Weed Management Guide

Weed of National Significance

CARING FOR OUR COUNTRY

Brooms: Scotch *(Cytisus scoparius)*, Montpellier *(Genista monspessulana)* and flax-leaf *(Genista linifolia)* brooms

Scotch broom in flower. Photo: Matt Baker.

Montpellier broom. Photo: Hillary Cherry.

Flax-leaf broom. Photo: Matt Springall.

Key points

- **Brooms shade out native vegetation and can impact forestry and grazing lands.**
- **Rapid growth and an ability to increase soil nitrogen enable brooms to out-compete desirable native plants and plantation species.**
- **Brooms produce masses of long-lived seed that can be spread long distances by animals, humans and water.**
- **Plants regenerate quickly after disturbance, such as fire. Broom infestations can also increase the risk and intensity of fire.**
- **The integrated use of chemical, mechanical and biological controls over the long term can help to effectively suppress and control broom infestations.**
- **Management activities can often promote broom germination, thus follow-up and further restoration are essential.**

The problem

Brooms invade native vegetation, plantation and pastoral systems in Australia causing significant environmental and economic impacts. Three species are recognised as Weeds of National Significance (WoNS): Scotch (or English) broom, *Cytisus scoparius*; Montpellier (or Cape) broom, *Genista monspessulana*; and flax-leaf broom, *Genista linifolia*. They are native to Europe, but have been widely cultivated across Australia for ornamental purposes. Brooms are now widespread across parts of southern Australia, where they form dense infestations that damage conservation and production assets.

Broom species grow quickly, produce large amounts of seed and can tolerate diverse environmental conditions. They also increase soil nitrogen which, in turn, creates ideal conditions for broom regeneration. Brooms establish rapidly after disturbance, such as fire or grazing, but can also invade relatively undisturbed areas. If not controlled, they can modify native ecosystems by increasing the frequency and intensity of fire, changing vegetation structure, altering soil chemistry and providing harbour for invasive animals. Broom invasion may also affect native animals, contributing to changes in species diversity and density.

Although effective control measures for brooms exist, their ability to rapidly re-establish from a persistent seed bank necessitates intensive follow-up

Montpellier broom invasion. Photo: Hillary Cherry.

Scotch broom: note five-sided stems and hairs along pod edges only. Photo: Hillary Cherry.

Montpellier broom flowers and leaves. Photo: Brad Rayner.

Flax-leaf broom leaves and pods. Photo: Jackie Miles.

and site restoration. Large infestations require integrated management using a range of methods, including biological, chemical and mechanical controls to effectively reduce the impact and spread of brooms.

The weeds

Brooms are shrubs in the pea family (Fabaceae). The three WoNS broom species are aggressive and capable of completely transforming invaded habitats. They fix nitrogen in the soil, which can inhibit the growth of native species accustomed to nutrient poor soils, and create soil conditions that favour brooms and other weeds. Brooms grow quickly and out-compete native and plantation species. They establish rapidly and re-sprout soon after disturbances such as fire or forest harvests. Scotch broom can significantly reduce yield in forestry plantations, particularly at the beginning of the rotation, as the increased competition for resources interferes with reforestation.

Robust growth enables brooms to dominate understory and shrub layers, which can lead to a less diverse understory flora and reduced over-story regeneration. Brooms form thickets that impede movement and harbour feral animals. Dense broom infestations can increase the risk of fire, as well as alter fire regimes and soil chemistry.

Brooms produce masses of long-lived seeds (over 15 000 seeds per plant per year for Scotch broom) and establish large seed banks (over 21 000 seeds/m^2 for Scotch broom), that contribute to mass germination events following disturbance. Seeds can survive in the seed bank for more than 20 years. In favourable conditions, seedlings have high germination and survival success, and plants can tolerate a range of habitats. Broom plants contain alkaloids that may be toxic to humans, livestock and other animals, especially when grazed intensively. Brooms can also hybridise within genera. Genetic studies indicate that hybridisation is occurring between the many forms of Scotch broom that have been introduced to Australia.

How to identify brooms

In general, brooms have numerous, flexible, broom-like young branches that give rise to their common name. The three WoNS are woody shrubs that lack thorns and have pea-like pods and bright yellow flowers. Table 1 summarises the key characteristics of these three brooms.

Scotch broom can be distinguished from the other brooms in Australia by its five-sided, green stems with few, deciduous leaves, large flowers (to 2 cm), and seed pods that are 2–7 cms long with obvious hairs along the edges. Mature plants grow up to 4 m high and have erect, sparsely-branched stems, which can collapse and become

prostrate in older infestations. Red (to pink) and yellow flowered varieties of Scotch broom are naturalised in Victoria and Tasmania.

Montpellier broom grows up to 3m high and has erect, ridged—but not five sided—green branches that are hairy when young. The persistent leaves are on short stalks and consist of three rounded leaflets. Small yellow flowers grow in clusters along the main stems. The pods are relatively small (1–3 cm long) and covered in dense hairs.

Flax-leaf broom is similar to Montpellier broom, but its leaves consist of three narrow, pointed leaflets. Leaf undersides and young stems have woolly, grey hairs, which can give plants a silvery look from a distance. Flowers grow in dense clusters at branch ends.

Some native Australian plants can be confused with brooms, so accurate identification is essential. Several species in the pea family, including *Viminaria juncea*, *Goodia lotifolia*, *Pultenaea daphnoides* and *Gompholobium* species can resemble one or more of the brooms. Cherry ballart (*Exocarpus cupressiformis*) can be mistaken for Scotch broom if it is not in flower.

Growth cycle

Scotch broom plants first flower 2–5 years after emergence, and can live for up to thirty years. Flowering occurs mainly in spring and early summer (October to December) but may continue until autumn in ideal conditions. Seeds ripen and shed in summer to early autumn (January to March), and germinate in the warmer, wetter months. Some seeds remain dormant and can survive in the soil seed bank for up to twenty years if buried. Scotch broom often loses its leaves in summer or when stressed, but green stems enable continued photosynthesis.

Scotch broom flowers and immature pods. Photo: Hillary Cherry.

Montpellier broom prefers more Mediterranean climates. It flowers in its second year and plants can live for about 10 years. Flowers appear in late winter or spring. Plants can flower again in late summer, under good growing conditions. Pods ripen in summer and seed mainly germinates in autumn, although it can germinate anytime given sufficient soil moisture and temperature. Populations are persistent and can reproduce from the seed bank without disturbance.

Flax-leaf broom also flowers at two years of age. Flowers are mainly produced from winter though to spring, with fruits present in summer and seeds germinating in autumn and spring. Both Montpellier and flax-leaf broom retain their leaves year-round and, like Scotch broom, retain long-lived seeds in the soil seed bank.

How they spread

Brooms grow from seed. Mature plants can produce massive amounts of seed in favourable seasons. Mature broom seed pods burst open in warm weather, ejecting seeds several metres. These seeds are often further dispersed through ant burial. Seed is also spread long distances by water and by a variety of animals, such as horses and sheep. Cattle were identified as the main animal vector of Scotch broom spread in the Victorian Alps and Barrington Tops National Park in New South Wales.

Brooms were commonly planted in gardens as hedges and to prevent soil erosion. They have spread from these plantings. Seeds are moved along transport corridors by road graders and other equipment, and through the dumping of garden waste. Seed is also spread in soil by humans, animals and vehicles. As a result, outlier infestations may establish at long distances from the parent plants. Disturbance, such as soil movement or fire, assists broom invasion by stimulating seed germination. Damaged broom plants re-sprout readily.

Where they grow

Scotch broom is native to temperate Western Europe and the Canary Islands region. Montpellier and flax-leaf broom are native to the Mediterranean, including south-eastern Europe and northern Africa. These brooms have naturalised in many parts of the world, including North and South America, South Africa, Asia, and New Zealand. They have invaded over one million hectares in Australia, and are present in all southern states and southeast Queensland. They tolerate annual rainfall of between 500–600 mm or more, and can grow in infertile soils.

Scotch broom has invaded a number of ecosystems, including sub-alpine

grasslands and woodlands, pasture, forestry plantations, open forest and riparian areas. Montpellier broom infests similar habitats, but can also invade drier, warmer areas and has been found in swamps. Significant infestations of Montpellier broom impact on the Australian Alps, Tasmania and south-west Western Australia. Flax-leaf broom is recorded from dry coastal vegetation, heathland, lowland grassland and grassy woodland, dry and wet sclerophyll forest and riparian vegetation. It is spreading in a similar fashion to Montpellier broom, but is less widespread in Australia.

Potential distribution

Climate modelling indicates that Scotch broom may have the potential to spread further across major areas of temperate southern Australia. Scotch broom was recently found naturalised in south-west Western Australia, where it has further potential to spread.

Montpellier broom and flax-leaf broom are capable of spreading into drier areas than Scotch broom. They also have the potential to spread more widely across the southern regions of Australia, especially south-east New South Wales and south-west Western Australia. Modelling undertaken in Victoria indicates that Montpellier and flax-leaf brooms have the potential to spread across much of that state.

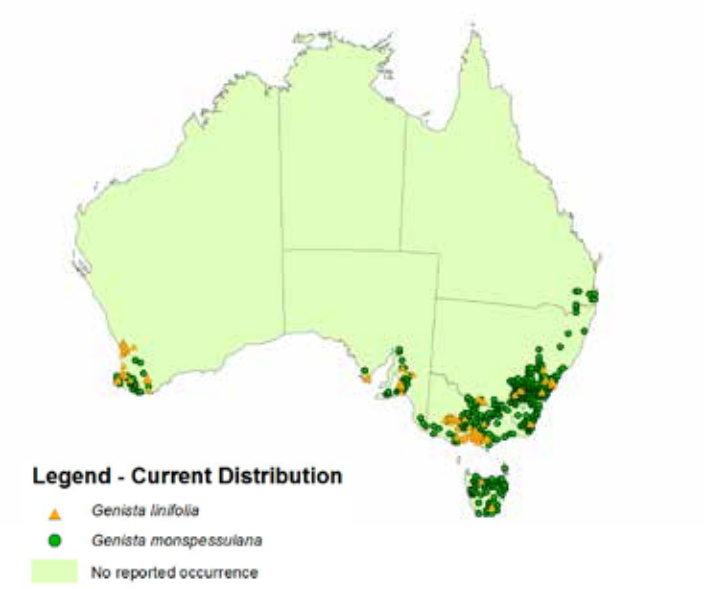
What to do about broom

Broom management strategies should aim to prevent spread to new areas, eliminate outlier populations and reduce the spread and impact of large infestations. Actions should be commensurate to the size of the infestation.

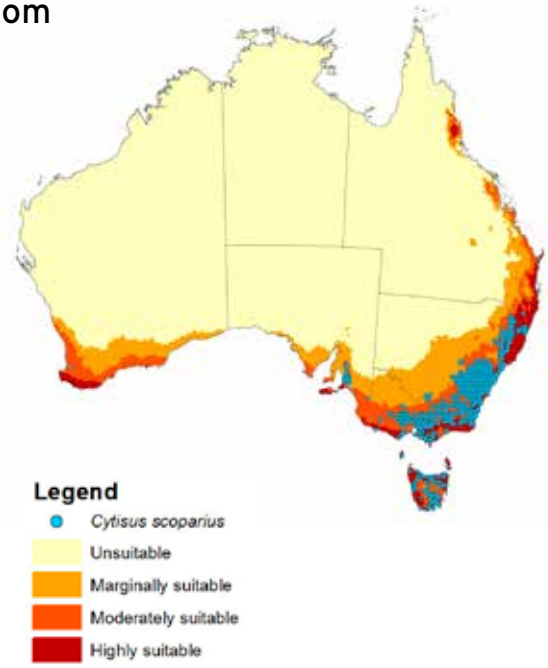
- Prevent new infestations in areas free of broom.
- Control young, isolated plants before they seed set. Eradication of brooms may not be feasible after a seed bank is established. Map and monitor all infestations.
- Locate infestations when plants are flowering in spring and control prior to seed set. Treat small, outlier populations first; contain larger infestations to prevent spread. Ensure follow-up control.
- Protect priority assets where infestations are too large to treat all plants. Identify the most significant assets and prioritise areas for control.
- Raise community awareness of brooms, as plants may continue to grow in gardens or be available for sale. Remove plants from gardens and provide advice on non-weedy alternatives. Legislation in some states prohibits the sale of brooms (see Table 1).

The capacity for site recovery following broom removal will vary according to vegetation condition and type, as well as the age and intensity of the broom invasion. Site restoration, including long-term follow-up, should also be incorporated into broom management strategies, especially for large or old infestations. A planned, strategic approach is essential to ensure that broom is replaced by desirable plants rather than new broom seedlings, regrowth or other weeds. Consult your state or territory weed authority for more information.

Map 1: Current (2012) distribution of Montpellier broom and flax-leaf broom



Map 2: Current (2012) and potential (Potter, et al 2009) distribution of Scotch broom



Control methods

Once brooms are well established in native vegetation, restoration through natural regeneration will be difficult, particularly in older brooms stands where the native seed bank may be depleted. The key to successful broom management is to use a range of integrated treatments suited to the situation. Different methods will be appropriate for controlling sparse broom plants in native vegetation, compared with dense, established infestations, or broom incursions in forestry plantations or pastures. With all control methods, follow-up is essential.

Mass germination of Scotch broom after fire in the Victorian Alps. Photo: Parks Victoria.

Mechanical removal

Small or isolated broom plants can be hand pulled when working in high value native vegetation. The resulting soil disturbance and increased light will promote germination of soil-stored broom seeds, so follow-up control will be necessary.

In accessible areas, such as plantations or pastures, equipment can be used to mulch large, non-seeding broom infestations. The layer of mulch may suppress broom germination and regrowth temporarily, thereby assisting with follow-up measures. Bulldozing or mulching, followed by repeated disc cultivation over several years, has been used to successfully control large infestations.

Large Scotch broom infestations tend to collapse once plants are over 20 years old. If disturbance is minimised, regeneration in older stands is not as intense. Therefore large scale control after natural senescence occurs may reduce control costs.

In large infestations with an established seed bank, cut stems bearing viable seed should be left on-site to prevent accidental spread. Legislation may prohibit movement of broom plants and seeds. Ensure machinery and footwear is cleaned and free of soil prior to leaving the site. Avoid driving vehicles or machinery through infestations when seed pods are present, as they can explosively release seed that may lodge on vehicles.

Fire

Burning can be an effective first step in managing broom. It can remove above-ground biomass and reduce seed banks, depending on the duration and intensity of the burn. Fire triggers mass seed germination which can help deplete the soil seed bank. However, seeds can still remain dormant in the soil after fire.

Sustained follow-up control is required each year to kill re-sprouting plants and new seedlings before they reproduce. Post-fire herbicide should be applied as soon as ecologically feasible but care is required to minimise its impact on regenerating native species. If post-fire treatment commences too late, high seedling densities can prevent herbicides reaching all broom seedlings.

Caution is required when using fire, as more severe infestations can develop if resources are not available for immediate post-fire control. If not controlled rapidly after fire, broom can dominate native vegetation and become a more significant problem. Thus, any fire, planned or unplanned, must be followed by comprehensive weed control. Decisions about if and when to burn require careful consideration and consultation with local authorities. In broom infested areas, wildfire contingency plans should include broom management.

Pink-flowered Scotch broom. Photo: Matt Baker.

Chemical control

Herbicide can be highly effective on brooms, provided the correct application methods and chemicals are used. Young plants can be controlled relatively easily because of their low tolerance to herbicides. They should be controlled before they set seed. This is less critical for established stands that already have a seed bank, but can help to prevent further spread. The main herbicide treatments for brooms are foliar spray, cut-stump, basal bark application or stem injection. These methods are only effective if plants are actively growing at the time of application. While more labour intensive than foliar spray, stem treatments of larger plants are reliable and minimise off-target damage.

Foliar spray

For effective foliar spraying, all weed foliage must be wetted with herbicide. In native vegetation, careful spot spraying of each plant using hand-held equipment, such as a knapsack or handgun sprayer, is required to avoid non-target damage. Larger equipment, such as a boom sprayer, can be used when there is little risk of damaging native vegetation, (for example in plantation systems or where a carpet of broom seedlings emerges after disturbance). Follow-up spraying will be necessary to treat re-growth of mature plants.

Repeated spraying of dense broom infestations can result in significant off-target impacts on native species, including loss of native floristic diversity, increased bare ground, and invasion by other weeds. These impacts can be minimised by the type of herbicide used, the frequency of treatment, and the amount of care taken during spraying.

Cut-stump application – all basal stem sizes

All stems are cut horizontally with secateurs, saw or chainsaw no higher than 10 cm from the ground. Herbicide is then immediately applied to the entire cut surface, using a hand held spray bottle or brush. For large infestations, a team of two people working together is most effective. Use a dye in the herbicide mixture to show that stems have been treated.

Basal bark application – for basal stems up to 5 cm

Herbicide is applied to the bark of the entire stem around the circumference of the plant, from the ground to a height of at least 30 cm.

Stem injection – for basal stems greater than 5 cm

Herbicide is applied through holes drilled in stems. Holes are drilled at approximately 5 cm intervals around the stem, angled downwards and sideways. Holes should only be as deep as the sapwood (living wood) just under the bark. Fill holes immediately with herbicide using a squirt bottle or plastic syringe.

Registered herbicides for brooms

Several triclopyr and glyphosate products are registered for foliar spraying of Scotch, Montpellier and flax-leaf brooms. Glyphosate is not selective and can affect any type of plant; triclopyr affects all plants other than grasses. Other active ingredients, such as 2, 4-D and picloram, are also registered for use on brooms. Consult your weed authority or the Australian Pesticides and Veterinary Medicine Authority (APVMA) for specific information. When using herbicides, always read and follow label directions carefully. Particular care should be taken near water bodies because rainfall runoff can carry herbicides.

A permit to allow the minor use of an agricultural and veterinary chemical product may be issued to allow registered products to be used in a manner not included on the approved label. Permits that include stem treatment of brooms with various herbicides exist in Tasmania, Western Australia, Queensland, South Australia, New South Wales and Australian Capital Territory. Minor use permits can be specific to brooms or issued for environmental or woody weeds more broadly. Refer to the APVMA website at www.apvma.gov.au for the relevant permit and obtain advice on local conditions from the permit holder.

Biological control

All three broom species are approved targets for biological control in Australia. Three insects and a mite for Scotch broom, as well as a psyllid for Montpellier broom, have established in Australia. These agents are causing some damage in areas of southern New South Wales, South Australia, Victoria and Tasmania. The most effective agents appear to be the mite on Scotch broom and the psyllid on Montpellier broom. Research suggests that these agents are able to cause significant damage to brooms, and biological control efforts such as redistribution are being continued with an expectation of future success. No biological control program has yet been initiated for flax-leaf broom in Australia.

Land managers, community groups, and schools can sometimes become involved in raising and/or re-distributing biological control agents. For opportunities to assist these efforts, contact your relevant weed control authority.

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Dept of the Environment, Climate Change, Energy and Water	13 22 81	environment@act.gov.au	www.environment.act.gov.au/environment
NSW	Dept of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds
NT	Dept of Land Resource Management	08 8999 4567	weedinfo@nt.gov.au	www.lrm.nt.gov.au/weeds
QLD	Department of Agriculture, Fisheries and Forestry	13 25 23	callweb@daff.qld.gov.au	www.daff.qld.gov.au
SA	Biosecurity SA, Dept of Primary Industries and Regions SA	08 8303 9620	nrmbiosecurity@sa.gov.au	www.pir.sa.gov.au/biosecuritysa/nrm_biosecurity/weeds
TAS	Dept of Primary Industries, Parks, Water and Environment	1300 368 550	See contacts at www.dpipwe.tas.gov.au/weeds	www.dpipwe.tas.gov.au/weeds
VIC	Dept of Primary Industries	13 61 86	customer.service@dpi.vic.gov.au	www.new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds
WA	Dept of Agriculture and Food	08 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	02 6210 4701	contact@apvma.gov.au	www.apvma.gov.au

Consult your state or territory weed authority for more information on managing weeds and for local contacts, including community groups working on weeds in your area.

Legislation

Scotch broom, Montpellier broom and flax-leaf broom are prohibited entry into Australia. All three species are declared weeds in some states or territories and may be restricted from sale and/or require control. Invasion and establishment of Scotch broom is a key threatening process under the New South Wales *Threatened Species Conservation Act 1995*. Broom control that could damage native vegetation may also be regulated by legislation.

Acknowledgements

Compiled by H. Cherry, NSW OEH, Dec 2011 as an update of 2008 guide by J.R. Hosking and J.G Virtue. Weed management guide: Scotch broom, Cytisus scoparius and other introduced brooms. CRC for Australian Weed Management, Adelaide, South Australia.

Maps: Data provided by state and territory weed management agencies. Production by Chris Auricht.

Key references:

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Table 1: Main features of Scotch, Montpellier and flax-leaf brooms

	Scotch or English broom *Cytisus scoparius*	Montpellier or Cape broom *Genista monspessulana*	Flax-leaf broom *Genista linifolia*
Species	 Photo: H. Cherry	 Photo: H. Cherry	 Photo: J. Miles
Habit	Shrub 1–4 m tall; young stems 5-angled, green with few leaves	Shrub 1–3 m tall; stems ribbed, green and hairy when young	Shrub 1–3 m tall; stems ribbed, with woolly grey hairs when young
Flowers and flowering time	 Photo: H. Cherry Yellow but some naturalised hybrids have red (to pink) and yellow flowers; 15–25 mm long; single or in pairs Mainly late winter to summer	 Photo: M. Baker Yellow, 8–13 mm long; usually in groups of 3–7 on long branches Late winter and spring, sometimes late summer and autumn	 Photo: M. Baker Yellow, 1–15mm long; in clusters of 3–16 at branch tips Mainly in spring
Leaves	Simple or 3 leaflets on a stalk; deciduous when plants are stressed	3 egg-shaped leaflets on a short stalk; leaflets often have short point on tip.	3 narrow lance-shaped leaflets; 10–23 mm long, 0.5–4.5 mm wide; margins rolled under; grey-hairy undersides
Seed pods	 Photo: M Baker Narrowly oblong, 25–70 mm long, hairy along the opening; up to 22 seeds	 Photo: J. Miles Narrowly oblong, 15–30 mm long, densely hairy all over; 5–8 seeds	 Photo: M Baker Narrowly oblong, 13–30 mm long densely hairy all over; 2–6 seeds
Legislation	Declared in ACT, NSW, SA, Tas, Vic. Quarantine weed in WA DAFF Biosecurity not permitted	Declared in ACT, NSW, SA, Tas, Vic. DAFF Biosecurity not permitted	Declared in ACT, NSW, Vic. DAFF Biosecurity not permitted
Distribution	ACT, NSW, SA, Tas, Vic, WA Widespread in cool, moist areas Origin: Europe and Canary Islands	ACT, NSW, Qld, SA, Tas, Vic, WA Widespread in southern Australia Origin: Mediterranean	NSW, SA, Tas, Vic, WA Scattered locations; locally widespread Origin: Mediterranean