



NEW ZEALAND'S
BIOLOGICAL
HERITAGE

Ngā Koiora
Tuku Iho

National
SCIENCE
Challenges



New Zealand's Biological Heritage

Ngā koiora tuku iho

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Cooperative Research Model

- 'Leveraged' funding
- Australia: Cooperative Research Centres
e.g. Invasive Animals CRC, Plant Biosecurity CRC
- USA: Industry/University Cooperative Research Centres (I/U CRCs)
- Germany: Fraunhofer-Gesellschaft Institutes
- UK: Catapult Centres
- **Collaboration**

Challenge Mission

*“To reverse the decline
in New Zealand’s biological heritage
Through a national partnership to deliver
a step change in research innovation,
globally-leading technologies,
and community and sector action”*



Biological Heritage Challenge

Distinctive role of new funding

- Aim with the Biological Heritage Challenge is to bring *both* Biodiversity- and Biosecurity-related research under one roof
- New funds catalyse innovative research
- Strengthen connections among research and stakeholder communities
- Interdisciplinary approaches
- Align/build on existing research programmes

Biological Heritage Challenge

Funded for 9 months (10-year timeframe)

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- Revised research plan submitted to MBIE in April has now been accepted
- End-user Advisory Panel (20 representatives from across Biodiversity and Biosecurity spectrum)
- Kāhui (6-person Māori advisory committee; independent representatives)
- Kaihautū (Māori researchers) embedded into all projects and programmes
- Emphasis on integration across disciplines, embedding social & economic researchers and Citizen Science

Biological Heritage Challenge

Programmes and Projects

3 Programmes

- Projects being developed within the Programmes

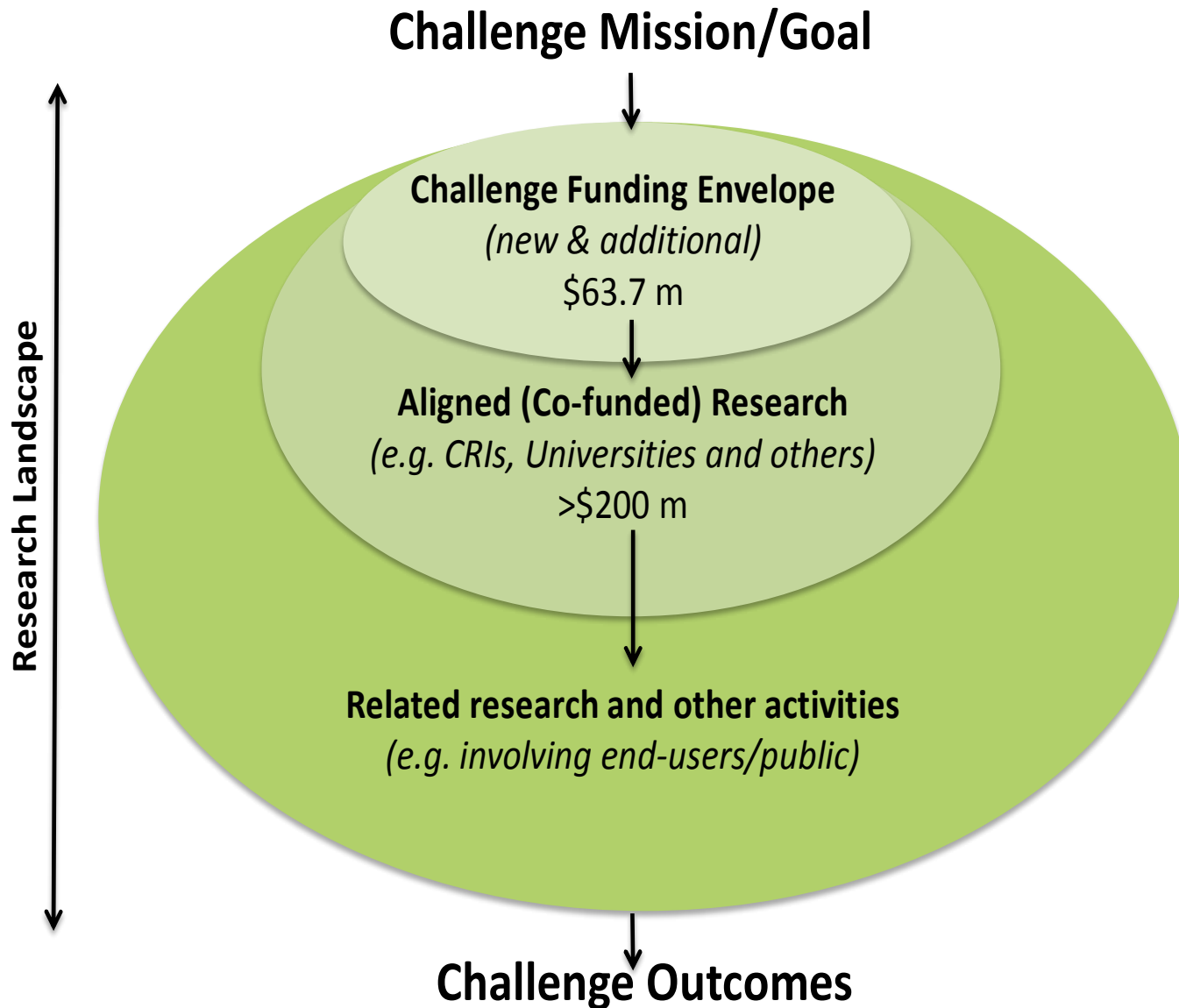
Projects being developed with these criteria in mind:

- Stick to broad areas set out in peer reviewed proposal
- Integrate across taxa, sectors, and ecosystems
- Emphasise novelty with explicit links to aligned funding
- Highlight both science *excellence* and *relevance*
- Vision Mātauranga
- Pull in co-funding and co-investment

Biological Heritage Challenge

Current state of play

- Projects on a continuum: 'good to go' through to 'more work to do'
- 3 projects to be contracted shortly
- Kāhui Māori and End-User Advisory Panel formed and developed criteria for project assessment
- Kaihautū providing input to all project briefs
- Māori Manager (Melanie Mark-Shadbolt) appointed and oversees all projects
- Director (Andrea Byrom) appointed



**Programme 3:
Restoring resilient ecosystems**

Reversing the decline of biological heritage

From: Climate change, invasive alien species, habitat loss, land-use change

Sustaining and restoring: Ecological processes and ecosystem connectivity

Involving: People and biological heritage: governance and stewardship

Whakawhānaungatanga

A process of: Establishing relationships - with the world, the people and with life

Optimising outcomes: Social, cultural, environmental, and economic

**Programme 1:
Real-time assessment**

Characterising biological heritage

1. Genomic characterisation of ecosystem function
2. Real-time surveillance and monitoring tools
3. Early detection of unwanted organisms
4. Citizens as active participants in monitoring and surveillance

**Programme 2:
Reducing risks and threats**

Protecting biological heritage

1. Next generation tools and technologies to mitigate threats
2. Social license to operate
3. Resilient networks to reduce unwanted organisms
4. Large scale management interventions

Upscaling: Local + Regional + National

- 3 Programmes in the Challenge
- P3 provides framework and context for the Challenge as a whole
- Overarching theme: resilience

Programme 1: Real-time biological heritage assessment

Outcome: Biological heritage information is available at relevant scales and in real time to enable biodiversity and biosecurity impacts to be considered in management decisions

KPI: Methodologies adopted for rapid biosecurity and biodiversity assessment and monitoring

Three Projects, all interrelated and dependent

Programme 1: Real-time biological heritage assessment

- Project 1.1: Mātauranga Māori characterisation of NZ's biodiversity
- Project 1.2: Genetic characterisation of NZ's terrestrial and freshwater biota
- Project 1.3: A national framework for biological heritage assessment across natural and production landscapes

A national framework for biological heritage assessment across natural and production landscapes

Project Leader, Robert Holdaway (LCR)

PRIMARY GOAL: To develop a New Zealand-wide framework and platform for bioheritage measurement and monitoring using environmental DNA (eDNA) data*

1. Develop standardised robust methods for studying eDNA
2. Establish national eDNA informatics platform for the measurement and monitoring of NZ's bioheritage
3. Use eDNA data to address questions on ecological function, biosecurity and biodiversity conservation at the NZ-wide scale

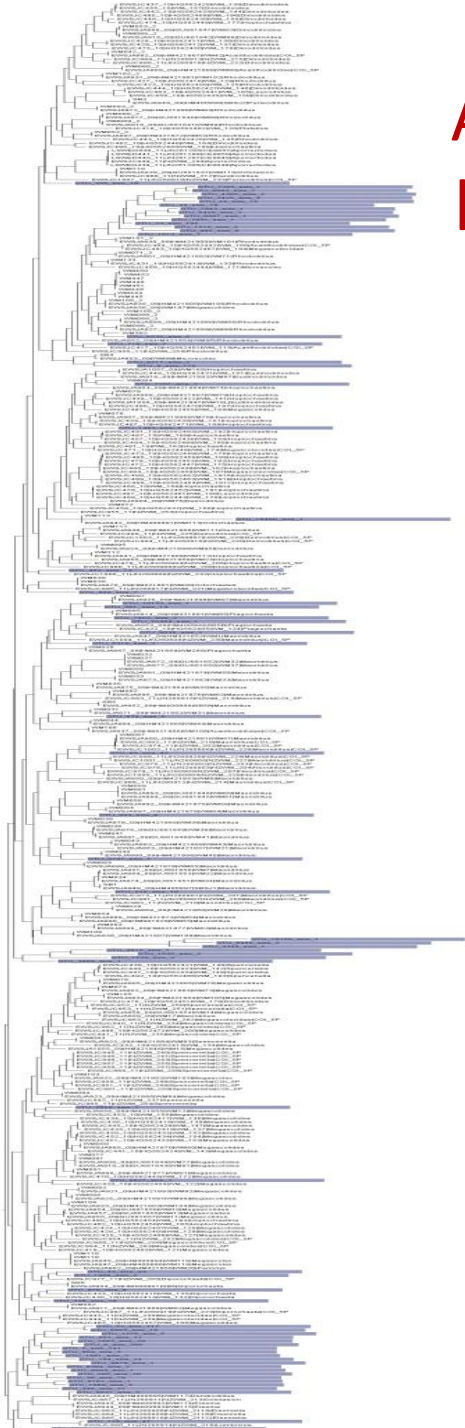
*Stakeholder workshop (Sept 28-29)

A national framework for biological heritage assessment across natural and production landscapes

- **Methods development** (sampling - integrating with existing methods, molecular, bioinformatics)
- **Data compilation** (eDNA “virtual hub”)
- **Data interpretation** (biosecurity, interpretation metrics “eDNA indicators”)
- **Case studies applications** – citizen science, VM, freshwater/terrestrial – these will rely on techniques and infrastructure developed above

A national framework for biological heritage assessment across natural and production landscapes

- eDNA can detect target species of biodiversity and biosecurity concern
- Requires cultural licence (**Project 1.1**)
- Requires connection to taxonomic knowledge...(**Project 1.2**)



Project 1.1: Mātauranga Māori characterisation of NZ's biodiversity

- Leader: Phil Wilcox (Otago Uni)
- **Part 1:** Cultural license to operate eDNA framework
- **Part 2:**
 1. How can Māori communities halt the decline of Traditional Māori Ecological Knowledge by reconnecting with their TEK and biodiversity?
 2. How do we reconnect Māori communities with local genotypes and genetic information, and integrate these data with other information sources?
 3. Mātauranga hou: our evolving knowledge base. How do Māori communities generate and utilise new knowledge about new species?

Project 1.2: Genetic characterisation of NZ's terrestrial and freshwater biota

- Large scale genetic characterisation to underpin **1.3**
- Need to focus research questions, methods, and outcomes:
 - Connect taxonomic names to eDNA data
 - Connection to NZ taxonomic capability, collections and data bases
 - Prioritisation process (soil biota, biosecurity relevant groups, threatened species, etc)

Programme 2: Reducing risks and threats across landscapes

Outcome: Prevent biosecurity invasions and mitigate damage to indigenous and managed ecosystems at landscape scale

KPI: Reduced rates of incursion/establishment and impacts of pests, diseases and weeds of significance to natural and production ecosystems

Four Projects, all interrelated and dependent

Programme 2: Reducing risks and threats across landscapes

- Project 2.1: Biosecurity network interventions
- Project 2.2: Novel wasp control technologies
- Project 2.3: Hi-tech solutions to invasive mammal pests
- Project 2.4: Māori solutions to biosecurity threats and incursions to taonga species

Project 2.1: Biosecurity network interventions

- Leader: Philip Hulme (Lincoln University)
- Research will focus on the relative roles of four different human-assisted networks:
 - a. Ornamental horticulture network
 - b. Livestock transport network
 - c. Lakes and recreational user network
 - d. Natural area visitor network
- Biosecurity managers will use our integrated tools to predict post-border pathways and the optimal management for specific pests. This will improve targeting of pest surveillance, prioritisation and management at multiple scales.

Project 2.2: Novel wasp control technologies

- Leader: Philip Lester (Victoria University Wellington)
- Research will focus on the relative roles of new technologies for wasp control:
 - a. Novel genetic technologies (RNAi and mtDNA)
 - b. 'Trojan mites' to deliver pathogens into wasp nests
 - c. Smart dispensers to deliver pheromones or insecticides
 - d. Develop wasp eradication strategies for these tools
- Socially acceptable, cost-effective and targeted next-generation tools will be in use at landscape-scale to control wasps in natural and production ecosystems.

Project 2.3: Hi-tech solutions to invasive mammal pests

- Leader: Dan Tompkins (Landcare Research)
- Research will focus on the relative roles of new technologies for small mammal control:
 - a. Novel tools and technologies for cost-effective, landscape-scale control, eradication and surveillance
 - b. Designer lures to increase knockdown efficiency
 - c. Tailoring specific lethal control agents
- Production and conservation sectors, iwi and communities have access to an array of improved tools, methodologies and strategies for the improved surveillance; intervention prioritisation; and eradication/control of small mammal pests.

Project 2.4: Māori responses to biosecurity threats

- Leaders: Amanda Black (Lincoln Uni); Nick Waipara (Auckland City)
- Research will use case studies to understand how we incorporate mātauranga Māori with contemporary methods to improve biosecurity:
 - a. landscape epidemiology of *Phytophthora* (including PTA);
 - b. threat of myrtle rust (*Puccinia psidii*) to taonga species
 - c. safeguard Māori kiwifruit economy from *Pseudomonas syringae* *pv.* *actinidiae* (Psa-V).
- Case studies demonstrate how iwi and Māori organizational responses to biosecurity risks and threats can incorporate mātauranga approaches and culturally appropriate solutions, and protect taonga species.

Programme 3

Enhancing and restoring resilient ecosystems

Outcome

Resilience to vulnerable ecosystems is enhanced, preventing irreversible tipping points resulting from biotic invasion and biodiversity loss compounding stressors such as land-use intensification and climate change

***KPI:** National and regional strategies for sustaining natural capital are reducing rates of degradation/loss of significant biodiversity in natural and production ecosystems*

Programme 3

Enhancing and restoring resilient ecosystems

- 3.1 Predicting and managing ecosystem tipping points
- 3.2 Customary approaches and practices for optimising cultural and ecological resilience *
- 3.3 Enhanced biodiversity and ecosystem services in production landscapes
- 3.4 Interdependencies within and between ecosystems

Programme 3

Project 3.1 Predicting tipping points

Jason Tylianakis (UoC)

Identify biotic and abiotic attributes that confer ecosystem resilience

Predict tipping points before thresholds are crossed

- ID interventions that drive positive feedbacks
- Indicators of state transition
- Drive recovery of native biota in landscapes yet deliver on primary production goals
- Local, regional and national scale resilience
- Social indicators in addition to ecological indicators
- Freshwater and terrestrial ecosystems

Programme 3

Project 3.2 Customary strategies for optimising cultural and ecosystem resilience

Phil Lyver (LCR)

Quantify ecological and cultural resilience in multifunctional landscapes

Link to community well-being and livelihoods

- Quantify mechanisms or 'rules of thumb' used by Māori to optimise resilience and social utility
- Determine how Māori identify and account for risk and uncertainty, and define safe opportunity, interventions, and stopping rules
- Ensure that customary use is built more explicitly into policy and legislation

Opportunities

- Engagement with you, the stakeholders and end users, is critical to Challenge success
- Additionality / the 'sweet spot'
- Transferable skills, integrated research opportunities, 'big picture' thinking
- 'Ask not what the Challenge can do for you, but what you can do for the Challenge'



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