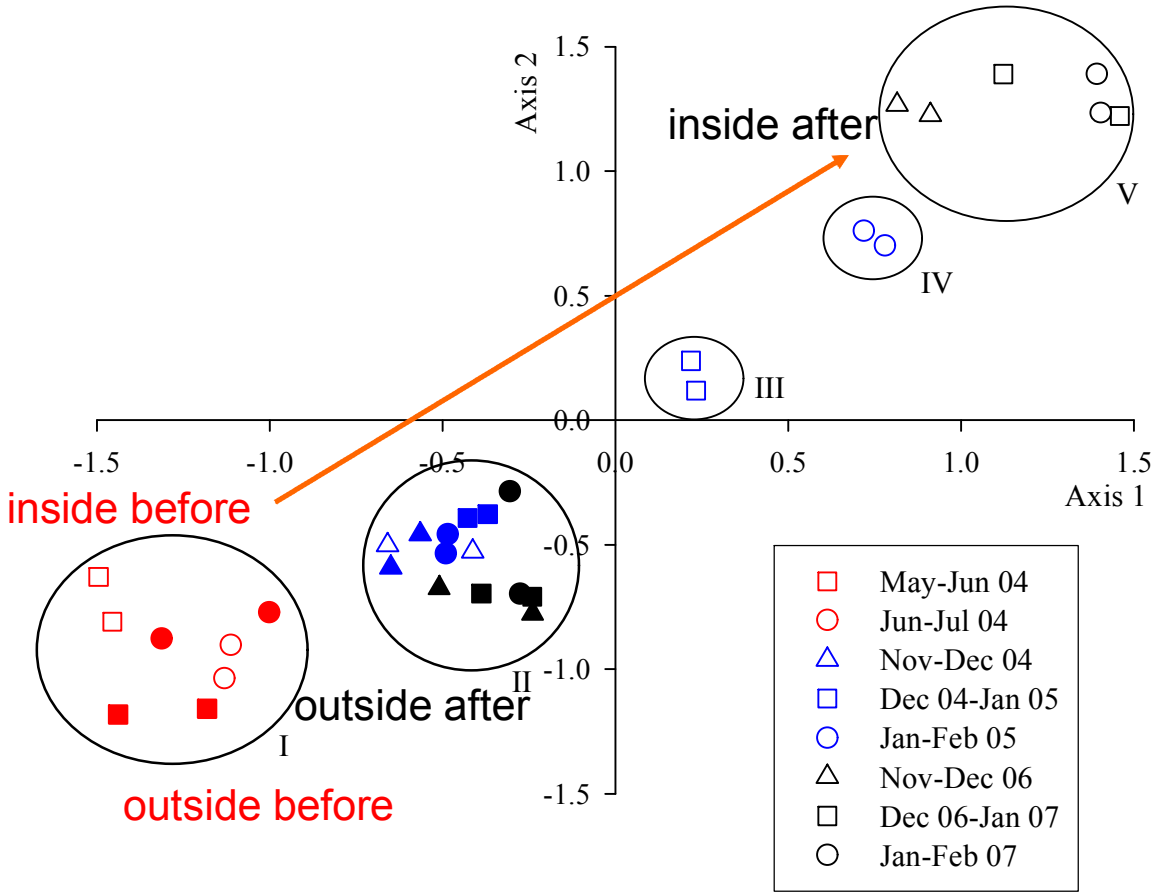
Invertebrate abundance increases

Mean pitfall trap catch set within pest-free enclosure and in reference sites



Beetle composition changes

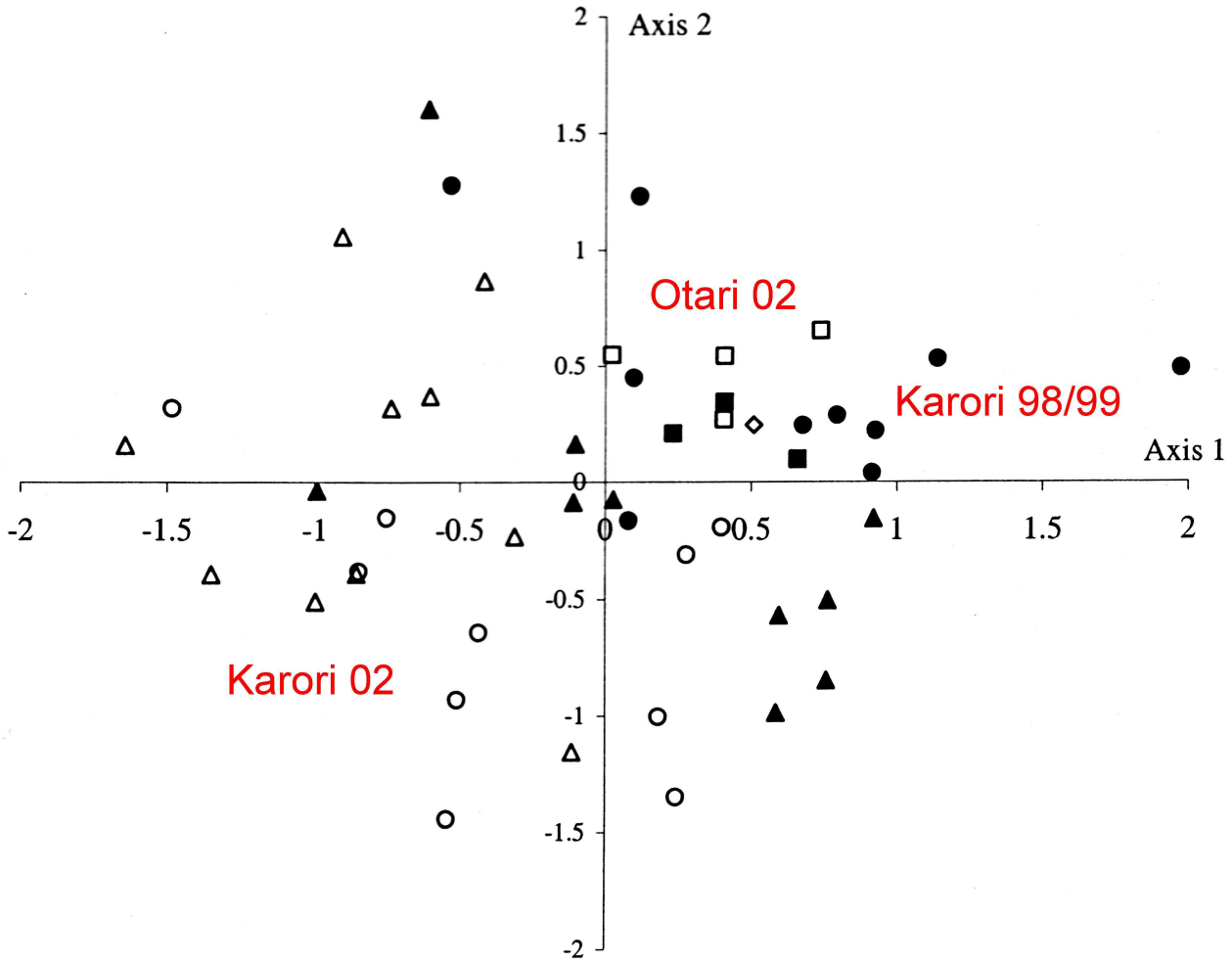
PCA



Changes in invertebrate community at Karori 3 years post mammal eradication

- No difference in number of beetles caught (beetle activity density)
- No difference in number of beetle species caught
- Proportions of small (<10 mm) and large (>30 mm) beetles increased in Karori but stayed similar at Otari

(Watts 2004)



Ordination showed beetle communities changed in composition within Karori but stayed similar at Otari (compared to pre-fence data)

What changes could we look for?

- Detecting changes in species abundance and diversity
  - 5-minute bird counts, permanent vegetation plots, pitfall traps for invertebrates
- Detecting changes in ecosystem processes
  - pollination effectiveness, regeneration rate in treefall gaps, nitrogen mineralisation rates
- Detecting consequences of ecological release
  - competition between bird species, weed abundance, mesopredator release
- Detecting and managing trophic cascades
  - rates of herbivory

Can we use measures of change to indicate restoration success?

- What is success?
  - How close the restoration site resembles a reference ecosystem
  - Conservation value provided (e.g. no. of threatened species present)?*
  - Quantity of ecosystem services provided?
  - Ecological integrity of the restored site?*
  - Public satisfaction provided?*

Elements of ecological integrity

- Indigenous dominance
  - Level of indigenous influence in ecosystem
- Species occupancy
  - How many of the full potential complement of species are present.
- Environmental representation
  - How many of the full range of potential environments are represented in a protected area.

(Lee et al. 2005)

Draft success indicators demonstrating progress towards restoration in sanctuaries

1. A measure of public participation:

No. visitors per year, or no. involved volunteers per year.

2. A measure of indigenous dominance:

a. Counts of abundance of resident native bird species

b. Changes in 5 minute bird counts of native compared with exotic bird species in annual counts.

3. A measure of species occupancy:

Number of threatened species present.

4. A measure of ecosystem process:

Rates of pollination of fuchsia flowers.

We would like to obtain baseline measurements using them in as many Sanctuaries as possible in 2008, then take annual snapshots until 2013.