best practice management guide

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BEST PRACTICE MANAGEMENT GUIDE FOR ENVIRONMENTAL WEEDS

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Blackberry, *Rubus fruticosus* aggregate

Blackberry flowers.
Photo: K. Blood.

Blackberry invasion.
Photo: K. Blood.

Blackberry alongside Buffalo River, Vic.
Photo: J. Hosking.

Taxonomy and status

Botanical name: *Rubus fruticosus* L. aggregate - Family Rosaceae (rose family).

Blackberry comprises a number of closely-related plants which for convenience are dealt with (aggregated) under the one Latin name. On a world basis, *R. fruticosus* includes approximately 2 000 named species, subspecies and varieties, collectively referred to as taxa (singular: taxon). The identities and correct names of the taxa occurring in Australia require clarification.

Standard common name: blackberry, also known as European blackberry.

Relationship to other species in Australia: The term 'European blackberry' is used to distinguish it from closely-related North American *Rubus* species which occassionally escape from cultivation in Australia. There are native species of *Rubus* (some known as brambles) in Australia. Care should be taken not to confuse blackberry with the indigenous *Rubus* species or commercial varieties of raspberries, blackberries and brambleberries.

Legislation: Blackberry is a *Weed of National Significance*. It is declared noxious in Qld, NSW, Vic, SA, Tas, and WA. Blackberry is not declared in ACT or NT. Keep up to date with the latest legislation through local and State/Territory government weed agencies or on the web at www.weeds.org.au

Description

Habit/lifeform: Blackberry is a perennial, semi-deciduous, prickly, scrambling, semi-prostrate to almost erect shrub with arching and entangling stems that form thickets up to several metres high.

Description: The only perennial part of the plant is the root system which consists of a woody crown (to 20 cm in diameter), a main root that grows vertically to a maximum depth of 1.5 m, and numerous secondary roots which grow horizontally from the crown for 0.3-1.5m and then vertically. Many thin roots grow in all directions from the secondary roots.

Figure 1. Rapidly growing blackberry primocane.
Photo: K. Blood.

Stems or canes are erect or semi-erect, arched or trailing, up to 7 m long and bear numerous curved or straight prickles. Canes are biennial (living for two years) but occasionally live longer. Young canes emerge from buds on the crown each spring and grow very rapidly (5-8 cm per day) (*Figure 1*). These first-year canes (known as *primocanes*) grow in an arching manner and in autumn as their tips touch the ground, they sprout roots and produce a new bud that will grow into a new primocane in spring. The new plants at the tips of canes are called *daughter plants*.

Buds at the ends of the canes that have overwintered (second-year canes) sprout in spring and produce short flowering canes (*floricanes*) (*Figure 2*) that bear the flower clusters. Only two-year-old canes are able to flower and fruit.

After fruiting, the second-year cane system dies back to the crown over autumn and winter, leaving an independent daughter plant that is one year old and the mother plant that will re-sprout in spring.

Figure 2. Blackberry floricanes bearing young fruit.
Photo: K. Blood.

Simple leaves may occur near the flowers. Leaves are arranged singly at different levels on the canes. Simple leaves may occur near the flowers. They are compound leaves (made up of leaflets), consisting of 3 or 5 shortly-stalked oval leaflets with toothed edges and a longer stalk attaching the leaf to the cane. Leaflets are usually dark green on the upper side and lighter green underneath. Some blackberries have the underside of the leaflets covered with whitish hairs. Short prickles occur on the leaf stalks and the underside of the leaf veins. Leaves are usually shed in winter in southern Australia.

Flowers are white or pink, 2 to 3 cm in diameter (*Figure 3*) and grow in clusters on side branches of the floricanes. Flower clusters are either cylindrical or pyramidal, depending on the type of blackberry. Flowers occur from late November to late February.

The fruit is a berry, 1-3 cm in diameter, which changes colour from green to red to black as it ripens and consists of an aggregate of fleshy segments (drupelets) (*Figure 4*), each containing one seed. The number of seeds in a berry depends on the particular blackberry taxon, but there can be as many as 80. Fruiting occurs from late December to April. Seeds are light to dark brown, oval, 2-3 mm long and deeply and irregularly pitted.

Figure 3.
Blackberry flowers.
Photo: K. Blood.

Only *Rubus ulmifolius* produces seed sexually – the ovum (female) is fertilised by a pollen grain (male). The other blackberry taxa produce seed asexually by a process termed pseudogamy. In this process a pollen grain stimulates the ovum to further development but does not fertilise it. The seed produced is an exact genetic duplicate of the mother plant, and the offspring can be considered clones.

Occasionally, sexual reproduction occurs between two blackberry taxa, one parent usually being the sexually-reproducing *R. ulmifolius*. The resulting hybrids reproduce asexually and breed true to type.

Figure 4. Blackberry fruit.
Photo: K. Blood.

Origin and distribution

Origin: All the *Rubus fruticosus* aggregate naturalised in Australia are of European origin or derived from plants of European origin or derivated from plants of European origin, but it is difficult to establish where in each taxon of them originated.

Introduction: Blackberry was deliberately introduced to Australia for fruit in the 1840s or possibly earlier.

Distribution: Blackberry is restricted to temperate climates with an annual rainfall of at least 700 mm, and can occur at any altitude in Australia. It is now present and considered a weed in all States and Territories except NT (*Figure 5*). The blackberry aggregate has probably reached the climatic limits (in terms of rainfall and temperature) of its potential distribution in Australia, although individual blackberry taxa in the aggregate may not have yet done so. At present, some blackberries are widespread whereas others still have a very restricted distribution. It is possible that eventually each blackberry may spread further to occupy the full climatic range of blackberry in Australia.

Figure 5. Distribution of blackberry in Australia
(Parsons and Cuthbertson 1992).

In badly affected areas, dense infestations frequently fill whole stream banks and can extend for a width of tens of metres along both sides of watercourses. The total area occupied by blackberry in Australia is estimated to be 8.8 million ha. It is also a weed overseas in New Zealand, the east and west coasts of the USA, South Africa, Chile, Indonesia, India and Sri Lanka.

Ecosystems invaded: Blackberry is now one of the most important weeds in temperate Australia because of its invasiveness in both natural and agricultural ecosystems. It has invaded the banks of watercourses, roadsides, pastures, orchards, plantations, forests and bushland. It establishes mostly in disturbed areas, including those disturbed naturally by fire, and has invaded grassland, grassy woodland, sclerophyll forest (dry to wet), riparian vegetation of all types (*Figure 6*) and seasonal freshwater wetland.

Figure 6. Blackberry invasion.
Photo: K. Blood.

Impacts

Species and ecosystems at risk: In natural ecosystems blackberry infestations impact on indigenous plants and animals, and the visual and recreational values of public land. Grazing and forestry are affected on cleared land. Substantial displacement of indigenous plants and loss of habitat for animals is occurring in many environments because of direct effects of blackberry invasion. Blackberry thickets provide harbour for pest animals such as rabbits and foxes which further impact on the indigenous flora and fauna. Blackberry fruit is a seasonal food source for some birds and pest animals during summer and may help to increase the populations of these species. Because of its biennial growth habit, the majority of biomass in a bramble is dead material from previous years, and large infestations may therefore be a fire hazard.

Economic impact: Net annual cost to Australia using early 1980s data for Vic, NSW, Tas and WA was $41.5 million based on estimated losses from primary production and costs of control and not including non market costs or any estimate of the impact on natural ecosystems. It is estimated that $0.3 million would need to be spent to obtain a reasonably accurate estimate of current costs.

Dispersal and establishment

Reproductive techniques: Blackberry reproduces by seed, root suckers and by developing roots and daughter plants at the stem tips. Each berry may contain as many as 80 seeds.

Vectors and dispersal mechanisms: The fruits are eaten and spread kilometres by birds and pest animals especially foxes. Blackberry and foxes are believed to have a mutually beneficial relationship. The fox spreads the plants while gaining food and shelter. Blackberry-eating bushwalkers and recreationists can also spread seeds. The movement of contaminated soil is another means of spread. Blackberry roots can be spread by cultivation to clean areas. Otherwise blackberry plants its own daughter plants at the stem tips.

Persistence: Blackberry will persist indefinitely in an area unless treated. Plants that die are replaced by seedlings or daughter plants produced by adjacent individuals. There may be up to 13,000 seeds per square metre.

Properties

Health risks and other undesirable traits: The prickles of blackberry make it objectionable to humans and grazing animals. Blackberry restricts recreational access in many areas (*Figure 7*). It can occupy large areas in short periods, effectively competing with and dominating other vegetation because its dense canopy reduces light intensity at the soil surface.

Cultural uses: Blackberry has some beneficial aspects. Browsing animals such as goats and deer (which can also be pest animals) can use blackberry as a major food source; these animals are used occasionally to control the weed. Blackberry fruit is collected by many people and consumed fresh, or made into jam, pies, wine and liqueur. The leaves can be used to make herbal teas and have medicinal value for treatment of chest ailments and as an astringent. Beekeepers value blackberry as a source of pollen and nectar and to increase honey quality.

Figure 7. Blackberry forms impenetrable thickets that restrict wildlife movement and recreational access.
Photo: K. Blood.

Biology and ecology

Biology and ecological notes: The introduced honeybee may be the main pollinator. Thickets provide shelter and protection for small birds – removal of blackberry may displace some avian species or lead to local extinctions if alternative shelter plants are not available. Blackberry readily regenerates from the crown after fire. Seed generally has a low viability (10-30%) and seedlings are very susceptible to shading and competition from other plants.

Growth calendar: Young canes start growing in spring, flowering occurs from late November to late February, fruiting from late December to April, daughter plants develop at the tips of first year canes in autumn. The plant is semi deciduous with most leaves shed in winter.

Management

Prevention: It is important to keep uninfested areas clear of blackberry. Identify and address existing or potential sources of this weed in nearby areas before it invades clean areas. Are there plants in local gardens or neglected industrial sites? To reduce weed sources, gardeners should be encouraged to maintain their gardens, use more appropriate garden plants and dispose of garden waste responsibly.

Once an infestation is established, preventing its spread into surrounding areas should be a priority. This may include the quarantining of an area to stop movement of seeds in mud on vehicles. It may be impractical to control vectors such as birds but fox control may be feasible. Vigilance in clean areas for new blackberry seedlings should be a high priority.

Public land managers need to make accurate judgements of the threat to private land posed by blackberry on adjoining public land. If private landholders are keeping their land free of blackberry, public land managers may have a responsibility to limit spread of blackberry from public land.

Integrated management: Weeds need to be treated as a symptom of larger land and water management issues. When treating blackberry in a natural ecosystem, it is essential to consider its management in light of other management priorities. When using these guidelines, it is essential to realise their limitations and modify them in light of experience and local knowledge. Each situation should be considered individually.

If the weed occurs in small isolated infestations, removal to prevent expansion is advisable. Larger infestations require planning to efficiently reduce the population to an acceptable level determined by the management objectives for the area and the resources available. An accurate assessment of the problem is an important prerequisite to any weed management program and land rehabilitation plan. Assessment involves determining the distribution and density of the weed, the associated vegetation, and the intended use of infested sites.

Isolated plants or small infestations: Ensure that you have correctly identified the plant before removal. Isolated plants can be physically removed, preferably before they have seeded. Lightly infested areas can be treated with herbicide. Success has been achieved in smaller infestations by slashing the canes and within seconds (before the tissues seal) applying concentrated herbicide to the cut surfaces. Other successful management programs have included slashing canes, followed by burning off where possible, then re-treating the crowns by cutting and painting herbicide, and revegetating with indigenous grass. Subsequent seedlings can be treated with herbicide and treated areas then replanted with indigenous shrubs after a year or two. As infestations become larger, a strategically staged approach for removal is advisable to ensure that treated areas are not reinfested.

Larger infestations: Extensive infestations can best be tackled in small sections as finances permit. Rust disease may be the only control option applicable to large inaccessible infestations and will occur naturally at a level determined by the relative susceptibilities of the different blackberry taxa and by seasonal conditions.

A feature of many blackberry management programs in some States is the chemical treatment of large areas of blackberry as required by its status as a declared weed. If the management of the infested land is not changed after treatment, the blackberry infestation soon returns. Blackberry management programs must be planned and sustained over a number of years, and must include the rehabilitation and maintenance of the land to the desired state, particularly with grasses. It is important not to 'bite off more than you can chew' and clear more land of blackberry than you are able to maintain in a state that will resist re-invasion.

Treatment methods: There are a number of different treatment methods that can be used, but no weed treatment technique used in isolation will succeed as well as a range of techniques integrated with each other.

Herbicide information: **When using chemicals always read the label and follow all instructions carefully. Consult a specialist for advice on registered chemicals in your particular State or Territory. Herbicide information is available at the National Registration Authority web site at** www.affa.gov.au/nra/pubcris.html

A number of herbicides are registered for use on blackberry. Most are taken up by the leaves and transported to all parts of the plant, especially to the woody crown and roots, where they start to act. Use of these herbicides is intended to ensure that the active constituent is carried inside the plant to the roots and crowns, where it can kill these parts of the plant.

Herbicides can be applied by spraying, by painting foliage and cut stems, and as granules. 'Cut and paint' or 'slash and paint' methods are time consuming but are often used near water courses to avoid herbicide runoff. An effective approach is to cut all canes about 30cm above ground level, remove all the cut canes and then cut the stems at ground level and immediately paint on herbicide.

In general, the best time to spray blackberry is over the flowering–fruiting period, but the effective spraying season can commence before flowering and extend after fruiting into autumn. Check if there are any legal restrictions in your State to the spraying of blackberry during the fruiting period. It can be dangerous to spray blackberries while fruiting, as people and wildlife may eat sprayed fruit. Post multi-language signs to warn people.

Herbicides should not be applied to stressed plants. Any conditions which stress blackberry and decrease its growth, such as drought periods or times of severe low or high temperatures, can decrease the effectiveness of herbicide action. As a guide, look at the tips of the canes. In times of active growth (the best time to spray), these will be producing fresh new leaves. Any new growth should be healthy, not wilted.

Herbicide effectiveness can also be affected by the thicket age. First year seedlings are easily killed with herbicides but well-established thickets with older and bigger crowns are harder to kill. Herbicides have been shown to be effective on lightly to moderately rust-affected blackberry. Herbicide effectiveness can vary between different blackberry taxa. Some produce fewer crowns per square metre than others and fewer canes per crown. Other plant features such as larger leaves and canes (area available for herbicide uptake to each crown is greater) and leaf surfaces (some have hairier leaves which may reduce absorption) can also affect herbicide uptake. These factors may explain inconsistent herbicide results on different blackberry taxa.

Slashing and herbicides: The effect of slashing or removal of live top-growth of blackberries before herbicide application depends on whether the particular herbicide is taken up by the leaves or the roots. With foliar-uptake herbicides, slashing in the season before application reduces the available leaf area and therefore could reduce the amount of herbicide taken up by the plant. Because the plant has a biennial growth pattern, only the first-year canes will be available for herbicide uptake in the spring following slashing. Slashing in the season before a planned foliar herbicide treatment is therefore not recommended and should be carried out only for fire prevention. Many land managers want to remove the blackberry 'eyesore' in a hurry and want to slash established blackberry thickets so that they can spray the regrowth later, but this is not recommended.

Results of some trials with granular herbicides (taken up by the roots) have shown that slashing before application gives better results than using granules alone.

It is often important to know how soon the dead or dying canes can be slashed after spraying without affecting the result. This period varies with herbicides, so it is best to check the label. Most labels indicate a period of about six months.

Slashing: Removing live top growth is generally ineffective in killing the crown of established plants. Frequent and regular cutting can reduce the density and spread of infestations and may deplete crown and root reserves so that plants are more susceptible to death from other causes. Slashing does not kill blackberry but can be used in accessible areas to open up dense stands for follow-up treatment using other techniques. Regular (fortnightly or monthly) slashing or mowing forces the plant to regrow, using up root reserves and thereby weakening the plant. Irregular slashing can leave the plant with a strong root system and little top growth, thereby reducing the efficacy of subsequent herbicide treatment. Slashing may also stimulate suckering. Slashing in summer can enhance the effect of blackberry leaf rust because the regrowth stimulated by the slashing is very susceptible to the rust.

Hand-weeding: This is effective only under very limited circumstances. Even seedlings and small plants are difficult to pull out by hand. If possible, all of the root system should be removed using a mattock or shovel because blackberry will regrow from any root fragments left in the soil.

Mechanical removal: Mechanised weeding with large earthmoving equipment may infrequently be necessary, e.g. where dense infestations occur. 'Scalping', the removal of all plants and surface soil with a bulldozer, can be undertaken to ensure crowns and the majority of roots are dug out. A root rake or similar equipment should be used in conjunction with, or immediately following, scalping to ensure that roots and crowns either are exposed on the ground surface to dry out in the sun or to enable collection of plants in piles for burning. Regrowth from crowns, root fragments and seed is inevitable, so follow-up treatment coupled with site rehabilitation is essential.

If necessary for rehabilitation, cultivation needs to be frequent and at the appropriate time of the year to achieve good control. It may be useful as part of a re-sowing program but is inappropriate for natural ecosystems and some soil types.

Grazing: Browsing animals such as goats and deer can be a useful short-term control technique. Fencing must be adequate to restrict the animals to the chosen area. Grazing must be continuous in the short term, otherwise regrowth will occur. Browsing animals eat a range of plants and may destroy desirable indigenous vegetation as well as the blackberry.

Competition: Maintaining good-quality ground cover is a useful technique for controlling seedlings. In natural ecosystems competition from some indigenous grasses may smother blackberry seedlings.

Fire: This is used mainly as a follow-up to herbicide application to clear areas of dead canes and to re-establish access for rehabilitation of the treated area.

Biological control: The blackberry leaf rust *(Phragmidium violaceum*) is a defoliating fungal disease introduced from Europe that attacks the non-woody, above-ground parts of blackberry. This rust is now present throughout all areas of southern Australia where blackberries are a problem.

The rust (*Figure 8*) attacks the younger leaves and can also be found on flower buds, unripe fruit and the green parts of growing canes. It appears as characteristic purple-brown blotches, 2–3 mm in diameter, on the upper surface of the leaf. Corresponding powdery yellow or sticky black pustules of spores appear on the leaf's lower surface.

Figure 8. Yellow and black rust pustules on lower surface of a leaflet.
Photo: E. Bruzzese.

The rust neither damages native *Rubus* species nor varieties of commercial raspberry and brambleberry, such as loganberry, boysenberry and youngberry, although it is capable of damaging some varieties of thornless blackberry that are hybrids of the European blackberry. The susceptibility of different blackberry taxa to the released strain of the rust varies.

Epidemics of rust, caused by summer spores, initially kill leaves in summer and autumn, thereby forcing the plants to grow new leaves, which in turn are attacked by the rust. Rust epidemics result in shorter canes, fewer fruit and seed, and fewer daughter plants produced at the cane tips. Continuous defoliation weakens plants by depleting root reserves. Defoliation allows light to penetrate the thicket, aiding in the establishment of other vegetation, especially in autumn and winter. Competing plants can then grow through the blackberry and in turn limit its growth by shading.

Although rust epidemics can look spectacular, blackberry is a very vigorous plant and can take repeated attacks over a number of years before the root system begins to be depleted. After five years of rust infection, large well-established blackberry infestations have begun to open up enough to allow other plants to grow through.

The rust alone will not eradicate blackberry. A natural balance has been reached between the weed and the rust. The level of control at which that balance has been reached varies according to climate and land use.

The rust has impacted heavily on the more common forms of the widespread blackberry taxa, but some less widespread taxa are resistant to the particular rust strain released. This has given an advantage to these resistant blackberry taxa, resulting in their gradual takeover and a continuation of the overall blackberry problem. Blackberry should be inspected during summer–autumn and herbicide treatment planned for any infestations that are not attacked heavily by rust.

Rehabilitation: This involves the deliberate revegetation of the treated area and its maintenance. The revegetation phase of a rehabilitation program can be undertaken in two ways: either by encouraging natural regeneration of indigenous vegetation or by replanting with suitable replacement species.

Disposal: If blackberry is being removed from gardens, dispose of waste using appropriate home composting techniques or dispose of it through local government kerbside collection or tip facilities. Ensure seeds, crowns and root material that can resprout are not dropped in transit. It is advisable to dispose of plants when they are not carrying seeds. Cover trailers and ensure that local tip facilities are following the Australian standards for composting and the transfer station or tip management best practice guidelines. Encourage gardeners to avoid dumping garden waste over back fences or in bushland areas. It is best not to include blackberries in material being used for mulching.

Community awareness: Arrange activities as part of national Weedbuster Week in October each year to increase local community awareness of the problem. See the web site at www.weedbusterweek.info.au for more information.

Follow-up: Once an area has been treated it will be necessary to monitor the area for many years and destroy new plants. Effective monitoring is important to help measure the progress of the management and rehabilitation program. Whilst you may think the program is progressing well, the analysis of simple records could indicate ways to improve it. The most important records to keep are the efficacy and cost-effectiveness of the various treatment techniques.

Replacement plants: Seek the advice of local flora and revegetation experts about suitable indigenous plants for revegetation. Plants used for fruit can be replaced with non-invasive cultivars.

WeedWatch: Legislation prohibits the sale of blackberry in a number of areas. If the plant is being sold in such areas then the garden centre or nursery should be informed that sale and propogation is illegal and the local weed management authority should be notified. Let garden centre staff know how weedy it is and the damage it is doing locally. Encourage them to provide safer alternatives.

Where plants are found in the bush they should be reported to those managing the area so that infestations can be treated where feasible. If you are uncertain about identification, send a specimen to the State or Territory herbarium with details on where and when it was found and the contact details of the person who sent the specimen (see the *White Pages* or the *Weed Navigator* for address details of herbaria).

Further reading

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There are a number of management guides on different weeds being published by the Weeds CRC (see contact details below). Other CRC weed publications include the *Weed Navigator* (lists many weed publications, information resources and contacts in Australia and New Zealand), workshop proceedings, field and management guides, brochures and posters.

Further contacts: Many people interested in environmental weeds communicate regularly through the *Enviroweeds* email discussion group established in Australia. If you would like to join this group free of charge, send this email message <subscribe> to the following email address: enviroweeds@majordomo.nre.vic.gov.au

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