Chilean needle grass (*Nassella neesiana*) control – the ACT experience

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Summary Mapping Chilean needle grass (*Nassella neesiana*) infestations using the *Collector* application (app) with *ArcGIS On-line* has made it easier to recognise factors associated with successful control: winter control, use of flupropanate for initial control of large infestations, thorough follow-up control, and field staff with good plant identification and weed control skills. Rapid spread of Chilean needle grass is associated with: proximity to large infestations, mowing/slashing, incomplete control, grazing and high levels of people/vehicle movements.

Keywords Control, *Nassella*, weed, WoNS.

INTRODUCTION

Chilean needle grass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) is an invasive grass from South America. It is a Weed of National Significance (WoNS) and a legislated Pest Plant in the Australian Capital Territory (ACT) (Must be Contained and Prohibited). It favours heavier soils, wetter areas, mown areas and readily fills gaps in disturbed and un-disturbed native grassland. It has coarse leaves with many fine hairs. It takes on a distinctive straw colour after frosts in winter. Upright awned seed heads with a purple corona give it a characteristic look. Cleistogene seed or 'stem/basal seed' are also present. Chilean needle grass is readily spread by mowers/vehicles/animals, bushwalkers and water.

Faithfull (2012) notes very high rates of spread for Chilean needle grass from mowing. This has been observed across the ACT in both urban and rural areas.

Chilean needle grass is widespread across urban areas in the ACT. Infestations are also starting to be detected and controlled in the upland grasslands of Namadgi National Park. Chilean needle grass is a significant threat to native plant diversity in a wide range of grassland and woodland areas, and as such has a 'Very High' risk rating in the ACT. It is able to invade intact native grassland and smothers the surrounding grasses and wildflowers (Figures 1 and 2).

Figure 1. Chilean needle grass (yellow-green grass) at centre, invading frosted-off kangaroo grass (*Themeda triandra*) at St Marks Grassland Reserve, 2015.

MATERIALS AND METHODS

Photopoints and mapping have revealed some common factors that affect successful control of this invasive grass. Although these observations have not been tested statistically, we are confident that these are the key factors that dictate success or otherwise with control work.

Mapping of infestations and photo points are the main ways weed control efforts are monitored in the ACT.

The *Collector* app (Esri 2016a) which syncs with *ArcGIS On-line* (Esri 2016b) has been used for mapping since 2015. When the *Collector* app is used in streaming mode, very accurate mapping is achieved (similar to tracking with a global positioning system (GPS)). Patterns have emerged from control data dating back to 2009. The data is stored on *ArcGIS On-line* and allows adaptive management. The figures below include screenshots from the *Collector* app. All are orientated north. The hatched polygons are either areas of weed infestations or where weed control has occurred. The faded green background to the screenshots denotes nature reserve or other reserve.

RESULTS

Case study 1 – Crace Grasslands Nature Reserve
Crace Grasslands (105 ha) is natural temperate grassland with large patches of phalaris and Chilean needle grass. There are also rare and endangered wildflower species such as button wrinklewort (*Rutidosis leptorhynchoides* F.Müell.). There are cattle grazing in the southern part of the reserve and eastern grey kangaroo (*Macropus giganteus* Shaw) grazing over the entire reserve. Tracks are slashed for vehicle access.

A 2001 survey of Chilean needle grass showed infestations (orange shaded polygons in Figure 3) developing across the north-western part of the reserve, cantered on spread from the grounds of a now demolished Defence Department building.

Mapping treated areas using the *Collector* app in 2015 showed that the Chilean needle grass had spread greatly but at varying densities. The density ratings before thorough control in 2015 ranged from 1–10% in least disturbed areas to >50% in most disturbed and mown areas. The only areas with isolated or no Chilean needle grass detected were the waterlogged areas dominated by *Phalaris aquatic* L., some of the kangaroo grass (*Themeda triandra* Forssk.) areas and some of the driest hill tops or rises.

There had been control work spot spraying Chilean needle grass with glyphosate 360 g L^{-1} at 1 L 100 L^{-1} water over the period 2001 to 2015, so the infestation densities could have been worse without this work. However, mapping shows that follow-up control was missed in some years. The 2015 control work used flupropanate 745 g L^{-1} (residual grass herbicide) in the higher density areas to contain the spread (Australian Pesticides and Veterinary Medicines Authority – APVMA permit 9792).

The rate of spread observed at Crace Grassland supports observations elsewhere of rates of spread exceeding 20% per year (Faithfull 2012). In some

Figure 2. Chilean needle grass monoculture in woodland. at Stirling Ridge Reserve, 2016.

Figure 3. Chilean needle grass at Crace Grasslands Nature Reserve – orange shaded polygons are from the 2001 survey, the larger green hatched polygons are treated areas in 2015. Pink spots are protected plants.

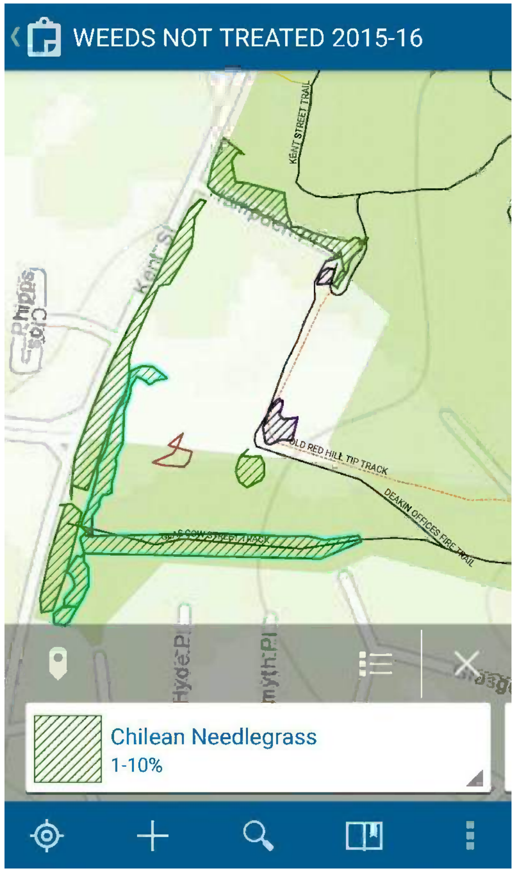

Figure 4. Chilean needle grass at Red Hill Nature Reserve.

parts of Grace Grasslands the rate of spread well exceeded this level.

Case Study 2 – Red Hill Nature Reserve Red Hill Nature Reserve (210 ha) is an *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) listed yellow box (*Eucalyptus melliodora* A.Cunn. ex Schauer) – red gum (*Eucalyptus blakelyi* Maiden) grassy woodland. Unlike many other ridges in the urban area, clay soils support this community at summit areas. The reserve adjoins suburbs that have extensive areas of Chilean needle grass on nature strips, backyards, and open space.

Most of the infestations on Red Hill are found in disturbed and slashed areas at the reserve perimeter. However, patches have readily formed well within the reserve in rough spear grass (*Austrostipa scabra* (Lindl.) S.W.L.Jacobs & J.Everett), snow grass (*Poa sieberiana* Spreng.) and kangaroo grass (*Themeda triandra* Forssk.) areas. These are quickly controlled due to early reporting and mapping. A Parkcare group, the Red Hill Regenerators, and a Weeds Officer who lives nearby has helped in this regard.

Control in buffer areas and disturbed areas is by spot spraying with flupropanate 745 g L^{-1} at 150 mL and glyphosate 360 g L^{-1} at 335 mL 100 L^{-1} water (APVMA permit 9792). Spot spraying glyphosate 360 g L^{-1} at 1 L 100 L^{-1} water is used for scattered plants in high conservation value sites, and for follow-up control of other areas.

Areas are mapped with the *Collector* app in streaming mode for greatest accuracy of mapped boundaries (Figure 4). The mapped areas were synced with *ArcGIS On-line*.

Kangaroo grazing intensity varies greatly. There are many walkers, bike riders, and frequent water utility vehicle access. As a result infestations often begin adjacent to tracks and trails and in over-grazed areas.

The spot spraying of Chilean needle grass before the first spring slashing or mowing has reduced the density in the mown areas, but the extent has increased. These observations are based on photo points and mapping. Figure 4 shows how the infestations favour slashed areas at the perimeter of the reserve. Rigorous follow-up control has reduced the density of the infestations.

Case Study 3 – Jaramlee Reserve Jaramlee Reserve (112 ha) is a remnant native grassland and woodland that has had a long grazing history. It was transferred to government land management in 2015. The former land manager did not control Chilean needle grass when it first invaded in the 1990s. As a consequence it spread across the reserve and Figure 5 shows some of the primary control areas, which varied in density from 1 to 10% to >50%.

Use of flupropонate was restricted due to concerns about its impact on the endangered golden sun moth (*Synemon plana* Walker) larvae that feed on grass roots including those of Chilean needle grass. There was also a general restriction on any herbicide use during the golden sun moth flight season (October to December).

Seedlings from cleistogene or basal seed and seed banks were the main reasons for a high level of follow-up control required at Jaramlee. The basal seed may have been the reason for the apparent re-sprouting of a number of plants that appeared killed by glyphosate.

To avoid the basal seed development and subsequent reinfestation (which can develop in under six months), more frequent follow-up control is required (when relying on glyphosate). In the worst case this can be two to three times per year. However, it is extremely difficult to identify Chilean needle grass from look-a-like species outside of the winter months, making twice yearly spraying difficult. The golden sun moth flight season restriction also makes twice yearly control difficult to achieve.

Despite these complexities there has been effective initial control at a number of sites. Figure 5 shows Chilean needle grass control polygons (green). Other control polygons include serrated tussock (brown), and Paterson's curse (purple).

Case Study 4 – Oakey Hill Nature Reserve Oakey Hill (61 ha) is surrounded by urban areas with large Chilean needle grass infestations. It is also a popular recreation area like Red Hill. But unlike Red Hill it has less yellow box-red gum grassy woodland.

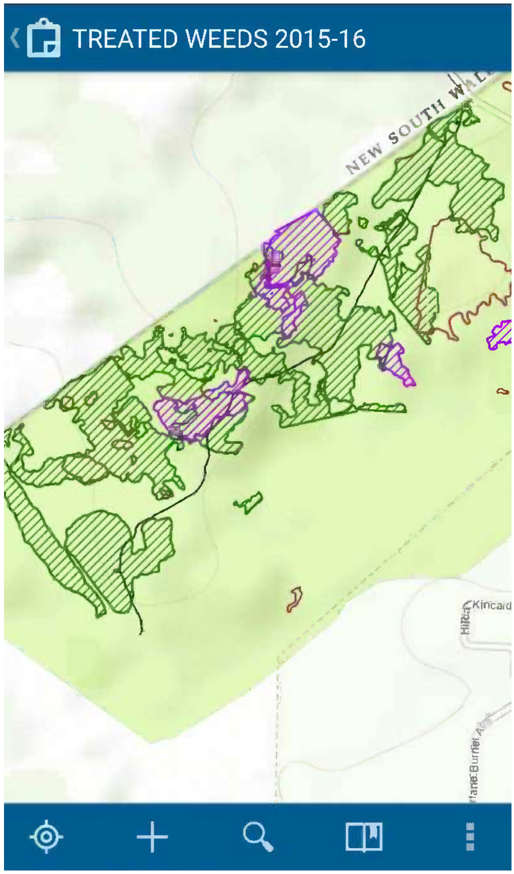

Figure 5. Chilean needle grass control at Jaramlee Reserve.

Infestations tend to be concentrated in the mown areas, but it spreads from these areas along walking trails and animal tracks. A mown area at the reserve summit is heavily infested and seed washes down into the surrounding woodland where new infestations establish (Figure 6).

Flupropонate 745 g L^{-1} has shown to be more effective halting spread in mown areas than glyphosate 360 g L^{-1}, due to its residual properties.

Case Study 5 – Dudley St Reserve Dudley St Grassland is a very small (2 ha) urban native grassland that has become highly degraded due to constant mowing. It is surrounded by very dense (>50%) infestations of Chilean needle grass, so there is a ready supply of seed to re-infest treated areas.

The lower lying kangaroo grass is degraded with one section becoming dominated by Chilean needle grass.

Figure 6. Chilean needle grass control at Oakey Hill Nature Reserve.

The grassland is mowed by machines used in areas infested with both Chilean needle grass and African lovegrass (*Eragrostis curvula* (Schrad.) Nees). Lack of hygiene leads to seed being spread between sites. Spread of invasive grasses like Chilean needle grass by slashers is well documented (Snell *et al.* 2007).

DISCUSSION

Overgrazing and associated animal movement spreads Chilean needle grass. This is a difficult subject as kangaroo culling is contentious.

The main factors affecting Chilean needle grass management have been identified from the case studies discussed above.

The pressure to mow or slash grassland reserves in urban areas is great, due to perceptions of amenity, fire danger and concern about snakes. There is a strict wash-down policy on slashers operating in nature reserves, but this policy is not applied in urban open space. This has lead to a rapid spread of invasive grasses across urban Canberra.

Employing field staff and contractors with very good grass and weed identification skills is required for successful control.

The following factors have been associated with spread of Chilean needle grass: Mowing-slashing, lack of machinery and equipment hygiene, poor grass identification skills, in-complete control, and competing winter duties of land managers so optimal control time is missed. Factors associated with effective control are: winter control, use of flupropanate 745 g L^{-1} for residual control, good follow-up control, and accurate mapping to allow adaptive management.

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