

## Park-scale weed risk assessment in Victoria

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**Summary** Land managers need to make informed decisions as to the most effective way to allocate the resources available for weed management. A park-scale weed risk assessment process has been developed to help prioritise weed management activities. This process evaluates the invasiveness of weeds, their potential distribution and their impacts on park values.

**Keywords** Weed risk assessment, weed impacts.

### INTRODUCTION

Worldwide, the invasion of weeds is considered a serious threat to the conservation of natural ecosystems and weed control is a major component of managing such areas (Randall 1996). Parks Victoria, as the agency responsible for the management of Victoria's parks and reserves, invests considerable resources in weed management programs. A key objective in the development of such programs is to achieve the greatest possible reduction in environmental risk in areas of high environmental value. Therefore, to ensure that the limited resources available for weed management are used most effectively, it is necessary to identify which weeds have the greatest risk potential.

Numerous weed risk assessment (WRA) systems have been developed in recent times (Groves *et al.* 2001). These have been designed to predict which species are likely to become weeds (pre-border entry) or to assess the risk potential of existing weeds, that is the level of damage they may cause. Such post-border WRAs have been applied at various scales (e.g. multiple land uses, natural areas, specific ecosystems) and may include an evaluation of the ability of a weed to spread (invasiveness), its potential impacts on the system/s of interest, the area potentially affected and the feasibility of control.

In Victoria, the Department of Primary Industries (DPI) had previously developed a decision support system to assess the invasiveness of weeds. Using a tool known as analytical hierarchical process (AHP), key criteria that contribute to the invasiveness of weeds were identified. These were grouped into similar themes within a hierarchy and groups and criteria were then weighted according to their perceived importance. Intensity ratings (low, medium, high) were defined for each criterion and assigned a score between 0 (lowest rating) and 1 (highest rating). A relative invasiveness score is obtained for a species by multiplying

the intensity score by the criteria weight and respective group weights, summed across all criteria. This invasiveness assessment, together with an approach for modelling the potential distribution of weeds, has been described in detail elsewhere (Weiss and Iaconis 2002, Weiss and McLaren 2002, Weiss and McLaren 2003).

In 2002, Parks Victoria instigated a project, building on this initial work, to develop a weed risk assessment process for determining priority weeds within individual parks. This WRA incorporated three component scores: invasiveness, impact, and distribution.

### MATERIALS AND METHODS

**Invasiveness** The invasiveness score is derived using the original process developed by DPI (Weiss and Iaconis 2002).

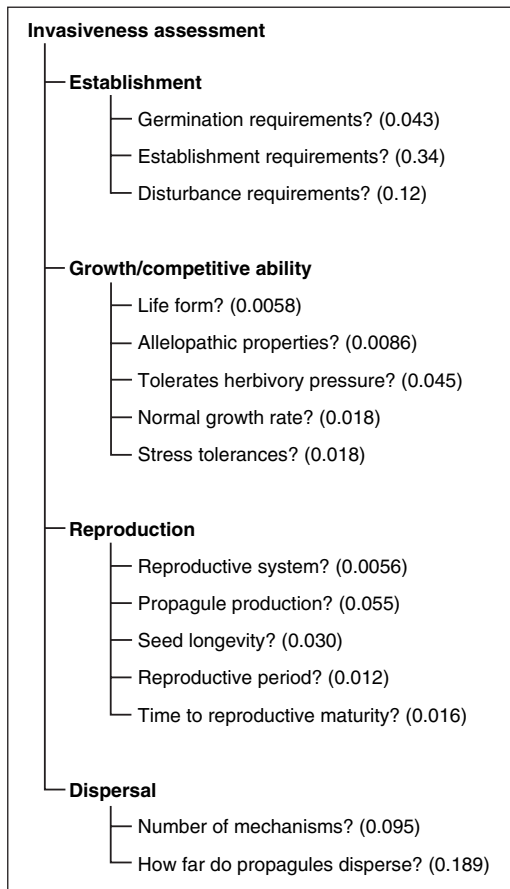
**Impact** Using AHP, a decision support system was developed for scoring weed impacts. Workshops were held with park rangers, planners and program managers to identify the potential impacts that weeds may have on park values. Criteria for evaluating these impacts were then developed, grouped into similar themes and assigned weightings according to their perceived importance. Intensity ratings, describing different levels of impacts, were also defined for each criterion.

**Distribution** The distribution score is based on a single criterion, the ratio of the present to potential distribution of a weed. Following consultation with weed experts, intensity ratings were assigned to a range of scenarios describing the extent of weed distribution.

**WRA** The AHP process was used to weight each of the three WRA components – invasiveness, impact and distribution. These evaluations were made by weed experts and reflect the perceived importance of each component in determining the risk potential of a weed.

### RESULTS

**Invasiveness** DPI developed 15 criteria to assess the invasive potential of weeds (Figure 1). Of these, establishment requirements were considered to be



**Figure 1.** Hierarchy of the groups and criteria for determining invasive potential. The proportion that each criterion contributes to the invasiveness score is indicated in parentheses.

the most important, accounting for one third of the invasiveness score.

**Impact** Workshop participants identified 21 criteria, grouped into broad categories of environmental and social issues, that could be used to assess the impact of weeds on park values (Figure 2). Of these, environmental criteria were considered to be the most important, particularly impacts on vegetation structure, composition of high and medium value ecological vegetation classes and threatened flora and fauna. Collectively, these five criteria constitute over 50% of the overall impact score. Weed impacts on grazing, either on neighbouring land or within the park, were considered to be the least important criteria, contributing less than 2% to the final impact score. There was some debate as to whether a park assessment should consider weed impacts on grazing at all. However, AHP advocates listing all criteria to maintain transparency of the process: giving contentious criteria low weightings means they will have very little influence in the overall ranking of weeds.

**Distribution** Eight intensity ratings were described for the distribution score (Table 1). These reflect that a weed currently occupying only a small area of its potential range may be more feasible to control and may represent a greater future risk than a weed that has already reached the full extent of its distribution.

**Weed risk score** In determining the overall risk score, weed impacts were considered to be the most important factor, while the invasiveness of a species was considered to be the least important (Table 2). The final weed score is obtained by multiplying the score

**Table 1.** Intensity ratings for determining the distribution score, based on the ratio of a weed’s present and potential distribution.

Intensity rating	Intensity score	Description
Very high	1	Infestation(s) that are able to be eradicated with no chance of reinvasion from outside of area of control (interstate/other region etc)
High	0.85	Infestation(s) that are able to be eradicated with some chance of reinvasion
Medium high	0.71	Present to potential distribution >1:10,000 e.g. several small infestations
Medium	0.57	Present to potential distribution 1:10,000 – 1:100 e.g. a large partially dispersed infestation
Medium low	0.42	Present to potential distribution 1:100 – 1:10 e.g. numerous large dispersed infestations
Low	0.28	Present to potential distribution 1:10 – 1:2 e.g. the majority of region infested with some largish areas still clean (more clean areas than infested)
Very low	0.14	Present to potential distribution <1:2 e.g. the majority of region infested with some smallish areas still clean (less clean areas than infested)
Extremely low	0	Reached full potential 1:1

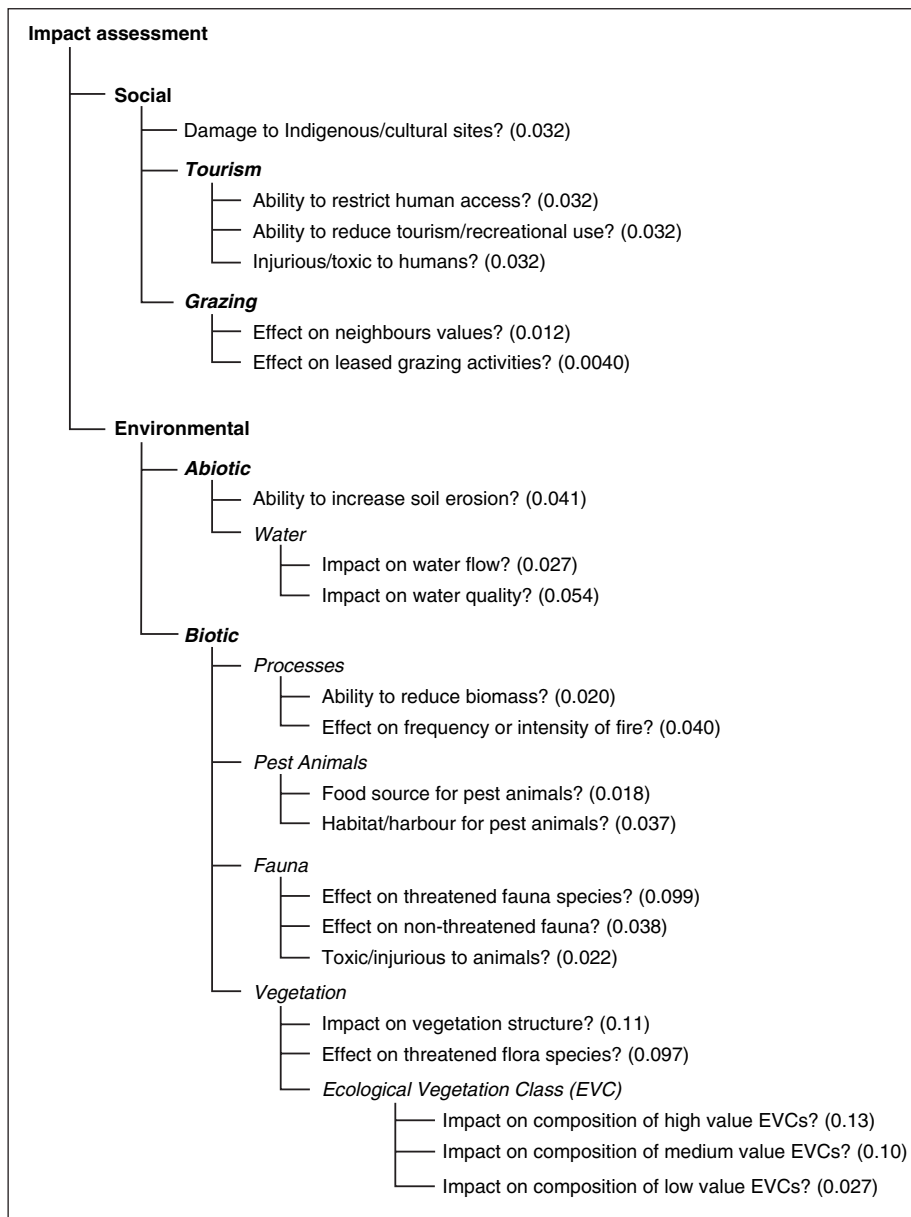
for each component by its weighting to obtain a value between 0 and 1. The higher the score, the greater the risk potential of a species.

DISCUSSION

This weed risk assessment process will assist park managers to prioritise weed management activity.

**Table 2.** Weightings for the three components of the weed risk score.

Component	Weightings
Invasiveness	0.12
Distribution	0.32
Impact	0.56



**Figure 2.** The 21 criteria for assessing weed impacts on park values. The different levels indicate the groupings within the hierarchy. The number in parenthesis is the proportion that each criterion contributes to the overall impact score.

Although the decision support system used is fairly complex, the process has a number of advantages.

- It is highly transparent in that the importance of each criterion and component of the weed risk score can be illustrated. The justification for rating a weed against each criterion can also be recorded, which means that ratings can be reassessed and updated when new information becomes available.
- The impact assessment is robust to minor changes in the weighting of criteria. Such changes may be required to better reflect the values of individual parks. For example, managers of a wilderness park may wish to increase the importance of environmental criteria, relative to social criteria. However, weights of all criteria will need to be re-evaluated using AHP if major changes are required.
- Most of the criteria in the assessment process are not spatially related and therefore only need to be answered once for each species. A database of answers can be built up over time, which will reduce the level of effort required to complete future assessments of the same species. Only six of the criteria within the impact assessment and the distribution score are spatially linked and will need to be answered for each location where a weed is assessed.
- A final advantage is that the process described here formed the basis of the WRA used by DPI to assess the risk potential of weeds across all land tenures as part of the revision of Victoria's noxious weeds list. This should facilitate a cross-tenure approach to weed management in Victoria.

**Next steps** This process will be trialled at a number of parks across Victoria during 2004–2005. Spreadsheets will be developed that will enable scores to be calculated automatically and facilitate the use of the process. Feedback from these trials will then be used to review the process. Assessments will also be undertaken over larger scales (i.e. district/state-wide). This is likely to require some changes to the impact assessment, particularly the intensity ratings for some criteria. These broader-scale assessments will be used to help inform management decisions at a strategic level.

Additional factors, other than perceived risk, also need to be considered when prioritising weed management activity. These include the feasibility of control (e.g. accessibility of weeds, availability of techniques and sufficient resources), the potential benefits a weed may have (e.g. shelter/food source for native fauna, soil stabilisation, protection of cultural sites), and cooperative or complementary projects (e.g. cross-tenure projects). Although the distribution score currently

includes a component of feasibility (i.e. the smaller the proportion of potential distribution occupied by a weed, the easier it may be to manage), these factors should be evaluated in more detail as part of the decision-making process.

Timmins and Owen (2001) describe two approaches to weed management: a weed-led approach is warranted if there is a high chance a species can be eradicated or contained; while a site-led approach focuses on protecting the values at a particular site. The WRA process described here identifies which species pose the highest risk to park values (weed-led), but not priority sites (site-led). Parks Victoria has commenced a separate project to evaluate the importance of individual parks to the state's protected area network and accordingly, determine appropriate objectives for park management. This project will help identify which parks are considered to be a high priority for weed management.

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