Eyre Peninsula Landscape Board

PEST SPECIES REGIONAL MANAGEMENT PLAN

Chrysanthemoides monilifera
Boneseed

This plan has a five year life period and will be reviewed in 2027.

INTRODUCTION

Synonyms

Osteospermum moniliferum subsp. moniliferum

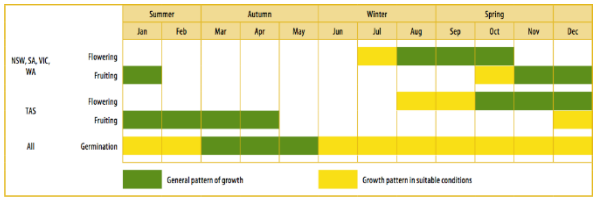
Biology

The erect perennial shrub *Chrysanthemoides monilifera* subsp. *monilifera* (L.) Norl. or boneseed is in the Asteraceae (daisy) family. It grows to 3 m high, typically with a single trunk up to 20 cm or more **[1]**.

Boneseed can grow in full sun or shade and will grow throughout the year if moisture is sufficient **[2, 3]**. Boneseed is capable of growing in coastal ecosystems such as dune and estuarine habitats, and grows in heathlands, headlands, grasslands, and dry sclerophyll forests **[1]**. It also occurs inland in mallee shrublands and open eucalypt woodland.

In South Australia, flowering generally occurs between July and October (Figure 1), with fruit production between October and January **[1]**. The flowers are fertilised by a variety of insects, including bees **[1]**. Up to 50,000 seeds are produced per plant per year, with seed viability between 800-3,000 / m^2 **[1]**. Seeds can germinate at any time of the year once the seed coat is cracked and if there is sufficient soil moisture, but seedlings mainly emerge in autumn **[4]**. Flowering may commence at 18 months of age, although with fire or good conditions, plants may flower earlier **[1]**. Plants are estimated to live for 10 to 20 years **[3]**. Boneseed is fire-sensitive (i.e. killed by fire), intolerant of water-logged soil conditions, salt spray and mild frosts **[2]**.

Figure 1: Boneseed seasonal growth patterns. Source: [2].



Origin

In South Africa there are six subspecies of *Chrysanthemoides monilifera*, each with a well-defined geographical range **[1]**. Boneseed *C. monilifera* ssp. *monilifera* is native to the Cape region of South Africa, where it occurs along the south west and south coast and adjacent mountains **[1]**. The bitou bush *C. monilifera* ssp. *rotundata* is the only other subspecies present in Australia. It is restricted to the eastern states of Australia, and is also a Weed of National Significance.

Boneseed was first recorded in Sydney in 1852, and was recorded in Adelaide in 1892 **[1]**. It was originally cultivated in most states as a garden shrub, and most of the present infestations are garden escapees.

Distribution

In Australia boneseed is widely distributed throughout the southern states (Figure 2). In South Australia, extensive infestations occur around Adelaide, the Mount Lofty ranges, and in the Murray River and south east regions, with scattered infestations also occurring on the Eyre and Yorke Peninsulas **[1]**.

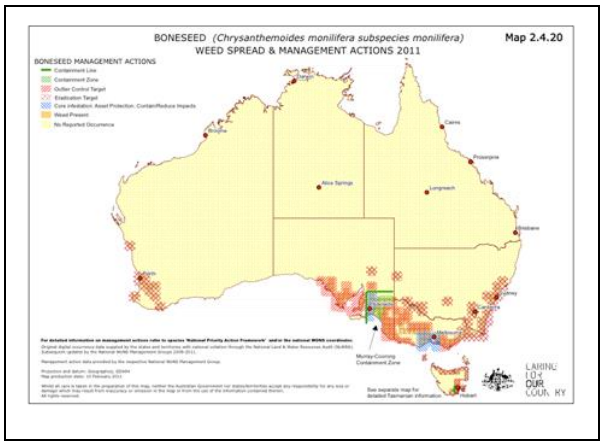


Figure 2: Australian distribution (2011) and management actions for boneseed *Chrysanthemoides monilifera* ssp. *monilifera*. Source:

In South Australia boneseed occurs in regions that receive 200 mm or more of rain a year **[1]**. BIOCLIM analysis indicates that boneseed could expand into vast tracts of southern Australia (Figure 3). Recorded distribution from control efforts on the Eyre Peninsula demonstrate significant infestations across the region (Figure 4).

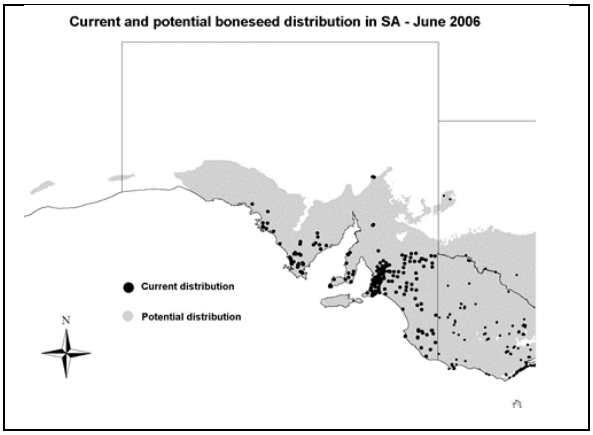


Figure 3: Current (2006) South Australian distribution (dot) and potential distribution (grey shading) – BIOCLIM analysis (Clare O'Brien 2006, Department of Environment and Climate Change, NSW) Source: [1].

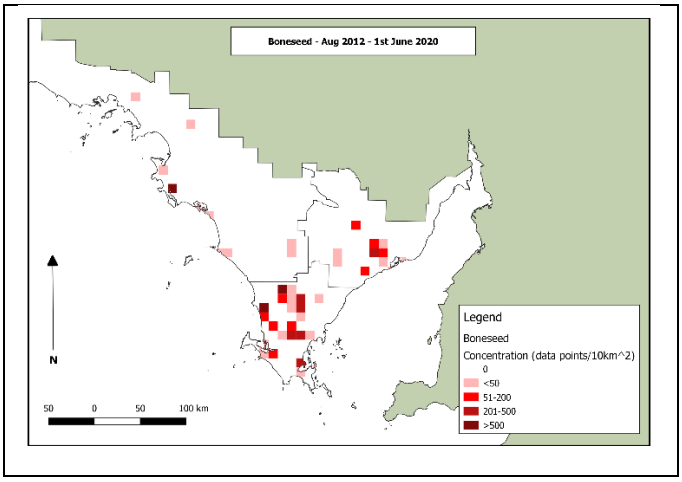


Figure 4: Distribution of Boneseed on Eyre Peninsula using BDBSA data and EPLB control data collected from August 2012 to June 2020.

RISK ASSESSMENT

Pest risk

Boneseed is a pest plant due to its ability to invade and displace native plant communities where it reduces native plant diversity and soil seedbank diversity **[5]**. Boneseed can become the dominant plant in the middle storey of native plant communities **[3]**, and can reduce native plant species richness by up to 25%.

Boneseed proliferates in Australia because of its rapid growth, large seed production, capacity to develop large dormant soil seed banks, and lack of natural enemies in Australia (native or introduced).

Seed dispersal occurs either by fruit falling off the parent plant or by animals ingesting the fruits and either defecating or regurgitating viable seeds in a different location – possibly resulting in long-distance dispersal. The fleshy fruit of boneseed is attractive to a wide range of vectors including rabbits, foxes, emus, and many other frugivorous birds, brushtail possums, ants, and stock such as cattle and sheep **[1]**. Seeds can also be transported by fresh or salt water. Humans can spread the seeds by dumping garden waste and soil, and by transporting seeds on machinery **[2]**. Analysis of seed dispersal by blackbirds suggests that typical dispersal distance are usually up to 100 m, with occasional long-distance gap-crossing 'saltation' dispersal events reaching up to two kilometres **[6]**. Based on these data, an effective dispersal distance of up to 500 m from an infestation can be anticipated, but where emus and foxes are important vectors this distance should be extended to two kilometres.

Maximum dormancy of seeds is unknown, but as long as the seed coat remains intact the seed can remain dormant in soil **[2]**. The seed bank is long-lived (greater than three years) **[7]**, with a low percentage of seeds remaining viable up to ten years **[8]**. Fire and physical disturbance can trigger mass germination events **[2]**, with field germination after a fire up to 150 times greater than unburnt areas **[9]**. Vegetative reproduction can occur when stems come into contact with soil, for example in sand dune systems when plants are covered by sand **[1]**.

Feasibility of control

Boneseed can be suppressed by an integrated approach using a combination of manual control, chemical control, (e.g. cut-and-swab, stem injection, foliar spray, or splatter gun), mechanical control (e.g. mechanical pulling, slashing and grooming) fire, and revegetation, with for example, direct seeding of native grasses **[2]**.

There are three stages to achieving successful weed control **[2]**:

1. primary treatment – removal of mature boneseed plants and existing seedlings;
2. secondary treatment – intensive control of the seedlings that emerge after removal of mature boneseed plants, and control of resprouting mature plants; and
3. maintenance weeding – ongoing removal of boneseed seedlings that establish from the seedbank or from seeds imported to the area by birds or other sources.

Follow-up control (i.e. secondary treatment and maintenance weeding) is crucial because boneseed seedlings can continue to germinate from the long-lived seedbank, possibly for up to ten years **[2]**. But, as boneseed rarely flowers in its first year, the first flush of seedlings after clearing can be left to naturally thin out over summer, before they are pulled up in autumn. Subsequent to fire the main consideration is the need for follow-up seedling control, as fire stimulates boneseed germination **[2]**, with seedling densities as high as 2300 / m^2 **[10]**.

Biological control agents introduced for boneseed have had no impact to date. The boneseed leaf buckle mite (*Aceria* sp.) was released in 2008, but has yet to establish **[11]**. Another potential agent, the boneseed rust fungus (*Endophyllum osteospermi*), is still in the research phase **[11]**.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national framework for environmental management (including the recognition of nationally threatened species and ecological communities), thereby directing resources towards the delivery of improved environmental protection. The EPBC Act applies where boneseed threatens any listed species or ecological community or where its control may have adverse effects on matters of national environmental significance on Commonwealth land. *Chrysanthemoides monilifera* was listed as one of the 20 Weeds of National Significance (WONS) in 2000 **[12]**, following which a national strategy was produced **[13]**. The national strategy aims to: prevent further introduction and spread of bitou bush and boneseed; minimise adverse impacts of bitou bush and boneseed on biodiversity.

As part of this national strategy the eradication of Western Australian and Yorke and Eyre Peninsula's infestations will allow the establishment of a western boneseed containment line (Figure 5).

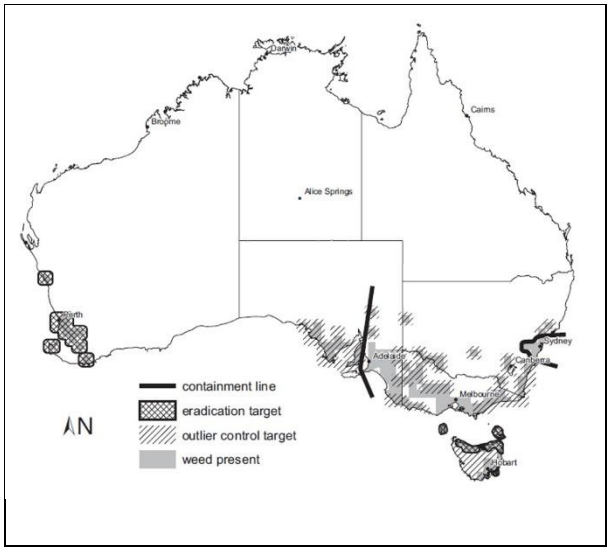


Figure 5: Western boneseed containment line and eradication zones. Source: [14].

Status

Within the EP Landscape region a risk management assessment **[15]** shows boneseed merits a contain spread management category in native vegetation and urban environments. (Table 1)

Land Use	Pest Risk	Feasibility of Control	Management Action
Native vegetation	Very High	Medium	Contain Spread
Urban	High	High	Contain Spread

Table 1: Regional Assessment

REGIONAL RESPONSE

Outcome

Destroy all boneseed infestations.

Objectives

To:

1. destroy all known boneseed infestations
2. prevent the spread of boneseed by searching for outlier infestations near known infestations;
3. destroy any new infestations identified;

Area/s to be protected

All areas.

Actions

Land managers to:

1. survey and control known infestations before they have a chance to seed (at least every second year) and supply survey and control information on request to Eyre Peninsula Landscape Board staff; and
2. prevent the spread of boneseed by searching annually for outlier infestations near known infestations.

Landscape Baord staff to:

3. facilitate, encourage or compel (develop action plans) control on private land before plants can seed;
4. facilitate, encourage, compel or undertake control on public land, including roadsides, before plants can seed (costs may be recovered from landmanagers);
5. where possible hasten boneseed control by using prescribed burning to kill or germinate the seedbank;
6. carry out opportunistic monitoring for sale of boneseed plants at markets and community events;
7. develop localised annual action plans to achieve the objectives and actions of this management plan
8. assess opportunity for boneseed control post fire or other disturbance;
9. undertake systematic data collection (control and survey numbers, location and date information) and storage in a central spatial database;
10. raise community awareness to promote boneseed control across the region; and
11. write a 10 year Management Plan for the large infestation in Eastern EP.

Evaluation

Evaluation of success will be based on:

- annual analysis in November of monitoring and control data to evaluate the success of pest plan actions (including the update of spatial layers);
- identify any gaps in delivery and action as soon as possible; and
- review of this pest management plan every five years.

Declarations

In South Australia boneseed is a declared weed under Schedule 2 (CLASS 18 – Provisions: 186 (1) (2), 188 (1) (2), 192 (2), and 194 for the whole state) of the *Landscape South Australia Act 2019* (Table 2). Meaning that movement or transport of the plant on a public road by itself or as a contaminant, its entry to South Australia, or the sale by itself or as a contaminant are prohibited. Land owners are required to control any boneseed plants growing on their land. Landscape authorities are required to control plants on road reserves, and may recover costs from the adjoining land owners.

Table 2: Relevant sections of the South Australian *Landscape South Australia Act 2019*. Declared Weed Status provisions for Boneseed for the whole of state.

Section	How the section applies
186 (1) (2)	Prohibiting entry to area Prohibiting movement on public roads
188 (1) (2)	Cannot sell the plant Cannot sell any produce/goods carrying the plant
192 (2)	Land owner must control the plant on their land
194	Landscape board may recover costs for control of weeds on road reserves from adjoining land owners

More information

Contact your local Eyre Peninsula Landscape Board office

www.landscape.gov.au/ep/contact-us

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References

1. Weiss, P.W., et al., 2008. *Chrysanthemoides monilifera subsp. monilifera (L.) T.Norl. and subsp. rotundata (DC) T.Norl.* Plant Protection Quarterly, **23**(1): p. 3-14.
2. Brougham, K.J., H. Cherry, and P.O. Downey, eds. 2006, *Boneseed Management Manual: current management and control options for boneseed (Chrysanthemoides monilifera ssp. monilifera) in Australia.* Department of Environment and Conservation NSW: Sydney. 82.

3. Muyt, A., 2001, *Bush Invaders of South-East Australia: a guide to the identification and control of environmental weeds found in South-East Australia*. Melbourne: RG and FJ Richardson.
4. Lane, D., 1976, *Boneseed (Chryanthemoides monilfera L.). Pamphlet No. 60 Keith Turnbull Research Institute*. Department of Crown Land and Survey: Victoria.
5. Thomas, P.B., H. Possingham, and R. Roush, 2005. *Effects of boneseed (Chrysanthemoides monilfera (L.) Norl. ssp. monilifera) on the composition of the vegetation and the soil seed bank of an open eucalypt woodland*. Plant Protection Quarterly, **20**: p. 74-80.
6. Williams, P.A., 2006. *The role of blackbirds (Turdus merula) in weed invasion in New Zealand*. New Zealand Journal of Ecology, **30**(2): p. 285-291.
7. Schoeman, J., et al., 2010. *Inter-population variation in seed longevity for two invasive weeds: Chrysanthemoides monilifera ssp. monilifera (boneseed) and ssp. rotundata (bitou bush)*. Weed Research, **50**(1): p. 67-75.
8. Weiss, P.W., 1984. *Seed characteristics and regeneration of some species in invaded coastal communities*. Australian Journal of Ecology, **9**: p. 99-106.
9. Lane, D.W. and K. Shaw. 1978. *The role of fire in boneseed (Chrysanthemoides monifera (L.) Norl.) control in bushlands*. in *1st conference of the Council of Australian Weed Science Societies*. Weed Science Society of Victoria, Melbourne.
10. Weiss, P.W., 1983, *Invasion of coastal Acacia communities by Chrysanthemoides*, PhD. Australian National University: Canberra.
11. Natural Resource Ministerial Council of Australia & New Zealand, 2011, *Weeds of National Significance Bitou bush and Boneseed (Chrysanthemoides monilifera ssp rotundata and monilifera) Strategic Plan*. Australian Weeds Committee: Launceston, Tasmania. p. 29.
12. Thorp, J.R. and R. Lynch, 2000, *Determination of Weeds of National Significance*. National Weeds Strategy Executive Committee: Launceston.
13. Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and Australian and New Zealand Environmental and Conservation Council (ANZECC) and Forestry Ministers, 2000, *Weeds of National Significance Bitou Bush and Boneseed (Chrysanthemoides monilifera ssp. rotundata and monilifera) Strategic Plan*. . National Weeds Strategy Executive Committee: Launceston.
14. Cherry, H. 2010. *Boneseed in Australia: research, management and coordinated action*. in *Seventeenth Australasian Weeds Conference*. Christchurch Convention Centre, Christchurch NZ.
15. Virtue, J.G., 2008, *SA Weed Risk Management Guide February 2008*. Adelaide: Department of Water Land and Biodiversity Conservation - South Australia. 22.
16. N&YNRM & EPNRM, 2008, *Ten Year Boneseed Management Plan*. Northern and Yorke Natural Resources Management Board & Eyre Peninsula Natural Resources Management Board.