

Fireweed



A Best Practice Management Guide for Australian Landholders

Brian Sindel & Michael Coleman

Preface

Fireweed: A Best Practice Management Guide for Australian Landholders has been produced as part of the *Fireweed Control Research* project conducted by the University of New England (UNE) and CSIRO, and funded by the Australian Government through the Department of Agriculture, Fisheries and Forestry (DAFF). The Guide is designed in a handy and readable booklet format to complement existing technical publications on fireweed produced by State and Territory governments and councils.

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All photographs used in this booklet are sourced from Brian Sindel and Michael Coleman, University of New England, unless otherwise acknowledged in the captions.

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Disclaimers

Descriptions of herbicide use in this guide are not to be taken as recommendations. Herbicides must only be used in accordance with the recommendations provided on herbicide labels. Readers are reminded that off-label use of herbicides may be restricted or not permitted under relevant legislation, such as the Chemical Usage Act 1988 (Qld) and the Pesticides Act 1999 (NSW). Landholders are advised to consult with their State or Territory government departments regarding the legal requirements relating to herbicide use and weed control.

A PDF of this booklet is available on the University of New England website by searching for the word ‘fireweed’.



Australian Government
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Key points

- Fireweed (*Senecio madagascariensis*) is a Weed of National Significance (WoNS), and is one of the worst weeds of coastal pastures in south eastern Australia.
- It contains pyrrolizidine alkaloids that if consumed cause liver damage and occasionally death in livestock, particularly cattle and horses.
- Poisoning is more likely to occur where livestock are new to the weed, where it makes up a high proportion of the pasture, or where it is contained in hay or silage. Otherwise, livestock tend to avoid the weed.
- Fireweed is highly invasive due to its numerous wind-borne seeds.
- Stop seeds from entering your property through hay by only buying weed-free hay. Feed hay out in areas that can be regularly checked for fireweed.
- Learn to recognise fireweed and pull out plants by hand in new and small infestations when they are young before they flower and set seed.
- Having flowered, seed of fireweed may remain viable in the soil for several years so you will need to remain vigilant in detecting and removing plants.
- Dry conditions in late summer/early autumn or practices that open up pastures or create bare ground particularly favour the development of fireweed.
- Most seedlings emerge in flushes during autumn and then to a lesser extent in late winter/spring, though the weed is capable of germinating and flowering throughout the year.
- Look for seedlings 2 weeks after rainfall events in autumn in bared areas. If populations are detected, act early to control to cut costs and increase the likelihood of success.
- For large-scale and dense infestations, herbicides can be effective in killing plants before flowering but vigorous pasture competition will be needed to prevent plants emerging in future.
- Rotate grazing between paddocks and avoid high stocking rates in heavily infested pastures at times prior to and when fireweed is germinating, particularly in late summer and autumn.
- Timely fertiliser application and/or irrigation at the start of the active growth period of the pastures can help suppress fireweed.
- Graze your pastures with sheep or goats since they readily eat fireweed and are much less susceptible to poisoning than cattle and horses.
- Slashing can worsen the fireweed problem due to the increased chance of spreading seeds, and of livestock poisoning.

What is fireweed?

Fireweed (*Senecio madagascariensis*) is a common, poisonous and invasive weed of coastal pastures in eastern Australia.



A fireweed infestation near Gloucester, NSW

It is native to the KwaZulu-Natal region of South Africa, and having been introduced to Australia, has also invaded parts of Argentina, Uruguay, Brazil, Japan, and the USA (Hawaii).

Worldwide, there are many species of plants that have been given the name ‘fireweed’. In Australia, the most likely reason for applying the name to this species is its ability to ‘spread like wild fire’. Another possible explanation is its appearance soon after a fire.

There are several Australian native *Senecio* species (belonging to the Asteraceae family) with yellow daisy-like flowers that look similar to fireweed. However, as explained later, fireweed can be distinguished from these relatively easily.



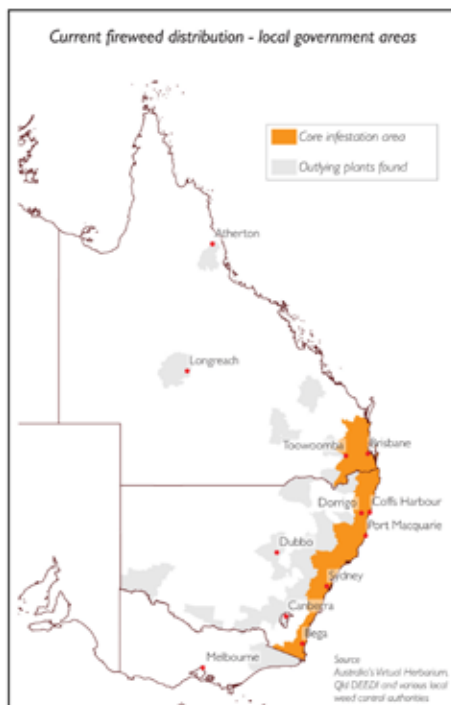
Fireweed has a bright yellow daisy-like flower

Where does fireweed occur in Australia?

Fireweed was first identified in Australia in the Hunter Valley region of NSW around 1918. By the 1980s the weed had spread north and south in coastal NSW and southern Qld, establishing in temperate and subtropical pastures similar to those of its area of origin in southern Africa and to those it occupies in South America.

Since the 1980s, the weed has invaded grazing areas along the far South Coast of NSW around Bega, on both the Southern and Northern Tablelands of NSW, and in Northern Qld on the Atherton Tablelands.

The map below shows the current distribution of fireweed across eastern Australia, based on local government areas. It is predicted that fireweed will continue to spread further into cooler southern and highland regions of temperate Australia.



Why is fireweed a problem for landholders?

Fireweed is a problem because it is invasive, poisonous, and imposes economic costs on producers!

Fireweed has the capacity to:

- *invade a range of pasture types*
- *establish quickly following drought-breaking rain*
- *grow during winter when pasture production is low*
- *reduce pasture or forage yield and availability in dense infestations*
- *produce seeds 6-10 weeks after germination*
- *produce up to 18,000 seeds during its lifecycle*
- *spread quickly by wind over long distances*
- *poison cattle and horses*
- *impose productivity and control costs on dairy and beef farmers*

Invasiveness

Fireweed is an opportunistic weed with the ability to invade and colonize a great variety of habitats in a short period of time. Its rapid spread along the east coast of Australia in the last 90 years is a clear indication of its invasive potential. It can invade a range of pasture types, including those growing on highly fertile soil, though it is less of a problem in irrigated pastures or crops, probably due to more intensive management and competition. It occurs more frequently on sites with relatively poor ground cover, such as failed, poorly grassed or over-grazed pastures, stock camp sites, and cultivated land (during the autumn to spring period). A dry summer or drought period causing poor pasture density and vigour can result in a large germination of fireweed once it rains.

Fireweed has a natural competitive advantage over many summer-dominant pasture species such as kikuyu, paspalum and kangaroo grass, given its ability to grow during winter when their growth is low. This situation is exacerbated by the tendency of cattle to avoid grazing fireweed plants, which favours their branched growth over the surrounding pasture. Such growth in heavy infestations can impact on pasture yield and access for

livestock to desirable pasture species. Research indicates that pasture in and around heavy infestations of fireweed is often left ungrazed by livestock to grow tall and rank, whereas livestock will graze up to and around sparsely separated fireweed plants.



Pasture plants growing amongst fireweed at high density may be inaccessible to livestock thereby reducing carrying capacity

Fireweed plants may produce flowers (and thereafter drop seeds) from 6-10 weeks after germination, depending on climatic conditions, and an individual plant may produce up to 18,000 seeds during its lifecycle. However, the quantity of seed set commonly varies from several hundred to several thousand per square metre. Wind is responsible for most local spread of fireweed seed and occasional long distance dispersal. Seed may also be carried long distances as a contaminant in hay and other stock feeds, pasture seed, mulch products, and vehicles.

Aim to restrict seedling emergence, control seedlings early, and prevent seed set and seed spread.

Toxicity

Cattle may be forced to consume fireweed when insufficient pasture is available, when there is too much fireweed in the paddock, or when the weed is contained in hay or silage.

When ingested by livestock, the pyrrolizidine alkaloids (PAs) contained in fireweed may accumulate and damage the liver, reducing livestock growth (particularly in younger livestock). In severe cases, poisoning may cause death. PAs pose a higher health risk to cattle and horses than sheep and goats. Once cattle are familiar with the weed, they tend to avoid it, reducing intake and incidences of poisoning.



Cattle and horses are susceptible to poisoning from the pyrrolizidine alkaloids in fireweed

Economic costs

A recent survey of fireweed affected farmers by the University of New England indicated that nearly half spend more than 50 hours and \$1,000 annually controlling fireweed. This included farmers who felt they had fireweed under control. The researchers also estimated that herbicide control costs alone on impacted properties in NSW would amount to \$18 million annually, assuming a single herbicide treatment at a cost of \$30 per hectare.

In addition to the cost of herbicide control on farms, fireweed imposes an economic penalty on landholders and local communities in other ways. These include:

- loss of production on dairy and beef farms as a result of PA (alkaloid) consumption;
- reduced carrying capacity as a result of high fireweed densities;
- financial and labour costs associated with non-chemical control methods such as hand pulling of fireweed plants;
- having to use scarce farm labour to control fireweed during critical periods, instead of completing other farm activities;
- reduced productivity for dairy and beef producers associated with using sheep or goats to control fireweed, destocking, or using less efficient paddock rotations;
- the infrastructure costs (fencing, shearing equipment, stock yards) associated with introducing sheep and/or goats onto a dairy or beef cattle property; and
- the costs imposed on local government and ratepayers by the need to enforce weed management plans, control fireweed on public land and roadsides, and forego other important activities to undertake fireweed control.

At this stage fireweed is not a significant problem in natural bushland areas. However, it has the potential to invade natural grasslands in both coastal and tablelands settings.

Detecting fireweed on your property

- **Prevention** is much better than **cure** when it comes to fireweed! It is essential to detect plants early before they flower, and stop spread on your property before fireweed becomes troublesome.
- For new and small infestations, pull out all plants using protective gloves and, if flowering, place in a sealed bag for destruction by burning or burial.

Where should I look for fireweed on my land?

- Near and downwind of previous or neighbouring fireweed infestations
- Roadways and traffic areas
- Areas in which earthmoving and other contractors have been working
- Boundaries with neighbours and along fencelines
- Livestock camps and feeding areas
- Newly sown or recently ploughed or sprayed pasture paddocks
- In remote or relatively inaccessible areas (such as steep or rocky country)
- Near sheds, tanks, stock yards and other structures
- Revegetation areas (tree plantings), gardens and other bare ground
- The leeward side of ridges
- Around dams and other wet areas

When determining where on your property to check for fireweed, consider:

- those areas that have had fireweed infestations in previous seasons (*seeds can persist in the soil for several years*); and
- focusing on areas that may be particularly vulnerable to new fireweed infestations, such as those listed above (*identify these areas and inspect them for fireweed on a regular basis - plants can germinate and flower within 6-10 weeks, with the peak germination period likely to be from March to May*).

Relatively inaccessible areas on your property (such as remote areas, steep and/or rocky country) may be difficult to check for weeds. However, it is these areas that often have new fireweed infestations, particularly if they coincide with areas of bare ground.

Identifying fireweed

Learn to recognise fireweed when it is young so that you can remove or control plants before they flower and set seed. When first germinated, seedling leaves may be red underneath and green on top.



Young fireweed seedlings showing the typical leaf shape of the plant

Fireweed can grow up to 60 cm tall, but is most commonly around 30-40 cm tall, with canary-yellow, daisy-like flowers. It is typically found as an erect plant with a woody lower stem and branches above (see below).



A fireweed seedling and a mature fireweed plant

Leaves

Leaves are bright green, alternate along the stems and branches, and are up to 12 cm long by 2.5 cm wide, but are often much smaller. The shape of the leaves is variable but mostly narrow, with slightly curved and finely toothed edges leading to a pointed tip (see above). Occasionally, the leaf edges will be irregularly toothed or deeply lobed.

Flowers

An individual plant may produce anywhere from a few to several hundred flower heads, most of which have 13 'petals', 8-14 mm long (see first photo below). Other similar looking plants can also have 13 petals, so this is not the only identifying feature. Below the petals, the green head is 3-5 mm wide and is comprised of 20-21 long narrow vertical bracts (see second photo below).



Fireweed flower heads with 13 'petals'



Fireweed flower heads before the seed is released showing the 20-21 long narrow vertical bracts typical of fireweed

Seeds

Each flower head of fireweed may contain up to 120 seeds that are released when the flower head opens at maturity (see below).

The seeds of fireweed are small and light, about 1.5-2.2 mm long and up to 0.5 mm wide, and each is attached to a relatively persistent pappus of white hairs (3.5-6.5 mm long) which aids dispersal by wind. Most seeds are light brown in colour, though some may be dark brown or green at the time they are released from the plant.



Fireweed seeds being released from the flower heads at maturity, each with its pappus of hairs

Roots

Fireweed has a shallow, branched, annual or perennial taproot with numerous fibrous roots, growing from 10-20 cm deep. Plants are relatively easily pulled out of the ground by hand.



The shallow root system of fireweed makes it relatively easy to pull out of the ground by hand

Similar-looking species

- Fireweed (*Senecio madagascariensis*) has sometimes been confused with several similar-looking native Australian *Senecio* species, including *Senecio pinnatifolius* and *Senecio brigalowensis*.
- Combined with its 13 petals and lance-shaped leaves (see pages 9 and 10), the 20-21 long, narrow, vertical green bracts on the flower head of fireweed (see page 10) is a key feature distinguishing it from most native *Senecios*.

It can be important to differentiate between fireweed and these native *Senecio* species, because these species are often (though not always) non-weedy, their geographic range can differ to that of fireweed (see example below), and their level of toxicity varies.



Native Senecio brigalowensis in central Queensland in 2007 (source: R. McFadyen)

If you are not sure whether what you have on your property is fireweed, please contact your local weeds officer to have him or her identify a sample of the plant for you. Other useful sources of information may include local agronomists (such as those working for your rural merchandise store), Landcare members, and neighbours or nearby residents who have already identified fireweed on their property.

Understanding fireweed behaviour

Fireweed germinates between 15 and 27°C (at the soil surface) and so is able to germinate, grow and reproduce throughout much of the year, making timing of control measures difficult. However, most seed germinates in flushes during autumn and to a lesser extent in late winter/spring, with most plants dying off in late spring and summer of the same year.

Fireweed is a short-lived perennial plant which behaves most commonly as an annual. The majority of plants live for several months before dying off at the end of their first year of growth, especially in agricultural soils. But it is not uncommon to find plants continuing to grow and reproduce actively for a second year. The reason for this is that fireweed has indeterminant growth. If environmental conditions are suitable, it may begin to flower when small, and continue to grow, flower and set seed until it dies from some external cause e.g. summer drought. It is thought that over-summering fireweed plants may play an important role in maintaining a soil seed bank of fresh viable seeds for autumn reinfestation.



Favourable conditions may allow fireweed plants to grow and reproduce for a second year

The majority of seeds produced by fireweed are light brown in colour and at the moment of dispersal, are viable and ready to germinate. For this reason, more than one generation may occur throughout the winter period. On the other hand, the fewer dark brown and green seeds produced have higher levels of dormancy and so persist in the soil for longer periods of time, allowing the weed to take advantage of suitable conditions that may arise in the future.

While most seeds are likely to lose their viability in the soil in 3-5 years, there appears to be large variation in seed longevity depending on conditions. In one study in a wet environment, most fireweed seed germinated in the first

3 months after dispersal and only a few percent remained ungerminated and viable a year later. In a separate study under somewhat drier conditions, it was estimated that a small proportion of seed would remain viable in the soil for up to 10 years.



Different coloured seeds of fireweed show variation in dormancy and germination characteristics, aiding in its adaptation and survival

As occurs with other annual plants, the size of fireweed germination flushes and resulting population densities vary greatly from year to year and between sites, depending largely on rainfall moderated by pasture competition. For example, if there is a failure of late summer/early autumn rains, this is likely to open up pastures under grazing and predispose them to high fireweed risk when rains do fall (seeds are stimulated to germinate by light). Under such conditions, producers should take appropriate and timely measures to prepare for and treat fireweed outbreaks.

Seedlings develop rapidly and may produce flowers several weeks after emergence, with time to flowering decreasing with increasing temperature. Seedlings demonstrate a degree of tolerance to shade and an ability to recover quickly if shade is removed. Nevertheless, increasing shade reduces the growth of roots and shoots and particularly flower production, reinforcing the benefits of pasture competition in fireweed control.

Flushes of flowering occur in spring and autumn. However, some plants can be found flowering at most times of the year, making it difficult to completely prevent fresh seed from entering the soil. The quantity of seed set is dependent largely on the time of seedling establishment and the consequent size of the plant at the peak flowering periods.

Although most seed will fall near to the parent plant, the ability of seed to be spread by wind contributes largely to the success of fireweed as an invader of pasture land.

Controlling fireweed on your land

Your control responsibilities

If fireweed is a declared or prohibited weed under legislation in your district (for example under the NSW Noxious Weeds Act 1993), you may have a legal responsibility to the broader community to control the weed. Regardless of whether it is declared or not, you should control new fireweed outbreaks on your property, most particularly along property boundaries or areas exposed to wind-borne spread, simply to be a good neighbour and to ensure that it does not gain a strong foot hold on your property. You may also be required by law to inform neighbours or authorities before undertaking certain control activities, particularly large-scale spraying.

Your local weeds officer will be able to advise whether fireweed is a declared or prohibited weed in your district.

The 3 dimensions to success

Have a plan, in which you use several methods of control, and be dedicated to achieve success.

Experience shows that landholders who have a plan (Deliberation), in which they integrate several control methods (Diversity), and with which they persist over many years (Dedication), are the ones most likely to succeed in controlling weeds. In applying this '3D' approach, a variety of options is available for fireweed control.




The control methods used and extent of control possible will be dictated by fireweed growth stage, the size of the infestation, the situation or site in which you are controlling it, and your available resources (see over).

For fireweed, you will have more success by controlling small areas well than large areas less effectively. Work inwards from outlying smaller infestations to larger core infestations, and target areas of higher value or those used for particular purposes such as holding yards, birthing and finishing paddocks, and silage and hay paddocks.

What is your goal?

Eradication of weeds (reducing the population to zero) is rarely achievable except when infestations are relatively small and detected early in the invasion process. Because of this, the goal for most farmers is unlikely to be eradication of fireweed but rather to reduce the population to a manageable level that has minimal impact on pasture and livestock production.

The best approach will depend on the severity of the fireweed infestation. Some general guidelines are included below.

<i>Infestation severity and control aims</i>	<i>Most likely methods</i>	
New or small isolated infestation <i>Aim:</i> Remove all plants regularly to prevent reinfestation and drive down soil seed bank levels to zero.	<ul style="list-style-type: none"> • Farm hygiene (p. 17) • Hand weeding (p. 20) • Spot spraying selective herbicide (p. 22) 	
Light widespread infestation <i>Aim:</i> Maintain low population levels that do not allow build up of seed numbers in the soil.	<ul style="list-style-type: none"> • Pasture competition (p. 17) • Grazing management (p. 19) • Occasional/strategic hand weeding or spot spraying of selective herbicide (p. 20 and 22) 	
Heavy infestation <i>Aim:</i> Reduce the population to a manageable level that has minimal impact on pasture and livestock production.	<ul style="list-style-type: none"> • Broadacre selective herbicide (p. 22) • Grazing management (p. 19) • Pasture competition (p. 17) 	

Farm hygiene

Have good hygiene protocols for your property to stop the spread of fireweed.

Stop seeds from entering your property by:

- only buying weed-free feed/hay;
- only feeding out hay in areas that can be regularly checked for any fireweed growth; and
- pulling out and destroying plants that you detect before they seed.

If you already have fireweed you need to stop it spreading to other properties. Do not sell hay if it comes from a paddock with fireweed.

Pasture competition

A competitive pasture is a key requirement of effective long term fireweed control. However, if re-establishing pasture, it is vital that this is managed carefully, so that the fireweed problem is not made worse when disturbing soil and weakening or killing existing pasture.

A central principle of any fireweed control programme must be maintenance of a vigorous, competitive pasture. Any factors that open up pastures, such as drought, overgrazing, uncompetitive pasture species, cultivation, spraying out a pasture with a non-selective herbicide, and areas bared by trampling (e.g. livestock camps and those around watering or feeding places), favour the development of fireweed.

On the other hand, landholders have found that the maintenance of competitive perennial pastures offers some level of success, preventing substantial emergence of fireweed despite favourable climatic conditions for germination. An ideal pasture mix, where climatic conditions allow it, will contain a mixture of perennial grasses and clovers. In coastal pastures, various locally adapted species have been found to effectively compete with fireweed, particularly kikuyu and white clover. Ryegrass may offer some competition in both coastal and inland pastures, while paspalum also appears to be somewhat effective.

Managing your existing pasture well to ensure a dense cover will go a long way towards minimising the growth of fireweed on your land.

A dense pasture during early autumn to winter and spring (including maintaining a moderate level of leaf litter into the winter) is likely to provide the best form of control. This may be achieved by growing early winter pasture species, by allowing standover of summer pasture feed, or by using winter-summer pasture combinations. This is particularly relevant since fireweed is often of greatest abundance in naturalized summer-growing pastures. Drought, low productivity and high stocking rates leading up to the fireweed growing season can predispose these pastures to invasion, whereas timely fertiliser application and/or irrigation at the start of their active growth period can promote competition with fireweed.

Given productive soils and pasture species, experience suggests that landholders in areas of Australia receiving higher rainfall, such as the North Coast of NSW, may achieve greater pasture competition than those in areas that receive less rainfall, such as the South Coast of NSW.



Overgrazing opens up pasture and exposes the paddock to fireweed invasion

Improved pastures require optimal conditions and appropriate long-term management to allow them to become effective competitors with fireweed, and are therefore not a realistic option during extended drought periods. Sub-optimal pasture improvement has actually been associated with higher rates of fireweed invasion than native or unimproved pastures.

Where pastures are to be resown this process must be managed carefully, and may worsen the fireweed infestation in the short term. For example, spraying of pastures with a non-selective herbicide, or cultivation prior to re-sowing, may well stimulate fireweed seeds to germinate, resulting in a massive infestation. Follow-up spraying with a selective herbicide, and/or extensive hand weeding may be required to bring fireweed under control in the re-established pasture.

Grazing management

Grazing management may involve:

- *grazing strategies that ensure pasture cover is maximised and fireweed has less chance of establishing and spreading; and*
- *using livestock that are able to consume fireweed to control established fireweed populations.*

Landholders running cattle on their property can adapt their grazing strategy to allow pasture to become more competitive, and minimise the chance of fireweed establishing dense populations. A simple approach involves avoiding a high stocking rate (i.e. not grazing your pastures with too many animals), rotating your grazing between paddocks, and reducing grazing pressure at certain times in impacted paddocks. Removing livestock is particularly helpful prior to fireweed germination to increase pasture competition, and when pasture plants are setting seed (often in summer) to fill in the pasture gaps with new seedlings.

Experience shows that grazing with sheep or goats may also be of some use in fireweed control, since they readily eat fireweed and are some 10-20 times less susceptible to poisoning than cattle and horses. A recent survey of farmers found this to be the most successful fireweed control method. Farmers who used the method suggested that sheep or goats will control most but not all fireweed plants.



Sheep may be used to control fireweed (source: G. Steain)

Grazing with sheep or goats, however, is not without difficulties, including a possible increased incidence of parasites and diseases on your land, and the need for improved fencing and infrastructure such as shearing facilities and stock yards capable of handling these animals. Although relatively tolerant, sheep and goats are not totally resistant to the effects of PAs, and will eventually show signs of poisoning if over-grazed on fireweed affected paddocks.

Physical control

- *Hand pulling is most useful for small-scale or small area fireweed outbreaks, or as a follow-up to other control methods such as herbicide application.*
- *Care must be taken to ensure that slashing does not worsen the fireweed problem by further spreading seed from already flowering plants or reinvigorating mature plants.*

While hand weeding is a widely practised form of fireweed control, it is particularly useful for smaller outbreaks of fireweed on farms of all sizes, on rural-residential blocks of about 1 hectare or less, or as an alternative to spot spraying for control of mature plants that were not controlled successfully by boom-applied selective herbicide. Gloves should be worn and removed plants (complete with root system) bagged for disposal. Hand weeding is easiest after rainfall. *Once fireweed plants have produced buds or flowers, removing and bagging the plants is the only way to contain the seed that will be produced. Bagged plants should either be burned when dry, or buried.*



Hand weeding is useful for smaller fireweed infestations. Plants that have been removed after flowering must be bagged before disposal to contain the spread of seed

Slashing or mulching of fireweed early in its life cycle reduces its rate of survival. While one cut may have relatively little effect, two cuts over a 2 month period can reduce plant survival by up to 70%. Slashing will also be most effective on small areas at times when pasture is growing rapidly (at certain times of year or during a wet season), as it is at these times that pasture competition is most likely to restrict fireweed regrowth.

When using slashing as a control technique, landholders need to be aware of a number of possible drawbacks:

- that it may further spread fireweed if cut plants have started flowering;
- that it may only delay flowering until later in the season and promote regrowth of plants in the following season;
- that it will be detrimental to control at times when pasture is growing poorly as fireweed plants may recover more quickly than pasture species; and
- that it may increase the chance of stock poisoning by making fireweed plants more attractive and difficult to differentiate for livestock.

On the other hand, if carried out before flowering and when pasture is growing rapidly, slashing may assist landholders in controlling dense fireweed outbreaks.

Cultivation is *not* recommended as a fireweed control method as it generally stimulates fireweed seed germination and results in an increase in the density of fireweed.



Cultivation generally results in an increase in fireweed density

Herbicides

The NSW and Qld government fact sheets listed on page 33 of this Guide include registered herbicide lists and management (timing) calendars.

There are two broad categories of herbicides. ‘Selective’ herbicides will kill certain target weeds but cause little damage to other weeds and certain desirable species. In contrast, ‘non-selective’ herbicides, such as the commonly used glyphosate (e.g. Roundup), will kill most plants with which it comes in contact. It is particularly important when using non-selective herbicides, to apply the chemical only to the target weed to avoid damage to surrounding vegetation.

For example, using the non-selective glyphosate herbicide through a wick-wiper can be effective as the herbicide is only wiped on to the taller weeds and not the shorter grazed pasture. Even with older more resilient flowering plants, two passes of an applicator using glyphosate can give up to a 95% kill of fireweed.

Alternatively, large outbreaks of fireweed may best be sprayed with a registered selective herbicide using a vehicle mounted ‘boom’ applicator. Small outbreaks can be ‘spot sprayed’ using a backpack or handheld spray applicator.



The optimum time for herbicide application on fireweed is during the small seedling to pre-flowering stages (normally autumn to winter)

It is crucial to commence fireweed control with herbicides well before the first flowers appear and the plant becomes more highly visible in the paddock. Look for seedlings 2 weeks after rainfall events in autumn in bared areas, and if populations are detected, act early to control to cut costs and increase the likelihood of success.

Once the plants reach maturity, they are more difficult to control with herbicides, and will have a much better chance of setting seed.

The selective herbicide bromoxynil is effective on young plants, and is suitable in pasture situations as it will not affect most desirable pasture species. However, when applied to larger, more advanced plants, the effectiveness of bromoxynil drops. Even when higher recommended rates are used, the plant may recover from its lower parts as bromoxynil is a contact herbicide, i.e. it only affects the parts of the plant with which it comes in contact.

A general herbicide strategy is to apply a selective herbicide with a boom spray during autumn, when the highest proportion of fireweed seedlings will be present in the pasture. This may mean waiting for a second flush of germination where further rain is expected to make the most of your single herbicide treatment. Selective herbicides registered for boom spray application for fireweed include bromoxynil (e.g. Bromicide 200) and a mixture of bromoxynil and diflufenican (e.g. Jaguar). Jaguar has a shorter 2 week withholding period for livestock, compared with 8 weeks for Bromicide. A permit has also been issued to allow off-label use of 2,4-D amine (e.g. Amicide 625) to control fireweed. Trials suggest a mix of bromoxynil and 2,4-D amine may offer the best fireweed control.



If fireweed plants begin to grow taller than the grazed pasture they may be able to be wick-wiped with a non-selective herbicide such as glyphosate

Follow-up spot spraying of more mature or flowering plants may be undertaken later in the season (for example in spring) using herbicides registered for that purpose, including triclopyr/picloram/aminopyralid (Grazon Extra) and fluroxypyr/aminopyralid (Hotshot). However, late spraying is not ideal for the reasons already described, and these less selective herbicides may also result in greater damage to desirable legume plants where they are present in the pasture.

*Herbicide application has been a key aspect of some successful fireweed control programmes. However, **herbicides do not generally kill fireweed seeds** if applied after flowering. Herbicides are short term solutions and pasture improvement should be the long term goal. Herbicide resistance in weeds is also a potential problem from repeated broadscale applications of a particular herbicide group.*

It is important to check with your supplier or reseller regarding currently registered herbicides for fireweed control (both selective and non-selective), and to use any herbicides in accordance with the instructions included on the label or packaging. You will also need to adhere to recommended livestock and hay/silage withholding periods, and plant back periods after spraying, and keep records of herbicide use in your pasture to comply with legislation or animal production quality assurance programmes. Finally, be sure to comply with recommended safety procedures for herbicide use, and determine whether you need to obtain accreditation or certification in correct chemical safety, handling, application and record-keeping procedures. Your herbicide supplier or reseller, or your local weeds officer, will be able to advise you regarding your obligations in these areas.

Bringing the control methods together

- *Plan your approach to fireweed control.*
- *Use a combination of both 'weed removing' and 'pasture improving' techniques.*
- *Maintain a thick competitive pasture and avoid creating bare ground to suppress emergence.*
- *Target seedlings with herbicides.*
- *Pull mature plants or slash before flowering.*
- *Enlist the help of sheep or goats.*
- *Stick at it!*

An integrated approach to fireweed control may include promoting vigorous year-round pasture growth and ground cover, e.g. through lower stocking rates, to minimise the emergence and growth of fireweed seedlings, good farm hygiene practices, as well as early control of small outbreaks using targeted chemical application (spot spraying) or physical control (hand pulling). Minimising the chance that fireweed will spread onto your land, and limiting the spread of existing infestations, will maximise the chances of success of integrated management. However, this approach is less likely to succeed in drought years and after subsequent drought-breaking rain. Sheep or goats may be considered as an effective control option where it is practical to run these animals on your land.

Large-scale herbicide applications (e.g. using a boom sprayer) should only be considered a short-term solution, one that is most useful as a first step towards controlling a significant fireweed outbreak, or for high value and special purpose production e.g. lucerne hay and silage.

Many farmers seek long term fireweed control by combining grazing management strategies (such as rotational or cell grazing) with pasture improvement activity to maximise dense pasture coverage. An integrated approach that brings together a number of control methods will be the most effective strategy for controlling fireweed outbreaks and preventing further spread, especially when applied diligently over the long term.

A word on fireweed biological control

Biological control involves government agencies introducing to Australia ‘natural enemies’ of a particular weed from where the weed originated overseas. Only three agents have been host-tested against fireweed – two moths from Madagascar and one rust fungus from South Africa. The agents were found to have an unacceptably wide host range, causing severe damage to native and other *Senecio* species.

This lack of specificity means that there is currently no biological control method available for fireweed in Australia. However in 2011, further research began in South Africa as part of the *Fireweed Control Research* project, to identify and test potential biological control agents. If this research is successful, it will be several years before biological control agents are released.



The Puccinia lagenophorae rust that commonly infects fireweed in Australia

Natural insect predators and pathogens have been observed in fireweed populations in Australia, notably three rusts, the most common of which is the orange-coloured rust fungus *Puccinia lagenophorae*. Rusts can cause considerable growth retardation on heavily infected fireweed plants, though the severity of their impact and their spread is heavily dependent on prevailing weather conditions, particularly protracted wet weather. None of the other predators or pathogens seem to keep fireweed in check. It is important to remember that biological control, even if introduced to Australia, will not be a ‘silver bullet’ for eradication of fireweed. Biological control can help reduce the target weed population but needs to be combined with a diversity of other control techniques to be successful.

Herbicide use guidelines

Herbicides must be used in accordance with the instructions included on the label or packaging. You must always follow these instructions, as they maximize your chance of success, and it is illegal to do otherwise. It is important to wear appropriate protective clothing when using herbicides, which may include a long sleeved shirt and long pants, waterproof gloves, heavy duty shoes, eye protection and a respirator. Care is also needed to prevent herbicide spray droplets from drifting onto non-target vegetation and neighbours' properties and to protect the environment, such as watercourses, from chemical contamination. Drift can largely be avoided by not spraying in too windy conditions and by adjusting your spray nozzle so that it does not produce fine, misty (small) spray droplets.

You may also be obliged by State or Territory legislation to undergo training and obtain accreditation or certification in correct chemical safety, handling, application and record-keeping procedures. Some States or Territories only require accreditation for those who use more than a certain amount of chemicals annually (although these requirements may have changed since this booklet was published). Several organisations offer accreditation or certification courses. Examples include SMARTtrain (freecall 1800 138 351) and ChemCert Australia (freecall 1800 444 228). Training may also be available locally from your State farmer association, TAFE, or other local provider.

You may also be required to keep records of chemical use on your property to comply with legislation or quality assurance programmes, such as the Livestock Production Assurance programme administered by Meat & Livestock Australia. If you participate in any quality assurance or primary production accreditation programmes, make sure you understand the requirements relating to chemical use. Chemical use records may not be required if you are only spot-spraying isolated plants in a paddock. Herbicide use may also be restricted or prohibited altogether if your property has certified organic status. Organisations administering quality assurance and certification programmes will be able to provide advice on how chemical use records must be kept.

Case studies - fireweed control

Case study - Grazing with Dorper sheep

Mr Bill Davies of Falls Creek, coastal NSW, attempted without success to control fireweed on his 80 hectare cattle property with herbicide applications and direct drilling of pasture species. After considerable research, Mr Davies introduced a small flock of Dorper sheep on to his property. He immediately found these to be highly successful at controlling fireweed, estimating 2 years after their introduction that his fireweed infestation had been reduced to about 5% of its peak level.

Sheep are able to ingest a much higher proportion of PAs safely compared with cattle. Dorper sheep in particular do not require shearing, saving landholders the costs of shearing infrastructure and contractors. Their meat value will also offset some of the loss incurred by decreasing cattle herd size.

Mr Davies rotates the sheep year-round through each of his 12 paddocks, following the cattle. The Dorper flock favours fireweed plants, consuming the plants and flowers early in the season and minimising fireweed seeding. While for many farmers fireweed populations expanded rapidly during the wet 2010-11 season, Mr Davies considered this to be his best year for fireweed control, since the fireweed seed bank had been reduced to the extent that pasture species were able to outcompete fireweed.

Dorper sheep may control the vast bulk of fireweed, with other approaches such as spot-spraying with a selective herbicide or hand pulling being available to control remaining plants.



Bill Davies, Falls Creek NSW, with his Dorper flock (source: B. Davies)

Case study - Combining physical control with herbicide application

A farmer on the NSW mid-North Coast hinterland has found after several years of experimentation, that an integrated approach to fireweed control has eliminated serious infestations on the property.

The fireweed infestation on this property originated when a pasture improvement programme (seed and superphosphate) led to a serious fireweed outbreak. Five years of dedicated control using spot spraying with selective herbicides (bromoxynil and 2,4-D amine), and many hours of digging or pulling out plants (with the help of friends and volunteers) were required before the farmer observed a noticeable reduction in the fireweed infestation. Other farmers in the district have noted that it may take more than 5 years to reduce the incidence of fireweed on a property if the initial soil seed bank is large.



Fireweed outbreak on case study property in northern NSW (source:Anonymous)

Over time the integrated management approach used by the farmer has evolved into the following:

- Diligent willingness during the whole year to remove fireweed plants by hand, taking appropriate equipment every time any work is being done in the paddocks (e.g. digging implements, gloves, and a bag to dispose of removed fireweed plants).
- Beginning a more specific programme to control fireweed outbreaks early in the main growth period (as early as February) by removing weeds by hand.

- Once the weather has cooled sufficiently (in the autumn months), spray fireweed infested areas on the property with bromoxynil and 2,4-D after removing more advanced visible plants by hand. If spraying before the appearance of fireweed flowers, a low rate of bromoxynil was found to be effective.
- Inspect areas with a history of heavy infestation again in late winter, remove all visible plants by hand, and within a week or two of removal, spray the area with bromoxynil to control smaller less visible plants.

After several years of dedication to this method, the farmer now considers fireweed to be less of a problem than other weeds on her property, although she remains committed to controlling any fireweed outbreaks she sees given her experience with previous outbreaks, and awareness that the soil weed seed bank takes several years to decline.

This farmer continues to look for new ways to limit the spread of fireweed on the property which has recently included planting windbreaks to stop wind-borne seed. She is also considering grazing control using goats as an addition to her current strategy.

While this case study shows that considerable hard work is required by farmers initially to bring fireweed under control, it also indicates that commitment to controlling fireweed can lead to eventual success.



Local students from Dorrig High School volunteered to help pull out fireweed on the property during a time of heavy fireweed infestation (source: Anonymous)

Assistance and support

Government assistance

To obtain further information on fireweed, your control responsibilities, and possible advice and assistance in your district, please contact your local weeds authority or local government/council, whose contact details should be listed in the White Pages. Alternatively, a list of State and Territory contacts are provided below. Please be aware that these contact details may have changed since this booklet was produced.

National <i>Department of Agriculture, Fisheries and Forestry - Exotic Plant Pest Hotline</i> Phone: 1800 084 881 Web: www.daff.gov.au <i>Weed of National Significance Coordinator - Fireweed</i> Bronwen Wicks, NSW DPI Phone: 02 4828 6632 Email: bronwen.wicks@dpi.nsw.gov.au	
Australian Capital Territory <i>Territory and Municipal Services</i> <i>ACT Parks, Conservation and Lands</i> Phone: 13 22 81 or 02 6207 5111 Web: www.tams.act.gov.au/live/environment	South Australia <i>Biosecurity SA</i> <i>Emergency Plant Pests Hotline</i> Phone: 1800 084 881 Web: www.pir.sa.gov.au/biosecuritysa/
New South Wales <i>Department of Primary Industries - Weeds Hotline</i> Phone: 1800 680 244 Email: weeds@dpi.nsw.gov.au Web: www.dpi.nsw.gov.au/weeds	Tasmania <i>Department of Primary Industries, Parks, Water and Environment - Exotic plant pests</i> Phone: 1800 084 881 Web: www.dpiw.tas.gov.au
Northern Territory <i>Natural Resources, Environment, the Arts & Sport - Weed Management Branch (Darwin)</i> Phone: 08 8999 4567 Email: weedinfo.nretas@nt.gov.au Web: www.nt.gov.au/nreta/natres/weeds/	Victoria <i>Department of Primary Industries</i> <i>Customer Service Centre</i> Phone: 136 186 Email: customer.service@dpi.vic.gov.au Web: www.dpi.vic.gov.au
Queensland <i>Department of Agriculture, Fisheries and Forestry</i> Phone: 13 25 33 or 07 3404 6999 Web: www.daff.qld.gov.au	Western Australia <i>Department of Agriculture and Food Western Australia - Invasive Species Program</i> Phone: 08 9368 3333 Web: www.agric.wa.gov.au

Community groups

Bega Valley Fireweed Association

<http://thebegavalley.org.au/fireweed.html>

Dorrigo Community Weed Action

Personal assistance

Weed officers are responsible for weed detection and control within a district, but are also available to help all farmers, including small farm owners, to manage weeds on their land. They will be able to advise you on the most effective methods to control weeds. *If you need assistance or advice on weed control, your local weeds officer is the best first contact.* Your local government office or State/Territory government will be able to advise you who to contact locally.

Many rural merchandise stores now employ agronomists, who may also be able to offer you advice on controlling particular weed species such as fireweed. Your State or Territory government may also employ local or district agronomists. A list of State and Territory contacts is provided in the section *Government assistance*.

Your neighbours may also be a useful source of assistance and advice. It may be in the best interests of neighbouring landholders to see that fireweed is kept under control in their district, as rapidly spreading fireweed infestations may impact on the profitability of their land. Whether they are prepared to help you manage fireweed on your land will depend on the individuals concerned.

Accredited spray subcontractors

For rural land owners who may be busy or who do not have appropriate equipment, using a subcontractor for fireweed control may be an attractive option. Combining resources with your neighbours may make employing a spray contractor more affordable. When employing a contractor, ensure that they have the correct licencing and/or accreditation. Requirements vary across Australian States and Territories, so if you are not sure, contact your local weeds officer or authority for advice. They may even be able to undertake the work themselves.

Further reading

Reports and papers

Sindel, B. 2009. *Fireweed in Australia: Directions for future research*. Report to the Bega Valley Fireweed Association. Available online from <http://thebegavalley.org.au> and <http://www.ruralfutures.une.edu.au>

Fact sheets and guides

Allan, H., Lauenders, T., and Walker, K. 2009. *Fireweed: Primefact 126*. 2nd ed. NSW Department of Trade & Investment, Regional Infrastructure & Services. Available online from <http://www.dpi.nsw.gov.au>

Cooma-Monaro Shire Council. n.d. *Fireweed: Senecio madagascariensis*. Available online from <http://www.cooma.nsw.gov.au>

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Sindel, B., and Coleman, M. 2010. *Weed detection and control on small farms: A guide for owners*. University of New England, Armidale. Available online from <http://www.ruralfutures.une.edu.au>

Sindel, B., Jhorar, O., Reeve, I., Thompson, L., Moss, J., and Coleman, M. 2009. *Weed detection on farms: A guide for landholders*. University of New England, Armidale. Available online from <http://www.ruralfutures.une.edu.au>

Southern Rivers CMA. 2009. *Managing weeds on the far south coast of NSW: Fireweed*. Available online from <http://www.begavalley.nsw.gov.au>

Wicks, B. 2012. *Weed management guide: fireweed (Senecio madagascariensis)*. Caring for Our Country, Australian Government, Canberra. Available online from <http://www.weeds.org.au/WoNS/fireweed/>



Australian Government
Department of Agriculture,
Fisheries and Forestry

