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SA Buffel Grass Project Report 2013-2016

FUNDED BY THE NATIVE VEGETATION COUNCIL

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SA Buffel Grass Project Report 2013-2016

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Background

Buffel grass (*Cenchrus ciliaris*, *C. pennisetiformis*) is a perennial tussock grass native to Africa, India and Asia. Since its introduction into central and northern Australia for pasture improvement and for dust control, buffel grass has become invasive and spread well beyond plantings. Buffel grass is now widely distributed across northern arid South Australia as scattered infestations varying in size and density. Most known infestations occur in South Australia's arid rangelands. However, spread and establishment of new infestations continue to take place and the actual distribution of buffel grass is likely to be greater than is currently known.

Buffel grass is recognised as one of the worst weeds to invade Australia's arid rangelands. Its impacts include its ability to outcompete native plants, degrade or replace habitats for native animals, and increase fire intensity and frequency. These can lead to alteration of entire ecosystems. It also poses significant risk to human health through the increased risk of fire to remote and outback communities. Impacts in indigenous communities include a loss of bush foods and bush medicines, reduced availability of hunting opportunities through species decline, reduced ability to track prey and infestation of rock holes and sites of cultural significance.

Buffel grass is tolerant of drought, fire and grazing. Many of the characteristics that make it a favoured pasture species are also those that make it such a problematic environmental weed, such as its ease of establishment, rapid growth rate, fast maturation, persistence as a perennial, prolonged flowering periods, prolific seed production, ease of seed dispersal and relatively long seed dormancy (Franks, 2002).

In recognition of the potential impacts caused by this serious weed, buffel grass has been declared under the *Natural Resources Management Act 2004* in South Australia. Buffel grass has also been recognised under the *Environment Protection and Biodiversity Conservation Act 1999* and the Commonwealth Department of the Environment has prepared threat abatement advice for ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of buffel grass. The threat abatement advice was developed to guide a national approach to reducing the impacts of buffel grass on biodiversity.

Native vegetation council funded buffel grass project.

In 2012, Biosecurity SA submitted a funding application in partnership with Department of Environment, Water and Natural Resources (DEWNR) through the Native Vegetation Council Significant Environmental Benefit Grant Scheme. The project was developed to align with priorities of the SA Buffel Grass Strategic Plan 2012-2017 and targets established in NRM and Nature Link plans. It further contributes to the protection of threatened and endangered flora, fauna and vegetation communities listed under the *Environment Protection and Biodiversity Conservation Act, 1999*.

The three year project, Buffel Grass Control in Arid Rangelands, received funding of \$500,000. The key deliverables focused on improving the state's knowledge of the density and distribution of buffel grass infestations through roadside surveys, targeted strategic control activities, development of best practice control options, education and capacity building and coordination and provision of technical advice to a number of the states NRM regions regarding buffel grass management. All key project objectives were achieved and in many cases exceeded (Table 1). Delivery of additional activities such as the development of the prioritisation tool and a short film on the impacts of buffel grass on APY communities added to the capacity building and community engagement components of the project. The project was delivered through Rural Solutions SA and administered by Biosecurity SA.

Table 1: Summary of milestone delivery through the SA Buffel Grass Project

SA Buffel Grass Project Milestone Delivery: November 2013 – November 2016		
Objective 1:	Reduce threat or impact of buffel grass on biodiversity by control of strategically important infestations	
Targets	Key Performance Indicator	Milestone Achievement
Rapid response to control 50 hectares of buffel grass at high priority sites	<i>A total of 50 hectares of regional incursions treated by rapid response team by the end of year 2 (June 2015)</i>	Two rapid response team activities were undertaken to target strategic priority infestations for control. Together, the 2015 and 2016 strategic response activities treated a total of 160 ha of buffel grass at high priority sites in the N&Y and SAAL NRM regions. In addition, through engagement of contractors, approximately 400 km of priority roadsides (and rest stops) were surveyed and buffel grass controlled.
Objective 2:	Determine what is best practice for buffel grass control	
Develop, produce and distribute extension materials on what is best practice	<i>By December 2014, distribute extension materials on what is best practice</i>	In February of 2015, a two day buffel grass best practice workshop was held in Port Augusta. A total of 84 stakeholders attended the forum and provided input into the development of best practice guidelines for buffel grass management. A report synthesising the resulting best practice principles was produced and distributed to attendees and made available to the public via the buffel grass webpage.

Establishment of field trial and demonstration sites	<i>A total of 4 (transport corridor, aboriginal land, conservation property and township.</i>	Four herbicide trial sites and one demonstration site were established as part of the project. Sites included a roadside, drainable line, township, conservation property and indigenous protected area. A demonstration site was also set up in the north east pastoral region adjacent to Balcanoona. Establishment, treatment and monitoring took place throughout the project and, following statistical analysis, a fact sheet and report were produced. The results of these trials were incorporated into best practice extension materials.
Objective 3:	Surveillance and early detection to keep high risk areas clean of buffel grass	
Map high risk pathways	<i>By June 2016, 4200 kilometres of high risk pathways are surveyed for infestations</i>	Two buffel grass roadside surveys were conducted (2014 and 2015). A total of 4570 km of roadside were surveyed, 80 buffel grass specimens' collected and identified and opportunistic DNA samples taken as part of this project activity.
Objective 4:	Inclusion of buffel grass management in pest management planning by stakeholders	
SAAL NRM district pest management plans	<i>By December 2014, SAAL NRM Board has received strategic advice on buffel grass management to inform planning processes</i>	Regular advice was provided to SAAL NRM regarding the incorporation of buffel grass management in district pest management plans. Specific advice was provided on the management of buffel grass at Innamincka Regional Reserve, prioritisation and allocation of funds for strategic buffel grass control and methods of community engagement.
NY NRM Upper North District pest management plan	<i>By December 2014, NY NRM Board has received strategic advice on buffel grass management to inform planning processes</i>	In February 2015, a planning meeting was held with managers from the N&Y NRM region at Clare. Advice was provided regarding buffel grass management in the region and a "zoning" exercise was undertaken to prioritise control activities and aid in the establishment of a southern containment line at Warnertown.
Objective 5:	Improve communication and sharing of knowledge and information between weed managers	
Knowledge capture workshop on best practice control	<i>Knowledge capture workshop held by June 2014</i>	A two-day buffel grass best practice workshop was held in Port Augusta on 25th and 26th February 2015 with 84 attendees. The participants were from state and local government, NRM boards, non-government organisations, mining/exploration companies, pastoralists, indigenous communities, railway managers and research organisations. Breakout sessions were held to capitalise on the extensive experience of attendees in identifying best practice buffel grass management, and the results captured to feed into development of best practice extension materials.
Set up a cross-regional communication network of managers	<i>Communication network established by June 2014</i>	Extensive communication networks were established throughout the buffel grass project. A key conduit for distribution of communications through NRM regions and key stakeholders was the SA Buffel Grass Taskforce. Representation included a mixture of regional DEWNR representatives, conservation organisations and government and non-government officers with experience in weed policy and management. Additional networks were established through community and industry engagement. Regular advice has been provided to representatives from NT, WA and Victoria regarding best practice buffel grass management.

Develop awareness raising materials e.g. factsheet, new websites (cf Australian Invasive Cacti Network)	<i>4 Fact sheets and 1 website complete by December 2014</i>	A total of five fact sheets were developed as part of the buffel grass project covering 1) best practice identification, 2) buffel grass control and 3) hygiene, 4) a decision support tool for control options, and 5) a summary of the buffel grass herbicide trial results and associated recommendations. The buffel grass web page was developed to provide members of the public with a single location to source information on buffel grass management. The webpage contains reports and extension materials developed throughout the project, in addition to links to additional resources. Since development, the buffel grass webpage has received 616 visits (as at 24 Nov 2016).
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Buffel grass taskforce

The Buffel Grass Taskforce was formed in 2012. It was formed to provide independent expert advice regarding implementation of the Buffel Grass Strategic Plan 2012-2017. Representation includes a mixture of regional DEWNR representatives, conservation organisation and government and non-government officers with experience in weed policy and management. Other government agencies involved in the taskforce include Department of State Development (DSD), Department of Planning, Transport and Infrastructure (DPTI) and Biosecurity SA.

In 2015, eight members of the buffel grass taskforce visited Coober Pedy and the APY Lands to assess the scale and severity of buffel grass in the region. Coober Pedy was identified as a strategic control opportunity to establish a “highway containment line”. Given the high rate of visitation to Coober Pedy by tourists and travellers driving through the surrounding arid and semi-arid rangelands it serves as a significant risk to nearby cultural and environmental assets of the Kanku-Breakaways and Tallaringa Conservation Parks as well as the Great Victoria Desert (GVD).

Beyond the life of the SA Buffel Grass Project, it is envisaged that the taskforce will continue to be the driving force behind coordinated strategic management of buffel grass throughout the state, with on-ground delivery occurring through DEWNR.



Figure 1: Buffel Grass Taskforce Visit to Coober Pedy (left) and APY Lands (right)

Community engagement

Community engagement and capacity building are key components in the management of any pest plant and particularly important in the management of buffel grass. Early in the delivery of the Buffel Grass Project it became clear that the weed is a matter of contention, with buffel grass seen for its virtues as a beneficial grazing species to pastoralists and as an environmental and amenity weed by other sectors of the community.

Throughout the project, eleven separate community engagement activities were undertaken to educate various sectors of the community in the identification, control, biology/ecology, impacts and best practice management of buffel grass. Workshops engaged over 270 individuals. These were in addition to presentations at the Australasian Weeds Conference and the SA Weeds Conferences.

Stakeholders engaged throughout the project included:

- Community groups i.e. Upper North sustainable farming systems group, Mid-Murray Local Action Planning Association, the North-East and North-West pastoral groups, indigenous ranger groups and trainee staff.
- Administrative groups such as APY Land Management, Buffel Free Great Victoria Desert (GVD) Working Group, Buffel Grass Taskforce, NRM Groups and local government bodies.
- Industry and government bodies i.e. Department of Planning Transport and Infrastructure, Department of State Development, mining industry, herbicide manufacturers, weed control contractors and the Environment institute of Australia and New Zealand.
- Members of the community, 4WD Clubs, Friend of Parks, pastoralists and conservation organisations.

Provision of technical advice was also a key component of the project. Extensive advice regarding management of buffel grass and the development of industry and property management plans was regularly provided to a range of stakeholders. These included DEWNR staff, pastoralists and conservation organisations, transportation and mining industries and indigenous communities. Key outcomes of these communications included increased application of best practice identification, control and vehicle hygiene as well as improved legislative compliance of projects such as the APY road upgrade, Port Augusta National Broadband Network upgrade and Santos mining operations.

Development of an extensive communications network took place through a variety of formal and informal discussion forums. A distribution network was established through which relevant research, new management advances and best practice buffel grass control techniques could be shared.

Numerous communications activities were undertaken as part of the project to raise awareness of the impacts of buffel grass and encourage its management. Multiple ABC radio interviews, a Southern Cross Television interview and a number of newspaper articles were delivered, in addition to articles in regional newsletters.



Figure 2: Community engagement activities at Bon Bon Station (left) and Umuwa (right)

Best practice forum

A two-day Buffel Grass Best Practice Workshop was held at the Arid Lands Botanic Gardens (Port Augusta) on 25 - 26 February 2015. The forum had two main aims. First, to raise awareness of buffel grass and its impacts. Second, to draw on and consolidate the expertise of numerous practitioners from SA and interstate regarding best practice management of buffel grass. Eighty-four participants attended the forum from state and local government, NRM boards, non-government organisations, mining/exploration companies, pastoral stations, indigenous communities, railway managers and research organisations.

The forum comprised presentation of a number of control case studies, facilitated “break-out” sessions on best practice identification, control, hygiene and surveillance, and a herbicide trial site visit. Some valuable networking took place among not only SA buffel grass practitioners but also with a number of interstate agencies. Outcomes of this included improved surveillance and control of buffel grass in Victoria through the Weeds at the Early Stage of Invasion (WESI) project.



Figure 3: Best practice workshop forum (left) and herbicide trial visit (right)

End of project forum

A two day end of project forum was held at the Plant Research Centre, University of Adelaide on 25 and 26 October 2016. A total of 63 people attended the forum, with representatives for South Australia, the Northern Territory, Victoria, Queensland and Western Australia. Presentations focused on best practice management, ecological impacts of high biomass grasses and the social dimensions of buffel grass management, in addition to talks from herbicide producers and regulatory agencies, conservation and indigenous groups and a summary of key activities and findings from the Buffel Grass Project. Of particular interest to both local and interstate agencies was the outcome of herbicide trials, which identified improved options for the control of buffel grass infestations.



Figure 4: Attendees of the 2016 buffel grass project forum (left) and networking opportunities over lunch (right)

Best practice fact sheets

A key deliverable of the project was the development of a practical guide for the best practice management of buffel grass. Early in the project, the buffel grass taskforce determined a preference for a series of fact sheets as opposed to the traditional best practice guide. It was thought this was likely to lead to better uptake by the target audience.

Fact sheets were developed covering 1) best practice identification, 2) buffel grass control and 3) hygiene, 4) a decision support tool for control options, and 5) a summary of the buffel grass herbicide trial results and associated recommendations. When utilised as a package, the series of fact sheets provide a comprehensive guide to assist with the management of buffel grass. Copies of these fact sheets have been distributed to the broad range of stakeholders involved in buffel grass management and are available to the general public through the Biosecurity SA buffel grass webpage.



Figure 5: Examples of best practice buffel grass fact sheets

Buffel grass webpage

A buffel grass webpage was created to provide a single point for members of the public to access key outputs of the project and links to additional resources. Content of the buffel grass web page includes roadside survey and project reports, best practice workshop summary, fact sheets, links to the ABC Landline and SAAL buffel grass videos, the SA Buffel Grass Strategic Plan 2012-2017, key threat abatement advice and the SA buffel grass policy. Since its development, the buffel grass webpage has received a total of 616 visit, with the buffel grass fact sheets being the most highly visited content on the web page. The buffel grass webpage is available at:

http://www.pir.sa.gov.au/biosecurity/weeds_and_pest_animals/weeds_in_sa/weed_id/plant_id_notes/buffel_grass

Roadside surveys

A total of 4200 km of roadside survey was initially planned as part of the SA Buffel Grass Project. Roadside surveys were planned and conducted to provide a rapid insight into buffel grass distribution along high risk invasion pathways throughout the state. In conjunction with existing surveys, conducted since 2005, the majority of high risk roadsides in far north SA have now been mapped. This has allowed us to delimit the southern end of the “core” population to assist in the establishment of a containment line and targeting of outliers for eradication.

To take advantage of the most suitable seasonal conditions, roadside surveys were conducted in both 2014 and 2015 with a total of 8500 km travelled and 4570 km of priority roadsides surveyed. Plant specimens were taken as part of the survey to provide the state herbarium with records of the distribution of *C. ciliaris* and *C. pennisetiformis* and confirm identification of specimens when necessary. A total of 80 specimens were collected throughout the two roadside surveys and all records were entered in the SA herbarium records. Opportunistic DNA sampling was also undertaken to enable future research into the varieties of buffel grass present throughout the state.

2014 Roadside survey - Northern and Yorke NRM region

The 2014 survey route was designed to supplement and complement previous buffel grass roadside surveys. Previous survey reports were examined for ‘gaps’ in survey data and staff from Natural Resources Northern and Yorke were consulted regarding the potential survey route. A total of 1620 km was surveyed, 26 plant specimens collected and 14 DNA samples taken as part of the survey. Isolated outliers were also controlled where feasible within time constraints. The survey was effective in delimiting the extent of buffel grass along roadsides west of the southern Flinders Ranges between Warnertown and the Wilmington Rd and mapped the distribution of buffel grass in the Port Augusta region. Outliers were also mapped on the Yorke Peninsula, highlighting the importance of further surveillance to prevent the establishment of buffel grass beyond its known distribution. The actual route, survey results and specimen collection undertaken during the 2014 roadside survey is available at:

http://www.pir.sa.gov.au/biosecurity/weeds_and_pest_animals/weeds_in_sa/weed_id/plant_id_notes/buffel_grass

Findings of particular concern included the presence of numerous large, high density infestations in the roadside disturbance zone from Port Germein to Port Augusta. Buffel grass in some cases extended up to 100m beyond the road verge onto private land. Furthermore, it appeared that buffel grass is threatening to encroach into vast expanses of high conservation value native vegetation in the Mount Remarkable and Winninnowie Conservation Parks. Due to the high traffic volumes and regular maintenance undertaken, such infestations present particular risk through the spread of buffel grass via tourists and other road users, they also present a risk of roadside maintenance workers (who travel significant distances with slashers and ground engaging machinery) resulting in further spread of existing populations in addition to the establishment of outlier populations in road corridors.

Rail corridors weren't mapped in full during this survey due to access restrictions, although where possible distribution in the rail corridor was recorded. Rail corridors in the region have significant infestations of buffel grass. These populations are a sources of seed for new infestations in neighboring pastoral country. Perhaps more significantly, they also pose a significant risk of long distance dispersal, potentially leading to establishment of buffel grass to the southern portion of the state.

2015 Roadside survey - South Australian Arid Lands NRM region

The 2015 roadside survey was designed to complement existing roadside surveys and identify the distribution of buffel grass infestations threatening key assets, including the Witjira and Gawler Ranges National Parks. A total of 6000 km was travelled as part of this survey with 2950 km of roadside surveyed and mapped.

The focus of this survey was to support existing buffel grass management activities by delimiting the distribution of an outlier population in the Mallala region, surveying key introduction pathways into the Gawler Ranges and mapping of populations threatening the Oodnadatta Track and environmental assets in the Witjira National Park region.

As with the 2014 roadside survey, small outlier infestations were treated, DNA and plant specimens were collected and detailed mapping of buffel grass distribution in both the disturbance and naturalised zones was undertaken.

Key findings of the survey were a number of infestations in the Witjira region (Opossum waterhole and Dalhousie). These consisted of several smaller sparse infestations in creeks extending into the dune systems around locations including Federal HS / Bloods Creek and Dalhousie Springs, while much larger and higher density infestations exist just north of Opossum Waterhole. Another key finding was a number of small to medium infestations in the disturbance zone heading west from Lake Everard Station out toward the lake.

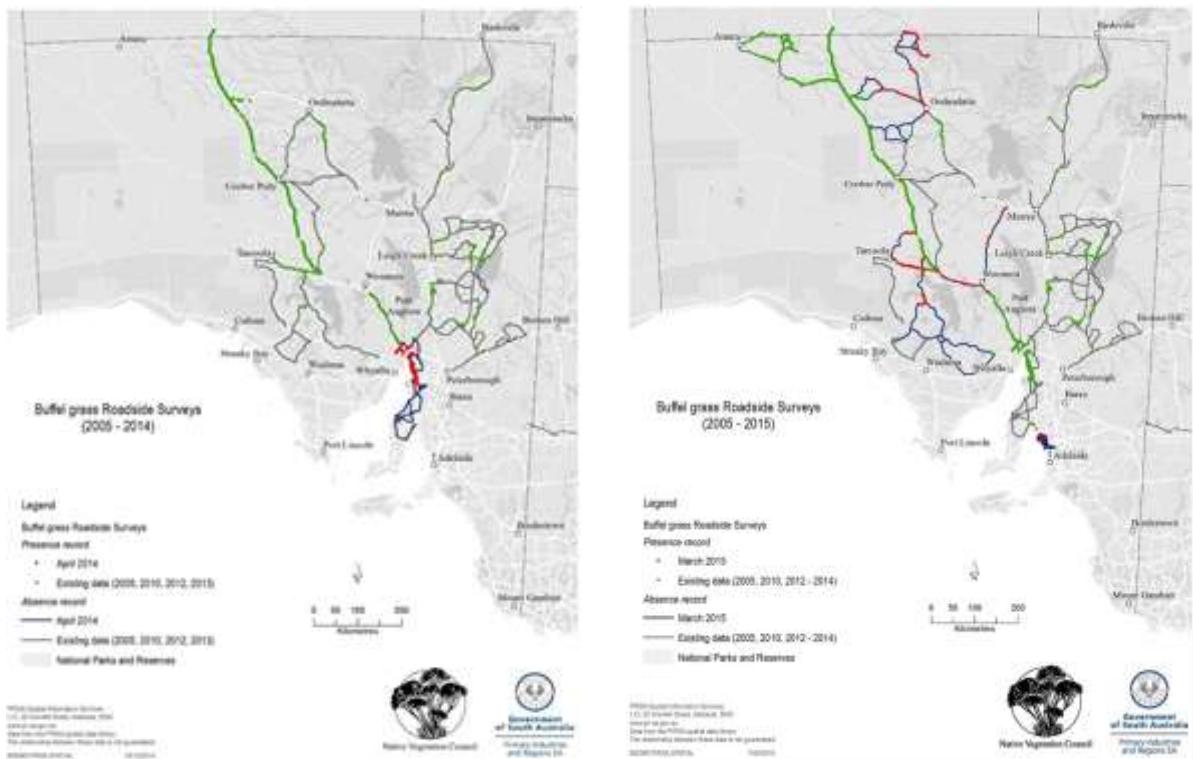


Figure 6: 2014 buffel grass roadside survey route (left) and 2015 buffel grass roadside survey route (right)

State-wide distribution

Known buffel grass distribution in the southern half of South Australia is largely restricted to the roadside disturbance zone and rail corridors, with the exception of a few populations south of Port Augusta. Natural Resources SE, SAMDB, AMLR, EP and the vast majority of N&Y and AW have eradication targets as per the SA Buffel Grass Strategic Plan 2012-2017. The majority of infestations in these regions are limited in both numbers of plants and extent, and eradication is achievable given appropriate resources.

In the SAAL Natural Resource Management (NRM) region, known buffel grass distribution is patchy on roadsides, in drainage lines and on private property, with infestations ranging from isolated individual plants to large, high density infestations. Infestations in this region appear to require greater resourcing than is available to eradicate and consequently the region's priority is containment of infestations. Regional priorities identified include the control of populations along the Barrier Highway and in the region from Port Augusta to Glendambo, Glendambo to Kingoonya and through the Gawler Ranges to prevent spread into neighbouring regions.

APY (Anangu Pitjantjatjara Yankunytjatjara) communities are significantly impacted by the invasion of buffel grass. Vast expanses of the APY region are heavily infested with buffel grass with noticeable reductions in the diversity and abundance of native plant communities as well as populations of kangaroos, goannas, emus, and other birds and animals.

Buffel grass distribution is patchy from the Stuart Highway to approximately fifty kilometres from Umuwa. Widespread infestations occur around the townships of Indulkana and Mimili although roadside distribution is patchy. Once in the vicinity of Umuwa, buffel grass distribution and density dramatically increases, with high density infestation extending well into the naturalised zone. Large expanses of the region from Umuwa to Ernabella, Amata and Pipalyatjara contain heavy infestations of buffel grass in both the disturbance and naturalised zones. Management in this region is limited to the protection of assets of cultural and environmental significance and in communities to minimise seed dispersal.

Buffel grass occurrences dramatically drop off in the region South of the Anne Beadell highway and throughout the Great Victoria Desert (GVD), with comparatively small infestations largely limited to roadsides and indigenous communities. Due to limited distribution of buffel grass in this region and the high value asset of the GVD presents, an eradication target is in place.

An area of particular concern includes Innamincka Regional Reserve where there are high value assets at risk such as the Coongie Lakes. A challenge in this region is that rainfall sufficient to promote buffel grass germination and growth often also results in closure of roads in the region, making prevention of seed set and dispersal impossible. Other populations of concern include those in and around Witjira National Park, those on pastoral properties in close proximity to the Flinders Ranges and Tallaringa Conservation Park and infestations along the rail corridor west of Kingoonya and in the Great Victoria Desert (GVD), Strzelecki and Oodnadatta Tracks. The remote nature of these populations make it difficult to undertake regular surveillance and control activities and infestations often go unnoticed for some time. Although distribution is currently limited in the GVD, buffel grass poses a significant risk to this, one of the few largely untouched areas of South Australia. Access to this region is limited due to the lack of roads and presence of indigenous protected areas. While this poses challenges for surveillance and control, it also limits dispersal in this region, presenting a good opportunity to achieve an eradication target in the medium term.

Buffel Grass Management Zones and Distribution in South Australia

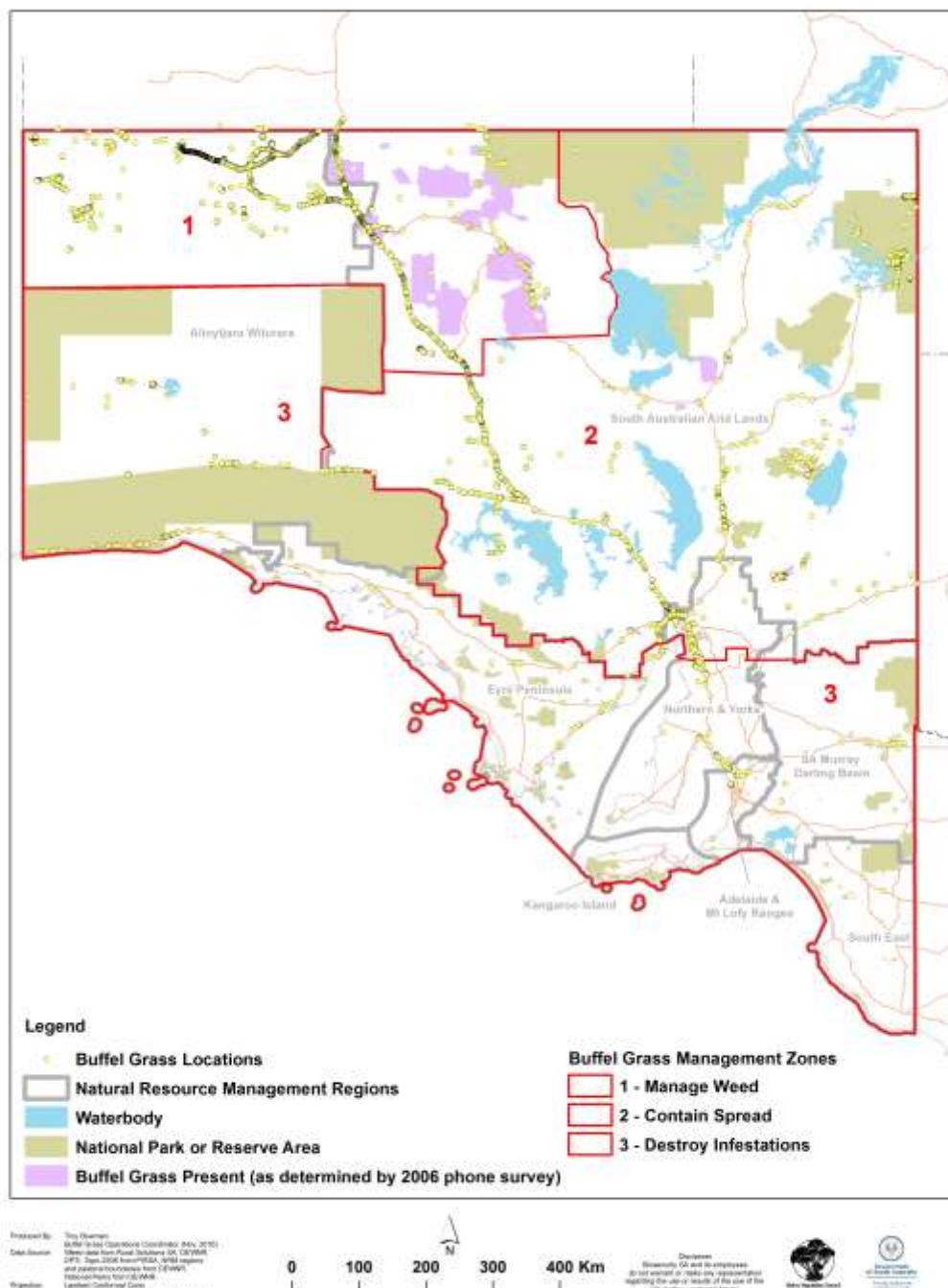


Figure 7: Buffel grass distribution in South Australia

Prioritisation tool

The buffel grass prioritisation tool was developed to assist NRM regions and other agencies in prioritising buffel grass infestations for control, building on existing work undertaken by the University of Adelaide (Marshall et al. 2013). The tool uses a multi-criteria analysis shell with the ability to feed in variables thought to influence priority for control. The tool uses the buffel grass geodatabase containing both roadside survey and other buffel grass distribution data, incorporates habitat suitability and landscape susceptibility with the feasibility of control (i.e. isolation, clustering and location of infestations) as well as the assets to be protected (i.e. conservation reserves, occurrence of threatened species). Weightings are applied to each of the input layers and the tool produces an output layer of priorities for control which can be exported into Google Maps or ARC GIS software and analysed further (or used to create maps of the priority outputs). Weightings of each of the secondary inputs can be adjusted to reflect user priorities and the target areas for priority control will automatically be updated.

The prioritisation tool has the ability to be updated with additional buffel grass distribution data as collected and re-run to update the priority scores for infestations. The tool also has scope for further development, including incorporation of additional inputs/criteria such as fire-sensitive plant communities, control history, indigenous protected areas.

The concept of this prioritisation tool could be applied to other weeds and pest animals, by supplying the multi-criteria analysis shell software with suitable input data.

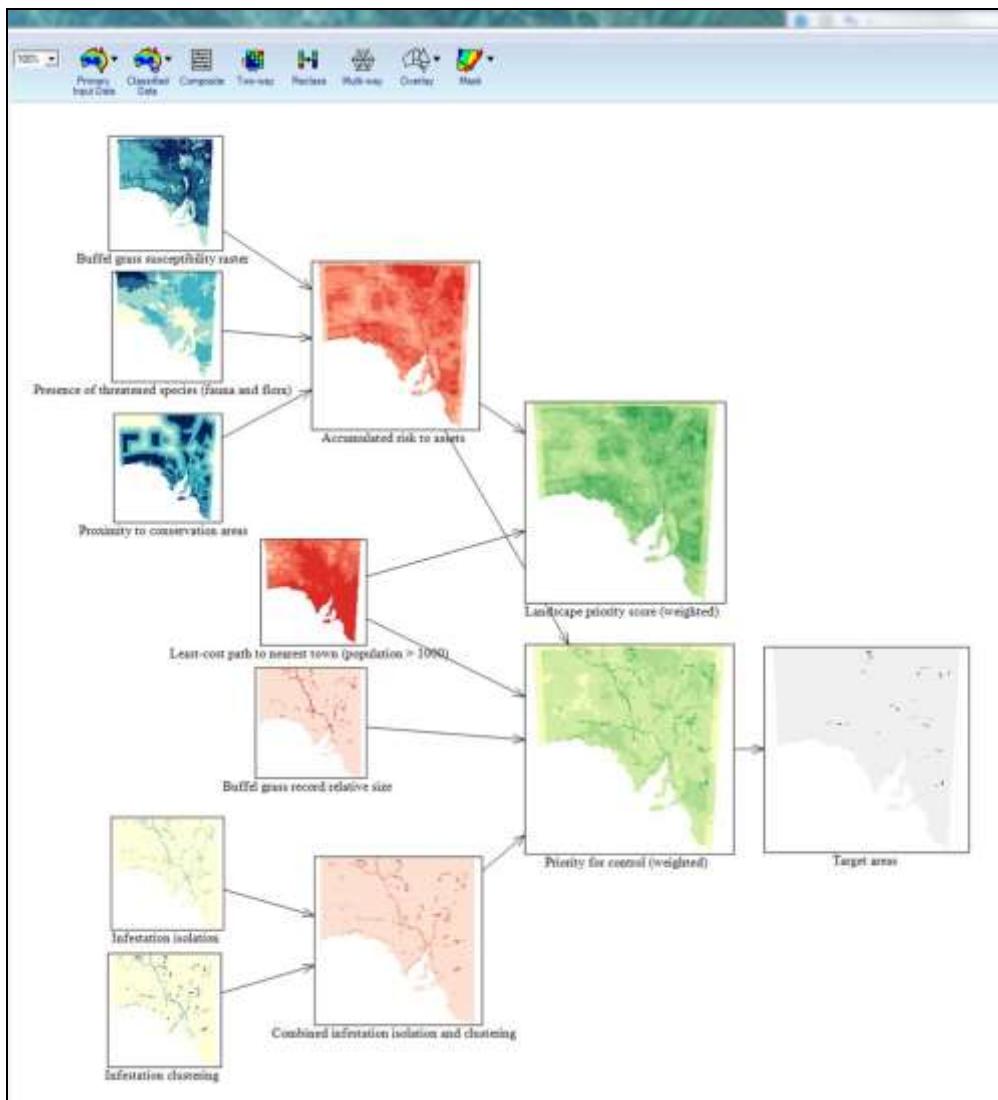


Figure 8: Buffel grass prioritisation tool (MCAS interface)

At completion of the project a handover was conducted with GIS officers from each of the NRM regions. All GIS data, instructions for use of the tool and Arc Map templates were provided, in addition to a copy of the program used to run the tool and a practical demonstration of the tool. The tool was well-received and should prove valuable in helping NRM regions to target and prioritise management activities to obtain the maximum benefits from available resources.

Herbicide trials

Introduction

Buffel grass herbicide trials were established to support the development of best practice buffel grass control guidelines. Four trial sites were established across the latitudinal range of buffel grass in South Australia at sites representing the key situations in which buffel grass infestations occur (township, roadside, drainage line and indigenous protected area). Sites were also selected to account for the differences in climatic conditions, soil type and varieties of buffel grass.

The aim of the trials was to identify the herbicides and application rates most effective in:

- killing mature buffel grass tussocks
- suppressing buffel grass germination
- reducing buffel grass cover
- controlling buffel grass whilst minimising impacts on native vegetation

The main herbicide trial (glyphosate and fluopropanate) was conducted at sites on Bon Bon Station, Umuwa (in the APY Lands and Arid Lands Botanic Gardens at Port Augusta). A further trial at the North Well site compared different rates of Roundup Biactive™ (glyphosate 360 g /L), Fusilade™ (fluazifop-P 212 g/kg) and the physical removal of tussocks.

Another trial at ALBG examined herbicide control after tussocks had been burnt. Roundup Powermax™ (glyphosate 540 g/L) was applied at a rate of 4 L/ha to tussocks 2, 4 and 6 weeks after they had been burnt.

Methodology

Trials were established with three replicates at Arid Lands Botanic Gardens, Bon Bon Station, North Well Station and Umuwa (APY Lands). Each plot was 3m x 10m (30m²) with 3m buffers (Bon Bon Station) and 2m buffers (North Well and Arid Lands) in between treatments. Untreated control plots were included in the design. A calibrated knapsack and operator were used to apply the treatments at designated rates using multiple passes to achieve full coverage.

All treatments were applied at a rate of 300L/ha with the exception of one Roundup™ treatment that was applied at 600L/ha and the Taskforce™ treatments which were applied at a rate of 1000L/ha.

Results

The herbicide trials identified the most effective control option in most situations as the use of Taskforce™ + Roundup™ at a rate of 3L + 250ml/ha. Use of this mix controlled mature tussocks, prevented further seed set in the short term and suppressed new germinations for approximately 20 months. Taskforce alone proved effective in controlling mature tussocks and suppressing new germinations at a rate of 3L/ha although was not as successful in controlling mature tussocks at a rate of 1.5L/ha. Following burning of tussocks, effective control was achieved by applying Roundup Powermax™ at a rate of 4L/ha 4-6 weeks after burning (allowing for a minimum of 15-20cm of regrowth prior to treatment). Herbicides available for use in close proximity to drainage lines are limited; however, trials identified effective control of tussocks in these situations could be achieved by applying Roundup Biactive™ at a rate of 5L/ha. Physical removal of tussocks promoted new germinations through disturbance, highlighting the importance of follow-up control. For full results of the herbicide trials please see the attached report in the Appendix.

Buffel grass strategic response

2015 Strategic response - Northern and Yorke NRM region

In 2015, each of the state's NRM regions were approached to support a pilot buffel grass strategic response. The aim of the pilot program was to establish a rapid response framework that could be used by staff from across the state to collaboratively implement strategic buffel grass control. The activity provided officers with training in the identification, control and best practice management of buffel grass. In addition it also provided an opportunity for networking, discussing local issues and priority pest species and observing the impacts of buffel grass at high density.

All logistics, planning and management of works crews and traffic management was undertaken by the Buffel Grass Operations Coordinator. Expenses such as meals, accommodation and herbicides were provided by the project and officer time and vehicle expenses were provided as an in-kind contribution by the NRM regions. Each region was also requested to provide spray equipment suitable for the strategic response.

In 2015, the target area for strategic response was the southern limit of the core population as mapped in the 2014 roadside survey (between Crystal Brook and the Wilmington Road). All populations along roads from Warnertown to Port Germein (including the highway) and all roads east and west of the highway from Port Germein to the Wilmington Road were controlled. The aim of the activity was to establish a southern containment line and protect the southern Flinders Ranges from buffel grass invasion.

Eighteen NRM staff from seven regions were involved with the response. A total of 19,750L of herbicide was sprayed over 123 km of roadside. 78 ha of roadside was protected from the impacts of buffel grass over the five days of strategic response, at a total cost of \$11,500.

Reports from the NRM officers involved in the program were overwhelmingly positive and resulted in an increased appreciation of the importance of buffel grass control in regions with very limited buffel grass distribution. Feedback from the regions highlighted the value of the strategic response and many of the staff indicated a willingness to be involved in a 2016 strategic response.

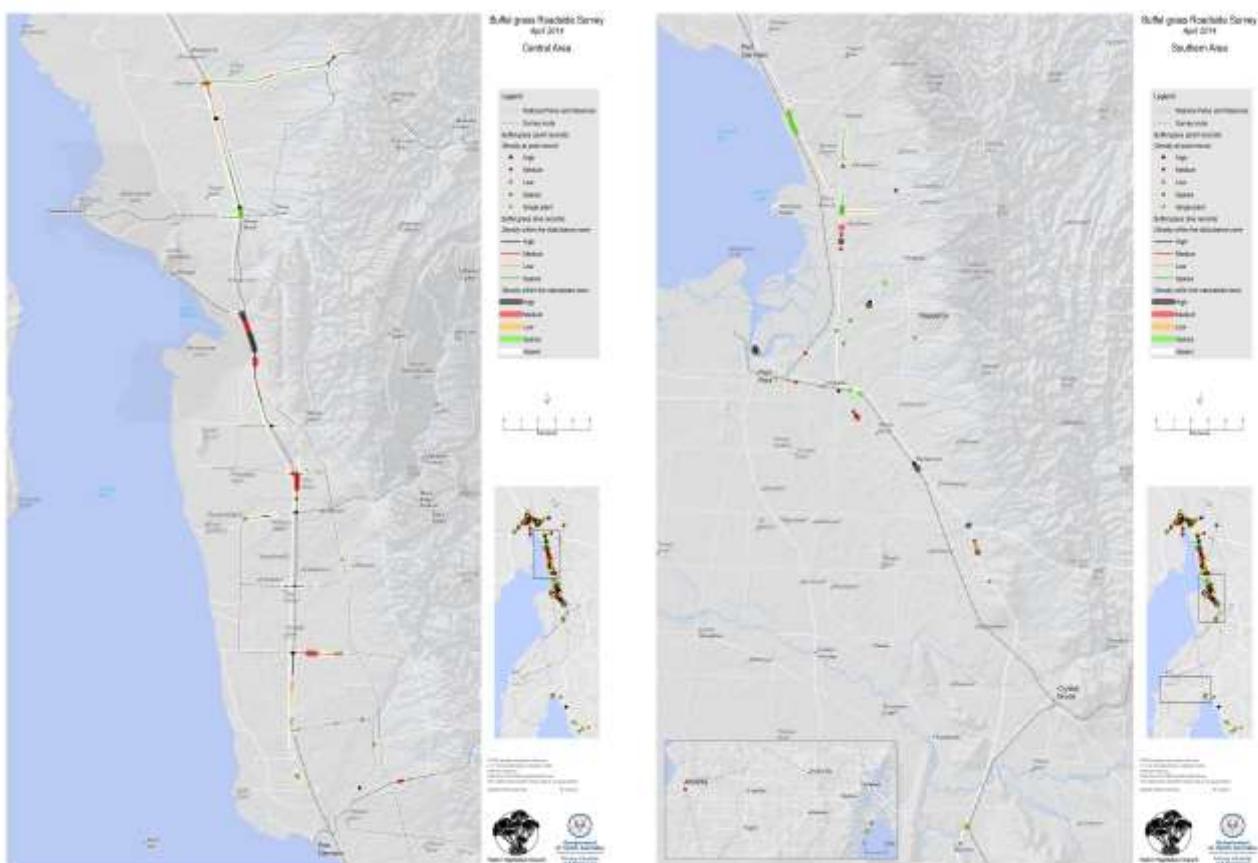


Figure 9: 2015 Strategic response priorities for control



Figure 10: 2015 Buffel grass strategic response team

2016 Strategic response - South Australian Arid Lands NRM region

Following the success of the 2015 strategic response, consultation with the buffel grass taskforce and Natural Resources South Australian Arid Lands and the Coober Pedy Council, a 2016 strategic response was planned in the Coober Pedy region.

Given the distribution of buffel grass in the region, Coober Pedy was identified as being a potential source population for invasion into the surrounding rangelands, and nearby Kanku-Breakaways and Tallaringa Conservation Parks. Extensive control was undertaken in and around the township and along the Anne Beadell highway portion of Mabel Creek Station, which is a potential introduction pathway into the Great Victoria Desert.

Twelve staff from five of the state's NRM regions were involved in the 2016 strategic response over five days. 20,100 L of herbicide was sprayed throughout the week over approximately 82 ha of roadside and drainage line. Two teams conducted three and a half days of surveillance and control on Mabel Creek Station over approximately 50 ha. All major roads in and out of the township were surveyed and control of approximately 32 ha of buffel grass was undertaken by the strategic response teams. Coober Pedy Council assisted with traffic management and the provision of water for the week's activities.

Infestations in the Coober Pedy township varied from isolated individual plants to large, high density infestations on roadsides, drainage lines and small depressions. Buffel grass was also present in a number of front yards, although control was undertaken on only three private properties. Of particular concern was the large, high density infestation of approximately 1 km of drainage line at the eastern end of town. This infestation posed a significant fire risk to township infrastructure in addition to being a potential seed source giving rise to infestations downstream. South of Coober Pedy (down the Stuart Highway), buffel grass distribution is patchy and in most cases limited to the roadside disturbance zone. Occasional infestations occur in depressions in the naturalised zone although generally only within approximately 50 m of the roadside. Existing control efforts of DPTI, SAAL NRM and Bush Heritage Australia have controlled all known buffel grass from Port Augusta to the northern Bon Bon Station boundary, resulting in a strategic opportunity to link up roadside control efforts along the 85 km of highway.

Distribution on Mabel Creek Station appeared to be largely limited to the disturbance zone along the Anne Beadell highway and naturalised zone within approximately 100 m of the main road. In some cases buffel grass had infested drainage lines adjoining the road, however in most cases had only spread a short distance downstream. All buffel grass within this zone was controlled from approximately 10 km east of the Ghan Railway to approximately 10 km beyond the Mabel Creek Homestead (beyond which no buffel grass was observed).

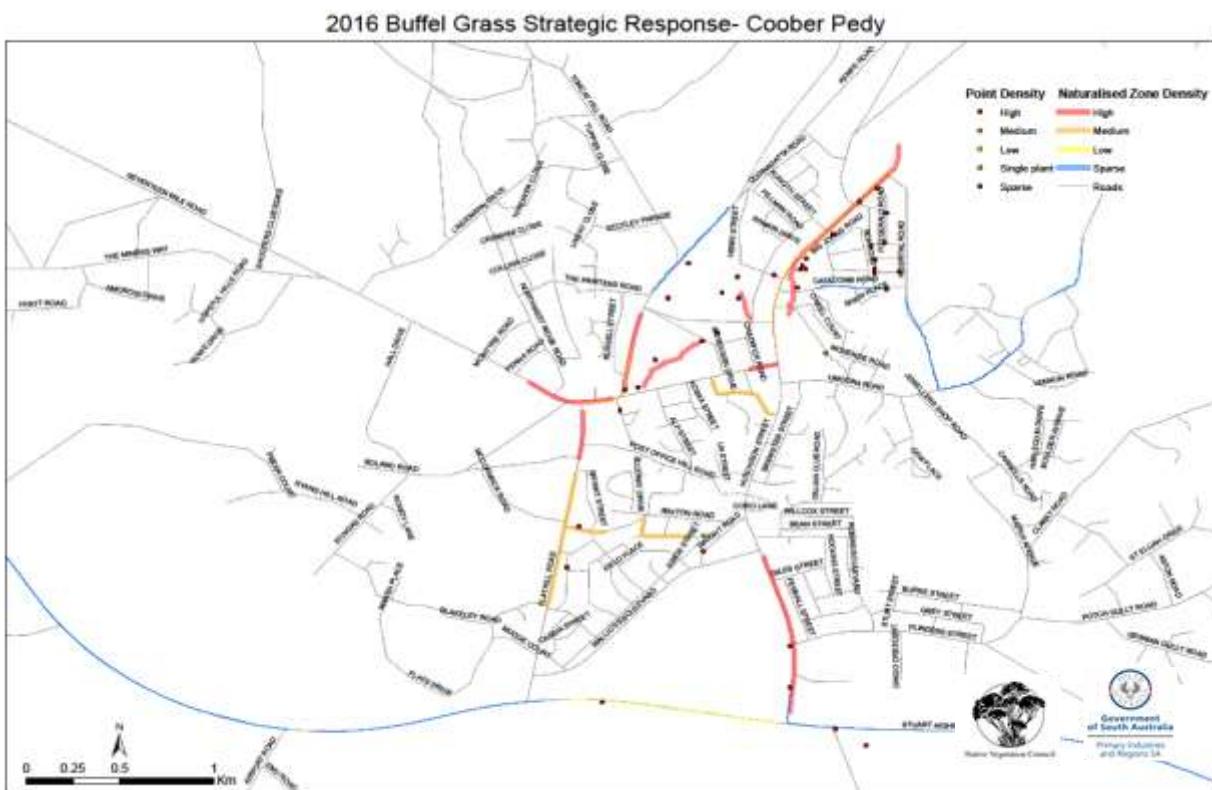


Figure 11: Control undertaken in Coober Pedy as part of the 2016 buffel grass strategic response

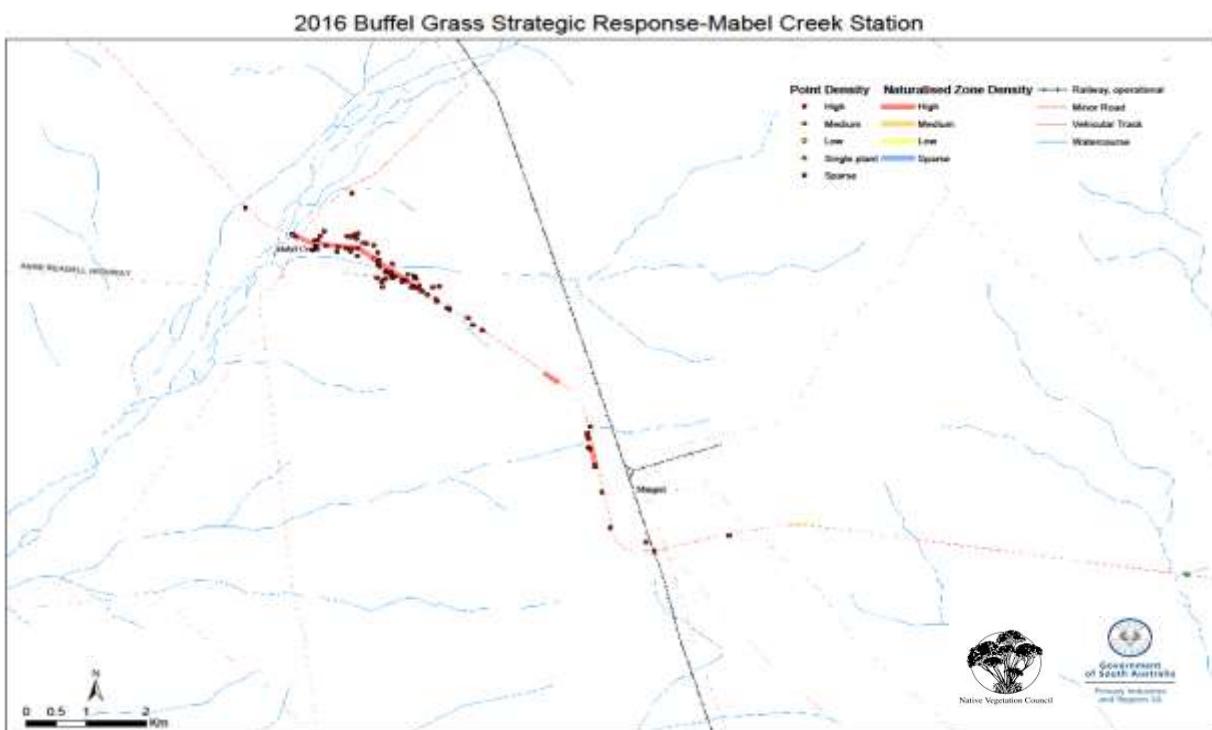


Figure 12: Control undertaken in Mabel Creek as part of the 2016 buffel grass strategic response



Figure 13: 2016 Buffel Grass Strategic Response Team

Contractor works

Targeted strategic control of buffel grass was undertaken as part of the Buffel Grass Project. Roadsides are a known major vector for the spread of buffel grass, therefore the focus of contractor works was to establish three key roadside containment lines, south of Port Pirie, from Port Augusta to Glendambo and from Port Augusta to the Strzelecki track. Contractors targeted infestations along roadsides that have the potential to spread out into the naturalised zone and/or act as seed sources. In addition to key stretches of road, three townships were targeted for control; Port Pirie, Port Augusta and Coober Pedy.

These works were conducted at a cost of approximately \$80,000. Each of the target areas received annual control. Seasonal conditions resulted in multiple germinations and an opportunity to undertake two rounds of control in 2015, thereby depleting the seedbank. Contractor works undertaken were a resounding success with significant reduction in buffel grass occurrence in these target areas. During recent observations along the roadside from Port Augusta to Leigh Creek, it proved difficult to spot any buffel grass. This is in contrast to the numerous obvious infestations observed prior to the commencement of the Buffel Grass Project.

Port Augusta

Thorough annual control was undertaken in the Port Augusta area. The distribution of buffel grass along roadsides suggests that the Port Augusta area is a central node from which buffel grass is dispersed into neighbouring regions. This area is frequently visited by tourists and local pastoralists, who then travel throughout the arid and semi-arid rangelands of South Australia to undertake both work and recreational activities.

Coober Pedy

Contractors were engaged to undertake targeted control in the Coober Pedy township and council staff were trained in the application and use of herbicides for the control of buffel grass in 2015. As with Port Augusta, the Coober Pedy township is visited by large numbers of tourists travelling to and from the Fink Desert Race and traveling out into the remote South Australian outback. The area acts as hub for dispersal of buffel grass seed that is picked up on vehicles and machinery with the potential to infest the production, cultural and environmental assets across outback South Australia.

Priority national highways

Through partnerships with DPTI and the Natural Resources SAAL, annual control was also undertaken along roadsides, rest stops and high traffic areas (such as the Prairie Hotel) along the Outback Highway from Port Augusta to the Strzelecki Track, from Port Augusta to Glendambo and the region south of Port Germein. Ongoing commitment through Natural Resources SAAL and N&Y will see continued roadside control south of Port Pirie, along the Barrier Highway and the region from Port Augusta to Glendambo.

Recommendations

Throughout the Buffel Grass Project, significant gains have been made in building the capacity of stakeholders and targeting strategic populations for surveillance and control. Numerous opportunities exist to build on the activities of the Buffel Grass Project in addition to opportunities to secure existing investment by conducting follow-up control in areas where viable seed remains in the soil seed bank. It is recognised that these opportunities will need to be assessed in the context of wider management plans and available resources. To aid in this process, key recommendations are presented to guide future prioritisation and investment decisions.

1. The SA Buffel Grass Taskforce serves as a key ‘brains trust’ and conduit for the dissemination of research and best practice management information, in addition to driving initiatives such as strategic response activities and cross regional surveillance and control activities. Continuation of the Buffel Grass Taskforce would provide a driving force in buffel grass management throughout the state in addition to a forum for the identification of future research priorities, development of funding applications and the provision of advice to buffel grass management practitioners.
2. Further engagement of a range of stakeholders is integral to the management of buffel grass and success in achieve regional management objectives. Increased engagement of the mining industry, road and rail corridor managers, National Parks rangers and pastoralists will play a significant role in reducing the risk of further establishment of buffel grass and protection of South Australia’s key environmental assets.

3. A key priority for investment is to conduct ongoing follow-up surveillance and control in areas treated through the 2015 and 2016 strategic response activities and in key seed dispersal nodes such as Port Augusta and Coober Pedy (through engagement of local councils).
4. Annual strategic responses are a cost-effective way of achieving significant benefits. These would leverage off those undertaken in the Port Augusta region, along roadsides from Port Augusta to Leigh Creek and in the Port Germein and Coober Pedy areas. These activities have been targeted to establish containment lines, prevent further spread and protect key assets such as the Southern Flinders Ranges, Kanku-Breakaways and Tallaringa Conservation Parks from buffel grass invasion.
5. Roadside surveys should be undertaken in the region south of the Barrier Highway, east of Mount Remarkable National Park and throughout the Great Victoria Desert to delimit the distribution of buffel grass along this front and identify outlier populations for priority control.
6. Thorough surveillance and control in the Tallaringa Conservation Park should be a priority given the presence of buffel grass on neighbouring Mabel Creek Station. To reduce the likelihood of introduction of buffel grass into Tallaringa Conservation Park and the Great Victorian Desert, follow up surveillance and control should be undertaken along the Anne Beadell Highway portion of Mabel Creek Station in 2017 and beyond.
7. Given the extensive works undertaken by DPTI, NR SAAL, Bush Heritage Australia and the 2016 buffel grass strategic response, an opportunity exists to leverage this via the control of buffel grass from the northern Bon Bon Station boundary to Coober Pedy. Buffel Grass is largely limited to the roadside disturbance zone in this region (with the exception of a few small populations) and control of this population before it encroaches on the naturalised zone (beyond roadsides) and becomes widespread would be cost-effective.
8. Further delimitation of the extent of buffel grass in areas in which there is an eradication target. Buffel grass surveillance and the resulting distribution data are integral to the prioritisation of control. Prioritised early intervention and control are by far the most cost-effective options for buffel grass management. Surveillance (roadside surveys) should be undertaken to enable targeting of populations at the early stage of invasion.
9. Further project development and allocation of resources should be prioritised to the Buffel Free GVD (a project to build the capacity of agency staff and indigenous groups across the GVD to conduct buffel grass surveillance and control), to enable achievement of long-term eradication objectives in the Great Victoria Desert. Consideration should be given to development of working partnerships with neighbouring NRM regions to undertake control along key introduction pathways into the GVD.
10. Incorporate buffel grass mapping into property planning and activities undertaken on pastoral properties by Natural Resources Management authorities. There are significant gaps in our knowledge of buffel grass distribution on pastoral properties.

11. Identify options to continue state-level coordination of buffel grass management to maintain priority on-ground works, prevention, surveillance and land holder capacity to undertake best practice control.

Conclusion

A number of South Australia's key cultural and environmental assets are at risk of significant impacts arising out of buffel grass invasion. Buffel grass is a transformer species, with the ability to completely alter ecosystems through outcompeting vegetation and increasing both the frequency and intensity of fires. Outback and indigenous communities are facing increased risk of impacts to infrastructure and human safety from fire and environmental assets are at risk due to the variety of impacts caused by buffel grass invasion.

The need to prioritise resources to achieve a variety of NRM outcomes makes effective buffel grass surveillance and control challenging, particularly in the AW, SAAL and N&Y NRM regions. It is increasingly important for organisations to work together to achieve a common goal. Success of activities such as the strategic response program provide a framework for the cross-regional management of buffel grass to support delivery of state-wide outcomes.

Significant gains have been made toward a broader community appreciation of the impacts of buffel grass, best practice control and management throughout the three years of the South Australian Buffel Grass Project. The level of participation in buffel grass surveillance and control across the state has increased and the risk of buffel grass invasion to some of the states key cultural and environmental assets has been significantly reduced. Best practice extension materials developed have provided practitioners with practical aids for the identification, control, hygiene and decision making process associated with buffel grass management.

Significant progress has been made in the management of buffel grass in South Australia, achieved through the delivery of strategic response, capacity building and targeted control has achieved. Considerable momentum has been built and to ensure the long term benefits of this project are realised, careful consideration of recommendations of this report is crucial.

References

- Biosecurity SA (2012). South Australia Buffel Grass Strategic Plan: A plan to reduce the weed threat of buffel grass in South Australia. Government of South Australia.
- Biosecurity SA (2014). Buffel Grass Roadside Survey April 2014. Government of South Australia.
- Bowman, T., and Prider, J. (2016). Buffel grass herbicide trial: A summary of results and recommendations, Government of South Australia.
- Department of Environment (2014). Threat abatement advice for ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of buffel grass (*Cenchrus ciliaris* and *C.pennisetiforumis*). Australian Government.
- Franks, A. J. (2002). The ecological consequences of buffel grass *Cenchrus ciliaris* establishment within remnant vegetation of Queensland. *Pacific Conservation Biology* 8, 99–107.
- Rural Solutions SA (2015). Buffel Grass Roadside Survey March 2015. Government of South Australia.

Acronyms

APY	Anangu Pitjantjatjara Yankunytjatjara
AMLR	Adelaide and Mount Lofty Ranges
AW	Alinytjara Wilurara
DEWNR	Department of Environment, Water and Natural Resources
DPTI	Department of Planning, Transport and Infrastructure
DSD	Department of State Development
EP	Eyre Peninsula
GVD	Great Victoria Desert
NRM	Natural Resources Management
N&Y	Northern and Yorke
SAAL	South Australian Arid Lands
SAMDB	South Australian Murray-Darling Basin
SE	South East

Appendix

Herbicide trial report to be inserted.



Buffel Grass Identification

FACTSHEET

Buffel Grass – Collective term for *Cenchrus ciliaris*,
C. pennisetiformis

Description

Buffel grass is an introduced, summer-growing, perennial grass 0.2 – 1m high. It is often found along roadsides and rail corridors. It has the ability to invade a variety of landscapes throughout South Australia.

Key Identifying Features

Habit:
Erect, tussock-forming, deep-rooted grass 0.2 – 1m high. Buffel grass can vary significantly in appearance depending on the time of the year. Following summer rain and active growth, buffel grass leaves are green and in dry times when the plant is dormant the leaves are straw coloured.



Roadside buffel grass infestation



Cenchrus ciliaris



Cenchrus pennisetiformis



FACTSHEET

Buffel Grass – Collective term for *Cenchrus ciliaris*,
C. pennisetiformis

Buffel Grass Control

Buffel grass has been recognised as one of the greatest pest threats to the arid rangelands of South Australia. It is referred to as a 'transformer species' meaning it has the ability to alter entire ecosystems through the alteration of fire regimes and competition with native plants.

In recognition of its social and environmental impacts, buffel grass has been declared as a weed under the *Natural Resources Management Act 2004*.

Buffel Grass Biology

Buffel grass is an erect, tussock-forming, deep rooted perennial grass 0.2 – 1m high. It has an extensive, fibrous root system which resides mainly in the top 20cm of soil. Due to this extensive root system, buffel grass has the ability to respond rapidly to summer rain. Falls of 20mm can see the weed grow and flower in as little as three weeks after the rain event.



Cenchrus ciliaris

This weed has the ability to produce prolific small seed which are enclosed in burrs. It has the potential to disperse great distances by wind, water and animals. However, human spread via vehicles and machinery is regarded as a major cause of new infestations in South Australia.

Buffel grass generally has active growth during summer months and is dormant (i.e. does not actively grow) during winter. However, seasonal and regional variation in temperature and rainfall can result in buffel grass growth year round.

Integrated Weed Management

Integrated weed management (IWM) is a term used to describe the long term management of a weed using a combination of different prevention and control techniques. An IWM approach will be tailored for a given weed based on its ecology, density and the land-use in which it occurs.



Cenchrus pennisetiformis





FACTSHEET

Buffel Grass – Collective term for *Cenchrus clandestinus*,
C. pennisetiformis

Buffel Grass Hygiene

Buffel grass has been recognised as one of the greatest pest threats to South Australia. It is often referred to as a transformer species meaning it has the ability to alter entire ecosystems through the alteration of fire regimes and through competition with native flora.

Following introduction into South Australia, buffel grass has invaded a significant portion of the states arid and semi-arid rangelands.

Why is Hygiene Important?

Weeds reduce the quantity and quality of Australia's agricultural products. It is estimated that weeds cost Australian farmers around \$1.5 billion a year in weed control activities and a further \$2.5 billion a year in lost production.

Hygiene is important to protect agriculture as well as priority assets such as the Flinders Ranges, Great Victorian Desert and other sites of cultural and/or environmental significance.

Buffel grass is a prolific seeder. Due to the seeds small size and fine hairs it has the ability to spread long distances into remote areas via vehicles, earth moving and other machinery, stock, wind, water and other human activities.

Preventing Weed Spread – What Can I Do?

- Ensure vehicles are clean before entering a new site.
- Stay on tracks.
- Avoid areas of high-risk or known buffel grass infestations. If unavoidable, plan a route from areas of low infestation to areas of high infestation.

To Minimise Buffel Grass Spread by Animals and Other Products

- Quarantine any animals suspected of carrying buffel grass seed in a withholding paddock for a minimum of 7 days. Monitor the withholding paddock following summer rains and carry out control as necessary.
- Be sure to decontaminate vehicles used for transportation of stock or other products. If not possible, be sure to undertake regular surveillance and control in the loading and unloading paddocks following summer rains.
- Avoid enabling dogs to run freely though areas infested with buffel grass.
- Avoid stockpiling items close to buffel grass infestations.





A Decision Tool for Buffel Grass Control

FACTSHEET

Buffel Grass – Collective term for *Cenchrus ciliaris*,
C. pennisetiformis

Buffel grass is widely regarded as one of the greatest environmental weed threats to the ecosystems of arid and semi-arid South Australia. It is recognised as a transformer species through competition with native plants, its ability to alter fire regimes and the resulting impact on plant and animal communities. Buffel grass also presents an increased fire risk to human safety and infrastructure assets.

This fact sheet has been developed to assist land managers in deciding the appropriate course of action for the control of buffel grass infestations.

The decision support tree, illustrated overleaf, is intended to assist managers to select the appropriate herbicide and management action. The associated control calendar is intended to inform the appropriate timing for each of the management activities recommended over the life cycle of the buffel grass infestation.

Integrated Weed Management

Integrated weed management (IWM) is a term used to describe the long-term management of a weed using a combination of different prevention and control techniques. In the rangelands, IWM is important to achieve effective long-term control that encourages the regeneration of native plants and animals within the infested area.

A successful buffel grass management plan should include:

- correct identification and knowledge of the weed's life cycle to inform the appropriate management approach
- ongoing surveillance to assist in the prioritisation of sites and early detection of new infestations for control
- mapping and monitoring weed populations to measure the success of control activities
- a control strategy that uses a combination of methods to control the weed population taking account of site characteristics

- prevention of weed invasion and spread through decontamination of vehicles and equipment.
- follow-up control and management measures to exhaust the seed bank and prevent re-establishment.

Selection of Herbicides

(see decision support tree on next page)

Selection of the appropriate herbicide is determined by a number of factors. The size, density and location of a population, in addition to the availability of resources and the situation in which the infestation occurs, will determine the appropriate herbicide.

For example:

- Flupropanate is a grass selective herbicide that is taken up by the roots of actively growing tussocks. It is residual in the soil for approximately two years and prevents new germinations. It is a very stable herbicide and can be stored for extended periods of time when mixed with water. Large-scale high density infestations are practical to treat with flupropanate alone due to the significant seed bank already present on-site and the preference to encourage competition by native plants.
- The use of flupropanate is allowed under the existing APVMA permit PER9792. For more information see the buffel grass control factsheet on the Biosecurity SA buffel grass webpage.
- Granular flupropanate has the benefit of being grass selective and will be washed into the root zone by rainfall. It is ideal for application on isolated outliers and in difficult terrain where access to water is a limitation.
- Glyphosate is a non-selective fast-acting foliar herbicide that is compatible with flupropanate. It is preferable to treat small infestations and outliers with a mixture of glyphosate and flupropanate as this will prevent seed set and minimise the likelihood of new germinations.
- BioWeed is an organically certified herbicide that has proven to be effective in killing buffel grass seed. BioWeed is a pine-oil formulation suitable for application on organic properties and small isolated populations, where it is desirable to prevent the likelihood of new populations arising from wind-blown seed.



FACTSHEET

Buffel Grass – Collective term for *Cenchrus ciliaris*,
C. pennisetiformis



Figure 1: Buffel grass stand at ALBG site following application of treatments.

Buffel Grass Herbicide Trials

Introduction

The efficacy of herbicides recommended for buffel grass control has not been formally tested under South Australian conditions. Herbicides with the active ingredients glyphosate and fluopropanate have been effective in controlling other perennial tussock grasses. This series of trials was designed to trial the effectiveness of these herbicides, along with fluazifop-P, physical removal and burning in conjunction with glyphosate, for buffel grass control.

Aims

The aims of the research were to identify the herbicides and application rates most effective in:

- killing mature buffel grass tussocks
- suppressing buffel grass germination
- reducing buffel grass cover
- controlling buffel grass whilst minimising impacts on native vegetation.

Methods

Four trial sites were established across the latitudinal range of buffel grass in South Australia. The sites were located in the north eastern corner of the state (APY), an hour south of Coober Pedy (BB and NW) and at Port Augusta (ALBG).

The main herbicide trial (comparing glyphosate and fluopropanate) was conducted at three sites (BB, APY and ALBG).

A further trial at the NW site compared different rates of Roundup Biactive™ (glyphosate 360 g/L), Fusilade™ (fluazifop-P 212 g/kg) and the physical removal of tussocks.

A final trial at ALBG examined herbicide control after tussocks had been burnt. Roundup Powermax™ (glyphosate 540 g/L) was applied at a rate of 4 L/ha to tussocks two, four and six weeks after they had been burnt.

