

### Acknowledgments

Much of this work was funded by the Australian Government's Defeating the Weed Menace Program and the National Heritage Trust. The National Coordinator would like to thank all state, regional and local groups and the dedicated community volunteers who have made these excellent outcomes possible.

### 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 *Chrysanthemoides 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

Scott A. King<sup>A,B</sup> and Paul O. Downey<sup>A</sup>

<sup>A</sup> Pest Management Unit, Parks and Wildlife Group, Department of Environment and Climate Change (NSW), PO Box 1967, Hurstville, New South Wales 1481, Australia.

<sup>B</sup> Current address: Monitoring, Evaluation and Reporting Unit, Scientific Services Division, Department of Environment and Climate Change (NSW), PO Box 1967, Hurstville, New South Wales 1481, Australia.

---

### 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 wide-scale 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 photo-points (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%

stored their data in a spreadsheet and 21% in a database. This trend carried through to data analysis, with 39% not undertaking any form of analysis. Of those who did analyse data, 72% performed simple analyses such as calculating percentages, but only eight percent graphed their data, and only four percent did statistical analysis.

The most commonly cited reasons for not undertaking more monitoring were: a lack of time (80%), funds (64%), guidance (44%) and expertise (28%). Given the importance of monitoring in assessing the outcomes of management programs, these results suggest that many bitou bush control programs may need to be restructured to accommodate monitoring programs, especially once monitoring guidelines become available (see below).

### Standard monitoring guidelines

The survey revealed clear support for further assistance with monitoring and the development of monitoring guidelines. In response, and to assist with implementing the NSW Bitou Bush Threat Abatement Plan (Bitou TAP; DEC 2006), a monitoring manual is being developed (King *et al.* 2008). These guidelines are not restricted to monitoring the response of bitou bush following control, but also cover other weed species and the response of priority native species and ecological communities to bitou bush control. Lastly, the guidelines include information on monitoring the investment of time and resources stakeholders commit to controlling bitou bush and protecting native species.

The Bitou TAP monitoring guidelines are structured using a three tiered approach, with options of techniques ranging from simple qualitative mapping through to robust research studies. Site managers select the techniques most suitable to their needs and resources as well as the aims of their management program. Techniques described in the guidelines include mapping, photo-point monitoring, qualitative observations, population censuses, and estimates and measurements of cover and density. The guidelines also contain a series of data sheets for the different techniques to simplify data collection in the field. Lastly, the guidelines explain how to analyse and present the results of a monitoring program.

In the first instance, these guidelines will be used to establish monitoring programs at many of the 169 priority Bitou TAP sites along the coast of NSW. The benefit of using standard monitoring guidelines is that we can centrally compile results from every site to provide a state-wide analysis and overview of the Bitou TAP, including the control of bitou bush, the response of the native species at risk and the cost of implementing such actions. Copies of the Bitou TAP monitoring guidelines can be downloaded from DECC (2007). It is anticipated that the Bitou TAP monitoring guidelines can be adapted for use in monitoring other weed control programs for biodiversity conservation.

### Acknowledgments

We thank the survey respondents for their input. In addition we thank the referees for comments on an earlier version.

### References

- DEC (2006). 'NSW threat abatement plan – invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)'. (Department of Environment and Conservation NSW, Hurstville).
- DECC (2007). 'Bitou bush and boneseed threat abatement plan'. (Department of Environment and Climate Change NSW, Sydney). URL: [http://www.nationalparks.nsw.gov.au/npws.nsf/content/bitou\\_bush\\_tap](http://www.nationalparks.nsw.gov.au/npws.nsf/content/bitou_bush_tap) (accessed 2 August 2007).
- Downey, P.O. (2008). Determination and management of alien plant impacts on biodiversity: examples from New South Wales, Australia. *In* 'Plant invasion: human perception, ecological impacts and management', eds B. Tokarska-Guzik, J. Brock, G. Brundu, L. Child, C. Daehler and P. Pyšek, pp. 369-85. (Backhuys Publishers, Leiden).
- King, S.A., Burley, A.L. and Downey, P.O. (2008). 'Monitoring manual for bitou bush control and native plant recovery'. (Department of Environment and Climate Change, Sydney).
- Reddiex, B., Forsyth, D.M., McDonald-Madden, E., Einoder, L.D., Griffioen, P.A., Chick, R.R. and Robley, A.J. (2006). Control of pest mammals for biodiversity protection in Australia. I. Patterns of control and monitoring. *Wildlife Research* 33, 691-709.
- WRI, IUCN and UNEP (1992). 'Global biodiversity strategy: guidelines for action to save, study, and use the earth's biotic wealth sustainably and equitably'. (World Resources Institute (WRI), The World Conservation Union (IUCN) and United National Environment Programme (UNEP), Washington).