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Do natural ecosystems benefit from the management of Weeds of National Significance?

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The issue

Weeds pose a significant threat to natural ecosystems in Australia and consequently large quantities of resources are spent each year to manage them. Amongst these, species identified as Weeds of National Significance (WoNS) are particularly important. The capacity of weed management programs to contribute to biodiversity conservation in Australia has not been comprehensively assessed.

A desktop analysis was undertaken to investigate how native ecosystems respond following weed management. The project: 1) reviewed the scientific literature for studies on management of WoNS in natural ecosystems, 2) surveyed by e-mail land managers managing WoNS in these ecosystems and 3) analysed data gathered in field experiments on two WoNS species: bridal creeper and bitou bush (pictured below).



Findings

The literature search found 94 published papers on the management of WoNS in natural ecosystems in Australia. A review of these papers revealed that the response of natural ecosystems following WoNS management was rarely monitored. Of the 17 studies that did incorporate some form of plant communities monitoring, it was found that native plant species did not necessarily recover. Moreover, in many cases the WoNS either re-invaded or was replaced by other weed species. There was also a distinct lack of information (only three studies) on the response of animal and microbial communities and ecosystem processes following the control of a WoNS.

A total of 168 replies to the land manager survey were received, with more than 50% of management programs focusing on four WoNS: blackberry, bitou bush/boneseed, bridal creeper and willows. Results from the survey revealed that although biodiversity conservation was the aim of 76% of programs, monitoring efforts focused on the response of the target weed to management and to a much lesser extent on the response of other plant species. Respondents who answered the question on changes in plant communities after management reported that the WoNS was replaced by bare ground (8%), by weed species only (including the target WoNS) (13%), by native plants only (25%) and by a combination of native and weed species (44%). Ten per cent of respondents did not record the replacement species.

The native plant species *Pimelea spicata* threatened by bridal creeper. Photo Tony Willis, CSIRO Plant Industry.



The rust fungus (*Puccinia myrsiphylli*) released in 2000 for the biocontrol of bridal creeper. Photo CSIRO Entomology.

The bridal creeper and bitou bush case studies provided examples of scientific monitoring of plant communities following management of WoNS in natural ecosystems. These studies showed that while management effectively reduced densities of bridal creeper and bitou bush, there was limited recovery of native plant species over the monitoring period. The relatively short-term nature of these studies (two to three years), which is comparable to the majority of on-ground monitoring programs, may be in part responsible for the limited recovery reported.



Discussion

Given the combined findings of the three components of this project, it is clear that management programs for WoNS and other weed species in natural ecosystems should put greater emphasis on monitoring the response of native species to the reduction or removal of target weeds. Some monitoring is essential to check whether the management methods used damaged native plants and to decide whether additional interventions are required to assist native plants recover. Microbial and animal communities, and ecosystem processes should also be monitored for a more thorough assessment of how natural ecosystems respond to weed management. However, it is unrealistic to expect most on-ground land managers to implement this type of detailed monitoring. Such monitoring is better left for trained researchers to undertake at representative sites.

A whole-system approach, integrating weed management programs with other actions (e.g. planting native species) is essential to assist the recovery of native communities and restore the structure and function of ecosystems, protecting against future weed invasion. Long-term monitoring is crucial to evaluate the effectiveness of this integrated approach for restoring ecosystems.



Evaluating the impact of a biological control agent on bridal creeper and the response of associated vegetation to a reduction in the weed population. Photo Peter Turner, CSIRO Entomology/University of Western Australia.

Recommendations

Management of weed-invaded natural ecosystems

1. Weed management programs should target sites with high conservation value, such as those containing threatened native species or ecological communities and where management and recovery are likely to succeed.
2. Weed management programs should be set into a broader context of natural ecosystem management and restoration to encourage recovery of degraded habitats and increase their capacity to resist future weed invasions.
3. Before starting weed management programs, native species at risk and other significant impacts (e.g. changes in soil nutrients) from weed invasion should be identified at a site level and carefully monitored during and after management. This would enable ongoing evaluation and implementation of additional or different management strategies, if necessary, to ensure recovery of the ecosystem.
4. Unless a WoNS (or other dominant weed species) of natural ecosystems is targeted for eradication or containment, management should target multiple weed species at a site, by combining a range of appropriate methods where necessary, and have the long-term aim of restoring native communities and ecosystem processes.

5. Active monitoring of the response of weeds and native plant communities using quantitative methods should be an integral component of weed management programs in natural ecosystems to underpin subsequent adaptive management actions and document outcomes of programs.
6. National or state/territory-based systems, such as the Threat Abatement Plans developed for bitou bush and lantana that identify native species or communities at risk from weed invasion, should be developed for other priority weeds (including WoNS) within regions to prioritise invaded sites for management in order to achieve the greatest outcomes for conservation.

Support for land managers

7. A core set of monitoring and restoration protocols (with a strong emphasis on measuring the response of plant communities to weed management) should be developed to assist land managers responsible for weed management within natural ecosystems.
8. Training should be provided to land managers in plant community monitoring (including data collection, analysis and interpretation) and restoration principles and techniques.

Funding

9. Applications for funding to support weed management programs in natural ecosystems should include details of the monitoring schedule that will be used to assess the response of native communities and outline strategies that will be implemented to restore the habitat.
10. Funding bodies should tie subsequent weed management funding to on-ground outcomes that demonstrate effectiveness of the initial management program and the response of plant communities.
11. Longer-term funding should be made available for programs that integrate weed management with native species conservation and/or habitat restoration, underpinned with sustained monitoring and reporting activities.



WoNS program

- 12. During the review of each of the 20 WoNS strategies, specific actions on monitoring the response of native species to weed management programs over a sufficient timeframe should be included.
- 13. Priority should be given to ensuring that all WoNS that invade natural ecosystems have baseline data on their impacts to native species and ecosystems.

Partnerships

- 14. Weed management and restoration practitioners should work more closely together to ensure better outcomes for conservation following weed management programs.
- 15. National and state/territory meetings of weed scientists, restoration ecologists and practitioners should be organised to establish dialogue, identify needs and develop collaborative research programs.

Research

- 16. While a better understanding of the impact of weeds on natural ecosystems is still required, particularly for ecosystem processes, more emphasis should be given to research investigating:
 - the process by which weeds cause native species to decline and the implications for management
 - the effects of reducing or removing weeds on restoration of ecosystems
 - ways of overcoming persistent effects of weed invasion that prevent or delay ecosystem recovery (e.g. change in nutrient levels, residual allelopathic chemicals, slow decomposition of below-ground organs)
 - long-term field comparisons of the benefits for native species and cost effectiveness of various weed management and restoration approaches
 - mechanisms that increase resilience of native communities to weed invasions.
- 17. Research findings should be made available to practitioners in a format that allows them to adapt their management actions to a range of situations.



Willow. Photo Roger Charlton.

This project was conducted by Drs Adele Reid and Louise Morin (CSIRO Entomology), Dr Paul Downey (NSW Department of Environment and Climate Change), Associate Professor Kris French (University of Wollongong) and Dr John Virtue (South Australian Department of Water, Land and Biodiversity Conservation).

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The full report is available from lwa.gov.au/weeds
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