

Defeating the Weed Menace R&D: facilitating innovation and adoption

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Summary Since 2004 the Australian Government has committed \$44.4 million to a national program to identify Australia's most threatening weeds and to implement measures for their control.

A research and development (R&D) component of the Defeating the Weed Menace program is managed by Land and Water Australia on behalf of the Department of Agriculture, Fisheries and Forestry and the Department of the Environment, Water, Heritage and the Arts. The goal of this two year R&D component is 'To generate new knowledge to prevent the development of new weed problems, to reduce the impacts of existing weeds of national priority, and to build capacity for their management into the future' (Land and Water Australia, undated).

Between June 2006 and June 2008, 25 projects have been directed to: assessing risks of different pathways of weed ingress; impacts of land use change on weed incursion; developing 'best practice' early detection, survey and eradication of potential weed species; identifying biocontrol agents for priority weed species; developing new integrated weed management strategies that incorporate an understanding of landscape scale ecological processes; and quantifying the impacts of weeds on sustainability and the environment (including the ecological costs of weeds) and the relative benefits and costs of different weed control measures, as well as providing knowledge to support a national information system for weeds.

This paper will present a snapshot of several projects that have developed and piloted new approaches to the prevention and control of weed invasion and spread, and the ways in which the portfolio of Defeating the Weed Menace R&D is being used to develop integrated weed management advice.

Keywords Weeds R&D, national priorities, innovation, adoption.

INTRODUCTION

The Australian Weeds Strategy (Commonwealth of Australia 2007) identifies that weeds have major economic, environmental and social impacts in Australia. Each year, weeds are estimated to cost Australian agriculture around \$4 billion. To that can be added similar costs in damage to natural landscapes, waterways and coastal areas.

The Defeating the Weed Menace Research and Development component (DWM R&D) sought to commission a diversity of projects addressing various aspects of weed management for those species that have significant impacts at a national scale.

As the program is nearing completion, this paper provides a timely overview of the research that has been conducted and the products of that research.

MATERIALS AND METHODS

A scoping study completed by CSIRO scientists for the CRC for Australian Weed Management (2005), provided the basis for a program of weeds research and knowledge management. Land and Water Australia entered into an agreement with the Australian Government's Department of Agriculture, Fisheries and Forestry (DAFF), to manage that research to support other aspects of the DWM program and to complement existing weeds research.

The key focus of this work has been the generation of new knowledge, and assimilation of that knowledge with existing knowledge to help prevent the development of new weed problems, to reduce the impact of existing weeds that are of national priority, and to build capacity for their management into the future

Integrating scientific and policy priorities DWM R&D is managed by Land and Water Australia, with its commitment to sustainable natural resource management across natural and production landscapes. This work is overseen by a management committee that brings together weed science with both agricultural production and environmental policy. DAFF and Environment, Water, Heritage and the Arts (DEWHA), together with a member of the Land and Water Australia Board and the CEO of the CRC for Australian Weeds Management have overseen the program.

Projects addressing national priority themes The work of the DWM R&D component was shaped by a set of priority themes, each underpinned by several sub-themes, which can be summarised as follows.

Theme 1: Reducing the rate of emergence of new weed problems.

- Assessing risk of different pathways of weed ingress
- Land use change impacts on weed incursion
- Developing 'best practice' early detection, survey and eradication of potential weed species
- Developing efficient methods for surveying and eradicating agreed emergent weeds, and options.

Theme 2: Reducing the impact of existing weed problems of national priority.

- Identifying biocontrol agents for priority weeds
- Developing new integrated weed management strategies that incorporate an understanding of landscape scale ecological processes

Theme 3: Supporting national frameworks and capacity for sustainable weed management.

- Quantifying the impacts of weeds on sustainability and the environment and the relative benefits and costs of different control measures
- Providing knowledge to support a national information system for weeds.

RESULTS

Through a mix of selective tender and open call processes at intervals during the life of DWM, a total of 25 projects have been commissioned addressing the above themes and sub-themes.

All projects aim to be completed by 30 June 2008. Each will have identified both knowledge products arising from the project, and additional knowledge assets to be developed through assimilating existing weed management knowledge and new knowledge from projects within DWM.

The development of biological control agents occupies a prominent place among weeds research proposals. Approximately 30% of all R&D funds in this program are directed to projects seeking to improve biological control of nationally significant species, with projects addressing alligator weed, boneseed, cape broom, noogoora burr, parkinsonia, salvinia, and Scotch broom.

While considerable effort has been invested in finding the preferred biological agent for a particular weed, little has previously been done to improve targeting of funding to those weeds most likely to provide good control benefits for the funds invested. Developing a framework to improve targeting of biocontrol investment remains an important task.

Climate change and the impacts of drought are high among the issues of concern when addressing weed invasion. Two of the DWM projects have explored the relationships between flooding and weed invasion in riparian areas, while another has modelled

the change in distribution of sleeper and environmental alert weeds as a result of climate change.

The role of changing soil nutrients that result from changing land use (in coastal, peri-urban, and rural production areas) has produced further interesting results. Comparison between grazing land and ungrazed control sites is assisting in clarifying the role of soil nutrients in the relationship between exotic invasive annual species and native perennial grasses. The use of aquarium studies, larger mesocosm experiments and comparative work in healthy and unhealthy catchments is also assisting in defining the extent to which nitrogenous runoff and other environmental traits influence the growth of the aquatic weed *Cabomba caroliniana* in peri-urban waterways. Social influences on land use and management of weeds are also explored in areas subject to considerable 'tree change' uptake of what was once rural production land.

One of the areas in which weed management presents major challenges is in early detection and control, especially in aquatic systems. Perhaps the most innovative of all the DWM R&D projects is the adaptation of robotic aircraft to weed detection, using a combination of visual and infrared spectral data to 'fingerprint' aquatic weeds of national priority.

These projects are nearing a point where they are producing new outputs. These will assist in preventing the development of new weed problems, reducing the impacts of existing weeds, and enhancing capacity among landholders, land managers and policy staff to manage weeds into the future.

Translating new knowledge into practice that assists sustainable natural resource management is a key focus of research brokered by Land & Water Australia. Throughout the DWM R&D component, research teams have been encouraged and assisted to identify knowledge assets that can be harvested as this program draws to a close.

DISCUSSION

Through the 25 projects being completed within the DWM R&D component, Land and Water Australia has sought to address broad landscape scale and more localised aspects of weed management in a changing landscape. The final impacts of these projects are yet to be seen. Weeds have enormous impacts on agriculture and the environment, and the range of issues which arise from preventing weed incursions through to reducing their impacts, presents a substantial challenge. This requires an enduring commitment from governments, industries and communities. The DWM R&D is making a useful contribution to meeting this challenge but it is clearly evident that research on biological control agents, for example, will need

to continue for many years to come. Given the significance of biocontrol as a mechanism for managing weed invasions, it is also critical that governments and industry investors have the capacity to identify where the best return on investment can be obtained. Land and Water Australia hopes that the investment made in this area will enable smarter and more cost-effective investment decisions to be made into the future.

Climate change and changing land uses are exerting new influences on weed invasion and spread. The knowledge that is generated from DWM R&D is being assimilated both by the bringing together of project teams to identify possible complementary outcomes and products, and by Land and Water Australia as a research broker that values the integration of public good and production outcomes.

It is intended that innovation spawned by DWM will help identify new pathways for future weeds R&D, tackle the problems on the ground and continue to build national capacity to address these issues in the future.

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