

# Section 3

## Pre-control considerations



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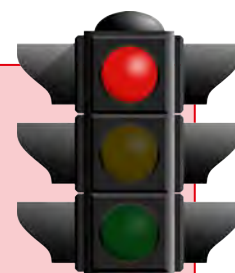
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# Pre-control considerations

## Important pre-control considerations for broom management



Before commencing broom control activities, you should consider the following:

☑ **Do you have commitment and/or resources to conduct follow-up management?**

Follow-up management is critical given the long-lived seed banks and ability for broom seeds to suddenly germinate *en masse* following disturbance.

☑ **Do you have plans for site restoration?**

Site restoration can be particularly challenging on conservation land because brooms can fix high levels of nitrogen in the soil, which can alter soil properties and affect regrowth of native plants and weeds.

☑ **How accessible is the site?**

Your best control options may depend on easy site access.

☑ **How will you ensure that seeds are not moved to other sites during or after control?**

What time of year will you conduct works? Who else uses this site and have you engaged them? To prevent seed spread from a control site, it is important that all people with access to the site follow good hygiene practices.

## Preventing broom spread

Preventing the spread of broom to other areas is critical to all management plans, and should be a major consideration in planning your control.

Long distance spread of broom commonly occurs along easily identified pathways such as roadsides, railways, animal paths, bushwalking tracks and watercourses. It is typical for brooms to establish along these pathways and gradually spread into surrounding areas over time. Remember that seeds are easily spread by:

- moving machinery along roadsides, where seeds can get stuck in tyres in mud,
- bushwalkers, where seeds can get stuck on muddy boots or caught in clothing,
- livestock or native animals, where seeds attach to fur or muddy feet, and
- heavy rains, which can create fast-moving streams that push seeds quickly down slopes



Seed spreads along culverts and road edges

A. Shackleton

and along tracks, or carry seeds further into creeks and rivers (often via flooding) and then into remote and difficult to access locations.

**Keeping mature broom away from these potential spread pathways will go a long way towards preventing spread to other areas.**

See Section 1 for further details on how brooms spread.

Manjimup Weed Action Group, in Western Australia, has found that seed transported on graders and heavy equipment used in road maintenance seems to be a major factor in the spread of Montpellier broom and, in areas where

timber harvesting is active, isolated outbreaks have been associated with harvesting coupes and vehicle parking bays (see Case Study 2 on page 118).

### **Good hygiene can prevent broom spread**

Good hygiene practice is important as long distance broom spread is usually assisted, albeit inadvertently, by human activities such as movement of machinery and soil.

*It is crucial that you establish protocols for good hygiene practices and have them adopted by anyone who works in and around broom infestations in your area.*





# Pre-control considerations

## Case study

### Preventing broom spread along roadsides and other corridors – developing machinery hygiene protocols

Andrew Matthews, Weeds Officer, Shire of Bridgetown-Greenbushes

*This work was supported by the Western Australia Natural Resource Management Office. The complete project summary is available at [www.nrm.wa.gov.au/projects/10060.aspx](http://www.nrm.wa.gov.au/projects/10060.aspx).*

The Shire of Bridgetown-Greenbushes has developed a set of guidelines for Montpellier broom management on roadsides as part of a larger project titled 'Strategic washdown bays, equipment and procedures to minimise soil-stored Cape [Montpellier] broom seed dispersal'. These guidelines are relevant to all broom weeds, and are also useful to help prevent the spread of other weeds and diseases. The following information is adapted from these guidelines.

#### Roadsides and corridors as vectors for broom spread

Brooms thrive on roadsides and corridors, such as utility easements, which represent high-risk reservoirs for further spread of this weed. By their nature, road reserves and corridors are highly accessible, frequented by many and susceptible to regular soil disturbance. These factors make broom-infested roadsides a high-risk source of seed that can cause new infestations. Thus, strategic planning and implementation of good hygiene to prevent spread in these corridors is critical to managing broom on a landscape scale.

Broom can easily spread along roadsides as:

- broom seeds are numerous, hard and long lived, making them highly suited to transport by machinery,
- the explosive release of seeds (which can be expelled up to 3 m from plants) enables seeds to be deposited in roadside drains and shoulders, and on vehicles and machinery,
- broom seeds readily spread along roadsides by run-off and during grading or drainage maintenance,
- other road verge works such as installing signage and removing fallen trees can also spread seeds,
- slashing throws seed from parent plants and contaminated slashing machinery or vehicles move seed between sites,
- seed travels long distances in soil on contaminated earthmoving equipment, and
- contaminated soil is hard to identify and is often transported by grading.



*Seeds can easily spread on soil trapped on machinery, as on this grader*

A. Matthews

**Any work where contaminated soil becomes trapped and transported by machinery can spread seeds.**

To limit the spread of broom seeds by machinery, trapped soil must be removed from equipment and machinery before moving from an infested area. This can be difficult to achieve in practice, as the task of checking for and removing soil from machinery and vehicles can be time consuming and costly; worse, it can be overlooked or forgotten, if not correctly included in standard procedures.

When good maps of weed locations are available, and for major works such as road construction where planning occurs well in advance of the actual works, prevention and hygiene activities can be included in the planning and costing of proposed works. Such forward planning, however, is not always possible because work crews are often deployed on short notice for incidents such as storm or fire recovery.

Achieving a workable 'day to day' biosecurity outcome depends on work crews having the right knowledge and resources when situations arise. Prior planning and training are important to ensure that crews have:

1. An understanding of how machines spread broom seeds (further information page 49).
2. The ability to identify high risk spread zones (further information page 50).
3. The ability to assess the risks of machinery contamination (further information page 52).
4. Suitable alternative work practices that minimise contamination risks (further information page 53).
5. Simple hygiene procedures and suitable facilities/equipment to clean machinery (page 54).

Further information on each of these points is provided below.

## 1. How machines spread broom seeds

Any machinery that comes into contact with contaminated soil can spread seeds. However, backhoes and graders are the most common vectors, as:

- they are the most frequently used machines on roads,
- both cause significant soil disturbance, and
- they are highly mobile.

The way these machines spread seeds differs however, and is reflective of the individual function of each machine in road maintenance.

**Backhoes** are more likely to relocate seeds to new areas, thereby creating new infestations, by transferring soil from one culvert/drain to the next.



*Washing down a backhoe*

A. Matthews

# Pre-control considerations

## Case study continued/...

**Graders** are more likely to extend existing stands by dragging contaminated gravel along the road. However, like backhoes, they can also relocate seeds to new areas when used for cutting offshoot drains, as soil is more likely to accumulate and fall off the top of the blade assembly when the grader crosses the shoulder and digs into the soil in the verge.



A. Matthews

Grader and broom

Machinery such as **excavators**, **trenching machines** and **truck mounted augers** are also highly likely to spread broom seeds when workers are maintaining infrastructure such as water mains, telecommunication cables and electricity supplies.



A. Matthews

Truck mounted auger

## 2. Identifying infestations and high-risk spread zones

Work crews need specific knowledge and skills to identify high-risk spread zones and to assess the risk of machinery contamination. Only then can effective hygiene procedures be incorporated into daily work practices.

Observation and recording of living (or dead) broom is valuable for identifying infestations and soil seed banks that occur in works areas, as are weed maps with accurate broom data points.

In field situations, there may be no live broom plants or other visible evidence of a seed bank. This 'hidden contamination' represents a high risk for machinery contamination and seed spread. Thus, other methods should be used to indicate infestations (or seed banks) to anyone who uses these areas.



## Using signs to mark infestations

In the Shire of Bridgetown-Greenbushes, most roadside Montpellier broom infestations have been mapped, but are also delineated in the field by highly visible, bright orange weed marker signs. These signs are placed in the middle of isolated infestations, or at regular intervals along extended infestations or areas that may be contaminated with seed. As the signs are often placed in the middle of seed banks, crews are asked to consider the contamination risk to their machines if they are operating within sight of a sign, not just in the 10–20 m radius around the sign itself.

Weed marker sign indicating dead broom plant

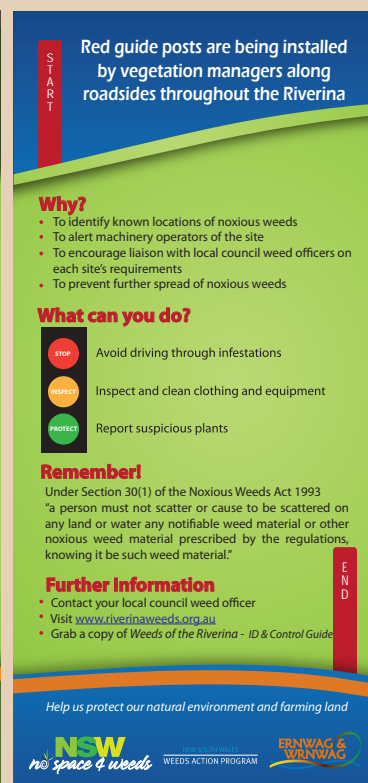


A. Matthews

Similar signage is used elsewhere in Australia, for example:

- **'Red guide posts'**, which are being installed along roadsides throughout the Riverina and western NSW (see [www.riverinaweeds.org.au/Documents/images/WAP\\_2.1.1.9\\_Vehicle\\_Hygiene\\_Protocol\\_040613.pdf](http://www.riverinaweeds.org.au/Documents/images/WAP_2.1.1.9_Vehicle_Hygiene_Protocol_040613.pdf)), and
- **Enviromark**, a national program marketed by Greening Australia, where coded field markers can be purchased and placed along roadside areas and roadside managers are then provided with a specification sheet to cross-reference the code and carry out the appropriate action/s (see [www.greeningaustralia.org.au/our-projects/land/enviromark-targets-roadside-weeds](http://www.greeningaustralia.org.au/our-projects/land/enviromark-targets-roadside-weeds)).

Red guide posts are used along roadsides in the Riverina and western NSW to alert road workers and others to keep clear of weed infested areas



Riverina Noxious Weeds Advisory Groups

# Pre-control considerations

## Case study continued/...

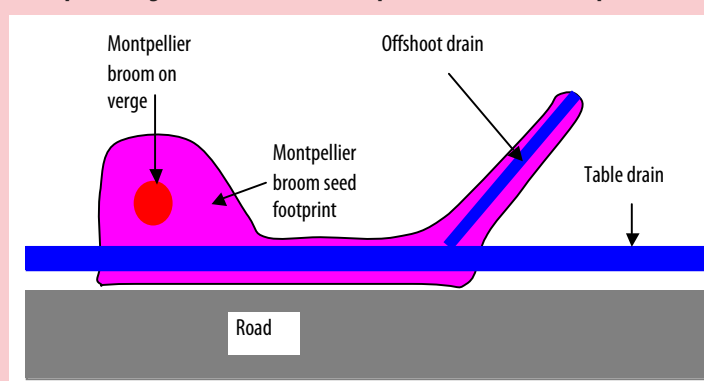
### 3. Assessing the risks of machinery contamination

Assessing the contamination risk at a particular site is a dynamic process and involves multiple factors, including knowledge of the work area, the biology and ecology of the weed and the extent and history of nearby infestations. Such knowledge can help works crews make an informed judgement, enabling them to optimise both their work output and biosecurity goals.

Prior to conducting works, workers on site should consider the risk factors outlined in the table below.

A seed footprint assessment can be conducted to help identify the areas at high risk of contamination, by considering where vehicles are most likely to travel and the order in which works are conducted on site. This then enables consideration of how you can minimise any risks of machine contamination.

**Conceptual diagram of a roadside Montpellier broom seed footprint**



**Risk factors for machine contamination by Montpellier broom seed on roadsides**

Risk factor	Highest risk	High risk	Medium risk
<b>Proximity</b>	<ul style="list-style-type: none"> <li>Less than 10 m from an infestation boundary</li> </ul>	<ul style="list-style-type: none"> <li>Within 10–20 m of an infestation boundary</li> </ul>	<ul style="list-style-type: none"> <li>Greater than 20 m from an infestation boundary</li> </ul>
<b>Soil type and moisture content</b>	<ul style="list-style-type: none"> <li>Top 10 cm of soil</li> <li>Wet or sticky soils, e.g. clays and heavy loams with humus and leaf litter</li> <li>Soil and leaf litter from washouts</li> </ul>	<ul style="list-style-type: none"> <li>Dry friable loams, clays and gravels</li> </ul>	<ul style="list-style-type: none"> <li>Soil from 10 cm below surface</li> <li>Dry sandy or highly friable soil</li> </ul>
<b>Drain/culvert frequency and steepness of hills</b>	<ul style="list-style-type: none"> <li>Table drains downhill from infestations, up to and including 1st downhill offshoot or culvert and discharge area</li> <li>Bottom of steep hills with long table drains and few offshoots/culverts</li> </ul>	<ul style="list-style-type: none"> <li>Table drains between 1st and 3rd downhill offshoot or culvert</li> </ul>	<ul style="list-style-type: none"> <li>Drains beyond 3rd downhill offshoot or culvert</li> <li>More than 10 m uphill from infestation</li> </ul>
<b>Age and size of infestations or soil seed banks</b>	<ul style="list-style-type: none"> <li>Old actively or recently controlled infestations with plants older than two years</li> <li>Seed banks less than 30 years old</li> </ul>	<ul style="list-style-type: none"> <li>New infestations less than 1.5 years old (prior to first flowering)</li> </ul>	<ul style="list-style-type: none"> <li>Controlled infestations that have had no new seed production for 30–50 years</li> </ul>
<b>Season and prevailing weather conditions</b>	<ul style="list-style-type: none"> <li>During winter and spring or after storms that cause heavy run-off, erosion and uprooting of trees</li> <li>During early summer when seeds are explosively released from seed pods</li> </ul>	<ul style="list-style-type: none"> <li>Late summer and autumn, during dry, hot conditions</li> </ul>	



#### 4. Alternative work practices that minimise contamination risk

Weed marker signs that delineate Montpellier broom infestations, such as the orange markers used in Shire of Bridgetown-Greenbushes, enable works crews to identify the exact location of infestations and seed banks. After assessing the risks of machinery contamination, crews can reduce or prevent contamination by making an informed decision about how they undertake the job. A key aim should be to reduce the number of times crews need to clean their machinery. These decisions can include:

- the order of jobs e.g. leaving contaminated areas until last,
- working from weed free areas towards infested areas,
- choosing a lower risk practice, e.g. chainsaw to remove a fallen tree instead of a backhoe, or
- being more aware and careful not to disturb and/or pick-up soil.

If contamination of machinery is unavoidable, crews can then:

- use hand tools to remove accumulated soil and associated weed seed from machinery,
- request on-site washdown with mobile washdown equipment for larger contaminations, or
- travel directly to nearest washdown bay or a shire depot for thorough decontamination.



A. Matthews

*Orange weed markers are used to designate broom sites to warn those working along roadsides to avoid the areas*



A. Matthews

*Mobile washdown trailers can be used to clean machinery on site, preventing further spread of seed*

# Pre-control considerations

## Case study continued/...

### 5. Simple hygiene procedures and suitable facilities/equipment to clean machinery

The document 'Managing Phytophthora Dieback – guidelines for local governments' ([www.dieback.org.au/index.cfm?objectid=72055B2C-A0CC-3C8C-D9DC7E33E2D4F9AD](http://www.dieback.org.au/index.cfm?objectid=72055B2C-A0CC-3C8C-D9DC7E33E2D4F9AD)) provides guidelines for preventing the spread of weeds and diseases. Although these guidelines are designed to help people remove the microscopic fungal spores of *Phytophthora cinnamomi* (root rot) from machinery, a task more difficult than removing weed seeds, adopting hygiene procedures of this standard will ensure your efforts reduce the spread of most weeds and diseases.

**In general**, removing all mud and soil from vehicles, machinery, tools and equipment is usually sufficient to minimise the risk of spreading weeds and diseases.

#### Cleaning footwear

- ✓ Before leaving infested site, remove as much mud and soil as possible with a brush or stick, and minimise the amount of water used.
- ✓ If you have left the infested site, collect all mud and soil removed in a bag or bucket. Dispose of this material at a deep burial tip or with household garbage.

**Work crews should carry a small brush and plastic bag in their vehicles, where possible.**

#### Cleaning vehicles and machinery

Cleaning will be easier and more effective if it is completed at a depot or a permanent/ designated cleaning area.



A. Matthews

**Engaging all groups who move machinery and vehicles is critical to preventing spread.**

If cleaning is to occur in the field:

- ☑ select a site with a hard, well-drained surface (e.g. a road) that is well away from remnant vegetation,
- ☑ if possible, wash down in an area that is close to the area you have been operating in,
- ☑ minimise the amount of water used,
- ☑ try to remove soil and mud as soon as possible (a stiff brush may assist this process), and use a brush or stick to remove compacted soil,
- ☑ wash down on ramps if possible,
- ☑ do not allow mud and wash-down effluent to drain into bushland or enter a watercourse,
- ☑ do not drive through wash-down effluent, and
- ☑ pay particular attention to mudflaps and tyres.

**Washdown sites should be preferably in the field:**

- ☑ Wash down near the infestation.
- ☑ Don't wash down where run-off can enter a watercourse.
- ☑ Avoid native vegetation.
- ☑ Select a site with grass, gravel, bark or timber cording.
- ☑ Allow enough space to move tracked machinery.
- ☑ Avoid hazards e.g. powerlines.



A. Matthews

*Washdown bay in the field*

The following table (see page 56) describes some typical machinery used on roads and verges and, for each, identifies:

- actions with high risk of contamination,
- where seeds will most likely accumulate on the machine, and
- recommended washdown procedures.

This information is based on the Tasmanian Washdown Guidelines for Weed and Disease Control, Machinery, Vehicles and Equipment (see [dpiwwe.tas.gov.au/invasive-species/weeds/weed-hygiene/washdown-guidelines](http://dpiwwe.tas.gov.au/invasive-species/weeds/weed-hygiene/washdown-guidelines)).



# Pre-control considerations

## Machinery types and associated contamination risks from broom seed

Vehicle/ machine	High risk actions	Major points of soil accumulation	Washdown procedure
<b>Grader</b>	<ul style="list-style-type: none"> <li>Gravel road grading where infestations are within 5 m of the shoulder</li> <li>Cutting drains within 15 m of an infestation or up to 100 m downhill from infested areas</li> <li>Road construction/widening with any verge infestation</li> </ul>	<ul style="list-style-type: none"> <li>Blade assembly</li> <li>Grills/guards/steps around cab</li> <li>Wheels and axle housings</li> <li>Rippers</li> </ul>	<ul style="list-style-type: none"> <li>Remove as much soil as possible from top of blade assembly and rippers using a brush/scrapper</li> <li>Wash off remaining soil from blade, rippers, wheels and grills</li> </ul>
<b>Back-hoe</b>	<ul style="list-style-type: none"> <li>Installing or digging out sediment from culverts and drains within 10 m of an infestation or downhill from infestations</li> <li>Digging/moving/loading soil from infested areas using the bucket</li> <li>Pushing up/removing fallen trees</li> </ul>	<ul style="list-style-type: none"> <li>Bucket</li> <li>Backhoe assembly</li> <li>Stabiliser legs</li> <li>Wheels and rims</li> <li>Top of axles/housings</li> <li>Grills/guards</li> </ul>	<ul style="list-style-type: none"> <li>Remove any clumps of soil from buckets and stabiliser legs with brush/scrapper</li> <li>Wash buckets, wheels, grills and stabiliser legs to remove remaining soil</li> </ul>
<b>Loader</b>	<ul style="list-style-type: none"> <li>Pushing up/removing fallen trees</li> <li>Carting/moving/loading soil from infested areas using the bucket</li> </ul>	<ul style="list-style-type: none"> <li>Bucket</li> <li>Wheels and rims</li> <li>Axle housings</li> </ul>	<ul style="list-style-type: none"> <li>Remove any clumps of soil from bucket and wheels with brush/scrapper</li> <li>Wash bucket and wheels and to remove remaining soil</li> </ul>
<b>Skid steer</b>	<ul style="list-style-type: none"> <li>Use of auger, or</li> <li>Bucket to move soil</li> </ul>	<ul style="list-style-type: none"> <li>Tracks</li> <li>Around hydraulics, grills/guards</li> <li>Bucket</li> <li>Auger</li> </ul>	<ul style="list-style-type: none"> <li>Remove any clumps of soil from bucket/auger and tracks with brush/scrapper</li> <li>Wash bucket, auger and tracks and to remove remaining soil</li> </ul>
<b>Auger (truck mounted)</b>	<ul style="list-style-type: none"> <li>Digging holes to install signs etc. within 10 m of an infestation</li> </ul>	<ul style="list-style-type: none"> <li>Auger</li> <li>Stabiliser legs</li> </ul>	<ul style="list-style-type: none"> <li>Remove any clumps of soil from auger and stabilising legs with brush/scrapper.</li> <li>Wash auger and stabiliser legs to remove remaining soil</li> </ul>
<b>Tip-trucks</b>	<ul style="list-style-type: none"> <li>Transporting soil from infested sites</li> <li>Transporting fallen trees with attached root mass and soil</li> </ul>	<ul style="list-style-type: none"> <li>Inside back of truck</li> <li>In recesses along the sides and rear – especially the side it was loaded from</li> </ul>	<ul style="list-style-type: none"> <li>Wash out any caught soil in back of tray and tailgate</li> <li>Wash off any soil trapped on wheel arches and guards</li> </ul>
<b>Tractor with slasher/ scarifier</b>	<ul style="list-style-type: none"> <li>Slashing verges with seed bearing plants</li> <li>Installing/maintaining fire-breaks</li> </ul>	<ul style="list-style-type: none"> <li>Any grills or guards, wheels and axles</li> <li>PTO assembly</li> <li>Top of slasher and around blades</li> <li>Entire scarifier assembly</li> </ul>	<ul style="list-style-type: none"> <li>Remove all accumulated plant material from wheel mounts, grills, PTO, slasher deck and around blades</li> <li>Brush/wash off any accumulated soil from slasher or scarifier</li> </ul>
<b>Fire control vehicles</b>	<ul style="list-style-type: none"> <li>Fire control activities where vehicles drive or hoses are dragged over seed banks or over/around seed bearing plants</li> <li>Pushing out fire control tracks/containment lines near or through infestations</li> </ul>	<ul style="list-style-type: none"> <li>In tyre tread, rims and axles</li> <li>Around hose reels</li> <li>Fire crews' boots and foot wells</li> <li>Soil on hand tools</li> <li>Entire machine, especially tracks/wheels, buckets, blades and scarifiers</li> </ul>	<ul style="list-style-type: none"> <li>Wash ash/soil from wheels and arches</li> <li>Wash hose and around reel</li> <li>Kick tyre several times to dislodge ash/soil from footwear</li> <li>Wash down entire lower section of machine to remove ash/soil/mud</li> <li>Clean all hand tools used in area before using elsewhere</li> </ul>
<b>Any vehicle</b>	<ul style="list-style-type: none"> <li>Parking within 5 m of or driving through mature seed bearing plants from mid December to February (when spring loaded seed pods eject seeds into air)</li> </ul>	<ul style="list-style-type: none"> <li>Ute trays and any upward facing crevice where seeds ejected from pods could land</li> </ul>	<ul style="list-style-type: none"> <li>Sweep out crevices and trays using brush or compressed air</li> </ul>

## Reducing the soil seed bank

Dense infestations of broom have large and persistent seed banks, even without any additional seed input from mature plants. Generally, the deeper the seed is buried, the longer it will remain dormant.

Management that aims to stimulate germination of the seed bank and control seedlings before they flower can effectively reduce the amount of time and resources needed for long-term broom control. Germination can be stimulated by fire or by cultivation and other mechanical control techniques. It is important to note, however, that cultivation may also bury some seeds deeper into the soil, allowing them to remain dormant for longer.

**When combined as part of an integrated approach with other control techniques, deliberate stimulation of broom seed germination can help reduce the seed bank. But ensure resources are available to control seedlings, which cannot be allowed to set seed.**



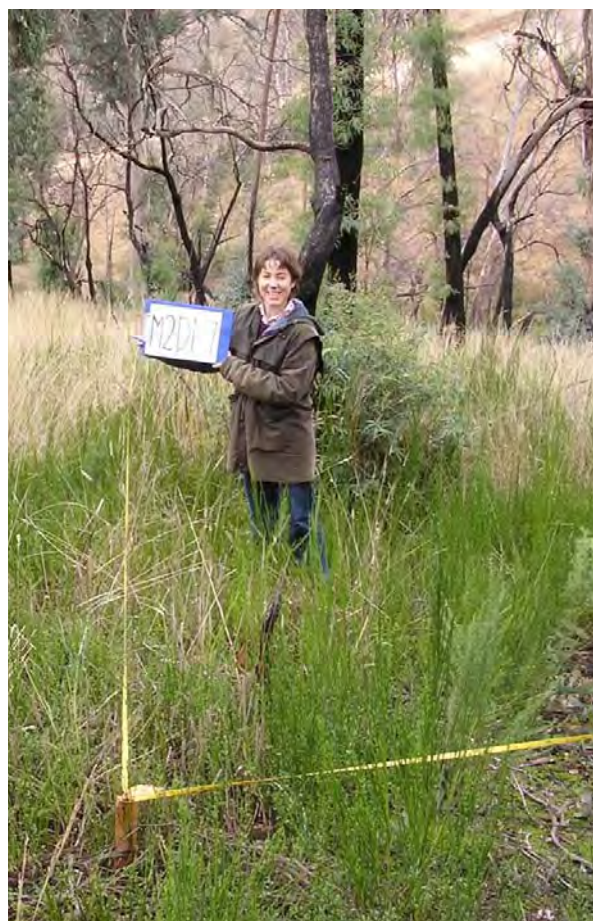
Parks Victoria

Mass broom seed germination can occur after fires, but seedlings must be controlled to prevent broom invasion

## Fire and broom management

Fire can trigger 70–80% of the seed bank to germinate, depleting the number of seeds in the soil. This can encourage growth of seedlings that are easy to control during follow-up management. Because it stimulates the mass germination of broom seeds, fire should only be used as part of an integrated control strategy, which must include follow-up seedling control.

***On high fire risk days, broom can increase fire risk and intensity, so extreme caution is needed!***



Parks Victoria

Fire can be used as part of an integrated control program that includes monitoring and seedling/seed bank management



# Pre-control considerations

As a general rule, controlled (prescribed) burns are of a low to medium fire intensity; however weed infested areas may not burn well because weeds often contain too much moisture or may not provide good fuel structure. This can be especially



S. Garland

true of dense stands of broom, where shade and competition can exclude a grassy understorey, leaving the ground bare of fuel. Thus, controlled burning of broom infestations requires careful planning to ensure a fire of sufficient intensity. Alternatively, in times of severe fire weather, such as low humidity, high temperatures and strong winds, dense broom stands will carry a fire very well and can actually increase the fire risk and fire intensity, even allowing fire to carry into the canopy.

**Dense broom stands can contribute to reducing the intensity of fire in benign weather or act as a fire hazard in dangerous fire weather.**



H. Cherry

*Dense old broom stands can be a fire hazard*



Site preparation, timing and technique play a critical role in the successful use of fire for weed management and for aiding restoration of degraded ecosystems. Important considerations in using fire include:

- ☑ Talk to the land manager and relevant fire authorities. Public lands that are fire prone will usually be covered under a fire management strategy and this should be consulted to determine if and when the next prescribed burn will occur.
- ☑ To prepare for prescribed burns, you may need to treat broom and other weeds to ensure they will burn properly. You can do this by either:
  - cutting plants down and leaving them on site to dry out, adding to the fuel load,
  - spraying plants with herbicide to kill them and reduce their moisture content, or
  - cutting down plants without herbicide, allowing them to resprout and then spot spraying regrowth a few months prior to burning. As the regrowth dries out from the foliar spray, it also adds to the fuel load, which may increase the intensity of the fire. A hot enough fire may kill small broom plants and seedlings.
- ☑ Be sure to treat the large number of seedlings that germinate after the burn. This should be done before they flower or set seed set to prevent further recruitment to the seed bank. Growth rates of resprouting plants and seedlings will be dictated by rainfall. Monitoring of sites at 3, 6 and 12 months following the burn will allow you to determine when best to conduct follow-up control.
- ☑ Where dense seedling growth occurs, treat the seedlings while they are still small. If using a foliar spray for broad-scale seedling control, it can be difficult to get complete herbicide coverage of foliage in dense stands of waist high plants. Observations of Montpellier broom in Western Australia following fire indicate that broom seedlings emerge before many native

seedlings, giving a brief window where off-target damage may be reduced. Because each burn is different, post-burn monitoring is critical to assessing opportunities at each specific site.

### **Rapid response after fire can turn devastation into opportunity!**

When wildfires and back-burning operations triggered mass germination of over 6 million Scotch broom seeds in the Blue Mountains in 2002, a collaborative effort by a network of skilled volunteers, contractors, and environmental agencies ensured a swift response. Within just 12 months, a grant was secured to provide resources, and control was undertaken in all burnt areas before broom was able to flower or seed. For more on this story, see Case Study 3 page 121 'Call to action after fire: community groups shaping the on-ground response to Scotch broom in a World Heritage area'.



P. Vale


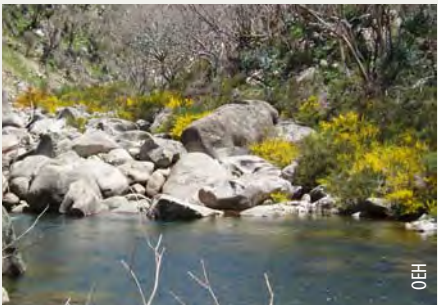

*Treatment of seedlings post-fire must be swift to prevent flowering and seed set*

# Pre-control considerations

## Management considerations within specific habitats

Habitat	Considerations for management
<p><b>Broom as a refuge for native animals</b></p>  <p>WildCount OEH</p>	<p>While broom infestations can provide harbour for feral animals, they can also provide habitat and refuge for native animals. In areas where habitat is fragmented by urban development or cleared for production, these refuges may be important for the survival of native species. If you think that broom is important for birds or mammals at your site, consider the following before taking control measures:</p> <ul style="list-style-type: none"> <li>▪ Survey sites to assess their importance for native fauna.</li> <li>▪ Retain dead broom <i>in situ</i> and allow native understorey to re-establish.</li> <li>▪ Remove broom over a number of seasons, and replant or revegetate with native shrubs.</li> <li>▪ Chemical control (e.g. foliar spraying) can offer better habitat protection than mechanical clearing or burning.</li> <li>▪ Mechanical control/burning is more effective in autumn than spring for habitat protection.</li> </ul>
<p><b>Natural ecosystems</b></p>  <p>H. Cherry</p>  <p>S. Rumney</p>  <p>R. Cleary</p>	<p>Brooms invade many types of native habitats, including grasslands, heath, riparian vegetation, woodland including sub-alpine woodland, dry and wet sclerophyll forest, and wetlands such as alpine bogs. Flax-leaf broom can also be a weed in coastal dunes. Many of these areas are sensitive and may include threatened species, endangered ecological communities and regionally significant native vegetation remnants. Control measures adopted in all these natural ecosystems must minimise damage to desirable vegetation, minimise soil disturbance and encourage native regeneration.</p> <p>While native systems vary, there are some general management principles that apply to all conservation areas. The selection of control techniques is very important, as some control methods may further reduce the ability of the vegetation community to recover and make restoration efforts more costly and less successful. An understanding of native plant species and vegetation on site will help to minimise off-target damage.</p> <p>See 'Riparian areas' on the next page for information specific to riparian habitats and Section 4 for details of the control methods discussed below.</p> <div data-bbox="758 1691 1337 2000" style="border: 1px solid black; padding: 10px;"> <p><b>Take care when planning and choosing control techniques to minimise impacts to native vegetation.</b></p> <p><b>In particularly sensitive areas, the use of more costly or resource-intensive control methods may be warranted.</b></p> <p><b>Contact your state/territory environment department for more information (for a contact list, see Section 7).</b></p> </div>







Habitat	Considerations for management
<p><b>Natural ecosystems</b> continued/...</p>  <p><i>Scotch broom (flowering in background) is often found with other weeds such as gorse (foreground)</i></p>	<p><b>Choose your control method carefully</b></p> <p>Inappropriate control techniques can potentially cause more long-term impacts on native vegetation than broom invasion. Hand removal and chemical control are generally the best choice in natural areas. Low impact techniques, such as hand pulling, cutting (without herbicide), cut-and-paint, and stem injection are preferred over foliar spraying. Although foliar spraying may be a more efficient initial herbicide treatment than cut-and-paint or stem injection, off-target damage can have significant impacts on native vegetation. Native ground cover species can be killed by off-target spraying, which will open up areas to further invasion by broom and other weeds. Where spraying is required to effectively manage large areas, herbicide selection and foliar spraying techniques should be chosen to minimise short- and long-term off-target damage.</p> <p>The City of Greater Geelong has developed methods for managing flax-leaf broom in sensitive grasslands and grassy woodlands. Read Case Study 5 on page 129 for their story.</p> <p><b>Watch out for other weeds</b></p> <p>Clearing a dense broom infestation can allow other weeds, such as blackberry or invasive grasses, to spread rapidly by reducing competition for light, water, nutrients and space. Before removing broom, take note of what other weed species are growing under and around the broom infestation. Other weeds may need to be treated at the same time to prevent scattered weed populations expanding after broom is removed.</p>
<p><b>Riparian areas</b></p>  	<p>Brooms readily establish in open areas such as on sand and gravel banks, and in intermittently dry creeks and river beds. Many Australian creeks and rivers have a 'chain of ponds' system in the upper reaches that provides suitable areas for broom to colonise and establish.</p> <p><b>Minimising bank erosion and excess nutrient input to the water</b></p> <p>When controlling weeds along watercourses:</p> <ul style="list-style-type: none"> <li>☑ select control methods that minimise bank erosion,</li> <li>☑ treat small areas to allow native plants to regenerate and stabilise the bank, and</li> <li>☑ try to prevent large amounts of plant material falling into pooled water, as the breakdown of organic matter can deplete oxygen levels, which can negatively impact aquatic systems.</li> </ul> <p>For these reasons, mechanical control methods should be avoided in riparian areas. Cut-and-paint is the most appropriate method to use, especially when the cut stems and foliage are removed from the water's edge. The cut-and-paint technique also decreases the chance of bank erosion because broom root systems are left in the ground.</p> <p style="text-align: right;">continued on page 62/...</p>



# Pre-control considerations

## Management considerations within specific habitats.../continued from page 61




Habitat	Considerations for management
<p><b>Riparian areas</b> continued/...</p>   <p><i>Accessing thick riparian vegetation in the Blue Mountains</i></p>  <p><i>Scotch broom transforming ecosystems in a remote and inaccessible area of Kosciuszko National Park (above and opposite)</i></p>	<p><b>Using herbicides in riparian zones</b></p> <p>It is important to consider the risks associated with the use of herbicides in and around riparian and aquatic zones. Guidelines for herbicide use in and around water can be found at: <a href="http://pandora.nla.gov.au/pan/64168/20080620-0000/www.weeds.crc.org.au/documents/gl01_herbicides_water.pdf">pandora.nla.gov.au/pan/64168/20080620-0000/www.weeds.crc.org.au/documents/gl01_herbicides_water.pdf</a>. Another useful resource is Ede, F.J. and Hunt, T.D. (2008). <i>Habitat management guide—Riparian: Weed management in riparian areas: south-eastern Australia</i>. CRC for Australian Weed Management, Adelaide, which can be found at: <a href="http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/319448/ahmg_riparian.pdf">www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/319448/ahmg_riparian.pdf</a>.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p><b>Some herbicides contain surfactants that are toxic to aquatic organisms such as frogs. Use only herbicides registered for use in aquatic environments, and follow all label or permit directions. See Section 4 for information on herbicides.</b></p> </div> <p><b>Accessing remote areas</b></p> <p>Often broom seed is carried into remote and inaccessible areas by water, especially during flood events. Gaining access to these areas for monitoring and control work can be very time consuming and costly. Control techniques are restricted by the ability to transport equipment and limitations on herbicide use around water. The use of chest waders, canoes, kayaks and lilos can help with access to these areas by using the waterway to avoid walking through thick riparian vegetation and/or on steep banks. Scattered and isolated plants can be easily treated using cut-and-paint or hand removal techniques. Larger patches may be mapped for later spraying. Aerial spot spraying using glyphosate registered for aquatic use is undertaken in remote riparian areas in Kosciuszko National Park in NSW, where sudden flows from hydro-electricity generation are hazardous for operators on the water or on foot.</p> <p>See Case Study 3 on page 121 for an example of where broom is being successfully managed in remote areas in the Blue Mountains.</p> 

Habitat	Considerations for management
<p><b>Pastures and grazing lands</b></p>  <p><i>Scotch broom infestation along a creekline in grazing land, Braidwood NSW</i></p> <p>K. Harvey</p>	<p>Integrating pasture maintenance and/or improvement with broom control is important because:</p> <ul style="list-style-type: none"> <li>▪ broom seedlings compete poorly with grasses, so well-managed pasture reduces recruitment of new broom seedlings,</li> <li>▪ broom that has been fertilised, especially with nitrogen, is more attractive to sheep, and</li> <li>▪ lime suppresses broom seedlings.</li> </ul> <p>See Case Study 4 on page 126 for an example where primary producers have been successfully managing large-scale Scotch broom infestations in their pastures near Braidwood NSW for over 40 years.</p>
<p><b>Forestry</b></p>  <p><i>Spraying broom with herbicide is an issue near plantation species</i></p>  <p><i>Hygiene is important to prevent seed spread in forestry operations</i></p> <p>D. Tucker</p>	<p>Broom easily spreads by seed along access tracks in soil attached to machinery or on vehicles used in maintenance, harvesting and other forestry operations. Good machinery hygiene practices can help to protect clean areas (see hygiene information on pages 47–56). Preventing broom from setting seed within 10 m of access roads will also help reduce spread along corridors.</p> <p>Follow-up control of broom after fire should be prioritised and, if resources for post-fire control are not available, consideration should be given to excluding broom infested areas from prescribed burns. Annual monitoring and control of known broom sites and surveillance for new incursions should be a part of regular forest maintenance programs.</p> <p>The Manjimup Weed Action Group in Western Australia have found that, in active timber harvesting areas, isolated broom outbreaks are associated with harvesting coupes and vehicle parking bays, implicating forestry machinery in broom seed dispersal (see Case Study 2 on page 118 for their story).</p>
<p><b>Cultural heritage sites</b></p>  <p><i>Bushcare with Care A Field Guide for Bush Regenerators Protecting and Conserving Aboriginal Landscapes</i></p> <p>CMA</p>	<p>Weed control around Indigenous and historic heritage sites needs to be managed carefully. Before starting any activities at your site, find out if the site holds any historical or cultural significance. Asking locals is a good place to start. All stakeholders who have an association with, or interest in the site need to be involved in planning the weed management program. Many states and territories require that assessments be done before beginning work in areas of cultural significance. Initially, contact your local government, public land manager or natural resource management authority, as they will be able to inform you of any issues and advise you on how to proceed. For further information and contact details, see the table 'Cultural heritage legislation and information' on page 137.</p> <p>continued on page 64/...</p>



# Pre-control considerations

## Management considerations within specific habitats.../continued from page 63

Habitat	Considerations for management
<p><b>Road, utility and railway corridors, and vacant land</b></p>  	<p>Broom often occurs along road, utility and railway corridors, which are managed by local councils, state governments, utility providers and transport operators. Although these areas are often degraded, roadsides and utility corridors can contain significant remnants of native bushland. If this is the case, these areas have conservation value, and weed control methods should be chosen that minimise disturbance to desirable vegetation and soil (e.g. hand pulling or cut-and-paint). Management of broom in these corridors is important in containment programs as they are key areas along which further spread can readily occur (see 'Preventing broom spread along roadsides and other corridors – developing machinery hygiene protocols' on page 48).</p> <p>Vacant land, such as land awaiting development, is often unmanaged. Weed infestations on such land can easily spread to neighbouring properties and native bushland. At a minimum, broom infestations should be managed to prevent spread to other areas. On heavily degraded land, this can be achieved by slashing (mechanical slashing or with a brush-cutter) at least once a year before flowering. Alternatively, foliar spraying from a vehicle-based spray unit at least once a year will also prevent seeding, and should kill all broom plants. Land managers or contractors can carry out these control methods cost effectively. Use caution when clearing broom by any method, as resprouting broom can set flower and produce new seed rapidly after disturbance.</p> <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p><b>Cooperation between all landholders in an area is essential for successful control, as broom can easily spread from an unmanaged property and invade neighbouring properties.</b></p> </div>
<p><b>Steep and inaccessible sites</b></p> 	<p>Terrain can greatly influence the choice of control methods, and in some circumstances even prevent control. Broom on cliff faces, steep slopes, remote areas, or at the water's edge may be inaccessible. It is important to identify inaccessible and difficult-to-access areas in your management plan, as you may need to engage trained contractors or government agency staff to control broom in such areas. People with the appropriate training and experience can control broom on cliff faces and steep slopes using safety equipment such as harnesses and ropes. You should always consider workplace health and safety guidelines when planning to control broom in difficult to access areas.</p> <p><b>Managing erosion on steep slopes</b></p> <p>Dense broom stands provide very poor erosion control because they exclude grasses and groundcovers, leaving the ground bare under the broom canopy. In addition, broom control on steep slopes can also result in erosion, so control methods that limit soil disturbance should be chosen to minimise areas of bare ground. Chemical control methods are the most suitable as the roots are left in the ground and soil is not disturbed. Manual control may be used on small infestations, although hand pulling should only be performed when the soil is moist or loose to prevent erosion (see Section 4 for details on each control method).</p>