

A strategic framework for managing the environmental impacts of weeds on public land in Victoria, Australia

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Summary A new framework that facilitates strategic and outcome-based management of weeds impacting on environmental values in Victoria is presented. In complex decision-making processes, such as weed management on public land, a strategic approach with clearly defined priorities is required. A preventative approach directed at the eradication of new and emerging weeds is Victoria's highest environmental weed management priority. This is complemented with an asset-based approach designed to protect important sites from the impacts of established weeds. The practical application of the framework was piloted in a case study in the Otway region of south-western Victoria. High value asset areas were identified, together with the weeds that threaten them. Community engagement assisted in identifying weed threats. New monitoring and evaluation protocols have been developed to measure changes in vegetation condition over long time frames. This approach now forms the basis for state-wide management of environmental weeds on public land.

Keywords Weed guidelines, public land management, weed management, environmental weeds.

INTRODUCTION

Environmental weeds are a major threat to natural, social and economic assets on public land and in Victoria are listed as a Potentially Threatening Process under the State's *Flora and Fauna Guarantee Act 1988*.

The problem The indigenous flora of Victoria (an area roughly the size of England) is rich with around 3140 vascular plant species and over 300 vegetation classes. However, more than 580 species of exotic plants invade native vegetation and new species are frequently reported. Victoria's public land covers 8.5 million hectares. A decision-support framework designed to prioritise management efforts, together with methods to determine intervention outcomes, is required to assist public land managers to deal with the complexities of environmental weed invasions.

This paper reports briefly on a project that identifies biodiversity assets within Victoria, ranks

weed threats and develops long-term monitoring protocols.

GUIDELINES

Guidelines were developed to provide overarching objectives, summarise the legislation, principles, program logic, priorities, proposed local area planning steps and a monitoring approach for managing the threat of environmental weeds in Victoria (Environmental Weeds Working Group 2007). New and emerging weeds (statewide or regional) are Victoria's highest management priority and are ranked according to the level of potential risk to biodiversity assets. The management objective for high risk weeds is eradication at the State or regional scale. A different approach is used for established weeds, where an asset-led suppression program identifies priority areas and high risk species.

This tiered approach reflects two important stages of invasion (Environmental Weeds Working Group 2007). Newly naturalised weeds can have reasonable prospects of eradication (subject to their biology and number and size of infestations), and so a species-led approach is appropriate. A species-led containment approach may also be worthwhile for some high threat weeds that are beyond eradication, but have significant potential for further spread. When dealing with weeds that are already very widespread, however, the emphasis should be on protecting important assets against potential impacts via an asset-led approach.

The final result is a government-supported policy framework for environmental weed management on public land (EWWG 2007).

CASE STUDY

A case study was established in the Otway region of Victoria. This study aimed to demonstrate how the Guidelines could be implemented and to establish and improve relevant procedures.

A Regional Weeds Working Group (RWWG), consisting of key public land stakeholders, guided the development of the project including science input.

Highest priority – new and emerging species A spatially-explicit model of weed invasion risk was developed using land system, road density and old growth (as a measure of disturbance history).

Next priority – important asset areas Asset areas were modelled using a combination of spatial layers: Ecological Vegetation Classes (units of vegetation variation, that have been mapped across the whole State) and their conservation status, habitat models of threatened fauna, a density surface of rare plant records and a landscape score component adopted from the Habitat Hectares method (Parkes *et al.* 2003). To validate the result against local knowledge, the modelled ‘asset areas’ – an area containing one or more environmental, social, cultural, or economic assets of value to the community – were compared with a map independently produced from subjective views of members of the RWWG.

Weed records were collated from three government databases. Additional records were obtained from local community groups and through rapid weed surveys focusing on important asset areas. Information on the practicality of control and potential cause of infestation was also collected.

An expert panel of three people evaluated 290 weed species and used a multi-criterion decision model to determine weed risk rankings. The rankings can be further tested against field observation by practitioners.

Specific management tasks were identified and ranked according to the priorities set out in the Guidelines. In the first year of implementation, 33 out of 34 sites of new and emerging weed infestations were treated and, for example, in one asset area 40 of 60 established infestations were treated. Such reporting is a considerable advance on the previous practice of recording the number of hectares treated.

A web-based information system ‘eWeed’ has been developed to assist with managing increasing data, shared by staff across numerous locations.

The case study forms the basis of a ‘practitioner’s guide’ (Platt *et al.* 2008).

MONITORING

Understanding the outcomes of weed management for environmental, social and economic values is fundamental to managing weed risk. Whilst methods of monitoring inputs and outputs of weed management are available, a method for monitoring outcomes for biodiversity at a broad scale in relation to weeds was not available prior to the current project. The objective was to develop such a methodology for practical application on public land in Victoria.

The proposed monitoring system (Ainsworth *et al.* 2008) is based on frequency measurements in permanent, nested quadrats that are applied along transects arranged systematically throughout a particular study area. The system is simple, time efficient and flexible and can incorporate a broad range of monitoring parameters. An optional whole site monitoring procedure is also specified, designed to detect arrival and changes in new weed species.

MODELLING

In order to demonstrate the economic and ecological benefits of early intervention in the management of environmental weeds, a spatial and temporal model of the spread of *Billardiera heterophylla* (Lindl.) L. Cayzer & Crisp (syn. *Sollya heterophylla*) in the Otway region was developed.

This model contained three sub models: a model of the potential niche of *B. heterophylla* based on known records of naturalised populations of the plant, a dynamic model of the rates and pathways of dispersal and infestation through time and a cost model for control intervention at various intervals following initial infestation.

The invasion model for *B. heterophylla* in the Otway region indicates a progressive and radial expansion from established populations within contiguous blocks of suitable bush habitat. As such, the interface between urban gardens, typically the source of *B. heterophylla* propagules, and bushland is a critical focus for control intervention.

The model predicts that after 23 years without management intervention infestations of *B. heterophylla* in the Otway region will occur on 3600 hectares. The model also indicates that considerable cost savings, in the order of \$170,000 to \$15,289,000 over a 12–23 year time frame, could be achieved by early intervention.

ASSET AND WEED RANKING

A spatial assessment and ranking of biodiversity assets and the relative risk to these assets was undertaken across Victoria. The method expanded on the approach used in the case study. A map showing the relative importance of biodiversity assets in different areas was created from a state-wide assessment of the rarity and degree of depletion of ecosystem types as defined by the Ecological Vegetation Class, the relative richness of threatened species per unit area supported by various ecosystem types across the state, and a condition or integrity model based on the habitat hectares approach (Parkes *et al.* 2003). The assets surface integrated data input through weightings applied by public land management stakeholders.

All naturalised vascular plant species in Victoria were ranked using known or estimated ecological attributes: ecological impact on natural systems; their degree of invasiveness in native vegetation; their relative rates of spread; and their current distribution assessed as a proportion of their potential distribution. Weed rankings were independently determined for four regions, each comprising clusters of related bioregions. Aquatic weeds were assessed at a State-wide level.

FUTURE DIRECTIONS AND ISSUES

This project has identified a wide range of issues and future challenges. Whilst the Guidelines present a new approach to environmental weed management at a statewide level, it will take some time and effort before the necessary cultural change within government, non-government organisations and the community occurs that supports this approach. The Department of Sustainability and Environment (DSE) will continue to work with stakeholders to support this process.

The historical approach to prioritising weeds has been to focus on the legislative process and declaration of species as noxious under the *Catchment and Land Protection Act 1994*. It is important that the risks posed by the many undeclared weeds impacting on environmental values are properly recognised by land managers.

The outcome monitoring protocols developed by this project should be integrated with the overall approach to monitoring public land.

This project has identified important asset areas using available spatial layers. Further work to determine an agreed approach that incorporates wide ranging views on assets is proposed by DSE.

Protecting rare and threatened species will require a short-term focus on sites which may be wide-ranging and outside key asset areas. In the longer term, the focus on protecting important ecological systems, represented by asset areas, will provide a more secure future against the threat posed by weeds. Adopting a triage approach to threatened species management would assist with determining where to focus weed management efforts.

We found that a budget process that allocates resources to various public values (e.g. private economic vs. public environmental, threatened species vs. ecosystems), benefits public land managers in determining where the government's emphasis between competing community priorities lies.

In the context of predicted climate change, there will be debate about the definition of what an invasive species is, and priority of those species. The framework

will need to follow and incorporate public views on this debate, as appropriate, but is already sufficiently flexible to modify risk identification using established ranking procedures. Our monitoring protocols are robust and designed to cope with changing suites of invasive plants.

DSE and the Department of Primary Industries are undertaking further work on pathways (Weiss *et al.* 2006). Victoria's Weed Spotter network is developing the surveillance skills that could support management of high risk pathways relating to public land. There is also a potential role for other groups and volunteers to associate with these tasks.

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