6TH SA WEEDS CONFERENCE

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Selling the Weed Problem

Tim Lowe, Invasive Species Council

Weeds are more serious than most Australians realise; why is understanding lacking? Compared to feral animals, weeds seem to lack agency. They are powerful when they promote fire, but most Australians doesn't understand that. There is no defining image of the weed problem, and many weeds look beautiful. Peak conservation groups undermine the weed message by not supporting it, because their campaign priorities lie elsewhere. The very existence of a problem is denied by some academics who argue that weeds enhance biodiversity, and who want invasion biology dropped as a discipline. Weed workers need to understand the many barriers and how to circumvent them.

Towards a policy for the exemption of low-risk, commercially valuable cultivars of declared plants

Ross Meffin and David Cooke, Biosecurity SA, GPO Box 1671, Adelaide, SA 5001

Declarations of weedy taxa are framed to capture all weedy biotypes of the target plant, while excluding plants of value to agriculture or horticulture. The aim is for regulation to minimise the economic, environmental and social impacts of weeds where these are not adequately managed in the absence of policy.

However, since there can be considerable variation within species, declaration of a species with weedy forms may inadvertently capture other non-weedy forms in cultivation. This is problematic if such low-risk forms are widely used in production or as ornamentals.

The issue is coming to the fore as more plants utilised in horticulture are being added to declared weed lists. This has highlighted the need to formalise the current case-by-case approach to exemptions through development of an associated policy. This would aim to:

- Minimise the economic, environmental and social impacts of weeds and weed regulation.
- Provide certainty to stakeholders regarding the criteria, processes and evidential requirements for exemptions.
- Ensure that a transparent, evidence-based approach is used to assess applications for cultivars of declared plants to be exempted.
- Provide a basis for industry to plan and participate as a partner in the process.

Under such a policy, any taxa to be exempted must be clearly defined and readily and reliably identifiable, as well as stable in their characteristics under propagation. In addition, there must be adequate evidence that the taxa do not constitute a weed risk.

Biosecurity SA has drafted an exemption policy and is exploring the potential for a nationally coordinated approach to this issue. Many major plant breeders, wholesalers and retailers operate nationally, and this would allow one successful application for exemption to be applied across multiple jurisdictions. This will be especially important to plant breeders seeking to develop low-risk cultivars, due to the considerable investment required in this process.

An evolving battle: Weeds in South Australian cropping systems

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Recent estimates show that dryland agricultural cropping accounts for 4 million hectares of the land area of South Australia (SA). Wheat, barley, canola, field peas and lentils are the main crops grown. In 2016/2017 the farmgate value of this sector was $2.2 billion. One of the major biotic threat to the success of the grains sector are weeds. It is estimated that weeds cost the SA grain sector $694m in expenditure. Weeds have a direct outlay through control costs but also create many indirect costs such as lost productivity, negative impacts on product quality and potential loss of market access. Weeds heavily influence management decisions on crop and variety choice.

Major weeds of the grains industry in SA include annual ryegrass *(Lolium ridigum*), brome grass (*Bromus* spp.), wild oats (*Avena* spp.) and wild turnip (*Brassica tournefortii*). All of these weeds are exotic species which have been present in SA for more than 80 years and present on grain farms for a similar time.

However, due to the intense selection pressure placed on weeds in grain crops through limited control methods, these species continue to be problematic as a result of unintentional selection for different biotypes such as herbicide resistant annual ryegrass or brome grass which requires a period of vernalisation to germinate. The emergence of other weed species long naturalised in SA has also occurred in some instances through changing management practices. Hence, weeds continue to be a major impediment to crop profitability.

The capacity of weed populations to evolve and adapt requires growers to continually deploy a range of control strategies in an integrated weed management approach. Available techniques include diverse herbicide application, harvest weed seed control, strategic cultivation, plant competition and farm hygiene. Research and development of novel management tactics such as robotics, microwaves, allelopathy and weed competitive crop types is also paramount.

Cover crops can reduce the cost of under-vine weed control

Jake Howie[1], Chris Penfold[1], Tom Nordblom[2,4], Mark Norton[2,5] and Melanie Weckert[3,4,5]
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A lot of time and money is spent by vignerons attempting to maintain a weed-free environment in the under-vine zone of their vineyards, primarily to conserve moisture and enhance amenity. This is typically achieved with the use of herbicides or straw mulch, however the repeated use of herbicides can lead to negative outcomes such as herbicide resistance and reduced soil quality from loss of organic matter, soil compaction and reduced infiltration.

We investigated the ability of a range of herbage species to create a "living" mulch to achieve the broad aims of weed control while maintaining, or even improving, grape yield, quality and soil health.

A site was established in 2014 on a block of Shiraz (SARDI Research Centre, Nuriootpa, SA) where the performance of ten cover crop treatments (including herbicide and straw mulch controls) were compared over the 2015/16 and 2016/17 seasons. A range of parameters were monitored including the performance of the cover crops (eg dry matter production, botanical composition); vine productivity (eg cane growth, berry quality and grape yield); soil health (eg soil resistance, moisture, nutrient and microbial status).

The two best performing treatments, (1) a mixture of *Medicago polymorpha* (cv Scimitar) and *Lolium rigidum* (cv Safeguard) and (2) *M. littoralis* (cv Angel) and *M. truncatula* cv (Sultan), resulted in similar suppression of weeds and improved grape yields (cf. herbicide control). Combined with lower operational costs, this provided an average gross margin advantage of $1,610 and $1,750/ha/yr (32-35% increase) respectively, equal to that of the straw mulch.

The higher yields suggest a beneficial response to the presence of selected herbage species with a possible enhancement of soil quality, both physical and microbiological. Our preliminary results suggest that vignerons could consider using locally adapted herbage species as cover crops, as a positive alternative to under-vine weed control by herbicide.

Grow Me Instead - A long range nursery industry initiative

Grant Dalwood, Nursery and Garden Industry of South Australia

The nursery and gardening industry in South Australia has joined with the Natural Resources regions in South Australia and Biosecurity SA in the fight against invasive garden plants.

The Grow Me Instead campaign is an industry-driven initiative providing relevant local information to gardeners and the general public about plants which are potential weeds in their area and suggests non-invasive plants which can be used instead.
This initiative began at a national level in 2009 between the horticulture and nursery industries, the Australian Government and weed management bodies to help ensure horticulturalists and gardeners receive the information they need to combat the spread of weeds. It is estimated that weeds cost the Australian agricultural industry around $4 billion a year, while the real cost of weeds to the environment is difficult to calculate but is likely to be at least equal to the cost to agriculture.

Of the almost 3000 introduced plant species now known to be established in the Australian environment, 65% are 'escaped' garden plants, so an important step in preventing the spread of weeds is public education to help change attitudes and behaviours that contribute to the weed problem. In South Australia, Grow Me Instead has been a resource appreciated by the general public with more than 28,000 copies distributed since 2009. An accompanying website has provided an alternative source of this information. With new plant declarations in South Australia in recent years, this revised edition of Grow Me Instead features new inclusions and updated suggestions for alternative plantings. The revised information can also be found on the Grow Me Instead website for South Australia.

The New Biocontrol Hub App. Enhances Weed Control

Phil Cramond President WMSSA; Paul R Sullivan Invasive Species Officer - Biocontrol
NSW Department of Primary Industries Biosecurity Branch Vertebrate Pest and Weed Research Units

The Atlas of Living Australia (ALA) is a community accessible on-line database. This Australian database captures and stores data from most other important Australian biodiversity databases including those made by museums and herbariums. All living organisms recorded in Australia such as plants, vertebrates and invertebrates are included. Information on organisms and their distribution can be easily obtained and mapped.

The Australian Biocontrol Hub (ABH) is a portal within the ALA and is a one stop shop that is a biocontrol repository for data and information sharing. It contains extension material and establishment data on weeds and weed biocontrol agents. The ABH provides information on biocontrol agent availability and their redistribution methods. There is a comprehensive field guide of biocontrol agents to enhance agent recognition and links to many other online resources. Everyone is encouraged to download biocontrol extension material, records and maps, and upload their own weed biocontrol agent sightings. This uploaded biocontrol agent establishment data is vital for the success of new biocontrol programs as it provides possible sites for the collection of biocontrol agents.

The new ABH App. has placed all this information in the hands of the community through their smartphones and tablets. The ABH is now accessible in the field. Anyone can register and when logged in you can access uploaded data including knowledge on weeds targeted for biocontrol, where and how to obtain biocontrol agents suitable for their region, how to start up biocontrol programs, and how to integrate biocontrol programs with other weed management activities. The new ABH App. helps facilitates community participation and is an effective way to speed up the delivery of weed biological control programs.

Visit http://biocollect.ala.org.au/biocontrolhub

Parasitic plant as a native biocontrol for major invasive weeds

Robert M. Cirocco, José M. Facelli and Jennifer R. Watling

Major invasive weeds cost Australians around 4 billion dollars annually in addition to incalculable costs to biodiversity. Native parasitic plants may have detrimental effects on performance of invasive weedy hosts by removing resources via 'suckers' called haustoria and thus contribute to their demise. Glasshouse studies have documented severe effects of parasites on invasive species, but the effects of parasites may be highly variable depending on environmental conditions. We conducted physiological measurements to investigate the effects of the native parasitic vine *Cassytha pubescens* on the major invasive weed *Ulex europaeus* (gorse) across three field sites in the Mt. Lofty Ranges of South Australia. Photosynthetic performance and nitrogen of gorse were strongly decreased by *C. pubescens* consistently across sites. In addition, at two of the three sites, the parasite had a negative effect on the long-term water-status of gorse and there was also evidence of breakdown in the photosynthetic apparatus of the host in response to infection. The data indicate that the native parasite negatively affects photosynthesis of gorse by removing large amounts of nitrogen and likely water from the host. Thus, *C. pubescens* shows promise as an effective native bio-control against major invasive weeds in Australia and if successful, may be used to help restore our native biodiversity.

Pictures from the field: *Cassytha pubescens* naturally impacting on woody weeds

Henry Rutherford, Department of Environment and Water.

Cassytha pubescens is a South Eastern Australian native hemiparasitic plant that vegetatively transfers from host to host by sending out lending tendrils. In South Australia *Cassytha pubescens* natural range extends from Eyre Peninsular to the Victorian Boarder. A non-host specific generalist it has been observed attached to several of South Eastern Australia's highest impact non-native woody weeds.

Weed hosts include: gorse, blackberry, boneseed, olive, roses, and brooms, and for this reason it is been considered as a novel type of biological control for the above non-native woody weeds. One aspect of using a native species as a biological control is with the inherent circumnavigation of the standard processing through quarantine and approval as a biological control release. Precautionary principles in mind there are still unknowns about introducing any species (native or not) on mass into an existing ecosystem. In conjunction with "Parasitic plant as a native biocontrol for major invasive weeds", Robert M. Cirocco, José M. Facelli and Jennifer R. Watling, we expand on the *Cassytha pubescens* story to inform the audience as to where trialling and experimentation is currently at.

A photographic inventory capture pictures from the field of where *Cassytha pubescens* is naturally impacting on woody weeds. These sites offer a representative indication of what the end result of a *Cassytha pubescens* program to target woody weeds in a natural bush setting may indeed look like in the longer term.

Clarity for roadside weed management in South Australia

Michaela Heinson, Natural Resources Adelaide and Mt Lofty Ranges, Department of Environment, Water and Natural Resources SA,
David Cooke and Ross Meffin, Biosecurity SA, GPO Box 1671, Adelaide, SA 5001

Worldwide, roadsides are considered to be a high risk pathway for weed dispersal and effective management of road corridors is an integral part of any landscape scale weed strategy. Although the benefits of roadside weed management to landholders, NRM authorities, local government, road infrastructure managers, the environment and broader public are well-known, information regarding best practice can be difficult to access and there is a lack of clarity regarding stakeholder roles and responsibilities. Identifying how to tackle these issues was the key driver for the formation of an inter-agency working group.

The working group considered best practice for roadside weed management in a South Australian context, under the existing legislation. It produced recommendations for communication and collaboration between stakeholders focusing on effectiveness, efficiency and safety. Seven stages for a planned approach to roadside weed management were identified. A major consideration was the importance of reporting new incursions of Alert Weeds – high risk, declared plants that are not yet established in the state – to NRM authorities.

The working group has recommended the publication of a manual to provide a one-stop-shop to answer such questions as: 'Which laws are relevant? Who pays for roadside weed management? How can I apply for written permission to control weeds on roadsides?' and 'What should I do to prevent the spread of weeds by vehicles and machinery along roadsides?'
The manual would be a reference for stakeholder agencies, and could be accompanied by two brochures, one as an executive summary of key facts and the other for wider public distribution.

Best practice management of opuntioid cacti – from principles to paddock

Shauna Potter, Matthew R. Sheehan and Henry Rutherford

Opuntioid cacti are often described as cryptic plants. Their distribution ranges from widespread to isolated. Growth form varies from low growing shrubs to 8-metre-tall trees. For some species seed germination requirements and longevity remain knowledge gaps. Some species are kept in check by one of Australia's most successful biological control agents (*Cactoblastis cactorum*), whilst others require specific, labour intensive chemical or physical control. Field identification is challenging, and common and scientific names are often misapplied. What is certain is that, largely, opuntioid cacti remain difficult to control and can out persist the resources and will of land managers.

Approximately five years after their listing as Weeds of National Significance, a best practice control manual for opuntioid cacti has been developed. The manual goes a long way in demystifying this group of 27 species by providing a comprehensive synthesis of known information on the weeds' biology, ecology, distribution and impacts. Details on planning and case studies from across Australia provide useful ideas to consider before control work begins.

Additionally, the manual offers practical, easy to follow field advice through identification guides; descriptions of control methods; registered, available herbicides; and tips for safe working conditions. A decision support tool helps weed managers chose and implement best practice control options based on:

- Cacti growth form;
- Weed density;
- Site sensitivity; and
- Site accessibility.

Combined, the use of these tools and other resources, provides the best chance of successfully managing opuntioid cacti in Australia. This presentation will provide a hands-on look at the relevant challenges, decisions and solutions using South Australian weed infestation examples.

Cactus Weeds in the Flinders Ranges and other areas in South Australia

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Cacti have become an encroaching problem in many areas of South Australia, gradually covering valuable land areas and rendering the land useless for grazing stock which avoid the thorny plants. The remedy is so labour intensive that landholders are unable to give the time and so volunteers and contractors are involved. The problem is enormous and will never be eliminated. At best it may be controlled.

History. The old story around Bliman is that the old Angorichina hostel for tuberculosis was where it all started in that area. Presumably when a patient died the small pot plant with a cactus was thrown out onto the refuse heap. Eventually it bore fruit which the crows ate and the seeds were spread in their droppings. After a while there was concern about the spread and control work started on a patch of Wheel cactus (*opuntia robusta*) in Alpana station in 1980s to 1990s.

There was subsequently a very rapid large spread over much larger areas. The local community had widespread concern and formed a Bushcare group which developed strategies. The NRM authorities offered some initial support and that has been ongoing.

Some volunteer groups became engaged and they have developed ongoing and valuable long term relationships with the landholders. The volunteer groups increase the ability of the local community to respond and for more than 10 years have lifted the morale of the local community. A champion for the eradication of cacti emerged in the form of Lorraine Edmunds who became the project coordinator. She recruited hard for new volunteers for the area and lobbied for resources.

The current outbreak. Currently there are hundreds of square kilometres around Blinman that have cacti. There are two main varieties. The Wheel cactus (*opuntia robusta*) are mainly west of Blinman, Prickly pear (*opuntia stricta*) are mainly to the east of Blinman. The area around

Wheel cactus (*opuntia robusta)*

Prickly pear (*opuntia stricta*)

Blinman is mostly mountainous woodland. The mountains present a problem to the volunteers who are mostly retired and aged up to 80 years old.

There is a separate outbreak in the Flinders Ranges National Park that is now receiving attention.

There are other varieties of cacti that are found in the Blinman area. Among them

are Indian Rope cactus (*Cylindropuntia imbricata*) and jumping cholla (*Cylindropuntia prolifera*), the latter appearing recently at Arkaroola.

Around South Australia. Cacti are widely spread around South Australia. Peterborough has a large infestation, the Onkaparinga Gorge, Tailem Bend, Walkers Flat on the River Murray and along many of the Murray River banks. I have treated prickly pear in Argadells, a mountainous property NW of Quorn that provides excellent 4WDing. It seems the more we kill there, the more that grow. These places are just the ones in which I have worked to eradicate the cacti. Cacti are very widely spread.

Growth of cacti. Cacti are extremely hardy plants and can survive droughts. They open their pores during the night and catch dew. At about five years old they produce fruit. Birds and animals love the fruit. Crows eat the fruit and then tend to fly along creek lines resting in the tall eucalypts. So many plants are found under large trees growing near creeks. We see plants that are 50 or more years old. They are large and have produced tons of fruit over the years. Emus eat the fruit. They defecate and drop a large splat containing several hundred seeds. Several years later after a good rain a large copse of cacti grow starting in a bed of emu fertiliser. Goats also spread the seeds. Plants also grow from pieces broken off a plant. Roots grow from the areoles that are in contact with the ground. Very few animals eat cacti. At present there is a drought around Blinman and in some areas goats have been eating cacti. But the cacti are not killed by goats.

Treatment. There are two methods of killing cacti. There are mechanical methods. Drilling involves 10 mm dia holes in every second pad (cladode) and then 4 ml of neat glyphosate injected into the holes. About six weeks later the cactus is very sick and 12 months later the dried skeletonised plant can be seen. Spraying with poisons is faster and contractors usually opt for that method. Spraying is not suitable for volunteers because of the restrictions on spray poisons. Prickly pear have two different kinds. One id thick leafed like wheel cactus. The other is a thin leaf plant that cannot be treated by drilling and injecting. Spray or mechanical removal has to be used or biological.

The other means are biological. The cochineal insect is a natural enemy of cacti. The tiny insects dehydrate the plant and may eventually kill it. There are various kinds of cochineal and one has to use the correct one with various cacti.

Cochineal (*Dactylopious* coccus)

Cochineal are useful where there is a concentration of plants so the insects can spread on the wind. Cochineal is also useful in mountainous areas that are difficult to access. Another biological method is the cactoblastis caterpillar that eats the inside of each cladode away and skeletonises it. There is some cactoblastis in the Flinders Ranges but it doesn't look successful. It was hugely successful in Queensland in 1920-1930 but it doesn't seem to propagate here in South Australia. We occasionally find infected plants in the Flinders Ranges but the grubs appear to

only occupy the topmost cladodes of the plants.

Cactoblastis (*Cactoblastis cactorum)*

Volunteers. It is too time consuming for leaseholders to try to eliminate cacti from their land. A local Bushcare group was formed in Blinman in the late 1980s. Lorraine Edmunds in that group became a champion for the control of cacti in the Blinman area. Lorraine spoke to many groups and recruited many volunteers.

Since 1990s volunteer groups have given time to deal with the cacti problem. Initially bushwalking groups were contacted and worked in Alpana station then later in Gum Creek. Since 2009 4WD clubs have been involved. The Toyota Club began at Gum Creek station in 2009 then presented to other 4WD clubs to encourage them to become involved. Now the Mitsubishi club spends a week at a time at each of Mooloolooo and Angorichina stations. The Overland Club spends a week at Oratunga Station. Bicycle riders have been recruited into that Oratunga week.

The final Solution. There is no final solution. We will have cacti in South Australia forever. The cork has been removed and the genie let out of the bottle. Even with all the money in the world they will never be totally eliminated. The best we can hope for is to keep the numbers down and to keep useful land clear for farming.

Buffel Grass Management in South Australia

Troy A.J. Bowman[1], Rural Solutions SA, P.O. Box 469 Murray Bridge

Buffel grass has been recognised as one of the greatest threats to biodiversity in South Australia's rangelands. It has the capacity to transform ecosystems through habitat loss, competition with native plants and alteration of natural fire regimes. Buffel grass is increasingly impacting on the culture, health and safety of Indigenous communities.

Advances gained from South Australian research has resulted in the application of new control options, increasing the efficiency and effectiveness of herbicide application. The emergence of new technologies has resulted in the use of drones and user-friendly platforms for the mapping of buffel grass infestations in Indigenous communities.

These new and innovative ways of effectively managing buffel grass are being employed to improve the condition of country and manage the threats posed to the environment and culture in Australia's rangelands.

A focus on building the capacity of Indigenous communities has seen a changing face of Indigenous managed lands. 'Healthy Country planning' is being used to develop achievable management objectives for a range of cultural and environmental issue such as weed management.

The 'healthy country planning' process has a strong emphasis on traditional owner engagement. An inaugural Southern Desert Ranger Forum was held in the Great Victoria Desert in 2017 as part of the 'Buffel Free GVD' project, providing an opportunity for indigenous rangers from SA, NT and WA to learn from the experiences of researchers, fellow rangers and traditional owners. This presentation will outline research findings and provide an overview of buffel grass management in indigenous communities.

The biodiversity impacts of non-native species should not be extrapolated from biased single-species studies

Ben Sparrow, Adelaide University

The presence, diversity and abundance of non-native plant species in natural vegetation are common condition indicators used to determine conservation status, with consequences for management strategies and investment. The rationale behind non-native species metrics as condition indicators is the assumption that non-natives have negative consequences on native biodiversity and habitat condition. The case against non-native species is not so clear-cut, with some studies reporting neutral or even facilitative interactions, often depending on spatial scale. Observational and experimental evaluations of the impact of particular non-native species on biodiversity provide a vital evidence-base for general conservation management strategies. Unintentionally though, many studies that quantify the impacts of non-native species have resulted in a publication bias in which species with known impacts are selected for investigation far more often than benign species. Here we argue that meta-analyses of the impacts of individual non-native species on natives, no matter how meticulous or objective, should not be generalized beyond the set of 'training' species. The likelihood of such extrapolation is increased when meta-analyses are reported with little qualification as to the skewed sampling towards problematic species, and because alternative findings such as non-native assemblages having positive interactions with native biodiversity, are under-reported. To illustrate, we discuss two meta-analyses that make general conclusions from impact studies skewed towards 'transformers', the most extreme invaders. We warn that if generic non-native species management strategies were to be based on these conclusions, they could not only fail to meet objectives but in some instances harm native biodiversity.

Zero-tolerance-to-weeds in ecological restoration

Andrew Crompton, Ecological Restoration Practitioner

In "Bringing Back the Bush" (1988) Joan Bradley states the 7th rule for working in the bush – "remove all species of exotics from the areas weeded". Even where ecological restoration is the stated goal, this rule is generally not applied, often because;

- work areas are too large,
- the implementation time frame is too short,
- workers do not have enough plant and management knowledge,
- it is often assumed that this rule is impractical.

The Bradley sisters were tackling weeds in otherwise intact bushland, but adopting a zero-tolerance-to-weeds approach can also be very effective at restoring sites dominated by exotics, provided that careful management can be assured for a considerable period of time.

This approach is best undertaken with a "bite and hold" strategy. Firstly, a manageable area is selected, and all native plants are located and protected. Appropriate methods are then used for the primary weed clearance. Follow-up patrols are done to kill all weeds that appear and to find and protect any natural regeneration. Appropriate local native flora is introduced to the site when this does not militate against the elimination of weeds. When management inputs have dropped to a very low level, the next bite can be started.

It takes more initial time and care to develop quality weed-free native vegetation sites but on-going management is much lower and site quality is much higher. Weed-free sites can also provide habitat for small native plants which would not persist if there were chronic weed infestations.

Success requires

- a good knowledge of local flora
- a willingness to learn all plants as they appear at the site,
- an understanding of plant response to different actions,
- close site supervision and attention to detail,
- keeping each bite a manageable size
- timeliness of operation

Biocontrol of Silverleaf Nightshade – trials and tribulations.

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Australia has a proud history as a world-leader in biological control that goes back 100 years. Along with the USA, South Africa and New Zealand we pioneered many innovative projects. Although some projects fail, many work well - and on average there is a 23:1 benefit cost return. Biological control of weeds in Australia reached its zenith in the 1970-1980s. We had a world-class scientific community delivering many successful projects (e.g. salvation Jane). But then declining public funding and economic rationalism began to bite, leading to a steady decline in staff numbers, facilities, and capability.

In 2015, at last, things started to change! A large three-year national biocontrol program was given the green light, under the banner of MLA. The federal Department of Agriculture, along with MLA and many other jurisdictions and organizations, co-funded eight projects that comprise the program. In South Australia, PIRSA Biosecurity and the South Australian Grains Industry Trust lead and co-fund the silverleaf nightshade project. Other sub-projects around Australia will benefit SA through work on blackberry, *Cylindropuntia* (cactus) spp., gorse and a biocontrol App., and further projects are currently running in a "Round 2" program brokered by RIRDC, including further SLN work.

The SA SLN biocontrol project is based on the silverleaf nightshade leaf beetle (SLNLB; *Leptinotarsa texana*). This beetle was released by South Africa in the 1990's, and since then it has established and contributed to a major decline in SLN density in South Africa. It defoliates SLN shoots, then attacks the bark on the stems.

This paper describes the project through a range of stages and activities, as an example of what a biocontrol project entails; from inception, multiple funding applications, Australian Government import permits, sourcing and rearing the beetles, designing a host-specificity testing list, DNA-based phylogenetic research, collecting and cultivating Australian native relatives of SLN, liaison with the vegetable industry, bush foods industry and the aboriginal community, and finally host specificity testing in quarantine and in the field in Texas, USA.

Behind the scenes, the often unseen potential impacts of weeds on our flora—insights from DNA based techniques and detailed taxonomic revisions

Michelle Waycott, School of Biological Sciences, The University of Adelaide and State Herbarium of South Australia, Department for Environment and Water.

Despite all our ongoing efforts, weeds continue to be a conspicuous component of our natural and managed landscapes in Australia, or indeed around the world. Amazing efforts to reduce these impacts are achieved through the work of individuals, communities, managers and institutions and are a critically important. However, there are a range of impacts that weeds may have even in the early stages of invasion through their interaction with native species with which they can breed. In addition, when detailed study of the local taxonomy of some weed groups has been undertaken, we find considerable more diversity present than expected. I will present the results of work our botanists undertake demonstrating the ability of some weeds to hybridise with local native species leading to combined genetic forms, as well as the potential for improved understanding of weed group taxonomy to provide insights for managers. These examples provide a context where we should consider even more carefully ways to prevent the early stages of new potential weed establishment in particular where they have closely related native species in their regions of potential occupancy.

New and existing weeds threats to South Australia and its regions and challenges associated with identification.

Chris Brodie[1]
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A weed is classified by the State Herbarium of South Australia (State Herbarium) as a plant that has originally been introduced by humans to an area deliberately or accidentally, then has self propagated without aid where it is not wanted, possibly spreading by natural means to new areas. Scientific verification of new naturalised 'weed' taxa to South Australia is achieved through the lodgement of voucher specimens in the State Herbarium that are identified by a botanist. Recognition of new taxa to South Australia requires this process to be completed and an entry to be made in the Census of South Australian Vascular Plants, Algae and Fungi http://flora.sa.gov.au/census.shtml

A major effort in recent years by the State Herbarium and its associates to collect and identify weeds within South Australia has resulted in the detection of new weed incursions, such as, *Cardiospermum grandiflorum* (Ballon Vine), *Carex divulsa* (grey sedge), *Chasmanthe aethiopica* (Small Cobra Lily), *Chlorophytum comosum* (Spider plant), *Cleretum bellidiforme* (Livingstone Daisy) non-native *Eucalyptus* species, *Fraxinus ornus* (Manna Ash), and *Nerine sarmiensis* (Guerney-lily). Collection of previously recorded introduced plants has expanded our knowledge of these weeds such as, *Hedra helix* (ivy), *Fraxinus angustifolia* (Desert Ash) and some invasive grasses. Information will be presented relating to basic morphology, ecology, means of propagation, and probable invasion pathways. The potential weed threat to South Australian landscapes will be discussed. Potential problems with identifying weeds and identification solutions will be presented. This information should enable workers to identify, or access resources to identify suspected weeds within the South Australian landscape.

Onkaparinga River Prickly Pear Problem

Johnathon Conlon, City of Onkaparinga

Prickly Pear (*Opuntia monacantha)* has become well established within the Onkaparinga Catchment and the management of up-stream populations has proven to be problematic due to their sheer size and the steep terrain in which the populations occur.

During September 2016, a major flood event transported segments, pads and seed pods from an upstream infestation down to the Onkaparinga River floodplain and coast. Once the flood waters had subsided, an immediate response was required to remove hazardous Prickly Pear portions from the beach environment and higher use recreational trails through the Onkaparinga Estuary.

Subsequent surveys were undertaken in October 2016 to determine the distribution and densities between the river mouth at South Port Noarlunga though to the up-stream established populations. This information collected was utilised to estimate the cost of cacti search and removal activities.

Removal activities are on-going and the second year of Prickly Pear collection has recently been completed. This presentation will provide detail on the distribution, methodology and partnerships created in the clean up.

Southport Dunes weed control

Grant Glazier[1], Andrew Sinel[1] and Johnathon Conlon[2]

The Southport dune system is one of the largest sand dune complexes along the southern Adelaide metropolitan coastline and is situated at the mouth of the Onkaparinga River, which is also one of Adelaide's most important estuaries. Since 2015, EBS Restoration have been commissioned by the Onkaparinga Council and AMLRNRM Board to undertake weed control activities within the Southport Dune System.

Weed control activities have focussed on a variety of species including woody weeds, succulents and herbaceous species. However, the primary focus has been on controlling the highly invasive South African Grass *Ehrharta villosa*, commonly known as Pyp grass. This species was originally introduced to stabilise the dune system.

In 2014-15 EBS Restoration undertook a Pyp Grass spray trial with a grass selective herbicide. The aim of the trial was to gauge the most effective approach to controlling Pyp Grass within the dunes and any possible off-target impacts on native vegetation. The trial also tested whether brushcutting the target species, and letting it re-shoot prior to herbicide application, increased the effectiveness of the selected herbicide.

The methodology involved establishing six 10m x 10m plots within the dune system. Three plots were brushcut and allowed to regenerate and three were left uncut to determine the value in brushcutting the species prior to herbicide treatment. Three different rates of the grass selective herbicide were then applied to two plots each, one brushcut and one uncut. As this was a field trial no herbicide application rates were replicated. All Pyp Grass and native vegetation was sprayed with the grass selective herbicide to ascertain control on the Pyp grass and to identify potential off target damage to native vegetation.

The most effective results were from the brushcut plots where the actively growing Pyp Grass provided fresh leaf growth and leaf area to absorb the herbicide. Results indicated that effective control of uncut Pyp Grass was not achieved with the lower application rates of the grass selective herbicide. Native vegetation within the plots (except grass species) were relatively untouched with some minor burning of leaves noticed on several species such as *Olearia* and *Rhagodia* species, where the higher rates were used. These species all recovered from the minor burning over time.

Brushcutting Pyp grass and allowing it to reshoot prior to spraying with grass selective herbicide has now been utilised over large areas with very effective results. Some follow up herbicide control has been required to effectively remove the Pyp Grass from areas which has allowed native vegetation to recover. Marram Grass and Veldt Grass found within the Dune system are currently being targeted using this same technique. The lack of the native grass species *Spinifex sericeus*, within the project area, greatly helps this technique as this species would be affected by the grass selective spray. Follow up control is crucial to the success and should be coupled with the revegetation of native species in areas of control to ensure long-term dune stabilisation.

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Spiny Rush (*Juncus acutus*) Management in the Torrens Catchment

Sheree Bowman, TS Environmental Consulting

In the late 1990's members of the Upper River Torrens Land Care Group (URTLCG) went on a spring walk along the dis-used railway corridor between Birdwood and Mount Pleasant. They came across a plant they hadn't seen before and given its immediate invasive distribution they thought 'this has to be a weed!' That was the start of a journey for the local community in managing spiny rush.

With very little known about the plant, its biology, growth habit and local distribution the URTLCG started to seek more information about the plant and control options. They commenced control of the weed on some sites and over time sought government support and grant funding to manage spiny rush. Over the last decade there has been a significant control effort by the NRM Board, the URTLCG and land managers which has seen the significant reduction in the weed across the district. This resulted in an improved knowledge of the weed and its distribution and the most effective ways to control it.

Recently there has been a renewed call to action on controlling spiny rush in the Upper Torrens area. At the request of the local community, Natural Resources, Adelaide & Mt Lofty Ranges worked with landholders to communicate the significant learnings that had been made over the years about how to identify Spiny Rush, dispersal mechanisms and best practice methods to control it. Landholders left feeling united in the prospect of a community led offensive against spiny rush.

Using Prescribed Burns to Achieve Biodiversity Outcomes through Weed Management

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While the primary purpose of prescribed burning is usually to minimise the risks that bushfires pose to human life and property, there are often opportunities to achieve ecological benefits from prescribed burn programs. In the Mount Lofty Ranges of South Australia, areas that are subject to prescribed burning are also often those that are degraded by weeds due to their proximity to urban areas. Managing fire-responsive weeds is therefore a significant challenge from a fuel and biodiversity management perspective.

The Department of Environment, Water and Natural Resources are undertaking trials and using adaptive management to determine how they can use prescribed burns to their advantage to manage weed infestations. Preliminary results from a recent trial involving the control of *Erica arborea* (Tree Heath) show that prescribed burning can increase the efficiency of weed control and the recovery of the previously out-competed native vegetation. The results from this trial also highlight the potential benefits of using pre-fire weed control to increase the effectiveness and efficiency of post-fire weed control.

Invasive Weed control – Things have Changed

Iggy Honan, Industry Practitioner

This presentation will take us through my involvement in the weed control area, primarily looking at how things have changed in local and regional programs. We will also look at possible future directions that may be guided by success's I noted over the last 40 years.

Changes in management practices

In the areas of agriculture (wheat/sheep) the changes have been stark. With a zero tolerance to weeds by the best farmers, with the possible exception of those still involved with grazing. I've had almost no involvement with horticulture or forestry and so I won't touch these.

The changes have seen better use of chemicals (perhaps over use). High tech machinery allowing more accurate applications. An appreciation for soil biota and natural systems. A more flexible crop rotation based on price, climate and new varieties. Where a winter annual rainfall of 150mm would have seen a drought and soil erosion, local farmers can now grow a 2t/ha wheat crop. A BIG change.

Changes in governance

40 years ago the Animal& Plant Control Act was in its infancy, however a system of rural Councils along with a State Commission produced a reasonably well resourced system with local input. The initial programs followed on from past noxious weeds Boards but there was a more central direction. Many though continued on as they had. The introduction of NRM and later DEWNR were developing in a much changed field and a multipurpose ACT. There was a massive opportunity for CHANGE when the new Act and related Regulations were introduced, but typical politicians and bureaucrats opted for little actual change so as not to rock the boat. Was this change all about $$? I would propose that the mixture of change allowed managers to sway towards funding opportunities and to satisfy key stakeholders who little in common with local land managers.

Changes in priorities

Those older landholders in the community would claim that the dropping of the word 'Noxious' was a mistake as it gave a clear distinction of what was good and bad. The change that I have seen, is that very few would have thought of Gazania as noxious, or that an introduced fodder grass such as Buffel posed a huge risk to much of South Australia's conserved areas such as the Flinders ranges. The introduction of the (J. Virtue) risk assessment system was a breath of fresh air for decision makers. It appears though we have little appetite for real change and find ourselves left with a list so long it can be meaningless and confusing to almost all sectors of the community.

Where to from here?

Given that approaches have changed and resources reduced the emphasis has to be:-

1. Ensure new weeds are assessed and prioritised correctly with good biology
2. Attempt to eradicate a top 3 weeds for the State and a top 5 for regions
3. Provide advice and assist with programs that seek to protect high value assets
4. Go back to #2 and do it properly!

Cobbler Creek Recreation Park 'Proof of Concept' Hyparrhenia hirta (L.) Stapf (Coolatai Grass) Control Demonstration Site

Henry Rutherford & Tracey Hardwick

Within the Cobbler Creek Recreation Park Natural Resources, Adelaide & Mount Lofty Ranges Natural Resources staff have demonstrated an effective methodology for broad scale control of Coolatai grass where it forms monocultures. The demonstration aimed to show that affordable control could be achieved by exhausting the soil seed bank which has been reported as mostly unviable after 12 months (Chejera 2008). The program started in March 2016 with the slashing of an infestation of Hyparrhenia hirta (L.) Stapf (Coolatai Grass) over an 8ha area. The area was then treated by repeated application by blanket spraying with glyphosate via a tractor mounted boom sprayer. The interval between slashing and treatments with glyphosate, and subsequent glyphosate treatments were considered at around the 8-week period, with the site been monitored to determine an actual time for treatment, optimised where maximum germination and growth had occurred yet seed set was not yet occurring. In total 9 treatments were applied resulting in a total kill and exhaustion of Coolatai across the entire site. The site is now host to various weed species, though none are as invasive as the Coolatai grass that has been controlled.

An introduction to Australia's pest animals and the damage they cause, with a particular emphasis on their role as weed dispersers.

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Around 650 different vertebrate species have been introduced to Australia since European settlement. Most of these were brought for exhibition and conservation in zoos, while others were brought for food, transport and exploration, sport and companionship. Of these, approximately 73 different species have established wild populations that now cost the agriculture industry between $720 million and $1 billion per year in lost productivity. They also cause significant damage to natural ecosystems, though it is difficult to quantify.

Some of the more publicised damage caused by pest animals is predation of native wildlife and livestock, destruction of crops and natural ecosystems, competition for resources, and infrastructure damage. They also the carry endemic diseases and have the potential to spread exotic diseases that could seriously threaten wildlife, livestock and human health should they ever entre the country. There is another important damage that pest animals cause, but it often receives little attention, and that is they can facilitate the spread of various weed species. Pest animals can/do spread weeds in a variety of ways, but it generally occurs when they carry weed seeds in their hair/fur, they modify environments that suits weed growth or they spread fruit and berry seeds in faeces. Therefore, it is important when developing a weed management strategy to also identify which pest animal species occur in that area and whether they should also be managed for best results. This presentation will discuss common damage caused by pest animals, with particular emphasis on their role as weed dispersers. It will also provide details on control techniques used to manage pest animals and how to develop a suitable pest animal management strategy, using well-recognised strategic pest animal management principles.

Technological advancements to increase the effectiveness and target specificity of feral pig management in Australia.

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In Australia, feral pigs cause immense damage to biodiversity through habitat degradation, competition and predation. They also cost the agricultural industry in excess of $100 million in lost productivity each year and have the potential to carry and spread exotic diseases that could infect livestock, humans and native wildlife. Feral pig populations are often managed where they occur and poison baiting commonly used as it is cost effective and it can provide significant population reductions. Sodium fluoroacetate (1080) is the main toxicant used for baiting feral pigs in Australia and it is typically added to grain or meat and then offered to feral pigs where they occur. There are concerns that some non-target species, that also eat grain or meat, may be accidentally poisoned and the risk is exacerbated by the high 1080 dose required to kill feral pigs.

Animal Control Technologies (Australia) and its partners have developed, and continuously evolving, a series of feral pig specific targeted factory-manufactured bait products to increase the efficacy of feral pig baiting. The first in the series was PIGOUT® feral pig bait, which was launched in 2008. PIGOUT® feral pig bait contains 1080 in a centralised core and has proven to be more target specific than traditional meat or grain bait. The second development is PIGOUT® econobait 1080, which is a second-generation smaller, flavour enhanced, bait that offers better stability especially in hotter climates. The third, and perhaps most significant, is HOGGONE® meSN® feral pig bait. HOGGONE® meSN® feral pig bait is different from the others because it contains microencapsulated Sodium Nitrite (meSN), which is a new toxicant for controlling feral pigs. The bait matrix is also changed to a semi-solid peanut flavoured paste. This presentation will discuss research and development process for each of these products and highlights the potential advantages associated with their use.