Phytophthora Management Guidelines

Phytophthora Technical Group

2003

Government of South Australia

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Acknowledgements

The Phytophthora Technical Group is supported by *Yurrebilla – The Greater Mount Lofty Parklands an initiative of the Department for Environment and Heritage*.

The assistance of the following organisations is gratefully acknowledged:
PIRSA / SARDI
Southern and Hills Local Government Association
ForestrySA
Apple and Pear Growers Association of South Australia Inc.
Transport SA
Department for Environment and Heritage

Front Cover photo courtesy ForestrySA
Map on page 11 courtesy Transport SA
Map on page 13 and diagram on page 8 courtesy Department for Environment and Heritage

Yurrebilla – The Greater Mount Lofty Parklands an initiative of the Department for Environment and Heritage funded this publication.

Contents

1. Aim:

The aim of the Phytophthora Management Guidelines is to provide a framework for the management of *Phytophthora*, by Government and non-government organisations, landholders, community groups and individuals, in order to achieve the following goals:

1. To contain and minimise the spread of *Phytophthora* in South Australia.
2. To manage infected areas in such a way as to minimise the effect on the environment and on recreational activities.
3. To protect uninfected areas and minimise the risk of them becoming infected.
4. To promote a “whole of Community” approach to the management of *Phytophthora* in South Australia.

2. Introduction

Phytophthora causes dieback of native and introduced plants including ornamentals, vines, fruit and vegetables. *Phytophthora* dieback occurs in native bushlands such as open forests, woodlands and heathlands, farmlands, nurseries and gardens. It is a major threat to some of Australia's threatened native species (both animal and plant) and ecological communities. There are 32 species of *Phytophthora* in Australia. Of these, *P. cinnamomi, P. citricola, P. cryptogea* and *P. megasperma* are the most common with *P. cinnamomi* being the most widespread and destructive species. *Phytophthora cinnamomi* is listed as a key threatening process in Schedule X of the Commonwealth "Environment Protection and Biodiversity Conservation Act 1999". As part of the Commonwealth Government obligations under this Act, a "Threat Abatement Plan for Dieback caused by the root-rot fungus *Phytophthora cinnamomi*" was developed in 2001. This can be viewed at the following web site:
http://www.ea.gov.au/biodiversity/threatened/tap/phytophthora/index.html

Once an area is infected with *Phytophthora*, eradication is not possible. However, well developed management plans can assist in containing the disease and preventing further spread to uninfected areas.

These Phytophthora Management Guidelines apply to all species of *Phytophthora*. It is anticipated that all organisations will use these guidelines as a basis for their own management plans and operational procedures. The implementation of the management strategies in these guidelines by Government agencies, private organisations, landholders, clubs and societies and by anyone whose activities take them into *Phytophthora* affected areas is essential if the goals outlined are to be achieved.

3. Glossary:

Confirmed*:* Symptoms (see 5.3) of *Phytophthora* infection are present in plants and *Phytophthora* has been confirmed by soil analysis.

Suspected/Unconfirmed: Symptoms (visual) of *Phytophthora* infection are present in plants but *Phytophthora* has not been tested for or confirmed by soil analysis.

4. History and Distribution in South Australia

Phytophthora is native to South East Asia. It was probably introduced into Australia shortly after European settlement in the late 1800's. *Phytophthora* is now present in all states of Australia.

In South Australia, *Phytophthora* was first identified in 1969 in the Mount Lofty Ranges. The present known distribution in South Australia includes several Conservation Parks, National Parks, Forest Reserves and many roadside reserves in the Mount Lofty Ranges, Fleurieu Peninsula and on Kangaroo Island. The presence of *Phytophthora* is suspected on Eyre Peninsula. It has not yet been identified on Yorke Peninsula. In the South East, *P. cinnamomi* was identified in the 1970's from nursery stock in Mt Gambier (this nursery site no longer exists) but has not been identified since then, though other *Phytophthora* species are found in several areas.

Phytophthora is generally found in areas with

- greater than 500mm average annual rainfall
- warm, moist conditions (optimum temperature = 15-30°C)
- soils low in nutrients and organic matter, open textured
- neutral to acid soils
- poor drainage
- presence of host plants ie plants that are susceptible to infection (see 8.1)

The South Australian Department for Environment and Heritage (DEH) maintains a database of all confirmed and suspected *Phytophthora* locations. New confirmed or suspected infestations should be reported to the Ecologist - Phytophthora Management at DEH (contact phone number: 8552 0306).

5. Information on Phytophthora

5.1 What is Phytophthora?

Phytophthora is a microscopic, soil borne organism that attacks the roots and basal stem tissue of living plants. It is often referred to as a “fungus”. *Phytophthora* acts by stopping the movement of water and nutrients to the plant, causing root-rot and dieback.

Dieback is very common - particularly in native plants. However *Phytophthora* is only one of many possible causes. Other causes include drought, salinity, old age, insects and other fungi and diseases. Identification of *Phytophthora* requires analysis of soil and root samples by qualified scientists in the laboratory.

Once an area is infested with *Phytophthora* it is always infested.

5.2 Life cycle and spread of Phytophthora

Phytophthora produces a mass of thread-like filaments (known as mycelia) that can be transported to new hosts via soil or infected plant material. Under warm, moist conditions, *Phytophthora* reproduces via microscopic fruiting bodies that produce spores. Three types of spores are produced : zoospores, chlamydospores (both vegetative spores) and oospores (sexual spores). The most important spores in the spread of *Phytophthora* are:

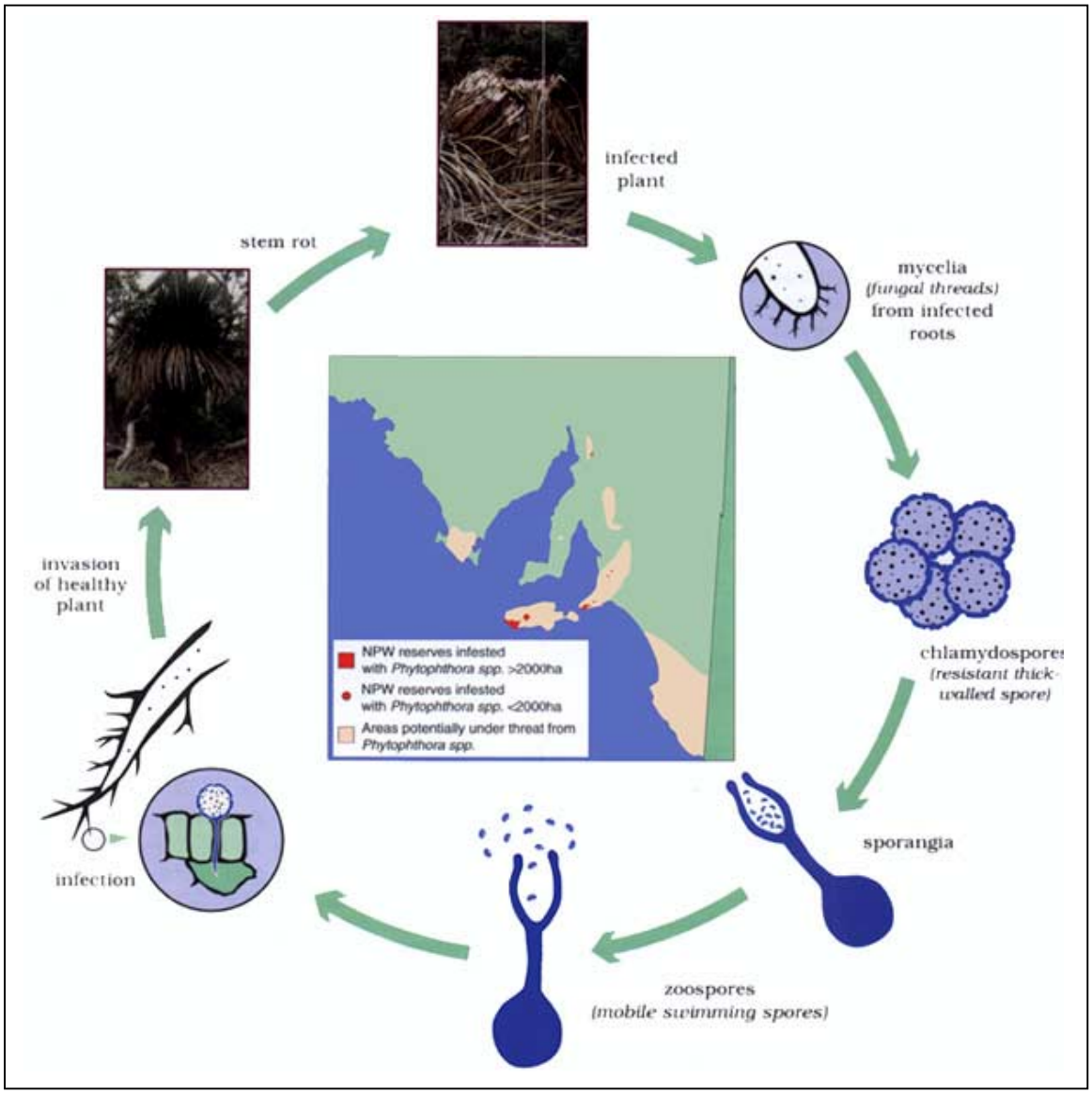
- zoospores - these are short-lived (approximately 48 hours)and are released in large numbers in moist conditions. They move through the soil in ground water and surface water and infect susceptible plants
- chlamydospores - these can survive in soil and in dead plant tissue for many years. They are hard-coated and can easily withstand long periods of dry conditions. They germinate when conditions are favourable (warm and moist).

Any movement of soil and/or plant material has the potential to spread *Phytophthora* to new areas.

The most common means of spread is through movement of infested soil and plant material by humans (see 6.2). Phytophthora can also be spread by movement of water (both surface and groundwater) and animals.

Another means of spread is from plant to plant via mycelial growth through the soil from infected roots. This is a relatively slow method of spread.

Spread is very site-specific depending on conditions and the topography of the site.



From: Department for Environment and Heritage brochure “Phytophthora Root Fungus”

5.3 Disease Symptoms

Dieback is common – particularly in native plants. Indications that point to the likelihood of dieback being caused by *Phytophthora* include:

1. Disease/death of susceptible plant species - some plants are more susceptible to Phytophthora than others and these can be used as "indicator" species to detect the possible presence of *Phytophthora*. One of the most susceptible species is *Xanthorrhoea*. See below.
2. Diseased plants with general discolouration of foliage, usually red or yellow foliage.
3. Species known to be resistant to *Phytophthora* remain healthy.
4. Progression of deaths over time. On slopes, deaths progress down the slope.
5. A sharp boundary may be present between diseased and healthy areas.

Note : visual symptoms may take years to develop after the initial infection. They may not develop until conditions are warm and wet. To confirm the presence of *Phytophthora*, samples of soil and vegetation must be analysed in the laboratory.

Species that are highly susceptible to *Phytophthora* have no resistance and once infected rapidly die. These species are often used as indicator species, as they are generally the first to show symptoms of infection. The best indicator species for the disease in native plants in South Australia is the grass-tree *(Xanthorrhoea* spp.) as it is highly susceptible. Other highly susceptible species are Banksias, Conebush (Isopogon ceratophyllus), peas (Fabaceaea), wattles (Acacia), heaths (Epacridaceae) and *Eucalyptus* species belong to the stringybark group: messmate stringybark *(E. obliqua*) and brown stringybark *(E. baxteri*). Adult trees are normally not killed by *Phytophthora* unless also exposed to environmental stress, such as waterlogging or drought. See 8.1 for a list of native plants known to be susceptible to *Phytophthora* infection.

There may be considerable variation in resistance within a plant genus – for example in the genus *Eucalyptus*, most species in the subgenus *Symphomyrtus* and subgenus *Corymbia* (gums, boxes and ironbarks) are relatively tolerant and thus relatively resistant to infection by *Phytophthora*, but most species in the subgenus *Monocalyptus* (ashes, stringybarks and peppermints) are susceptible.
Disease symptoms also vary between different plant species. For example, *Xanthorrhoea* species die rapidly and may collapse. Leaves of *Banksia* sp. turn yellow. *Eucalyptus* sp. may die suddenly or there may be dieback of branches over several years. Trees may reshoot (epicormic growth), but will eventually die. The peas (Fabaceae), some species of heath (Epacridaceae), wattle *(Acacia*) and tea tree *(Leptospermu*m) turn yellow, with dieback occurring in warm moist periods during spring and autumn. Plants may recover during dry periods in summer or cold periods in midwinter, but dieback occurs again the following spring and autumn.

There are few plants that are truly resistant to *Phytophthora. Phytophthora* is capable of infecting the roots of most species - but some plants are able to contain the pathogen once it penetrates the roots and prevent it from invading the rest of the root system and plant collar. Other plants, such as grasses and sedges, are able to rapidly produce new roots to replace those infected by the pathogen and so are able to withstand infection.

6. Management of Phytophthora

There is NO cure for *Phytophthora* – Once an area is infested with *Phytophthora* it is always infested. It is not possible to control the spread of *Phytophthora* by native animals nor is it always possible to control spread via soil moisture or surface water once Phytophthora is present in an area. However it is possible, and most important, to control the spread of *Phytophthora* by humans. Management strategies involve modifying /adapting human behaviour and activities to minimise the spread of *Phytophthora* to uninfected areas by:

- modifying activities
- controlling access
- adopting hygiene procedures

6.1 Risk Areas / Zones

6.1.1 State Risk Areas

The map on the following page (Figure 1, courtesy Transport SA) shows those areas of South Australia where *Phytophthora* poses a high, moderate or low risk.

- *High Risk Areas* - areas where *Phytophthora* is known to be present or is likely to become established. They are:
  - The Mount Lofty Ranges
  - Fleurieu Peninsula
  - Western and Central Kangaroo Island

- *Moderate Risk Areas* - areas where Phytophthora has not been recorded but which have the potential for Phytophthora to become established. They are:
  - Southern Eyre Peninsula
  - South East
  - Eastern Kangaroo Island

- *Low Risk Areas* - areas where it is unlikely that Phytophthora would become established. These are all other areas of South Australia not mentioned above.


PORT AUGUSTA
YUNTA
POOCHERA
WHYALLA
PETERBOROUGH
KIMBA
PORT PIRIE
CRYSTAL BROOK
ELLISTON
COWELL
CLARE
WALLAROO
CUMMINS
PORT WAKEFIELD
RENMARK
MAITLAND
BLANCHETOWN
GAWLER
PORT LINCOLN
ADELAIDE
YORKETOWN
MURRAY BRIDGE
LAMEROO
KINGSCOTE
VICTOR HARBOR
PARNDANA
SALT CREEK
BORDERTOWN
NARACOORTE
ROBE
MOUNT GAMBIER
Produced by Transport Information Management Section 22 September 2000
Phytophthora Risk Areas
Nil or very low risk
Moderate risk
High risk
Region Boundaries
TSA Maintained Roads
Figure 1
Phytophthora (Dieback) Risk Areas
in South Australia
The information and data are provided herein as an information resource only. Whilst all reasonable care has been taken in the preparation of this information, Transport SA is not able to warrant the accuracy of this information and accepts no responsibility for any loss, injury or any other liability incurred by any person that arises as a result of the use of this information by any person or organisation.
Government of South Australia
TRANSPORT SA

6.1.2 Risk Zones within State Risk Areas

Within each Risk Area there are Risk Zones. The Department for Environment and Heritage (DEH) has designated *Phytophthora* Risk Management Zones for use in Parks. It is proposed that similar zones be adopted by other land managers so that a uniform system may be developed across South Australia.

The proposed zones are:

- *High Risk Zone* - zone where *Phytophthora* is confirmed (by laboratory testing) or is suspected (from a visual inspection – indicator plants showing typical symptoms of infection). (This zone includes a 100m buffer zone)

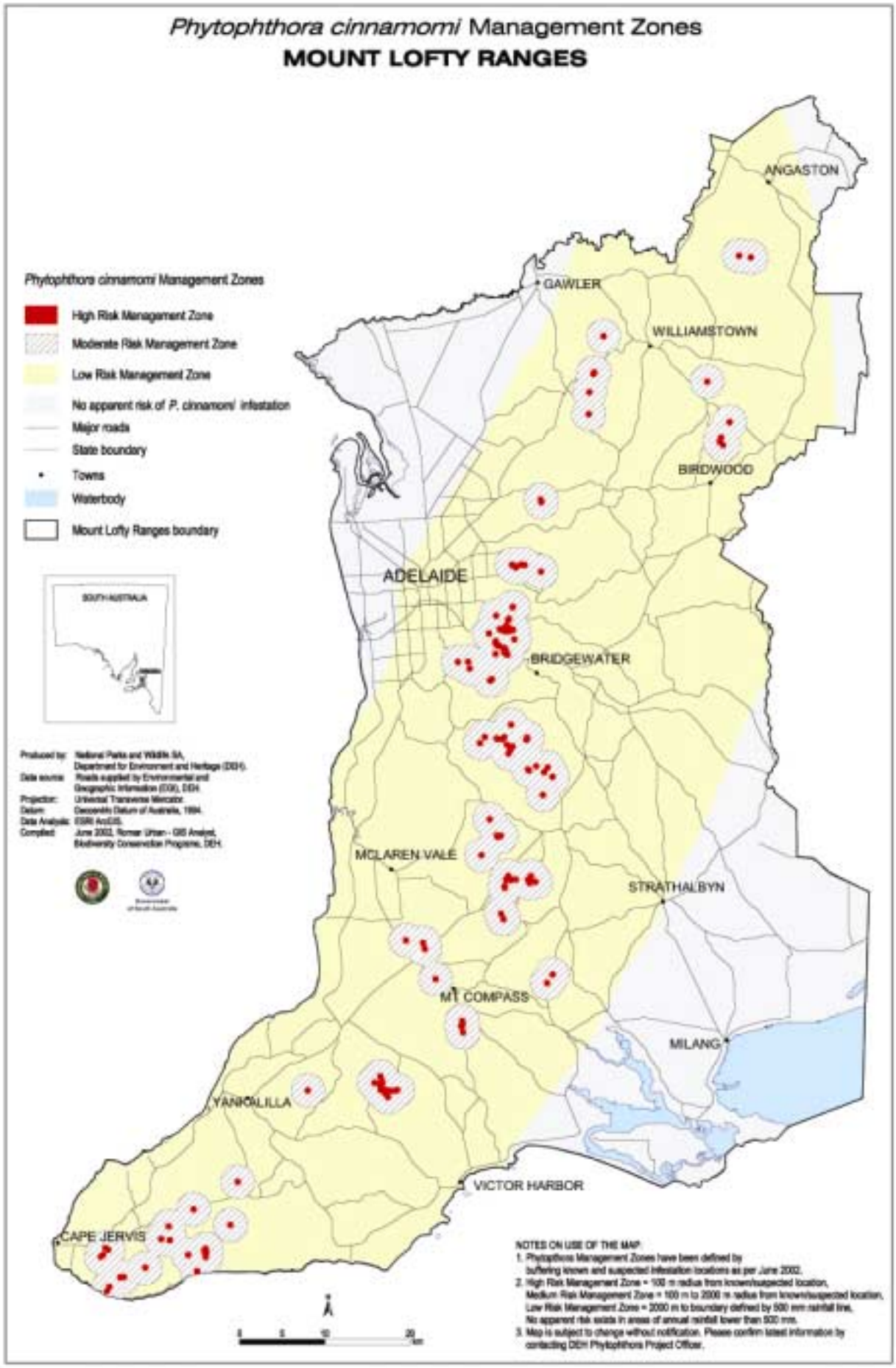
- *Moderate Risk Zone* - zone where *Phytophthora* is not yet suspected or confirmed but has the potential to be infected based on the presence of susceptible plant species and appropriate environmental / climatic conditions

- *Low Risk Zone* - *Phytophthora* is not suspected or confirmed and the potential for *Phytophthora* to become established is low

Strategies adopted for *Phytophthora* management depend on the risk zone and the proposed activity in that zone. Risk Zones within the Mount Lofty Ranges High Risk Area are shown on page 13. Each Council will have more detailed maps of High Risk Zones in their area.

It is important to recognise that management procedures can only be implemented according to available resources. High risk activities carried out in High Risk Zones require stricter *Phytophthora* management than those carried out in low risk zones.

NOTE: Any sites where a Phytophthora infestation is suspected should be treated as if the presence of Phytophthora has been confirmed at that site.



From: Phytophthora Threat Management – (Standard Operating Procedure) 2002 DEH

6.2 Risk Activities

The spread of *Phytophthora* can be minimised by the adoption of management strategies appropriate to the zone and to the proposed activity in that zone. Any activities that involve movement of soil and plant material are high risk for spreading *Phytophthora*. Moist soil and plant material readily adhere to machinery, equipment, vehicles, tools and footwear.

High Risk activities include:

1. Earthworks
    - construction and maintenance of roads
    - construction and maintenance of walking trails
    - landscaping
    - construction and maintenance of firebreaks
    - management of drainage

2. Movement of machinery, equipment, vehicles, stock
    - between sites and along roads and tracks
    - firefighting
    - maintenance of powerlines
    - logging operations
    - forest management
    - pest and pest plant management
    - off-road vehicles – (4WD's, trail bikes etc)
    - movement of stock through the area

3. Nursery production and Revegetation
    - plant propagation
    - movement of plant stock
    - planting out operations

4. Recreational activities
    - bushwalking
    - orienteering and associated activities
    - bike riding
    - horseriding
    - motorbike riding
    - 4-wheel driving
    - camping

6.3 Management strategies

Management strategies are aimed at minimising the spread of *Phytophthora*. These strategies should be incorporated into the planning of high risk activities. Contractors should also be required to follow these strategies.

For high risk activities (see 6.2), in High and Moderate Risk Zones, the following strategies apply:

1. Plan all activities in advance. Ensure risk status of the area is known.
2. Schedule work in low/moderate risk zones before high risk zones.
3. Restrict movement of people, vehicles and equipment. It may be necessary to quarantine areas, either permanently or temporarily (for example when the soil is moist).
4. Avoid working in wet conditions. Restrict activities to times when dry soil conditions exist (generally from November – March). Postpone activities in wet weather.
5. On leaving high risk zones, ensure vehicles, machinery, equipment and footwear are free of mud, soil and plant material.
6. Travel only on designated roads and tracks. Avoid entering surrounding bushland.
7. Carry out activities down-slope first.
8. Ensure all materials used, including gravel, are free of *Phytophthora*. If in doubt, have soil/gravel samples tested in the laboratory.
9. Ensure all water used is free of phytophthora. Disinfect water obtained from dams and streams with chlorine (6ml pool chlorine to 10L water). Water from domestic supplies, deep bores or rain water does not usually require treatment unless stored in containers exposed to soil organic matter.
10. Do not remove any water, soil or plant material from a high risk zone. Restrict soil movement within this zone. Replace at original site if possible.
11. Disturb the soil as little as possible when controlling pests and pest plants.
12. Ensure water and effluent does not drain towards vegetation. Avoid sites prone to flooding and ponding.
13. Provide hygiene stations as appropriate.
14. Erect signs as appropriate.
15. Educate staff as to the importance of *Phytophthora* and their role in preventing its spread.
16. Provide information to relevant organisations as to their obligations to prevent the spread of *Phytophthora* and the location of High Risk Zones.

For recreational activities in High and Moderate Risk Zones the following strategies apply:

1. Restrict activities to times when dry soil conditions exist (generally from November – March).
2. Postpone activities in wet weather.
3. Restrict/control access of off-road vehicles, bicycles, horses, bushwalkers particularly in High Risk Zones (where *Phytophthora* is present).
4. Erect signs in appropriate locations informing of restrictions on access to the area.
5. Restrict vehicles, bicycles, horses, people to designated tracks, picnic and camping areas.
6. Locate camping sites carefully (at lower part of the landscape), especially with respect to drainage.
7. Provide wash down stations with instructions as appropriate and encourage people to use them.
8. Educate public, club members etc of the importance of *Phytophthora* and their responsibilities.

For revegetation activities in High and Moderate Risk Zones the following strategies apply:

1. Carry out activities only in dry conditions.
2. Minimise the number of tracks made into the area.
3. Know the location of *Phytophthora* confirmed and suspected sites before commencing revegetation projects.
4. Comply with all management strategies for the relevant zones in which activities are to be carried out.
5. Ensure plants come from nurseries that adhere to the Nursery Industry Acreditation Scheme, Australia (NIASA) “Best practice guidelines”. (See references).
6. Control pest plants with minimum disturbance to the soil.
7. Comply with all hygiene measures re vehicles, machinery, equipment and footwear.

In Low Risk Zones - minimal *Phytophthora* management procedures are required. However if entering a Low Risk Zone from a High Risk Zone, strict hygiene measures, including disinfection, should be applied to ensure machinery, equipment, vehicles and footwear are free of mud and soil.

Sites of High Conservation Value – Sites of High Conservation Value are those sites that contain:

- A highly diverse range of species for the type of vegetation
- significant remnant vegetation
- few pest plant species and are generally undisturbed
- Threatened or rare plant species that are susceptible to *Phytophthora*
- Threatened or rare plant communities that are susceptible to *Phytophthora*
- Habitat, critical to the survival of threatened or rare animal species, that is susceptible to *Phytophthora*

- A high number of endemic plant species

Sites of High Conservation Value should be managed as for High/Moderate Risk Zones. Access should be discouraged and restricted at all times. The appropriate signs should be erected at these sites.

Nurseries:

Nurseries represent a high risk for the spread of Phytophthora with the movement of soil and plant material. *Phytophthora* can be managed in nurseries by:

- Strict hygiene procedures
- Soil fumigation/sterilization
- Systemic fungicides

Hygiene is particularly important as *Phytophthora* can cause serious losses in nurseries**.**

Nursery management also includes the following:

- Run-off must drain away from site
- Disinect all machinery and equipment (and footwear) before entering the site
- Use water that is clean and free from *Phytophthora* (if in doubt use chlorinated water (600ml pool chlorine to 1000L water)
- Adherence to the Nursery Industry Association's "Guidelines for best practice for production nurseries and the manufacture of growing media". See www.ngia.com.au

Fire Protection activities: In bushfire situations the primary objective is the saving of life and property and it may not be possible to implement appropriate hygiene procedures. However in training, mopping up, firebreak maintenance and prescribed burning activities it is important to comply with *Phytophthora* management strategies as far as possible when in high/moderate risk zones.

- Comply with *Phytophthora* management strategies where possible
- Obtain information on location of *Phytophthora* confirmed sites and avoid these areas where possible
- Comply with all hygiene measures
- Keep movement of all vehicles and machinery to a minimum
- Maintain firebreaks in dry months (November – March)
- Minimise soil disturbance
- Consider drainage when constructing fire breaks
- Conduct maintenance in Low/Moderate Risk Zones before moving to High Risk Zones
- Assign cleandown areas for vehicles, machinery and equipment

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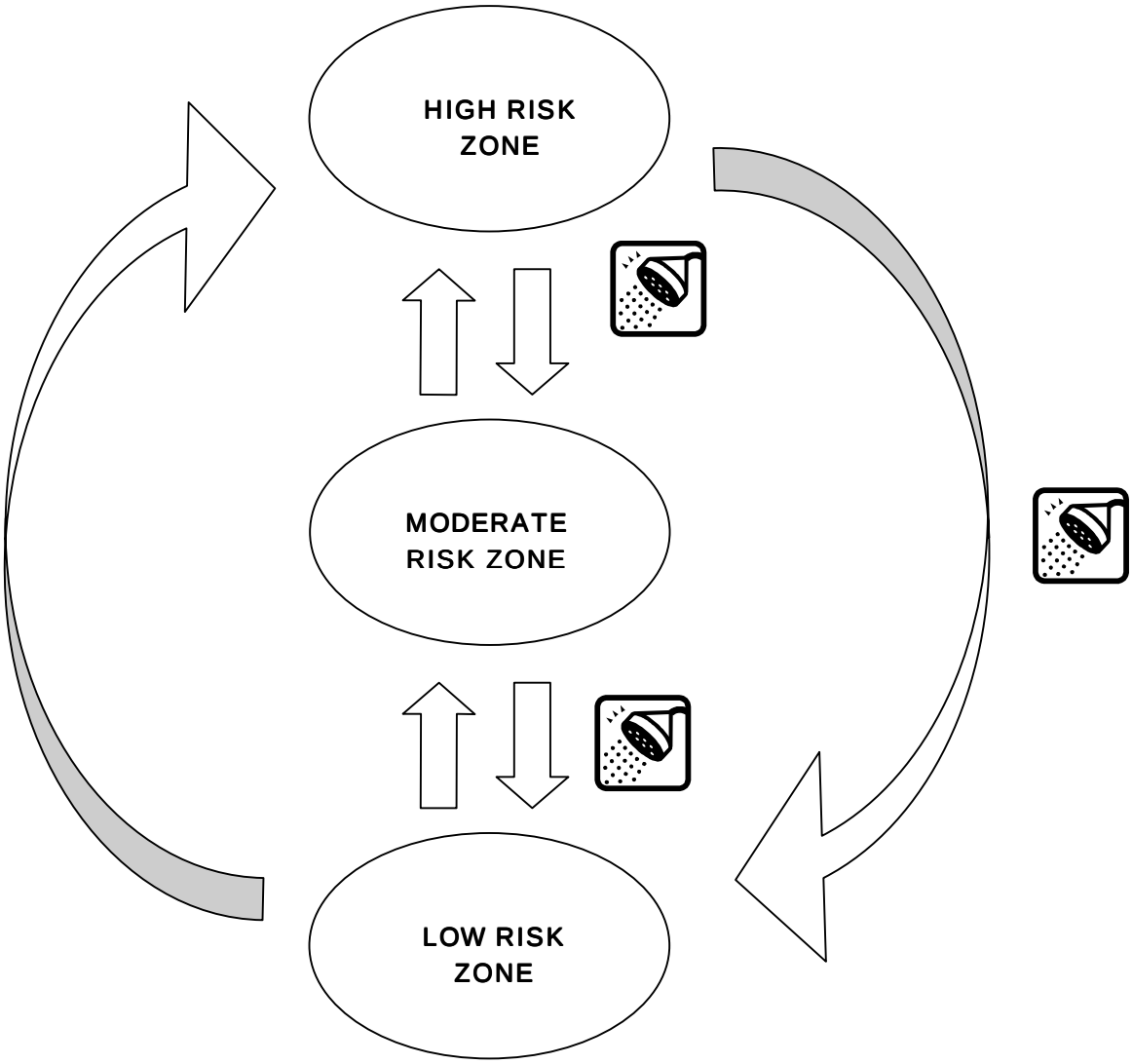

= Cleandown of all, machinery, equipment, vehicles and footwear,

= Direction of movement

7. References and further reading

Department of Conservation and Land Management (CALM) 2000 *Phytophthora cinnamomi* and disease caused by it Volume 1 Management Guidelines

Department for Environment and Heritage 2002 Phytophthora Threat Management (Standard Operating Procedure) 48pp.

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Podger, FD and Vear, KR 1991 Management of Phytophthora and disease caused by it: A revision of Department of Conservation and Land Management Policy Statement No.3 of January 1991 also Policy statement No.3 of December 1998

Statewide Operational Coordination Group (Transport SA) 2000 Phytophthora (Dieback) Control Operational Instruction 21.3

Zuvela,P; Colquhoun,I and Vear, K 2001 Hitting back at Dieback - Spreading success instead. Dieback working Group

8. Appendices

8.1 Known native plant species susceptible to Phytophthora cinnamomi in South Australia.

Family	**Species name**	**Common name**
Casuarinaceae	*Allocasuarina verticillata*	Drooping Sheoak
Dilleniaceae	*Hibbertia* spp.	Guinea-flower
Epacridaceae	*Epacris impressa*	Common Heath
	Leucopogon virgatus	Common Bearded-Heath
	Acrotriche fasciculiflora	Pink Ground-berry
	Acrotriche serrulata	Honeypots
	Acrotriche halmaturina 1)	**Kangaroo Island Ground-berry**
Fabaceae	*Daviesia brevifolia*	Leafless Bitter-Pea
	Pultenaea daphnoides	Large Leaved Bush-Pea
	Pultenaea involucrata	Mount Lofty Bush-Pea
	Pultenaea trifida 1)	**Kangaroo Island Bush-Pea**
	Platylobium obtusangulum	Common Flat-Pea
Mimosaceae	*Acacia myrtifolia*	Myrtle Wattle
Myrtaceae	*Eucalyptus baxteri*	Brown Stringybark
	Eucalyptus obliqua	Messmate Stringybark
	Leptospermum continentale	Prickly Tea-Tree
Proteaceae	*Banksia marginata*	Silver Banksia
	Banksia ornata	Desert Banksia
	Banksia serrata	Saw Banksia
	Grevillea quinquenervis 1)	**Five-veined Grevillea**
	***Grevillea* rogersii** 1)	**Rogers Grevillea**
	Isopogon ceratophyllus	Cone-bush
	Adenanthos terminalis	Adenanthos
	Adenanthos macropodiana 1)	**Kangaroo Island Grand Flower**
	Petrophile multisecta 1)	**Kangaroo Island Conestick**
Tremandraceae	*Tetratheca pilosa*	Pink-eyed Susan
Xanthorrhoeaceae	*Xanthorrhoea quadrangulata*	Mount Lofty Grass-tree
	Xanthorrhoea semiplana	Yacca
	Xanthorrhoea tateana	Tate's Grass-tree

1) plant species endemic to Kangaroo Island

8.2 Signage

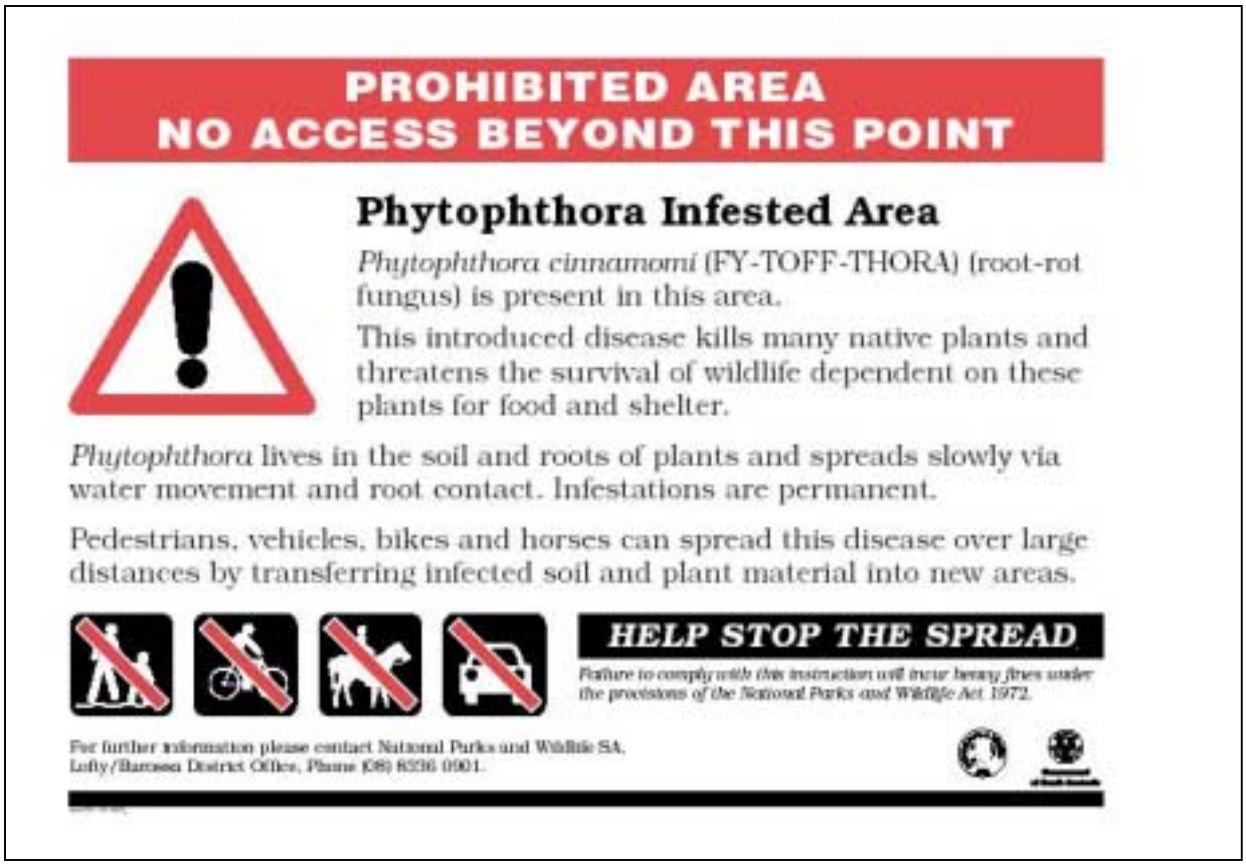
Signs are useful management tools to inform people entering *Phytophthora* Risk Zones as to the status of the disease in that zone.

Signs need to be simple and easy to read and must contain all the relevant information.

Several categories of signs are recommended:

- *Information signs:* - These contain general information on *Phytophthora* and are for both information and to warn people they are entering a High or Moderate Risk Zone. They may be placed at entrances to parks, forests or on roadside areas.
- *Management signs:* - These are signs at specific sites where *Phytophthora* is present, They include information signs, prohibited area, restricted access and hygiene signs. They may be temporary or permanent.
- *Marker signs:* These are intended for recognition primarily by staff of road managing agencies or service authorities. They may be discreet markers on roadsides or painted posts, paint marks on trees, or flagging tape marking the boundaries of an infestation.

Some examples of signs are shown below.



HIGH RISK

PHYTOPHTHORA ZONE

Phytophthora **is an introduced organism that:**

- Kills many native [indigenous] plants
- threatens wildlife dependent on these plants for food and shelter
- threatens [often kills] a range of home garden and commercial horticultural plants.

Phytophthora **water mould:** lives within the soil subsurface. Infestations are permanent. Pedestrians, vehicles, bicycles and horses can spread this disease over large distances by transferring infected soils into new areas. This applies particularly to damp soil.

PLEASE: KEEP TO ROADS AND MARKED TRAILS
AVOID CONTACT WITH ROAD SHOULDERS OR ADJACENT VEGETATION
AVOID DISTURBING SOIL AND VEGETATION, PARTICULARLY WHEN DAMP
USE HYGIENE STATIONS WHERE PROVIDED

HELP STOP THE SPREAD

For farther information please contact the City of Playford Parks and Recreation office, Phone 8254 0404

8.3 *Hygiene procedures for vehicles, machinery, equipment and footwear*

Visual inspections should confirm that vehicles, plant and equipment and footwear, are free of clods of soil, slurry (water and soil mixture) and plant material. **Dust and grime need not be removed.**
If available, use facilities specifically designed for cleaning vehicles, plant and equipment or footwear, or select a hard, well-drained site (such as a road or compacted rubble), preferably away from native vegetation and just inside the infested zone, so that *Phytophthora* isn't spread to an uninfested area.

The clean down procedure consists of two steps:

1. Dry brushing

- Remove all mud and soil with a hard brush or other tool.
- For vehicles, machinery and large equipment, pay particular attention to wheels, mudflaps and undercarriage.
- Disinfect if necessary. Remember to also disinfect brush or tool used to remove mud and soil.

2. Disinfection

NOTE: The use of large amounts of water/disinfectant is to be avoided. Disinfection with a light spray is all that is required. Never wash down with water only. Always use a disinfectant.

Vehicles, machinery and large equipment:

- Disinfect heavy equipment and vehicles (paying particular attention to wheels, mudflaps, undercarriage and areas that are difficult to access) using a pressurised spray unit containing a disinfectant/fungicide:
  - **Phytoclean**. Add 1 part of Phytoclean® to 50 parts of water.

OR

  - **Sodium hypochlorite** (pool chlorine). Add 1 part of pool chlorine to 1500 parts of water.

  (Phytoclean is preferred above Sodium hypochlorite as it is a more effective disinfectant, biodegradable and non-corrosive.
  The use of a pressurised spray unit is preferred as less water will be used and run-off will be minimal).

- Disinfectant should be allowed to penetrate for at least one minute (preferably 10 minutes) before equipment departs.
- Do not drive through washdown effluent.
- Do not allow mud and wash-down effluent to drain into bushland and surface waters, such as rivers, creeks, reservoirs and dams.
- Use vehicles that are easy to clean, such as machines with rubber tyres rather than tracks.

Footwear, small equipment and hand tools:

1. Disinfect the entire sole of your footwear using a spray bottle with disinfectant (methylated spirits (70-100%)) or household bleach (1part bleach to 4 parts water)
2. Allow the sole to dry for approximately one minute.
3. Step forward to avoid recontaminating footwear
4. repeat steps 1-3 for the other boot

Disinfect small equipment and hand tools using the spray bottle and disinfectant.

Footwear can also be disinfected using a footbath containing disinfectant. This is useful when large groups of people need to disinfect their footwear at one location. Do not leave footbath unattended where children and animals may come in contact with the chemical.

SUMMARY OF HYGIENE PROCEDURES

	Hygiene procedure	**Disinfectant / rate**	**Comments**
Vehicles, machinery, large equipment	- dry brushing - disinfection	Phytoclean – I part to 50 parts water OR Sodium Hypochlorite (pool chlorine) 1 part to 1500 parts water	- pay particular attention to wheels, mudflaps, undercarriage and other areas difficult to access - remember to disinfect brush or tool used in dry brushing
Small equipment, hand tools, footwear	- dry brushing - disinfection	1 part household bleach to 4 parts water OR Methylated spirits (undiluted)	- all soil should be removed before disinfecting - use spray bottle - avoid recontaminating footwear - remember to disinfect brush or tool used in dry brushing
Footwear	- dry brushing - footbath	Phytoclean – I part to 10 parts water OR 1 part household bleach to 4 parts water	- all soil should be removed before disinfecting - useful for large groups of people