

8

Weed and disease management



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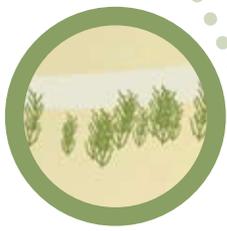
This chapter deals mainly with the special considerations for weed and disease management on or near the shoreline. Many aspects of coastal weed management away from the immediate shoreline are the same as further inland, but conditions are quite different beside the sea, where salt laden winds, unstable sands, and sandy soils are common.

Weed and disease management is an essential component of any coastal works. Weeds often spread quickly after any disturbance to the soil and diseases are easily introduced via machinery, tools and mulches. Weeds are a major problem in many coastal areas, and their removal is often the most important part of any revegetation program.

Weeds degrade coastal ecosystems by competing with native plants, reducing biodiversity, disrupting ecological processes (e.g. weeds like boneseed and gorse may increase the frequency of fire) and disrupting coastal processes (e.g. by altering dune shape – marram grass). Diseases such as phytophthora root rot can be devastating to coastal heath vegetation.

Disturbance of the soil, including the removal of existing weeds, can expose the soil and promote new weed growth. It can also destabilise dunes, cause erosion and result in the introduction of soil pathogens. Planting and/or mulching may be required soon after weeding, to prevent more weeds from establishing.

*Tab photo: Boneseed infestation in south-east Tasmania.
© Leah Page.*



8.1

8.1 Weed management

This section deals with the tools and techniques required for effective weed management.

Good weed management – not just trying to eradicate weeds – is part of good land management. It aims to maintain native biodiversity and landscape resistance to invasion by weeds, by protecting sites that are weed-free, restoring natural vegetation cover and improving soil health. In the long run, this approach will prevent weed invasion and reduce the damage caused by weeds and the time and money spent on controlling weeds. **Refer to Chapter 7 Vegetation management.**

Many coastal sites have a large number of weeds present from grasses and small herbs through to large shrubs or trees. To make effective use of the resources available, good weed management does

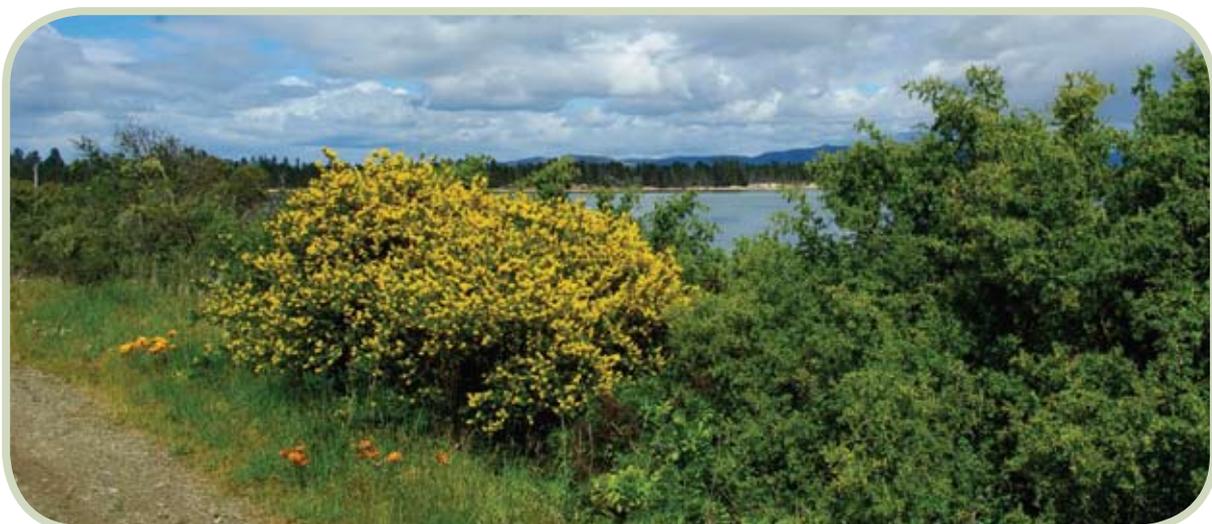
not necessarily require that all weed species are controlled or that complete eradication of any one weed species will achieve biodiversity protection. It is important to determine the priorities and degree of weed control required for any particular site.

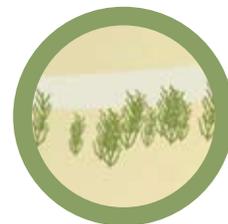
Making landscapes resistant to weed invasion requires an integrated approach. This means using a variety of control methods to target each weed, reducing the risk of introduction of weeds and improving the health of the site to reduce the risk of weeds re-establishing.

Timing of weed control is also important, to ensure that weed species are treated when they are most vulnerable.

Weed management is obviously a long-term exercise. To have a real impact, it needs thorough planning and regular targeted work on an annual basis, done at the right time.

Figure 8.1 Roadsides in coastal areas can be subject to a number of significant weed invasions. This roadside is supporting a community of African boxthorn *Lycium ferocissimum*, boneseed, *Chrysanthemoides monilifera* subsp. *monilifera*, Montpellier broom, *Genista monspessulana*, gazania, *Gazania linearis*, and some plants that have escaped from nearby gardens. © Leah Page





8.1.1 Legislation and policy

In addition to legislation detailed in **Appendices 1 and 2**, the following legislation provides specifically for the management of weeds.

The objectives of the *Weed Management Act 1999* further the objectives of the resource management and planning system (RMPS) of Tasmania and, in particular, provide for the control and eradication of weeds, having regard to the need to:

- minimise the deleterious effects of weeds on the sustainability of Tasmania's productive capacity and natural ecosystems
- promote a strategic and sustainable approach to weed management
- encourage community involvement in weed management
- promote the sharing of responsibility for weed management between the different spheres of government, natural resource managers, the community and industry in Tasmania.

A core component of the legislation is the legal process of declaring a weed species under the Act. A Statutory Weed Management Plan (SWMP) must be prepared for all declared weeds under the Act.

The *Plant Quarantine Act 1997* provides for the quarantine of plants and the control of pests and diseases. The **Tasmanian Biosecurity Policy 2006** and the **Tasmanian Biosecurity Strategy 2006** provide guidance for the implementation of the Act.

8.1.2 Weeding in coastal environments

Weed management activities have potential impacts on other coastal values and it is important to plan for ways to minimise those impacts when weeding in coastal environments.

Unique and vulnerable values such as Aboriginal heritage sites and shorebirds must be considered when planning weed management on the coast. There are many Aboriginal heritage sites along the coast such as middens and artefact scatters that will be vulnerable to soil disturbance associated with mechanical weed removal. Weeding on Aboriginal sites might require a permit under the *Aboriginal Relics Act 1975*. **Refer to Chapter 5 Cultural heritage management.**

Beach-nesting shorebirds and colonies of penguins and shearwaters can be adversely affected by the level of activity and disturbance associated with weed-removal techniques. In less natural coastal environments, weeds sometimes play useful roles in stabilising dunes and even protecting wildlife habitat. For instance, African boxthorn can provide shelter for penguin or bandicoot burrows and removing these weeds during breeding times, and without a careful replacement strategy, can put wildlife at risk. **Refer to Chapter 10 Wildlife management.**

Weeding activities that disturb and expose the soil can promote weed growth, destabilise dunes and cause erosion. Planting and/or mulching may be required soon after weeding, to prevent more weeds from establishing.

New weeds and diseases can be introduced on vehicles, footwear or dumped garden rubbish, and by birds, wind and waves. To protect the spread of weeds and protect natural ecosystems, it is vital to practise good weed and disease hygiene during all coastal work activities.

8.1.3 Planning for weed management

Plan works carefully: a good tool is the development of a local weed management plan. Plans should comply with the *Tasmanian Weed Management Act*



8.1

1999, statutory weed management plans for declared weeds, national strategies for Weeds of National Significance (WoNS) and regional weed strategies.

Seek specialist advice from Weed officers within regional Natural Resource Management organisations and Department of Primary Industries, Parks, Water and Environment (DPIPWE) Regional Weed Management Officers.

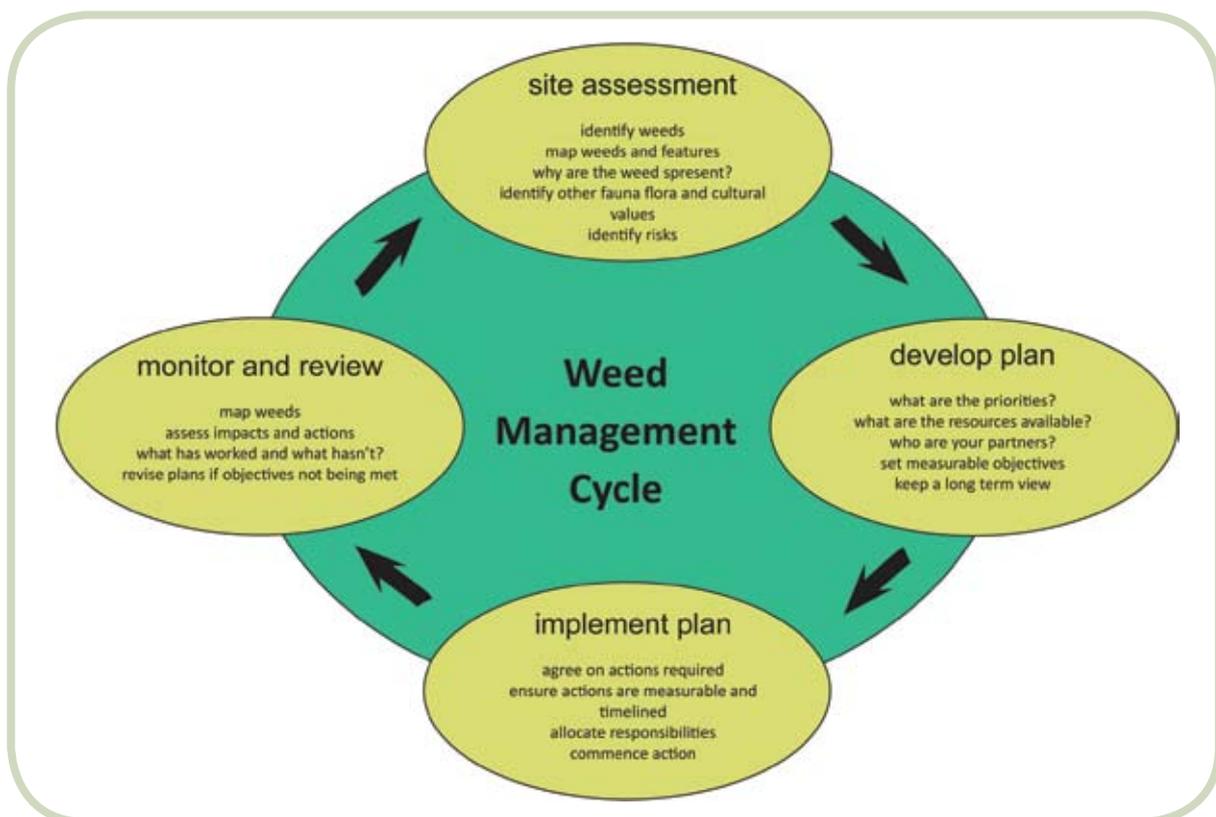
Consult with local groups such as Coastcare about their involvement in and aspirations for weed management in the area. Many of these groups have acquired external funding enabling them to

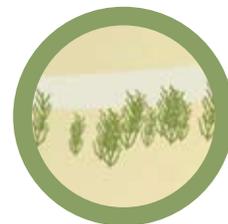
develop local weed management plans. It is extremely beneficial and important to incorporate these into any new management plans.

The *Bushcare Toolkit, Kit 3, Weeds in your Bush* (Glazik & Rudman 2002) has comprehensive guidelines for weed management planning.

As part of the planning process, identify risks to other coastal values as a result of weed management works. Consult specialists such as wildlife and cultural heritage experts.

Figure 8.2 Weed management cycle. Adapted from *Introductory weed management manual* (Cooperative Research Centre for Australian Weed Management, Natural Heritage Trust Australia & Department of the Environment and Heritage, 2004)





General principles of weed management planning:

- Mapping the weeds will enable sound weed management planning and progress to be assessed (refer to *A field manual for surveying and mapping nationally significant weeds*, McNaught et al. 2006).
- Identify the weed problems.
- Identify the causes of weed problems.
- Determine the priority weed species. These are the greatest threats to native vegetation and wildlife.
- Determine the resources available.
- Identify the best times and the best methods to control priority weeds to minimise environmental damage.
- Identify whether rehabilitation will be required and if any land management changes are needed to make the site more resilient to future weed invasion.
- Develop a works program to control weeds in the most timely and effective way with the resources available.
- Implement the works program
- Monitor and record results.
- Be persistent in applying follow-up treatment.

These steps need to be repeated over time. Weed management is an ongoing cycle of planning, doing, reviewing and re-planning, as set out in Figure 8.2.

What are the weeds? What effect are they having?

Which weeds are a high priority? Why should they be controlled?

Who is going to control the weeds? How and when will they control the weeds?

8.1.4 Weed identification

Some coastal weeds are similar in appearance to native species, so it is very important that plants have been identified correctly before management works commence.

Good weed identification resources are available. The *WeedDeck* is a pocket-sized deck of laminated cards with full colour photos for identifying weeds. The *Community Coastcare handbook* has helpful comparisons between common weeds and look-alike native species. **Refer to 8.7 Tools and resources.**

It is important that land managers are trained to identify weed species so that they can play a role in identifying new weed incursions during the course of their land management activities.

8.1.5 Priorities for weed control

Effective weed management requires prioritisation. It is not possible to manage all weeds in a given area and it is important to maximise the benefit of any investment in weed works. Some weeds are more invasive than others and some vegetation communities and habitats are more susceptible to weed invasion or have other values that warrant special consideration or protection. Some land managers have limited resources and capacity for weed management.

In prioritising weed management works, first consider state and regional plans, which cover all declared weeds, Weeds of National Significance (WoNS) and weed alerts.

Assess the impact of each weed and the feasibility of controlling it. Weeds that invade bushland and threaten native plants by out-competing them are known as environmental weeds. The result can be the death of these native plants and often the animals,



birds, insects and other creatures that depend upon them. This loss can in turn cause further declines in local biodiversity.

Consider any localised or site-specific issues such as impacts on fauna, threatened species or communities, geoheritage and cultural heritage. Consideration of available and future resources will also govern priorities. Sensitive habitats with few weeds or new incursions of invasive weeds may be more important than large established infestations of WoNS.

In many cases weed surveys may uncover new weed problems and these should be reported to DPIPWE Regional Weed Management Officers for documentation. They can provide advice on the importance of managing new weeds and their likely impact. Reporting weeds improves the understanding of the behaviour of weeds.

Declared weeds

The *Tasmanian Weed Management Act 1999* requires that each declared weed is contained or eradicated. Approved Statutory Weed Management Plans (SWMPs) are on the DPIPWE website.

The SWMP for each declared weed specifies what land managers are required to do to manage that weed within each municipality. It provides information about the distribution and extent of the weed, restrictions and measures required to control, eradicate or restrict the spread of a weed.

Weed Plan: Tasmania's weed management strategy (DPIWE 2005) and *Response Plan* are also on the DPIPWE website.

Declared coastal weeds with SWMPs in place:

African boxthorn
blackberry*
boneseed*
gorse*
bridal creeper*
English broom
pampas grass
Montpellier broom
Spanish heath
serrated tussock*

(* indicates a Weed of National Significance)

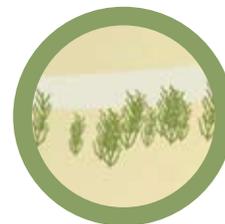
Weeds of National Significance (WoNS)

Weeds of National Significance (WoNS) are listed in the *National Weeds Strategy: A strategic approach to weed problems of national significance* (ANZCC & ARMCANZ 1997). All WoNS are declared under the *Tasmanian Weed Management Act 1999*.

Seven of the 20 Weeds of National Significance occur in Tasmania: blackberry, willow, serrated tussock, bridal creeper, boneseed, Chilean needle grass and gorse. From time to time, Australian Government funding is targeted at the management of WoNS weeds, because of their national recognition.

National Alert List weeds

The Alert List for Environmental Weeds, available on the Australian Government weeds website, is a list of 28 non-native plants that threaten biodiversity and cause other environmental damage. Although only in the early stages of establishment, these weeds have the potential to seriously degrade Australia's ecosystems. In Tasmania these include *Calluna vulgaris* or heather, orange hawkweed and horsetail species.



Tasmanian beach weeds

The *Tasmanian beach weed strategy* (Rudman 2003) contains information for identifying and managing sea spurge (*Euphorbia paralias*), marram grass (*Ammophila arenaria*), sea wheat grass (*Thinopyrum junceiforme*), pyp grass (*Erharta villosa*) and beach daisy (*Arctotheca populifolia*). The strategy is on the DPIPWE weeds website.

Rice grass

The *Strategy for the management of rice grass* (*Spartina anglica*) in Tasmania, Australia (DPIWE 2002) contains information for identifying and managing this estuarine weed. The strategy is on the DPIPWE weeds website.

8.1.6 Deciding whether to eradicate or contain weeds

Eradication may not be realistic. Certain weeds are widespread, aggressive colonisers that are impossible to eradicate. It is generally too difficult to remove large infestations of some long-established species such as marram grass. But it is extremely important to report and control new infestations in areas that were previously free of the weed, including those listed in the *Tasmanian beach weed strategy for marram grass, sea spurge, sea wheat grass, pyp grass and beach daisy* (Rudman 2003).

Containment to prevent and control new infestations is more realistic than eradication if the weeds are widespread and well established. Focus on treating outlying infestations, on the fringes, rather than the main infestations. This will help to prevent the spread of weeds into new areas. Containment also involves restoring

Figure 8.3 Boneseed seedlings have germinated where adult plants have been removed and require follow-up removal.
© Leah Page





weeded areas by assisting regeneration of native vegetation to limit opportunities for weeds to re-invade.

For those areas where it is not the objective to remove the weed, it may be appropriate to mitigate against the impact of the weed by periodically controlling infestations to prevent the population growing to the point where it is detrimental to the native biodiversity.

NOTE: Regardless of your decision, it is essential that weed programs are followed up with monitoring and control at least annually.

8.1.7 Timing of weed management works

Knowing the life cycle of each species is essential to determine the timing of different treatments. Refer to the *Introductory weed management manual* (CRC for Australian Weed Management 2004).

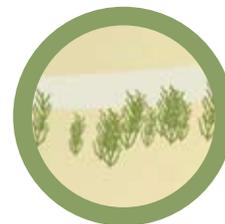
The best times for various methods of weed control are shown in Table 8.1.

Some methods, such as slashing weeds, may also remove seed heads of native vegetation – thereby reducing the success of natural regeneration. Before undertaking non-specific mechanical weed control, it is important to consider the life cycle of local native species and time works to benefit them.

Table 8.1 Weed control methods and timing for the southern temperate zone.

	Woody weeds	Shrubs	Herbaceous plants	Grasses	Vines & scramblers	Bulbs, tubers & rhizomes
Mulch/smother			All year	All year		All year
Solarisation*			Spring & summer	Spring & summer		Spring & summer
Pull	Before seed set	Before seed set	Before seed set	Before seed set	Before seed set	Before seed set
Cut & paint	Spring	Spring			Spring & summer	
Foliar spray			Spring	Spring & summer	Spring & summer	Spring & summer
Inject	Spring				Spring	
Wipe					Spring	Before flowering

*Soil solarisation is the laying of black plastic over the soil. The heat generated by the sun on the plastic kills many weed seeds and soil diseases.



Shorebirds nest on many Tasmanian beaches and disturbance to their breeding sites could be fatal for their eggs and chicks.

Shorebirds nesting between September and March will be disturbed by activities on beaches and dunes. Penguin and shearwater rookeries should also be avoided during breeding and moulting times. **Refer to Chapter 10 Wildlife management.**

SPRATS (Sea Spurge Remote Area Teams) have incorporated shorebird monitoring into their weed work programs. They have worked closely with Birds Tasmania and the Parks and Wildlife Service to minimise their impacts on breeding and roosting birds. **Refer to case study 8.1.**

Best time for hand removal

There are optimal times for hand removal of some common coastal weeds. However, when planning the timing of weed-removal activities, it is important to consider other environmental, cultural and recreational values.

Most weeds in Tasmania are flowering by September and set seed soon after. As a general rule, pulling weeds out in September–October is the safest option (avoid shorebird nesting beaches) but there are exceptions, such as Spanish heath, which is best done earlier (June–July). Note that flowering times vary from season to season, and often by months, not just weeks. Check the growth and flowering times of individual species to ensure weeds are targeted at the optimum times.

Best times for hand-removal of some common coastal weeds:

Early spring: boneseed, boxthorn, brooms, Cape Leeuwin wattle, Spanish heath, sweet pittosporum (but watch for attached fruit), tree lucerne

Spring: coprosma, rice grass, sea spurge (CAUTION: spurge sap produces a toxic sap that is irritating to the skin and can be particularly painful if rubbed into the eyes)

This is shorebird breeding season.

Autumn: sea spurge, boneseed



Figure 8.4 Sea spurge volunteers removing weeds at Pennerowne Point in the remote south-west. © Nick Fitzgerald

Case Study 8.1: Weed Management on Tasmania's South & West Coasts

Sea Spurge Remote Area Teams

*Winners of the 2009 Community Award
Tasmanian Awards for Environmental Excellence*

Sea spurge and marram grass are devastating coastal ecosystems across southern Australia including Tasmania's World Heritage-listed south and west coasts. SPRATS (Sea Spurge Remote Area Teams) formed in 2007, following a trial weeding program and site surveys, to tackle coastal weeds in the south-west before it was too late. SPRATS received the 2009 Tasmanian Award for Environmental Excellence in the Community section for their achievements.

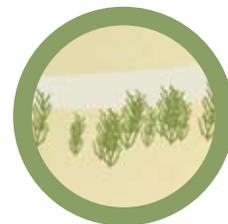
The SPRATS volunteers have a 10-year plan to remove these weeds from the coastline between Cape Sorell and Cockle Creek. In the past three summers they have surveyed the south-west coastline; 350km of its 600km has been mapped as susceptible to invasion. To date they have treated 315km (91%) of susceptible areas. SPRATS groups have secured funding support from the Australian Government to undertake their valuable work.

While sea spurge is the main weed problem, the volunteers are also targeting marram grass. Both weeds form huge colonies which displace native sand-dune vegetation and also blanket flat sandy areas used for nesting by beach birds, including rare and endangered species such as the little tern.

The south-west coast presents a number of challenges including inaccessibility, rugged terrain, wild weather and thick scrub. These challenges are part of the attraction for SPRATS volunteers, who are experienced bushwalkers.

Their remote area weeding techniques are highly practical and effective, with the potential to remove up to 99% of weeds after two or three treatments. SPRATS have developed best practice techniques that minimise the impact of their weeding activities on significant coastal values such as shorebirds and Aboriginal heritage.

By the end of the 2012–13 field season SPRATS are aiming to have controlled all infestations of these weeds, and to be concentrating on surveillance and follow-up of minor infestations. SPRATS work closely with the Parks and Wildlife Service, Birds Tasmania and regional NRM bodies and are also supported by Wildcare Inc.



8.2 Methods of weed control

It is important to choose methods that minimise disturbance of the soil near the shore, especially in sand dunes, which are easily destabilised.

The porosity of some soil types – especially sandy soils – and the amount of organic matter and clay they contain can affect the way herbicides work and move once they enter the ground. Herbicides generally move further in sand and sandy soils, but have a shorter residual effect (i.e. do not last as long in the soil). The typically windy weather on the coast is often unsuitable for spraying weeds – a sea breeze may blow up suddenly by mid-morning.

Choose weed control methods that suit the purpose, budget and site conditions, and avoid damaging native vegetation.

Often the most efficient and cost-effective way to control weeds is to combine a number of different methods, at different times. Each method needs to target the weeds when they are most vulnerable.

Many weed species, especially perennials, are successful because they have more than one way of reproducing. To control or eradicate these species from a site, a three-pronged approach may be necessary:

1. kill/remove the mature plants
2. kill/remove newly emerged seedlings
3. stop opportunities for further re-infestation.

Suitable weed control works may include any or all of the following:

- prevention
- mechanical/physical removal
- biological control
- chemical control
- fire.

Guidelines for weed control methods are readily available from the DPIPWV weeds website and are only briefly covered here.

8.2.1 Prevention

Methods include over-planting to shade weeds and cultivation to stop seed germinating. These are ineffective alone and are normally combined with other methods.

8.2.2 Mechanical/physical removal

Methods include hand-pulling, slashing, mowing, scalping, burning, steam and solarisation. Mechanical removal is almost never a solution by itself, but it can reduce the mass of weeds to be treated and limit further seeding. Timing of these methods is critical – they must be done at or before flowering.

Hand-weeding can be easy and effective for a number of weeds, particularly young plants that have not developed an extensive root system. This method can be very effective when dealing with small infestations of woody weeds (e.g. boneseed, broom and sweet pittosporum). It is not suitable for plants that produce lots of small underground bulbs (e.g. bridal creeper). If tubers are carefully dug out and surrounding area sieved then this can be a good way to treat isolated bridal creeper plants.

Mowing and slashing are not suitable for plants that may regrow from roots or fragments (e.g. poplars) – and can make it much harder to control them by



other methods. Mowing is also not appropriate for weeds that send out extensive underground root systems such as pyp grass.

Wherever possible, if slashing grass, do it before weeds flower and set seed, and after the flowering and seed-setting of native species.

Scalping causes substantial soil disturbance and is only appropriate in areas dominated by weeds where immediate rehabilitation is planned. This works quite well for plants such as monbretia and watsonia, but in sandy soils the risk of erosion and destabilisation is very high.

Burning can be useful as an initial treatment for certain species (e.g. gorse, blackberry and willow) in some situations. It must be followed up with spraying or other treatment. Burning should only be considered in consultation with biodiversity, vegetation, wildlife and fire specialists.

8.2.3 Biological control

Sometimes invertebrate predators or pathogens from the country where the weed originated can be introduced to reduce the vigour of the weed infestation.

Biological control can be useful for a few species that have been identified as suitable after stringent testing. To eradicate a weed from a site, consider direct controls instead. If using a biological control, the site needs to be monitored for effectiveness and this may place limitations on the use of direct control techniques such as spraying.

Before using chemicals, find out if any biological control agents are present. Contact a Regional Weed Management Officer in DPIPWE or the Tasmanian Institute of Agricultural Research (TIAR) Biological control program.

8.2.4 Chemical control

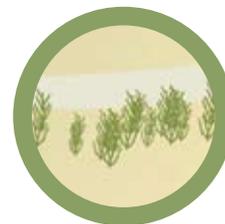
Herbicides can be applied by cut and paint, drill and fill, or stem injection methods, or by spraying. Herbicides have the advantage of not disturbing the soil, but they are poisons that should be used with great care, especially near waterways and coastal environments. Minimise their use.

Personal health and safety are paramount: anyone handling and using herbicides should wear correct personal protective equipment and is advised to attend a ChemCert training course on chemical use at the Tasmanian Skills Institute. Land managers should address these matters in a risk assessment prior to any chemical control works.

When spraying weeds, wear a protective suit, gloves, eye goggles and breathing apparatus. After applying herbicides, wash hands and any other skin that may have come into contact with the chemical. Store and dispose of the chemicals safely.

Avoid spraying chemicals in winds greater than 15 km/hr, or when conditions are hot, dry and dusty. Significant spray drift can occur even in very still conditions, when it is hot, dry and dusty, as droplets stay in the air for longer periods. Spray drift can harm native plants and pollute nearby waters, killing frogs and other aquatic life. If spraying near waterways, check that the chemical is appropriate for this use: read the label. To reduce spray drift and target small plants, a plastic guard (like an upside-down funnel shape) can be attached to the end of the nozzle.

Selecting the appropriate herbicide and dilution is critical. Get specialist advice about the best herbicide to use and any dilutions required. Note that by law, only chemical herbicides registered for specific weeds and situations may be used. Information on choosing herbicides, and precautions when using herbicides, are available in the *Tasmanian Bushcare Toolkit, Kit 3, Weeds*



in your bush (Glazik & Rudman 2002).

Follow the DPIPWWE Codes of practice, guidelines and information sheets for using herbicides, available from the DPIPWWE website.

Note that some herbicide use is off-label (meaning that it is necessary to apply the herbicide using methods not included on the label). This is often the case when treating environmental weeds as they are usually not listed on the label. A general off-label permit exists in Tasmania for a range of herbicides, weeds and situations for environmental use. If in doubt, contact a DPIPWWE Regional Weed Management Officer.

Follow herbicide instructions carefully. It is very important to wear the recommended personal

protective equipment and read the information on the label and any other documentation provided (which is often in a plastic sleeve attached to the container), e.g. the Material Safety Data Sheet. Never remove the label from the container, and always ensure all the documentation is on-site during weed control work.

The cut-and-paint method is often the best technique for large or woody weeds. Check with DPIPWWE Regional Weed Management Officers about correct dilutions of herbicide for this purpose. Add a dye to herbicides to identify treated plants and any unintended damage to native plants, and to make spillage easy to see.

Figure 8.5 Spray application of herbicides should only be undertaken by trained individuals with the appropriate personal protective equipment. © Tim Rudman





8.3

8.3 Monitoring weed management works

All weed management works require regular maintenance for years afterwards. It is essential to monitor the area, at least annually, for new weeds and spread of existing weeds into new areas. Community groups can play an important role in monitoring but should be supported by land managers and other community coordinators.

Inspection and maintenance should involve:

- photopoint photos
- mapping changes to weed distribution and extent
- checking for germinants (e.g. seedlings)
- checking for regrowth of previously treated plants
- searching for new weed invasions
- determining what ongoing works are required and when.

Marking weed-infested sites with information signs can be useful to inform all land managers, contractors and users of the presence of weeds and the management techniques required to minimise their spread. **Refer to section 7.3.6 Marking sites for protection or management.**

Tasmanian Weed Alert Network

The Tasmanian Conservation Trust (TCT) has received funding from the Tasmanian Community Fund to re-establish the Tasmanian Weed Alert Network during 2009–2011. The project is being run in collaboration with the Department of Primary Industries, Parks, Water and Environment's Weed Management Section, Tasmanian Herbarium, Tasmanian Farmers and Graziers Association and the Tasmanian Weed Society. This project aims to establish the Tasmanian Weed Alert Network as a self-sustaining network of volunteers which assists with preventing the establishment of new weeds in Tasmania.

8.4 Phytophthora root rot

This section provides information on an important soil-borne disease in Tasmania. Phytophthora root rot (*Phytophthora cinnamomi*) is a key management issue in the relatively warm and moist lowland parts of Tasmania. It is a microscopic pathogen (disease-causing organism) that can be spread by moving soil and infected machinery and vehicles.

P. cinnamomi spores and infected root material can be transported in minute quantities of soil the more soil is moved, the more risk of infection increases. Machinery, especially earth-moving equipment, vehicles, infected planting stock and the movement of infected soil or gravel, produce the greatest risk of infestation of native vegetation.

P. cinnamomi (root rot or die-back) is listed as a key threatening process in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. A national *P. cinnamomi* threat abatement plan has been prepared and is supported by national guidelines.

The pathogen is recognised as being a very real and rapidly spreading threat to many of Tasmania's plant species and communities. It has the capacity to kill a wide variety of native plant species and is widely recognised as one of the most threatening of all disease epidemics to affect native plant communities anywhere on the globe (Schahinger et al. 2003).

Signs of phytophthora infection include patches of dead or dying peas and heaths, often extending down slopes and showing older areas of mortality towards the centre. Sedges and grasses remain unaffected.

In areas with phytophthora root rot, follow procedures outlined in the *Interim Phytophthora cinnamomi management guidelines* (Rudman 2005).

8.5 Weed and disease hygiene

See also section 5.3 Plant Disease Management in the *Tasmanian reserve management code of practice* (PWS et al. 2003).

P. cinnamomi Management Areas have been designated to protect plant communities and species that are highly susceptible. The locations of these and maps of areas infested with or susceptible to phytophthora are at the DPIPWE weeds website.

Vulnerable vegetation types include coastal heathlands, heathy eucalypt woodlands and buttongrass moorland. Phytophthora root rot is unlikely to be an issue in wetland or foreshore beach vegetation.

The best way to prevent the spread of phytophthora is to clean all tools and machinery before entering and leaving work sites. **Refer to section 8.5 Weed and disease hygiene.**

Figure 8.6 Evidence of die-back in grass trees due to phytophthora root rot disease. © Tim Rudman

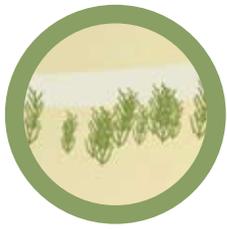


This section highlights the importance of good weed and disease hygiene, which is critical in coastal areas to avoid introducing weeds and diseases in imported materials and spreading weeds or diseases from an infested area to an uninfested area on vehicles, machinery, other equipment and clothing.

Mulches are often used to prevent the spread of weeds onto bare patches of soil. It is important to ensure that imported landscape materials such as mulches are free of weeds and diseases – ask for a statement from the vendor. Mulches tend to be made from a variety of products with varying origins and may contain weed propagules (e.g. seeds or root fragments). Use mulches made from single products (e.g. gum bark) or which are heat treated in some way (avoid materials treated with chemicals or irradiation, which may harm the natural vegetation).

Avoid slashing in weed infected areas when seed heads are mature, to reduce the risk of spreading the weed on-site and collecting seeds on machinery that could be transported to new sites.

Wash down tools, machinery and personal equipment when moving between work sites. This is particularly important when a site is known to be either infested or free of weeds and disease. Although washdown procedures take time, they will soon save time and money by greatly reducing future weed and disease management needs.



Washdown is advisable:

- before entering a new site
- after operating in an area affected by a weed or disease
- after transporting weeds or soil known to be infected with weed seeds or a plant pathogen
- before moving machinery along roadsides or river banks
- before transporting soil and quarry materials.

Washdown standards are detailed in DPIPWE *Tasmanian washdown guidelines for weed and disease control* (Rudman et al. 2004).

Personal equipment and small tools

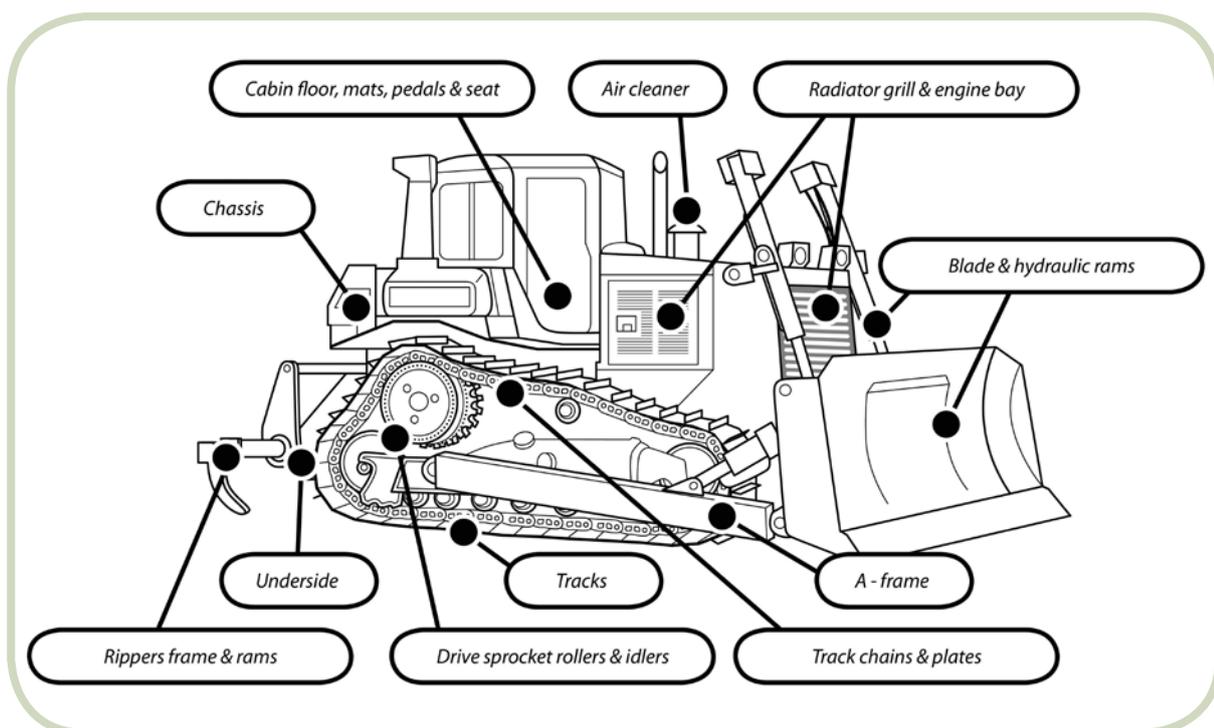
Portable washbaths are recommended for washing footwear and small tools.

Washbaths can be made from a fish box (or other suitably sized plastic box) fitted with an open weave plastic doormat, a scrubbing brush, a pair of safety gloves, glasses, detergent or fungicide, and a container of clean water. For backpacking, a 2L bottle, scrubbing brush, safety gloves and glasses can be used for washing small tools and boots.

A biocide such as F10SC or Phytoclean™ should be added to washbaths to control the spread of pathogens and disease (e.g. *P. cinnamomi*) if required.

Figure 8.7 Important washdown points on vehicles and machinery to control the spread of weeds and diseases.

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8.6 Climate change and weeds and disease in Tasmania

Machinery

Permanent commercial washdown stations are installed in most large towns.

Portable washdown stations can be taken out into the field and involve a tank and pump fixed to a trailer. A shovel, crow bar and stiff brush are also required. Where a blowdown only is required, compressors or portable blower vacs may be used along with a small brush.

Ensure the siting of the portable washdown station will minimise the potential to spread weeds and diseases. Choose sites at the edge of the work site where the land slopes back into the infested area and will not enter a watercourse. Mud free sites are best but avoid sensitive vegetation.

General washdown techniques for machinery:

- remove cover plates etc that can be quickly and easily removed and replaced
- ensure no clods of dirt or loose soil are present after washdown (smear soil stains are acceptable)
- ensure radiator grills and the interior of vehicles are free of accumulations of seed and other plant material.

Note that some machinery, such as harvesting equipment, cannot be washed with water because of potential damage to sensitive electronic equipment. Always consult and comply with the manufacturer's recommended cleaning method. Such equipment can be treated with an air compressor.

This section summarises some of the potential impacts of climate change on weed and disease in Tasmania and recommended management approaches.

There may be unexpected and complex changes with weeds and diseases as Tasmania's climate varies into the future. The complex interactions between climate, carbon dioxide (CO₂), plants, pathogens and competition amongst species are not well understood.

Some current weeds and diseases may be less favoured by the changing conditions and others may thrive. New problems could also emerge as some vegetation communities may have less capacity to dominate existing weeds. Vegetation communities may become more susceptible to disease or weed invasion as new niches become available if ecosystem function degrades. For more information see *Vulnerability of Tasmania's natural environment to climate change: An overview* (DPIPWE 2010).

As the scale of climate shifts and the effects of carbon dioxide on plants are better understood, the way agencies and land managers approach weed and disease management will need to change. For instance, *P. cinnamomi* may become active in susceptible wet forest or rainforest communities at low elevation. If so, authorities would need to be prepared for this, and rehabilitation plans would need to consider using the best-adapted stock rather than stock of local provenance.

Weeds may spread to new areas of the state and decisions about which weeds to control will need to consider new potential and emerging threats. As weed problems change, reporting new incursions



will be a critical early warning system for effective management.

For the time being, management should continue dealing with the current problems but, increasingly, climate risk management guidelines will become available to aid preparation for emerging new threats. However, the highest priority now is to maintain healthy diverse ecosystems, to foster resilience and maintain the biological links across the landscape. Weed and disease management should support this through the principle of working from the most intact to the least intact areas, and addressing the most damaging and potentially damaging invasive species.

8.7 Tools and resources

Complete details of all printed publications listed here are provided in a reference list at the end of the Manual. Other tools and resources including websites are collated in **Appendix 5**.

Weed identification

Alert List for Environmental Weeds

<http://www.weeds.gov.au/publications/guidelines/alert/index.html>

Bush invaders of south-east Australia (Muyt 2001)

Coastal weeds of Tasmania: Are you growing invaders? (Connolly 2003)

A booklet containing descriptions and management recommendations for 50 environmental weeds and a list of alternative Tasmanian native coastal plants for use in garden plantings.

Community Coastcare handbook. (Thorp 2005)

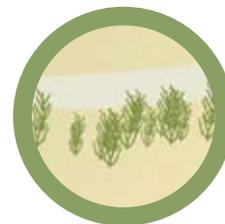
Photo comparisons between weeds and similar-looking native species

Environmental weeds: A field guide for SE Australia. (Blood 2001)

Natural Values Atlas

Maps and records of recorded vegetation values

<http://www.dpipwe.tas.gov.au/>



WeedDeck

Handy pocket sized ID cards of the major weeds of Australia

<http://www.sainty.com.au/>

Weeds of the south east: An identification guide for Australia (Richardson et al. 2006)

Weed management

A field manual for surveying and mapping nationally significant weeds (McNaught et al. 2006)

Australian weeds strategy – A national strategy for weed management in Australia (Natural Resource Management Council 2006)

Coastal weed strategy for the Cradle Coast natural resource management region (Coastal Weeds Working Group 2008)

DPIPWE Codes of practice and guidelines

Information for using herbicides on the website

www.dpipwe.tas.gov.au Go to Biosecurity > Agricultural & Veterinary Chemicals > Codes of Practice & Guidelines

- Code of practice for ground spraying
- Code of practice for spraying in public spaces
- Guidelines for disposing of washings and rinsates
- Rivercare guideline for the use of herbicides near waterways and wetlands
- Guidelines for interpreting labels

DPIPWE weed control guides

Control guides for specific weeds replace the former weed service sheets and are available online.

www.dpipwe.tas.gov.au Go to > Weeds, Pests & Diseases > Weeds > Weeds Index

DPIPWE weed information

Information on the website includes Approved Statutory Weed Management Plans, the *Strategy for the management of rice grass (Spartina anglica) in Tasmania, Australia* (DPIWE 2002) and *Weed plan: Tasmania's weed management strategy* (DPIWE 2005).

www.dpipwe.tas.gov.au Go to > Weeds, Pests & Diseases > Weeds

Introductory weed management manual

(Cooperative Research Centre for Australian Weed Management et al. 2004)

Southern Tasmanian weed strategy (Schrammeyer 2005)

Contains descriptions and management recommendations for 80 environmental weeds.

**Tasmanian beach weed strategy** (Rudman 2003)

www.dpipwe.tas.gov.au Go to Weeds, Pests & Diseases > Weeds > Weed Legislation and Management Plans > Tasmanian Beach Weeds Strategy

Tasmanian Bushcare Toolkit, Kit 3, Weeds in your bush. (Glazik & Rudman 2002)**Tasmanian Institute of Agricultural Research (TIAR) Biological Control Program**

A joint venture between the University of Tasmania and DPIPWE

<http://www.tiar.tas.edu.au/extensive/biological-control-of-weeds>

Tasmanian reserve management code of practice (Parks and Wildlife Service et al. 2003)**Tasmanian Skills Institute. Chemical Handling Training**

Contact Loretta Satterly on (03) 6434 5846.

Weed and disease hygiene**Conservation of Tasmanian plant species & communities threatened by *Phytophthora cinnamomi*: Strategic regional plan for Tasmania** (Schahinger et al. 2003)**Keeping it clean: A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens** (Allan & Gartenstein 2010)**Interim *Phytophthora cinnamomi* Management Guidelines** (Rudman 2005)**Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 2 . National best practice guidelines.** (O'Gara et al. 2005)

<http://www.environment.gov.au/biodiversity/invasive/publications/pubs/part2.pdf>

Management areas *P. cinnamomi* and maps of infected areas

www.dpipwe.tas.gov.au Go to Weeds, Pests & Diseases > Plant Diseases > Phytophthora > Distribution of *P. cinnamomi*

Tasmanian washdown guidelines for weed and disease control. (Rudman et al. 2004)

Detailed procedures for preventing the spread of weeds and diseases from tools and machinery

Threat Abatement Plan for dieback caused by the root-rot fungus *Phytophthora cinnamomi* (Environment Australia, 2002)

A national threat abatement plan

<http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/phytophthora.pdf>