

# Surveillance systems of airborne pathogens in Australia's Botanic Gardens

**Presenter:** Dr Rohan Kimber, SARDI – Plant Health & Diagnostics, PRC, Urrbrae, Adelaide

## Project team:

- Australian National University – Benjamin Schwessinger, Sonja Brodersen, Mareika Moeller, Yapeng Lang, Zhenyan Luo, Ashley Jones
- Data Effects – Andrew Baker, Paul Coldrey
- SARDI – Kelly Hill, Daniele Giblot-Ducray, Nicole Thompson, Jamus Stonor

## Project partners

- Nine major Botanic Gardens, and
- Australian Network for Plant Conservation

## Funded by:

- Department of Climate Change, Energy, the Environment and Water – Saving Native Species program



# Key outputs



- **Improve monitoring of airborne *Austropuccinia psidii* (myrtle rust)**, using next generation automated cyclone samplers, in partnership with Botanic Gardens throughout Australia.
- Improve threatened species and risk assessments using an **early warning system of new or environmentally influenced threats from airborne myrtle rust** within the Botanic Gardens network and importantly, identify strains/variances of concern implementing a novel diagnostic tool (ANU).
- **Engage in communication and education activities**, with our collaborative partners, highlighting the importance of plant conservation and biosecurity with schools and special interest groups, and the general public..



Australian Government  
Department of Climate Change, Energy,  
the Environment and Water



Australian  
National  
University



Government  
of South Australia  
Department of Primary  
Industries and Regions



This project received grant funding from the Australian Government Saving Native Species Program

# Airborne myrtle rust surveillance in Botanic Gardens

## Myrtle rust

A threat to native species



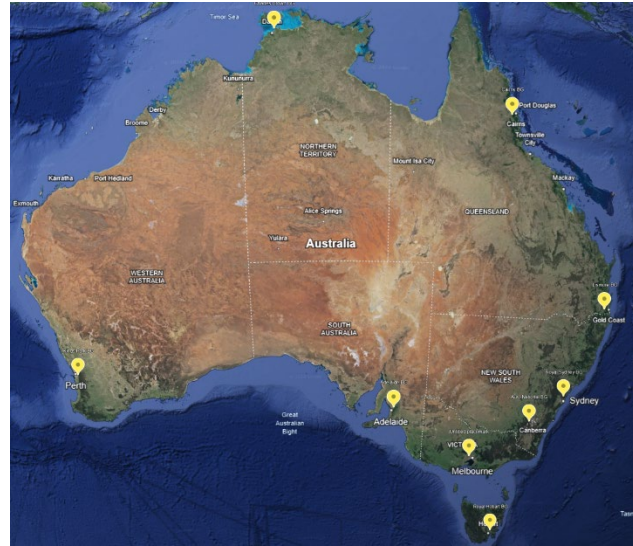
5 species  
Critically  
Endangered due to  
the disease



A further 30 native  
species in decline



Over 300 known  
susceptible  
species



Primarily spread by wind



Typically affects new shoots and young leaves



Limited active treatments for land managers



Growing need to identify and breed genetic resistance



Identified by its yellow dust like spores



Threatens iconic World Heritage areas



For more information, visit  
[anpc.asn.au/myrtle-rust](http://anpc.asn.au/myrtle-rust)



### Spore Trapping

Spore samples are collected from our partner Botanic Gardens across Australia by Data Effects. SARDI extracts DNA from spore samples.



### Myrtle Rust Detection

Strains of concern are reported to authorities via AusPESTCheck.



### Strain Analysis

ANU uses sequencing to differentiate strains and detect other fungi.



### Saving Native Species

We protect native plants through early detection, research, monitoring, and education.

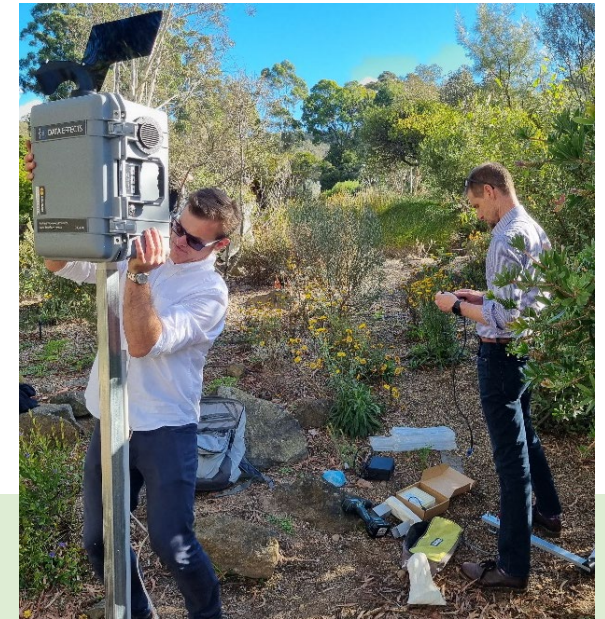


### Teaching Outreach

ANU leads STEM programs and workshops to engage the public.



# Airborne myrtle rust surveillance – Next Gen technology systems





# Delivery pipeline for airborne pathogen data

## Sentinel Surveillance in Botanic Gardens



lte



Samples

High volume cyclone sampler: MYRTLE RUST TARGET



DATA EFFECTS



## DNA extraction & Pathogen diagnostics 1



Molecular ID  
(qPCR & NGS)

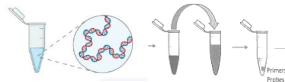


## Pathogen diagnostics 2

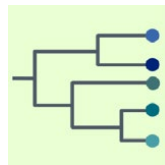
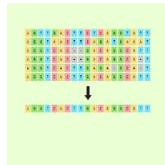
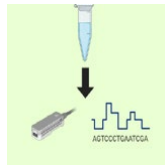
## Metabarcoding



Australian National University



DNA



Exotic strain & sensitive detections reported to relevant state biosecurity agency as per established biosecurity reporting protocols

Data

Secure data management



DATA EFFECTS



Central Databases

Data

Field, real-time IoT & laboratory diagnostic data matching

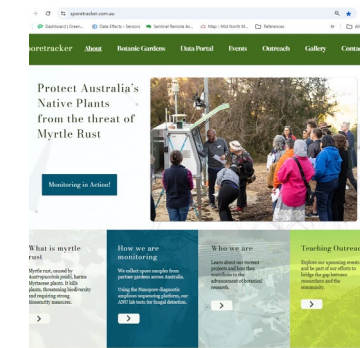
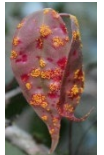
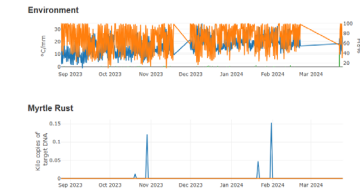
GIS referenced sampling

Real-time environmental data

## Diagnostic output 1

## High throughput analysis (qPCR)

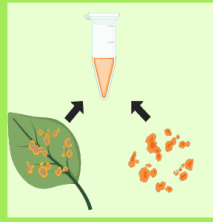
Canberra Botanic Garden



Pathogen incursions reported via web URL for Botanic Garden network and ANPC collaborators

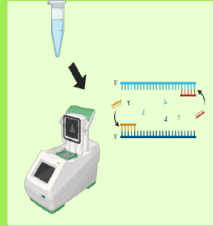
# 1 Sampling and DNA extraction

DNA are extracted from spores, infected leaves, or sporetrap samples.



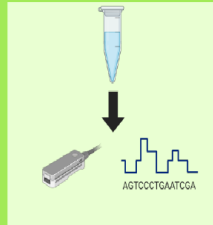
# 2 Amplification

PCR amplifies eight loci in the *A. psidii* genome.



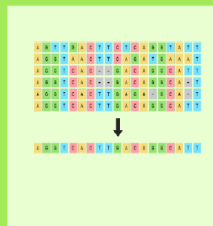
# 3 Sequencing

PCR products are sequenced with Nanopore long-read sequencing.



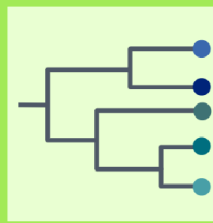
# 4 Reconstruction of alleles

Alleles of each locus are generated by clustering and consensus sequence reconstruction.



# 5 Comparison

Comparative analysis enables clear differentiation of exotic strains from the pademic biotype.



## Diagnostic pathway #2





Australian  
National  
University



## Strain variant tool

**Eight novel diagnostic markers differentiate lineages of the highly invasive myrtle rust pathogen *Austropuccinia psidii***

Zhenyan Luo, Jinghang Feng, Austin Bird, Mareike Moeller, Rita Tam, Luc Shepherd, Lydia Murphy, Lavi Singh, Abigail Graetz, Lillian Amorim, Nelson Sidnei Massola Júnior, M. Asaduzzaman Prodhon, Louise S. Shuey, Douglas Beattie, Alejandro Trujillo Gonzalez, Peri Tobias, Amanda Padovan, Rohan Benjamin Essex Kimber, A. R. McTaggart, Monica Kehoe, Benjamin Schwessinger  and Thais Regina Bouffleur 

Published Online: 16 Oct 2024 | <https://doi.org/10.1094/PDIS-10-24-2111-SR>

**Applied in Biosecurity settings for exotic strain diagnosis**



# Discovered something new?



## Have you discovered a new pest or pathogen?

Your research can have significant implications for plant biosecurity. If you find a potential new pest or disease through your research it is vital you report this to the Exotic Plant Pest Hotline.

New pests and diseases can devastate farm productivity and native ecosystems, and affect the access of Australian goods to overseas markets, with flow on financial consequences.

By reporting an exotic pest or disease detection early, there is a greater chance it will be successfully contained and eradicated. For this reason, it is vital to report any potential new pests, pathogens or new hosts prior to publishing your work.

Reporting potential new pests, pathogen or new hosts is a legal obligation under Commonwealth and state legislation.



## What information do I need to report?

Every report to the hotline is taken seriously and confidentially. Your call will be forwarded to an experienced officer who will ask some questions to help understand the situation such as:

- what was seen (describe or send a photo of the pest or disease) and when was it first noticed
- where it was found and what it was on
- how many pests are present or the severity of the infection
- how widely distributed it is.

If you are in doubt about what to do, ask and you will be advised by a biosecurity officer.

## Will reporting affect my ability to publish?

It is important that you report your finding before publishing since published articles about potentially new pests or diseases in Australia can impact Australia's access to overseas markets.

Calls to the hotline are confidential and your results will not be published.

Reporting to the hotline does not constitute a 'first report' so publishers can still accept manuscripts regarding the pest or pathogen.

**IF YOU SEE ANYTHING UNUSUAL,  
CALL THE EXOTIC PLANT PEST HOTLINE**

**1800 084 881**

## Reporting pests, diseases and weeds

In Australia, any unusual plant pest, disease or weed should be reported immediately to the relevant state or territory agriculture agency through the Exotic Plant Pest Hotline on 1800 084 881.

[planthealthaustralia.com.au](http://planthealthaustralia.com.au)

# Diagnostic pathway #2



Australian  
National  
University

## Strain variant tool – reports first to CPPO





# Project activities, data outputs and engagement - website

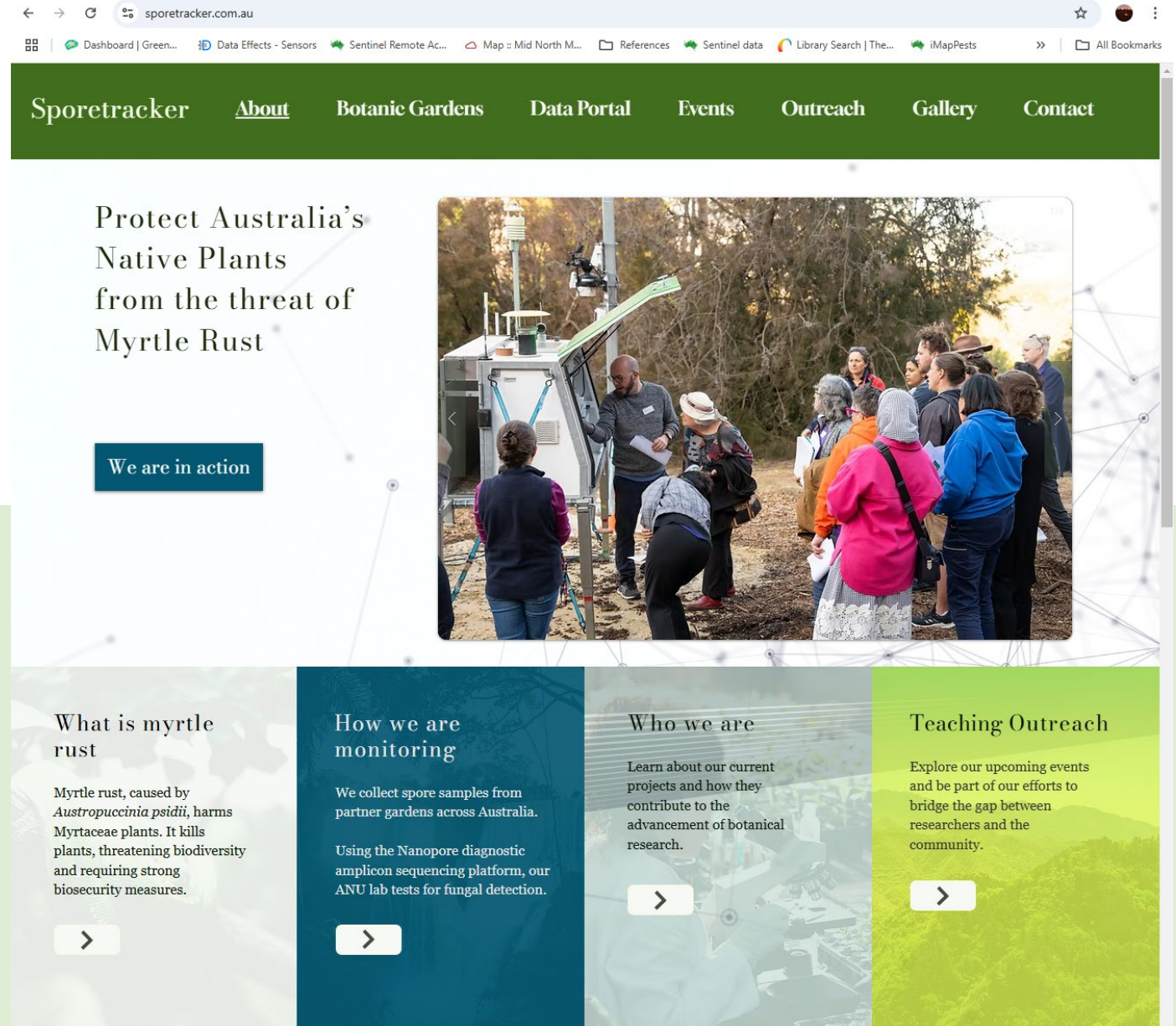


Visit ..

[www.sporetracker.com.au](http://www.sporetracker.com.au)



Australian  
National  
University



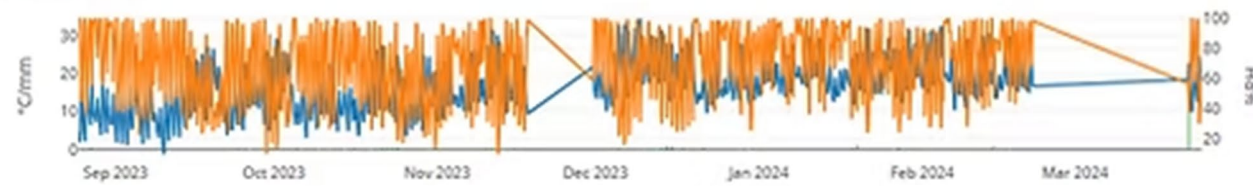


# Can we detect rare influxes? – previous pilot

Nov 2022 - Jun 2023

study

## Environment

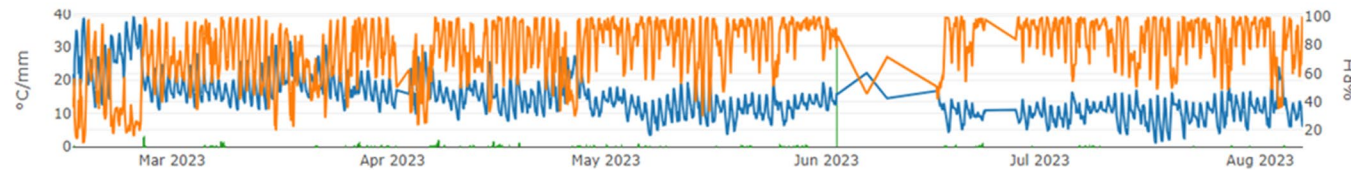


## Myrtle Rust



## Adelaide Botanic Garden (S7)

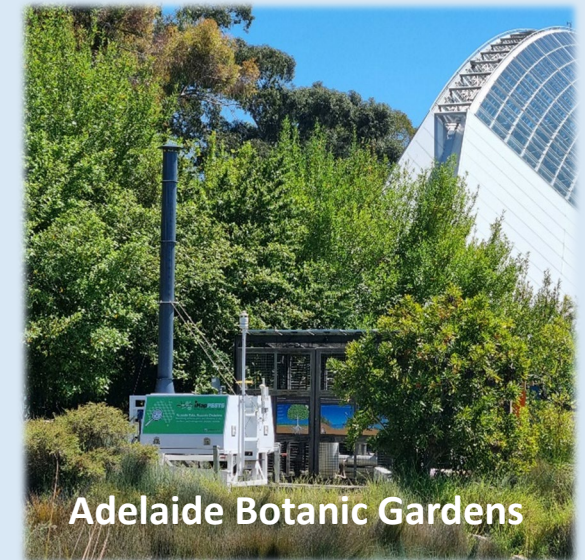
### Environment



### Myrtle Rust (*Austropuccinia psidii*)



## Strategic Surveillance Plan for Myrtle Rust



# Thank you ...

This project received grant funding from the Australian Government Saving Native Species Program

  
VIRTUAL  
**2025!**  
ANNUAL SURVEILLANCE WORKSHOP  
10-11 June 2025

  
Plant Surveillance  
Network Australasia-Pacific

Data Effects - Andrew Baker, Paul Coldrey, Gerard O'Connor,

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Adelaide Botanic Garden

Australian National Botanic Garden

Royal Botanic Garden Sydney

Royal Botanic Garden Melbourne

Kings Park and Botanic Garden

Lismore Rainforest Botanic Gardens

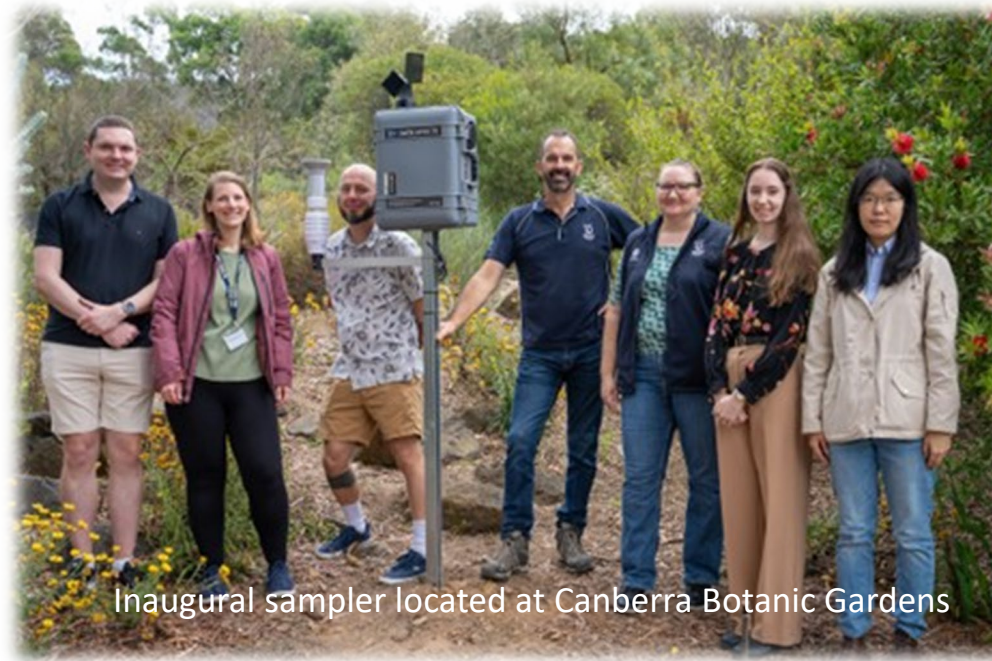
Royal Tasmanian Botanical Garden

George Brown Darwin Botanic Garden

Cairns Botanic Gardens

Australian Network for Plant Conservation

*Previous pilot study project partners University of Canberra and University of Sydney*



Inaugural sampler located at Canberra Botanic Gardens