Invasive weed control in grassy ecosystems

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Summary ACT grassy ecosystems are very prone to weed invasion. This is due to past disturbance, inter-tussock spaces and high edge effects. Management initiatives such as prioritisation based on 'biodiversity triage' and rapid response to new infestations helps to make the best use of limited resources.

Keywords Grassy ecosystems, invasive weeds, environmental weeds, ACT.

INTRODUCTION

The ACT Parks & Conservation Service (ACTPCS) is the main land manager in the ACT. The Service manages 177 121 ha or approximately 73% of the ACT. The main conservation reserves in decreasing order of size are: Namadgi National Park, Googong Foreshores, Tidbinbilla Nature Reserve, Murrumbidgee River Corridor, and Canberra Nature Park.

The native grasslands and woodlands of Canberra Nature Park and the Murrumbidgee River Corridor have a much higher proportion of their areas affected by environmental weeds compared to Namadgi National Park and Tidbinbilla Nature Reserve, where forests and shrubby woodland dominate.

The ACT Reserve system has relatively high edge effects, which increases disturbance, weed invasion and management costs. Table 2 shows the relatively higher edge effects in the ACT as measured by the perimeter to area ratio.

There are 35 000 ha of serious invasive weed infestations. Serious invasive weed infestations are defined as those with weeds that have a 'medium' or greater weed risk, and where the total cover is at least 'common and localised' (Taylor and Williams 2012). ACTPCS currently works on controlling 7000 ha to 9000 ha of these invasive weed infestations (Table 3).

Environmental weed control expenditure was $1.7m in 2009–10, $1.3m in 2010–11 and $2.4m in 2011–12.

MATERIALS AND METHODS

Four initiatives have been introduced to help conserve biodiversity from invasive weeds and to make best use of weed control budgets:

- Late winter control of invasive grasses to achieve thorough control and to prevent seeding before mowing begins.
- Parkcare volunteers spraying invasive weeds to help with a rapid response to new infestations.
- Weed maps include environmental assets, such as endangered plant sites, to show what we need to protect.
- Applying 'Feasibility of Co-ordinated Control' and 'Biodiversity Triage' to set priorities.

Table 1. Reserve size and 2010–11 expenditure.

Item	Canberra Nature Park	Namadgi National Park
Area	7969 ha	102 862 ha
Weed control costs per ha	$47 per ha	$1 per ha

Table 2. Perimeter to area ratios.

Item	ACTPCS	NSW National Parks & Wildlife Service
Area of land	177 000 ha	6 700 000 ha
Reserves perimeter	8000 km	57 000 km
Perimeter to area ratio	0.05	0.01

Table 3. Hectares of weed control 2009–11.

Species	Hectares
African Lovegrass (*Eragrostis curvula* (Schrad.) Nees)	895
Tall African Lovegrass (*Eragrostis curvula* (Schrad.) Nees)	56
Blackberry (*Rubus fruticosus* aggregate)	1963
Chilean Needlegrass (*Nassella neesiana* (Trin. & Rupr.) Barkworth)	576
Serrated Tussock (*Nassella trichotoma* (Nees) Hack. ex Arechav.)	1618
St John's Wort (*Hypericum perforatum* subsp. *veronense* (Schrank) H.Lindb.)	1598
Sweet Briar (*Rosa rubiginosa* L.)	375
Crack Willow (*Salix fragilis* L. nothovar. × *fragilis*)	269
Paterson's Curse (*Echium plantagineum* L.)	615
Other invasive weeds (eg. Nodding Thistle, Black Alder, Hawthorn, Cotoneaster)	938
Total	8903

- Assessment of initiatives will be by weed mapping, photo-points and monitoring similar to the 'standard tier' weed control monitoring used by NSW NPWS (Hughes *et al*. 2009).

RESULTS

All results are preliminary—it will take a number of years before success can be measured quantitatively. There are some encouraging early results.

Late winter control of all invasive grasses Chilean needlegrass and serrated tussock can be successfully sprayed with either glyphosate (knockdown foliage absorbed) or fluproponate (residual root absorbed) during winter, because they are still growing in all but the coldest of winters. The advantages of winter control are: target grasses are more conspicuous (so more thorough control occurs); less off-target damage to native 'warm season' grasses; and contractor availability.

Small scale trials indicate that late winter use of fluproponate on dormant 'warm season' african lovegrass killed most plants at the 2 L to 3 L ha^{-1} rate, as evidenced by the lack of re-growth in spring and summer from the cured or dead looking tussocks. The higher 3 L ha^{-1} rate was used for tall african lovegrass, dense infestations and on roadsides.

The new approach, if successful, will allow all the main invasive grasses to be treated in one pass in late winter, saving money, and reducing the chance of roadside slashers spreading invasive grass seed when the first mowing pass occurs in mid-spring.

Parkcarers helping with rapid response In the past Parkcare volunteers mainly cut and dabbed woody weeds, but now they also assist with the spraying of invasive weeds. This simple initiative will save thousands of dollars in avoided future weed control. It allows Parkcare volunteers to 'search and destroy' isolated invasive weeds before new infestations develop. It also helps stop re-infestation once the Rangers and contractors have undertaken the primary herbicide spot spraying.

All Parkcare volunteers who want to spray weeds have to complete a Chemcert or SmartTrain course. The cost is paid for by the ACT Parks & Conservation Service or by government grants.

Weed maps showing environmental assets The ACT Parks & Conservation Service Rangers and contractors use a variety of weed mapping techniques from hand drawn maps to GPS referenced shape files that are loaded into ArcGIS. A range of personal data assistants (PDAs) and Smartphone Apps are also being trialled to improve the accuracy and speed of mapping.

High turnover of temporary Ranger positions and other staff movements means that local knowledge is often lost at the depot/district level. Coordinated digitised mapping commenced in 2011 and map books are made available in the ACTPCS Environmental Weed Control Operations Plan (Taylor and Williams 2012). These show where priority weed control was undertaken. In this way new Rangers and other field staff know the location and density of the follow-up weed control sites. This saves time and will assist with long term monitoring of weed control success.

The maps are also crucial as they show environmental assets such as endangered plant locations that require protection from invasive weeds. This relates to 'biodiversity triage', which is discussed below.

Feasibility of control and 'biodiversity triage' ACT weed management prioritisation is based on the NSW Weed Risk Management System (Johnson 2009) and prioritising weed control to protect rare or threatened species (Downey *et al.* 2010a). The weed risks determined using the NSW Weed Risk Management System range from 'Negligible' to 'Very High' risk. African lovegrass, serrated tussock, blackberry and Chilean needlegrass have a 'Very High' rating in the ACT. The Weed Risk measures a weed's: invasiveness, impact, and potential distribution.

The NSW Weed Risk Management System gives broad weed management strategies. 'Biodiversity triage' (Downey *et al.* 2010b) guides how to allocate weed control resources to priority sites. The highest priority is when there is a high threat to biodiversity and there is a high probability of controlling the threat. As an example, St John's wort has a high weed risk rating and a medium feasibility of coordinated control. The management strategy across the ACT is to protect priority sites from this invasive weed. Biodiversity triage chooses between sites as shown in the table below.

Table 4. Biodiversity triage example.

Weed threat	St John's Wort at Red Hill NR	St John's Wort at Mt Pleasant NR
Biodiversity threat	High	Medium
Probability of protecting biodiversity	High. Action must be immediate and long term	Low. General low-level management to reduce the threat.

Actions undertaken from Table 4 for Red Hill:

- spot spraying St John's wort with selective herbicide (fluroxypyr)
- regular follow-up control
- putting the endangered plant sites at the top of the priority list for weed control work
- monitoring effectiveness of St John's wort control work.

DISCUSSION

The ACT grassy ecosystems are relatively expensive to manage for weed invasion. The reasons are: inter-tussock spaces, types of weeds that invade have very high rates of spread, long disturbance history, and relatively high edge effects.

The ACTPCS has four ways to help reduce this cost burden:

- Late winter control of all invasive grasses
- Parkcare volunteers boosting capacity to rapidly respond to new infestations
- Detailed weed maps readily available, which include environmental asset locations
- Applying 'Feasibility of co-ordinated control' and 'Biodiversity triage' to land management.

Preliminary results look promising. It is expected there will be enough data in a few years time to know if these initiatives are helping to protect ACT biodiversity from invasive weeds.

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