NEW ZEALAND'S BIOLOGICAL HERITAGE | Ngā Koiora Tuku Iho

National SCIENCE Challenges

New Zealand's Biological Heritage
Ngā koiora tuku iho
A National Science Challenge

Landcare Research Link Seminar

Featuring Programme 3

Duane Peltzer, Andrea Byrom

4 October 2017

NEW ZEALAND'S BIOLOGICAL HERITAGE

Ngā Koiora Tuku Iho

National SCIENCE Challenges

MISSION

Reverse the decline of New Zealand's biological heritage, through a national partnership to deliver step change in research innovation, globally-leading technologies, and community and sector action

OBJECTIVE

Protect and manage our biodiversity, improve our biosecurity and enhance our resilience to harmful organisms

Science Challenges are…

- Addressing national goals
- A change in the NZ science system
- Intended to align research efforts and stakeholder needs nationally
- Mission-driven, outcome-focussed

Biological Heritage Challenge

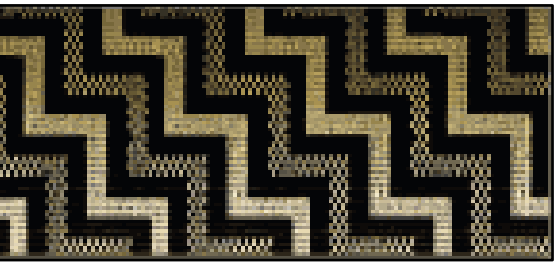
- Brings biodiversity- and biosecurity-related research together
- Includes 17 Parties (8 Universities, 7 CRIs, MPI and DOC)
- Not business as usual – future focussed research
- Identifying and addressing research gaps
- Landscape scale
- Broad in scope…

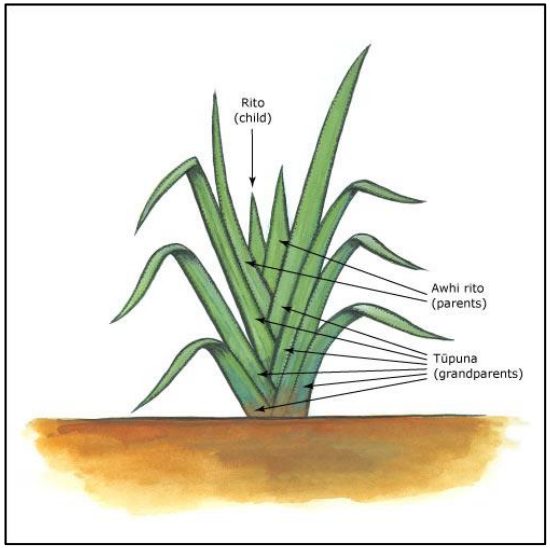
Research Programmes

- **Programme 1:**
  Real-time Biological Heritage assessment
- **Programme 2:**
  Reducing risks and threats across landscapes
- **Programme 3:**
  Enhancing and restoring resilient ecosystems

Programme 1: "*What do we have?*"

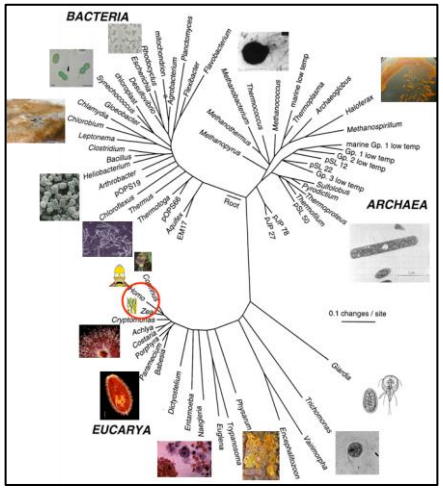
Mātauranga Māori characterisation of bioheritage





Genomics: risk-based analysis of pathogens

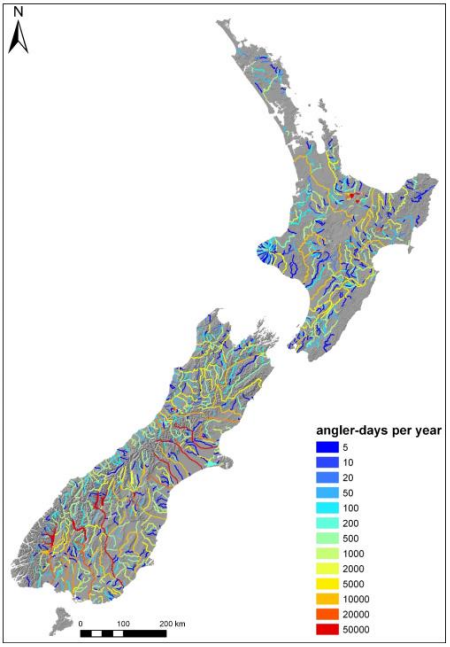
eDNA monitoring frameworks



Conservation genomics for restoration

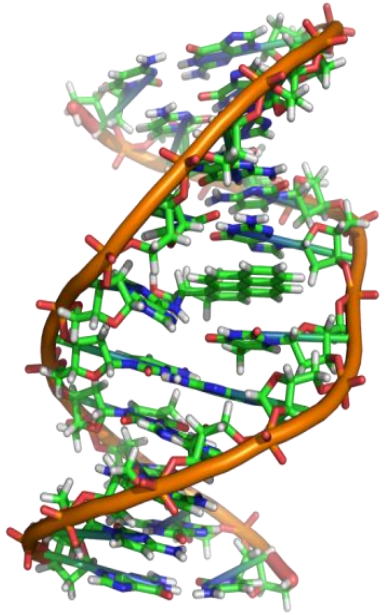
Programme 2: "*What we don't want*"

Biosecurity networks

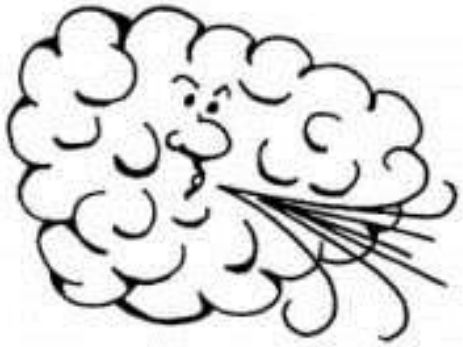


Novel technologies for wasp control

High-tech solutions
small mammal predators



Māori biosecurity solutions



Programme 3: "*Whole-of-system view*"

Goal: Improving resilience of vulnerable ecosystems
preventing irreversible biodiversity loss and damaging invasions

Programme 3: Enhancing and restoring resilient ecosystems

- What is a 'whole of system approach'?
- What is the Programme delivering? (projects)
- Looking ahead…

What is a 'whole of system approach'?

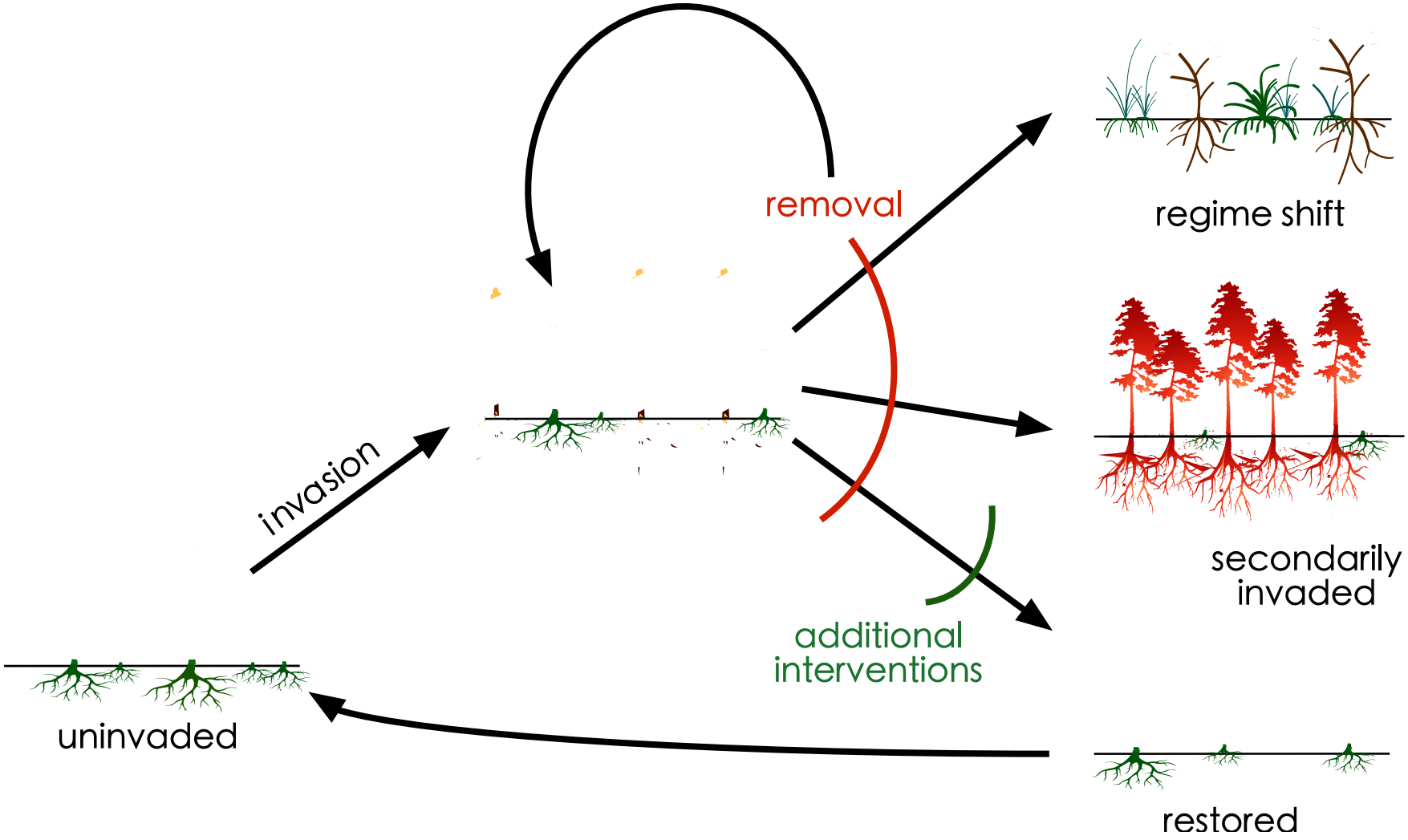
Ecosystem property

Abundance (biomass)


1998


2004


2015



Wardle & Peltzer 2017 Biol. Inv.

THE BIG KILL

New Zealand's crusade to rid itself of mammals.

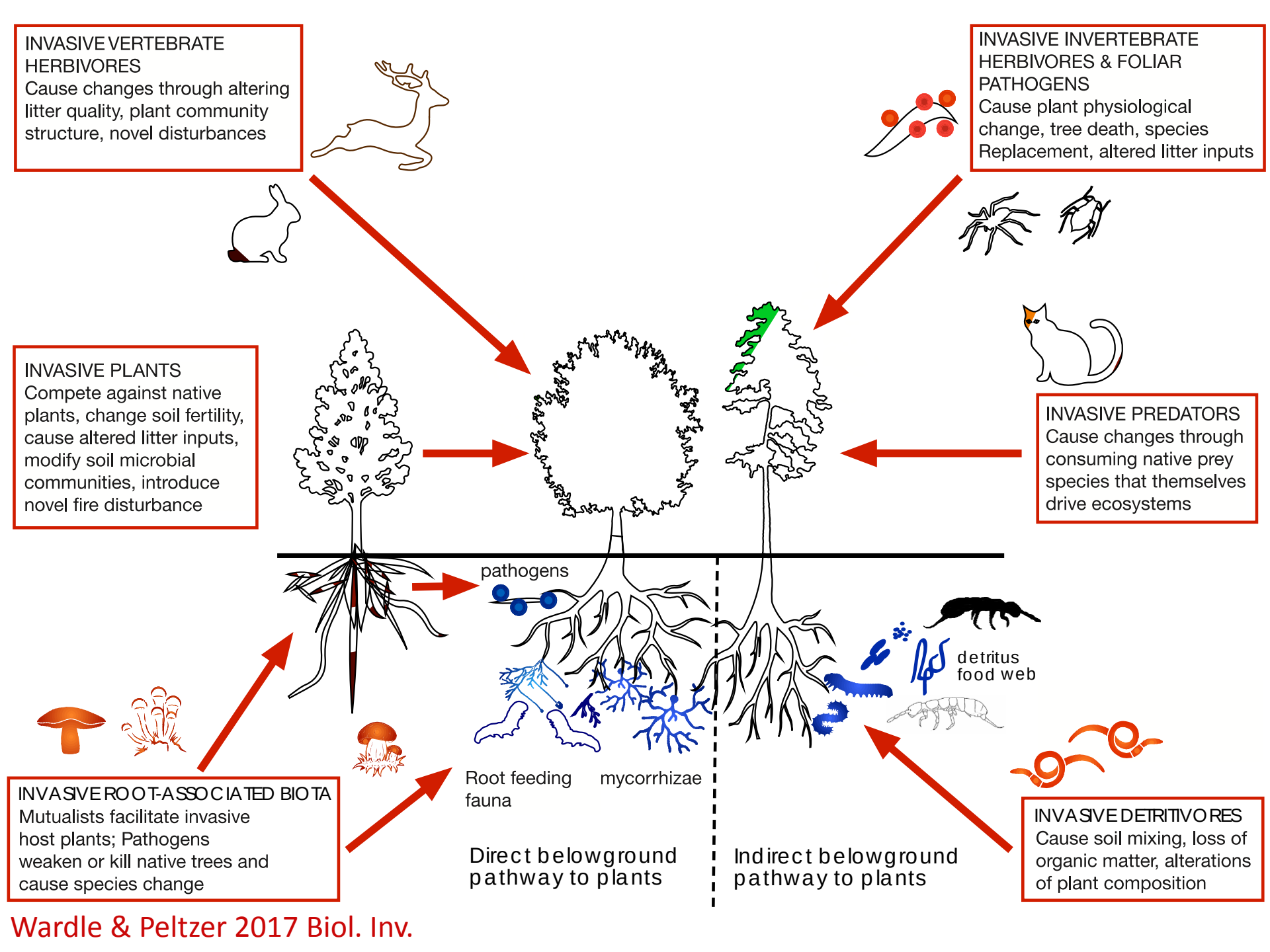
BY ELIZABETH KOLBERT

Rats and other invasive mammals are destroying New Zealand's native fauna. A quarter of native birds are extinct. The kiwi is threatened. What can be done? "Conservation is all about killing things," a volunteer coördinator said.

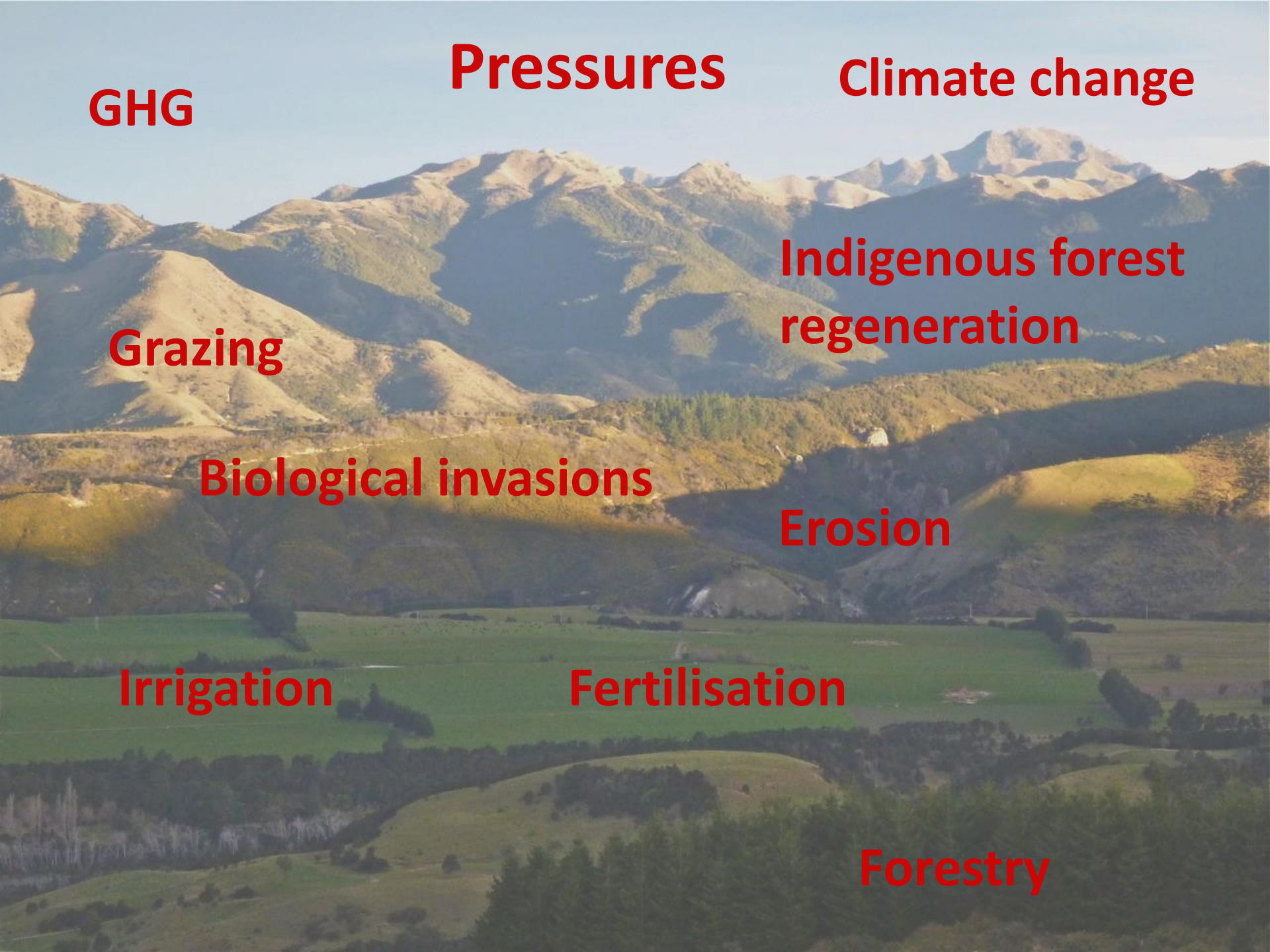
PHOTOGRAPH BY STEPHEN DUPONT

THE NEW YORKER

Eradication of predators from island reserves and large areas of unfenced landscape; science capable of eradicating one small mammal predator



Wardle & Peltzer 2017 Biol. Inv.


Pressures
GHG
Climate change
Indigenous forest regeneration
Grazing
Biological invasions
Erosion
Irrigation
Fertilisation
Forestry

Why is a 'whole of system approach' needed?

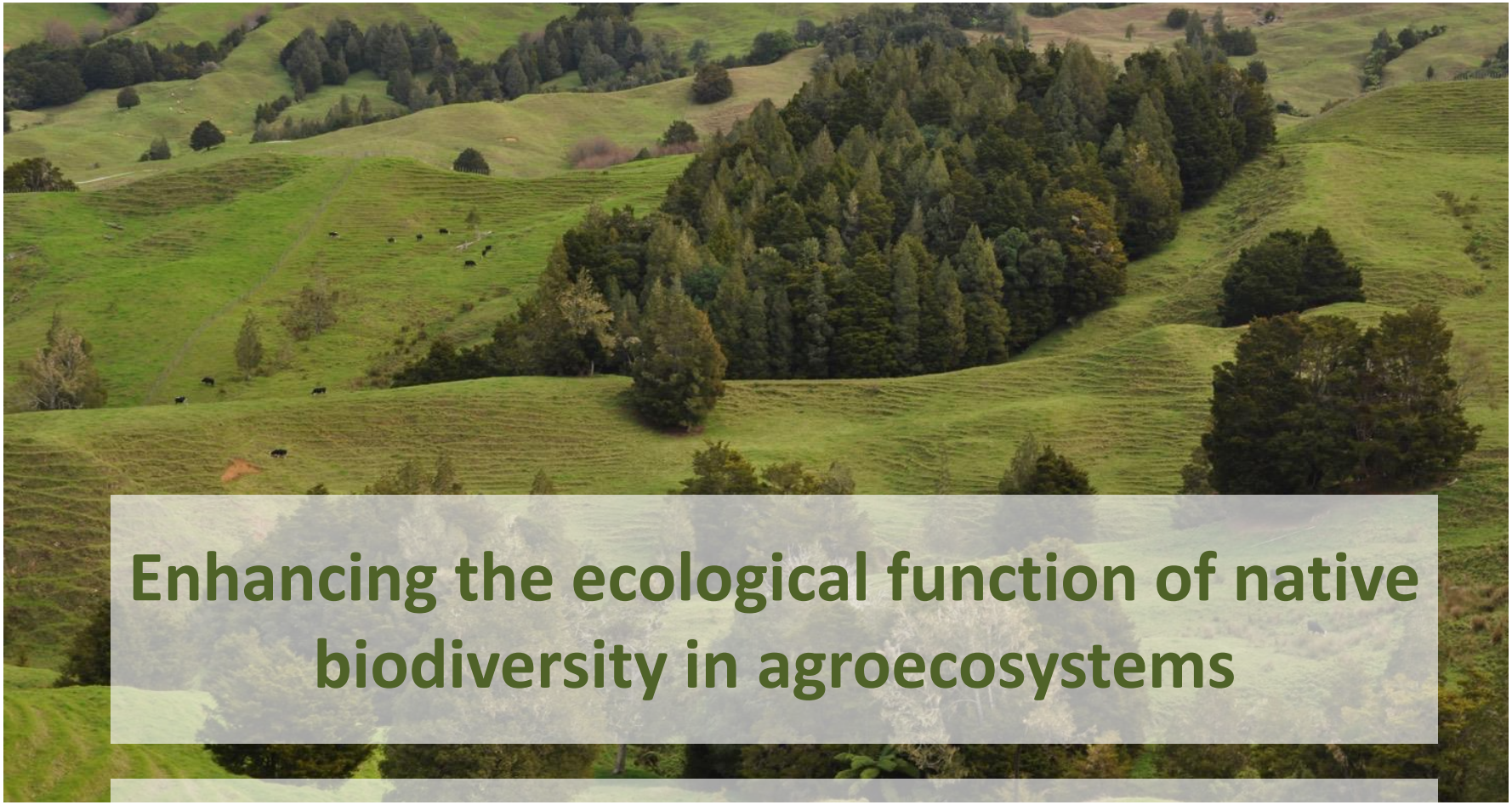
- To avoid perverse outcomes
- Drivers of landscape change interact
- Future changes in BH better understood
- Incorporates people as both 'problems' and potential solutions

Programme 3: Enhancing and restoring resilient ecosystems

NEW ZEALAND'S BIOLOGICAL HERITAGE

Ngā Koiora Tuku Iho

- What is a 'whole of system approach'?
- What is the Programme delivering? (projects)
- looking ahead…



Enhancing the ecological function of native biodiversity in agroecosystems

Project co-leaders:

David Norton (U of Canterbury) & **Hannah Buckley** (AUT)

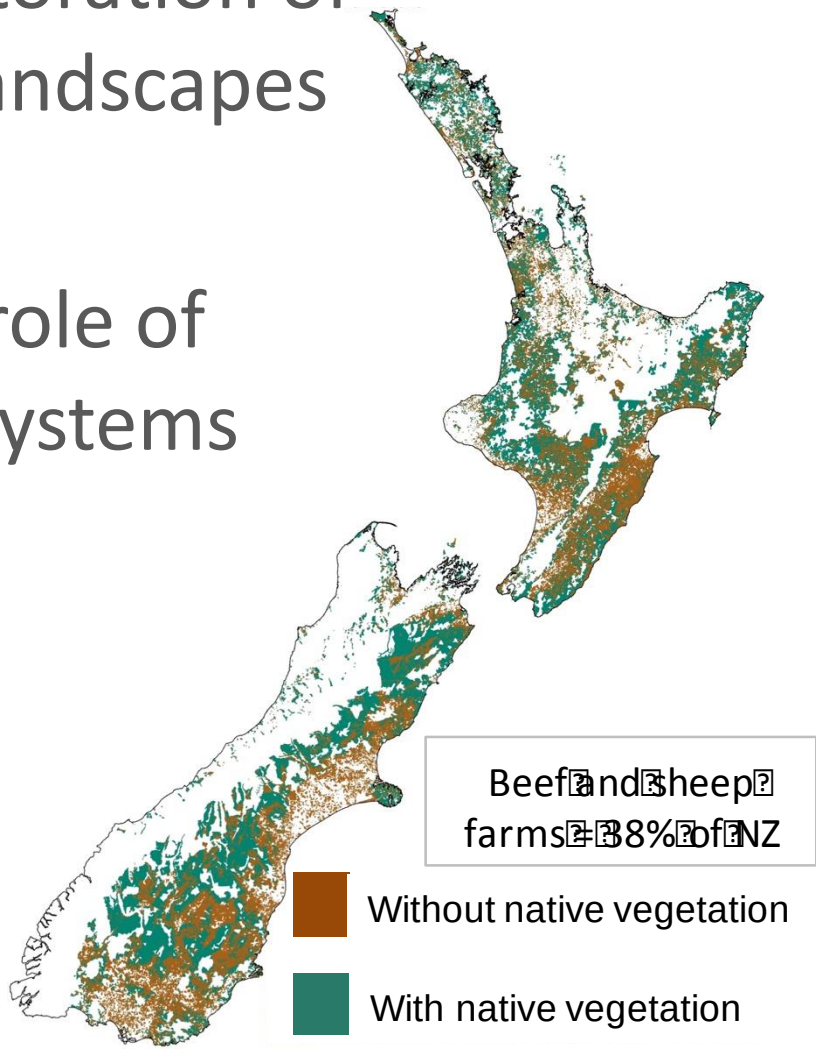
Postdoc: **Jenny Pannell** (AUT)

Researchers: **Toni White** & **Estelle Dominati** (AgResearch), **Brad Case** (AUT), **Margaret Stanley** (U of Auckland)

Knowledge broker: **Kevin Collins**

- Drivers of protection or restoration of biodiversity in agricultural landscapes

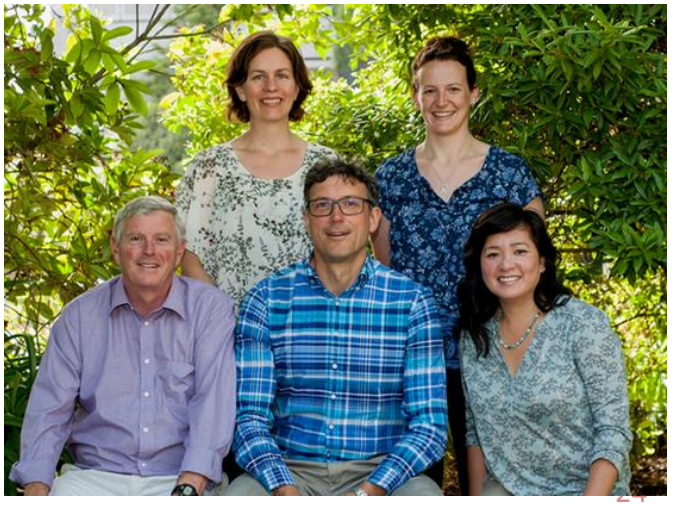
- Understand the functional role of biodiversity across agroecosystems



District Council
Catchment
Farm
Manawatu-Wanganui
Better Connectivity
Southland
Poor Connectivity
0 25 50 100 150
Kilometers
0 2 4 8 12
Kilometers
0 0.5 1 2 3
Kilometers

What is delaying the biological recovery of degraded streams & rivers?

Catherine Febria & Helen Warburton (Co-leaders)
University of Canterbury | Te Whare Wānanga o Waitaha
catherine.febria@canterbury.ac.nz, helen.warburton@Canterbury.ac.nz



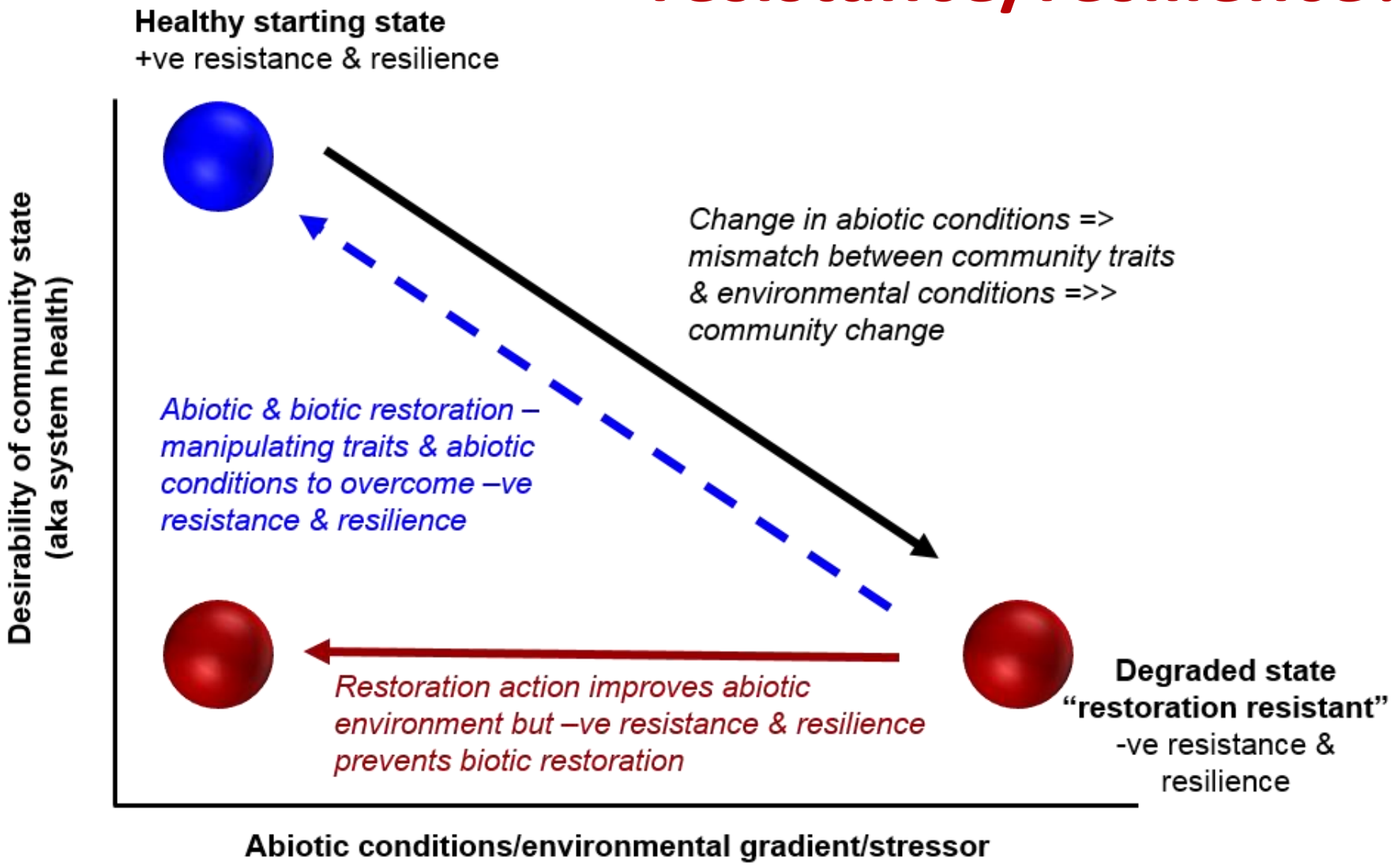
NIWA (Hamilton) – Elizabeth Graham

Environment Canterbury – Adrian Meredith

What inspired the project: A history of failed biotic restorations

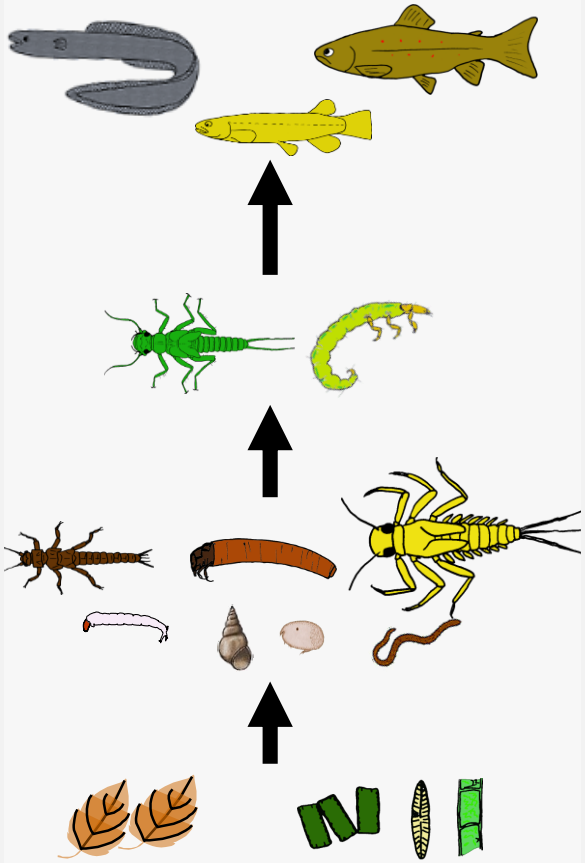
- Most restoration focuses on abiotic (habitat or structural) rehabilitation
- Biotic & functional restoration is more challenging
- ”Resilient” == “Healthy”
- Ecosystems are more than the sum of their parts

What is negative resistance/resilience?

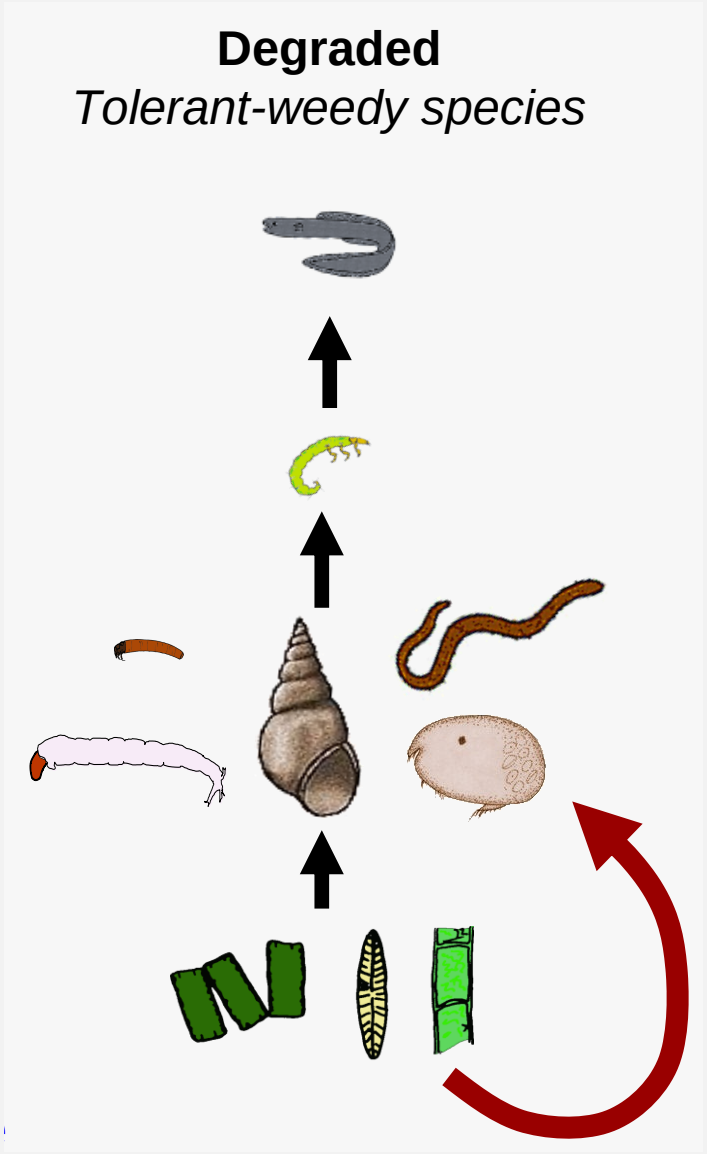


Healthy

Sensitive species

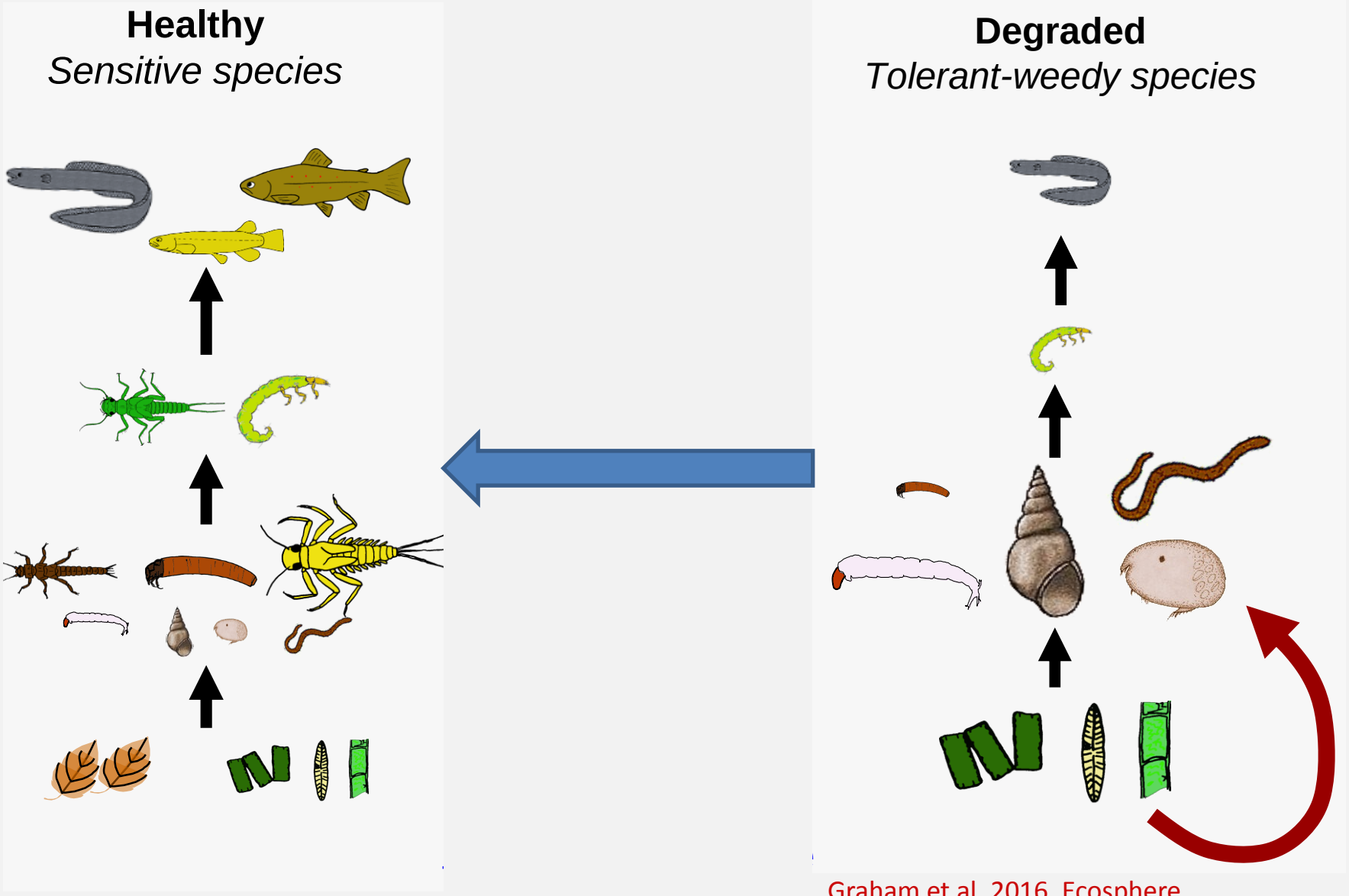


Typical agricultural waterway in Canterbury



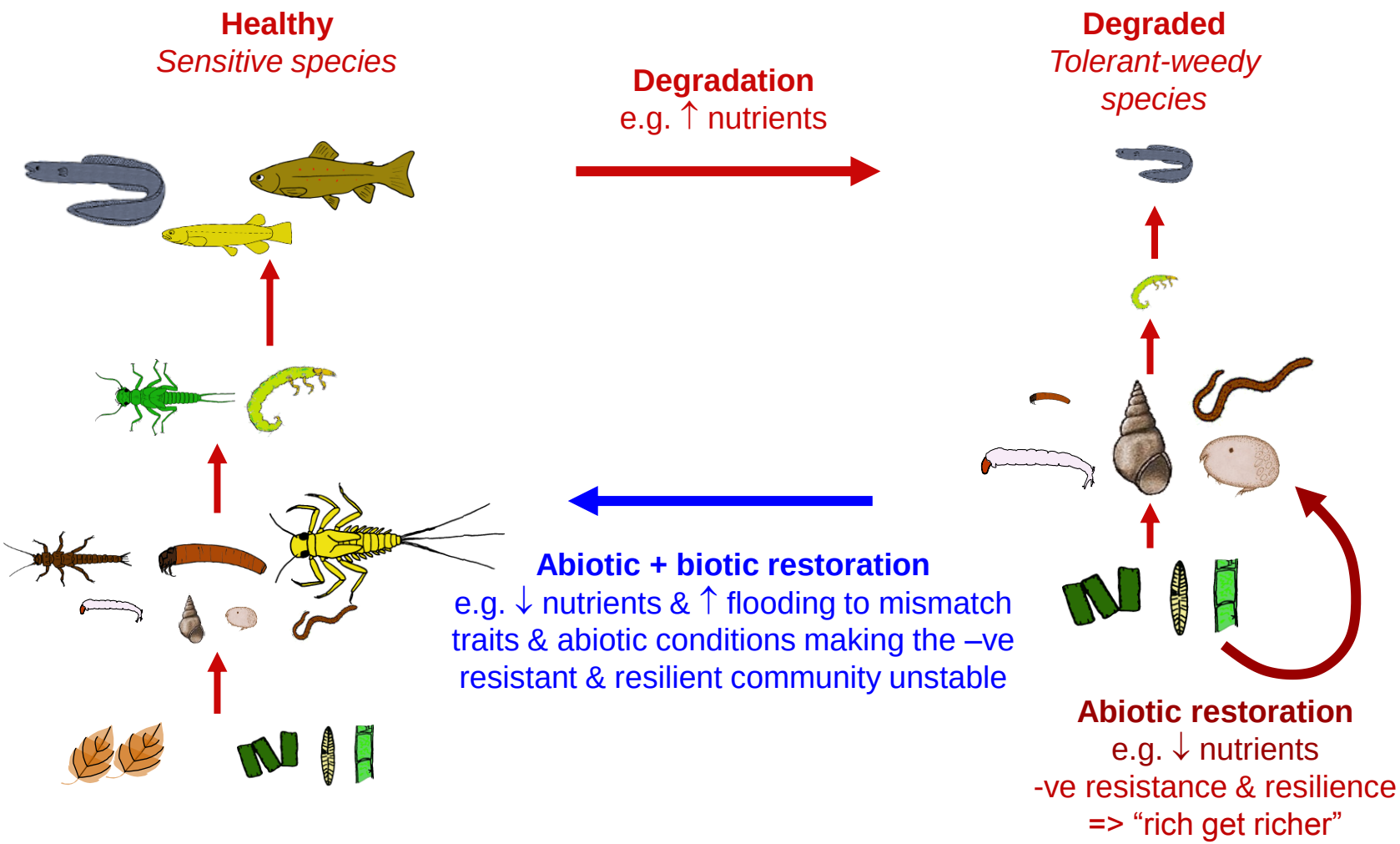
Graham et al. 2016. Ecosphere

Typical agricultural waterway in Canterbury



Graham et al. 2016. Ecosphere

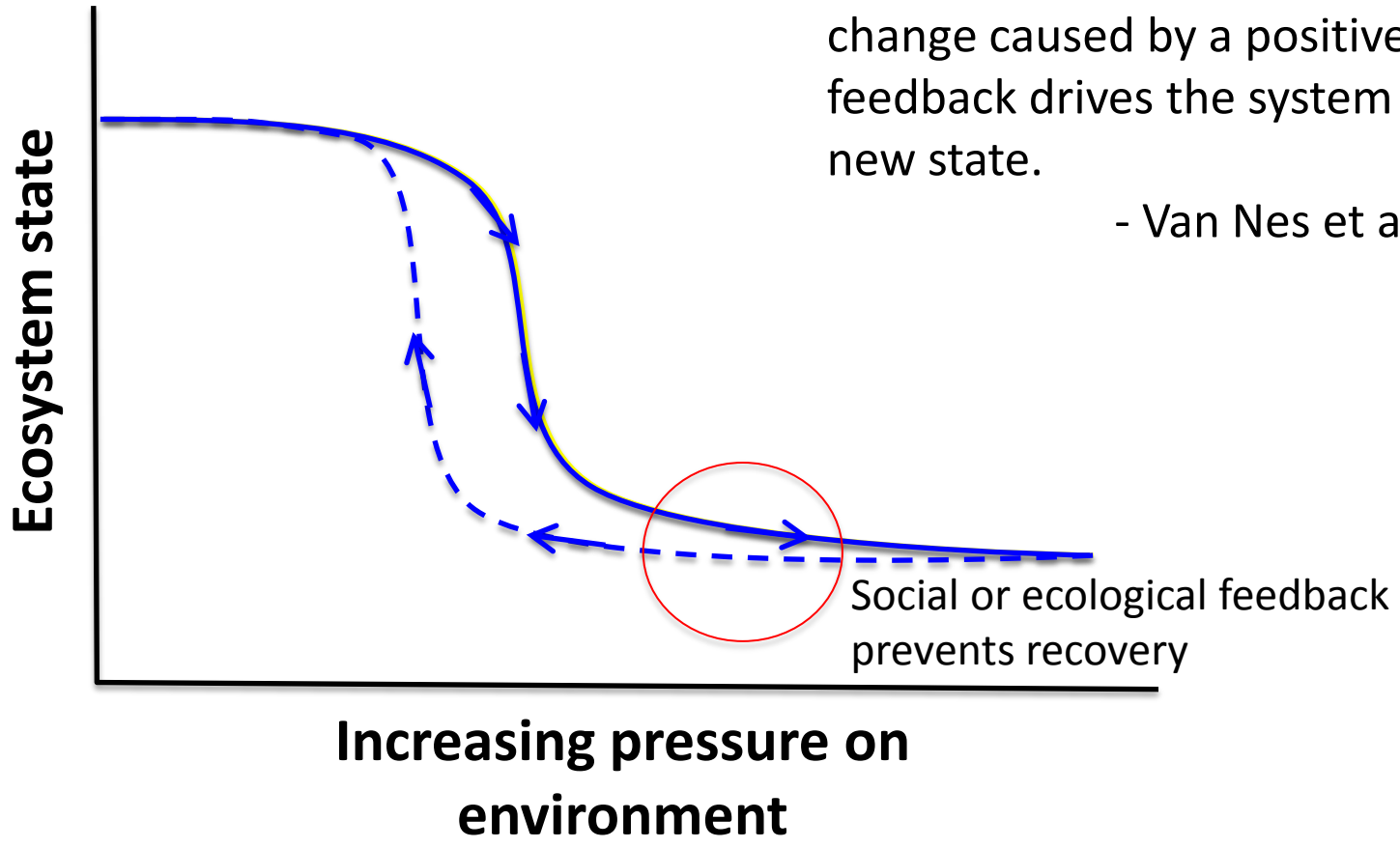
C. *Traits link individual or population processes with environmental processes & community structure/function will be an emergent property of this*



Predicting and managing ecosystem tipping points in social-ecological systems

Any situation where accelerating change caused by a positive feedback drives the system to a new state.

- Van Nes et al. *TREE*



Syntheses

Freshwater

Angus McIntosh & others

Production systems

Roger Pech, Pike Brown & others

Natural

Sarah Richardson, George Perry & others

Landcare Research
Manaaki Whenua
POLICY BRIEF

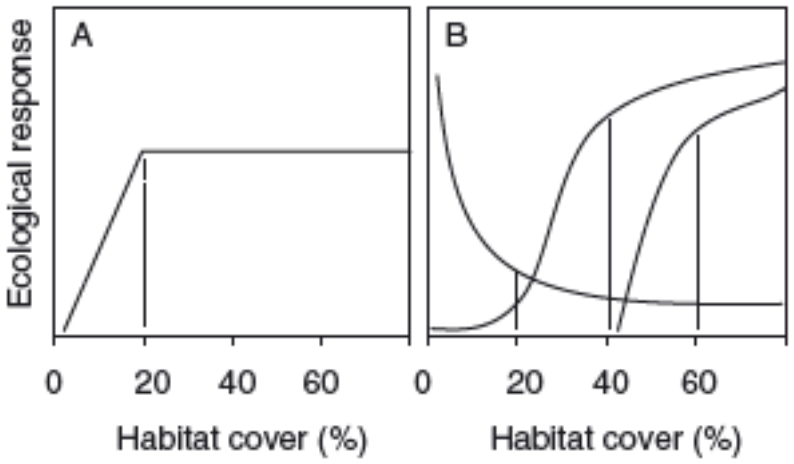
Planning for tipping points
and enhancing resilience in production landscapes

Johanna Yletyinen & Jason Tylianakis, University of Canterbury; Pike Brown & Roger Pech, Landcare Research

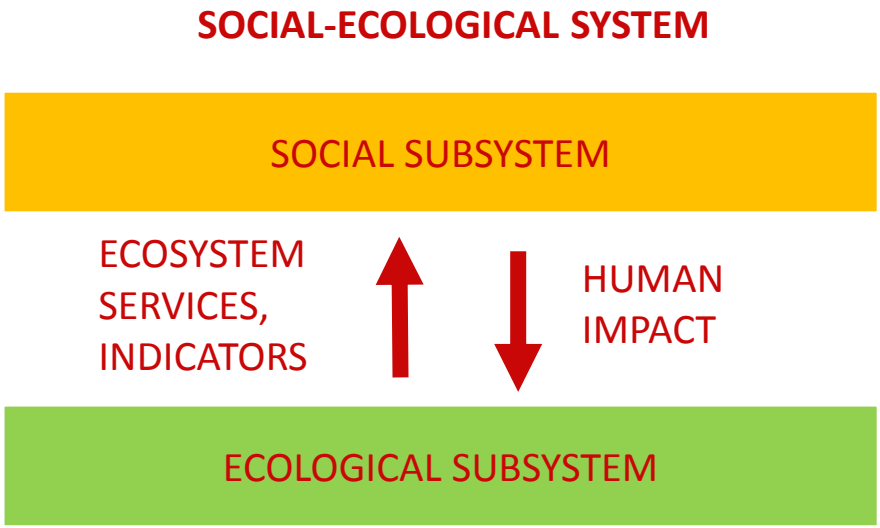
Social-ecological perspective on ecological critical thresholds

- Critical threshold levels for habitats: species respond to changes in habitat cover non-linearly.
- Most of the world's biodiversity is on lands used by people.

➢ Understanding social system (land users) and social-ecological interactions essential for reaching desired habitat thresholds

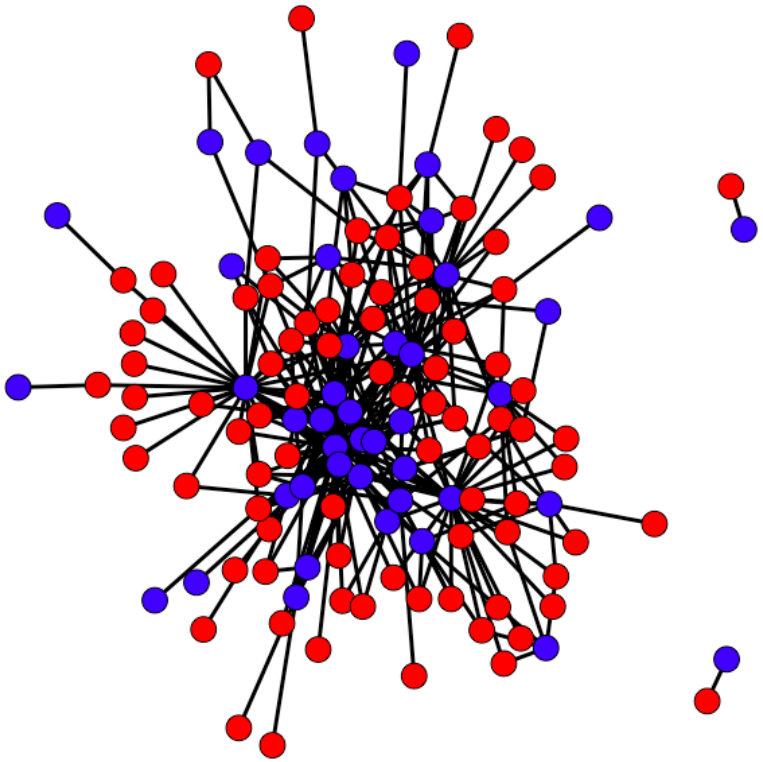


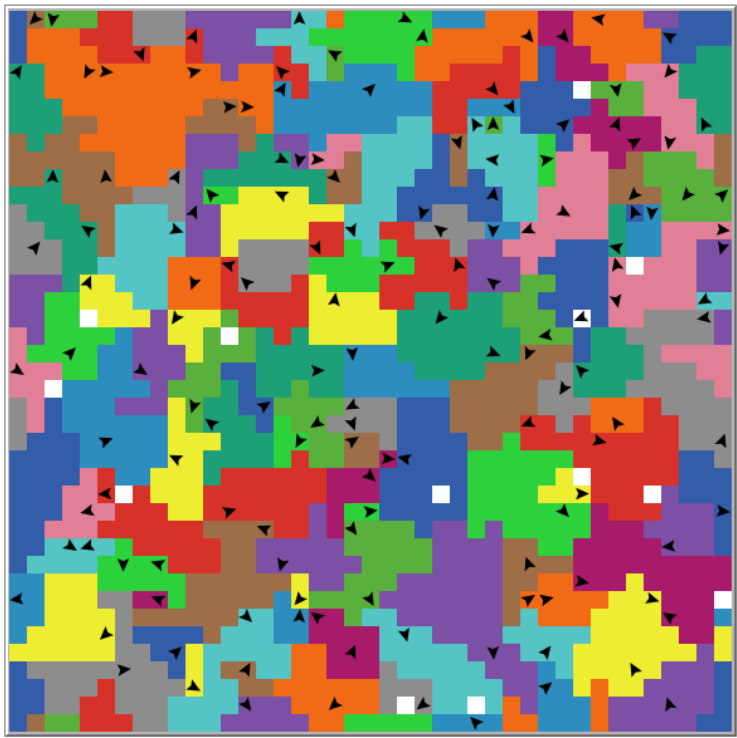
Modified from Swift & Hannon. 2010. Biological Reviews.



Rural Decision Makers

SURVEY2015





Contribution

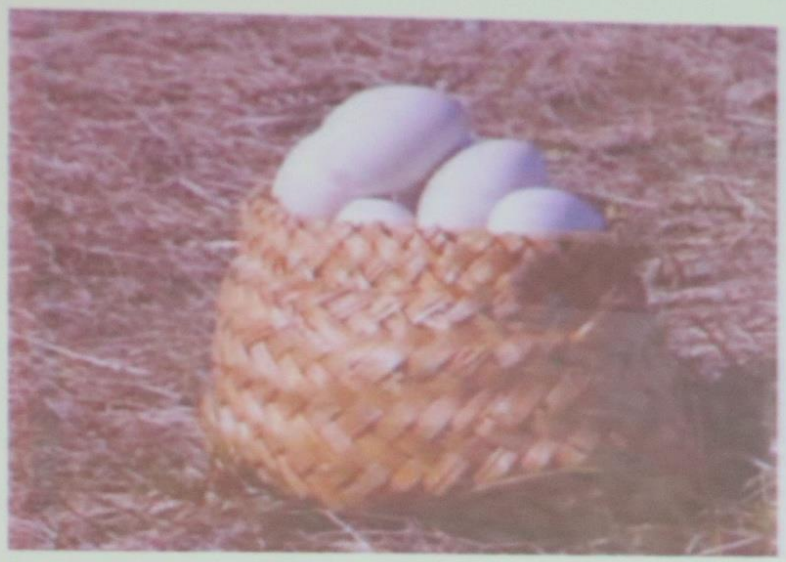
- A quantitative analysis on how ecological critical thresholds can be met through social system
- Increased understanding on NZ agricultural social-ecological systems and collective environmental action
- Addresses the call for social-ecological and social approaches on biodiversity and conservation research

REVIEW

Beyond the roots of human inaction: Fostering collective effort toward ecosystem conservation

Elise Amel,[1*] Christie Manning,[2] Britain Scott,[1] Susan Koger[3]

Science 2017



Project 3.2: Te weu o te kaitiaki

mary approaches for protecting and using biodiversity

National SCIENCE Challenges

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Customary approaches and practices

Goal: To support iwi, hapū and whanau with the application of customary approaches and practices to manage biodiversity within a culturally-responsive policy and legislative framework.

Theme 1: Evidence for policy reforms that are more responsive to Māori aspirations and kaitiakitanga

Theme 2: Te weu o te kaitiaki (The roots of the guardian)

Theme 3: Population and ecosystem responses to kaitiakitanga

Theme 4: Attitudes to Maori management of biodiversity

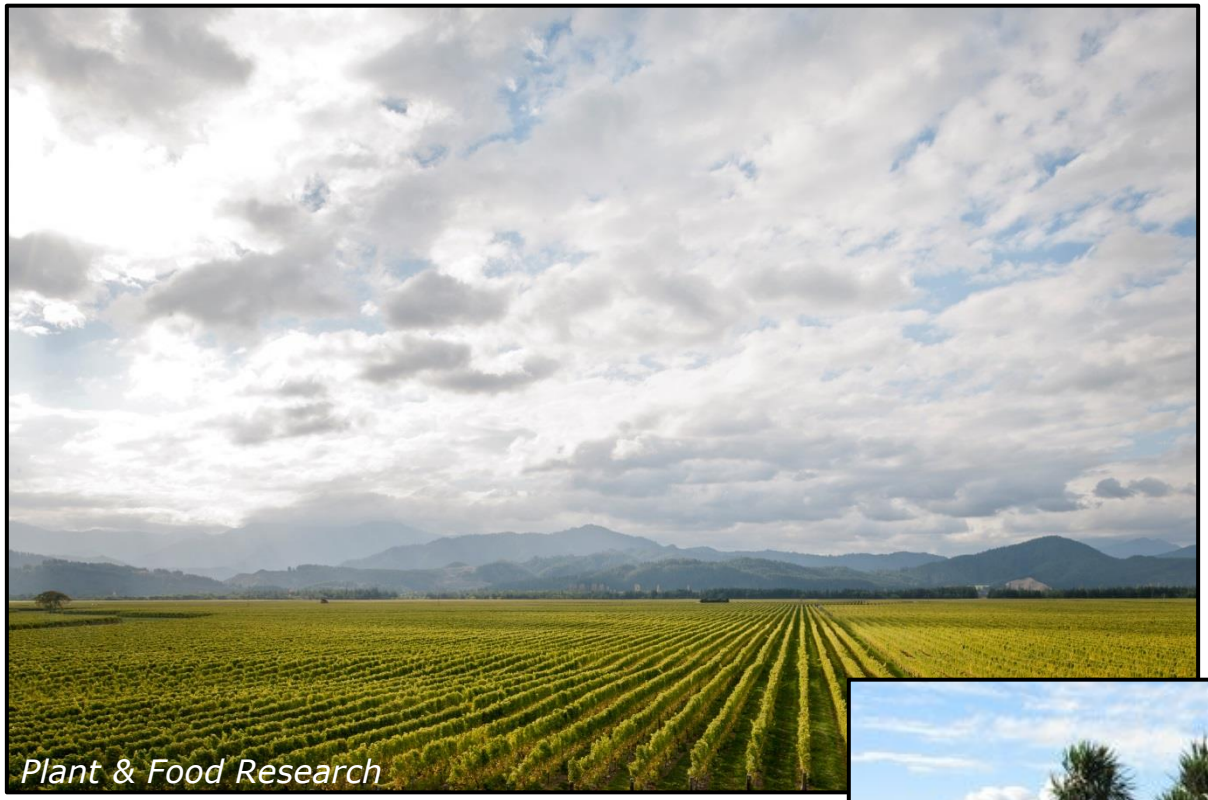
Mātauranga Māori

- What social/legislative feedbacks negatively influence environmental management? (Lyver & Tylianakis 2017 *Science*)
- Conservation law reforms should reflect and support the intent of hapu and iwi to act as kaitiaki (guardians) of New Zealand's biological heritage.
- Ruru at al. 2017. Reversing the Decline in New Zealand's Biodiversity: empowering Maori within reformed conservation law. Policy Quarterly 13: 65–71.

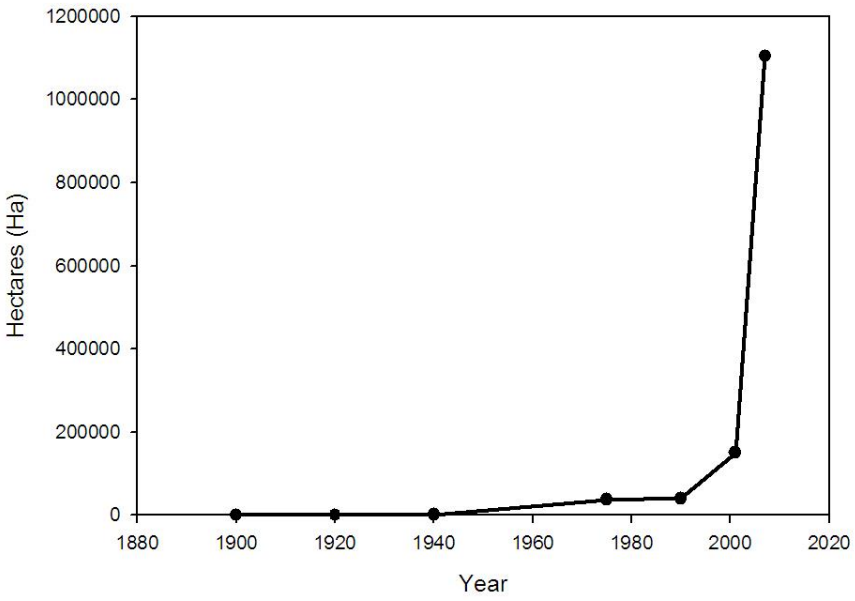
Programme 3: Enhancing and restoring resilient ecosystems

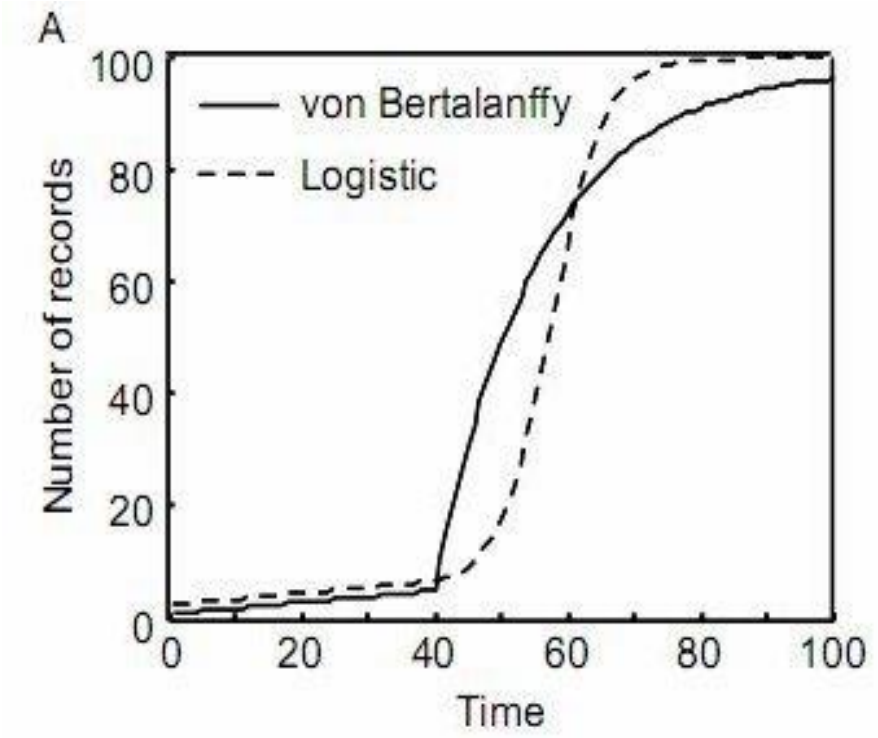
- What is a 'whole of system approach'?
- What is the Programme delivering? (projects)
- **Looking ahead…**

Linking terrestrial and freshwater ecosystems



Lag-phases and (extinction) debts





'Lag-phases are a nearly ubiquitous feature of alien plant invasions in New Zealand' (Aikio etal 2010)

Local climate change projections

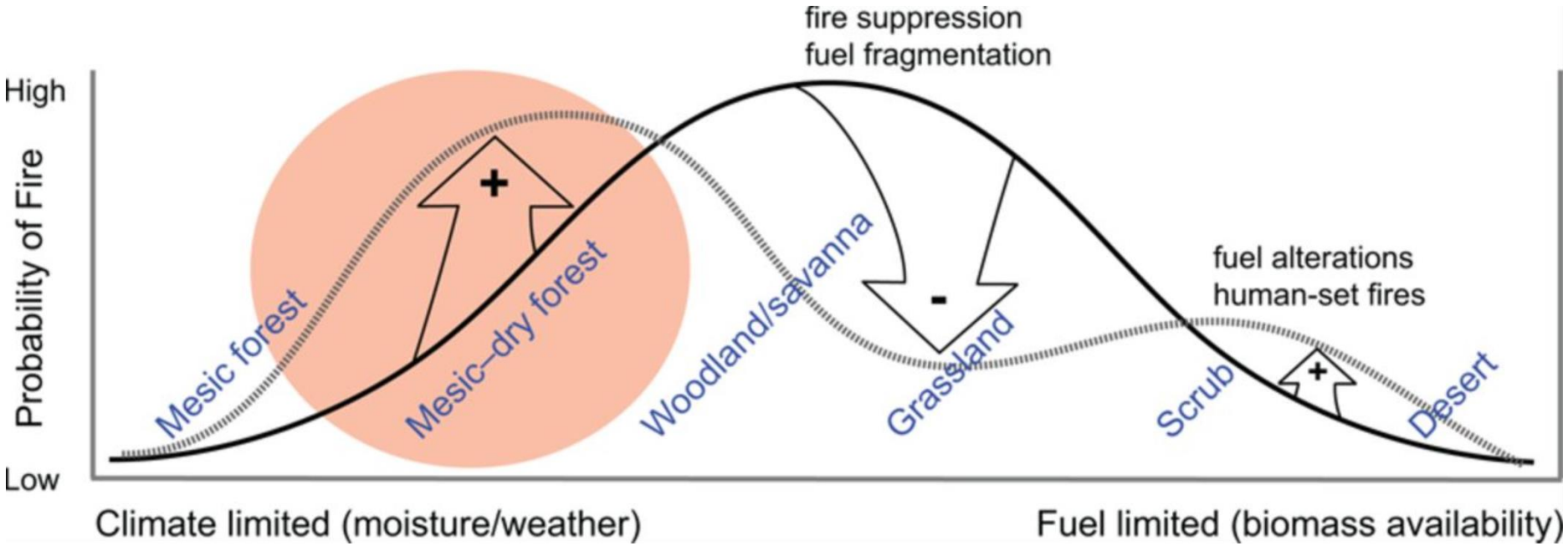
Biggest threats to biota in NZ

- Rising sea levels
- Extreme events
  - Droughts
  - Floods
  - Storms
  - Heat waves
  - Fires
  - Predictability, variability, magnitude
- Freshwater availability
- Ocean acidification

http://www.mfe.govt.nz/sites/default/files/climate-change-impact-map-a4.pdf

Climate change implications for BH

Tim Curran, Sarah Richardson, Kath Dickinson, Cathy Rufuat, Angus McIntosh, Helen Warburton, Richard White, James Renwick, Nicky Nelson, Charlie Clark, Jo Monks, Mike Clearwater, George Perry (not pictured), Margaret Stanley, Duane Peltzer, Souyad Boudjelas, Nick Waipara, (not pictured).



BioScience 2014 65:151


Ohinetahi bush

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION

OPINION ARTICLE

Renewal ecology: conservation for the Anthropocene

David M. J. S. Bowman[1], Stephen T. Garnett[2], Snow Barlow[3], Sarah A. Bekessy[4], Sean M. Bellairs[2], Melanie J. Bishop[5], Ross A. Bradstock[6], Darryl N. Jones[7], Sean L. Maxwell[8], Jamie Pittock[9], Maria V. Toral-Granda[2], James E. M. Watson[8,10], Tom Wilson[11], Kerstin K. Zander[11], Lesley Hughes[5,12]

…rapid environmental change is unavoidable, necessitating critical planning, and action, but also that human modifications of landscapes (for ESs) do not necessarily have to come at the expense of biodiversity.

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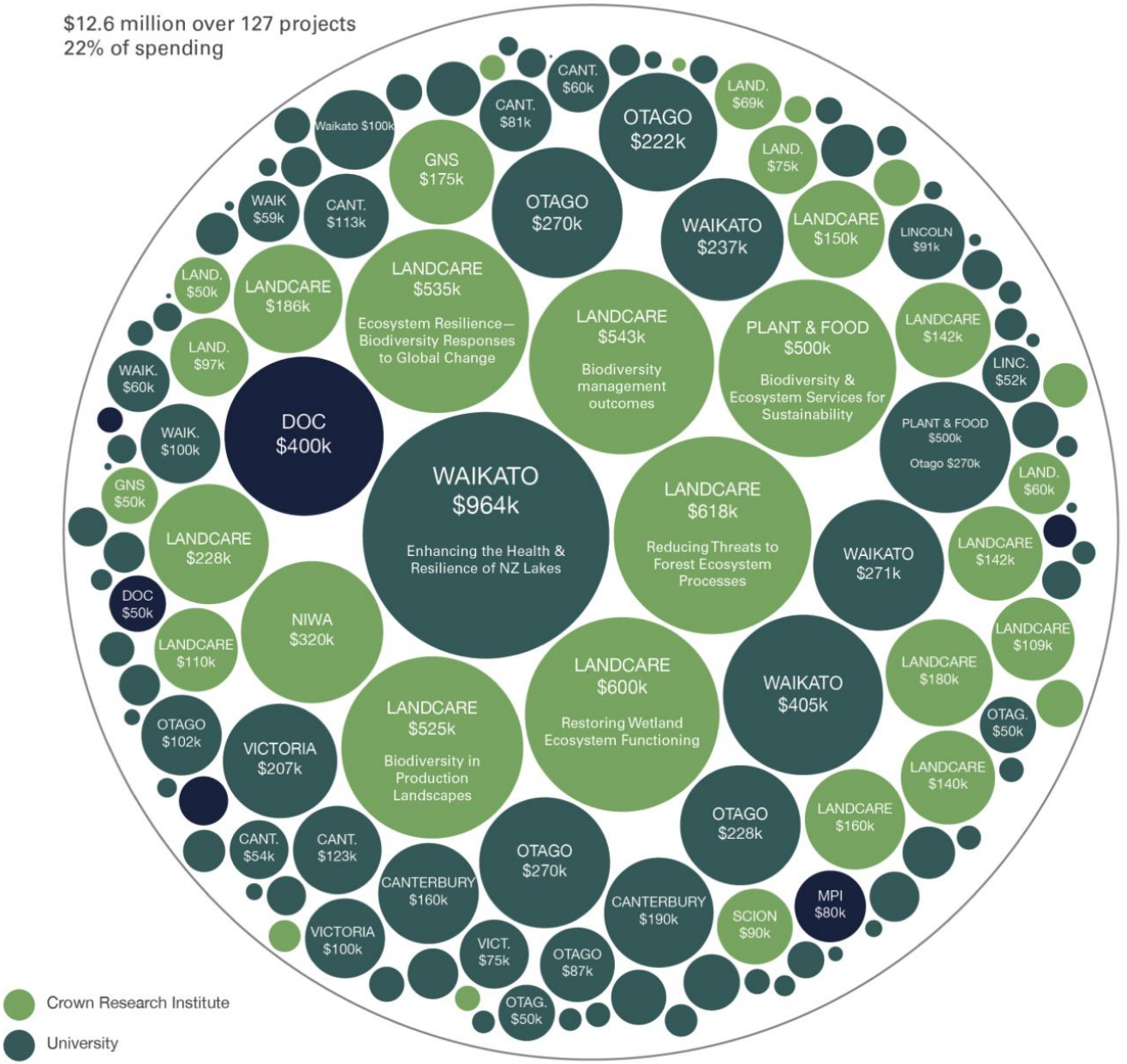
Biological Heritage Challenge

- Integrative collaborations across institutions
- Identifying and addressing research gaps
- Scoping future work and engagement for tranche 2
- Scaling up and adequate resourcing ongoing issues

ECOSYSTEMS, ECOLOGY, RESILIENCE

$12.6 million over 127 projects
22% of spending



Eradication of predators from island reserves and large areas of unfenced landscape; science capable of eradicating one small mammal predator

How to connect with the Challenge

www.biologicalheritage.nz

@BioHeritage_NZ

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