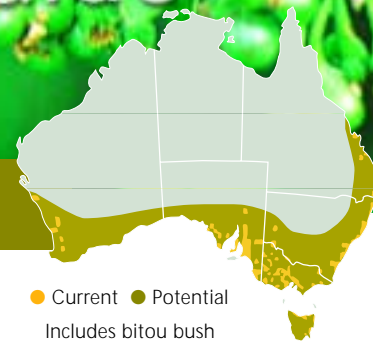


Weed Management Guide

Boneseed – *Chrysanthemoides monilifera* ssp. *monilifera*



Boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*)

The problem

Boneseed is a *Weed of National Significance*. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts.

Boneseed has become an aggressive invader of native bushland in Australia. Although it does not affect agriculture, it is considered a weed because of its ability to establish in areas of native vegetation ranging from mallee scrub to eucalypt dominated forests and, in particular, the coastal fringe.

Its success is due to its vigorous growth, aided by an absence of natural enemies and the ability to regenerate quickly and outcompete other species after fire.

The spread of boneseed threatens a number of significant rare or threatened species, such as the brittle greenhood orchid (*Pterostylis truncata*) in Victoria.

The weed

A perennial shrub, which grows up to 3 m high, boneseed reproduces by seed. In contrast to the closely related bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata*) which has a sprawling habit, boneseed is an erect shrub. It is relatively short-lived (10–20 years).



Boneseed grows under a wide range of climatic conditions but prefers disturbed situations: Mount Lofty Ranges, SA. Photo: Colin G. Wilson

It has woody branched stems and oval-shaped leaves with irregularly serrated edges. New growth is typically covered by white downy cotton-like material. The yellow flowers have 5–8 petals and are up to 30 mm in diameter. The round fleshy green fruit turn black when mature and contain a single smooth round seed 6–7 mm in diameter. The seed is bone coloured when dry, hence the name 'boneseed'.

Boneseed has a shallow root system. It can absorb moisture from light summer showers before it reaches the deeper rooting zone of other plants. This gives it a competitive advantage over deeper-rooted species, especially in areas of low summer rainfall.

Key points

- Remove isolated plants before they set seed.
- An effective control program often involves burning infested areas when conditions are suitable, waiting for seeds to germinate and then spraying with a herbicide.
- Biological control offers some hope for control in inaccessible areas.
- Monitor treated areas annually to detect and eradicate regenerating seedlings before they have a chance to produce seed.
- Because of the large and persistent seedbanks in the soil, control entails repeated treatments over several years.



Growth calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flowering							■	■	■	■		
Fruiting	■								■	■	■	■
Germination	■	■	■	■	■	■	■	■	■	■	■	■

■ General pattern of growth ■ Growth pattern in suitable conditions

Boneseed grows rapidly during winter and a few plants may flower in the first year, particularly on burnt areas where there is little competition. However, plants are usually at least 18 months and sometimes three years old before flowering. Flowers are formed in late winter and spring but not shed until summer, unlike bitou bush which flowers almost year round with a peak from April to June. Seeds germinate at any time of the year but mostly in autumn. An individual plant can produce 50,000 seeds a year and about 60% of seeds are viable. The hard seed coat splits open in some and these germinate as soon as there is enough soil moisture. In many seeds however, the seed coat remains intact and seeds can remain viable in the soil for more than ten years.

How it spreads

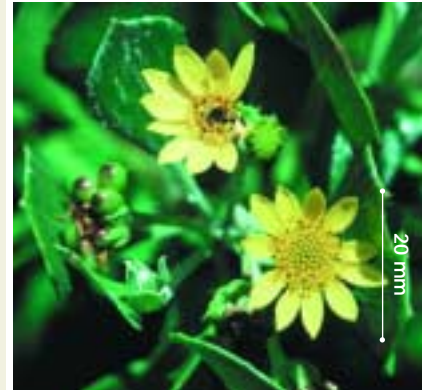
In Australia boneseed was originally planted as a garden species and to stabilise sand dunes. Birds are a major method of spread along with rabbits, foxes and cattle. Gravel carted from the You Yangs in Victoria has been a major method of spread from the infestation there. Boneseed has also been spread by dumping of garden waste.

Where it grows

Boneseed is a South African plant that was first introduced to Australia as an

ornamental and grown in Sydney, Adelaide and Melbourne gardens in the 1850s. Another four subspecies of *C. monilifera* occur in South Africa, but fortunately these have not been introduced into Australia.

Infestations of boneseed and the closely related bitou bush mainly occur on public lands. Boneseed grows under a wide range of climatic conditions but prefers sandy or medium-textured soils and disturbed situations, particularly near the sea because it tolerates salty conditions. Boneseed occurs over a wide area of southern Australia, especially in Victoria along the Mornington



The closely related bitou bush has 11–13 yellow petals on its flowers and smooth-edged leaves. For more information see other guide in this series. Photo: Kate Blood

Peninsula where remnant manna gum (*Eucalyptus viminalis*) vegetation is under threat, and in the You Yangs. Infestations also occur in the Mount Lofty Ranges, South Australia; parts of the Tasmanian north and east coasts; the south and central coasts of New South Wales; and near Perth in Western Australia. An eradication zone for boneseed has been established in Tasmania, where efforts on the northeast coast have been very effective. Boneseed is not an agricultural weed and does not persist when grazed and trampled by stock, nor when cultivated.

Potential distribution

Without effective control programs, boneseed has the potential to become more abundant within its current range and to spread into new areas. Most of southern Australia, including Tasmania, is threatened by boneseed. For example, a recent climate analysis has shown that virtually all of Victoria is potentially suitable for infestation by boneseed.

What to do about it?

There is considerable community interest and awareness of the adverse impacts of boneseed and bitou bush, especially in coastal areas. This is evident in the hundreds of volunteer coastal care and 'friends of the parks' groups which direct much of their energy towards removing these weeds.



Peak flowering occurs between August and October. Photo: Colin G. Wilson



The yellow-flowering boneseed infests two thirds of the You Yangs Regional Park, Vic.
Photo: Nick Pitsas

A range of effective control measures for boneseed are available, including hand pulling, herbicide treatment and fire. Natural regeneration or over-sowing with locally collected seed of native species is an important part of the rehabilitation process.

Because of the large and persistent seedbanks in the soil, long-term control will mean that areas have to be treated repeatedly for several years.

Prevention of spread

It is important to keep clean areas free of boneseed. Once an infestation is established, preventing its spread into surrounding areas should be a priority. This means destroying established plants before they flower and produce fruit.

Any boneseed plants in gardens should be destroyed since they represent a seed source and hence potential for further spread.



Each bush can produce thousands of flowers and up to 50,000 seeds per year.
Photo: Colin G. Wilson

Herbicides

Several herbicides are registered to control boneseed by spray or cut-stump application. The cut-stump application method reduces the risk to nearby non-target plants but is time-consuming, especially when dealing with large numbers of small boneseed plants.

Burning will trigger mass germination of boneseed and may also improve access for herbicide application. Spraying small seedlings in the first few months after germination is generally ineffective because they are quickly replaced by new ones. It is better to spray at the end of seedling emergence but, even then, follow-up control will be needed in subsequent years after further germination has taken place.



Fire kills boneseed but can also stimulate mass germination of seeds.
Photo: Rachel Melland

Use fire first on large infestations

Control of large infestations usually involves aerial spraying. In areas where fire can be applied safely, hand pull or cut woody plants between autumn and spring and allow foliage to dry on the ground for at least one month. There is no need to pull seedlings or immature plants. When conditions are suitable, burn the area to remove leaf litter and create bare ground. Successful use of prescribed fire will mostly occur between September and December or February and April when moisture levels are low. Follow all regulations and containment procedures.

You can remove regenerating seedlings either manually or by using herbicides, but treatment must be completed before the seedlings start flowering. Remove hand-pulled seedlings from the site or put them on the ground so that roots are clear of the soil. Most seeds will germinate within the first winter–spring period after fire. Seedling densities are likely to be high after fire so treatment areas must be matched to the resources available for follow-up works.

Keep soil disturbance to a minimum to reduce the risk of stimulating germination and establishment of other weeds. Press disturbed soil back in place by foot when pulling seedlings.

Poor access prevents the use of mechanical control of boneseed in many places. In these situations, contingency planning for treatment after bushfires should be considered but, in most cases, only small areas can be treated. Biological control offers the best prospect for suppression of boneseed in these areas.

Isolated plants or small infestations

Isolated plants can be physically removed, preferably before they have seeded. Small infestations can be treated with herbicide applied by spot spraying or cut-stump treatment.

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Environment ACT	(02) 6207 9777	EnvironmentACT@act.gov.au	www.environment.act.gov.au
NSW	NSW Agriculture	1800 680 244	weeds@agric.nsw.gov.au	www.agric.nsw.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9500	apc@saugov.sa.gov.au	www.dwlbc.sa.gov.au
Tas	Dept of Primary Industries, Water and Environment	1300 368 550	Weeds.Enquiries@dpiwe.tas.gov.au	www.dpiwe.tas.gov.au
Vic	Dept of Primary Industries/Dept of Sustainability and Environment	136 186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	(02) 6272 5852	contact@apvma.gov.au	www.apvma.gov.au

For up-to-date information on which herbicides are registered to control boneseed and the best application methods and dosages, contact your state or territory weed management agency or local council. This information varies from state to state and from time to time. Contact details are listed above, including contacts for the Australian Pesticides and Veterinary Medicines Authority, which hosts the PUBCRIS database. This database contains information on all herbicides that are registered for use on weeds in each Australian state and territory.

When using herbicides always read the label and follow instructions carefully. Particular care should be taken when using herbicides near waterways because rainfall running off the land into waterways can carry herbicides with it.



Seeds germinate at any time of the year but mostly in autumn: You Yangs Regional Park, Vic.
Photo: Kate Blood

A single herbicide application to young (less than one year old) seedlings will not be sufficient, as substantial replacement by new seedlings can be expected. A second treatment may be applied after the next seedling emergence period, or the first herbicide application may be delayed until the seedlings are almost at flowering stage.

If herbicides are applied later, higher rates may be needed to kill the larger boneseed plants but, because the seedbank will be much smaller by this time, one application may be sufficient and there will be fewer plants to re-treat.

Biological control

Bitou tip moth (*Comostolopsis germana*) was released in 1989. Since then the bitou seed fly (*Mesoclanis polana*) has been released. In 2001 the bitou leaf rolling moth (*Tortrix* sp.) was released on boneseed in the You Yangs and on bitou bush in New South Wales. None of these insects are having a significant impact on boneseed. High hopes were held for the leaf rolling moth, which has the most impact on the plant in its native habitat in South Africa. So far it has not established very well, possibly because it was released during a drought or because it suffered high predation (in one study up to 98% of caterpillars were eaten). If it can be established successfully, by enhanced breeding and wide dispersal, it could have a significant impact. Another agent, the boneseed leaf-buckle mite, is being tested for release.

Revegetation

Revegetation should only start after the infestation, including soil seed reserves, has been reduced to levels where follow-up treatments are no longer required or where control can be carried out by hand removal or spot spraying.

In boneseed infestations where indigenous plant populations or indigenous soil seed

levels have not been severely reduced, revegetation is usually not required. Natural regeneration will begin once the boneseed canopy has been removed. Where large amounts of indigenous vegetation have been lost, revegetation will be required after treatment programs to stabilise soils, reduce the visual impact of treatment works and hasten the return of indigenous biodiversity.

Establishing a healthy and competitive canopy of indigenous plants will slow down the rate at which boneseed and other weeds invade. Wherever possible, use local indigenous species, but species that establish readily and form a dense canopy cover within a short period of time are best. Revegetation should aim at establishing layers of indigenous cover, using herbaceous and woody species. Seed of indigenous grasses is best sown over the treatment areas in autumn for cool-season species such as *Danthonia*, *Austrostipa*, *Poa* and *Microlaena* and in spring for warm season species, such as *Themeda*. Sowing native grasses such as these also allows certain selective herbicides to be used on new boneseed seedlings without destroying the grass cover.

Direct seeding is preferable to hand planting although seed is not always available.



Protection of the brittle greenhood orchid in the You Yangs, southern Victoria

The story of boneseed in the You Yangs Regional Park in southern Victoria is definitely a case of 'the one that got away'. Boneseed was first used in the You Yangs in the late 1950s to early 1960s to control erosion. In 1985 a large bushfire swept through the area, killing most of the groundcover and middle storey species. This allowed boneseed to germinate and smother the regeneration of any native species. Some 1300 ha of the 2000 ha park is infested with boneseed.

A priority in managing boneseed in the park is to protect the rare brittle greenhood orchid. Mapping has identified the areas where the orchid grows and the aim in these priority zones is to control/eradicate boneseed and re-establish native vegetation. This strategic approach is now in its fourth year.

Herbicide and hand pulling have been the two methods used in the priority zones. Compaction of the ground could have a detrimental impact on the orchids so the use of heavy machinery is not allowed. Fire also harms orchid populations and is therefore not used for weed control.

To minimise the amount of herbicides used, boneseed is removed by hand. However, herbicides are used if the plants are inaccessible or too large to pull by hand.

Biological control agents, including the leaf rolling moth, have been released in the You Yangs but unfortunately they have not had an impact on the weed.

When looking at broadscale control in the park, You Yangs ranger Craig Bray is careful to consider the resources, including many volunteers, available for follow-up control. While it would be easy for them to spray large areas of boneseed, they do not have the resources to follow up on this scale in the long term.

However, a number of methods for large-scale boneseed control are being trialled at the You Yangs, including a machine to knock down and mulch mature boneseed. The mulch remains on the ground to act as fuel for a burn at a later date, which will promote germination of young plants. Afterwards, the park's regular volunteers will be enlisted to pull out the young seedlings as they emerge.

A program known as 'Adopt a block' has been running at the park since 1987. About 30 volunteer organisations, including 4WD clubs, scout groups and schools each have a 1 ha block which they visit once a year to remove the boneseed. In some blocks, boneseed has been eradicated and they are now planning revegetation with native species.



Boneseed restricts access to tracks in the You Yangs Regional Park.
Photo: Kate Blood

Disposal

Hand-pulled plants can be left lying on the ground providing roots are not in close contact with the soil surface. If the population has never dropped seed, any seeds present should be cut from plants, collected in bags and burnt. If the population has seeded previously, the seeds can be allowed to fall to the ground and then destroyed by treatments aimed at reducing existing soil-stored seed (eg fire).

If removed weed material cannot be destroyed on the site (eg mulched, dried on platforms, hung in trees), it can be buried in landfill. Seeds should not be included in vegetation to be used for the production of garden compost.

If the plant is being removed from gardens, dispose of waste through local government kerbside collection or tip facilities. As seeds are difficult to destroy, it is advisable to dispose of plants when they are not carrying seeds. Cover trailers and ensure local tips are following Australian standards. Discourage dumping of garden waste over back fences or in bushland areas.

Follow-up

Annual monitoring of treated areas is required to detect and eradicate regenerating seedlings. If boneseed infestations are present in neighbouring areas, animals may reintroduce seeds to treated sites. Regeneration of seedlings needs to be monitored and treated within 18 months of germination.

Legislation

The Australian Quarantine and Inspection Service prohibits the entry of boneseed into Australia. Legislation applies in Queensland, New South Wales, Victoria, South Australia, Western Australia and Tasmania. Landowners in these states are required to control boneseed. Check with your local council or state/territory government agency about the latest requirements for boneseed control.

Acknowledgments

Information and guide revision: Nigel Ainsworth (DPI Vic/Weeds CRC), Richard Carter (NSW Agriculture/Weeds CRC), Craig Bray (Parks Victoria) and John Thorp (National Weeds Management Facilitator).

Maps: Australian Weeds Committee.



How to control boneseed

Quick reference guide

Management calendar

Hand pull or cut standing plants all year round and use prescribed fire from February to April or September to December. Treat seedlings with herbicide or hand pull them 12–18 months after fire (the best time is June to October).

For large infestations

In areas where fire can be applied safely, hand pull or cut woody plants between autumn and spring and allow foliage to dry on the ground for at least one month. When conditions are suitable, burn the area to encourage germination of the seedbank. Remove young seedlings by hand pulling or herbicide treatment before they start flowering.

For small infestations

Hand pull isolated plants before they set seed. Small infestations can be treated with herbicide applied by spot spraying



Young boneseed seedlings are easy to pull by hand.

Photo: Kate Blood



After burning, herbicides are used to kill freshly germinated seedlings.

Photo: Rachel Melland

Revegetation

Direct seed indigenous grasses in autumn, and shrubs, trees and summer grasses from August to October. Monitor for seedlings and treat 24–30 months following fire (best time is July to October).

Follow-up control

Match treatment areas to the resources available for follow-up works. Monitor treated areas and treat new seedlings within 18 months of germination.

Control options

Type of infestation	Herbicide	Biological	Physical	Burning
Large infestation – large area, many plants	Spray to kill seedlings before flowering. Contact authorities for information about registered herbicides.	Release biological control agents, contact state or territory departments for advice.	Hand pull or cut woody plants in spring.	Burn area when conditions are suitable with a medium intensity fire.
Isolated plants or small infestations	Spot spray or use cut-stump treatment.	Not suitable.	Remove plants before they set seed.	Not suitable.

© 2003 Information which appears in this guide may be reproduced without written permission provided the source of the information is acknowledged. Printed in Australia on 100% recycled paper.

ISBN 1-920932-01-1

Disclaimer

While every care is taken to ensure the accuracy of the information in this publication, the CRC for Australian Weed Management and the Commonwealth Department of the Environment and Heritage take no responsibility for its contents, nor for any loss, damage or consequence for any person or body relying on the information, or any error or omission in this publication.

