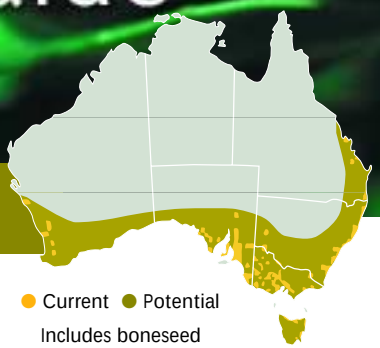
Weed Management Guide

Bitou bush – *Chrysanthemoides monilifera* ssp. *rotundata*



Bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata*)

The problem

Bitou bush 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.

Bitou bush threatens coastal dune vegetation along Australia's east coast. It can outcompete and in many cases totally replace native flora, and it invades undisturbed as well as disturbed areas. Infestations of bitou bush drastically alter the environment for many native birds and animals. It can also create a favourable environment for other highly invasive weeds, such as asparagus fern, lantana and glory lily.

Ironically, one of the plants being choked by bitou bush along the New South Wales coast, golden wattle (*Acacia longifolia*) has become a major pest of coastal dunes in South Africa, where it was introduced to serve much the same purpose as bitou bush in Australia.

The weed

Bitou bush is a perennial, evergreen shrub, normally 1–2 m high although it can form canopies up to 10 m high. Unlike its close relative boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*), which grows as an erect bush, bitou bush is a sprawling shrub.

Bitou bush aggressively invades both intact natural bushland and disturbed areas, particularly coastlines.
Photo: Paul Weiss

Its stems are branched and woody and the upper stems are often purple. The leaves, which are about 20–80 mm long, oval to oblong in shape and tapering at the base, alternate along the stems. Unlike boneseed, which has leaves with serrated edges, bitou bush has leaves with smooth edges. Bitou bush also has an extensive root system and appears more aggressive and more difficult to control than boneseed. The yellow, chrysanthemum-like flowers, up to 20 mm in diameter, are clustered at the ends of the branches. The small berries have green, fleshy skin that changes to brown and black on maturity. The fruit contains a single egg-shaped seed 5–7 mm long which is dark brown to black when dry.

Key points

- Prevention and early intervention are the most cost-effective forms of weed control. It is vital to keep clean areas free of bitou bush.
- Bitou bush infestations leave a large and persistent seedbank in the soil, so for long-term control infested areas must be treated repeatedly for several years.
- Integrated management using a range of control measures (eg mechanical, chemical and biological control, and the careful use of fire and/or grazing) is required to successfully control bitou bush.
- Monitor treated areas annually to detect and eradicate regenerating seedlings before they have a chance to produce seed.

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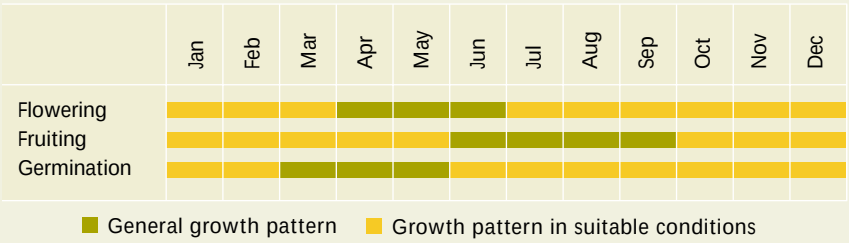
Growth calendar



Seeds germinate at any time of the year but mostly in autumn. Most seeds remain viable for at least two years. The seedlings grow 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. Bitou bush can flower almost year round, but peak flowering occurs between April and June, unlike boneseed which forms flowers in late winter and spring. Bitou bush fruits ripen during winter and the start of spring.

On the south coast of New South Wales, seedlings usually reach flowering age after three years (earlier if growing in burnt or favourable conditions), while on the north coast growth is much more rapid and flowering within one year is more usual.

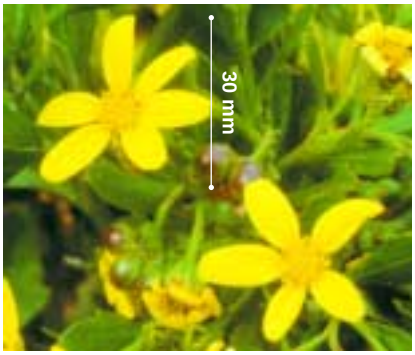
How it spreads

Bitou bush spreads primarily by seed, with each plant producing up to 50,000 seeds a year. In established infestations, soil seedbanks can contain up to 5000 seeds per square metre. Soil disturbance (eg after bulldozing), fire and ingestion of seed by birds and animals promote seed germination but seeds can still germinate in undisturbed situations.

Birds are important in spreading seed as they readily eat the fruit and then pass the seed, sometimes many kilometres from the original source. Rabbits and foxes also eat the fruit and spread the seed in their droppings. Seeds are also spread by water, in ocean currents or through coastal creeks and waterways. Human activities can lead to the spread of bitou bush by vehicles and equipment. On a local scale, seeds may be spread in windblown sand.

Bitou bush can resprout after fire, slashing and herbicide application.

Flowering can occur year round. This specimen was flowering in November near Byron Bay, NSW.
Photo: Kate Blood



The closely related boneseed has 5–8 yellow petals on its flowers and serrated-edged leaves. For more information see other guide in this series.
Photo: Colin G. Wilson

Where it grows

Bitou bush was first recorded in Australia near Newcastle, New South Wales, about 1908, probably introduced through dumping of ships' ballast. From 1946 to 1968 it was planted along the coast to revegetate areas after sandmining. It was also planted on sand dunes near Menindee in western New South Wales where a small infestation still persists.

Bitou bush is naturalised in all states and territories except the Northern Territory. It is mainly restricted to coastal ecosystems with summer rainfall, similar to its range in South Africa.

Bitou bush grows in a range of environments – from open exposed dunes to shaded forests. It is tolerant of shade, salinity, strong wind, wind-blown sand and water, drought, low nutrients and, to some extent, disturbances such as fire. It grows poorly in wet or swampy soils and has a low tolerance to frost.

A recent survey recorded bitou bush on 900 km, or 80%, of the NSW coastline, with an estimated 36, 000 ha infested. Around Sydney there are mixed populations of boneseed and bitou bush. National containment zones for bitou bush have been established in New South Wales on the far north coast and the south coast. In Queensland bitou bush occurred on coastal sandmining areas

Bitou bush threatens coastal dunes and rainforests across southern Australia.
Photo: John Vranjic

but has been targeted for eradication for the past decade. Smaller isolated infestations occur on Lord Howe Island and near Melbourne.

Potential distribution

Bitou bush is spreading further into the understorey of forests and woodlands next to the coastal strip. Recent mapping has recorded infestations up to 10 km inland. There are still large areas outside its current distribution which are potentially at risk, including the whole of Tasmania and much of southern Australia.

The sprawling bitou bush plants have branched, woody stems, which are often purple near the top.
Photo: Kate Blood

What to do about it

Preventing spread

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

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

Much of southern Australia including the whole of Tasmania is climatically suitable for bitou bush

Raising awareness amongst recreational vehicle users is important, particularly in coastal areas where seed may be spread by their activities.

Management strategies

In order to minimise the amount of seed produced, it is necessary to detect as many plants as possible. In areas where access is difficult, tracks may need to be cut to make control efforts easier. The greatest difficulty is the large area infested and the rapid reinvasion of an area after initial attempts at control. A sustained control effort is required for up to ten years.

Bitou bush responds much more quickly than native plants after burning or land clearing, and with a large seed bank in the soil it will quickly form a dense growth of seedlings, swamping native species.

Shallow roots make mechanical control easier

Unlike many other woody weeds, bitou bush has a shallow root system with no distinct taproot, so pulling the bushes is possible. Seedlings and plants up to 1 m in height can be hand pulled.

Bitou bush does not persist when grazed or cultivated. Slashing alone is not effective as regrowth occurs from the stump, but applying herbicide to stems immediately after cutting should prevent regrowth. The removal of adult plants stimulates seed germination so new seedlings must be removed before they produce further seeds.

Herbicides are effective

Herbicides registered for bitou bush can be applied in winter at low rates that effectively kill the weed, yet have minimal impacts on coastal vegetation. However, in northern parts of the weed's range where it matures more quickly, two spraying programs a year may be necessary to prevent seeding.

Herbicides registered for bitou bush can be applied from the air, from the ground or by a cut and paint method. Plants coated with dust or seaspray (eg those close to tracks or the beach) will be less affected by herbicides.

Isolated plants can be treated with herbicide applied by spot spraying. As infestations become larger, a strategically staged approach for removal is advisable to ensure that treated areas are not reinfested.

In New South Wales low dosages of herbicides have been applied from helicopters in winter, allowing large areas to be treated rapidly with minimum impact on native species. Reports indicate better than 95% control.

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
Qld	Dept of Natural Resources and Mines	(07) 3896 3111	enquiries@nrm.qld.gov.au	www.nrm.qld.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 bitou bush 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. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

There are several effective biological control agents

The lack of natural enemies attacking bitou bush in Australia is one of the reasons it has become a serious weed. In classical biological control these natural enemies are introduced into Australia if they are shown not to attack Australian native species or other valuable plants. Biological control is a slow process and will not eradicate bitou bush. It is useful as part of an integrated approach and in areas where the application of conventional control methods is inappropriate due to economic, practical or environmental constraints.

Since 1987, when the first biocontrol agents for bitou bush and boneseed were released in Australia, seven control agents have been released. Two are well established and require no further distribution: the bitou tip moth (*Comostolopsis germana*) which destroys developing leaves, buds and flowers and reduces seed production; and the bitou seed fly (*Mesoclanis polana*) which destroys developing seeds. Leaf-feeding beetles (*Chrysolina* and *Cassida* spp.) were also released but have either not established or are colonising only slowly.

In 2001 the bitou leaf rolling moth (*Tortrix* sp.) was released on boneseed in the You Yangs in Victoria and on bitou bush in New South Wales. Although it has failed to establish on boneseed, it has established well at two sites on bitou bush. Another agent, the boneseed leaf-buckle mite, is being tested for release.

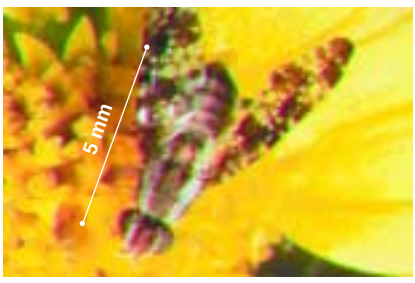
Fire can kill mature bitou bush

Intense fire kills most mature bitou bush, although a small proportion resprout. Fire also kills bitou bush seeds in the litter and topsoil and stimulates germination of seeds from lower in the soil profile. These new seedlings must be removed before they produce further seeds.

Trials have shown that the seedbank in the soil is significantly reduced following burning of mature plants previously killed with herbicide. In areas where a large proportion of the remnant vegetation is known to be fire-sensitive, fire should not be used. Fire can also cause other problems such as increased erosion potential, increased traffic and access by humans and pest animals, and further invasion by weeds. Note that permission of the landowners and a permit from the relevant state or territory fire authority are generally required to authorise the use of fire, and that the fire should be undertaken by properly trained and equipped personnel.

Grazing

Cattle eat bitou bush and this limits its spread onto grazed properties next to heavily infested areas. But grazing in many bitou bush infested areas is not appropriate due to problems associated with stock, such as browsing of native plants, erosion from stock movement and the spread of other undesirable weeds.



The bitou seed fly (*Mesoclanis polana*) destroys developing seeds.
Photo: Weeds CRC

The caterpillar stage of the bitou leaf rolling moth (*Tortrix* sp.).
Photo: Royce Holtkamp

...case study

Restoration of native vegetation at Iluka Bluff on the north coast of New South Wales

A collaborative project at Iluka Bluff on the north coast of New South Wales is helping to restore a badly degraded, bitou-infested coastline.

Iluka Bluff is next to the largest remaining coastal rainforest in New South Wales, the Iluka Rainforest World Heritage Area.

With funding from the Commonwealth Government's Natural Heritage Trust, the Iluka Land and Dune Care Group and the New South Wales National Parks and Wildlife Service (NPWS) began working in 1996 to restore the natural vegetation of the Iluka Bluff area.

Most of the 5 ha project site consisted of dense bitou on the Iluka Bluff headland with small areas of remnant kangaroo grass (*Themeda triandra*) on the eastern and southeastern slopes. The beachfront in the project site was almost exclusively bitou bush as well.

The project involved a number of weed control methods and also saw a new biological control agent, the bitou bush seed fly (*Mesoclanis polana*), established at the site.

The initial treatments for the dense bitou infestations used a Greencorp team to cut access tracks to clear the way for high volume spraying, which was done by contractors and NPWS staff. Bitou amongst the sensitive remnant grassland was either hand removed or cut and painted, with limited spraying.

Several months later, the dead standing mass on the hillside was burnt under controlled conditions. This was done to make follow-up treatment easier, and to destroy a portion of the bitou seedbank and stimulate the remaining seedbank to germinate. Afterwards, mats of cut tea-tree were placed on the bare hillside to help reduce erosion risks.

The bitou on the beachfront was sprayed and, after a suitable time, crushed with a tractor. Areas on the hillside and the beachfront with little native regeneration were then planted by the landcare group and other volunteers. Since then the site has been treated periodically to control regrowth of bitou and other weeds.

As a result of this work, native vegetation cover from natural regeneration and plantings is now dominant over 40% of the 5 ha site.

The project has complemented other regeneration work in the rainforest and has played a large part in Iluka Bluff being named as New South Wales' cleanest beach for 2002.

Integrated management

Wherever possible, an integrated management approach needs to be adopted using several control measures. As with most weed control programs in natural ecosystems, natural regeneration or over-sowing with locally collected seed of native species is an important part of the rehabilitation process. If bitou bush is eradicated without follow-up, other weeds such as glory lily quickly fill the gaps.

Rainforests require special treatment

A combination of spot spraying, mechanical removal and biocontrol may be the most appropriate for rainforest infestations. Fire is not recommended because of the sensitive nature of rainforest plants to burning. The number of new weed seedlings in the forest may be low, as bitou bush does not flower well under heavy shade conditions. Treat vigorous infestations of bitou bush surrounding the rainforest.

Disposal

The stands of dead bitou bush left after spraying can be removed by trampling, compacting or, if appropriate, fire. If they are left standing they may provide some protection to dune environments until they eventually decompose. Small amounts of bitou bush removed by hand pulling or mechanical clearing can also be left to decompose but, if possible, the seeds should be removed and burnt.

Legislation

The Australian Quarantine and Inspection Service prohibits the entry of bitou bush into Australia. The plant is declared in New South Wales, Queensland, South Australia, Victoria and Western Australia. Landholders in these states are required to control it. Check with your local council or state/territory government agency about the latest requirements for bitou bush control.

Acknowledgments

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Maps: Australian Weeds Committee.

In northern parts of its range, two spraying programs a year may be needed to prevent bitou bush seeding.
Photo: Rhonda James

How to control bitou bush

Quick reference guide

Bitou bush – *Chrysanthemoides monilifera* ssp. *rotundata*

Applying herbicide to stems immediately after cutting should prevent regrowth.
Photo: Rhonda James

For large infestations

A sustained control effort is required for large infestations. Hand pull seedlings and plants up to 1 m tall. For larger plants, apply a recommended herbicide immediately after cutting. Match treatment areas to the resources available for follow-up works. Under the right conditions, infested areas can be burnt to encourage germination of the seedbank. New seedlings must be removed before they flower.

For small infestations

Destroy established plants before they flower and produce fruit, to prevent the spread of seed. Treat isolated plants with a recommended herbicide applied by spot spraying.

In rainforests

A combination of spot spraying, mechanical removal and biocontrol may be the most effective for rainforest infestations. Keep soil disturbance to a minimum to reduce the risk of stimulating germination.

Treat healthy infestations of bitou bush near the edges of the rainforest. Once bitou bush is removed, fast-growing rainforest species will regenerate.

Revegetation in other areas

Once bitou bush is controlled other weeds may invade, so only tackle areas where follow-up control is possible. Follow up with direct seeding or planting of indigenous species.

Follow-up control

Because of the large and persistent seedbanks in the soil, follow-up control is required for about ten years.

Disposal

Remove seeds and burn them. Stands of dead bitou bush can either be left until they decompose or are physically removed.

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.	The bitou tip moth and bitou seed fly are distributed along most of the range of bitou bush.	Hand pull or cut woody plants in spring.	Fire can be used to reduce the large soil seedbank.
Isolated plants or small infestations	Spot spray or use cut and paint treatment.	Not suitable.	Remove plants before they set seed.	Not suitable.
Rainforests	Spray to kill seedlings before flowering. Contact authorities for information about registered herbicides.	Use in combination with spot spraying and mechanical removal.	Hand pull or cut woody plants in spring.	Not recommended because of sensitive nature of rainforest plants to burning.

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