National SCIENCE Challenges | NEW ZEALAND'S BIOLOGICAL HERITAGE | Ngā Koiora Tuku Iho

New Zealand's Biological Heritage National Science Challenge
Ngā Rākau Taketake

Risk Assessment & Ecosystem Impacts

About our research theme

Our overarching goal is to understand **which species and ecosystems are most at risk** and **what the impacts of the diseases are**, so we can prioritise efforts and inform better management decisions.

In this theme, **standardised impact measures** are being developed to quantify the impact both kauri dieback and myrtle rust are having on affected ecosystems. We take a holistic view of ecosystems, meaning the impact measures will also examine **broader ecological impacts,** including on **associated flora and fauna**, on **ecosystem functions** and on **human cultural, social and economic relationships**. We also take a holistic view of the threat, meaning we will consider the effects of both the pathogens themselves and the tools and systems used to manage them.

Our goal requires first characterising kauri and Myrtaceae ecosystems, establishing baselines against which to measure change, and prioritising key indicators for monitoring. Throughout this process, we will build on existing work and strengthen the collaboration between kaupapa Māori and western science approaches to ensure indicators are relevant and meaningful across communities.

The impact measures will in turn inform a more comprehensive **risk assessment for ecosystem impact**, and identify where risk lies, both geographically and with regard to the nature and degree of impact. Ecosystem impact assessment is comprised of measures of ecosystem health and resilience, using an integrated western science and Mātauranga Māori framework.

Māori have long advocated for an ecosystem-level approach to kauri dieback and myrtle rust, and this workstream aims for **a kaupapa Māori and ecosystem-level approach**, focused at site-to-landscape scales.

How the theme has been developed so far

This work plan is a work in progress. The goals and research areas described in the draft plan grow directly out of the Ngā Rākau Taketake Scoping Group Report and development process. That, in turn, was informed by the Kauri Dieback Science Strategy and Myrtle Rust Science Strategy all within the context of the overall Biological Heritage Challenge strategy. The theme co-leads have attempted to synthesize and give effect to the intentions of these existing efforts. However, our intention is that the work plan will grow and adapt over time as we learn and continue to engage with all those concerned with kauri dieback and myrtle rust.

Our work must be closely integrated with those of other Ngā Rākau Taketake Themes, wider Challenge Strategic Objectives and other research programmes. At present, we are aware of potential overlaps which will need to be addressed. We are engaging with these other programmes to agree how to divide or collaborate on such areas but have included the work here for the sake of completeness. This too will be an ongoing process throughout the life of the programme.

We are also aware we will not be able to fund all the work that needs to be done. It will be necessary to prioritise how funding is allocated, to share funding with aligned Challenge themes and strategic objectives, and to seek co-funding from outside sources.

Overview of the Research Areas

RA1 – Comprehensive ecological, cultural, social and economic indicators for assessment

This workstream seeks to establish agreed-upon indicators for assessing the impacts that kauri dieback, myrtle rust and their management have on kauri and Myrtaceae ecosystems. We will take a holistic view that considers impacts on:

- the affected host species,
- associated species and ecosystems,
- wider ecosystem functions,
- associated cultural, social and economic functions, and
- the processes (techniques) and relationships involved in management.

We aim to do this in a way that integrates mātauranga Māori and western science measures, recognising the value that each bring and helping to ensure our indicators are relevant and meaningful for mana whenua, communities, government, researchers and all others who will use them.

This work will build upon other relevant indicator frameworks, including: the MPI-funded projects to assess risks and impacts of myrtle rust, the Cultural Health Index, DOC biodiversity indicators. We will integrate these indicator frameworks and adapt them as necessary to provide the holistic view of ecosystem health we seek.

RA2 – Ecosystem characterisation

This workstream seeks to characterise affected kauri and Myrtaceae ecosystems and understand the risks and impact of these diseases from both western science and mātauranga Māori perspectives. It builds upon current projects assessing how the disease affects plant reproduction in the short term and recruitment and plant community composition over the long term. The work includes impacts on flora, fauna, and microorganisms that are dependent on the host species as well as impacts on the soil ecosystem and ecosystem functions (e.g. soil, carbon, water and nutrient cycling; pollination).

This work closely aligns with the Beyond Myrtle Rust programme (RA 1.2: Ecosystem Impacts: Investigate broad-scale impacts of *Austropuccinia psidii* on ecosystem functions) and builds upon the kauri dieback and myrtle rust science plans.

- Engage with mana whenua and existing research programmes to establish field trial locations and protocols
- Characterize kauri and myrtle ecosystems following western science and mātauranga Māori methodologies
- Develop and verify ecosystem level indicators

RA3– Social, cultural and economic characterisation

This workstream will address the social, cultural and economic impacts of kauri dieback and myrtle rust and the related management efforts. To do so, it will first be necessary to develop and test methods to assess key indicators where data is lacking.

Research on "Evaluating Impacts and Responses" under the initial myrtle rust response research highlighted the lack of social and cultural indicator data. Several key aspects of impact lacked either baseline data or even agreed-upon methods for assessment.

This RA will address the following challenges and questions:

- How to construct social and cultural indicators which are both relevant to affected mana whenua groups or communities while still comparable and consistent across a national scale.

- How to measure qualitative impacts in ways which are acceptable and meaningfully comparable.
- How to untangle the impacts of plant pathogens from among the many complex factors that may also be affecting social, cultural and economic measures.

Social, several cultural and economic impacts currently lack established or agree-upon indicators. For example, various measures have been developed to assess aspects of Māori cultural practice or wellbeing but may not be accepted outside the mana whenua groups they were developed for; several western science measures exist to assess aspects of wider social wellbeing but may not reflect Māori worldviews. We will work to integrate these efforts, applying kaupapa Māori approaches to address the span of cultural, social and economic measures while also adapting western science methodologies to better represent Māori. This RA may also include work to refine indicators to assess the process of management, governance, partnerships and relationships.

RA4 – Risk assessment

The final workstream brings together findings from RA1-3 to inform a comprehensive risk assessment for kauri dieback and myrtle rust. A flexible risk assessment framework will be established in year 1 to enable a preliminary risk assessment based on existing data and to highlight areas where data or research methods are lacking. The risk assessment will be revisited annually to incorporate additional findings from RA1-3 and other Ngā Rakau Taketake themes and Bioheritage strategic objectives (SOs).

Impact measures:

Success will mean that standardised methods to determine impact in broad socio-ecological systems have been developed. The monitoring and mapping framework combined with host range testing contributes to defining the long-term ecological impacts of kauri dieback and myrtle rust, including ecosystem health and resilience. Kauri and Myrtaceae ecosystems have been characterised and non-host species at risk of decline or extinction have been identified. These assessments will inform prioritisation of species for conservation. Bioindicators of impact have been identified, tested, and proved.

- Indicators of ecosystem, social, cultural and economic impacts have been developed, agreed-upon, validated and prioritised, and then applied in other workstreams and/or research programmes to assist with decision-making
- Ecosystems have been characterised with high-risk species identified, and this information has informed conservation and restoration work
- Social, cultural and economic indicators have been developed with agreed-upon methods and baseline assessments established.
- Risk analysis methodologies have been tested and applied in an iterative manner to guide ongoing management and research decisions.

The initial indicators and risk assessment frameworks will have gaps where we lack baseline data or, at times, clear assessment methods. Therefore, the frameworks will have to be iterative, beginning from those indicators and data sets which are available and working towards developing and including those which are best as we progress.

Project Team

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