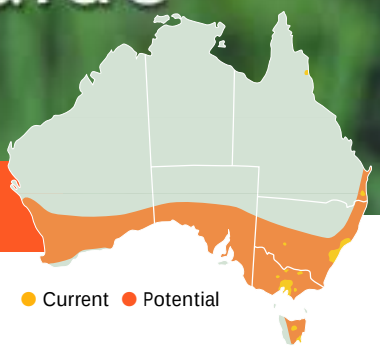
Weed Management Guide

Alligator weed –
Alternanthera philoxeroides



Alligator weed (*Alternanthera philoxeroides*)

The problem

Alligator weed 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. It is an especially troublesome weed because it invades both land and water, and is very hard to control.

When growing on land it displaces other more favourable plants such as crops or native vegetation, and can be harmful to animals. When growing in fresh water, alligator weed can cover the entire water surface, preventing flow, blocking up drainage channels and potentially increasing flood damage. Weed mats can also reduce oxygen exchange, affecting instream plants and animals and reducing water quality.

Alligator weed caused the failure of small crop and turf farms in parts of the lower Hunter region in New South Wales. Another infestation, in Barren Box Swamp, would have cost irrigation farmers in the Murrumbidgee Irrigation Area up to $250 million annually if left unchecked. So far, more than $3 million has been spent controlling this infestation alone.

The weed

Alligator weed can grow with roots embedded in the bank or on the bottom of shallow water bodies, or float freely on the water surface. It spreads its leaves across the water surface, forming dense mats. The long spreading stems are hollow, helping it to float. The roots are thin and stringy, and trail in the water from the joints between plant segments (the nodes).

Infestations can take over wetlands such as creeks and drainage channels and spread onto adjacent land.
Photo: Graham Prichard

When growing on land alligator weed is quite different in structure. The stems are shorter and barely hollow. Reddish-brown tap roots can reach depths exceeding 500 mm.

Whether it grows in water or on land, the shiny, dark green leaves occur in opposite pairs along the stem. The leaves are 20–70 mm long and 5–40 mm wide, with smaller veins almost perpendicular to a characteristic mid-line along the length of the leaf. The silvery-white flower is small (12–14 mm wide) and papery, with a short stalk growing from either the axil (where the leaf joins the stem) or the very end of the stem.

Key points

- Alligator weed poses a significant economic and environmental threat.
- It can grow in water or on land, and has been mistakenly grown in the past as a food.
- Prevention is the most cost-effective form of weed control. Quarantine, early detection and good hygiene within infestations will prevent its spread.
- Mechanical and chemical control, integrated with biological control, is effective on established aquatic growth forms.
- However, care must be taken because it spreads easily from fragments.
- Ongoing follow-up control will be required.

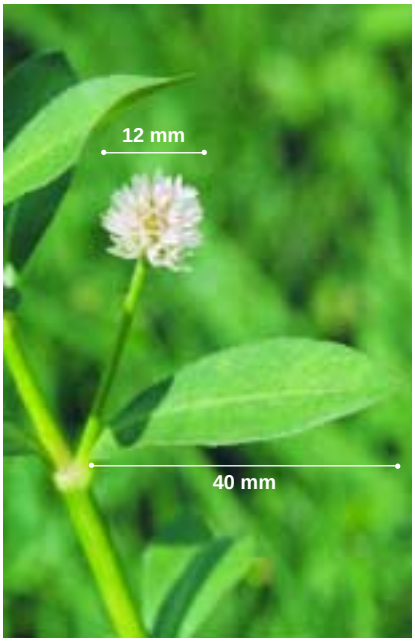
Natural Heritage Trust
Helping Communities Helping Australia
An Australian Government Initiative

Growth calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
New growth									■	■	■	
Active growth	■	■	■						■	■	■	■
Flowering	■	■	■									
Seed formation	No viable seed yet found in Australia											
Seed drop												
Germination												

■ General growth pattern

Growth in alligator weed commences during spring and continues in the warmer weather. New stems formed in spring grow quickly during summer, producing flowers by mid-summer. Flowering continues until the weather becomes cooler and the days shorter. In cooler climates leaves drop off and frost kills off most of the exposed vegetation during winter. However, some roots, rhizomes and protected stems survive and recommence growth during the following spring.



Silvery-white flowers are borne on short stalks during mid-summer.
Photo: Colin G. Wilson

How it spreads

Alligator weed does not produce viable seed in Australia, although it can in its native range. It spreads in Australia through vegetative reproduction, when fragments containing at least one node are moved from one place to another and take root in suitable habitat. It is commonly spread downstream when the plant is broken up into smaller fragments (eg by floods, or following mechanical or chemical control). Movement between river catchments is most commonly due to human activities. It has been spread in garden mulch and landfill, and attached to machinery and vehicles (eg bulldozers, trailers, boats and other watercraft). Animals may also spread the fragments (eg by transport of nesting material by ducks or in cows' hooves).

In water fine roots grow from the nodes.
Photo: Rebecca Coventry

It is believed that alligator weed first reached Australia near Newcastle in the 1940s in ballast. It has since spread to infest many waterways in New South Wales, including the lower Hunter region, Barren Box Swamp, the Sydney region, Griffith, Albury (which threatens the Murray River) and infestations in Brisbane, Cairns and Canberra.

Where it grows

One of the reasons that alligator weed poses such a dramatic threat is its ability to live in both aquatic and terrestrial habitats. It can tolerate brackish (slightly salty) water but thrives in nutrient-rich water. Ideal terrestrial habitats include places that are regularly inundated or that have high rainfall or irrigation. Alligator weed can survive in tropical and sub-tropical regions such as Darwin and Brisbane, and also cooler climates such as Victoria and Tasmania where the survival of some stems and rhizomes over winter allows it to regenerate during the warmer months.

Alligator weed is native to temperate regions of South America, especially Argentina. It is now found as a serious weed throughout tropical and warm-temperate regions, including the US, China, India, South-East Asia and New Zealand.

Potential distribution

The potential range of alligator weed, based on climate, includes waterways throughout most of southern Australia, extending south from Bundaberg in Queensland, through New South Wales, Victoria, Tasmania and South Australia, and north to Kalbarri in Western Australia. However, a different model predicts that alligator weed could also survive in the tropics, which may explain an infestation surviving in Cairns.

What to do about it?

Early detection is most cost-effective

Alligator weed has rarely, if ever, been successfully eradicated once it has infested a water body, despite numerous costly attempts. For this reason, the highest priority for the management of alligator weed in Australia is an effective system of early detection and eradication before infestations become established.

In the past alligator weed was mistaken as a traditional Sri Lankan herb and planted in gardens around Australia.
Photo: Lalith Gunasekera

The success of an early detection and eradication program depends on:

- maintenance of quarantine to prevent further introductions
- enhanced awareness and education to reduce the risk of spread
- the identification and monitoring of high-risk sites
- adherence to weed hygiene protocols (eg not removing material from infestations, carefully washing down equipment after contact with alligator weed)
- coordination between stakeholders and local and state/territory governments.

Some successes with small infestations

Much of this work is ongoing but significant inroads have recently been made. For example, alligator weed was being cultivated in backyards and mistakenly used in traditional Sri Lankan cooking instead of another herb known as 'mukunewenna' or 'pononcarni'. A campaign was initiated to educate the Sri Lankan community about the dangers of alligator weed, to eradicate infestations and to replace it with a less weedy species. In Victoria 784 backyard infestations were identified following an awareness campaign that included newspaper articles, radio segments, leaflets and fridge magnets. By working closely with the Sri Lankan community, the infestations have been controlled via repeated herbicidal treatments. An Australian native species, common joy weed *Alternanthera denticulata*, has been accepted as a suitable replacement.

Don't try and treat alligator weed on your own

The successful control of alligator weed in backyard situations has been achieved using the considerable experience and resources of local councils and state/territory weed management agencies. However, there is still much that is unknown about alligator weed. For example, the effectiveness of different herbicides in different environments is still being examined. For these reasons, and because it can spread so easily from small fragments, you must contact your local council or state/territory weed management agency to help you control alligator weed.

In aquatic situations the hollow stem helps floatation.
Photo: Rebecca Coventry

It is extremely difficult to control alligator weed in aquatic situations

In some aquatic habitats, alligator weed infestations can be reduced with weed harvesters or by manual removal, but small fragments are inevitably left behind or dislodged. These fragments readily create new infestations. Therefore, any living plant material must be very carefully disposed of to prevent further spread.

In water alligator weed can be treated with a registered herbicide. However, this rarely kills the entire plant, which often breaks up into smaller pieces. These smaller pieces can drift downstream and lead to new infestations. Additionally, there are restrictions on the use of herbicides in waterways, including concerns about impacts to non-target plants and the environmental health of waterways.

Therefore, both the chemical and mechanical control of alligator weed in aquatic habitats is extremely difficult and can lead to further downstream infestations.

Alligator weed has an extensive root system when growing on land.
Photo: Graham Prichard

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
NT	Dept of Natural Resources, Environment and the Arts	(08) 8999 4567	weedinfo.nreta@nt.gov.au	www.nt.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 alligator weed 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 directly onto water.

…and on land

When it grows on land, alligator weed can be controlled with repeated herbicide treatments. The Queensland Department of Natural Resources and Mines suggests three treatments during the growing season, each consisting of two applications separated by one week. Ideally, the last treatment should be undertaken close to the start of winter to target the rhizomes, which would otherwise allow the weed to survive through winter.

However, there are problems in this approach, including concerns about using herbicides near waterways, expense, and the difficulty of targeting alligator weed when other desirable species are also present.

Physical removal is also difficult because of the depth that roots and rhizomes can reach. It is recommended that all weed material be removed to a depth of one metre, and then be disposed of by deep burial. This is obviously a difficult and time-consuming task requiring mechanical assistance.

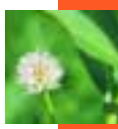
Flowering alligator weed in paddocks of the Lower Hunter, NSW, in February.
Photo: Mic Julien

Adult biocontrol agents (the alligator weed flea beetle *Agasicles hygrophila*) feed on leaves and stems.
Photo: Graham Prichard

Biological control can help manage alligator weed

Three insects have been released in Australia to control alligator weed. The aquatic alligator weed flea beetle *Agasicles hygrophila*, has been quite successful in controlling alligator weed growing in the water. It was first released in 1977 in New South Wales. The adults and larvae reduce the growth of alligator weed by feeding on the underside of the leaves and aerial parts of the plant.

Unfortunately, biological control does not yet offer a cure to the alligator weed problem. The flea beetle is only effective in warm, temperate areas that allow it to breed up to high numbers in early summer, and it does not attack alligator weed growing on land. Therefore, the search continues for new biological control agents in alligator weed's native range, particularly for agents to control the weed in cooler climates and when it grows on land.



Mechanical removal of alligator weed requires careful hygiene to prevent the spread of small fragments.
Photo: Brian Worboys

Given the difficulties and expense associated with chemical and mechanical control, biological control agents are an attractive option to tackle alligator weed in the long term. However, biological control is a complex process, requiring success at a number of separate stages. Once identified, suitable agents must be approved for release, reared in captivity and then become established in the field. The hope for future biological control agents must therefore be balanced by the possibility that they may not be available or successful.

Legislation

In all states and territories, landholders are obliged by law to control or eradicate alligator weed and to limit its spread and impacts. Most regions restrict its importation. Check with your local council or state/territory government agency about its requirements for alligator weed control.

Acknowledgments

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Maps: Australian Weeds Committee.

...case study

Integrated management of alligator weed in Botany Wetlands in Sydney

Sydney Water provides drinking water and wastewater services to over four million people in the Sydney, Blue Mountains and Illawarra areas, including the Botany Wetlands which are situated within the metropolitan area of Sydney.

The Botany Wetlands are ecologically and aesthetically significant, but are also historically important as they served as a drinking water supply for Sydney in the mid 1800s. Alligator weed was first noted in waterways around 1985, but only occasionally treated with herbicides until the mid 1990s, by which time the infestation was out of control and posed a significant threat to the wetlands.

Sydney Water has since introduced an integrated weed management approach to deal with alligator weed. This combines vigilant and systematic monitoring for any new infestations, with regular application of suitable herbicides for both terrestrial and aquatic infestations and manual removal of floating masses. Other active management strategies include the lowering of water levels to allow better control, the large scale planting of native water plants in treated areas, and the controlled burning of sedges and rushes in selected infested areas. Additionally, in order to minimise environmental damage from chemicals, herbicides are not applied when the biological control agents are most active.

In terms of actual control efforts, herbicides are applied as spot-treatments to persistent patches at monthly intervals during cooler months, and more frequently in the warmer months (September–May). New infestations are treated with herbicides or are removed by hand picking as soon as practicable, with the ultimate aim of preventing further downstream spread. Disposal of collected live plant material is by burial in the sand in selected locations, following drying and herbicide treatment.

It is estimated that, on average, 90–95% of the previous alligator weed infestation has been controlled and removed since the adoption of the new integrated management plan in 1997. Although this is a relatively successful result, the inability to completely eradicate the weed from the wetlands reflects its resilience to current control measures and its ability to spread even when being carefully managed. It must also be recognised that the current gains made on alligator weed in the Botany Wetlands have been achieved through diligent and committed action, continual assessment, persistent management intervention and investment of labour and other resources.

Impacts of alligator weed include flooding due to blocked drains.
Photo: Rebecca Coventry

How to control alligator weed

Quick reference guide

Preventing spread

The main aim of alligator weed management in Australia is to prevent its spread from core infestations into new areas by:

- preventing new plant material entering Australia
- using weed hygiene protocols, such as washing contaminated equipment
- educating people to recognise it and respond to outbreaks.

The importance of monitoring

Early detection offers the only likelihood of finding infestations that are small enough to hope to eradicate. Monitoring of likely areas is therefore crucial to successful alligator weed management.

The limitations of current control techniques

Available management techniques for controlling alligator weed include:

- mechanical (eg weed harvesters in water bodies)
- physical (eg digging all material out to a depth of one metre)
- chemical (several herbicides registered for use on land or water)
- biological (eg the flea beetle attacks alligator weed growing in water).

Unfortunately each of these techniques has its limitations. Mechanical, physical and chemical control can all leave small fragments behind and actually increase the spread of alligator weed. These techniques therefore require a great deal of care and should only be conducted with the assistance of experts.

Other issues with these techniques include expense, the intensity of work required (eg spraying land infestations requires three treatments of two sprayings each), concern over residual herbicides in and around waterways and effects on non-target plants and animals, the difficulty of disposing of collected material and the need for continual follow-up work.

This simple screen has effectively prevented the spread of alligator weed into nearby wetlands. Photo: Graham Prichard

Control options

Type of infestation	Best way to control
Backyard infestations	Backyard infestations should be reported to your local council or state/territory weed management agency. Herbicides have been used successfully in different regions, but will require many repeated treatments. Care must be taken to prevent the spread of weed through fragments escaping from the garden.
In a waterway	Alligator weed in waterways should be reported to your local council or state/territory weed management agency. Herbicides are most effective when above water vegetation is greatest. Manual or mechanical removal may also be possible. If not already present, flea beetles should be introduced. Integration of all of these techniques will ultimately provide the best results.
On land	Alligator weed on land should be reported to your local council or state/territory weed management agency. Effective herbicides are available; however, treatments must be repeated frequently during the growing season. Biological control does not yet impact on land infestations, but other management techniques such as revegetation or physical removal are useful.

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