



SAVING OUR SPECIES

Hygiene guidelines

Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, myrtle rust, amphibian chytrid fungus and invasive plants



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Department of Planning, Industry and Environment
4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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Foreword

This document sets out guidelines to reduce the risks of introducing pathogens (*Phytophthora cinnamomi*, myrtle rust and chytrid fungus) and invasive plants into new areas of New South Wales, especially those with susceptible threatened species, threatened ecological communities and areas of outstanding biodiversity value. The procedures in this document can also be applied to protect non-threatened species.

These guidelines promote the adoption of basic hygiene procedures into daily routines when working in the field. They are simple procedures to ensure potentially-contaminated material is not transferred to a new, susceptible area.

Under select circumstances, more strict hygiene procedures are recommended. These circumstances include when a general biosecurity eradication or containment effort is underway or when undertaking activities that could expose susceptible threatened species, threatened ecological communities or areas of outstanding biodiversity value to a new threat. Strict hygiene procedures are similar to the basic measures but include more thorough cleaning or disinfection.

These protocols and their application should be reviewed five years from the date of publication or if significant new information becomes available.

This document was developed as part of the NSW Government's *Saving our Species* program.

Who should use this guide?

This guide should be used by NSW Department of Planning, Industry and Environment (DPIE) employees, and contractors and volunteers undertaking works on behalf of DPIE, on public or private land.

This guide may also be used by private individuals or businesses working in conservation and revegetation, agriculture, construction, forestry, other primary industries or fields involving work in the agricultural or natural environments.

How to use this guide

Follow the steps below to determine which hygiene measures you should incorporate into your work plan. Clicking on an underlined word or phrase will take you to the relevant section of this document.

1. Read the section on planning considerations. This section provides information on what is likely to influence the risks a certain activity poses, but will not affect the level of hygiene recommended.
2. Read the section on determining your hygiene requirements, and review Appendix B and Appendix C to identify whether any species you are working with or near are susceptible to *Phytophthora cinnamomi* or myrtle rust infection. For *Phytophthora cinnamomi* and myrtle rust, use Decision tree 1 for Phytophthora and myrtle rust to determine which protocols are suitable for your work. If you are working on an island, use Decision tree 2 for visiting or working on islands. For invasive plants and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*), there are set protocols that should be applied in all circumstances.
3. Incorporate the relevant procedure(s) into your work activities.

Useful tools in this document

A list of species known to be susceptible to *Phytophthora cinnamomi* infection can be found at [Appendix B](#).

A list of species known to be susceptible to myrtle rust infection can be found at [Appendix C](#).

Lists of significant invasive non-native plants can be found at [Appendix A](#) and [Appendix D](#).

Additional advice for working with and handling amphibians can be found at [Appendix E](#).

A template for a hygiene management plan can be found at [Appendix F](#).

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Introduction

Purpose

This document provides guidance for people undertaking activities that have the potential to spread or introduce specific pathogens or invasive plant propagules in the natural environment of New South Wales. The protocols outlined in this document are recommended to ensure the risks of spreading pathogens and invasive plants are effectively managed to protect biodiversity in New South Wales.

Objective

The objective of these guidelines is to outline hygiene practices that can help avoid or minimise introduction of pathogens or invasive plants to areas in New South Wales with threatened species and threatened ecological communities. The guidelines were developed to address the following key threatening processes (KTPs) listed under the *Biodiversity Conservation Act 2016* (BC Act):

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae (myrtle rust)
- infection of frogs by amphibian chytrid causing the disease chytridiomycosis (chytrid fungus).

These guidelines can also be applied to invasive plant-related KTPs (see [Invasive plants](#)) and invasive plants identified in National Parks and Wildlife Service [branch pest management strategies](#). They may also have relevance to other disease and pest (including invertebrate and microbial pest) organisms, particularly those borne in soil or water, although these may require additional case-specific protocols (see Biosecurity Hotline contacts below).

The protocols in this document are also relevant to a number of KTPs listed under the Commonwealth [Environment Protection and Biodiversity Conservation Act 1999](#). Use of these guidelines may also reduce the risk from a number of pathogens and diseases yet to arrive in Australia, but assessed as being likely to do so and of high environmental risk (see [Priority list of exotic environmental pests and diseases](#), last reviewed 4 February 2020).

For more general information on managing disease risks in wildlife, including hygiene recommendations, see the [National Wildlife Biosecurity Guidelines \(PDF 2.3MB\)](#) (Wildlife Health Australia 2018).

Scope and application

In New South Wales, the most practical, outcomes-based approach to hygiene is to focus on protecting areas that are: (1) not infested, (2) habitat for threatened species and threatened ecological communities, and (3) not subject to high visitation by people. The protocols in this document can help to achieve this for *Phytophthora cinnamomi*, myrtle rust, chytrid fungus and invasive plants. They may also be useful in reducing risks associated with other pathogens. In the latter case, further information about the risks of transmission will help determine when and where the protocols should be applied.

Some sites or projects may require a specific hygiene management plan. If a hygiene management plan has been developed for your site or project, that plan should take precedence. This document is a guide and should not replace the development of specific hygiene management plans for areas, sites and projects. A template for a hygiene management plan can be found at [Appendix F](#). The template can be used to record the specific hygiene actions for your work.

Hygiene measures should be applied by people working in areas of high biodiversity importance across New South Wales, where appropriate (see [Determining your hygiene requirements](#)). People working with Bellinger River snapping turtles (*Myuchelys georges*) in the Bellinger River may need to take extra hygiene precautions due to the presence of Bellinger River virus. Those people should first contact the NSW Department of Primary Industries Aquatic Biosecurity Hotline on 02 4916 3877 or 131 555 or by [email](#) to confirm what hygiene precautions they should take.

This document does not:

- address biosecurity risks associated with handling animal biological samples, carcasses and waste (see the National Wildlife Biosecurity Guidelines (Wildlife Health Australia 2018) for general information on managing those risks)
- address the risks that native and pest animals play in transferring pathogens and invasive plants between locations, but acknowledges that control of pest animals may be important in reducing the spread of pathogens and invasive plants in some landscapes
- provide species-specific guidance for invasive plants
- replace the benefit or need for developing tailored landscape-, project- or site-specific hygiene management strategies for pathogens and invasive plants.

Pathogens

Pathogens are organisms that can cause disease, and they have the potential to cause significant declines in species and disrupt ecological communities. Preventing entry of pathogens is always the most cost-effective management strategy; however, when pathogens are detected, eradication should be the next option considered, followed by containment (when eradication is not feasible). When containment is not feasible, protecting susceptible threatened species, threatened ecological communities and areas of outstanding biodiversity value is of paramount importance.

Phytophthora cinnamomi

Phytophthora cinnamomi (Phytophthora) is a soil-borne water mould that attacks the roots of susceptible plants, destroying the root system and reducing the ability of the plant to conduct water and nutrients, which can sometimes kill the infected plant (Makinson 2018b).

Any activity that moves soil or plant matter can spread Phytophthora. Clothing, equipment, footwear and vehicles that can carry soil are potential vectors for transmission (NSW TSSC 2011). In most situations, Phytophthora is impossible to eradicate from infested areas, so the current approach to management aims to prevent its introduction to unaffected areas to protect threatened species and ecological communities that are most at risk.

The development of phytosanitary protocols to reduce risks of spreading Phytophthora is a strategic objective of the draft *Saving our Species* (SoS) Phytophthora KTP strategy. This document directly addresses that objective.

Other *Phytophthora* species (e.g. *P. aggregate*, *P. multivora*) are emerging as threats to biodiversity in New South Wales. They have similar dispersal characteristics to *P. cinnamomi* and so the application of hygiene measures outlined in this document will be effective in also containing their spread.

Myrtle rust

Myrtle rust is a disease caused by the fungus *Austropuccinia psidii* (Beenken 2017; Makinson 2018b). It affects trees and shrubs in the Myrtaceae family by attacking young, soft, actively-growing leaves, shoot tips, young stems, fruits and flower parts.

The primary vector of myrtle rust at local and intermediate scales is wind (Makinson 2018b; Pegg et al. 2014); however, myrtle rust spores can quickly spread via people on contaminated clothing, footwear, tools, vehicles and machinery, as well as on animals. While good hygiene practices cannot control the spread of myrtle rust by wind, they can help slow the spread by people to areas that are not yet infested.

The hygiene management approach outlined in this document is consistent with Action 2 of the [Management plan for myrtle rust on the national parks estate \(PDF 1.4MB\)](#) to limit the spread of myrtle rust from infested sites and limit the introduction of myrtle rust to non-infested sites (OEH 2015). No hygiene actions have been identified in the draft SoS myrtle rust KTP strategy; nevertheless, it is important to enact due diligence and ensure it is not spread to areas with susceptible species through poor hygiene. The protocols set out in this document are also consistent with the draft action plan for myrtle rust in Australia (Makinson 2018a).

Amphibian chytrid fungus

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is a fungal pathogen that causes the disease chytridiomycosis, which has led to the decline and extinction of frog populations globally and in Australia (OEH 2018). Chytridiomycosis has been detected in over 40 species of native Australian frogs (DECC 2008).

The fungus is transferred by direct contact between frogs and tadpoles or via zoospores in infected water (OEH 2018). Humans can spread the disease by contaminated footwear and equipment and by (illegally) moving frogs from one area to another.

Batrachochytrium dendrobatidis is listed as prohibited matter under the [Biosecurity Act 2015](#). Consequently, it is an offence to knowingly spread chytrid in New South Wales. Implementing the protocols detailed in this document will help people to carry out their [general biosecurity duty to prevent, eliminate or minimise risk](#) posed by chytrid fungus.

The protocols outlined in this document replace the *Hygiene protocol for the control of disease in frogs* (DECC 2008).

Invasive plants

Invasive plants are (generally) non-native to Australia and have an adverse effect on, or are suspected of having an adverse effect on, the environment, the economy or the community (Biosecurity Act). The financial impact of invasive plants in New South Wales on agriculture alone is approximately \$4.3 million every year (DPI 2017). Impacts on the environment have not been quantified but are likely equal to or greater than those on agriculture. Many invasive plants can occupy natural areas and disturb ecosystems by altering plant and animal community composition, nutrient cycles and fire regimes (DoE 2015).

Invasive plants can be spread by dispersal of seed and vegetative material on wind, animals, waterways and people (via contaminated clothing, hats, footwear, tools, equipment, machinery and vehicles; DoE 2015). Although non-human vectors are difficult to control, the dispersal capacity of humans can be reduced by modifying behaviour. Implementing hygiene protocols will assist with controlling the spread of invasive plants by preventing the transportation of plant material that is capable of proliferating in new sites. The primary approach to preventing spread of invasive species is through effective project planning and cleaning of clothing, equipment and vehicles.

The following KTPs under the BC Act involve one or more invasive plant species:

- invasion and establishment of exotic vines and scramblers
- invasion and establishment of Scotch broom (*Cytisus scoparius*)
- invasion, establishment and spread of lantana (*Lantana camara* L. *sens. lat.*)

- invasion of native plant communities by African olive *Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.
- invasion of native plant communities by *Chrysanthemoides monilifera*
- invasion of native plant communities by exotic perennial grasses
- loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Some invasive plants may be subject to targeted eradication or containment programs and may have increased hygiene requirements. Outside of those programs, the procedures in these guidelines can be used to reduce the likelihood of spreading invasive plants to new areas.

Invasive plants in New South Wales are regulated under the *Biosecurity Act 2015*. The Biosecurity Act establishes the concept of a 'general biosecurity duty', which requires that any person who deals with (e.g. possesses, breeds, propagates, moves, displays, acquires) a plant and knows (or ought to know) of any biosecurity risks associated with the plant, has a duty to ensure the risk is prevented, eliminated or minimised, as far as is reasonably practical.

Some invasive plants are listed as 'prohibited matter' under the Biosecurity Act. Invasive plants that are prohibited matter are more heavily-regulated than other invasive plants. Any dealing with prohibited matter (including movement) in New South Wales is an offence. Any person who becomes aware of or suspects the presence of prohibited matter must notify the Department of Primary Industries immediately on 1800 680 244 or by email at weeds@dpi.nsw.gov.au. Visit [NSW WeedWise](#) for details of the biosecurity duties for each invasive plant species.

See [Appendix D](#) for a list of invasive non-native plants that are listed as prohibited matter. You can contact the Botanical Information Service (Royal Botanic Gardens and Domain Trust) at botanical.is@rbgsyd.nsw.gov.au to confirm plant identification and lodge voucher specimens in the National Herbarium of New South Wales.

Hygiene management

Hygiene refers to specific measures to prevent the spread of pathogens and invasive plant propagules by removing seeds, spores, contaminated soil, water, and organic materials from machinery, vehicles, equipment, footwear and clothing.

The appropriate level of hygiene (basic or strict) is dependent on whether the location is already infested and whether you are working near any susceptible threatened species, threatened ecological communities or declared areas of outstanding biodiversity value, as well as any non-listed species known to be highly susceptible to a pathogen or threat process (susceptible high-risk entities). A list of known susceptible high-risk entities can be found at [Appendix B](#) (for *Phytophthora cinnamomi*) and [Appendix C](#) (for myrtle rust).

Where a pathogen is not present at a site but there are susceptible animals or plants present, hygiene measures should be more stringent.

Maintaining good hygiene is consistent with the management principles for national parks, historic sites, state conservation areas, regional parks, karst conservation areas, nature reserves and Aboriginal land set out in the *National Parks and Wildlife Act 1974*. Those management principles include conserving natural values and conserving biodiversity, maintaining ecosystem function and maintaining natural landscapes.

Good hygiene standards are also consistent with the national standards for implementing ecological restoration activities (Standards Reference Group SERA 2017).

Planning considerations

Below is a list of factors that can decrease the likelihood of transmitting pathogens and invasive plants. It is not intended as a list of activities prescribed by this document for all circumstances (because they may be impractical in many cases) but can help readers recognise risk factors when planning and undertaking their work.

Factors that can reduce the risk of introducing or spreading pathogens or invasive plants include:

- scheduling work during dry weather (and not immediately following wet weather) to reduce adhesion of soil to footwear, clothing, equipment and vehicles
- (when working across multiple field sites) visiting known non-infested sites first, followed by sites with unknown infestation status and lastly sites known to be infested
- scheduling activities so they do not immediately follow warm, moist conditions (which are favourable for spore production) or during times of peak seed production by invasive plants
- restricting movement of soil and plant material to and from a site
- keeping vehicles, machinery and people to dry surfaces, formed roads and walking trails
- maintaining drainage to prevent flooding or pooling
- planning to use methods that minimise soil disturbance.

Additional planning considerations for fire management work

The primary focus of emergency bushfire operations is the protection of life and property. It is rarely practical to implement strict hygiene procedures under those circumstances; however, it is advisable to maintain a basic level of hygiene wherever practical to reduce the spread of plant pathogens.

For non-emergency fire management practices (e.g. prescribed burning, firebreak construction and maintenance), appropriate hygiene measures should be incorporated. We recommend using [Decision tree 1](#) and/or [Decision tree 2](#) (when relevant) to identify suitable hygiene measures before undertaking fire management activities.

There are additional fire management planning actions that can be considered to reduce risks of spreading plant pathogens and invasive plants. These include:

- avoiding construction of firebreaks near susceptible threatened species and threatened ecological communities, where practical and where it does not increase risk to life and property
- constructing firebreaks in areas with good drainage
- preferentially burning areas bound by well-formed hard surfaces.

Determining your hygiene requirements

During the project planning phase, it is important to determine whether [basic](#) or [strict](#) hygiene protocols are appropriate. For example, when working in areas unsuitable for establishment of a pathogen or invasive plants, it may not be necessary to implement strict hygiene measures. [Basic hygiene protocols](#) should always be applied at a minimum.

You can use the hygiene management plan at [Appendix E](#) to summarise the relevant risks and record the recommended hygiene measures for your project.

Phytophthora cinnamomi

Phytophthora cinnamomi (Phytophthora) establishment typically occurs in areas with warm conditions (optimal spore production occurs at 24–25°C under laboratory conditions; Nesbitt et al. 1979) and average annual rainfall of >500 millimetres (*Phytophthora* Technical Group 2006). In New South Wales, *Phytophthora* has established in the following Local Land Services regions:

- Greater Sydney (including the Greater Blue Mountains World Heritage Area; Newby 2014)
- Hunter
- North Coast
- Northern Tablelands
- Central Tablelands
- South East.

Phytophthora is also present in parts of the Central West, Riverina and Murray regions.

Strict hygiene measures are recommended at sites in these regions where:

- susceptible high-risk entities exist
- *Phytophthora* is not present
- there is no public access OR there is public access with hygiene measures already in place (e.g. boot-cleaning stations)
- environmental conditions are conducive to the establishment of *Phytophthora*.

The aim of this approach is to reduce the introduction of *Phytophthora* to non-infested areas.

[Decision tree 1](#) can help you determine your hygiene requirements with respect to *Phytophthora*; however, if working on an island, see [Visiting or working on islands](#).

Myrtle rust (Austropuccinia psidii)

There are varied reports of climatic preferences for myrtle rust spore germination (Makinson 2018b). For example, Kriticos et al. (2013) found that laboratory germination occurred between 8.8 and 29.7°C, but was optimal between 12 and 20°C. Ruiz et al. (1989) reported a thermal tolerance range of 5–25°C on a eucalypt host. Myrtle rust prefers moist environments and incidence tends to decrease during dry periods (Carnegie et al. 2016).

Myrtle rust has established throughout coastal New South Wales (including some areas of the lower Blue Mountains) and spores are likely to have spread throughout almost all moist terrestrial habitats in the region due to high dispersal capacity by wind (DPI 2015). Consequently, it is not always practical or cost-effective to implement strict hygiene procedures for myrtle rust in this region.

Hygiene measures can go some way to reducing the spread of myrtle rust to some non-infested areas such as potential habitat on or west of the Great Dividing Range in New South Wales and jurisdictions not yet affected by myrtle rust (e.g. South Australia and Western Australia). Before travelling to other states and territories not affected by myrtle rust, you should launder all of your fieldwork clothes if you have been working in an area infested with myrtle rust.

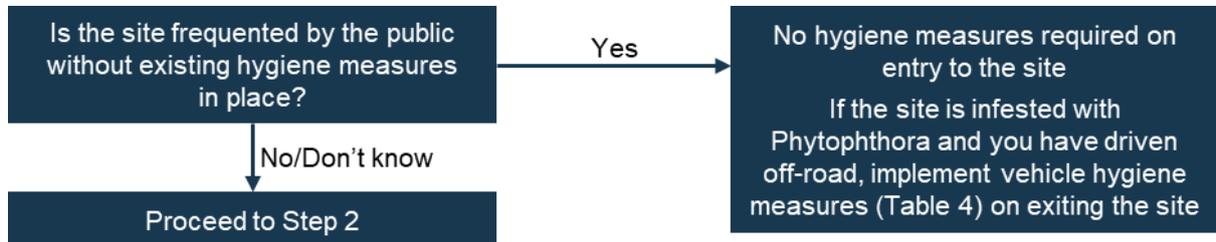
The far south-west of Western Australia contains approximately 40% of Australia's myrtaceous species (Makinson 2018b). Consequently, if introduced, myrtle rust has the potential to cause significant damage to the region. The continued exclusion of the pathogen from south-west Western Australia is a national biosecurity priority.

[Decision tree 1](#) can help you determine your hygiene requirements with respect to myrtle rust; however, if working on an island, see [Visiting or working on islands](#).

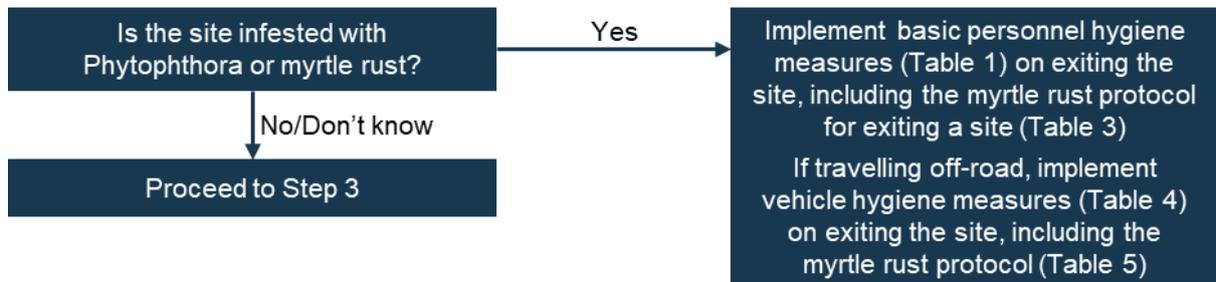
Decision tree 1: Phytophthora and myrtle rust

This decision tree should only be used when there is no site-specific hygiene protocol for the area you are visiting or working in.

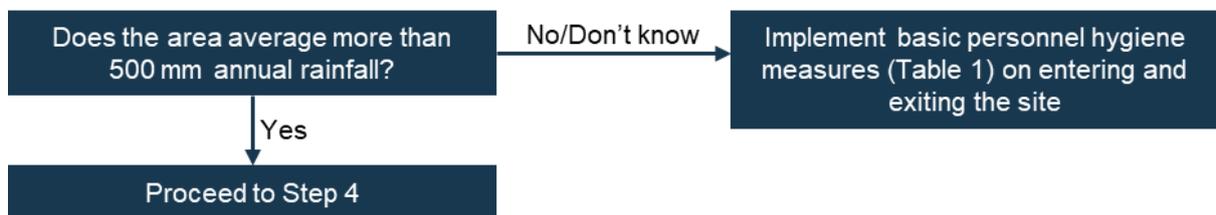
Step 1: Determine nature of public access



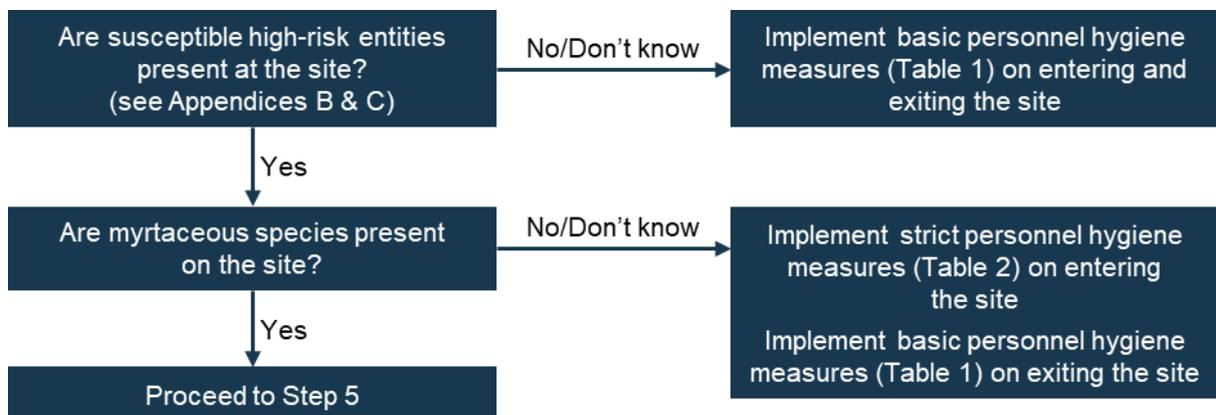
Step 2: Determine presence of Phytophthora or myrtle rust

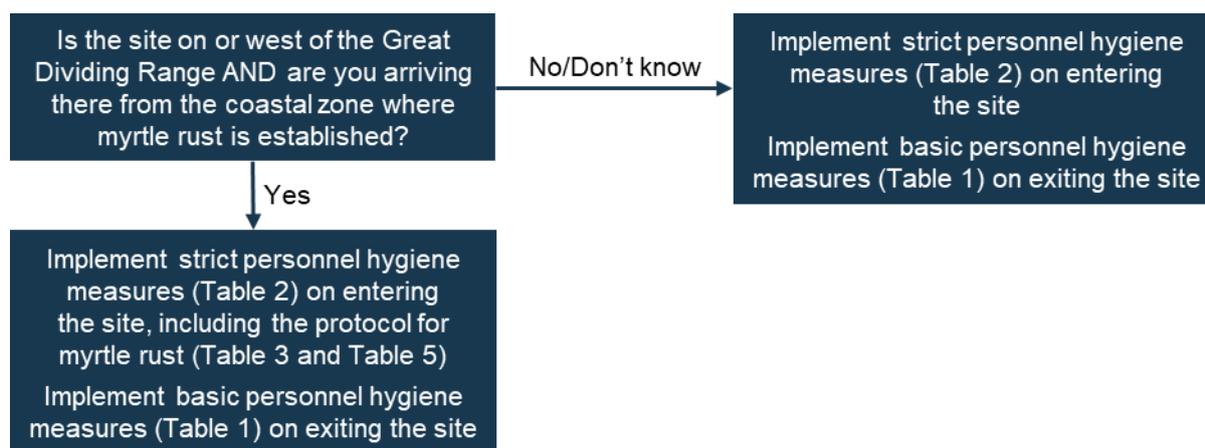


Step 3: Determine average annual rainfall



Step 4: Determine presence of susceptible entities and/or myrtaceous species



Step 5: Determine risk of spread of myrtle rust to or beyond the Great Dividing Range**Invasive plants**

[Appendix A](#) and [Appendix D](#) list invasive plants listed as KTPs or prohibited matter under the BC Act and Biosecurity Act, respectively. It is recommended that hygiene measures are implemented whenever working with these species or in areas where these species occur.

The basic hygiene procedure ([Table 1](#)) and the vehicle hygiene procedure ([Table 4](#)) recommend checking and removing seed and plant debris from clothing, footwear, equipment and vehicles. These measures are sufficient to remove invasive plant propagules under most circumstances, but people should be particularly vigilant when checking and cleaning after work on sites with KTP-listed plants, weeds of national significance or regional priority invasive plants (see the [NSW WeedWise website](#)).

During peak seed production, consideration should be given to additional measures, such as designating site-specific shoes, clothing or equipment that are used only at a single site and are bagged prior to leaving that site. When operating heavy machinery that captures a lot of soil in an infested site, implement strict vehicle hygiene measures ([Table 4](#)).

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*)

Reducing the spread of amphibian chytrid fungus between sites and between frogs should be a central objective when working with or near amphibians or in habitats where amphibian chytrid fungus is pervasive. Consequently, strict hygiene should be practised under all circumstances for personnel, clothing, footwear, tools and equipment. See [Table 6](#) for details; however, if working on an island, see [Visiting or working on islands](#).

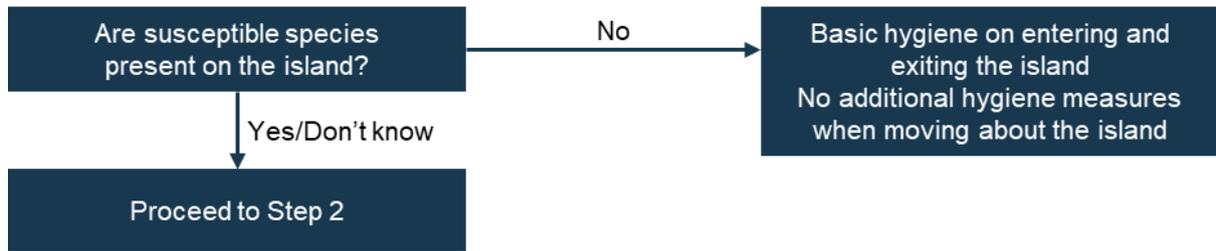
Visiting or working on islands

When visiting or working on islands, the recommended level of hygiene depends on whether or not the island is affected by pathogens and if so, to what extent. In some cases, this may be difficult to determine, so a cautious approach may be sensible. [Decision tree 2](#) is a general guide to the 'when' and 'what' of hygiene on islands. It can be applied to Phytophthora, myrtle rust and amphibian chytrid fungus. For invasive plants, follow the advice above under [Invasive plants](#).

Where hygiene measures are recommended for moving about an island (see Step 3 below), it will be important to establish hygiene points at the boundary of the infested area(s).

Decision tree 2: visiting or working on islands

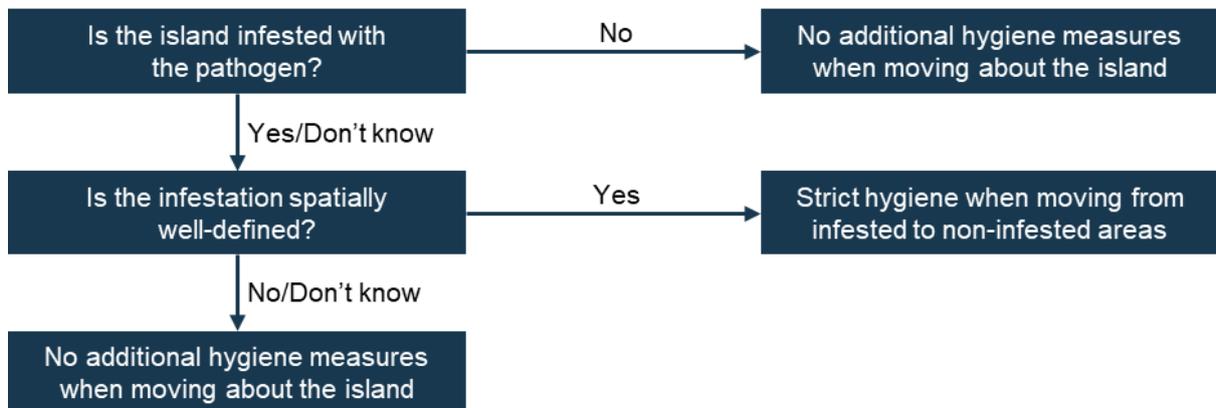
Step 1: Determine presence of susceptible species



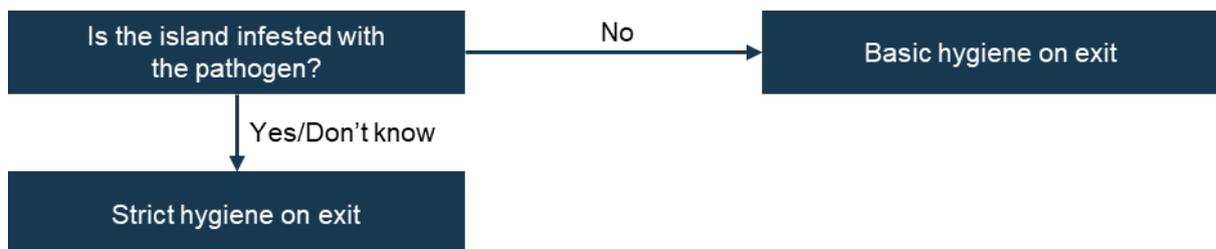
Step 2: Determine hygiene measures before entry to the island



Step 3: Determine hygiene measures for moving about the island



Step 4: Determine hygiene measures for exit from the island



Recommended hygiene protocols

Personnel, clothing, footwear, tools and equipment

Basic hygiene measures

Table 1 Basic hygiene protocol for personnel, clothing, footwear, tools and equipment

| Step | Description |
|----------|---|
| 1. Check | <ul style="list-style-type: none"> Check personnel, clothing, footwear, backpacks and equipment for soil, plant material/propagules and other debris. |
| 2. Clean | <ul style="list-style-type: none"> Remove all soil, plant material and other debris using a hard brush and (if required) clean water. If dirty, wash hands with soap and water¹. Remove seeds from clothing, footwear, tools and equipment by hand. Seeds that are difficult to remove can sometimes be scraped off clothing with a sharp implement (e.g. a knife), but use caution. Where possible, have a co-worker double-check that you have removed all seeds. |
| 3. Dry | <ul style="list-style-type: none"> Where practical, ensure hands, clothing, footwear, and equipment are dry before proceeding. |

Strict hygiene measures

Where possible, strict hygiene procedures should be implemented at a set hygiene point at the site boundary. The site boundary should be defined by the project or site manager. It could be the boundary of a national park. If not on-park, the boundary could be identified based on the distribution of the threatened entities at risk. Where a site boundary is unclear, it should be determined at the project or site manager's discretion.

Where possible, disinfectant should be applied and disposed of in a dry area that is at least 30 metres from a waterway or drainage channel, and where there is limited possibility of it running into a waterway or sensitive environmental area. The complete elimination of all spores on contaminated materials (e.g. boots, vehicles) is an unreasonable expectation, so the goal of disinfection is to *reduce* the spore load present.

Table 2 Strict hygiene protocol for personnel, clothing, footwear, tools and equipment

Project planning

| Step | Description |
|-----------|--|
| 1. Check | <ul style="list-style-type: none"> Ensure you have a fully stocked hygiene kit, or easy access to one. |
| 2. Select | <ul style="list-style-type: none"> Where practical, select clothing, footwear, tools and equipment that are easy to clean (e.g. non-absorbent). |
| 3. Clean | <ul style="list-style-type: none"> Make sure all equipment is clean before use (routinely following this protocol will achieve this). |

¹ For general information on hand hygiene, refer to the *National Wildlife Biosecurity Guidelines* (Wildlife Health Australia 2018).

Table 2, continued...*Protocols*

| Step | Description |
|--------------|--|
| 1. Check | <ul style="list-style-type: none"> Thoroughly check all clothing, footwear, backpacks tools and equipment for soil, water, organic material or other debris. Where possible, have a co-worker double-check for you. |
| 2. Clean | <ul style="list-style-type: none"> Remove all soil, water, organic material and debris using a hard brush and clean water. Remove any residual seeds from clothing, footwear, tools and equipment by hand. Where possible, have a co-worker double-check that you have removed all seeds. If dirty, wash hands with soap and water. |
| 3. Disinfect | <ul style="list-style-type: none"> Spray or soak potentially contaminated materials (e.g. footwear, equipment) with disinfectant (Table 7). Leave for 30 seconds before proceeding. Where practical, rinse with clean water. |
| 4. Dry | <ul style="list-style-type: none"> Where practical, ensure all personnel, clothing, footwear, tools and equipment are dry before proceeding. |

Myrtle rust

[Decision tree 1](#) identifies when hygiene measures specifically for myrtle rust should be considered. Generally, this will only be after visiting a site that is infested with myrtle rust or when travelling from an infested area to a non-infested site.

Table 3 Myrtle rust hygiene protocol for personnel, clothing, footwear, tools and equipment

| Step | Description |
|--------------|--|
| 1. Disinfect | <ul style="list-style-type: none"> Spray equipment and clothing with disinfectant. |
| 2. Clean | <ul style="list-style-type: none"> At the end of the day, launder all hats and clothing using detergent and warm or hot machine wash to kill residual spores. At the end of the day, shower thoroughly to remove residual spores from skin and hair. |

Vehicles and heavy machinery

Generally, protocols for vehicles and heavy machinery (Table 4) only need to be implemented when you have driven off-road. The myrtle rust protocol (Table 5) is an exception and should be implemented whenever you have driven in a site infested with myrtle rust, because spores can adhere to clothing and be transferred to the vehicle's interior.

Table 4 Hygiene protocol for vehicles and heavy machinery

| Step | Description |
|----------|--|
| 1. Check | <ul style="list-style-type: none"> Check the exterior and interior of vehicles and machinery for soil, plant material and other debris. Use Figure 2 as a guide for where to focus your attention. |
| 2. Clean | <ul style="list-style-type: none"> Remove large clods of dirt and soil using a stiff brush or crowbar. Remove all soil, plant material and other debris from the interior using a vacuum or dustpan and brush. Focus on the cabin floor, floor mats and pedals. Place debris in a bag and dispose of in a commercial waste bin. <i>If returning from a potentially-contaminated area, wash vehicle and/or machinery as soon as possible (e.g. at a commercial carwash) before heading back to base. If a carwash facility is not available, spray tyres thoroughly with a disinfectant (Table 7).</i> <i>If leaving a potentially-contaminated area and travelling to a new site, reassess your hygiene requirements using Decision tree 1 for Phytophthora and myrtle rust.</i> |
| 3. Dry | <ul style="list-style-type: none"> Where practical, allow vehicle or machinery to dry before proceeding. |

Myrtle rust

Table 5 Myrtle rust hygiene protocol for vehicles and heavy machinery

| Step | Description |
|--------------|--|
| 1. Disinfect | <ul style="list-style-type: none"> Use 70% alcohol wipes or a spray bottle to apply disinfectant (Table 7) to the interior of vehicle (focus on seats, steering wheel, gear stick, pedals and floor). Spray the exterior with disinfectant or hand pressure sprayer. Allow the disinfectant to remain in contact with the surface for at least 30 seconds before rinsing with clean water. |

Amphibian fieldwork

Table 6 Strict hygiene protocols for undertaking amphibian fieldwork

Project planning

| Step | Description |
|-----------|--|
| 1. Select | <ul style="list-style-type: none"> Where practical, select clothing, footwear, tools and equipment that are easy to clean (e.g. non-absorbent). Where practical, when visiting multiple sites, pack separate sets of equipment (including shoes) for use at each site. |

Before arriving at a site and on leaving a site

| Step | Description |
|--------------|--|
| 1. Check | <ul style="list-style-type: none"> Thoroughly check all personnel, clothing, footwear and equipment for soil, water, organic material or other debris. Where possible, have a co-worker double-check for you. |
| 2. Clean | <ul style="list-style-type: none"> Remove all soil, water, organic material or other debris using a hard brush and clean water. |
| 3. Disinfect | <ul style="list-style-type: none"> Spray or soak potentially-contaminated materials with disinfectant (Table 7). Leave for 30 seconds before proceeding. Where practical, rinse with clean water. |
| 4. Dry | <ul style="list-style-type: none"> Where practical, ensure all clothing, footwear, tools and equipment are dry before proceeding. |

When in the field

- Wear disposable, non-powdered gloves when handling amphibians.
- Use new gloves or a new bag for handling each individual amphibian.
- Wear well-rinsed (with water) vinyl gloves when handling tadpoles.
- If gloves are not available, wash hands with 70% alcohol between handling each animal. Make sure hands are dry before handling amphibians as alcohol exposure may be toxic to them. Rinse hands with potable water (if available) after disinfecting.
- Keep individual amphibians in separate containers. Dispose of containers after use.
- Where possible, keep tadpoles in separate containers. If necessary, tadpoles from the same pond or stream section can be grouped in one container but avoid overcrowding.
- Never mix amphibians from different sites.
- Amphibians should be released where they were captured.
- If using toe clipping or Passive Integrated Transponder (PIT) tagging, use disinfected instruments (preferably unused disposable instruments). Open wounds should be sealed using an appropriate tissue adhesive, followed by application of a topical anaesthetic disinfectant.

Hygiene tools

Hygiene kits

A simple hygiene kit should be kept in each field vehicle to allow staff to implement hygiene measures as required. At a minimum, hygiene kits should contain a stiff brush (for removing soil from boots, bags, etc.), a spray bottle and a container of disinfectant solution (with enough volume for several refills of the spray bottle).

A more comprehensive hygiene kit should include:

- stiff brush
- nail brush
- dustpan (for removing soil from vehicle interior)
- spray bottle
- container of disinfectant solution (enough for several refills of spray bottle)
- container of clean water (for disinfectant dilution and hand washing)
- disposable garbage bags for waste
- plastic tubs that can be used to carry items and for soaking equipment
- alcohol wipes or gel
- soap
- towel
- disposable gloves for handling disinfectant (long-arm waterproof gloves can further reduce risk of skin exposure when diluting disinfectant)
- non-powdered gloves (if working with amphibians).

Disinfectants

Disinfectants should be used for personnel, field equipment and tools, clothing, footwear, vehicles, machinery and personal items to reduce the number of residual spores and other pathogens. For disinfectants to be effective, all surfaces must first be cleaned of soil and organic matter.

All people must take reasonable care for their health and safety, and the health and safety of others, by following product safety instructions and wearing appropriate personal protection equipment when preparing and using disinfectants. Commercially-available fungicides should generally not be mixed with other chemicals (unless the manufacturer explicitly states it is safe to do so). This is especially important for chlorine-based compounds as these may produce toxic vapours when mixed with fungicides (Allan & Gartenstein 2010).

Table 7 Disinfectants

| Disinfectant | Application | Notes |
|--|---|--|
| 70% methylated spirits in water | Spraying absorbent and non-absorbent materials, including vehicle interiors. Can also be used to disinfect hands. | Store in a closed container to reduce evaporation. Solutions at lower or higher concentrations may be less effective or even completely ineffective. Can be used on clothing. |
| 1% sodium hypochlorite in water | Soaking non-absorbent materials | Dilution of household bleach is sufficient. Use only in a well-ventilated area. Do not use on clothing. Bleach has a limited shelf life. Degradation increases with exposure to UV light and at higher temperatures. See manufacturer's details for further information. |
| Benzalkonium chloride (various concentrations) | Spraying or soaking materials (e.g. equipment, vehicles, boot-cleaning stations) | Some commercial fungicidal products are available (e.g. Phytoclean®). Use as per manufacturer's instructions. Avoid contact with skin or items likely to come into contact with skin (e.g. clothing). |
| Industrial strength detergent | Cleaning and disinfecting vehicle exteriors, shoes and equipment | There are several commercial products available. Use as per manufacturer's instructions. |
| Chloramine and chlorhexadine-based products | Disinfecting hands, footwear and equipment | Examples include <i>Halamid</i> ®, <i>Halasept</i> ® and <i>Hexifoam</i> ®. Use as per manufacturer's instructions. |
| Alcohol wipes | Wiping down vehicle interiors | For multi-use packets, ensure the packaging is properly sealed between uses. |
| Alcohol gel | Disinfecting hands | |

Boot-cleaning stations

Installation of boot-cleaning stations along popular walking trails can help to mitigate the risk of bushwalkers spreading *Phytophthora* and other soil-borne pathogens, as well as some invasive plant propagules. Where present, they are a suitable alternative to a stiff brush for cleaning boots. Boot-cleaning stations can vary in complexity from simple systems with fixed brushes that people can use to scrub their shoes (see Figure 1), or a bench with a hand brush attached by chain, to mechanisms that deliver disinfectant to footwear (O’Gara et al. 2005). Boot-cleaning stations accompanied by instructional material and signage about *Phytophthora* increase awareness and provide context for users, and may increase compliance (Massenbauer 2018).

It is recommended that disinfectant solutions in boot-washing stations are regularly monitored and replaced as necessary. Solutions may need to be replaced more frequently in high traffic areas.



Figure 1 Boot-cleaning station in Barrington Tops National Park

Photo: Peter Beard/DPIE

Vehicle and machinery cleaning checklist

When you are likely to drive off-road or use heavy machinery, it is useful to develop a cleaning checklist during the planning phase of the project. The checklist should include components of the vehicle or machinery that are likely to come into contact with soil or plant material, whether through direct contact (e.g. tyres) or by transfer (e.g. cabin floor, gear stick). An example illustrated cleaning checklist can be found at Figure 2.

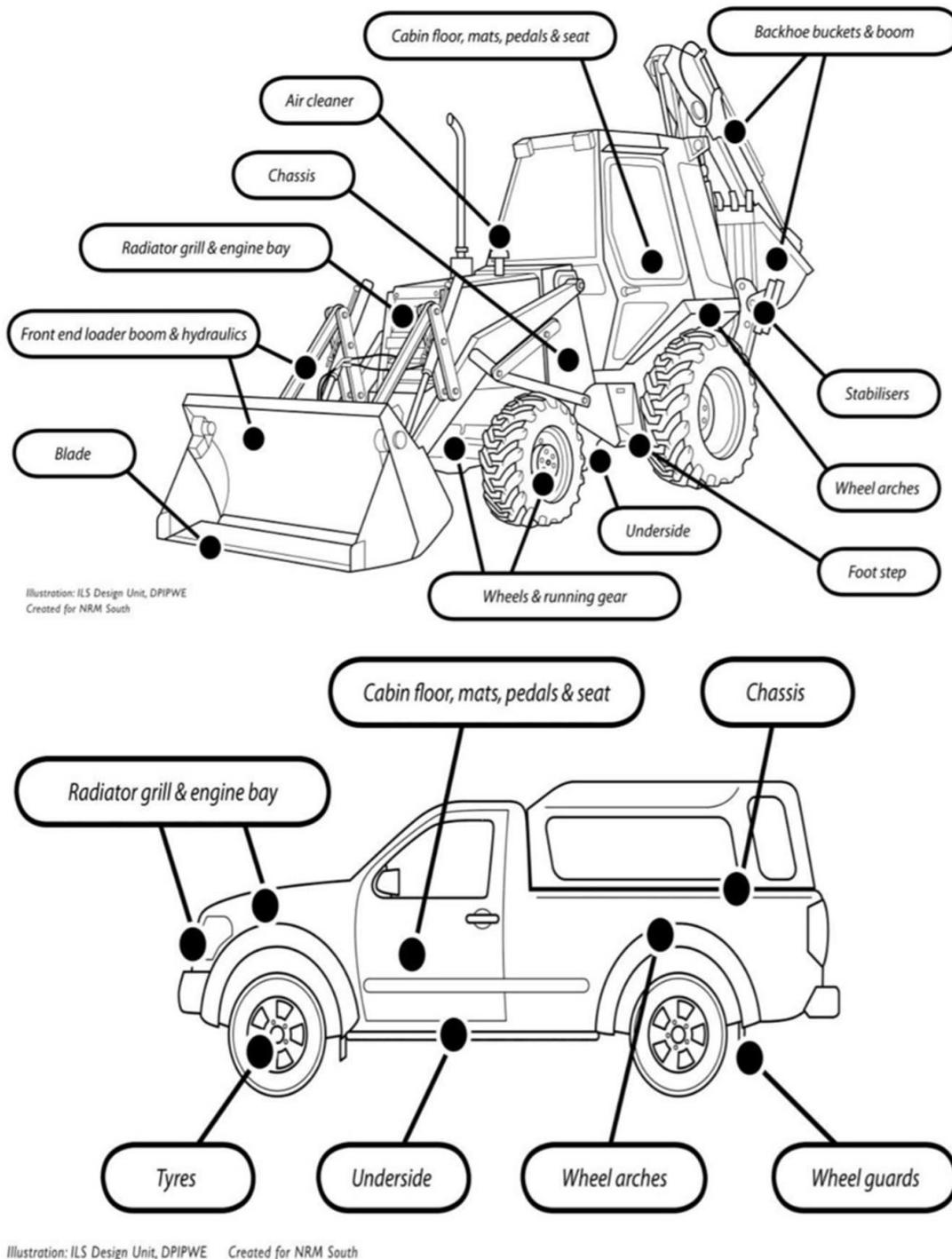


Figure 2 Example illustrated machinery and vehicle cleaning checklists

These are the parts of the vehicle that should be checked and cleaned. Reproduced from DPIPWE (2015) with permission. Original image credit: Allan and Gartenstein (2010).

Appendix A: Legislation

Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) is the primary piece of legislation that protects biodiversity in New South Wales. One of the purposes of the BC Act is to assess the extinction risk of species and ecological communities, and identify key threatening processes (KTPs), through an independent and rigorous scientific process (BC Act s.1.3(f)).

A threat may be listed as a KTP if, in the opinion of the Threatened Species Scientific Committee (NSW TSSC), it:

- adversely affects threatened species, populations of a species or ecological communities
- could cause species, populations of a species or ecological communities to become threatened.

There are several pathogen and weed-related threats that are listed KTPs under the BC Act, including:

- infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion and establishment of Scotch broom (*Cytisus scoparius*)
- invasion, establishment and spread of lantana (*Lantana camara* L. *sens. lat*)
- invasion of native plant communities by African olive (*Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.)
- invasion of native plant communities by *Chrysanthemoides monilifera*
- invasion of native plant communities by exotic perennial grasses
- loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Division 6 of Part 4 of the BC Act establishes the Biodiversity Conservation Program, known as *Saving our Species* (SoS). The objectives of SoS are:

1. to maximise the long-term security of threatened species and ecological communities in nature and
2. to minimise the impacts of KTPs on biodiversity and ecological integrity.

This document helps to achieve the second objective of SoS by outlining means of reducing the introduction and spread of pathogens and invasive plants throughout New South Wales.

National Parks and Wildlife Act 1974

The main act governing the management of national parks and reserves in New South Wales is the *National Parks and Wildlife Act 1974* (NPW Act). The NPW Act contains provisions for the reservation of land as:

- a national park
- a historic site
- a state conservation area
- a regional park
- a karst conservation reserve
- a nature reserve
- an Aboriginal area.

The National Parks and Wildlife Service administers the NPW Act and is responsible for managing reserved land. Implementation of hygiene measures in national parks helps to meet the obligation to manage national parks in accordance with the management principles set out in Division 2 of Part 4 of the NPW Act, which include conserving biodiversity, maintaining ecosystem function and maintaining natural landscapes.

Biosecurity Act 2015

The *Biosecurity Act 2015* provides a framework for managing biosecurity risks in New South Wales while promoting that biosecurity is a shared responsibility between government, industry and the public. The Biosecurity Act establishes the general biosecurity duty (s.22), which requires any person who knows or ought to know about a biosecurity risk to (so far as is reasonably practical) ensure that risk is prevented, eliminated or minimised.

The Biosecurity Act also establishes prohibited matter, which includes certain plant and animal pests and diseases listed in Schedule 2 of the Act. Any dealing with prohibited matter throughout New South Wales is an offence. An additional biosecurity duty applies to some people who become aware of prohibited matter, including those in charge of premises on which the prohibited matter occurs, as well as consultants who become aware of prohibited matter during the provision of professional services. Those people also have a duty to notify the Department of Primary Industries of any biosecurity event. Additional details of affected people can be found in Divisions 3 and 4 of Part 2 of the Act.

Adopting hygiene into fieldwork routines is a way that people can manage their biosecurity risks and meet their general biosecurity duty under the Biosecurity Act.

Appendix B: NSW species that are susceptible to *Phytophthora cinnamomi*

Phytophthora cinnamomi (Phytophthora) is as a threat to several threatened species and ecological communities. Further surveys and species-susceptibility testing is required to identify additional species and ecological communities that are susceptible to Phytophthora in New South Wales. The research is ongoing and, therefore, the list below is likely to be incomplete. Staff should check the best available and most recent information on any species or ecological community of interest.

Table 8 NSW plant species that are susceptible (or suspected to be susceptible) to *Phytophthora cinnamomi*

NSW conservation status in parentheses: Protected (P), Vulnerable (V), Endangered (E), Critically endangered (CE), Extinct (Ex).

| Species | Reference(s) | Species | Reference(s) |
|---|-----------------|---|--|
| <i>Acacia buxifolia</i> subsp. <i>buxifolia</i> | NSW TSSC (2011) | <i>Angophora costata</i> | NSW TSSC (2011) |
| <i>Acacia genistifolia</i> | NSW TSSC (2011) | <i>Aotus ericoides</i> | Podger et al. (1990); Schahinger et al. (2003); Weste (2001) |
| <i>Acacia siculiformis</i> | NSW TSSC (2011) | <i>Astroloma humifusum</i> | NSW TSSC (2011) |
| <i>Actinotus helianthin</i> (P) | Fraser (1956) | <i>Banksia cunninghamii</i> | Weste (2001); McDougall and Summerell (2003b) |
| <i>Acrotriche serrulata</i> | NSW TSSC (2011) | <i>Banksia ericifolia</i> | NSW TSSC (2011) |
| <i>Allocasuarina rigida</i> | NSW TSSC (2011) | <i>Banksia marginata</i> | Pratt and Heather (1973); Podger et al. (1990); Lee and Wicks (1977); Vickery (1997); Schahinger et al. (2003); Weste (2001) |
| <i>Allocasuarina verticillata</i> | NSW TSSC (2011) | <i>Banksia serrata</i> | Pratt and Heather (1973); Podger et al. (1990); Schahinger et al. (2003); Weste (2001) |
| <i>Amperea xiphoclada</i> (Ex) | NSW TSSC (2011) | <i>Banksia spinulosa</i> var. <i>cunninghamii</i> (P) | NSW TSSC (2011) |

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| Species | Reference(s) | Species | Reference(s) |
|----------------------------------|---|---------------------------------------|--|
| <i>Bauera rubioides</i> | Podger and Brown (1989); Podger et al. (1990); Schahinger et al. (2003); Weste (2001) | <i>Daviesia mimosoides</i> | NSW TSSC (2011) |
| <i>Boronia anemonifolia</i> (P) | NSW TSSC (2011) | <i>Daviesia wyattiana</i> | McDougall and Summerell (2003b) |
| <i>Boronia deanei</i> (V) | NSW TSSC (2011) | <i>Dianella longifolia sens. lat.</i> | NSW TSSC (2011) |
| <i>Bossiaea cinerea</i> | Podger et al. (1990); Schahinger et al. (2003); Weste (2001) | <i>Dillwynia cinerascens</i> | Weste (2001) |
| <i>Bossiaea obcordata</i> | NSW TSSC (2011) | <i>Dillwynia glaberrima</i> | Podger et al. (1990); Weste (2001); Schahinger et al. (2003) |
| <i>Bossiaea prostrata</i> | Weste (2001) | <i>Dillwynia phyllicoides</i> | NSW TSSC (2011) |
| <i>Brachyloma daphnoides</i> | Weste (2001) | <i>Dillwynia sericea</i> | NSW TSSC (2011) |
| <i>Callitris preissii</i> | NSW TSSC (2011) | <i>Dillwynia tenuifolia</i> (V) | NSW TSSC (2011) |
| <i>Calytrix tetragona</i> | Podger et al. (1990); Weste (2001); Schahinger et al. (2003) | <i>Diplarrena moraea</i> | NSW TSSC (2011) |
| <i>Cassinia aculeata</i> | NSW TSSC (2011) | <i>Dodonaea boroniifolia</i> | NSW TSSC (2011) |
| <i>Conospermum taxifolium</i> | NSW TSSC (2011) | <i>Dodonaea viscosa</i> | NSW TSSC (2011) |
| <i>Correa reflexa</i> | Podger et al. (1990); Weste (2001) | <i>Epacris hamiltonii</i> (E) | NSW TSSC (2011) |
| <i>Crowea exalata</i> (P) | NSW TSSC (2011) | <i>Epacris impressa</i> | Weste (2001) |
| <i>Crowea saligna</i> (P) | NSW TSSC (2011) | <i>Epacris paludosa</i> | NSW TSSC (2011) |
| <i>Darwinia biflora</i> (V) | NSW TSSC (2011) | <i>Epacris purpurascens</i> (V) | Fraser (1956) |
| <i>Darwinia peduncularis</i> (V) | NSW TSSC (2011) | <i>Epacris sparsa</i> (V) | NSW TSSC (2011) |
| <i>Daviesia leptophylla</i> | Weste (2001) | <i>Eriostemon myoporoides</i> (P) | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|--|-----------------|--|---|
| <i>Eucalyptus baxteri</i> | NSW TSSC (2011) | <i>Grevillea irrasa</i> subsp. <i>irrasa</i> | McDougall and Summerell (2003b) (NSW TSSC (2011)) |
| <i>Eucalyptus camfieldii</i> (V) | NSW TSSC (2011) | <i>Grevillea juniperina</i> sens. <i>lat.</i> | NSW TSSC (2011) |
| <i>Eucalyptus imlayensis</i> (CE) | NSW TSSC (2011) | <i>Grevillea lanigera</i> | NSW TSSC (2011) |
| <i>Eucalyptus macrorhyncha</i> | NSW TSSC (2011) | <i>Grevillea linsmithii</i> | NSW TSSC (2011) |
| <i>Eucalyptus niphophila</i> | NSW TSSC (2011) | <i>Grevillea molyneuxii</i> (V) | NSW TSSC (2011) |
| <i>Eucalyptus obliqua</i> | NSW TSSC (2011) | <i>Grevillea mucronulata</i> | NSW TSSC (2011) |
| <i>Eucalyptus polyanthemos</i> | NSW TSSC (2011) | <i>Grevillea oleoides</i> | McDougall and Summerell (2003b) |
| <i>Eucryphia moorei</i> | NSW TSSC (2011) | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> (V) | NSW TSSC (2011) |
| <i>Exocarpus cupressiformis</i> | NSW TSSC (2011) | <i>Grevillea parviflora</i> subsp. <i>supplicans</i> (E) | NSW TSSC (2011) |
| <i>Genoplesium rhyoliticum</i> (E) | NSW TSSC (2011) | <i>Grevillea polybractea</i> | NSW TSSC (2011) |
| <i>Goodenia hederacea</i> subsp. <i>hederacea</i> | Weste (2001) | <i>Grevillea rivularis</i> (CE) | NSW TSSC (2011) |
| <i>Goodenia humilis</i> | Weste (2001) | <i>Grevillea rosmarinifolia</i> | NSW TSSC (2011) |
| <i>Grevillea acanthifolia</i> subsp. <i>paludosa</i> (E) | NSW TSSC (2011) | <i>Grevillea victoriae</i> sens. <i>lat.</i> | NSW TSSC (2011) |
| <i>Grevillea acanthifolia</i> subsp. <i>stenomera</i> | NSW TSSC (2011) | <i>Grevillea wilkinsonii</i> (E) | NSW TSSC (2011) |
| <i>Grevillea alpina</i> | NSW TSSC (2011) | <i>Hakea bakeriana</i> | NSW TSSC (2011) |
| <i>Grevillea caleyi</i> (CE) | NSW TSSC (2011) | <i>Hakea ulicina</i> | NSW TSSC (2011) |
| <i>Grevillea granulifera</i> | NSW TSSC (2011) | <i>Hakea dohertyi</i> (E) | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|------------------------------------|-----------------------|---|---|
| <i>Haloragodendron monospermum</i> | NSW TSSC (2011) | <i>Leionema lachnaeoides</i> (E) | NSW TSSC (2011) |
| <i>Helichrysum collinum</i> | NSW TSSC (2011) | <i>Leionema ralstonii</i> (V) | NSW TSSC (2011) |
| <i>Hibbertia calycina</i> | NSW TSSC (2011) | <i>Leptospermum coriaceum</i> | NSW TSSC (2011) |
| <i>Hibbertia circinate</i> (CE) | Wan et al. (in prep.) | <i>Leptospermum juniperinum</i> | Lee and Wicks (1977); Vickery (1997); McDougall and Summerell (2003b) |
| <i>Hibbertia cistiflora</i> | Weste (2001) | <i>Leptospermum lanigerum</i> (P) | NSW TSSC (2011) |
| <i>Hibbertia fasciculata</i> | Weste et al. (2002) | <i>Leucopogon collinus</i> | NSW TSSC (2011) |
| <i>Hibbertia marginata</i> (V) | NSW TSSC (2011) | <i>Leucopogon confertus</i> | NSW TSSC (2011) |
| <i>Hibbertia obtusifolia</i> | NSW TSSC (2011) | <i>Leucopogon ericoides</i> | Podger et al. (1990); Weste (2001); Schahinger et al. (2003) |
| <i>Hibbertia procumbens</i> (E) | NSW TSSC (2011) | <i>Leucopogon esquamatus</i> | NSW TSSC (2011) |
| <i>Hibbertia villosa</i> | NSW TSSC (2011) | <i>Leucopogon exolasius</i> | NSW TSSC (2011) |
| <i>Hibbertia virgata</i> | NSW TSSC (2011) | <i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i> (E) | NSW TSSC (2011) |
| <i>Hovea linearis</i> | Weste (2001) | <i>Leucopogon lanceolatus</i> | NSW TSSC (2011) |
| <i>Isopogon fletcheri</i> (V) | NSW TSSC (2011) | <i>Leucopogon maccraei</i> | NSW TSSC (2011) |
| <i>Isopogon petiolaris</i> (P) | NSW TSSC (2011) | <i>Leucopogon microphyllus</i> var. <i>pilibundus</i> | NSW TSSC (2011) |
| <i>Kennedia prostrata</i> | NSW TSSC (2011) | <i>Leucopogon virgatus</i> | Taylor (1974); Lee and Wicks (1977); Podger et al. (1990); Weste (2001) |
| <i>Kunzea ambigua</i> | NSW TSSC (2011) | <i>Lissanthe strigose</i> | Weste (2001) |
| <i>Lasiopetalum joyceae</i> (V) | NSW TSSC (2011) | <i>Lomatia fraseri</i> | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|--|---|--|---------------------------------|
| <i>Macrozamia communis</i> | Pratt and Heather (1973); McDougall and Summerell (2003b) | <i>Persoonia glaucescens</i> (E) | NSW TSSC (2011) |
| <i>Macrozamia johnsonii</i> (E) | NSW TSSC (2011) | <i>Persoonia hindii</i> (E) | NSW TSSC (2011) |
| <i>Melaleuca biconvexa</i> (V) | NSW TSSC (2011) | <i>Persoonia hirsuta</i> (E) | NSW TSSC (2011) |
| <i>Melaleuca squamea</i> | NSW TSSC (2011) | <i>Persoonia juniperina</i> (P) | Weste (2001) |
| <i>Melaleuca uncinata</i> | NSW TSSC (2011) | <i>Persoonia marginata</i> (V) | NSW TSSC (2011) |
| <i>Melichrus urceolatus</i> | NSW TSSC (2011) | <i>Persoonia mollis</i> subsp. <i>maxima</i> (E) | NSW TSSC (2011) |
| <i>Monotoca elliptica</i> | Podger et al. (1990); McDougall and Summerell (2003b); Schahinger et al. (2003) | <i>Persoonia nutans</i> (E) | NSW TSSC (2011) |
| <i>Monotoca scoparia</i> | Taylor (1974); Weste (2001) | <i>Persoonia pauciflora</i> (CE) | NSW TSSC (2011) |
| <i>Nematolepis rhytidophylla</i> (V) | Wan et al. (accepted) | <i>Persoonia sylvatica</i> (P) | McDougall and Summerell (2003b) |
| <i>Oxylobium ellipticum</i> | Podger et al. (1990); McDougall and Summerell (2003a) | <i>Petrophile pulchella</i> (P) | NSW TSSC (2011) |
| <i>Ozothamnus obcordatus</i> subsp. <i>major</i> | NSW TSSC (2011) | <i>Phebalium phyllicifolium</i> | NSW TSSC (2011) |
| <i>Patersonia sericea</i> | NSW TSSC (2011) | <i>Phebalium squamulosum</i> spp. <i>alpinum</i> (P) | Rigg et al. (2018) |
| <i>Persoonia acerosa</i> (V) | NSW TSSC (2011) | <i>Philotheca myoporoides</i> (P) | Taylor (1974) |
| <i>Persoonia bargoensis</i> (E) | NSW TSSC (2011) | <i>Phyllanthus hirtellus</i> | NSW TSSC (2011) |
| <i>Persoonia cornifolia</i> (P) | McDougall and Summerell (2003b) | <i>Phyllota humifusa</i> (V) | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|--|--|--|---|
| <i>Pimelea linifolia</i> subsp. <i>linifolia</i> | Weste (2001); Weste et al. (2002) | <i>Prostanthera ringens</i> | NSW TSSC (2011) |
| <i>Podocarpus lawrencei</i> | NSW TSSC (2011) | <i>Prostanthera saxicola</i> var. <i>montana</i> | NSW TSSC (2011) |
| <i>Pomaderris delicata</i> (CE) | Wan et al. (in prep.) | <i>Pultenaea altissima</i> | NSW TSSC (2011) |
| <i>Pomaderris intermedia</i> | NSW TSSC (2011) | <i>Pultenaea aristata</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera askania</i> (E) | NSW TSSC (2011) | <i>Pultenaea baeuerlenii</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera cineolifera</i> (V) | NSW TSSC (2011) | <i>Pultenaea benthamii</i> | McDougall and Summerell (2003b) |
| <i>Prostanthera cryptandroides</i> (V) | NSW TSSC (2011) | <i>Pultenaea daphnoides</i> | Pratt and Heather (1973); Podger et al. (1990); McDougall and Summerell (2003b); Schahinger et al. (2003) |
| <i>Prostanthera cuneata</i> | NSW TSSC (2011) | <i>Pultenaea flexilis</i> | NSW TSSC (2011) |
| <i>Prostanthera decussata</i> | Weste (2001) | <i>Pultenaea glabra</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera densa</i> (V) | NSW TSSC (2011) | <i>Pultenaea humilis</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera discolour</i> (V) | NSW TSSC (2011) | <i>Pultenaea mollis</i> | Barker and Wardlaw (1995); Weste (2001) |
| <i>Prostanthera junonis</i> | NSW TSSC (2011) | <i>Pultenaea parrisiae</i> | Wan et al. (in prep.) |
| <i>Prostanthera lasianthos</i> | NSW TSSC (2011) | <i>Pultenaea parrisiae</i> subsp. <i>elusa</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera marifolia</i> (CE) | Wan et al. (accepted); NSW TSSC (2011) | <i>Pultenaea parrisiae</i> subsp. <i>parrisiae</i> (V) | NSW TSSC (2011) |
| <i>Prostanthera ovalifolia</i> | NSW TSSC (2011) | <i>Pultenaea parviflora</i> (E) | NSW TSSC (2011) |
| <i>Prostanthera palustris</i> (V) | NSW TSSC (2011) | <i>Pultenaea pedunculata</i> (E) | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|--|---|---|---|
| <i>Pultenaea procumbens</i> | NSW TSSC (2011) | <i>Tetradlea glandulosa</i> (V) | NSW TSSC (2011) |
| <i>Pultenaea pycnocephala</i> | NSW TSSC (2011) | <i>Tetradlea juncea</i> (V) | NSW TSSC (2011) |
| <i>Pultenaea</i> sp. Genowlan Point (CE) | Wan et al. (accepted) | <i>Tetradlea pilosa</i> (Ex) | Podger et al. (1990); Weste (2001) |
| <i>Pultenaea subcapitata</i> | NSW TSSC (2011) | <i>Tetradlea subaphylla</i> | McDougall and Summerell (2003b) |
| <i>Pultenaea villifera</i> var. <i>villifera</i> | NSW TSSC (2011) | <i>Triplarina nowraensis</i> (E) | NSW TSSC (2011) |
| <i>Rulingia prostrata</i> | NSW TSSC (2011) | <i>Westringia davidii</i> (V) | NSW TSSC (2011) |
| <i>Sprengelia incarnata</i> (P) | Podger and Brown (1989); McDougall and Summerell (2003b); McDougall et al. (2018) | <i>Westringia kydrensis</i> (E) | NSW TSSC (2011) |
| <i>Stylidium graminifolium</i> | NSW TSSC (2011) | <i>Wollemia nobilis</i> (CE) | Bullock et al. (2000) |
| <i>Styphelia adscendens</i> | Weste (2001); Schahinger et al. (2003) | <i>Woolfsia pungens</i> | Fraser (1956) |
| <i>Styphelia perileuca</i> (V) | NSW TSSC (2011) | <i>Xanthorrhoea australis</i> (P) | Weste (2001); McDougall and Summerell (2003b) |
| <i>Tasmannia glaucifolia</i> (V) | NSW TSSC (2011) | <i>Xanthorrhoea glauca</i> subsp. <i>glauca</i> (P) | McDougall and Summerell (2003b) |
| <i>Tasmannia lanceolata</i> | NSW TSSC (2011) | <i>Xanthorrhoea resinifera</i> (P) | Weste (2001); McDougall and Summerell (2003b) |
| <i>Tasmannia purpurascens</i> (V) | McDougall and Summerell (2003a) | <i>Xanthosia dissecta</i> | Weste (2001); Weste et al. (2002) |
| <i>Telopea mongaensis</i> (P) | NSW TSSC (2011) | <i>Xanthosia tridentata</i> | Fraser (1956) |
| <i>Telopea speciosissima</i> (P) | Taylor (1974) | <i>Zieria adenophora</i> (CE) | NSW TSSC (2011) |
| <i>Tetradlea ciliata</i> | Weste (2001); Schahinger et al. (2003) | <i>Zieria baeuerlenii</i> (E) | NSW TSSC (2011) |

Hygiene guidelines

| Species | Reference(s) | Species | Reference(s) |
|-------------------------------|-----------------|-------------------------------|-----------------|
| <i>Zieria buxijugum</i> (CE) | NSW TSSC (2011) | <i>Zieria murphyi</i> (V) | NSW TSSC (2011) |
| <i>Zieria coventyi</i> (E) | NSW TSSC (2011) | <i>Zieria parrisiae</i> (CE) | NSW TSSC (2011) |
| <i>Zieria formosa</i> (CE) | NSW TSSC (2011) | <i>Zieria prostrata</i> (E) | NSW TSSC (2011) |
| <i>Zieria laevigata</i> | NSW TSSC (2011) | <i>Zieria tuberculata</i> (V) | NSW TSSC (2011) |
| <i>Zieria lasiocaulis</i> (E) | NSW TSSC (2011) | | |

Appendix C: NSW species that are susceptible to myrtle rust (*Austropuccinia psidii*)

Myrtle rust affects plants in the Myrtaceae family. There are over 300 native species known to be susceptible to myrtle rust (Makinson 2018b). The Myrtaceae family is ecologically important in Australia, accounting for about 10% of Australia's native flora, with many Australian plant communities primarily comprised of myrtaceous species. Consequently, there are also many species of native fauna, which depend on the Myrtaceae family, that are also indirectly threatened by the impacts of myrtle rust.

Table 9 NSW endemic species susceptible to myrtle rust (Makinson 2018b; Soewarto et al. 2019)
NSW conservation status in parentheses: Protected (P), Vulnerable (V), Endangered (E), Critically endangered (CE), Extinct (Ex).

| Species | Species | Species |
|--|---|--|
| <i>Angophora costata</i> subsp. uncertain | <i>Backhousia subargentea</i> (Synonym: <i>Choricarpia subargentea</i>) | <i>Callistemon salignus</i> (Synonym: <i>Melaleuca salicina</i>) |
| <i>Angophora floribunda</i> | <i>Baeckea gunniana</i> | <i>Callistemon sieberi</i> (Synonym: <i>Melaleuca paludicola</i>) |
| <i>Angophora subvelutina</i> | <i>Baeckea linifolia</i> (P) | <i>Callistemon</i> sp. 'Rock of Gibraltar' (LM Copeland 3618) |
| <i>Archirhodomyrtus beckleri</i> [southern chemotype] | <i>Callistemon citrinus</i> (Synonym: <i>Melaleuca citrina</i>) | <i>Callistemon viminalis</i> (Synonym: <i>Melaleuca viminalis</i>) |
| <i>Austromyrtus dulcis</i> | <i>Callistemon linearifolius</i> (Synonym: <i>Melaleuca linearifolia</i>) (V) | <i>Calytrix tetragona</i> |
| <i>Austromyrtus tenuifolia</i> | <i>Callistemon linearis</i> (Synonym: <i>Callistemon rigidus</i>) | <i>Corymbia citriodora</i> subsp. <i>citriodora</i> and subsp. uncertain |
| <i>Backhousia leptopetala</i> (Synonym: <i>Choricarpia leptopetala</i>) | <i>Callistemon pachyphyllus</i> (Synonym: <i>Melaleuca pachyphylla</i>) | <i>Corymbia citriodora</i> subsp. <i>variegata</i> |
| <i>Backhousia myrtifolia</i> | <i>Callistemon pallidus</i> (Synonym: <i>Melaleuca pallida</i>) | <i>Corymbia gummifera</i> |
| <i>Backhousia sciadophora</i> | <i>Callistemon pinifolius</i> (Synonym: <i>Melaleuca linearis</i> var. <i>pinifolia</i>) | <i>Corymbia henryi</i> |

Hygiene guidelines

| Species | Species | Species |
|---|---|--|
| <i>Corymbia intermedia</i> | <i>Eucalyptus cinerea</i> | <i>Eucalyptus microcorys</i> |
| <i>Corymbia maculata</i> | <i>Eucalyptus crebra</i> | <i>Eucalyptus moluccana</i> |
| <i>Corymbia tessellaris</i> | <i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i> | <i>Eucalyptus nitens</i> |
| <i>Corymbia variegata</i> [= <i>citriodora</i>] x <i>C. torelliana</i> | <i>Eucalyptus deanei</i> (Synonym: <i>Eucalyptus brunnea</i>) | <i>Eucalyptus obliqua</i> |
| <i>Darwinia glaucophylla</i> (V) | <i>Eucalyptus delegatensis</i> | <i>Eucalyptus olida</i> |
| <i>Darwinia procera</i> | <i>Eucalyptus dunnii</i> | <i>Eucalyptus ovata</i> var. <i>ovata</i> |
| <i>Decaspermum humile</i> [Southern metapopulation] | <i>Eucalyptus elata</i> | <i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i> |
| <i>Eucalyptus agglomerata</i> | <i>Eucalyptus fastigata</i> | <i>Eucalyptus perriniana</i> |
| <i>Eucalyptus baileyana</i> | <i>Eucalyptus gillii</i> | <i>Eucalyptus pilularis</i> |
| <i>Eucalyptus baueriana</i> subsp. <i>baueriana</i> | <i>Eucalyptus globoidea</i> | <i>Eucalyptus planchoniana</i> |
| <i>Eucalyptus burgessiana</i> | <i>Eucalyptus globulus</i> subsp. <i>bicostata</i> (Synonym: <i>Eucalyptus bicostata</i>) | <i>Eucalyptus populnea</i> subsp. uncertain |
| <i>Eucalyptus camaldulensis</i> subsp. uncertain | <i>Eucalyptus globulus</i> subsp. <i>Globulus</i> (Synonym: <i>Eucalyptus globulus</i> [sens. strict.]) | <i>Eucalyptus punctata</i> (Synonym: <i>Eucalyptus biturbinata</i>) |
| <i>Eucalyptus camfieldii</i> (V) | <i>Eucalyptus globulus</i> subsp. uncertain | <i>Eucalyptus radiata</i> subsp. <i>radiata</i> |
| <i>Eucalyptus campanulata</i> (Synonym: <i>E. andrewsii</i> subsp. <i>campanulata</i>) | <i>Eucalyptus goniocalyx</i> subsp. uncertain | <i>Eucalyptus resinifera</i> [subsp. uncertain] |
| <i>Eucalyptus camphora</i> subsp. uncertain | <i>Eucalyptus grandis</i> | <i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i> |
| <i>Eucalyptus carnea</i> | <i>Eucalyptus haemastoma</i> | <i>Eucalyptus robusta</i> |
| <i>Eucalyptus cephalocarpa</i> | <i>Eucalyptus laevopinea</i> | <i>Eucalyptus rubida</i> subsp. <i>rubida</i> |

Hygiene guidelines

| Species | Species | Species |
|--|--|--|
| <i>Eucalyptus saligna</i> | <i>Lenwebbia prominens</i> | <i>Leptospermum trinervium</i> |
| <i>Eucalyptus siderophloia</i> | <i>Lenwebbia</i> sp. Main Range (P.R.Sharpe+4877) (CE) | <i>Leptospermum whitei</i> |
| <i>Eucalyptus sieberi</i> | <i>Leptospermum brachyandrum</i> | <i>Lophostemon suaveolens</i> |
| <i>Eucalyptus smithii</i> | <i>Leptospermum continentale</i> 'cv. Horizontalis' | <i>Melaleuca alternifolia</i> |
| <i>Eucalyptus tereticornis</i> subsp. uncertain | <i>Leptospermum deuense</i> | <i>Melaleuca armillaris</i> [subsp. uncertain] |
| <i>Eucalyptus tindaliae</i> | <i>Leptospermum juniperinum</i> | <i>Melaleuca biconvexa</i> (V) |
| <i>Eucalyptus viminalis</i> [sens. str.; = subsp. <i>viminalis</i>] | <i>Leptospermum laevigatum</i> | <i>Melaleuca comboynensis</i> |
| <i>Gossia acmenoides</i> | <i>Leptospermum lanigerum</i> (P) | <i>Melaleuca decora</i> |
| <i>Gossia bidwillii</i> | <i>Leptospermum liversidgei</i> | <i>Melaleuca howeana</i> |
| <i>Gossia floribunda</i> | <i>Leptospermum luehmannii</i> | <i>Melaleuca linariifolia</i> |
| <i>Gossia fragrantissima</i> (E) | <i>Leptospermum morrisonii</i> 'cv. Burgundy' | <i>Melaleuca nodosa</i> |
| <i>Gossia hillii</i> | <i>Leptospermum myrsinoides</i> | <i>Melaleuca quinquenervia</i> |
| <i>Gossia punctata</i> | <i>Leptospermum petersonii</i> | <i>Melaleuca sieberi</i> |
| <i>Homoranthus flavescens</i> | <i>Leptospermum polygalifolium</i> [subsp. uncertain] | <i>Melaleuca squamea</i> |
| <i>Homoranthus melanostictus</i> | <i>Leptospermum polygalifolium</i> x <i>L. scoparium</i> | <i>Melaleuca squarrosa</i> |
| <i>Homoranthus prolixus</i> (V) | <i>Leptospermum rotundifolium</i> (P) | <i>Melaleuca styphelioides</i> |
| <i>Homoranthus virgatus</i> | <i>Leptospermum scoparium</i> | <i>Metrosideros nervulosa</i> |
| <i>Homorathus croftianus</i> (E) | <i>Leptospermum scoparium</i> x <i>L. macrocarpum</i> | <i>Metrosideros sclerocarpa</i> |
| <i>Kunzea baxteri</i> | <i>Leptospermum semibaccatum</i> | <i>Pilidiostigma glabrum</i> |
| <i>Kunzea ericoides</i> | <i>Leptospermum spectabile</i> (P) | <i>Rhodamnia argentea</i> |

Hygiene guidelines

| Species | Species | Species |
|---|--|---|
| <i>Rhodamnia maideniana</i> | <i>Syzygium francisii</i> | <i>Syzygium oleosum</i> |
| <i>Rhodamnia rubescens</i> (CE) | <i>Syzygium fullagarii</i> | <i>Syzygium smithii</i> (Synonym: <i>Acmena smithii</i>) |
| <i>Rhodomirtus psidioides</i> (CE) | <i>Syzygium hemilamprum</i> [subsp. uncertain] (Synonym: <i>Acmena hemilampra</i>) | <i>Syzygium wilsonii</i> x <i>luehmannii</i> (Synonym: <i>S. luehmannii</i> x <i>wilsonii</i>) |
| <i>Syncarpia glomulifera</i> subsp. uncertain | <i>Syzygium hodgkinsoniae</i> (V) | <i>Tristania neriifolia</i> |
| <i>Syzygium anisatum</i> (Synonym: <i>Backhousia anisata</i> , <i>Anetholea anisata</i>) | <i>Syzygium ingens</i> (Synonym: <i>Acmena ingens</i>) | <i>Tristaniopsis collina</i> |
| <i>Syzygium australe</i> | <i>Syzygium luehmannii</i> | <i>Tristaniopsis laurina</i> |
| <i>Syzygium corynanthum</i> | <i>Syzygium moorei</i> (V) | <i>Uromyrtus lamingtonensis</i> |
| <i>Syzygium floribundum</i> (Synonym: <i>Waterhousea floribunda</i>) | | |

Appendix D: Invasive non-native terrestrial plants that are prohibited matter under the *Biosecurity Act 2015*

The *Biosecurity Act 2015* identifies prohibited matter in Schedule 2. Any person who deals with prohibited matter is guilty of an offence under that Act.

The definition of dealing includes moving, releasing, propagating, experimenting with, disposing, acquiring and possessing plants or animals that are listed prohibited matter.

Table 10 Invasive non-native terrestrial plants that are prohibited matter

| Scientific name | Common name | Related BC Act KTP |
|--|-----------------------|--|
| <i>Andropogon gayanus</i> | Gamba grass | Invasion of native plant communities by exotic perennial grasses |
| <i>Annona glabra</i> | Pond apple | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Asparagus declinatus</i> | Bridal veil creeper | Invasion and establishment of exotic vines and scramblers |
| <i>Bassia scoparia</i> (excluding subsp. <i>trichophylla</i>) | Kochia | |
| <i>Centaurea stoebe</i> subsp. <i>micranthos</i> | Spotted knapweed | |
| <i>Centaurea x moncktonii</i> | Black knapweed | |
| <i>Chromolaena odorata</i> | Siam weed | |
| <i>Clidemia hirta</i> | Koster's curse | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Cryptostegia grandiflora</i> | Rubber vine | Invasion and establishment of exotic vines and scramblers |
| <i>Hieracium</i> (all species except <i>H. murorum</i>) and <i>Pilosella</i> spp. (all species) | Hawkweed | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Miconia</i> spp. (all species) | Miconia | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Mikania micrantha</i> | Mikania vine | Invasion and establishment of exotic vines and scramblers |
| <i>Mimosa pigra</i> | Mimosa | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Nassella tenuissima</i> (syn. <i>Stipa tenuissima</i>) | Mexican feather grass | Invasion of native plant communities by exotic perennial grasses |

Hygiene guidelines

| Scientific name | Common name | Related BC Act KTP |
|---|-----------------|--|
| <i>Orobanche</i> spp. (all species except the native <i>O. cernua</i> var. <i>australiana</i> and <i>O. minor</i>) | Broomrape | |
| <i>Parthenium hysterophorus</i> | Parthenium weed | |
| <i>Striga</i> spp. (except the native <i>S. parviflora</i>) | Witchweed | |
| <i>Vachellia karroo</i> (syn. <i>Acacia karroo</i>) | Karoo acacia | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |
| <i>Vachellia nilotica</i> (syn. <i>Acacia nilotica</i>) | Prickly acacia | Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants |

Appendix E: Additional considerations for amphibian chytrid fungus

Captive frog hygiene management

Frogs and tadpoles should only be removed from a site when absolutely necessary. When holding frogs in captivity, it is important to maintain a high level of hygiene because turnover of frogs in a facility can lead to potentially high risk of amphibian chytrid transmission.

The risks of transmitting amphibian chytrid among captive frogs can be reduced by:

- keeping frogs collected from different sites separate from each other
- reducing the amount of water, equipment or filtration systems shared between tanks or aquaria that are housing frogs
- cleaning, disinfecting and drying tanks and aquaria immediately after removing frogs.

When removal of a frog from the wild is essential (e.g. for research purposes), you should keep frogs from different sites separate (as above) while you monitor for signs of illness or disease. If signs of illness or disease are detected, seek advice from a veterinarian to determine the nature of the problem.

If a frog (or frogs) is infected with chytrid, seek advice from a licensed veterinarian. Common treatments including anti-fungal agents such as *Itraconazole*® can be used to treat chytrid infection. Carefully controlled, ramping heat treatment can be an effective chytrid treatment or prevention strategy in some frog species, but this method can be lethal to native species that cannot withstand high temperatures. This approach should only be considered by experienced laboratories and only with authorisation from a relevant animal ethics committee.

If tadpoles have been bred or held in captivity, they should not be released into the wild. If considering a release of captive tadpoles, you should contact the National Parks and Wildlife Service wildlife team at wildlife.licensing@environment.nsw.gov.au (or 02 9585 6406) to determine your licensing requirements. Pathological testing should be undertaken prior to any release, to reduce the likelihood of releasing individuals infected with amphibian chytrid fungus.

Displaced frogs

Frogs may be inadvertently transported long distances in fruit and vegetable shipments and landscape supplies (this commonly occurs to *Litoria gracilentata*, *L. bicolor* and *L. caerulea*). These frogs pose a risk for the spread of disease and it is rarely feasible to return them to their place of origin with any accuracy.

If you encounter a displaced frog, you should contact a local wildlife carer organisation to collect the animal. The frog should be monitored for signs of infection.

Frogs found on or around roads, dwellings, gardens or swimming pools should not be considered displaced.

Sick and dead frogs

Symptoms

Frogs infected with amphibian chytrid fungus may exhibit a range of physical and/or behavioural symptoms, including:

- discoloured skin
- swollen hind limbs
- emaciation

- skin lesions, increased sloughing (shedding of skin)
- showing little or no response to physical stimuli
- being lethargic or having no appetite.

What to do with sick or dead frogs

Unless part of a licensed research project, sick or dead frogs encountered in the wild should not be touched, collected or moved due to risks of spreading disease.

If collection of a sick or dead frog is part of a licensed research project, you should first (i.e. before you encounter a sick or dead frog) establish what you intend to do with it. This may include preserving it at your own research institute for testing or sending it to a research institute for testing.

When handling sick or dead frogs, wear a new pair of disposable gloves for handling each frog, use a clean plastic bag for transporting each frog (for live frogs, ensure the bag is not airtight) and keep the frog cool during transport.

If the frog is dead, you should preserve it as soon as possible. A frog can be preserved in 10 times its own volume of preservative (70% ethanol or 10% buffered formalin). The frog's belly should be cut open prior to preservation to maximise preservation of internal organs. Alternatively, frogs can be frozen, although freezing can make tissues unsuitable for some laboratory tests.

Euthanasia

If the frog is sick and unlikely to survive, it should be euthanased using an acceptable method. The American Veterinary Medical Association's [Guidelines for the Euthanasia of Animals \(PDF 11.8MB\)](#) (AVMA 2020) prescribes a number of acceptable euthanasia methods, including using injectable and topical agents. These methods should only be undertaken by a licensed veterinarian.

Where other methods are not available, the generally-accepted method of euthanasia is blunt force trauma to the head, followed by decapitation or pithing to ensure quick death. This should only be applied by trained and skilled people (AMVA 2020). Gradually cooling the animal in the refrigerator prior to applying blunt force trauma may reduce the risk of causing suffering.

Euthanasia of frogs associated with animal research must only be done in accordance with an animal research authority.

Appendix F: Template for a hygiene management plan

| | |
|--|--|
| Team/region/area/park/project | Identify the team, region, area or park to which the hygiene management plan applies. If the plan applies to a specific project (e.g. construction works, conservation project, etc.) specify it here. |
| Background and infestation status | Provide relevant background information. Consider including: <ul style="list-style-type: none"> • infestation status (known, suspected, unknown) for pathogens of interest, or past occurrences • presence of susceptible species or ecological communities • the type of work generally being undertaken (earthworks, general maintenance, conservation projects, etc.). If the plan is for a specific project and/or species, specify why hygiene management is an important component. |
| Objective(s) | What are your specific objectives as they relate to your team, region or area? This could include: <ul style="list-style-type: none"> • restricting the entry of pathogens to certain locations • restricting exit of pathogens from infested locations in the area • prioritising specific sites or locations for protection • determining the extent of pathogen distribution. |
| Mapping and risk assessment | Do you propose to undertake any mapping exercises to determine the extent of pathogen distribution? Mapping can help to refine the objectives. What are the risks related to movement of the pathogen(s) throughout, into or out of the area? What are the potential consequences? |
| Hygiene measures | How will you apply the hygiene measures outlined in the hygiene guidelines? This should relate directly to your objectives and risks identified above and refer to both vehicle and personnel hygiene. For example, if the objective is to restrict pathogen entry to a specific site, strict hygiene measures could be applied at the border of the site prior to entry. Are there any circumstances or sites where additional hygiene measures might be required? Consider developing a tailored decision tree or simply identifying the sites or areas that are prioritised for strict hygiene. How (if at all) will you address hygiene risks posed by the general public? For example, through installation of boot-cleaning stations. Consider boot-cleaning station design and location. |
| Protecting vegetation | Will you consider any proactive treatments to protect susceptible plants from infection? If so, consider undertaking a risk assessment to help you prioritise areas (or species) for treatment. |

Hygiene guidelines

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| Prescriptions for external parties undertaking work on-park | Will you place any prescriptions on external parties undertaking work on-park? Work may include (but should not be limited to) contractors undertaking maintenance or earthworks, research or bush regeneration. If the prescriptions are different from the 'Hygiene measures' above, explain why. These should be included in contracts or agreements when engaging third parties to undertake work on your behalf. |
| Education and communication | How will you inform people about this hygiene management plan (or appropriate hygiene practices generally)? Consider relevant audiences, including internal staff, contractors and the general public. Examples include signage, pamphlets, information on a website, etc. |

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