Making a difference to invasive grasses management on the ground

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Summary Exotic, invasive, perennial grasses including African lovegrass, Chilean needle grass and serrated tussock have significant impacts on primary production (livestock) systems, rural communities, and the environment.

With prolific seed production and effective seed dispersal mechanisms, their spread to new areas continues mostly unabated. The dense growth habit of these grasses competes strongly with more desirable exotic and native pasture species, and negatively influences fire regimes, threatening ecosystem structure and function.

Management of these widespread invasive grass weeds is difficult to achieve at a regional scale. Impacts include reduced carrying capacity associated with decreased pasture productivity and quality, and contamination of hides, and wool. Affected farming-dependent communities are impacted by the economic cost of these weeds, potentially reducing community resilience (associated with a loss of services and facilities; human and social capital).

As part of a National Invasive Grasses Research, Development and Engagement Business Plan, New South Wales Department of Primary Industries (NSW DPI) have established three sites in NSW for the demonstration of best management practice (BMP) of African lovegrass, Chilean needle grass, and serrated tussock in stage 1 of this plan. The plan's second stage involves increasing the reach of the initial demonstration sites by working directly with land managers to establish 21 adaptation sites featuring co-designed BMP options for managing these invasive grasses. Formal and informal extension activities around these sites will raise land managers awareness of BMP options available to manage these weeds. These adaptation site networks will help build their knowledge, skills, and confidence to implement 'best management practices' to address invasive grasses on their properties. This staged demonstration and co-designed adaptation site approach is anticipated to accelerate uptake by land managers of effective BMP of difficult-to-control species, particularly these invasive grasses.

Keywords Adaptation, Adoption, Awareness, Best Management Practice, Coordination, Demonstration, Information Sharing, Weeds of National Significance.

EXOTIC INVASIVE GRASS SPECIES

Exotic grass species have a long history of introduction into Australia with at least 2,250 species (and 53,278 accessions) introduced in the 1900s alone (Cook and Dias 2006). While this impressive total represents less than a quarter of global Poaceae (Jacobs 2022), the ongoing legacy of these efforts has been considerable. A number of these grass species form a critical basis for improved pasture and animal production systems, and are used as grain crops. Grasses have environmental benefits for soil conservation and revegetation and have the potential for carbon sequestration and use as biofuels (Jacobs 2022). Other important uses of these grasses include amenity purposes (including lawns) and decorative features in gardens.

In contrast, some of these grass species have become invasive, with more than 180 now recognized as "weeds" in Australia (Virtue *et al.* 2004). Two of the most invasive grasses in southern Australia are serrated tussock (*Nassella trichotoma* (Nees) Hack. ex. Arechav.) and Chilean needle grass (*N. neesiana* (Trin. & Rupr.) Barkworth). In recognition of the impacts these weeds cause, both have been listed and managed as Weeds of National Significance (WoNS, Weeds Australia 2022). Infestations of serrated tussock in southern and central New South Wales (NSW) were estimated to reduce gross margins by more than $26.5 million over two decades ago (Jones and Vere 1998), with current costs of control far exceeding $100 ha^{-1} (Millar *et al.* 2016, AG DAWE n.d.). The potential distribution of serrated tussock in Australia is also

considerable and estimated at 0.32-1.30 million km^2 (McLaren *et al.* 1998, Watt *et al.* 2011, Gallagher *et al.* 2013). Chilean needle grass is thought to incur similar costs ($64-119 ha^{-1}, McLaren *et al.* 2002) but may have a far greater potential distribution at 0.40-2.19 million km^2 (McLaren *et al.* 1998, Bourdôt *et al.* 2012, Gallagher *et al.* 2013).

In contrast, little is known about the costs imposed by African lovegrass (*Eragrostis curvula* (Schrad.) Nees) with current research investigating this (Officer 2022). Despite the cultivar 'Consol' having been planted for pasture and soil conservation purposes in the past (Johnston 1989, Johnston *et al.* 2006), the distribution of African lovegrass is not yet well quantified. Conservatively, the species is known to occur across 10% of Queensland (Qld, Csurhes *et al.* 2016), and is recorded as particularly common across the eastern third of NSW (PlantNET 2022). It has considerable potential to spread in Qld, NSW, and from where it is currently growing in restricted areas of South and Western Australia, Tasmania, and Victoria (Csurhes *et al.* 2016, ALA 2022, VRO 2022). One estimate suggests that 11% of Australia or 2.99 million km^2 could be suitable (Gallagher *et al.* 2013). Despite some data being available, the impact of these species on environmental assets (Coutts-Smith and Downey 2006) and the community is not well known.

This paper will report on activities undertaken by NSW DPI for the National Invasive Grasses Research, Development and Engagement Business Plan, and the second stage of this plan.

PROJECT STRUCTURE

It is difficult to manage the impacts caused by, and the spread of, invasive grass species like African lovegrass, Chilean needle grass and serrated tussock. In response, the Centre for Invasive Species Solutions (CISS), Meat and Livestock Australia (MLA), NSW DPI and Wild Matters engaged with all Australian jurisdictions and Commonwealth Scientific and Industrial Research Organisation (CSIRO) to develop a National Invasive Grasses Research, Development & Engagement Business Plan. NSW DPI have since partnered with CISS and commenced stage 1 implementation of this plan by establishing "BMP Proof/Demonstration sites", one for each of the three species. In consultation with land managers, demonstration sites are trialing a number of BMP treatments which can inform land managers of the options most appropriate to their situation.

The project briefly detailed in this paper forms stage 2 of the plan aiming to increase the reach of the initial demonstration sites. It will improve and update the knowledge base of land managers, industry and community in current BMP methods and tools. This will be achieved through raising awareness and providing sessions linked to the existing demonstration sites, expanding to seven additional adaptation sites for each species (21 adaptation sites in total, Figure 1). The adaptation sites will allow the application of BMP options across a broader set of geographies, properties and manager preferences. Again, in consultation with the land managers, BMP will be tailored to fit the preferences, resources, and limitations that are encountered by each land manager. Infestations will be quantified before and after treatment and monitored to assess treatment efficacy in both demonstration and adaption stages.

Provision of further funding would see this approach expanded to the national level.

WHY THE PROJECT IS NEEDED

Land managers often lack the support and time to review management program outcomes and to refine future adaptive property management. A lack of capacity (including financial/resourcing) and activities/learning opportunities to build this capacity, including information-sharing and skill development, can also constrain the adoption of BMP options to manage these invasive weeds. Adequate resourcing, training and skills development can empower land managers to address these invasive grass weeds.

In stage 2 of this project, the approach is for NSW DPI weed and pasture experts, combined with land manager to co-design and implement best management across properties, landscapes and regions. This approach will build the capacity and skills of land managers to achieve practice change.

This project will seek practical answers to the following questions (but is not limited to just these questions):

i. Are parts of the infestation site arable or non-arable, and what BMP/herbicides could be used in such situations?

ii. What BMP is needed to prevent the evolution or progression of herbicide resistance in these weed species?

iii. Could herbicide applications be combined with grazing pressure and what time/s of grazing are best for suppressing/managing these weed species?

iv. What combination of BMP approaches can be used within the soil and financial constraints of certain land managers?

v. What is the role of competitive pastures, whether existing native or competitive, exotic species in suppressing these invasive grass weeds? and

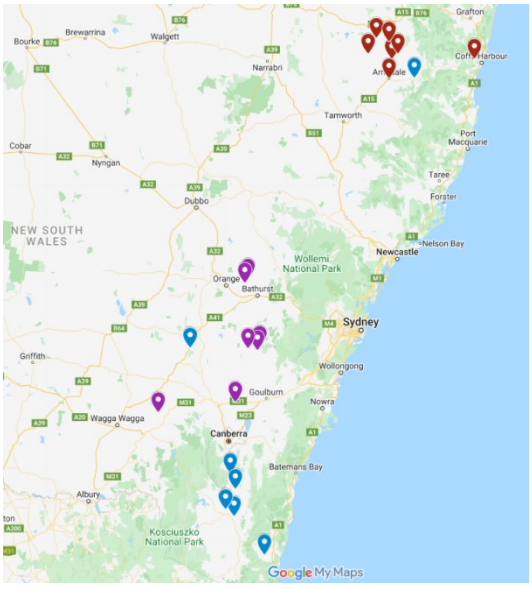
vi. How can BMP practices optimize these pasture species and competition?

SUMMARY

Using demonstration sites to inform BMP options that are then expanded into the adaptation sites, working with pasture and weed experts and codesign with land managers will be an effective way of enabling land managers to best manage their weeds.

Since our work is current, we hope to detail some of the questions explored and the answers derived from our work with various land managers at the presentation of this paper. Results arising from this project will appear in future publications.

Figure 1. Location of the 21 adaptation sites in south eastern NSW. The blue, red, and purple pointers represent African lovegrass (mainly south of Canberra), Chilean needlegrass (mainly north of Armidale) and serrated tussock (Orange-Yass), respectively (Credit A. Bajwa). The demonstration sites are not represented but are near Cooma, Tamworth and Yass, for the above species, respectively.



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