

Te Weu o te Kaitiaki – The roots of the guardian

(A bicultural forest monitoring and reporting system)

Phil Lyver, Puke Timoti, Brenda Tahi, Te Waiti Rangiwai, Andrew Gormley, Sarah Richardson, Chris Jones, Suzie Greenhalgh and Rangi Matamua with the Tūhoe Tuawhenua Trust and Ngāti Whare Trust Board



**TŪHOE TUAWHENUA
TRUST**



Acknowledgements



Ministry of Business,
Innovation & Employment



Manaaki Whenua
Landcare Research

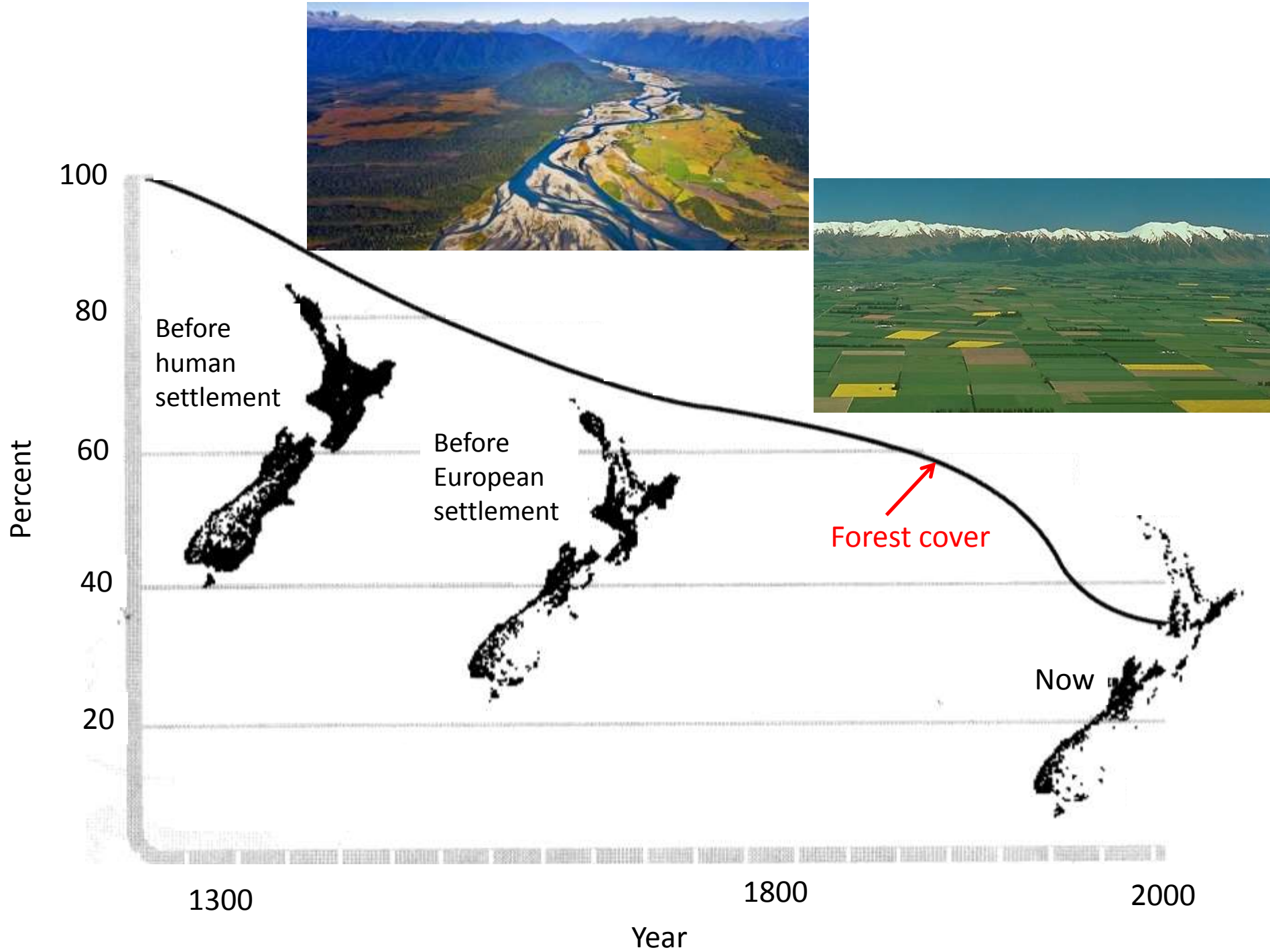
- BEST: Building biodiversity into an ecosystem service-based approach for resource management (C09X1307)
- Landcare Research '*Māori and Biodiversity*' SSIF Funding

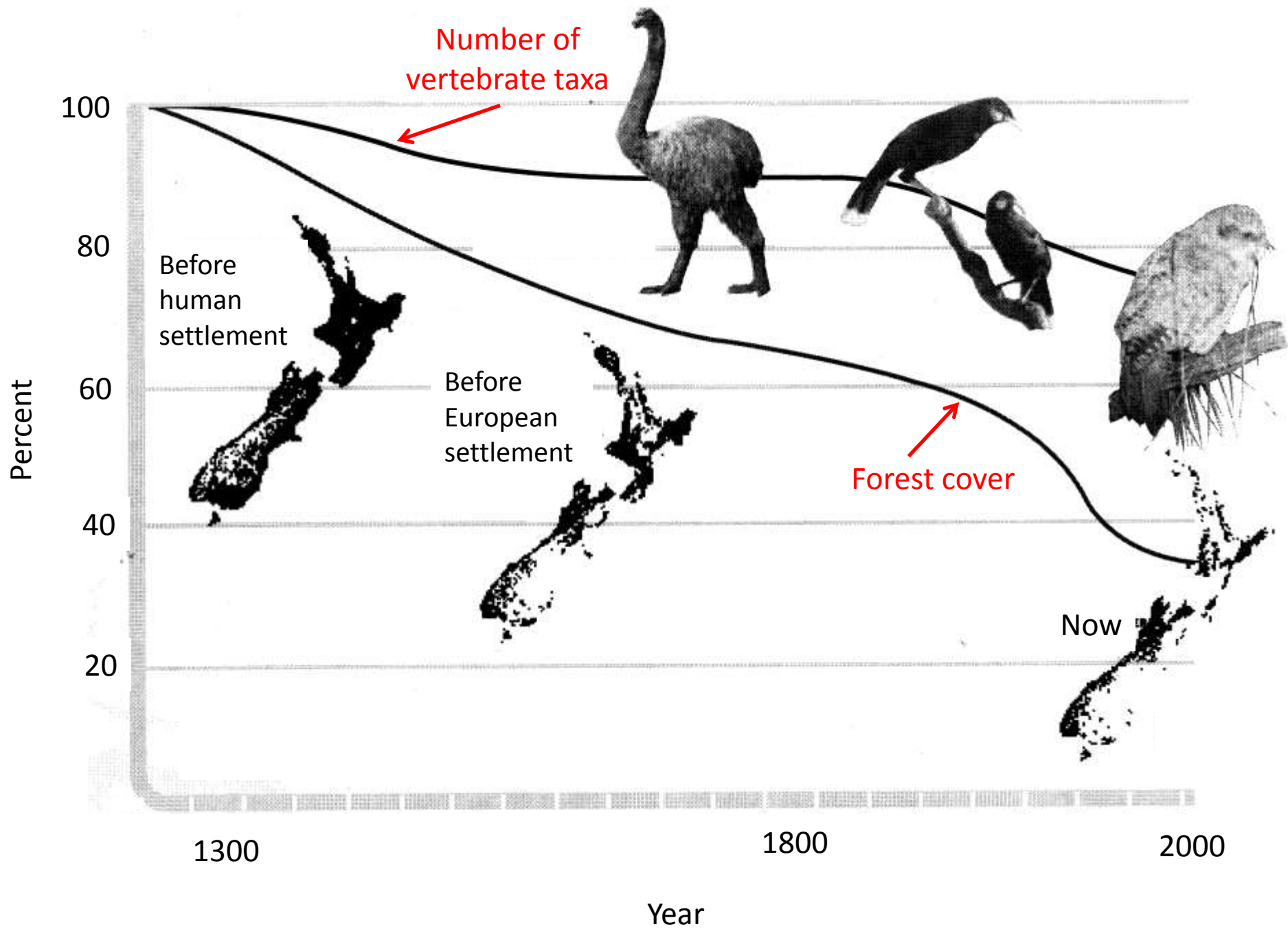
**TŪHOE TUAWHENUA
TRUST**



Department of Conservation
Te Papa Atawhai

Vegetation plot data are archived in the National Vegetation Survey (NVS) databank (<https://nvs.landcareresearch.co.nz/>)



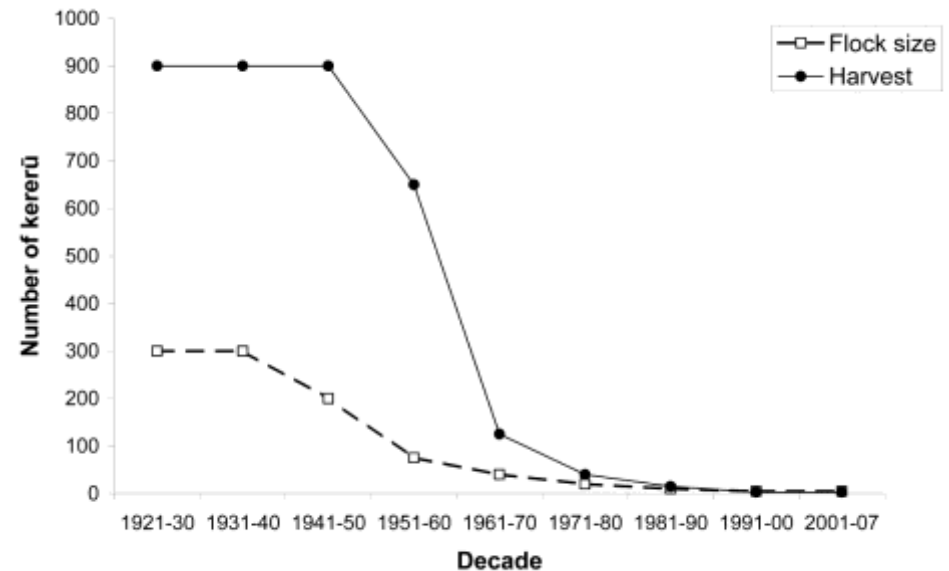


Why do this research – relevance for Tuawhenua and Ngāti Whare?

- Knowing the state and condition of our forests and lands
 - Fundamental to the maintenance and growth of our identity, our language, our knowledge systems, our pātaka kai and our people
 - Fundamental to our economic and community development
 - Fundamental to our relationship with Tāne
- Expression and support for *mana motuhake* (self-determination and self-authorisation) in relation to our forests and lands

Terrestrial biodiversity indicators based on mātauranga Māori

Example: An 80-year estimate of kererū populations in Te Urewera based on Tūhoe Tuawhenua mātauranga



Why do this research – relevance for national and international management and reporting

- Evidence base to show the difference that management makes
- Evidence base to improve practice
- Evidence base for resource management decisions
- Meeting national and international obligations and opportunities:
 - Iwi Environmental Management Plans
 - Environmental Reporting Act 2015
 - Draft Threatened Species Statement 2017 – *“integrate a Te Ao Maori worldview and mātauranga in species recovery programmes by 2025”*
 - New Zealand Biodiversity Action Plan 2016-2020 (e.g. National Targets and Actions 17.1 and 18.9)
 - Convention on Biological Diversity – Aichi Biodiversity Targets
 - United Nations - IPBES

Research framework - Te Weu o te Kaitiaki

Objective 1

Develop a Tuawhenua worldview representation

Objective 2

Identify key forest values and aspirations

A bicultural monitoring and reporting system to guide forest management

Objective 3

Identify community- and scientific-based forest indicators

Objective 4

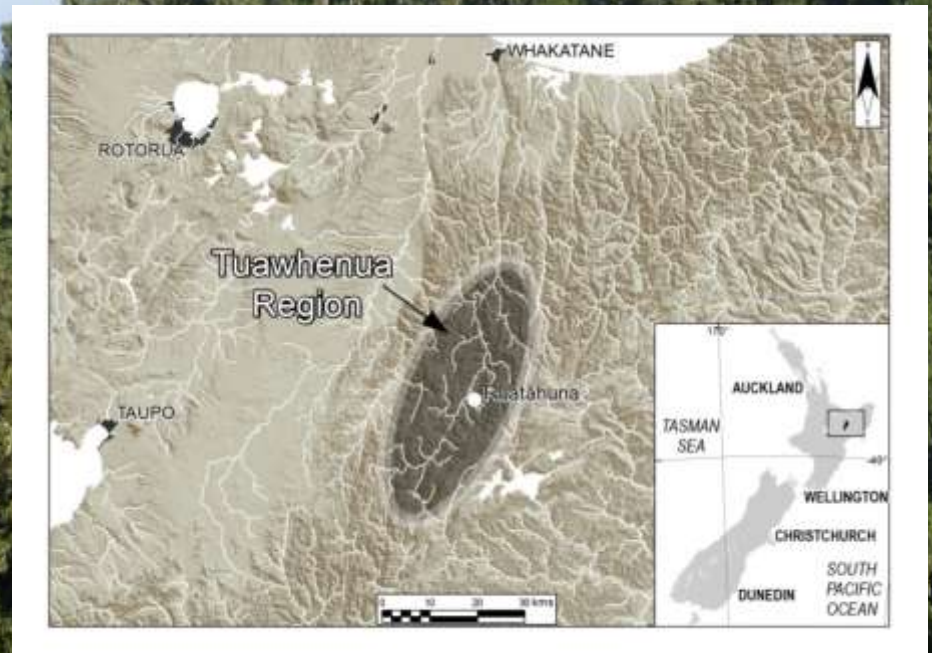
Apply a bicultural monitoring system in ecologically congruent forests



Study site – Ruatāhuna

- Ruatāhuna is located within Te Urewera and consists of approximately 300 people within 72 households clustered around 10 traditional marae
- Ruatāhuna is surrounded by approximately 20,000 hectares of Tuawhenua lands of which more than 95% is covered with mixed oceanic temperate rainforest

- Forest canopies dominated by evergreen angiosperms such as tawa, tawhero, rewarewa with emergent northern rātā and conifers (e.g., rimu, toromiro, mataī, tōtara)
- Selective logging between 1950 and 1975 removed large proportion of giant conifers (>30m height, >1m stem diameter)



Study site – Whirinaki Te Pua-a-Tane

- Ngāti Whare number just over 3,000 people and are represented by Te Rūnanga o Ngāti Whare in Murupara. The marae of Waikotikoti and Murumurunga, located at the settlement of Te Whaiti, are cultural centres.
- Whirinaki is a 55,000-ha forest area bordering the western boundary of the Ruatāhuna forest
- Large parts of the park remain in elevational-gradation forests consisting of rimu, mataī, toromiro and kahikatea as dominant emergents over a mainly tawa canopy with occasional understorey species such as tawhero, tōtara, rewarewa and māhoe
- Areas of Whirinaki were logged up until 1984, although some areas were protected and retain dense stands of native conifers

Obj 3 – Community-based forest monitoring indicators

Objectives

- 1) Identify the full range of themes and indicators relevant to Tuawhenua values
- 2) Develop a community-based forest monitoring approach that best fits the frequency of forest use by Tuawhenua
- 3) Identify a core set of indicators and metrics to apply within a community-based forest monitoring system

Methodology

- *Use semi-directed interviews (n=80 interviews) and wānanga (n=2) with Tuawhenua kaumātua to identify and verify community-based forest themes, indicators and metrics*
- *Core community-based forest indicators and metrics identified through a seven point Likert Scale survey (n=35 participants; mean age 57 years)*
- *Conduct survey with kaumātua (n=43) about changes in the frequency of forest use by the Ruatāhuna community*



Lyver, P.O'B., Timoti, P., Jones, C.J., Richardson, S.J., Tahī, B.L. and Greenhalgh, S. (2017). An indigenous community-based monitoring system for assessing forest health in New Zealand. *Biodiversity and Conservation*. DOI: 10.1007/s10531-016-1142-6.

Understanding what has changed in the forest?

“There was always a consistent uproar of birds singing in our forests. When we journeyed into the forest with our father he would dismount to give his horse a rest and he would tell us stories pertaining to the different species of birds and trees in our environment. I remember one particular time he says “Listen to what is going on in the forest. Can you hear the birds?” He would add, “You aren’t listening to the language of the trees and the birds. The language of the trees can be heard if you listen carefully” (Menu Ripia 2014).

“Our forest has changed significantly over time. There were a lot of pigs in earlier years however, those pigs didn’t dig up the land and forest like today’s pigs. In those days the fruits covered the forest floor and the pigs didn’t need to dig for their sustenance. Then came the introduction of other animals that devoured the fruits of the land and hence the pigs started to dig underground for their food source” (Tahae Doherty 2014).

Themes for categorising community-based indicators

Themes - Pae tukutuku

- | | | |
|----|----------------------|--------------------------|
| 1) | Procurement of food | <i>Mahinga kai</i> |
| 2) | Natural productivity | <i>Hua o te whenua</i> |
| 3) | Nature of water | <i>Āhua o te wai</i> |
| 4) | Nature of land | <i>Āhua o te whenua</i> |
| 5) | Nature of the forest | <i>Āhua o te ngahere</i> |
| 6) | Fires of occupation | <i>Ahikāroa</i> |
| 7) | Spiritual dimension | <i>Taha wairua</i> |
| 8) | Physical health | <i>Taha kikokiko</i> |
| 9) | Mental health | <i>Taha hinengaro</i> |



Examples - community-based forest indicators

Pae tukutuku (themes)	Ngā pae tata (indicators)
Mahinga kai (Procurement of food)	<ul style="list-style-type: none">➤ The abundance of native birds (sound of birds; flock sizes)➤ Intensity of fungi (harore) odour➤ Harvest rates (tuna – time to harvest; distances travelled)➤ Abundance and condition of pikopiko
Hua o te whenua (Natural productivity)	<ul style="list-style-type: none">➤ Intensity of flowering on trees (intensity of colour/odour)➤ Abundance and density of fruit on trees➤ Abundance and density of fruit on forest floor➤ Trap catch rates of possums
Āhua o te wai (Nature of water)	<ul style="list-style-type: none">➤ Taste and smell of water➤ Clarity of water➤ Prevalence of weed and algae➤ Language of water

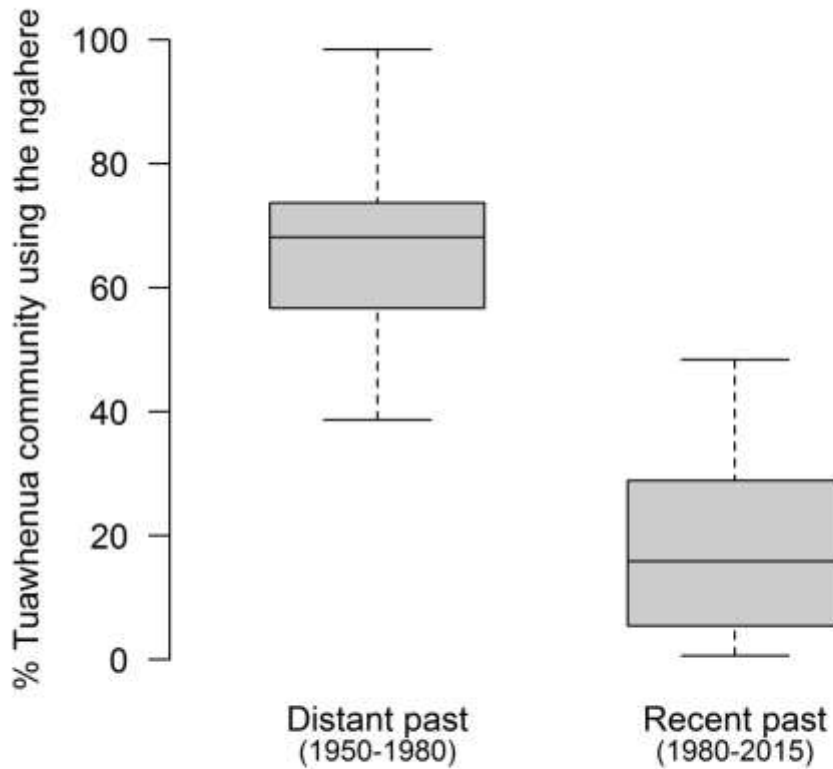
Examples - community-based forest indicators

Pae tukutuku (themes)	Ngā pae tata (indicators)
Āhua o te whenua (Nature of land)	<ul style="list-style-type: none">➤ Dryness of soil➤ Abundance, extent and depth of landslides➤ Structure of stream and river beds➤ Timing and intensity of frosts
Āhua o te ngahere (Nature of the forest)	<ul style="list-style-type: none">➤ Colour and shape of forest canopy➤ Seedling and sapling densities➤ Line of sight and travel in forest➤ Timing of flowering and fruiting
Ahikāroa (Fires of occupation)	<ul style="list-style-type: none">➤ Frequency of forest use and visitation➤ Strength of linkages to land and food➤ Prevalence of cultural expression (e.g. practice of karakia, mōteatea, and puha hari kai)

Examples - community-based forest indicators

Pae tukutuku (themes)	Ngā pae tata (indicators)
Taha wairua (Cosmological domain)	<ul style="list-style-type: none">➤ Presence and strength of mauri➤ Presence and strength of ia➤ Presence and/or encounters with tūrehu or patupaiarehe➤ Strength of sacredness related to species and place
Taha kikokiko (Physical health)	<ul style="list-style-type: none">➤ General health of people in community (e.g. nutrition; general wellness)➤ Prevalence of locally grown or hunted food in diet
Taha hinengaro (Mental health)	<ul style="list-style-type: none">➤ Strength of loneliness felt within forest➤ Commitment of community togetherness (matemateaone)➤ Quantity and quality of knowledge transfer➤ Commitment and adherence to spiritual dimension

Challenges confronting a community-based forest monitoring system



Core community-based forest indicators with metrics

Pae tukutuku (themes)	Ngā pae tata (indicators)	He pae-rūri (ordinal metrics)
Procurement of food (Mahinga kai)	The abundance of native birds (sound of birds)	<ol style="list-style-type: none"> 1. Thunderous (haruru) / deafening 2. Loud and noisy, but less intense 3. Noise faded / Not that great 4. Silent / muted 5. Dead silent
Natural productivity (Hua o te whenua)	The abundance of fruit on the trees	<ol style="list-style-type: none"> 1. Over-loaded (matomato) / heavily-laden (makuru) 2. Plentiful (manomano) / loaded / heaps 3. Some / quite a bit 4. Not a lot / poor / bugger all 5. Nothing (kore) / diminished 6. Absolutely nothing (korekore)
Taha wairua (Cosmological domain)	Strength and presence of mauri	<ol style="list-style-type: none"> 1. Active and flourishing / Alive / Healthy 2. Persists / Still present but waning 3. Diminished / Reduced capacity 4. Sleeping / Dormant / Hidden

Parting thoughts

Theme 3 – Community-based forest monitoring indicators

- Many indicators linked to the provisioning capacity of the forest
- Indicators need to be understood and trusted by the community
- Indicators representing the human-environment relationship important to Tuawhenua (e.g. sharing of resources)
- Dilemma of building monitoring approach that aligns to forest use by community, or is specifically focused around a survey, or both



Parting thoughts

Theme 3 – Community-based forest monitoring indicators

- Interview-based monitoring approaches rely on regular and repeated forest visits by community members
- Field survey approach fits current situation, however becomes quite ‘fixed point in time’
- Issues of ‘shifting ecological baselines’ or ‘ecological amnesia’ needs to be considered using an ordinal scoring system
- Whose indicators???



Obj 4 – A bicultural forest monitoring approach

Objectives

- 1) Determine a historical 'baseline' state for the Ruatāhuna forest
- 2) Field test a bicultural forest monitoring and reporting system in two compositionally similar forests (Whirinaki and Ruatāhuna)
- 3) Compare contemporary community-based forest surveys conducted within Whirinaki and Ruatāhuna forests with historical baselines surveys
- 4) Compare plot-based and community-based forest surveys conducted within Whirinaki and Ruatāhuna forests

Methodology

- *Conduct a baseline survey of forest state with Tuawhenua kaumātua using the core set of 16 community-based indicators*
- *Conduct plot-based forests surveys in Whirinaki and Ruatāhuna forests*
- *Conduct contemporary forest indicator surveys with Tuawhenua kaumātua (n = 19 participants) Whirinaki and Ruatāhuna forests*

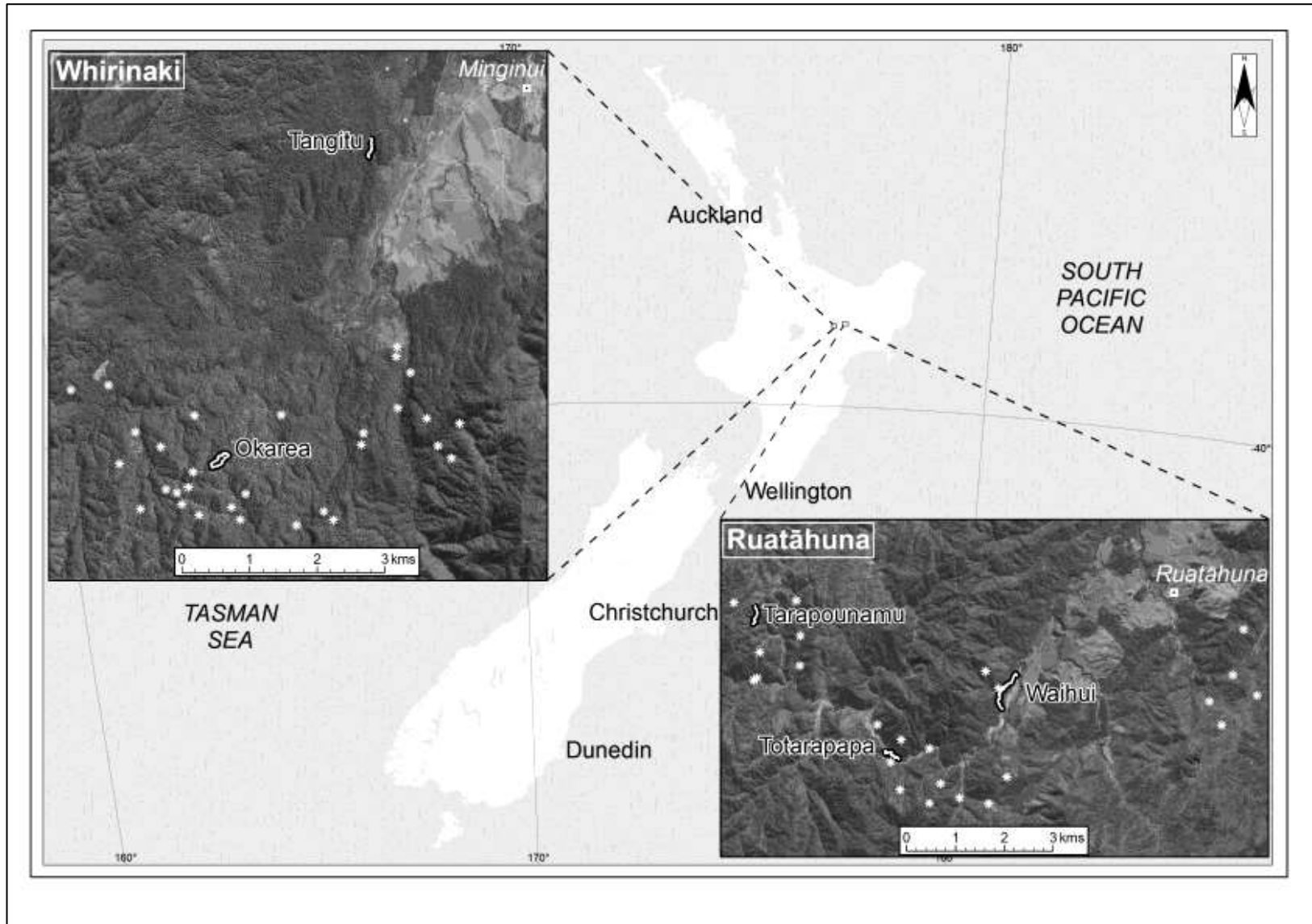


Plot-based forest surveys – Whirinaki & Ruatāhuna

1. Plots (20m × 20m) each sampling 1700 ha of forest mapped as rimu-general hardwoods (400m – 700m amsl), were randomly assigned to the Ruatāhuna (n = 24 plots) and Whirinaki (n = 30 plots) forests



Study sites – Whirinaki & Ruatāhuna



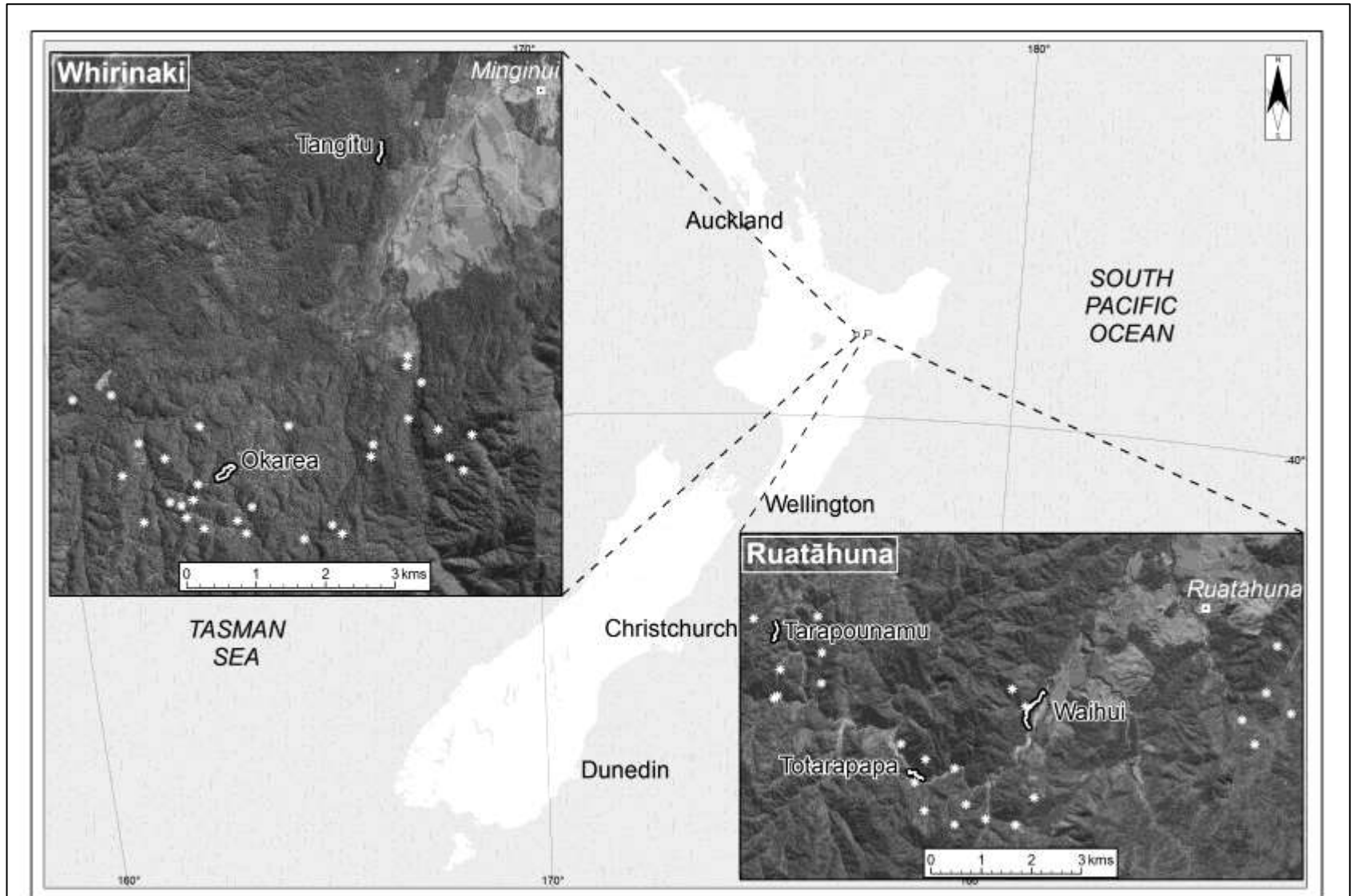
Plot-based forest surveys – Whirinaki & Ruatāhuna

1. Plots (20m × 20m) each sampling 1700 ha of forest mapped as rimu-general hardwoods (400m – 700m amsl), were randomly assigned to the Ruatāhuna (n = 24 plots) and Whirinaki (n = 30 plots) forests
2. Vegetation metrics assessed were:
 - a) **Forest structure** (stem density, tree fern stem density, basal area, mean stem diameter, above-ground live tree biomass, large tree density)
 - b) **Forest regeneration** (tree seedling frequency, palatable tree seedling frequency, canopy tree seedling frequency)
 - c) **Culturally important species** (presence of mauku, *Asplenium bulbiferum* / *A. gracillimum*)
 - d) **Invasive plant species** (species richness of weeds)
3. Pellet counts
4. Five minute bird counts

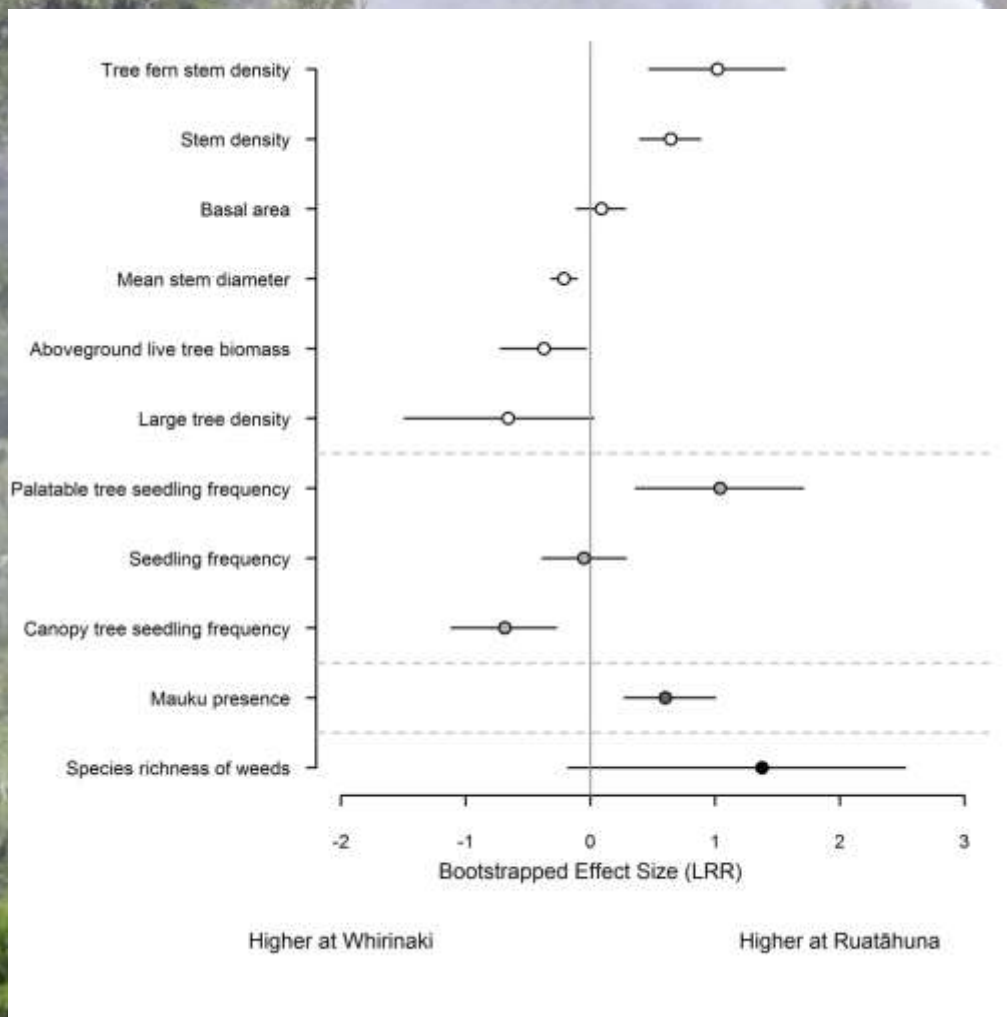
Community-based forest surveys – Whirinaki & Ruatāhuna

Forest region	Survey site	No. of elders	No. of surveys	Distance of route (m)	Mean time spent conducting survey (mins)
Ruatāhuna	Waihui	12	7	1050	135
Ruatāhuna	Tōtarapapa	4	1	680	80
Ruatāhuna	Tarapounamu	3	2	480	128
Whirinaki	Ōkarea	8	3	830	178
Whirinaki	Tangitū	11	7	380	146

Study sites – Whirinaki & Ruatāhuna

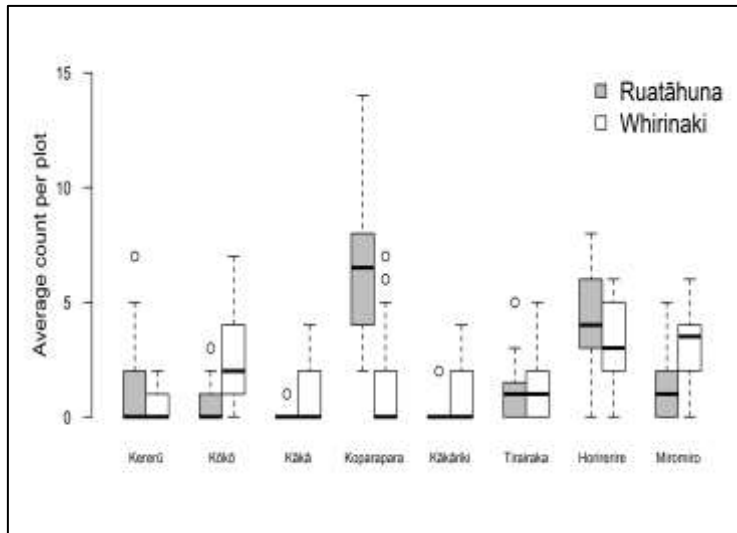
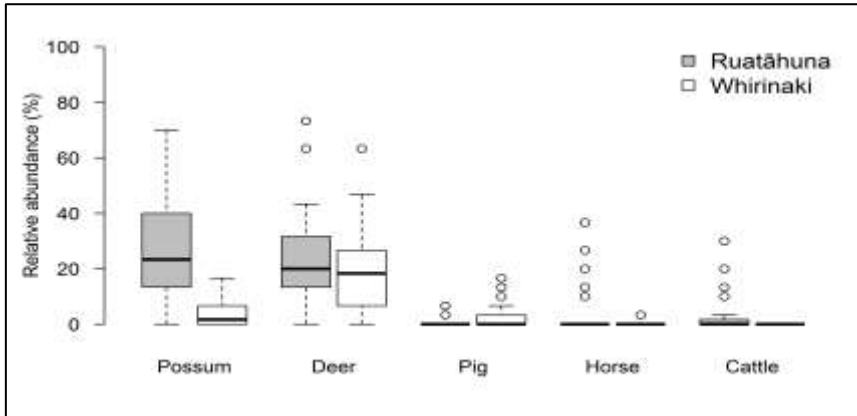


Plot-based forest monitoring system Whirinaki vs Ruatāhuna



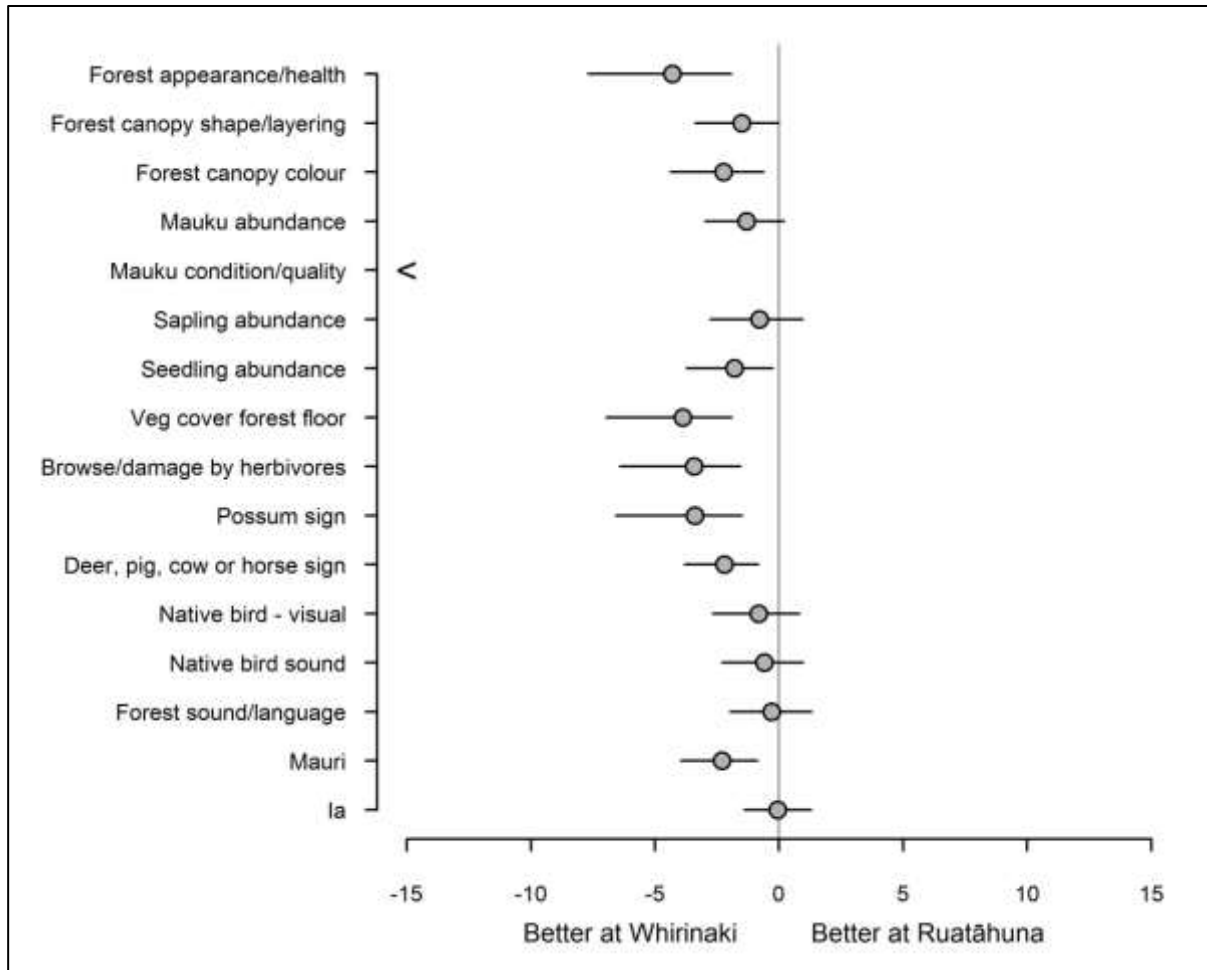
Plot-based monitoring system (pellet and bird counts)

Whirinaki vs Ruatāhuna



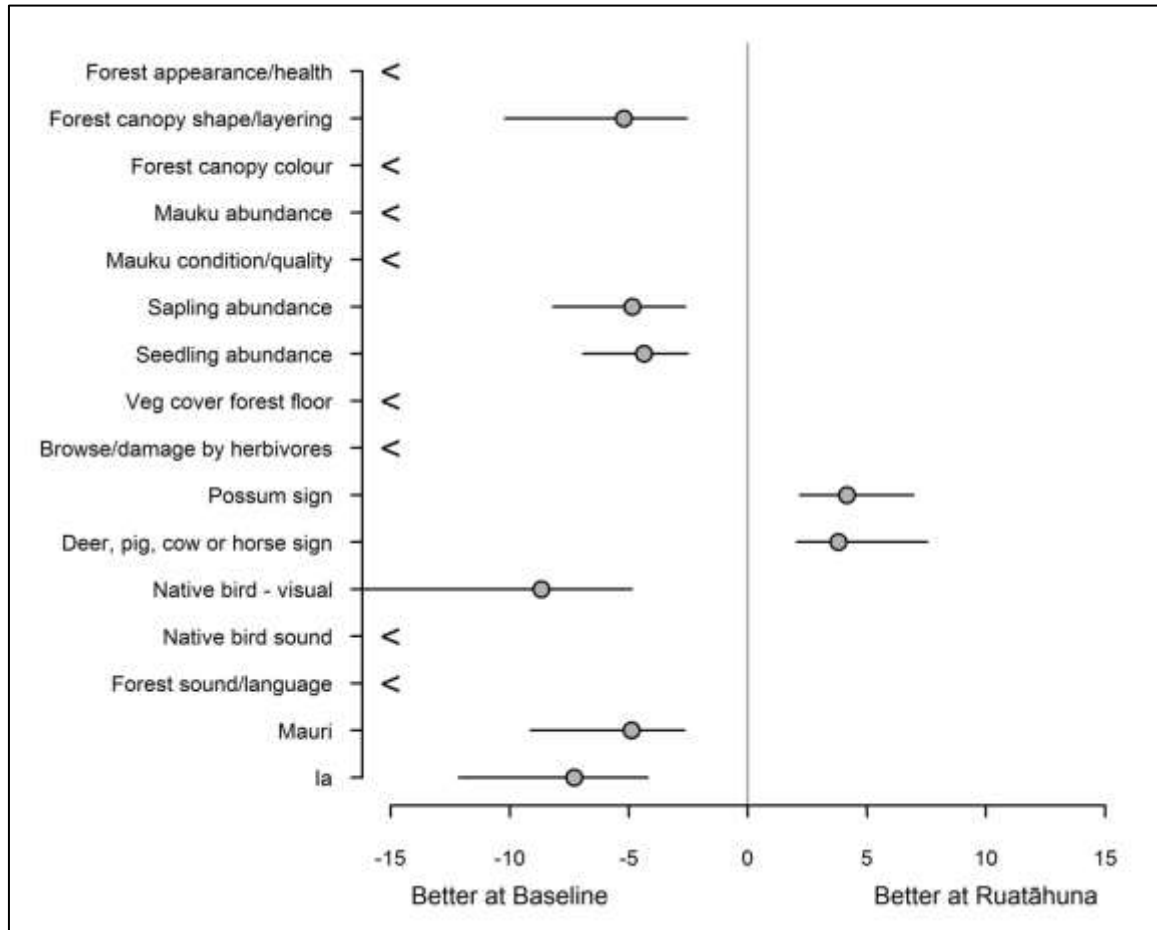
Community-based forest indicators

Whirinaki vs Ruatāhuna



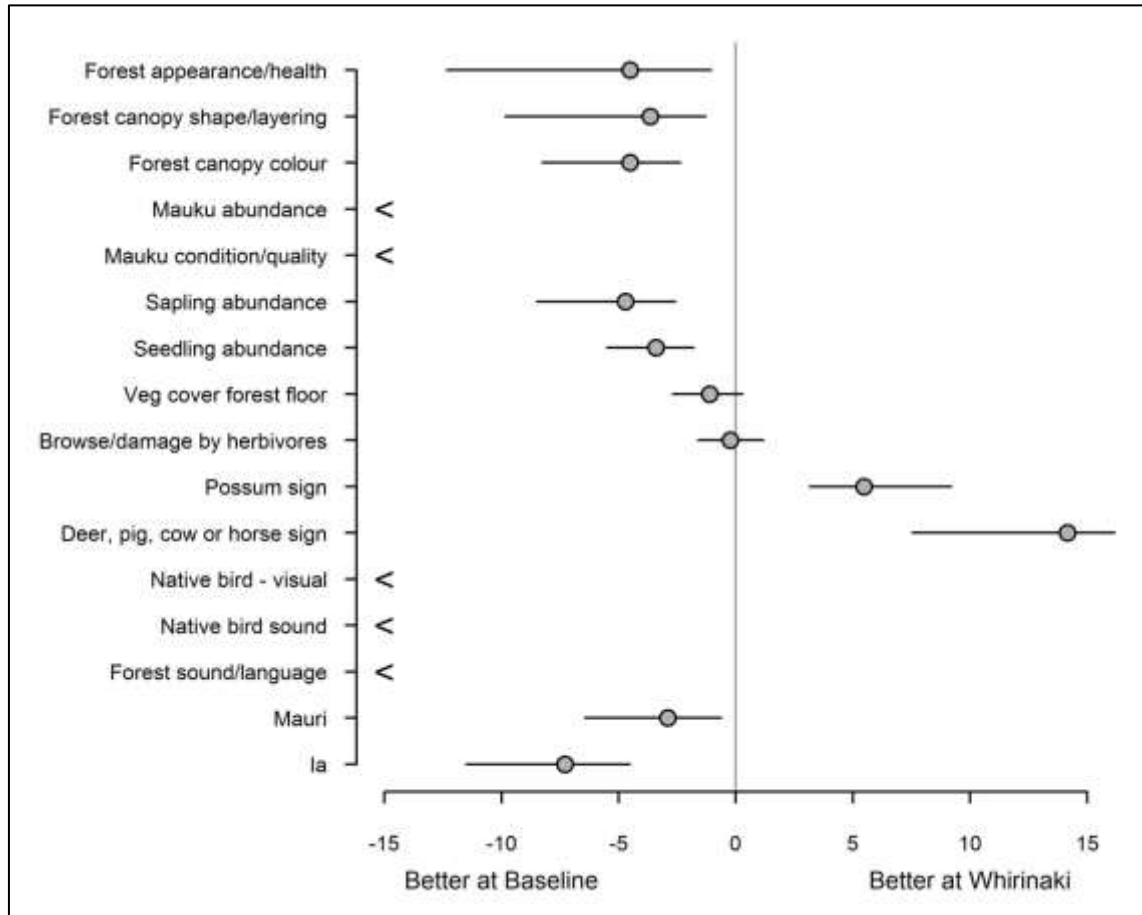
Community-based indicators

Oral history baseline vs. Ruatāhuna



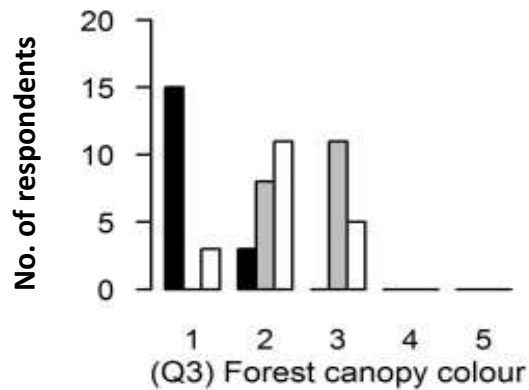
Community-based forest indicators

Oral history baseline vs Whirinaki



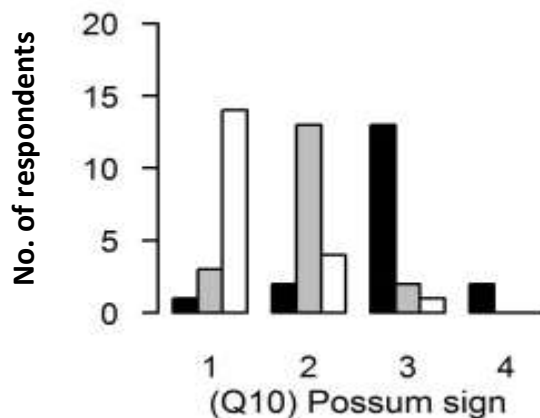
Frequency distribution scores for 16 forest indicators

- Historic baseline indicator scores for Ruatāhuna forests (black bars)
- Contemporary indicator scores Ruatāhuna forests (grey bars)
- Contemporary indicator scores Whirinaki forests (white bars)



The colour of the forest canopy

- 1) Glossy dark green
- 2) Olive green with patches of dark green
- 3) Olive green with shades of lighter greens and yellow
- 4) Grey and brown
- 5) Brown and dry

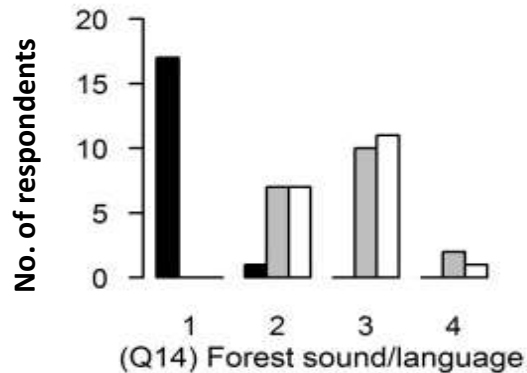


The amount of possum sign (possum pellets, bite marks and scratchings on trees) in the forest

- 1) Nothing
- 2) Not much
- 3) Common / Quite a bit
- 4) A lot

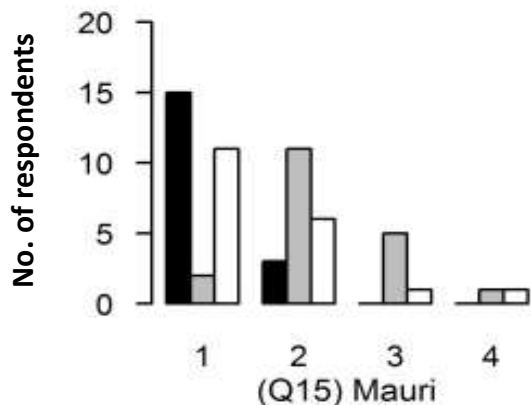
Frequency distribution scores for 16 forest indicators

- Historic baseline indicator scores for Ruatāhuna forests (black bars)
- Contemporary indicator scores Ruatāhuna forests (grey bars)
- Contemporary indicator scores Whirinaki forests (white bars)



The language or sound of forest

- 1) Loud and noisy / full diversity of sounds
- 2) Still lively and active but less forceful
- 3) Muffled / quiet / little sound
- 4) Dead silent / no noise



Overall health and well-being of the forest (*mauri*: life essence)

1. Active and flourishing / alive / healthy
2. Persists / still present but waning
3. Diminished / reduced capacity
4. Sleeping / dormant / hidden

Parting thoughts

Bicultural forest monitoring and reporting

General impressions

- Whirinaki forest generally in better state than Ruatāhuna forest (e.g. condition of mauri)
- Both Whirinaki and Ruatāhuna forests in poorer state than Baseline forest (e.g. condition of mauri)

Plot-based and community-based approaches

- Agreement - forest structure (Whirinaki better)
- Agreement - possum and ungulate abundance (greater in Ruatāhuna forest)
- Agreement - bird abundance (incl. language of forest)
- Contrasting results - forest regeneration (seedling and mauku abundance)



Parting thoughts

Bicultural forest monitoring and reporting

- Community-based monitoring approach allow for comparison with historical forest states
- Quantification of some indicators metrics will help negate shifting baseline effect – allow younger generation to survey
- Bicultural monitoring approaches offers ways to engage communities and weave in different knowledge systems
- Scaling up of community-based monitoring approach represents a challenge (nationally)
- Care needed to avoid institutionalisation of community-based monitoring approaches within current frameworks





Thank you! - Pātai?