Bitou bush and boneseed eradication and containment in Australia

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Introduction

Bitou bush and boneseed (*Chrysanthemoides monilifera* subsp. *rotundata* (DC.) T.Norl. and *C. monilifera* subsp. *monilifera* (L.) T.Norl., respectively) are highly invasive environmental weeds that pose a serious threat to Australia's natural ecosystems and biota. Bitou bush threatens coastal plant communities in New South Wales (NSW), eastern Victoria and south-east Queensland (Qld), while boneseed threatens inland and coastal native plant communities across NSW, South Australia (SA), Tasmania, Victoria, and Western Australia (WA). Over 200 plant species and ecological communities in Australia are negatively impacted by these weeds (ARMCANZ *et al*. 2000, DEC 2006) and over 15% (approx. 120 million ha) of Australia is susceptible to invasion (see maps in Weiss *et al* 2008).

In 2000, the National Bitou Bush and Boneseed Strategic Plan (ARMCANZ *et al*. 2000) was approved as part of the Commonwealth's Weeds of National Significance initiative. A key goal of this plan is to prevent the spread of bitou bush and boneseed in Australia. A national program sponsored by the Australian Government and the affected states has resulted in the development of national containment and eradication zones that prevent the spread of bitou bush and boneseed. This paper presents an overview of these bitou bush and boneseed containment and eradication programs.

Bitou bush containment

Queensland eradication and surveillance

By the early 1980s, bitou bush had infested approximately 700 ha of the south-east Qld coast, with the potential to invade as far north as Yeppoon. Land managers recognized this threat: bitou bush was declared noxious under Qld legislation and became the target of an eradication campaign. This led to one of the longest running bitou bush control programs in Australia. Control work began in 1982 on the major infestations and a decade later just small infestations remained. By 2007, infestations were reduced to only scattered individual plants, which are under annual control. However the initial areas still require annual searching to prevent reinvasion, thus the cost of controlling individual plants and searching for them has increased dramatically over the years.

In the late 1990s, aerial surveys were introduced to the eradication program as a means of monitoring progress and surveying infestations. Aerial surveys are now carried out every three years. Under the current treatment program, all known bitou bush infestations are physically surveyed and treated annually. When the eradication project commenced, 90% of plants found were adults, which were treated with herbicide, now the majority are seedlings that are manually removed.

This eradication and surveillance program is a joint effort between Qld Department Primary Industries and Fisheries, Qld Environmental Protection Agency, the relevant Qld local government authorities and Tweed Shire Council in NSW, as the project also includes maintaining a bitou bush-free buffer zone along the NSW/Qld border. The combined input from key stakeholders to maintain this program is estimated at approximately $80 000 annually. Given that bitou bush could invade extensive areas of coastal Qld, the investment to date has resulted in significant savings by eliminating the need to manage this weed over a wider area (either now or into the future).

Because the area of land to be surveyed annually is large and the probability of reinvasion from extensive infestations in neighbouring NSW is high, it is likely that this program will need to continue for many years to come. Although Qld is aiming at eradication, long-term surveillance and follow-up control will be necessary to ensure this eradication goal is achieved. Now that all major bitou bush infestations have been eliminated in Qld, sustained support for the program is critical to continue protecting the state from the impacts and costs associated with bitou bush reinvasion.

Northern NSW bitou bush containment line

In 1995, a bitou bush containment line and buffer zone was established along the Tweed River at the NSW/Qld border, thereby preventing the northward movement of bitou bush seeds into Qld. This project also aims to move the containment line south over time. The containment line supports the Qld eradication program (see above), as well as regional efforts to reduce the extent of bitou bush infestations in northern NSW. The containment line and buffer zone are jointly maintained by the Qld Department of Primary Industries and Fisheries and the Tweed Bitou Bush Steering Committee, in conjunction with other relevant stakeholders including the North Coast Weeds Advisory Committee (see Jamieson and Luxton 2008). The highly coordinated, regional approach ensures efficient management and has enabled the groups to obtain critical funding, including state and federal government grants. These funds have also been used to tackle other coastal weeds in the region in a holistic manner.

Southern NSW bitou bush containment line

In 2002, the South Coast Bitou Bush Task Force (SCBBTF), together with relevant stakeholders, prepared the South Coast Bitou Bush Management Plan, which identified the need for a national southern bitou bush containment line at Tuross Head, NSW (for further detail, see Thompson and Pomery 2008). The location of the containment line was decided upon after the SCBBTF mapped all bitou bush infestations and selected priority control and containment areas.

Since the inception of the Plan, the Task Force has been working together to stop the southward spread of bitou bush. Bitou bush infestations in southern NSW, below and above the containment line, have been significantly reduced. This has resulted in the northern movement of the containment line by over 100 km in just over five years. In the Eurobodalla Shire alone, bitou bush infestations were removed from over 2700 hectares of coastline and the beaches were returned to a native landscape.

In addition, an annual education, inspection and enforcement strategy for bitou bush was put in place across the south coast. Inspections carried out on public and private land since 2002 have led to over 420 private landholders controlling bitou bush on their land. North of the containment line, the SCBBTF is working to protect a number of Endangered Ecological Communities threatened by bitou bush. While south of the containment line, bitou bush is now under control and no longer represents a threat to biodiversity over the 350 km of coastline from Sussex Inlet to the Victorian border. The SCBBTF is also working with Victorian stakeholders to eradicate bitou bush from north-eastern Victoria.

The success of this program is due to a coordinated regional approach and

the overwhelming contribution of the community. Landcare and Coastcare groups have dedicated thousands of hours towards controlling this weed and restoring the beaches to their original condition

Boneseed eradication and containment

Western Australian eradication program

Boneseed in WA is currently restricted to 35 small (i.e. average of <1 ha) isolated populations. These small populations, however, have the potential to expand across the entire southwest of the state, an area of approximately 37 Mha. Thus, eradication of boneseed in WA is seen as a national priority.

A boneseed eradication program for WA began in 2007, led by the National Boneseed Coordinator in conjunction with the Department of Agriculture and Food WA, five affected Natural Resource Management (NRM) regions, local government and the community. Initially, a WA Boneseed Eradication Strategy was developed to engage the relevant stakeholders and ensure long-term commitment as well as establish an action plan for new incursions. All infestations were mapped and assessed. In addition, an intensive 'Boneseed Blitz' awareness campaign was undertaken during the flowering season to raise awareness and encourage the public to report infestations.

Following workshops held throughout southwest WA in May 2007, stakeholders committed to the strategy and to ongoing eradication at known boneseed sites. The eradication strategy is now being implemented with strong state and regional support, and all known population of boneseed are currently under control. A range of land managers and community members are currently engaged in development of individual site plans and long-term control and monitoring at each of the known sites. Successful implementation of this strategy, together with the National Boneseed Containment Line established in western South Australia (see below), will help to protect some of Australia's most biologically diverse ecosystems from the threat of boneseed.

Containment and control outlier infestations in Tasmania

Large areas of Tasmania remain boneseed-free, however they are still susceptible to invasion. Eliminating key outlier infestations and containing core infestations will prevent further spread into areas currently free of boneseed. In June 2007, the Australian Government's Defeating the Weed Menace Program and Tasmanian State and NRM bodies provided support for the strategic control of outlying boneseed infestations across Tasmania. The National Boneseed Coordinator, together with representatives from the three NRM regions, state agencies and non-government organizations, developed the Tasmania-wide project and formed the Tasmanian Boneseed Steering Committee. The committee identified priority outlier infestations for boneseed control throughout Tasmania and engaged contractors to undertake initial control works. The program is unique because it provides for initial boneseed control but also engages property managers and private landowners in follow-up control on their land for three subsequent years.

This project supports the work of 16 local government municipalities that have eradication of boneseed as a principle management objective under the Tasmanian *Weed Management Act 1999*, as well as supporting the Cradle Coast NRM program to eliminate boneseed from that region (see Taylor 2008). The program also supports the control of strategic boneseed infestations in remote areas where there is no local capacity, as these infestations are equally important from a strategic viewpoint. Community groups strongly support this program by continuing to contain and reduce core infestations. Thus, the Tasmanian program builds on current boneseed containment efforts by eliminating priority outlier populations, empowering landowners to prevent reinvasion, increasing community awareness and supporting the hard work of community volunteers.

National western boneseed containment line

With the exception of isolated populations in WA, the western edge of boneseed infestation in Australia is on the Eyre Peninsula, SA. However, only scattered populations occur on the Eyre and Yorke Peninsulas. A partnership between the Eyre Peninsula, and the Northern and Yorke NRM regions and the Australian Government's Defeating the Weed Menace Program was initiated to prevent further westward spread of boneseed in Australia, through the establishment of a western containment line. Land managers are coordinating and implementing on-ground works to control all of the 190 ha of boneseed west of this containment line (see Sheridan and Agnew 2008). In addition, this project aims to control key outlier populations across the Northern and Yorke NRM region as well as core infestations around Adelaide, to prevent further westward spread. The NRM bodies have committed to a 10-year boneseed containment and control program, including enacting community awareness campaigns to inform the public on the threat of boneseed in their regions. This program also strongly supports the WA Boneseed Eradication Program by reducing the possibility of westward spread.

National eastern boneseed containment

Revised potential distribution mapping of boneseed in 2005 indicated that a small number of existing populations could affect the majority of the Riverina region in NSW, if left uncontrolled. Following an awareness campaign based on the revised maps, the Eastern and Western Riverina Noxious Weeds Advisory Groups in southern NSW recognized boneseed as an emerging threat to their regions. The National Boneseed Coordinator is working with the NSW Department of Primary Industries and these regional advisory groups to develop a boneseed management strategy, including containment zones and a more stringent legislative listing for boneseed in the region under the NSW *Noxious Weeds Act 1993*. The goal of this strategy is to prevent further spread from current infestations, with the ultimate aim of eradicating boneseed from the region. While the establishment of a boneseed containment line at the NSW-Victoria border has not yet been achieved, the growing commitment to the problem is leading to a greater focus on boneseed in the area. The National Coordinator will continue to garner support for this program from a range of stakeholders in Victoria, the Australian Capital Territory and adjoining regions in NSW.

Conclusion

Raising awareness of the boneseed and bitou bush problem is a critical component of establishing nationally significant containment and eradication initiatives. The National Bitou Bush and Boneseed Program developed regionally-focused awareness materials such as posters, flyers and banners, which are freely available on the web (see www.weeds.org.au/WoNS/bitoubush) and from the National Coordinator (contact details above). These awareness materials are based on sound management information and research results. The National Bitou Bush and Boneseed Program will continue to support management efforts for these weeds and encourage research to improve our ability to control them. For example, information on seed longevity for both bitou bush and boneseed is unknown. In 2008, researchers will begin a 10-year seed longevity study and undertake a recently developed accelerated seed ageing test (Long 2007) for bitou bush and boneseed. These studies will provide insight into the length of time required to manage the seedbank, information which is critical to the success of eradication programs.

The programs outlined above highlight the success and significance of national eradication and containment programs, especially for managing widespread weeds that have yet to reach their full potential.

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References

ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand), ANZECC (Australian and New Zealand Environmental and Conservation Council) 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).

DEC (2006). 'NSW Threat Abatement Plan – invasion of native plant communities by C*hrysanthemoides monilifera* (bitou bush and boneseed)'. (Department of Environment and Conservation (NSW), Hurstville).

Jamieson, I. and Luxton, R. (2008). Management of bitou bush on the New South Wales north coast. *Plant Protection Quarterly* 23, 53-4.

Long, R.L. (2007). 'Predicting weed seed persistence: towards a technique for rapid and reliable assessment'. PhD thesis, The University of Queensland, Brisbane.

Sheridan, P. and Agnew, D. (2008). National western boneseed containment: a line in the sand on the Eyre and Yorke Peninsulas, South Australia. *Plant Protection Quarterly* 23, 47.

Taylor, G. (2008). The Cradle Coast boneseed incentive program. *Plant Protection Quarterly* 23, 42.

Thompson, K. and Pomery, D. (2008). New South Wales south coast bitou bush and boneseed control program. *Plant Protection Quarterly* 23, 55-6.

Weiss, P.W., Adair, R.J., Edwards, P.B., Winkler, M.A. and Downey, P.O. (2008). *Chrysanthemoides monilifera* subsp. *monilifera* (L.) T.Norl. and subsp. *rotundata* (DC.) T.Norl. *Plant Protection Quarterly* 23, 3-14.

Assessing the recovery of native plant species following bitou bush control – the need for monitoring

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Introduction

Weeds are acknowledged as a significant threat to the environment (WRI *et al*. 1992), but successful abatement of the weed threat has been hampered by a lack of information on the species at risk and inclusion of this information into weed management strategies (Downey 2008). This problem of lack of information persists because few people monitor weed control programs, and those that do rarely feed data into broader analyses. Monitoring is therefore vital for reporting on widescale trends and the success of individual control programs. However, designing a monitoring program is difficult because simple, clear guidelines for assessing the response of weed control on biodiversity are lacking. For example, which species should be monitored and what methods are the most appropriate?

We surveyed weed managers to determine the extent of monitoring being undertaken for the invasive plant, bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata* (DC.) T.Norl.), and the response of native species follow bitou bush control. The results support similar surveys of pest animal control programs in Australia (see Reddiex *et al*. 2006), albeit on a smaller scale, in that while biodiversity conservation is a stated aim, few people collect and analyse data to assess the success of control programs at protecting or promoting the recovery of native species. To rectify this problem we have developed standard monitoring guidelines, an outline of which we also present here.

Survey of monitoring programs

To determine the level of monitoring being undertaken for bitou bush control programs in New South Wales (NSW) and the nature of such programs, we surveyed over 70 land managers involved in control programs in early 2007. Of the 52 respondents, 85% said they undertook some form of monitoring. However, of the almost 90% of respondents who stated that an aim of their control program was biodiversity conservation, only 61% monitored the response of native plants to bitou bush control. Further, because the majority of these data were collected using photopoints (75%) or maps (64%), there are difficulties with determining specific species responses. Less than half these respondents collected data that could determine such responses as measured by density or estimated cover, with 43% using quadrats and 29% using species counts.

Surprisingly, just over a third of respondents used standard data sheets to record data in the field. But when asked if they would like to see standard data sheets developed, 84% answered yes. When asked about standard monitoring guidelines, 71% said they would like to see them developed, and none said they wouldn't.

Questions on data storage revealed that over one-third of respondents did not store their data electronically, while 44%