# Environmental Threats of National Significance

PHYTOPHTHORA





Phytophthora cinnamomi is a soil-borne, microscopic water mould that causes a severe plant disease known as Phytophthora root rot or dieback. It imperils 236 nationally listed threatened species and 32 threatened ecological communities.

*P. cinnamomi* is the most destructive and widespread of more than 60 Phytophthora (pronounced fy-TOFF-thora) taxa in Australia – some native and others introduced, some benign and others pathogenic to native or agricultural plants. It probably arrived on plants brought by early European settlers.

*P. cinnamomi* grows in a thread-like fashion through the roots and trunks of infected plants and limits uptake of water and nutrients. It is not easy to detect as infected plants often appear to be dying from drought and it can cause permanent damage before being identified.

Any activity that moves soil, water or plant material can spread the disease – including recreational activities such as bushwalking, off-road vehicle use and gardening, and economic activities such as road building, timber harvesting and mining.

*P. cinnamomi* thrives in temperatures of 15-30 degrees and where rainfall exceeds 400 mm. The threat to nature is greatest in the global biodiversity hotspot of south-west Western Australia, where it affects more than a million hectares and probably some 40% of plant species. The disease is also severe in Victoria, Tasmania and South Australia, affecting tens to hundreds of thousands of hectares. The Northern Territory is the only jurisdiction not affected.

# WHY PHYTOPHTHORA CINNAMOMI IS A THREAT TO NATURE

'Dieback caused by the root-rot fungus Phytophthora cinnamomi' was listed more than 25 years ago as a key threatening process (KTP) – first under the Endangered Species Protection Act 1992, and then under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. The pathogen is now classified as a water mould rather than a fungus. It is a major threat to nature because of the following impacts:

- *P. cinnamomi* causes severe disease that threatens the survival of hundreds of Australian native plants. Infected plants often lose their ability to develop new shoots, flowers, fruit and seeds. The disease often infects new plants and can completely exhaust a species' seed bank, leading to local extinctions. Of 30 known populations of the critically endangered *Banksia brownii*, for example, 10 are presumed extinct and 13 have fewer than 100 plants due to this disease. The species has lost 38% of its genetic diversity. Other threatening processes (fire, herbivory, other diseases and climate change) interact with *P. cinnamomi*, increasing the risk of extinction.
- Phytopthora dieback severely degrades ecological communities. Banksia and eucalypt woodlands are highly susceptible to the disease, which can dramatically alter structure and composition of plant communities and reduce primary productivity and functionality. Less than 14% of the critically endangered eastern Stirling Range montane heath



Phytophthora dieback is a major threat to Australia's biodiversity, placing important plant species at risk of death, local extirpation or even extinction. Its dramatic impact on plant communities can also result in major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources. Awareness that human activity can easily spread the pathogen, and adherence to messages such as 'Arrive clean, leave clean' and 'Check, Clean, Disinfect, Dry', will help prevent an increase in the extent of this disease.

- Commonwealth of Australia, TAP for Phytophthora, 2018



and thicket ecological community, for example, retains a representative suite of once-common plant species after the loss of many *Phytopthora*-susceptible species.

- Phytophthora dieback can cause permanent loss of habitat and food for native animals, such as dibblers, western ground parrots and honey possums. At least 14 nationally threatened animal species, mostly endemic to south-west Western Australia, are thought to be impacted.
- Phytophthora dieback threatens areas of national and international significance including world heritage areas, national heritage areas, national parks, and Ramsar wetlands. These are often popular or well-known destinations with large numbers of visitors who have spread the disease.

# **IMPACTS ON OTHER SECTORS**

*P. cinnamomi* affects agricultural crops and garden plants. The tourism, horticulture and forestry industries all have an interest in protecting biodiversity from the impacts of Phytophthora dieback. Macadamias, for example, are susceptible to the disease.

# **THREAT ABATEMENT EFFORTS**

#### Abatement planning

A threat abatement plan (TAP) for P. cinnamomi was produced in 2001, 2014 and 2019. The 2019 Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi has four objectives:

- identify and prioritise biodiversity assets for protection
- reduce spread and mitigate impacts on priority biodiversity assets
- inform and engage the community
- encourage research on Phytophthora species and infestation management.

### State and territory legislation

The threats of *P. cinnamomi* are recognised across all the state and territories where it exists, and numerous strategies and actions have been developed (see Appendix B of the 2018 Background Document). In NSW 'Infection of native plants by *Phytophthora cinnamomi*' was listed as a KTP in 2003 and in Victoria the 'Spread of *Phytophthora cinnamomi* from infected sites into parks and reserves, including roadsides, under the control of a state or local government authority' and the 'Use of *Phytophthora*-infected gravel in construction of roads, bridges and reservoirs' were listed as potentially threatening processes in 2016. Western Australia produced a Corporate Policy Statement on Management of Phytophthora Disease in 2015.

#### Abatement techniques

There is no known cure for Phytophthora dieback. Eradication is difficult and only possible in small infestations. Phosphite (a biodegradable fungicide) is the only available treatment for infected species and communities. It protects plants against Phytophthora dieback by boosting their natural defences, allowing some susceptible plants to survive in infected areas. Treatment is expensive and therefore used only in small areas. As a final resort, threatened plant species are being translocated to Phytophthora-free areas.

Preventing spread is a major focus, through public education, quarantine and access restrictions, and hygiene rules. 'Arrive clean, leave clean' is the message. Ensuring compliance is difficult, however, as it usually relies on self-regulation.

#### Abatement research

Current research, mostly occurring in Western Australia, includes:

- detecting and identifying new Phytophthora species and monitoring their spread
- investigating the susceptibility of plants to Phytophthora cinnamomi and other Phytophthora species
- investigating ways to reduce the spread of Phytophthora dieback and the role of fire in managing infestations
- understanding the long-term ecosystem impacts of *Phytophthora cinnamomi*.

# **THREAT ABATEMENT PROGRESS**

Despite being listed as a KTP for more than 25 years, P. cinnamomi continues to spread and cause biodiversity declines, and there is much yet to learn about the disease. The main advance has been the use of phosphite to protect areas of high conservation value and threatened species in Western Australia, Victoria and Tasmania. However, its costs preclude broad-scale application, and research into its toxicity to fauna is needed.

A 2006 review of the federal threat abatement plan noted that the ability of states to regulate access to public lands is one of the most powerful tools for managing P. cinnamomi, but that its use has been limited in some states by poor public understanding of the issue, opposition to changes in land-use, and the need for enforcement. Other deficiencies noted were a lack of expertise in P. cinnamomi management in some state agencies, inadequate information about the threat and a poor level of public awareness. And as is typical for threat abatement, insufficient, ad hoc and short-term funding has precluded a strategic long-term approach. A review of the 2014 abatement plan is not publicly available.





## THREAT ABATEMENT PRIORITIES

The cost of funding actions to address the problem will be substantial; the cost of inaction, however, will be monumental and the biodiversity assets lost will be lost forever.... There needs to be a significant change in the way we tackle the disease but we are largely constrained by current knowledge, beliefs, policies and funding.

- Cahill et al. (2008)

Abatement priorities over the next decade should include the following:

- **Conserve declining species and ecological communities:** The tools are limited but include using phosphite to treat infected sites, translocating susceptible plants, seed bank collections, and breeding for resistance. Areas to prioritise should include those with high endemicity or diversity, significant remnant vegetation, or ecological intactness.
- **Rigorously protect uninfected sites:** Given the limited treatment options, prevention of spread must remain a very high priority, which requires quarantining sites or adopting strict hygiene measures. Training and education need to be appropriate for all stakeholder groups. States should use their legal powers where this is feasible to limit access to susceptible sites of high conservation value.

• Learn more about the disease, its impacts and control options: More research is essential, with priorities including improved treatment and restoration options, and understanding the impacts of

P. cinnamomi on lichens, fungi, mosses, soil animals and other biota, the factors that enable P. cinnamomi to attack such a wide range of hosts, the effects of climate change on the disease, and mechanisms of resistance. Investigation of biological control agents to protect crop species from Phytophthora pathogens is underway, but biocontrol is considered less feasible for protecting native species.



#### Sources & further reading

ACT Government. Native Woodland Conservation Strategy and Action Plans. 2019

https://www.environment.act.gov.au/\_\_data/assets/pdf\_file/0003/1444098/ Woodland-Conservation-Strategy.pdf

Burgess Tl, White D, McDougall KM, Garnas J, Dunstan WA, Català S, et al. Distribution and diversity of Phytophthora across Australia. *Pacific Conservation Biology*. **2017**;23: 150–162.

Cahill DM, Rookes JE, Wilson BA, Gibson L, McDougall KL. *Phytophthora cinnamomi and Australia's biodiversity*: impacts, predictions and progress towards control. Australian Journal of Botany. 2**008**;56: 279–310.

Commonwealth of Australia. Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi **2014** https://www.legislation.gov.au/Details/F2017C00221

Commonwealth of Australia. Background document: Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi. **2018** https://www.environment.gov.au/system/files/resources/ee1f3b9f-6e2e-4a01-86f3-6abb167fb443/files/tap-phytophthora-cinnamomi-2018background.pdf

Commonwealth of Australia. Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi **2018** http://www.environment.gov.au/system/files/resources/ee1f3b9f-6e2e-4a01-86f3-6abb167fb443/files/tap-phytophthora-cinnamomi-2018.pdf

Commonwealth of Australia. Arrive Clean, Leave Clean – Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems. **2015** http://www.environment.gov. au/system/files/resources/773abcad-39a8-469f-8d97-23e359576db6/files/ arrive-clean-leave-clean.pdf

Department of Agriculture, Water and the Environment. Website details on Phytophthora dieback: http://www.environment.gov.au/biodiversity/invasive-species/diseases-fungi-and-parasites/phytophthora-cinnamomi-disease

Department for Environment and Heritage. Phytophthora is killing our plants! **2009**. Government of South Australia

Department of Biodiversity, Conservation & Attractions. Phytophthora dieback. Government of Western Australia. https://www.dpaw.wa.gov.au/management/pests-diseases/phytophthora-dieback

Kearney SG, Carwardine J, Reside AE, Fisher DO, Maron M, Doherty TS, et al. The threats to Australia's imperilled species and implications for a national conservation response. *Pacific Conservation Biology*. 2018;25: 231–244

Monks L, Barrett S, Beecham B, Byrne M, Chant A, Coates D, et al. Recovery of threatened plant species and their habitats in the biodiversity hotspot of the Southwest Australian Floristic Region. Plant Diversity. **2019**;41: 59–74

O'Gara E, Howard K, Wilson B, Hardy Ges. O'Gara, E., Howard, K., Wilson, B. and of Phytophthora cinnamomi for biodiversity conservation in Australia: Part 1. A review of current management. Centre for Phytophthora Science and Management, Murdoch, Western Australia; **2006**.



If Australians are to protect what is most distinctive about this country – our unique plants, animals and ecological communities – we urgently need to overcome the key threats facing them.



It is not possible to recover all of our threatened species one by one through species-focused efforts. We also need a concerted national focus to overcome the major threats our native plants and animals have in common – in particular **invasive species**, **climate change**, **habitat destruction**, **adverse fire regimes** and **changes to natural water flows**.

Australia's threat abatement system needs to be more ambitious, better funded and nationally coordinated.