



Australian Government

Department of the Environment

Arrive Clean, Leave Clean

Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems



The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

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Arrive Clean, Leave Clean

Help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems

When working in the bush, it's important to remember:

- Any activity in the bush has the potential to spread invasive species, including environmental restoration activities such as weeding and revegetation.
- Revegetation carries a particularly high risk as it involves the introduction of plants and soil. This risk increases through the use of dirty tools and equipment or plants and materials that are not certified to be free of pathogens and weeds.
- Clothing, hats, footwear, tools, equipment, machinery and vehicles can transport invasive species like *Phytophthora cinnamomi*, myrtle rust (*Puccinia psidii*), insects and weeds into our bushland.
- Even your skin and hair, as well as glasses, phones, watches, wallets and other pocket items can carry myrtle rust spores.
- Once these pathogens and weeds invade our bushland, eradication is often impossible. Follow these guidelines to help prevent their spread.



Photos: (left) Wildflowers on Mondurup Peak, Stirling Range before *Phytophthora* dieback (Robert Olver), (right) Mondurup Peak, Stirling Range after *Phytophthora* dieback (Department of Parks and Wildlife WA)

Phytophthora cinnamomi

What is *Phytophthora cinnamomi*?

Phytophthora cinnamomi is a soil-borne plant pathogen that attacks the roots of susceptible plants—destroying the root system and reducing the ability of the plant to absorb water and nutrients. This causes symptoms referred to as ‘dieback’ which can lead to plant death.

Under favourable conditions *Phytophthora* spp. can spread easily and quickly, destroying plants and plant communities. These guidelines to help minimise the risk of spreading *Phytophthora cinnamomi* also apply to other species of *Phytophthora* present in Australia, as the management of those species is similar.



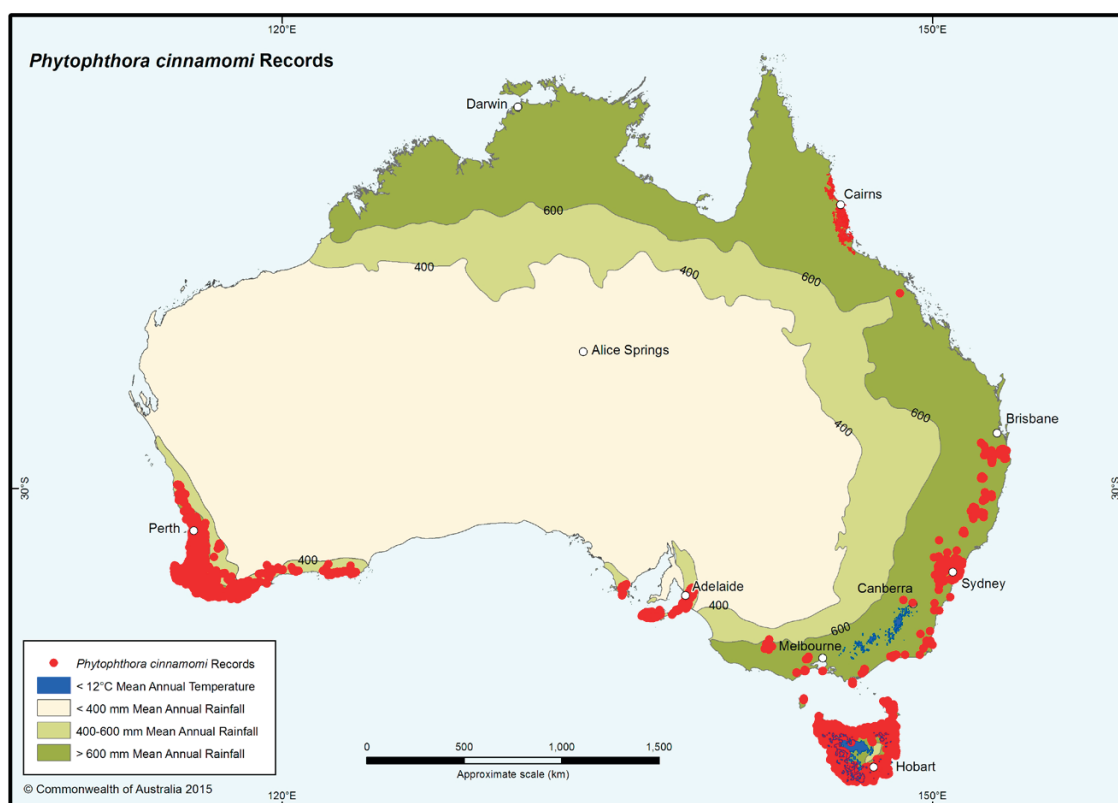
Photo: Impact of *Phytophthora cinnamomi* at Dwellingup, WA (Department of Parks and Wildlife WA)

What does *Phytophthora cinnamomi* threaten?

Thousands of Australian native plant species are susceptible to *Phytophthora cinnamomi*, and several of those species may be at risk of extinction due to its impacts. The dramatic impact of *Phytophthora* spp. infestations on plant communities may also lead to major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources.

Where is *Phytophthora cinnamomi* found?

Phytophthora cinnamomi thrives in warm, moist conditions with temperatures between 15°C and 30°C, and with rainfall greater than 400 millimetres a year. Its impact is greatest in Western Australia, Victoria, Tasmania and South Australia. The Northern Territory remains the only jurisdiction unaffected, as its environmental conditions are generally unfavourable to the pathogen.



Map: *P. cinnamomi* isolations, records of impact and broad climatic envelope of *P. cinnamomi* susceptibility in Australia.

This map was published in the *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi* in 2014. It does not represent the precise distribution of the pathogen in Australia and is for general information only.

How does *Phytophthora cinnamomi* spread?

Phytophthora cinnamomi spreads through soil, water and organic matter. It can remain dormant for long periods during dry weather and is impossible in most situations to eradicate from infested areas, which means limiting further spread is critical. Any activity that moves soil, water or plant material can spread the disease. This includes soil on tools, footwear and vehicles.

To help to prevent the spread of this plant disease:

- arrive clean, leave clean: ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of mud, soil and organic matter before entering and exiting bushland
- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, AS3743–2003 *Potting mixes* or AS4454–2012 *Composts, soil conditioners and mulches*.

Myrtle rust

What is myrtle rust?

Myrtle rust is a disease caused by the fungus *Puccinia psidii*, initially identified as *Uredo rangelii*. It affects trees and shrubs in the Myrtaceae plant family—attacking young, soft, actively-growing leaves, shoot tips and young stems, as well as fruits and flower parts.

The first signs of rust infection are tiny raised spots or pustules on infected leaves. After a few days, the pustules erupt into distinctive bright yellow spore masses. Left untreated, the disease can cause deformed leaves, heavy defoliation of branches, dieback, stunted growth and plant death.

What does myrtle rust threaten?

Plants susceptible to myrtle rust are those in the Myrtaceae family, which includes bottle brush (*Callistemon* spp.), tea tree (*Melaleuca* spp. and *Leptospermum* spp.), lilly pillies (*Syzygium* spp.) and eucalypts (*Eucalyptus* spp., *Angophora* spp. and *Corymbia* spp.). The Myrtaceae family in Australia is ecologically important, accounting for about 10% of Australia's native flora, with many Australian plant communities dominated by myrtaceous species.

Knowledge of the impacts of myrtle rust on Australian biodiversity is still limited. Myrtle rust infection may cause significant mortality among younger plants and therefore reduce the number of plants capable of maturing and reproducing. This may contribute to the decline of species, including threatened species, leading to potential impacts on the structure and function of ecosystems dependent on Myrtaceae. At the time of writing, nearly 350 native species are known to be susceptible to myrtle rust infection, some severely. The host list (see **References and resources** below) is expected to grow. However, all Myrtaceae are potentially susceptible and potential hosts for the disease.



Photo: Myrtle rust pustules on scrub turpentine (*Rhodamnia rubescens*) fruit (R.O. Makinson)



Photo: Myrtle rust pustules on scrub turpentine (*Rhodamnia rubescens*) leaves (R.O. Makinson)

Where is myrtle rust found?

Myrtle rust was first detected in Australia in 2010 on the New South Wales central coast. It is now established along the east coast of Australia from southern New South Wales to far north Queensland, mostly east of the Great Escarpment. It is also present in Victoria, mainly at production nurseries and wholesale outlets in and around metropolitan Melbourne. The first detection of myrtle rust in Tasmania was in February 2015 at a property near Burnie on the north-west coast. At the time of writing, myrtle rust has not been detected in the Australian Capital Territory, the Northern Territory, South Australia, Western Australia or on Lord Howe Island or Christmas Island, but moister regions and vegetation types in all these jurisdictions are at risk of myrtle rust establishment. Domestic import restrictions apply for non-infested jurisdictions.

How does myrtle rust spread?

Myrtle rust spores can spread easily via contaminated clothing, hats, footwear, equipment or vehicles. It can also be spread by infected plant material, insects and other animals, or the wind. Even your skin and hair, as well as watches, wallets and other pocket items can carry myrtle rust spores. It is impossible to eradicate myrtle rust from infested bushland, so limiting further spread is critical.

To help to prevent the spread of myrtle rust:

- arrive clean, leave clean:
 - Wash all clothing, hats and gloves between site visits—using warm or hot machine wash with detergent.
 - Ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of mud, soil and organic matter before entering and exiting bushland.
 - Use a solution of 70% ethanol or methylated spirits in 30% water to disinfect items that may be contaminated (including hats, footwear, tools, equipment, machinery, vehicles, walking sticks, tent pegs, phones, glasses, watches, wallets and other personal items).

- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- monitor plants carefully as nurseries and plant maintenance facilities may provide ideal conditions for myrtle rust (see Australian Nursery Industry myrtle rust management plan 2012 in **References and resources** below).



Photo: Myrtle rust spores on clothing after chance contact with an infected shrub (R.O. Makinson)

Weeds

What is a weed?

A weed is any plant that has a negative impact on our economy, environment, health and surroundings. Weeds are generally species which are not native to Australia. However, some native species growing outside of their native range can also become invasive. Many weeds are species which have escaped cultivation and become naturalised—that is, they have begun reproducing without human assistance.

What do weeds threaten?

Many weed species are able to invade natural areas and cause disturbance to bushland ecosystems. They can alter plant and animal community composition, cause changes to nutrient cycles, change natural fire regimes, outcompete native species for resources, impact threatened species and threaten biodiversity.

Where are weeds found?

The diversity of weed species recorded in Australia means that most terrestrial and aquatic ecosystems are vulnerable to weed invasion. Weeds have characteristics that help them grow well in many environments—from our towns and cities through to our coasts, deserts and alpine areas.

How do weeds spread?

Weeds typically spread easily by producing large numbers of seeds or reproducing vegetatively. They are often excellent at surviving and reproducing in disturbed environments and are commonly the first species to colonise and dominate in these conditions. Seeds and other plant material can spread into natural and disturbed environments via wind, animals, waterways and people (including contaminated clothing, hats, footwear, tools, equipment, machinery and vehicles).

To help to prevent the spread of weeds:

- arrive clean, leave clean: ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.
- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- if revegetating, select indigenous plants that occur naturally in your local area. Undertake weed control work well in advance to minimise the weed seed bank before you start planting. At the very least, slash the flower heads of weed species before they go to seed.

Before beginning a project

Undertake a risk assessment:

- Identify any planned activities with the potential to spread pathogens and weeds. This includes movement of people, equipment, vehicles and materials to/from/through infected or potentially infected areas.
- Determine the project site's pathogen and weed risks through liaison with land managers (for example government agencies, traditional owners, Indigenous Protected Area managers etc.).
- Consult sources of advice and expertise for contingent risks (for example state/territory departments of primary industry, pathology/weed identification services at botanic gardens).

Develop a hygiene management plan:

- Use your risk assessment to determine which hygiene procedures are necessary to prevent the spread of pathogens and weeds, and how and where to apply them.
- Ensure all materials taken onto the site—such as seedlings, mulch, soil, gravel, rock and sand—are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and ensuring materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- Create a checklist of hygiene procedures for project managers and participants to use.

Consider the following during project planning:

- Limit the number of sites you visit to one per day. If this is not possible, visit clean sites before infested sites.

- Provide training or briefing to all participants on the risks of spreading pathogens and weeds and risk mitigation strategies. If available, provide maps to participants with the location of infested and clean areas and wash-down points.
- Ensure that rigorous inspections and quality checks are built into the management of the entire supply chain for materials and plant material when carrying out revegetation or translocation activities where pathogens are a potential concern (see Australian Nursery Industry myrtle rust management plan 2012 in **References and resources** below). This is particularly important when working in areas where threatened species and threatened ecological communities are found.
- Where there is the risk of *Phytophthora* dieback (a plant disease caused by the pathogen *Phytophthora cinnamomi*), schedule activities for the dry season as it spreads more easily in wet and muddy conditions. If necessary, postpone activities and reschedule for a day when the soil is dry and doesn't stick to footwear, equipment and tools.
- If working in a weedy area, try to schedule activities for when the weed species are not in seed.
- Avoid taking vehicles into bushland. If a vehicle is necessary, ensure it is clean and dry on entry and exit, and restrict movement to hard, dry surfaces, formed roads and designated parking areas—avoid driving through puddles and mud. Where myrtle rust is a risk, avoid parking near myrtaceous plants—for example bottle brushes, tea trees, lilly pillies and eucalypts—and thoroughly clean vehicles inside and out between site visits.
- Avoid polystyrene boxes and tools with wooden or cracked handles. Use equipment that can be cleaned easily and thoroughly.
- Minimise the number of personal items you carry. Where myrtle rust is a risk, clean all items—such as GPS devices, glasses, phones, watches, wallets and other items kept in your pockets—with alcohol wipes before entering and leaving sites.

One site per day

Before entering or leaving a site

- Be aware of what plants look like when infected with myrtle rust and *Phytophthora* dieback (see images above).
- Remove all weed seeds, mud, soil and organic matter from clothing, footwear, tools, equipment, machinery, vehicles, boxes, backpacks, walking sticks, tent pegs and anything else that touches plants or the ground. Stay as clean as possible while in the bush.
- If you are entering clean bushland or have come from an area that is infested with *Phytophthora* spp. or myrtle rust, ensure everything with you is cleaned and disinfected with a solution of 70% ethanol or methylated spirits in 30% water. This includes footwear, tools, equipment, machinery, vehicles, backpacks, walking sticks, tent pegs and personal items.

Disinfecting clothing, footwear, equipment and other personal items

- i. Carry a hard brush and a spray bottle of disinfectant—made up of a solution of 70% ethanol or methylated spirits in 30% water. If you are able to carry more, assemble a simple hygiene kit—see Appendix A.
- ii. Set up a wash-down area for participants to wash and dry their face and hands and clean their footwear before entering and exiting the site.
- iii. To clean footwear, first use a hard brush or stick to remove as much mud, soil and organic matter as possible before disinfecting with a solution of 70% ethanol or methylated spirits in 30% water—applied through a spray bottle or a footbath.

- iv. Seal all personal rubbish in a bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.
- v. Collect all removed mud, soil and organic matter in a bag or bucket, and keep it out of clean bushland.

Disinfecting vehicles and machinery

- i. Use a wash-down facility for vehicles and machinery if available, or wash-down on a hard, well-drained surface, for example a road, and on ramps if possible. See **References and resources** below for links to online wash-down guidelines.
- ii. Pay particular attention to cleaning mud flaps and tyres.
- iii. Dispose of wash-down water so that it drains back into a low area of the infested zone away from waterways. If this is not possible, empty it into a waste container for responsible disposal offsite.
- iv. Don't allow wash-down water to drain into clean bushland.
- v. Don't drive through wash-down water.



Photo: Wash-down point (Department of Parks and Wildlife WA)



Photo: Truck undercarriage wash-down (South Coast Natural Resource Management, WA)

Additional considerations where myrtle rust is present

- Disposable overalls and caps may be worn over clothing upon entering a site, and removed when leaving the site. However, in high-risk cases, also shower and change into clean clothes (including hats, gloves and footwear).
- Wash all clothing, hats and gloves between site visits using warm or hot machine wash with detergent.
- Do **NOT** remove any plant material from sites infested with myrtle rust. Dispose of plant waste by burial on site. If this is not possible, seal the waste in a plastic bag, seal the bag in a second bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.

Revegetation

Where weeds and other disturbances are controlled, natural regeneration can assist the bushland to revegetate over time. Where revegetation activities are necessary, the following steps will help stop the spread of invasive species:

- Arrive clean, leave clean—ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.

- Liaise with land managers and relevant plant specialist stakeholders (for example Australian Network for Plant Conservation, Greening Australia, Landcare groups, botanic gardens, seed banks etc.) to collaborate on the revegetation strategy.
- Select indigenous plants that occur naturally in your local area wherever possible.
- Avoid species with the potential to become weeds of the environment or agriculture.
- If the site is infested with *Phytophthora* spp. or myrtle rust, select species resistant to the disease, or seed from more tolerant individuals of susceptible plant species.
- Consult the Australian Network for Plant Conservation translocation guidelines 2004 (see **References and resources** below). These focus on threatened species but many of the techniques and considerations also apply to non-threatened species.
- Consider a combination of revegetation techniques such as seed production areas, direct sowing and enhancement of natural sites to assist natural regeneration. Many of these will be lower risk than the use of seedlings.
- If using seedlings, purchase them from a supplier that can guarantee high standards of hygiene—such as NIASA-accredited businesses. For added certainty, ensure the supplier allows testing of a random sample of seedlings and soil for *Phytophthora* spp. 3–6 weeks before acceptance of the seedlings. If the pathogen is present, the batch must be rejected.
- Check plants on receipt and at intervals during any holding period. Seek specialist advice if any suspect symptoms appear (for example coloured pustules, leaf necrosis).
- If propagating, maintain high standards of hygiene—see the section on propagation below.
- Plant when the soil is moist but not wet.
- Use mains or disinfected water to irrigate plants.
- If you are aware of a plant pathogen infestation, begin revegetation in the clean part of the bushland before moving to the infested area. Ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are clean before leaving the infested area.

Weed management

When conducting weed management activities, the following steps will help stop the spread of invasive species:

- Arrive clean, leave clean—ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.
- Schedule weeding for dry soil conditions where possible.
- Use techniques that minimise soil disturbance. For example, mow or slash or use an appropriate herbicide in preference to digging or grading.
- Ensure transport and disposal of plant material does not introduce weeds to new areas. In sites free of myrtle rust, place weeds into a bag or container immediately for removal. Always cover trailers when transporting plant material to prevent anything from falling off. Some weeds can reproduce vegetatively—from leaves, bulbs or other plant material—while others use seeds, and some may require heat or cold treatment before composting, mulching or disposal.
- If a site is infested with myrtle rust, do **NOT** remove any plant material. Dispose of plant waste by burial on site. If this is not possible, seal the waste in a plastic bag, seal the bag in a second bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.
- If you are aware of a plant pathogen infestation, begin weeding in the clean part of the bushland before moving to the infested area. Clean all clothing, hats, footwear, tools, equipment, machinery and vehicles before leaving the infested area.

Propagation

The following steps will help stop the spread of invasive species during propagation activities:

- Ensure all benches, equipment, pots and containers are clean and disinfected.
- While using implements such as cutting knives or secateurs, wash them regularly with a solution of 70% ethanol or methylated spirits in 30% water.
- Steam-air pasteurise soil mixes for 30 minutes at 60°C, or select materials that conform to Australian Standard *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*. These standards require the materials to be free from plant pathogens, pests, harmful chemicals and weeds.
- Avoid bringing soil on boots and equipment into the nursery areas.
- If possible, keep pots on raised wire-mesh benches at least 30 centimetres off the ground. Otherwise, keep them on free-draining blue metal.
- Keep the whole nursery area clean and free of dead plant material and rubbish.

References and resources—general

Guidelines for the translocation of threatened plants in Australia— Second edition	2004	Vallee L, Hogbin T, Monks L, Makinson B, Matthes M and Rossetto M; Australian Network for Plant Conservation, Canberra	https://www.anbg.gov.au/anpc/publications/translocation.html
Leave no trace Australia	Web resources		www.lnt.org.au/resources/biosecurity/bio-security.html www.lnt.org.au/resources/skills-ethics-series.html

References and resources—wash-down procedures

Vehicle and machinery checklists— clean-down procedures	2014	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.daff.qld.gov.au/__data/assets/pdf_file/0011/58178/IPA-Cleandown-Procedures.pdf
Weed out the seeds— How to clean down your vehicle and machinery to help prevent the spread of weed seeds	2011	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.youtube.com/watch?v=dTNDcjTVfI
A guide for machinery hygiene for civil construction	2011	Civil Contractors Federation, State of Victoria, Department of Primary Industries, Department of Sustainability and Environment, VicRoads and the Association of Land Development Engineers	www.civilcontractors.com/Uploads/files/LR%20CCF%20Machinery%20Hygiene%20Bklt%2040pp.pdf
Keeping it clean: A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens	2010	NRM South, Tasmania	dpipwe.tas.gov.au/Documents/15130802_52keepingitcleanspreadswe.pdf
Biosecurity videos		NRM South, Tasmania	www.nrmsouth.org.au/biosecurity/
Field hygiene kits for landholders or community groups in Tasmania— available for purchase		NRM South, Tasmania	Landholders www.nrmsouth.org.au/wp-content/uploads/2014/08/Biosecurity-kits-sales-flyer-2015-Landholders.pdf Community groups www.nrmsouth.org.au/wp-content/uploads/2014/08/Biosecurity-kits-sales-flyer-2015-community.pdf

References and resources—seed production areas

Sowing seeds: bridging the gap between ex situ collections and reintroduction	2012	Guja L, North T, Taylor D and McAuliffe J; Australasian Plant Conservation 21(3)	www.anbg.gov.au/anpc/apc/21-3_guja.html
Developing seed production areas for native plants—Corangamite region guidelines	2008	Heyes S, Butler M, Gartlan C and Ovington A; Corangamite Seed Supply and Revegetation Project	www.florabank.org.au/files/documents/seedproductionareas/Corangamite%20Seed%20Production%20Area%20Guidelines08%20P1.pdf
Introducing seed production areas: an answer to native seed shortages	2008	Vanzella B; Greening Australia	www.florabank.org.au/files/newsattachments/SPA%20handout_%20master%20GACR%20Bindi%20Vanzella%20March08.pdf

References and resources—*Phytophthora cinnamomi*

Managing Phytophthora dieback—Guidelines for local government	2000	Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Managing_Phytophthora_Dieback_guidelines.pdf
Managing Phytophthora dieback in bushland—A guide for landholders and community conservation groups	2008	Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Managing_Phytophthora_Dieback_in_Bushland.pdf
Resistant native plant species—A list of resistant native plant species from Western Australia from the Centre of Phytophthora Science and Management at Murdoch University		Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Western_Australian_Natives_Resistant.pdf
Susceptible native plant species—A list of susceptible native plants species from Western Australia from the Centre of Phytophthora Science and Management at Murdoch University		Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Western_Australian_natives_susceptible.pdf

Management of <i>Phytophthora cinnamomi</i> for biodiversity conservation in Australia: Part 1—A review of current management.	2005	O’Gara E, Howard K, Wilson B and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of <i>Phytophthora cinnamomi</i> for biodiversity conservation in Australia: Part 2—National best practice guidelines. Appendix 1— <i>Phytophthora cinnamomi</i> Appendix 2—The rationale of current management options Appendix 3—Areas vulnerable to disease caused by <i>Phytophthora cinnamomi</i> Appendix 4—The responses of native Australian plant species to <i>Phytophthora cinnamomi</i>	2005	O’Gara E, Howard K, Wilson B and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of <i>Phytophthora cinnamomi</i> for biodiversity conservation in Australia: Part 3—Risk assessment for threats to ecosystems, species and communities: A review	2005	Wilson B, Howard K, O’Gara E and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of <i>Phytophthora cinnamomi</i> for biodiversity conservation in Australia: Part 4—Risk assessment models for species, ecological communities and areas.	2005	Centre for Phytophthora Science and Management—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation

Threat abatement plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>	2014	Australian Government Department of the Environment	www.environment.gov.au/ resource/threat-abatement-plan- disease-natural-ecosystems-cau- sed-Phytophthora-cinnamomi
Background: Threat abatement plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>	2014	Australian Government Department of the Environment	www.environment.gov.au/ resource/threat-abatement-plan- disease-natural-ecosystems-cau- sed-Phytophthora-cinnamomi
Response of selected South Australian native plant species to <i>Phytophthora cinnamomi</i>	2012	Kueh KH, McKay SF, Facelli E, Facelli JM, Velzeboer RMA, Able AJ, Scott ES	onlinelibrary.wiley. com/doi/10.1111/ j.1365-3059.2012.02593.x/full
Infection of native plants by <i>Phytophthora cinnamomi</i> —key threatening process listing	2002	New South Wales Government Office of Environment and Heritage	www.environment.nsw. gov.au/determinations/ PhytophthoraKTPListing.htm
Stamp out the spread of <i>Phytophthora</i> dieback		Royal Botanic Gardens Sydney	www.rbgsyd.nsw.gov.au/__data/ assets/pdf_file/0008/106937/ Phytophthora_brochure.pdf
Are you a carrier? <i>Phytophthora</i> dieback is a silent plant killer		Royal Botanic Gardens Sydney	www.rbgsyd.nsw.gov.au/__data/ assets/pdf_file/0007/106936/ Phytophthora_flyer.pdf
Management of <i>Phytophthora cinnamomi</i> in production forests	2009	Tasmanian Government Forest Practices Authority	www.fpa.tas.gov.au/__data/ assets/pdf_file/0004/58054/ Flora_technical_note_8_ Phytophthora.pdf
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/ documents/about/environment/ biodiversity_guidelines.pdf
Guide 7: Pathogen management			

References and resources—myrtle rust

Look out for myrtle rust	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/364870/myrtle-rust-brochure.pdf
Identification of myrtle rust	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/337374/identification-myrtle-rust.pdf
Preventing spread of myrtle rust in bushland	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/362096/preventing-spread-Myrtle-Rust-bushland.pdf
New South Wales Department of Primary Industries myrtle rust resources page		New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust/resources
Australian Nursery Industry myrtle rust management plan	2012	Nursery and Garden Industry Australia	www.ngia.com.au/Folder?Action=View%20File&Folder_id=135&File=Myrtle%20Rust%20Management%20Plan%202012%20Final%20V2.pdf
Myrtle rust—current information including national and international host lists; bibliography.	2014	The Australian Network for Plant Conservation	https://www.anbg.gov.au/anpc/resources/Myrtle_Rust.html
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/documents/about/environment/biodiversity_guidelines.pdf
Guide 7: Pathogen management			
Current Biosecurity Threats		Biosecurity Tasmania, Department of Primary Industries, Parks, Water and Environment	dpiptwe.tas.gov.au/biosecurity/current-biosecurity-threats

References and resources—weeds

Australian Weeds Strategy—A national strategy for weed management in Australia	2006	Natural Resource Management Ministerial Council, Australian Government Department of the Environment and Water Resources	www.environment.gov.au/biodiversity/invasive/weeds/publications/strategies/pubs/weed-strategy.pdf
Weeds in Australia web pages		Australian Government Department of the Environment	www.weeds.gov.au
Weeds of National Significance (WoNS) web pages		Australian Weeds Committee	www.weeds.org.au
Vehicle and machinery checklists—clean-down procedures	2014	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.daff.qld.gov.au/__data/assets/pdf_file/0011/58178/IPA-Cleandown-Procedures.pdf
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/documents/about/environment/biodiversity_guidelines.pdf
Guide 6: Weed management			

Appendix A

Example checklists

Risk assessment checklist

Determine all risks associated with the potential transfer of pathogens or weeds to/from/through the project site (consider all participants handling plant material and equipment, from collection to site through to on-site works and clean-up).

Liaise with the project site's land managers to determine the presence of:

- ☐ *Phytophthora* spp.
- ☐ Myrtle rust
- ☐ Weeds

Liaise with the project site's land managers to determine the presence of:

- ☐ Vulnerable native plant communities
- ☐ Species susceptible to *Phytophthora* spp. or myrtle rust
- ☐ Threatened species or communities listed under Commonwealth or state/territory legislation

Identify any planned activities with the potential to introduce or spread pathogens or weeds:

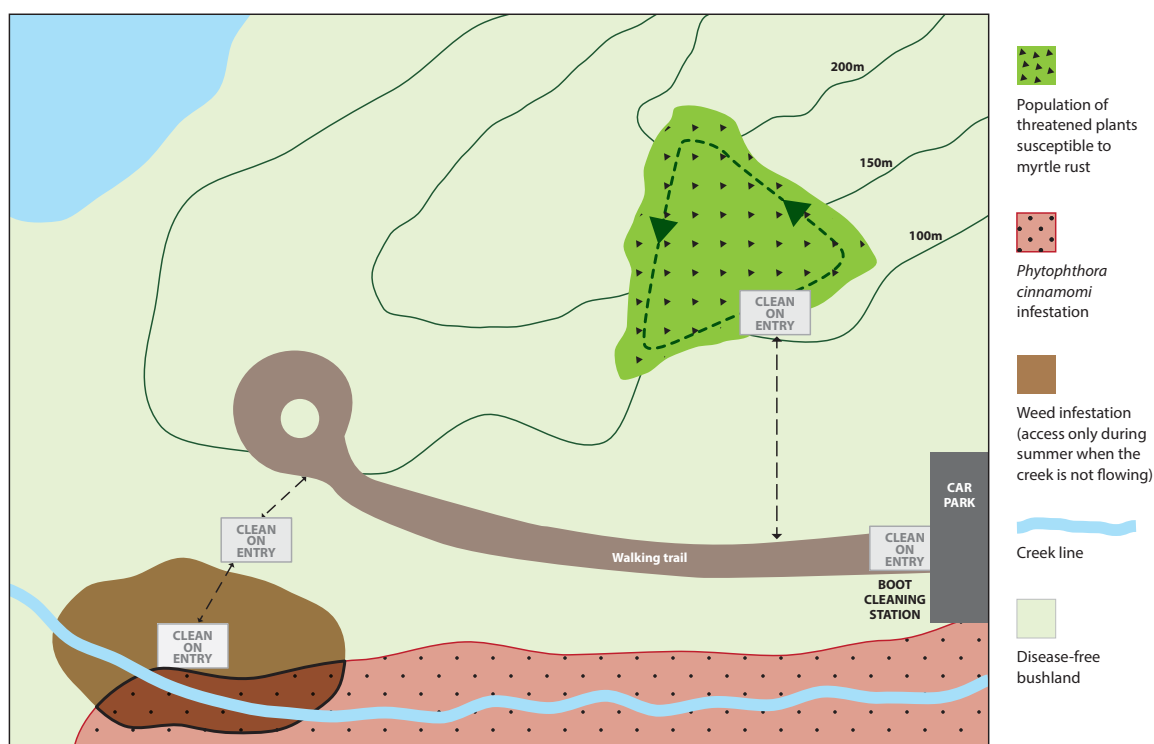
- ☐ Introduction of plant material to a site (seedlings, seeds, mulch etc.)
- ☐ Introduction of other materials to a site (soil, gravel, rock, sand etc.)
- ☐ Vehicle or machinery access to a site
- ☐ Any potential soil disturbance

Hygiene management plan checklist

To prevent the risks having an impact:

- ☐ Plan to visit only one site per day
- ☐ Schedule activities for the right conditions
- ☐ Use equipment that can be cleaned easily and thoroughly
- ☐ Minimise personal items that can carry pathogens
- ☐ Include training sessions so participants are aware of why hygiene is necessary, how to arrive clean, stay clean and leave clean
- ☐ Establish access controls including routes of access and timing on a management map
- ☐ Establish hygiene controls including hygiene procedures, hygiene infrastructure, clean on entry locations and wash-down points on a management map
- ☐ Maintain wash-down facilities and hygiene infrastructure
- ☐ Record and monitor site for any accidental spread of pathogens or weeds

Example hygiene management map



A large area within the project site is disease-free bushland, including a population of threatened plants susceptible to myrtle rust. This population must be monitored regularly during and after the project for any indications of disease.

There is an infestation of the weed arum lily (*Zantedeschia aethiopica*) limited to a small area on either side of the creek. Part of this area is also infested with *Phytophthora cinnamomi* which is present along much of the creek line. To avoid the spread of *Phytophthora cinnamomi*, all weed control activities should be scheduled during the dry season when the creek is not flowing.

'Clean on entry' access to the site is via a boot cleaning station at the car park entrance. From the walking trail there is one pathway of access to the population of threatened plants and another to the arum lily population. At both of these 'clean on entry' points there will be hygiene kits containing hard brushes, spray bottles of disinfectant and alcohol wipes.

Biosecurity hygiene kit: assemble a simple kit with the following items:

- ☐ Plastic tub with a lid (to carry items and to use as a footbath)
- ☐ Stiff brush
- ☐ Newspaper to cover the footwell of a vehicle (replace with clean newspaper regularly)
- ☐ Dustpan and brush; possibly also a long-handled broom
- ☐ Plastic bag for sweepings and dirty newspaper
- ☐ Drum of water and some disinfectant, for example a solution of 70% ethanol or methylated spirits in 30% water; or 20% household bleach (with 5% active ingredient) in 80% water; or quaternary ammonium disinfectant diluted according to manufacturer's directions.
- ☐ Spray bottle with a solution of 70% ethanol or methylated spirits in 30% water
- ☐ Alcohol wipes or gel for hands and personal items



Photo: Biosecurity hygiene kit (Department of Parks and Wildlife WA)

