

STRATEGIES FOR ECOLOGICAL WEED CONTROL ON CONSERVATION LANDS IN NEW ZEALAND

S-J. Owen and J.K. Sheldon

Department of Conservation, PO Box 10-420, Wellington, New Zealand

Summary New Zealand has over 200 species of introduced ecological weeds which have collectively invaded all native community types. In 1995 the Department of Conservation instituted two national strategies for ecological weed control on land it administers. ‘Weed-led control’ is a proactive strategy to address potential problems wherever possible before they become unmanageable. It is done only at a national or regional level to eradicate or contain a species. ‘Site-led control’ focuses on identifying management units requiring protection, and the management units’ associated buffers and seed sources. Prioritizing systems and decision-making tools have been developed for both of these strategies.

INTRODUCTION

The Department of Conservation administers approximately 7.9 million hectares, or about 29.5%, of New Zealand’s land area. These conservation lands include 13 national parks, two world heritage areas and approximately 3500 reserves. As a major land manager, the Department has invested considerable resources in the control of introduced animal pests and has national control plans for possums, goats and Himalayan thar. More recently the Department has been grappling with developing national strategies for controlling ecological plant pests on land it administers.

Controlling introduced ecological plant pests presents some major logistical and strategic problems

with establishing species continually spreading and new species becoming naturalized. New Zealand has over 20 000 species of introduced land and freshwater plants, of which about 2000 have so far become naturalized (in comparison, New Zealand has approximately 2700 native vascular plant species, 76% of which are endemic). The number of naturalized ecological plant pests has been steadily growing since the 1860s and this trend shows no sign of slowing down (Figure 1). In the Auckland region alone, about four new species naturalize every year (Esler 1988). Based on historical averages, we can expect 10% of naturalized plants to become significant ecological plant pests.

A 1995 study by the Department identified 217 introduced plant species that were causing concern on conservation lands. Of these, 96 species are known to significantly affect the community structure, native species composition, or regeneration in areas that have significant natural values. For another 43 species the Department has less information but strongly suspects they are having such impacts. Thirteen other species, such as pyp grass (*Ehrharta villosa*) and orange firethorn (*Pyracantha angustifolia*) are not yet affecting sites with high natural values, but are thought to have the potential to do so.

Weed invasions threaten the viability of many of New Zealand’s native community types. Low stature communities such as tussocklands, shrublands and frost flats are

being invaded and overtopped by such species as heather (*Calluna vulgaris*), broom (*Cytisus scoparius*), and lodgepole pine (*Pinus contorta*). In Tongariro National Park World Heritage Area, heather has dramatically reduced the biomass of indigenous plants in tussocklands, alpine herbfields, frost flats and high water table sites, is interfering with natural processes of plant regeneration and succession, and is threatening the viability of tussockland ecosystems. The diversity of native insects has been reduced, potentially leading to at least local extinction of some species.

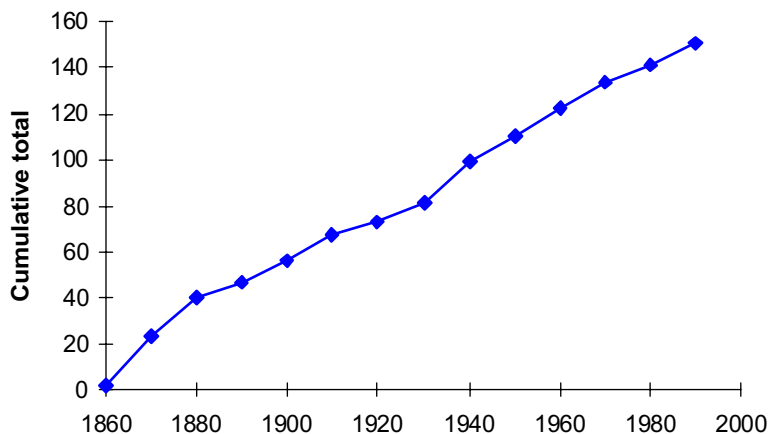


Figure 1. The naturalization of 151 ecological weeds in New Zealand since 1860.

Weed invasions are a particular threat to lowland and coastal communities where human development has already stressed and fragmented these communities. Over 90% of New Zealand's wetlands have been lost and crack and grey willow (*Salix fragilis* and *S. cinerea*) are a major threat to those remaining. Likewise the 15% of New Zealand's original lowland forest that remains is highly fragmented and vulnerable to weed invasion, particularly on the margins and in very small lowland forest remnants which are dominated by edge patterns and processes. Even large, relatively undisturbed forests are being invaded by some species: old man's beard (*Clematis vitalba*), wandering Jew (*Tradescantia fluminensis*), mistflower (*Ageratina adenophora*), wild ginger (*Hedychium gardnerianum* and *H. flavescens*), climbing asparagus (*Asparagus scandens*) and periwinkle (*Vinca major*).

STRATEGIC APPROACHES

The control of ecological weeds in New Zealand is therefore very complex, with over 200 species that each have different distributions and ecological impacts and which have collectively invaded all native land and freshwater community types. The goal for the Department of Conservation has been to develop national control strategies that will not only maximize conservation gains in priority protected natural areas, but also address potential problems wherever possible before they become unmanageable.

To meet these challenges, the Department has instituted two national strategies for ecological weed control on land it administers. We have called the two strategies 'weed-led' and 'site-led' control.

Weed-led control The objective of a weed-led control strategy is to eradicate or contain an emerging ecological plant pest species before it becomes a major problem either within a region or at a national level. The term 'weed-led' is used because such programs involve first selecting the species to be controlled and then determining where control is required to meet the program's eradication or containment objectives. The decisions required to identify a weed-led program are summarized in Figure 2. As weed-led programs will almost always require control on land other than that administered by the Department, identifying and gaining all the necessary co-ordination between the relevant private landowners and land management agencies is therefore essential. A weed-led program must also be technically practical—a species should have a limited invasion front and/or few vehicles for invasion.

To prioritize weed-led programs, a species' 'weediness' is calculated from scores for its effects on native

communities and the rate and ease with which it establishes and spreads (Owen *et al.* 1996). The species being considered for weed-led programs are further sorted by the species' practicality scores which indicate the rate and ease of eradication, control to zero-density, or containment. Quick and comparatively cheap eradication has the highest practicality score; difficult and/or expensive containment the lowest.

Site-led control Site-led control is the second strategic approach that the Department has developed for ecological weed control. Its objective is to protect the natural values of priority natural areas that are being threatened by weed impacts. The term 'site-led' is used because planning these programs involves first identifying an area with high natural values that requires weed control, and then determining which species require control and where control should take place.

A site-led control program is composed of (i) a core management unit that is the focus of the protection objectives; and (ii) the management unit's associated buffers and seed sources of weed infestations. Management units may be an entire reserve, or a subset of a larger protected natural area (such as a National Park) that is too big to manage as a whole.

The priority ranking of a proposed site-led program is based on the biodiversity value of the core management unit using a six-point scoring system for botanical and wildlife values, and a score for the urgency of control. Associated buffers and weed seed sources are carried by the rank of the core management unit rather than being ranked themselves. Using the rankings and other information, site-led programs can then be prioritized across the country.

DISCUSSION

The site-led control strategy outlined here is essentially the approach used in the Department's possum and goat control programs, and it is also likely to be the core business for the Department's ecological weed control. Of the 160 species so far listed in the Department's weed database (Owen *et al.* 1996), 153 have either already colonized most of the areas suitable for them, for example blackberry (*Rubus fruticosus* agg.) and gorse (*Ulex europaeus*), or are rapidly spreading within and between regions (such as lodgepole pine, spartina species, broom, wild ginger and climbing asparagus).

As a species that is widespread in a region will only ever be controlled as part of a site-led program, never a weed-led one, there are likely to be comparatively few weed-led control programs. A regional weed-led program to contain a spreading species may be possible if the weed species is either only just beginning to invade the

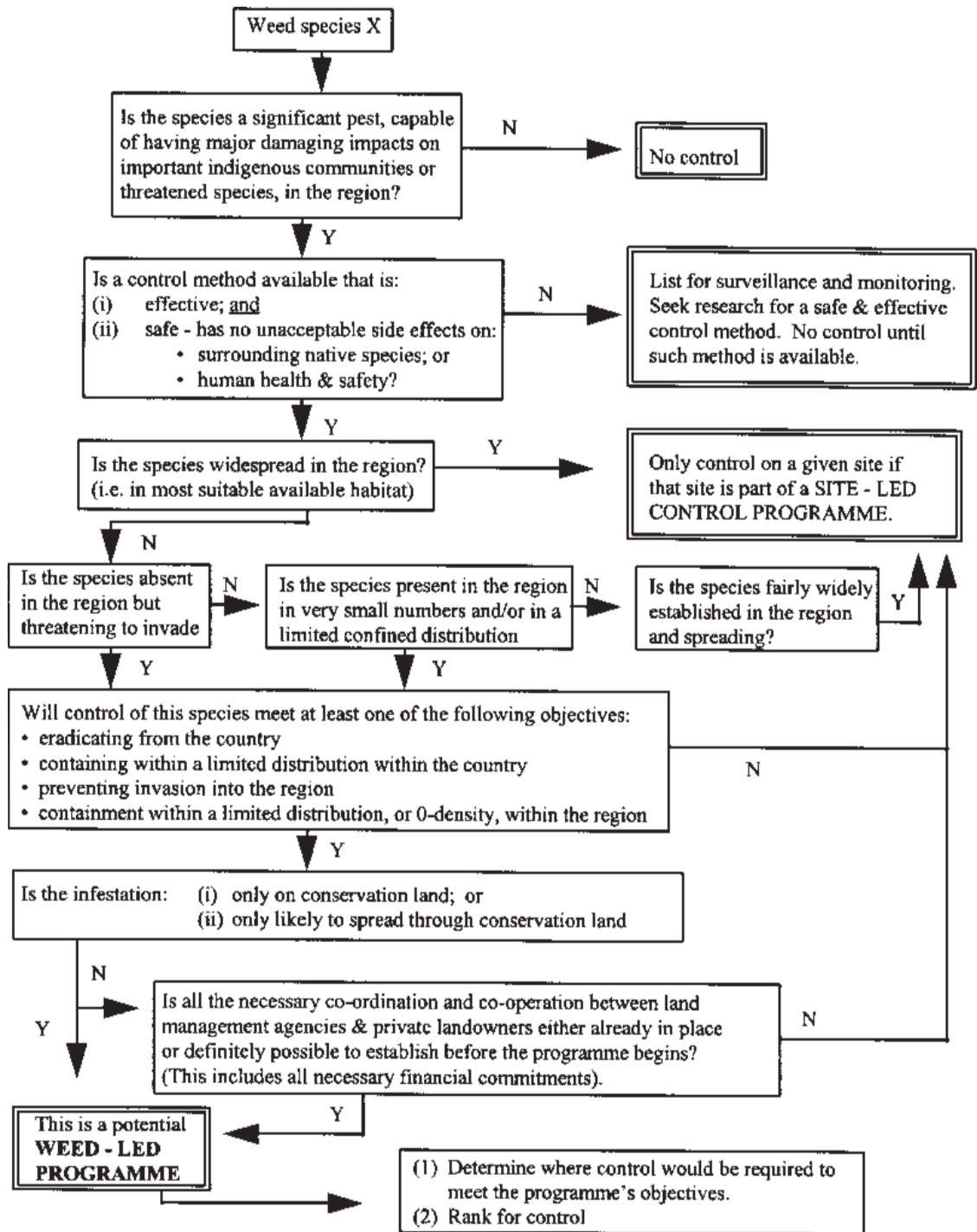


Figure 2. The decision making process for identifying a weed-led control program.

region, or still has a very limited distribution there. However, the number of weed-led programs will also be limited by the stringent filters in the program selection process outlined in Figure 2, as weed-led programs have the potential to quickly become both ineffective and extremely expensive unless they are carefully chosen and planned.

One example of a possible weed-led program to eradicate a species nationally, is hydrilla (*Hydrilla verticillata*) which is currently confined to three lakes and one farm pond in the Hawkes Bay region. Two examples of potential regional weed-led programs that conservancies have so far identified are reed sweetgrass (*Glyceria maxima*) in Southland where it is thought to be growing only in the eastern side of the region in the Titiroa stream and adjacent drains; and pyp grass in Wanganui where it is currently found in only two small infestations, one in the Koitiata dunelands and one a kilometre further inland. The list of priority site-led and weed-led programs will continue to evolve as inventory and threat assessment work and data about newly naturalizing species adds new sites and adjusts relative priorities.

The ideas behind the site-led and weed-led approaches described here are not new in terms of weed control theory. Dane Panetta for example has written a number of papers on the importance of controlling a weed species while it is still in its lag phase (Panetta 1993). What the Department has done has been to apply these theories in a dual site-led/weed-led approach which recognizes the need to tailor control objectives to the stage of invasion, and to develop practical prioritizing methods and tools with which to implement the two approaches.

In the past, it has been the spread and impacts of the more highly visible and familiar widespread species that has been more noticed and control has therefore also tended to focus on these species, often without any clear, achievable management objectives in mind. This focus on species that are already well established in a region has meant that there has been less attention paid to the ones that are just about to invade or spread but which are not yet a problem. These more recently introduced or newly naturalized species are often more difficult to find and identify and may not yet be having any significant ecological effects anywhere in the region or even nationally, but it is clear that controlling potentially significant new species is essential if weed management is to be efficient in the long term. The challenge for the Department, and for New Zealand as a whole, is to achieve a wise balance between the resources going into weed-led types of control, and those being spent on controlling more widespread species.

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REFERENCES

- Esler, A.E. (1988). Naturalization of plants in urban Auckland, New Zealand 5: Success of the alien species. *New Zealand Journal of Botany* 26, 565-84
- Owens, S-J., Timmins, S.M. and West, C.J. (1996). Scoring the weediness of New Zealand's ecological weeds. Proceedings Eleventh Australian Weeds Conference, Melbourne.
- Panetta, D. (1993). Identifying and managing the next century's problem weeds. In 'Potential problem weeds', eds. A.I. Popay and M.J. Hartley. Proceedings of a New Zealand Protection Society Meeting, pp. 9-31.