

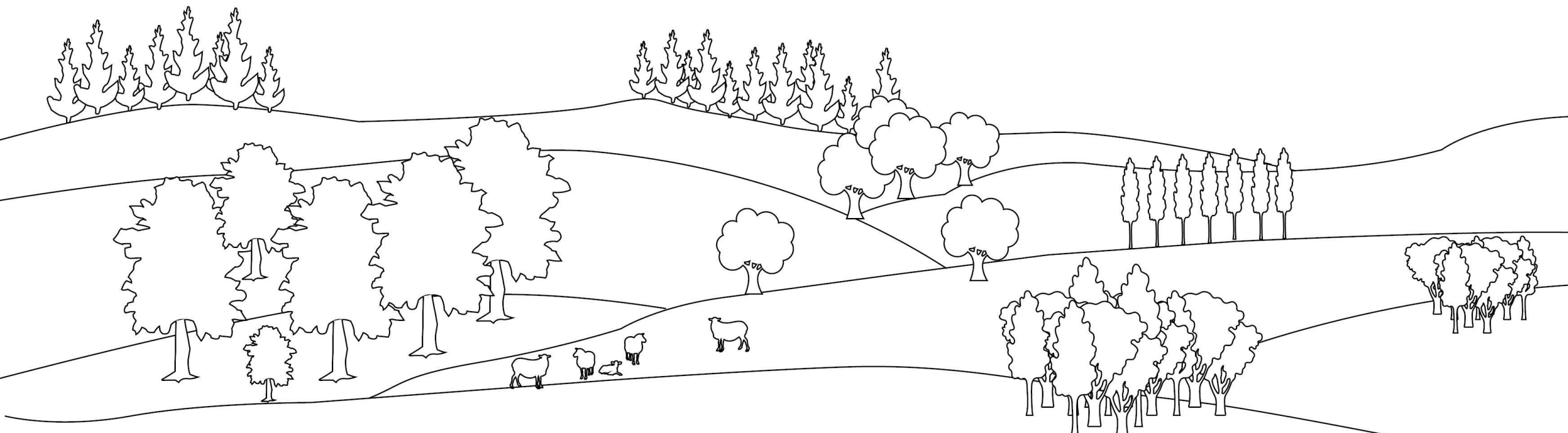


Manaaki Whenua
Landcare Research

How can small clusters of trees add value to rural landscapes?

MBIE Endeavour Research Programme 2022-27

David Whitehead & Sam McNally LINK Seminar 27 June 2023



Trees in landscapes

Te Kapunipunitanga a Tāne Mahuta

MBIE Endeavour Research Programme 2022-27



Critical issues

- Aotearoa New Zealand net carbon zero 2050
- Forest establishment is part of the solution
- 8.8 Mha hill country
- Impacts of exotic plantation forestry
- Present policy does not account for carbon stocks in isolated trees

Integrating mosaics of diverse tree clusters

- Edge effects not quantified
- Matched soil/tree type/climate not well tested
- Soil carbon measurement and accounting uncertain
- Landscape scale not tested
- Co-benefits not realised
- Te Ao Māori aspirations & priorities

Benefits of diverse tree clusters

- Increase biomass and soil carbon stocks
- Mitigate greenhouse gas emissions
- Increase diversity of commercial products
- Provide shelter and fodder for animals
- Maintain or enhance overall productivity
- Increase resilience of farm systems
- Reduce erosion
- Decrease fire risk
- Increase biodiversity
- Increase pollination
- Land-use is not 'locked'
- Increase visual amenity
- Enhance kaitiakitanga
- Improved livelihoods



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- kaitiakitanga
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Potential benefits from converting 170,000 ha (25% area proposed by Climate Change Commission) to grassland for the same land area of trees after 30 years

Assumes carbon stock increase is valued at \$50 tCO₂-eq
Land use classes 1, 2, 4, 5, 6^a

	Grassland	Permanent forestry	Optimised tree clusters
Biomass carbon tC/ha ^b	<2	148	184 (+24%)
Soil carbon tC/ha	106	92 (-13%)	117 (+10%)
Total stock increase 30 y MtC		22.8	33.1
Carbon value 30 y \$ billion		4.2	6.0
Methane reduction (MtC-eq) ^c		-0.53	up to -0.53
Value ecosystem services ^d \$ billion			0.64
Total benefits \$ billion		4.24	6.70

^a Beef+LambNZ ^b Te Uru Rākau, Climate Change (Forestry Sector) Regulations 2008
^c Ag Matters ^d Cameron et al (2020)

Outcomes

**Optimising
landscape
solutions**

**Values &
adoption**

**Biomass &
soil carbon
stocks**

**Predicting
scenarios**

Outcomes

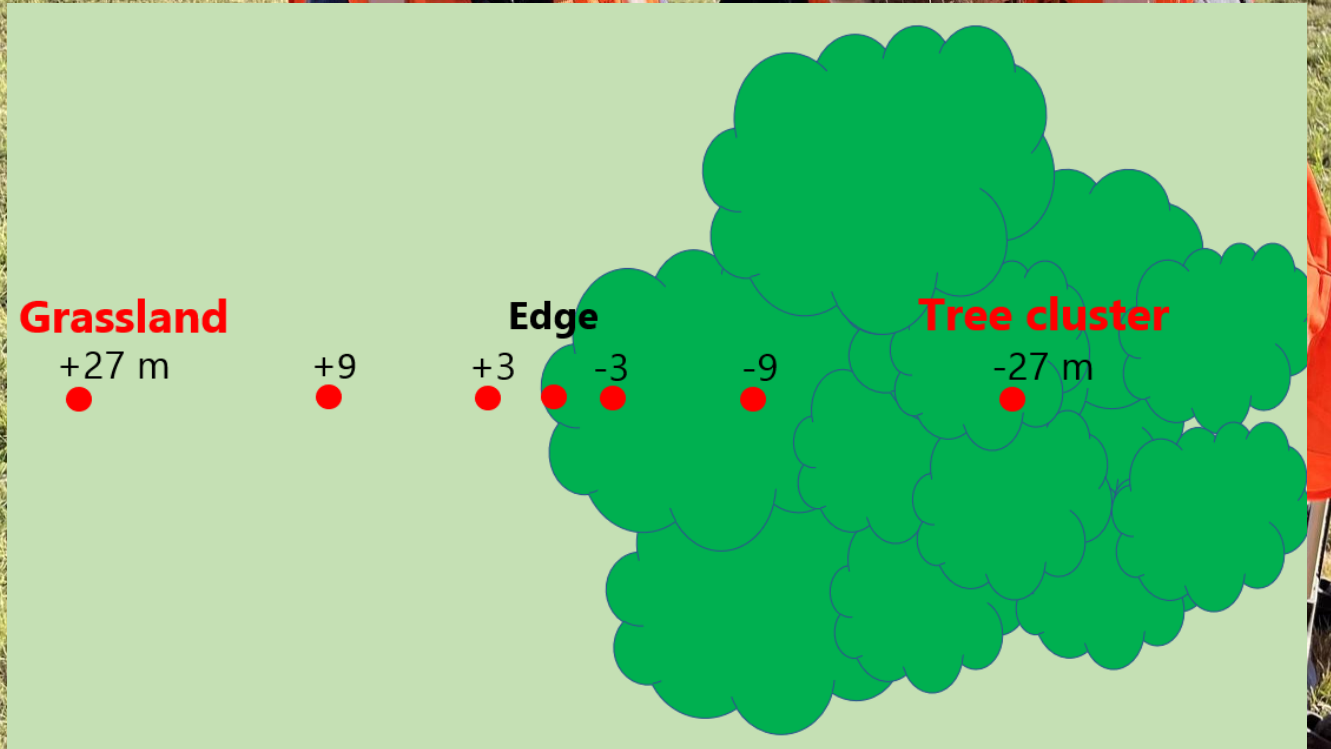
- Land manager awareness
- Barriers to adoption overcome
- Inform landscape design
- Inform emission reduction policy
- Enhanced kaitiakitanga

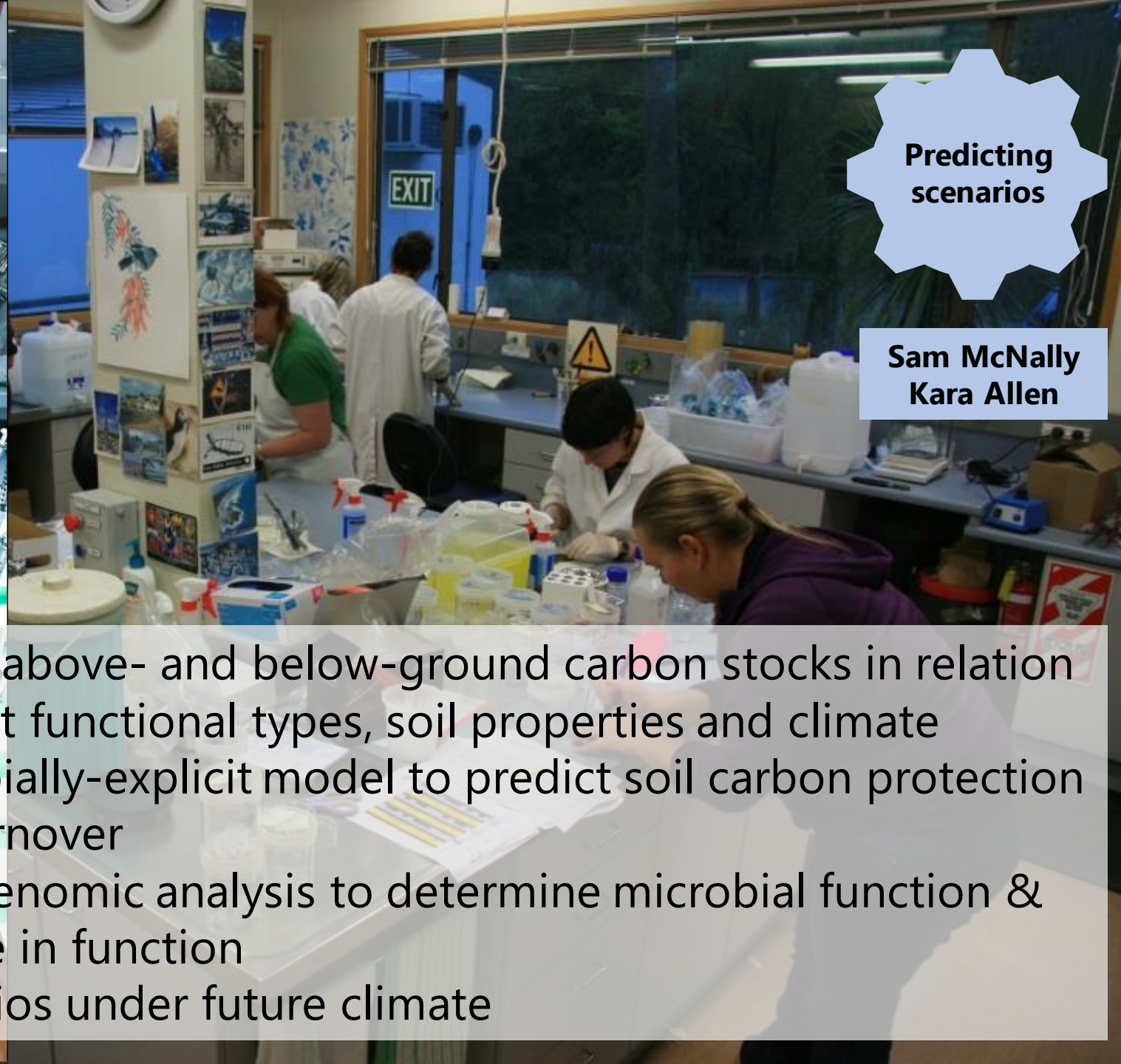
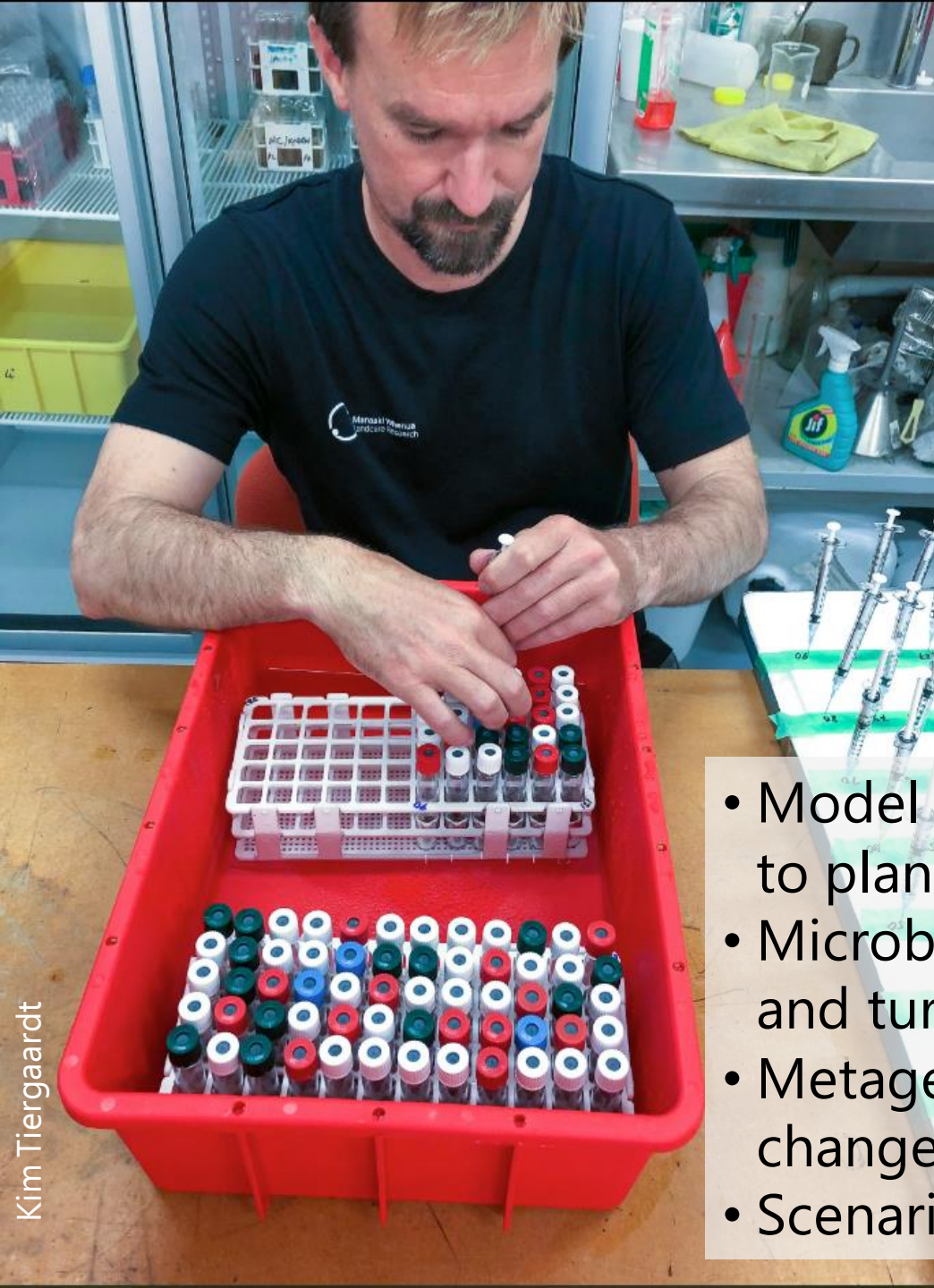
- Resilient agricultural systems
- NZ meets net zero carbon target
- Blueprint for future landscape design



Biomass & soil carbon stocks

**Scott Graham
Katherine Tozer**





Predicting scenarios

Sam McNally
Kara Allen

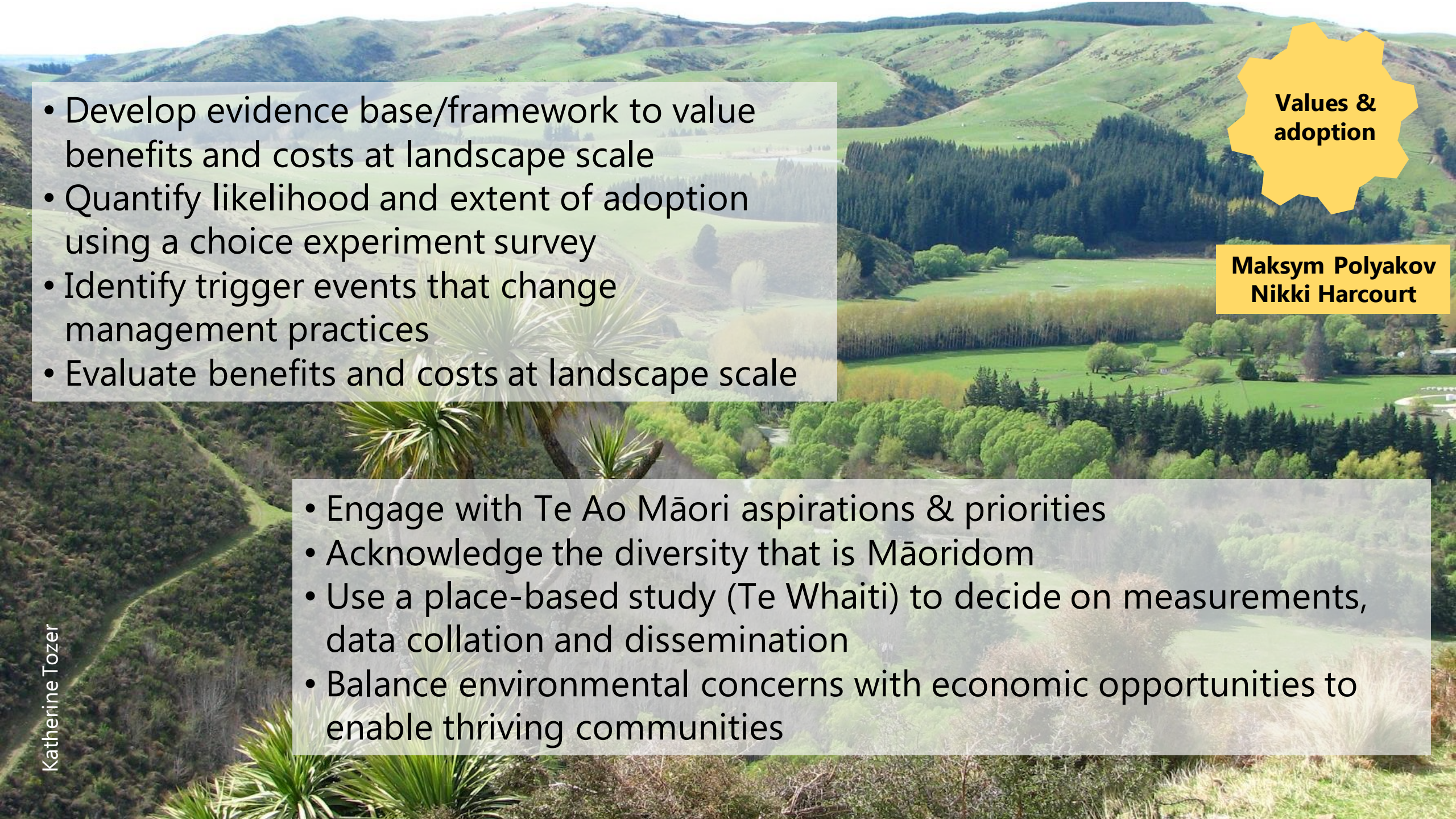
- Model above- and below-ground carbon stocks in relation to plant functional types, soil properties and climate
- Microbially-explicit model to predict soil carbon protection and turnover
- Metagenomic analysis to determine microbial function & change in function
- Scenarios under future climate



Optimising landscape solutions

Dan Richards
Alex Herzig

- Expand spatial carbon model to landscapes
- Model economic costs for all co-benefits
- Spatial simulation to test benefits of tree type, patch size, tree spacing, location
- Estimate impacts of scenarios on carbon stocks and other co-benefits including uncertainty

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- Develop evidence base/framework to value benefits and costs at landscape scale
 - Quantify likelihood and extent of adoption using a choice experiment survey
 - Identify trigger events that change management practices
 - Evaluate benefits and costs at landscape scale

Values & adoption

**Maksym Polyakov
Nikki Harcourt**

- Engage with Te Ao Māori aspirations & priorities
- Acknowledge the diversity that is Māoridom
- Use a place-based study (Te Whaiti) to decide on measurements, data collation and dissemination
- Balance environmental concerns with economic opportunities to enable thriving communities

How you can contribute

- Established groups of trees on your farms?
- Share your experiences using trees with us?
- Help us find suitable sites?
- Our databases to identify soil type and climate
- Non-destructive measurements on your farm?
- Participate in farmer surveys?
- We will share data from your farm with you
- Contribute additional research components?



End User Advisory Panel

MPI
MfE
Waikato Regional Council
Hawkes Bay Regional Council
Beef+LambNZ
PĀMU
Hikurangi Bioactives
Matekuare Whānau Trust
Kānuka Entity
Ngā Pou a Tāne
Tāne's Tree Trust

Research providers

Manaaki Whenua – Landcare Research
AgResearch
Scion
Lincoln University
Wageningen University, The Netherlands
University of Canterbury
Matekuare Whānau Trust

Centre Nationale de la Recherche Scientifique, France
West Virginia University, USA
Lawrence Berkeley National Lab, USA
University of Western Australia

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