

## 2022 UPDATE TO DONORS: Kauri Dieback Research Fund



### THANK YOU

Kauri, an iconic, national taonga, are the beating heart of New Zealand's northern forests, and no Kiwi would be able to imagine Aotearoa without them. When we began to focus our research on fighting to save this important species through the development of the Forest Health Research Theme within the George Mason Centre for the Natural Environment, we began with a goal – 'save a forest'. If we can find a way to save one forest, we can save many, many more.

With the support of almost 400 generous donors to the 2022 Christmas Appeal and the Auckland University Field Club Centenary fundraising, we have been able to progress three PhD and one MSc research projects including the impact of phosphite on *Phytophthora* communities, developing a biosecurity decision-making framework interfacing science and culture, virus diversity within *Phytophthora agathidicida*, and developing an integrated toolbox of kauri dieback management tools. Thank you for taking us so much closer to 'save one forest' (and more!).

It is a privilege to update you on the work you have made possible to contain, treat and manage forest health. We look forward to sharing future progress with you.

With best wishes,

**Nari Williams**

Forest Health Team Lead

George Mason Centre for the Natural Environment



## BACKGROUND

Kauri dieback disease is caused by a microscopic, soil-borne pathogen called *Phytophthora agathidicida* (PA), which is related to the golden-brown algae.

Since the first reported case of the disease on Great Barrier Island, the PA organism has been found as the cause of disease in the North Island, infecting regions in the North Island from the Coromandel Peninsular in the South, right up to the Waipoua Forest and beyond in the far north. This forest is home to the majestic, ca. 1,250-year-old Tāne Mahuta – the nation's most iconic kauri.

Although certain treatments such as phosphite have been used on infected trees to slow the spread of disease, there is currently no known cure.

The most critical research issues for Adaptive Management of Kauri Forest Health are focussed in two pipelines that feed into on-ground adaptive management: (1) Management Tools and (2) Pathogen Dynamics and Risk.

## FOREST HEALTH RESEARCH

The past year has been very busy in Forest Health, both within our projects and nationally.

In 2021, the science and operational team of the new Tiakina Kauri (Kauri Protection Agency, MPI) was appointed with a strong focus on operational surveillance at the landscape level to inform on-ground forest health management. Nari has been engaged as a science advisor to the program and has been working closely with Dr Lauren Waller, the newly appointed Science Lead for Tiakina Kauri.

Having identified priority areas throughout kauri lands, sizable areas of forest currently have on-ground operational surveillance programs being stood-up in parallel with aerial remote sensing

data captures that will give the first baseline forest health assessment of kauri for many significant forests and will naturally identify priorities for on-ground management and response to kauri dieback. Critically, this is being done in partnership and data sovereignty and transparency agreements between mana whenua and agencies.

Our collaborating partners, Te Roroa have recently progressed remote sensing of the entirety of Waipoua Forest. Data from this acquisition will be used in one of the PhD projects to assess the physiology of trees in existing treatment trials while also establishing baseline data for upcoming trials in these forests.

Recent Forest Health Highlights have included:

- Nari Williams appointed Regional and Executive Committee Chair for the International Union of Forest Research Organizations (IUFRO) Working Party 7.02.09: "Phytophthora in Forests and Natural Ecosystems".
- Successful New Zealand proposal to host IUFRO Working Party 7.02.09: "Phytophthora in Forests and Natural Ecosystems" conference in 2024.
- Steven Ou awarded student/Early Career Researcher (ECR) bursary from Australia Plant Pathology Society, to attend the Australian Plant Virology Workshop meeting in Melbourne in December 2022.

Student presentations have included:

- Shannon Hunter presented Phytophthora in Forests and Natural Ecosystems conference in Berkeley in June 2022.
- Matt Arnet and Steven Ou presented to the University of Auckland Field Club in October 2022.

- Steven Ou presented on Phytophthora Host Interactions Workshop in Christchurch in November 2022.

### Shannon Hunter PhD Update

Shannon Hunter has settled into the experimental work of her PhD and is making tremendous progress in characterising the Phytophthora populations associated with kauri, and testing the impacts on these of treatments that may be applied through targeted foliar sprays.



Shannon is analysing the data from a preliminary set of metabarcoding data targeting Phytophthora species within soils collected from the Waitakere Ranges. In spring Shannon commenced a series of lab trials testing the foliar application of phosphite formulations on leaves and twigs. Her plans to commence glasshouse trials needed to be adjusted due to restricted access to the glasshouse due to COVID and so are still running and will be harvested before Christmas.

Finally, Shannon has established a field site in the Auckland region and surveyed the tree health and Phytophthora community across the site and implemented a treatment trial in which she will monitor changes in the Phytophthora community associated with treatment with phosphite.

Prior to commencing her PhD, Shannon was a Research Associate at Plant & Food Research and holds a Bachelor's in Biology and Environmental Science from the University of Auckland and a Master's from the University of Waikato where she studied the variable response of Phytophthora species to phosphite and risk of pathogen populations developing resistance to treatments.

We are delighted to share that Shannon is now in the process of preparing the first two aspects of her studies for publication.

### Matthew Arnet PhD Update

Matthew Arnet began his PhD in June and will build on existing kauri treatment trials, integrating the use of remote sensing tools for monitoring tree and forest health following management interventions.



Matthew's PhD is identifying the current management strategies for PA including phosphite use; and using technology including thermal imaging to detect PA which can make tree canopies warmer. Matthew is also obtaining aerial images and identifying tree previously treated with phosphite (including trees treated by the Field Club up to 10 years ago – thank you!).

Matt was previously a research associate in the Hawke's Bay working at Plant & Food Research and holds a Bachelor's in Biology and a Master's in Plant Biology from the University of Canterbury.

### Steven Ou Master's Update

Steven Ou is undertaking his Master's research on viruses that infect *Phytophthora agathidicida*. This exciting project picks up on



emerging evidence that viral infections associated with fungi and oomycetes can lead to hypo- and hypervirulence, a phenomenon that has been reported in several fungi and oomycetes, where the pathogenicity was discovered to be increased, reduced, or lost completely upon viral infections. Steven will determine if such viruses are present in *P. agathidicida* and whether there is potential for

these to be used as novel biological controls for kauri dieback.

The soil biome is composed of complex interactions between multicellular organisms and microbes. The microbes may harbour viruses that can alter their pathogenicity, and subsequent interactions with other microbes and their host plants. Because of the devastating ecological effects of the causal agent of kauri dieback (*Phytophthora agathidicida*) and scarce knowledge of the kauri forest soil biome, the research aims to describe viruses of *P. agathidicida*. The total nucleic acid was isolated from New Zealand *P. agathidicida* isolates collected from soil within kauri ecosystems. Viral dsRNA was enriched using dsRNA antibodies and circular DNA viruses were enriched using rolling circle amplification. Illumina high-throughput sequencing of enriched viral nucleic acid was performed. The findings from this research will narrow the knowledge gap of the soil microbiome around kauri trees and hope to better inform biosecurity efforts to better manage kauri dieback in New Zealand.

Steven has a Bachelor's in Biology/Biological Sciences and a Postgraduate Diploma in Biosecurity and Conservation from the University of Auckland.

## NEXT STEPS

In 2023, as part of Matthew Arnet's project, we plan to set up new phosphite trials in the Waipoua forest in consultation with Te Roroa. The use of aerial multispectral images will assist

in identifying any phytotoxic effects from the phosphite, changes in canopy over time (an indicator of forest health), and changes in canopy temperature over time (an indicator of *Phytophthora* presence). We will also measure kauri physiology in response to phosphite injection.

We look forward to welcoming a new PhD researcher to our team in 2023, Ashika Prasad, whose project will be: Investigating the population structure, mating type, pathogenicity and phenotypic traits of *Phytophthora cinnamomic* in New Zealand – implications for disease impacts in horticultural and natural forest estates within climate change.

## IMPACT

*A society grows great when old men plant trees in whose shade they shall never sit.*

The future of our forests will require all of us, working together, to fulfil our roles of kaitiakitanga/guardians.

With your support, not only are we one step closer to 'save one forest', we are also growing the next generation of scientists to continue this work. You are providing postgraduate students with the financial assistance they need to continue their mission of protecting our country's national identity and ecosystem.

**Together, we can save our Kauri for future generations to treasure and sit beneath.  
Thank you.**

**If you would like to know more about supporting Kauri Dieback Research, contact:**

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**ANASTASIA PAPADAKIS, DONOR DEVELOPMENT MANAGER**

Alumni Relations and Development

**Waipapa Taumata Rau | University of Auckland**

Private Bag 92019, Auckland 1142, New Zealand

Telephone: +64 64 21 060 3616 | Email: [a.papadakis@auckland.ac.nz](mailto:a.papadakis@auckland.ac.nz)