

The impact of invasive pathogens of plants in Australia: what role for botanic gardens?

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Invasive species in Australia

- Weeds, feral animals, pests and pathogens – since 1788 (perhaps earlier?)
- Impact on agricultural sector = \$billions
- Impact on biodiversity = immeasurable
- Global Strategy for Plant Conservation:
Target 10 – Effective management in place to prevent new biological invasions and to manage areas for plant diversity that are invaded.

Invasive plant pathogens in Australia

- Introduced with the First Fleet and ever since!
- Most of the Australian flora has evolved in isolation to many of the most damaging pathogens.
- Two diseases used as examples of the impact
 - Phytophthora root rot
 - Myrtle Rust

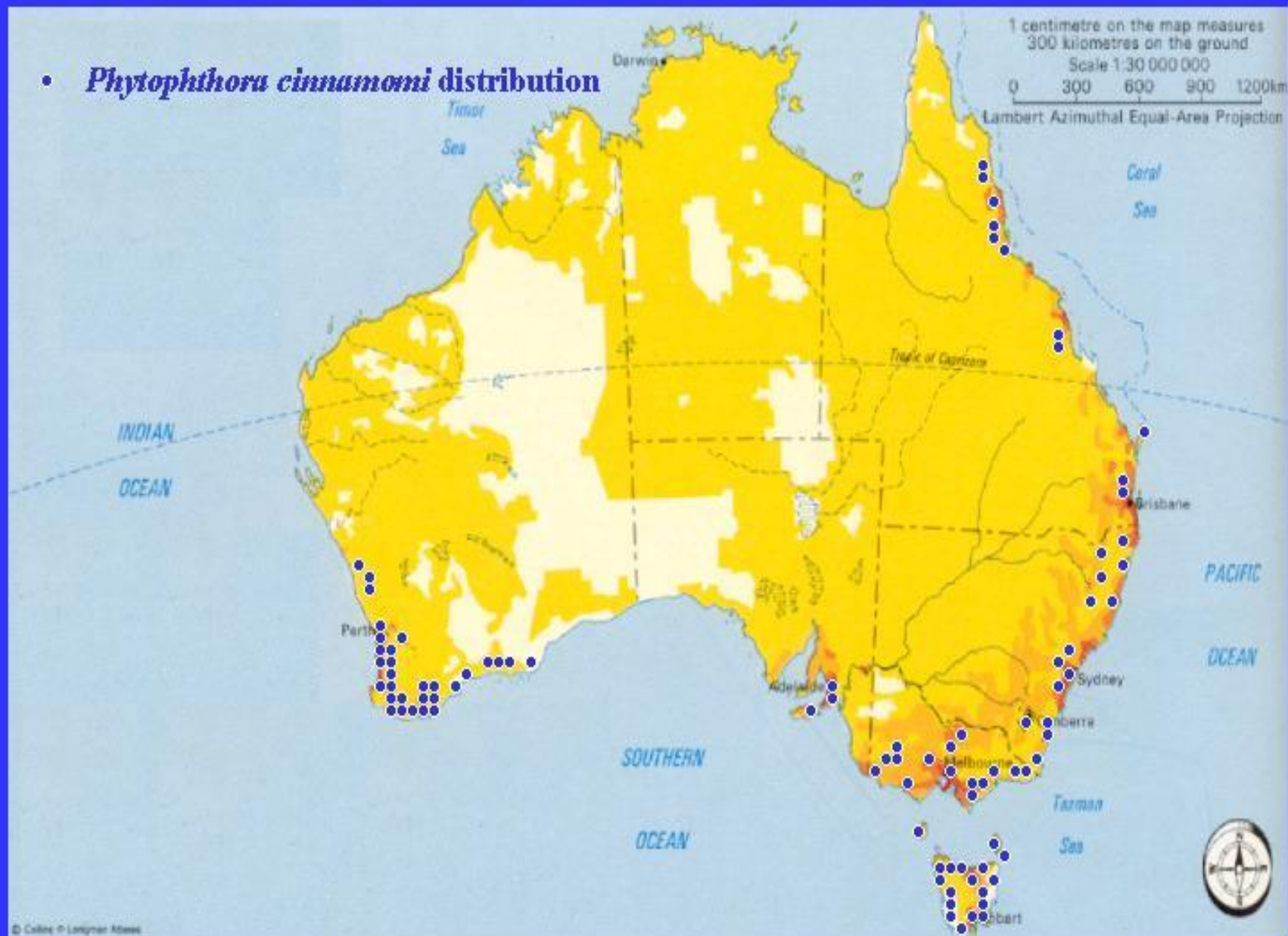




Phytophthora root rot

- Probably arrived with Europeans
- Root rot records in Brisbane in 1887; Western Australia 1921
- *Phytophthora cinnamomi* first identified in Australia in 1929 from pineapple
- First isolated from native vegetation in 1948
- DNA and mating type ratio clearly indicates an introduced pathogen

- Phytophthora cinnamomi* distribution**



Impact on ecosystems

- Reduction in biodiversity
- Decline in plant numbers
- Reduction in canopy cover & understorey species
- Replacement of susceptible species by rushes and sedges
- Impact on animals dependent on affected plant species



Production and release of zoospores of *Phytophthora cinnamomi*



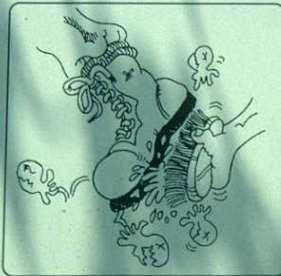








Dieback Disease Risk



Dieback disease is killing our native plants.

Plants in this area are threatened by this disease.

Your footwear can bring in or pick up infected soil and spread dieback.

Help stop the rot by scrubbing your boots clean before and after your walk.



Department of Conservation and Land Management
Albany (098) 417133 Esperance (090) 713733

Caring Naturally



Significance and impact

- Listed as a “key threatening process” to Australia’s biodiversity
 - Commonwealth Environmental Protection and Biodiversity Conservation Act 1999
- National (Draft) Threat Abatement Plan (NTAP) 2017

www.environment.gov.au/biodiversity/threatened/tap-drafts.html









What do we do about it?

- Sampling has been extensive to accurately determine the extent of the infestation
- Affected trees have been injected with potassium phosphonate and soil drenched with fungicide (Ridomil).
- Surveillance & monitoring at site increased
- Translocation experiments commenced to establish “back-up” population
- Horticultural release

Myrtle Rust (aka Eucalyptus Rust)



What is Myrtle Rust?

- A rust fungus
- A strain of Eucalyptus Rust (*Austropuccinia psidii*)
- Pathogenic to a wide range of Myrtaceae species
- First reported on guava (Guava Rust) – jumped across to *Eucalyptus*
- Originated in South and Central America – first reported in Australia, April 2010

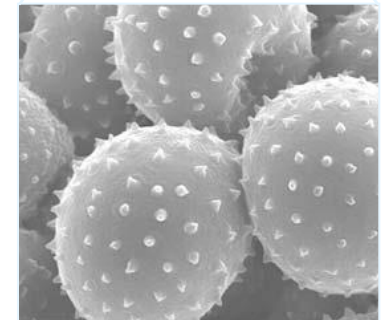
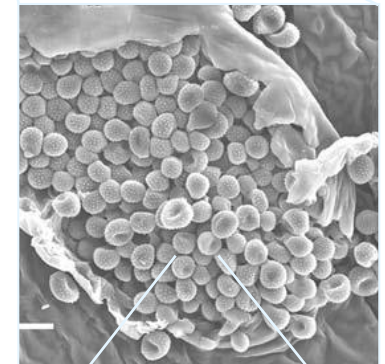


Photo: A. Carnegie

Photos: Kawanishi et al

What does it do?



Agonis flexuosa



Rhodamnia rubescens

Photo: Angus Carnegie



Rhodamnia rubescens



Photo: Angus Carnegie



Figure 3. Rapid decline of the Endangered *Rhodamnia angustifolia* caused by repeated myrtle rust infection



Rhodomyrtus psidioides

Photo: Angus Carnegie



Impact of Myrtle Rust

- Myrtle rust recorded in NSW, Qld, Victoria, Tasmania and NT
- Spread to LHI, Kermadec Is and NZ
- Records in Indonesia and Singapore
- Several species now on extinction trajectory
- First species now listed as threatened due to impact of MR – *Rhodamnia rubescens* and *Rhodomyrtus psidioides* in NSW.

And still to come

- *Phytophthora ramorum* – Sudden Oak Death



- *Phytophthora agathidicida* – attacking *Agathis* in NZ (and maybe *Araucaria* and *Wollemia* in Australia and New Caledonia?)



Photo:
Peter
Scott



Photos: Dr Peter Scott

***Acacia mangium* dieback**

Ceratocystis fimbriata



Clove dieback – *Ceratocystis polychroma*
attacking *Syzygium aromaticum*



What can we do about it?

- Detection & surveillance
- Ex situ preservation – highest priority
- Susceptibility assessment
- On the ground activities
 - Hygiene
 - Quarantine
 - Spot eradication
- Education, engagement & training

Detection & surveillance

- Botanic gardens principle point of first contact with overseas visitors.
- Diversity of species from all parts of the world.
- Botanic gardens and urban parks ideal sites for detecting incursions – see talk by Greg Fraser PHA.



International Plant
Sentinel Network

Ex situ conservation

- Seed bank susceptible species
- Living collections – especially those species not producing seed
- Cultivation of susceptible species outside of climatic zone for the pathogen



Susceptibility assessment

- Opportunity of collect diverse genetic representatives of susceptible species
- Could be grown across BG holdings to assess relative susceptibility response
- Ultimate aim to identify resistant or tolerant genotypes for reintroduction.
- Is there an opportunity for directed evolution?

Education, engagement & training

- Botanic gardens most visited scientifically based tourist sites in Australia
- Plant disease and diagnosis easily understood and relatable to human health
- Disease impact on plant conservation central to core role of BG's

REVEALING OUR PLANT PATHOLOGY LAB



Scientists in our Plant Pathology Lab work on vital research to protect Australian plants and food crops from disease.

Building works have commenced to improve access to this world-class lab so that more visitors can see the work we do.

You are invited back in late 2017 to find out more about plant pathology and see science in action.

If you would like to make a tax deductible contribution to the new Plant Pathology Lab visit rbgsyd.nsw.gov.au or visit the Foundation & Friends Cottage (behind the Maiden Theatre).

Foundation
& Friends of the
BOTANIC GARDENS



ROYAL
BOTANIC
GARDEN
SYDNEY





A PLANT BECOMES ILL, OR DISEASE IS SUSPECTED IN AN AREA —

Our scientists give advice on collecting plant samples or soil for tests. Samples are delivered to PlantClinic and a medical record is created for each one.

COLLECTION OF SAMPLE:



SOIL OR PLANTS DELIVERED TO PLANTCLINIC



SAMPLE RECORD



GREAT POTATO FAMINE (IRELAND, 1840s)
1 MILLION PEOPLE DEAD. CAUSE: POTATO LATE BLIGHT —
PHYTOPHTHORA FUNGUS

TIME TO VISIT THE DOCTOR!

Just like you, plants act
differently when they
are sick.

They can stop growing,
their leaves get spots or
even turn yellow.

Conclusions

- Invasive pathogens will continue to increase in occurrence and frequency:-
 - Globalisation & international trade and transport
 - Exposure to pathogens in unique situations
 - Changing climate
- Control in natural ecosystems will be complex – if not impossible
- Botanic gardens have a key role in:-
 - Detection and surveillance
 - Education
 - Ex-situ conservation