Government of South Australia
South Australian Arid Lands Natural Resources Management Board




DECEMBER 2014

South Australian Arid Lands Natural Resources Management Board

MARREE - INNAMINCKA NRM DISTRICT WEED STRATEGY

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NRM DISTRICT WEED STRATEGY

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DEWNR

DECEMBER 2014

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Photo front page: Acacia farnesiana (DEWNR); African Rue (DEWNR); Prickly Acacia (DAFF, Qld) and Noogoora Burr (depi.vic.gov.au)

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Purpose of Strategy

It is intended that this strategy be used by the Marree - Innamincka NRM District Group to guide prioritisation of weed management activities within their district over the next five years.

The strategy outlines management actions that the Group can implement within their District that will reduce the current and potential impacts of nine priority weeds.

The management actions outlined for each of the nine priority weeds are in line with South Australian state policies for declared weeds and the SA Arid Lands NRM Board regional weed policies.

The strategy also provides information regarding the distribution, possible threats and impacts and policy on each of the nine priority weeds and outlines current best practice control methods and surveying/monitoring activities.

Furthermore, it is recommended that the group review this strategy in five years to assess progress and update management actions where required.

Some of the plant species discussed in this strategy are valued amenity trees (e.g. Athel Pine) within station gardens, while others are generally undesirable plants (e.g. Noogoora Burr, Mimosa Bush). Most of the weeds are currently at low densities, whilst others have infested large areas. All the plants dealt with in this strategy have a demonstrated ability to rapidly expand their distribution given favorable seasonal conditions. Managing current infestations and removing potential sources for new infestations will save the considerable amounts of time and money required to control large infestations of persistent weeds.

The District groups can be influential in the implementation of on-ground natural resource management programs within their district. By implementing this strategy the Marree - Innamincka NRM District group can develop proactive weed management programs within their district for the long term protection of its environmental and productive assets.

The Marree - Innamincka NRM District

The Marree – Innamincka District covers more than 200,000 square kilometres and occupies the north east corner of the State. The District runs north from the northern Flinders Ranges to the Northern Territory and Queensland borders, and east from Lake Eyre to the New South Wales and Queensland borders. The resident population of the District is small with 150-200 residents working in the pastoral industry. There are no major towns in the District. At Moomba, a transient population of 200-300 petroleum industry workers boost the population. It is estimated another 40,000 to 50,000 tourists visit the District each year.

The climate is characterised by hot to extremely hot, normally very dry summers and mild dry winters. Occasionally, moist tropical air from the northwest monsoons penetrates into the northern parts of the region during summer bringing intense rainfall events that are normally short-lived. Rainfall is “reliably unreliable” in the District with the annual average being approximately 125mm but the average rarely occurs, with fluctuations in annual rainfall occurring between 0mm to over 500mm. Evaporation rates are between 3,200 mm per annum in the south to 3,800 mm in the northwest.

Arid, desert landforms dominate the District. Sandridge deserts cover much of the District, including the Tirari and Strzelecki Deserts and part of the Simpson Desert. Gibber-covered downs and plains extend across much of the south of the District and in a belt running along the Birdsville Track, including Sturt’s Stony Desert. The major ephemeral river systems of the Cooper Creek and the Diamantina River, known as the “Channel Country”, with their channels, floodplains and ephemeral lakes are associated with areas of heavy clay. The only ranges in the District are the Willouran Ranges, in the far south-western corner, with an elevation of 260m above sea level.

The dominant vegetation of the District includes:

- Dune systems: Sandhill canegrass, open hummock grassland, lobed spinifex hummock grassland, tall shrubland to low woodland, sandhill wattle, needlebush, whitewood and narrow-leaved hopbush

- Watercourses, floodplains and “Channel country”: Woodland with tall shrubland layer, red gum woodland, coolabah, river cooba and Broughton willow woodlands, old-man saltbush, Queensland bluebush, Mitchell grass,

cottonbush low open shrubland, tussock grassland and ephemeral herbland and lignum shrublands

- Gibber and stony plains and downs: Chenopod (saltbush/bluebush) shrublands, Mitchell grass tussock grasslands, copperburr low open shrubland, low open shrubland of bladder saltbush, low bluebush and cottonbush, tall open shrubland with emu-bush, naturally bare gibber plains.

The most important good quality groundwater source for the District is the main aquifer of the Great Artesian Basin (GAB). Groundwater is discharged from the GAB by mound springs, flowing bores (pastoral bores) and diffuse upward leakage through the Bulldog Shale. Cooper Basin petroleum wells and the Roxby Downs township rely on GAB water. Mound springs form along fault lines which allow the groundwater to discharge more easily through the Bulldog Shale. The aquifer is shallow is these areas. These springs are found along an arc from the south west area of the District across the northern end of the Flinders Ranges and across Lake Frome to the NSW border. Other groundwater in the District can be found in the dunefields at shallow depths adjacent to the major watercourses, Cooper and Strzelecki Creeks and Diamantina River. This water exists in unconfined aquifers and is mainly recharged from surface stream flows.

The primary land uses in the District are pastoralism (60% of the land), oil and gas exploration and production, conservation and tourism. Conservation areas in the District include Innamincka Regional Reserve, Coongie Lakes National Park (includes RAMSAR wetland), Strzelecki Regional Reserve, Simpson Desert Regional Reserve and Conservation Park and Lake Eyre National Park.

Land management issues include: increased mining and exploration impacts, increased use of infrastructure by tourists, total grazing pressure; pest plants and animals, GAB water extraction, geothermal testing and interstate hydrology management (e.g. Queensland government and Cooper Creek).

The Marree - Innamincka NRM District Group

The District Groups were established to provide a vital link in communicating community issues to the SA Arid Lands NRM Board and provide a local perspective on implementing on-ground projects.

The District Group members of the Marree - Innamincka NRM District Group as at October 2014 are:

Maree Morton	Janet Brook (NRM Board representative)
Raylene Ogilvy	Jacqueline Ogilvy
Valerie Fuschtei	Brooke Warren
Arthur Ah Chee	Tony Magor/Erik Dahl (DEWNR)
Gina Rieck	Lisa Taylor (NRMO, DEWNR)

Target Weeds

The weeds chosen as priorities for the Marree - Innamincka NRM District and dealt with in this strategy are declared weeds under the Natural Resources Management Act 2004 and/or demonstrated to be regional threats where the feasibility of control is realistic i.e. they are strategic control opportunities. An initial list of priority weeds were presented to the District Group from which the top nine priority weeds were selected.

Weed risk assessments have been undertaken by the SA Arid Lands NRM Board on each of the nine priority weeds. This process determines a weeds risk (low, medium or high) in a rangelands land system by assessing the weeds invasiveness, impact and potential distribution. Through the assessment of each weeds risk, the management strategy for each weed was identified (Table 1).

Table 1. Nine priority weeds included in the Marree - Innamincka NRM District Strategy, the management strategy and description of the management strategy for each weed.

Priority Weed	**Management strategy**	**Description of management strategy**
African Rue	Protect sites	African Rue has a limited current distribution in the District and the Group should aim to prevent spread to key sites/assets of high economic, environmental and/or social value. See page 11 for more details.
Athel Pine	Protect sites	Athel Pine is common but has a limited distribution within the District and the Group should aim to prevent spread (particularly along watercourses). See page 14 for more details.
Bathurst Burr	Manage sites	Bathurst Burr is limited to some drainage lines within the District. The Group should aim to reduce the overall economic and/or social impacts of this weed through targeted management. See page 18 for details.
Buffel Grass	Contain spread	Buffel Grass has a limited distribution within the District. The Group should seek to prevent ongoing spread through control of all infestations, aiming for a significant reduction in weed density. See page 21 for more details.
Mexican Poppy	Monitor	Mexican Poppy is limited to some drainage lines within the District. The Group should monitor to detect any significant changes in the species weed risk. See page 24 for more details.
Mimosa Bush *(Acacia farnesiana)*	Contain spread	Mimosa is widely distributed in the drainage lines of the Channel Country. The Group should seek to prevent ongoing spread through control of all infestations, aiming for a significant reduction in weed density. See page 27 for more details.
Neurada procumbens	Monitor	*Neurada procumbens* has a limited distribution in the District. The Group should monitor to detect any significant changes in the species weed risk. See page 31 for more details.
Noogoora Burr	Monitor	Noogoora Burr is limited to some drainage lines within the District. The Group should monitor to detect any significant changes in the species weed risk. See page 34 for more details.
Prickly Acacia *(Acacia nilotica)*	Destroy infestations	Prickly Acacia has a very limited distribution in the District. Any occurrences should immediately be reported to Natural Resources SA Arid Lands and destroyed as soon as practical. See page 38 for more details.

Table 2. Management Strategy aims and actions definitions

Management strategy	Aims & actions of management strategies
Alert	Species that are not known to be present in the management area and which represent a significant threat if permitted to enter and establish. **Aims to prevent the species arriving and establishing in the management area.** • Prevention of entry to management area • Ongoing surveillance for incursions of the species • Training & awareness activities for the community to enable early detection
Eradicate	**Aims to remove the weed species from the management area.** • Detailed surveillance & mapping to locate all infestations • Destruction of all infestations including seed banks • Prevention of entry to management area and movement within • Must not grow and all cultivated plants to be removed • Monitor progress towards eradication
Destroy	**Aims to significantly reduce the extent of the weed species in the management area.** • Detailed surveillance & mapping to locate all infestations • Destruction of all infestations, aiming for local eradication at feasible sites. • Prevention of entry to management area and movement and sale within • Must not grow • Monitor progress towards reduction
Contain spread	**Aims to prevent the ongoing spread of the weed species in the management area.** • Surveillance & mapping to locate all infested properties • Control all infestations, aiming for a significant reduction in weed density • Prevention of entry to management area and movement and sale within • Must not allow to spread from cultivated plants (if grown) • Monitor change in current distribution
Protect sites	**Aims to prevent spread of the weed species to key sites/assets of high economic, environmental and/or social value.** • Weed may be of limited current distribution but only threatens limited industries/habitats (lower weed risk). Or the weed may be more widespread but is yet to invade/impact upon many key industries/habitats (higher weed risk) • Surveillance & mapping to locate all infested properties • Identification of key sites/assets in the management area • Control of infestations in close proximity to key sites/assets, aiming for a significant reduction in weed density. • Limits on movement within the management area • Must not allow to spread from cultivated plants (if grown) in close proximity to key sites/assets • Monitor change in current distribution within and in close proximity to key sites/assets

Manage weed	**Aims to reduce the overall economic, environmental and/or social impacts of the weed species through targeted management** • Research and develop integrated weed management (IWM) packages for the species, including herbicides and biological control, where feasible • Promote IWM packages to landholders • Monitor decrease in weed impacts with improved management • Identify key sites/assets in the management area and ensure adequate resourcing to manage the weed species
Manage sites	**Aims to maintain the overall economic, environmental and/or social value of key sites/assets through improved general weed management.** • Promote general IWM principles to landholders, including the range of control techniques, maintaining competitive vegetation/crops/pastures, hygiene & property management plans • Identify key sites/assets in the management area & ensure adequate resourcing to manage these to maintain their values • Broaden focus beyond weeds to all threatening processes
Monitor	**Aims to detect any significant changes in the species' weed risk** • Monitor the spread of the species and review any perceived changes in weediness
Limited action	**The weed species would only be targeted for coordinated control in the management area if its local presence makes it likely to spread to land uses where it ranks as a higher priority** • Undertake control measures if required for the benefit of other land uses at risk • Otherwise limited advice to land managers, if required

Review period

It is intended that this strategy be implemented over the next five years. In the fifth year it is suggested that the District Group review progress and update management targets and actions accordingly.

Suggested time frame:

Year	Activity
2014	Draft strategy reviewed by the Group and feedback incorporated into the Strategy Strategy endorsed by the group
2015	Implementation
2016	Implementation
2017	Implementation and review progress and update the strategy as required (and then every 3 years)
2018	Implementation

Target Weeds and their strategy

African Rue

Common name(s): African Rue

Scientific name: *Peganum harmala*

Plant description: Perennial herb or shrubby plant 30-80 cm high.

Leaves 1-5 cm long, bright green, divided several times into three or more linear segments.

Flowers, with 5 white broad petals (12- 17 mm long).

Fruit is slightly flattened capsule (8-12 mm across, 7-12 mm long) which opens at the top, containing black angular seeds.

Photo 1: African Rue plant (Photo B. Shepherd)

Photo 2: African Rue flowers (Photo Courtesy DWLBC)

Flowering: Late spring – early summer

Origin: Mediterranean region and Middle East

When introduced: Unknown

Why introduced: Unknown, was once used in Medicine

Other information: African Rue is considered an aphrodisiac in India. Its seeds and leaves have been used medicinally for treatment of various aliments including asthma, jaundice, colic and as a diuretic.

Threats and Impacts

Invasiveness Dispersal of the plant is predominately through seed, with the majority of seed being dropped close to the parent plant. Seeds can easily be dispersed through water flow, but also in mud moved by animals or vehicles. Stock and other animals may also eat the fruit and aid in the dispersal of African Rue.

African Rue prefers disturbed sites with little or no competition, and requires moisture for seed germination.

African Rue is drought and salt tolerant, and therefore has the potential to have large impacts in semi-arid and arid areas.

Impacts	African Rue can be toxic containing more than 25 alkaloids, however the plant is highly unpalatable to livestock (few poisonings have been reported). The likely impact on native vegetation is unknown, but due to its tolerance to drought and salt the potential impacts could be large.
Persistence	African Rue is difficult to destroy once established as regeneration may occur from severed root pieces. African Rue is known to persist despite treatment with herbicide or manual removal.

Distribution

Current Australian distribution:	Confined to News South Wales and South Australia.
Current South Australian distribution:	Known to occur in patches at Tintinara, Taylorville and Snowtown as well as numerous other sites. In the SAAL region African Rue primarily occurs along roadsides and flood out areas. A core infestation exists in the eastern pastoral district and other occurrences exist in the northern Flinders Ranges and in the area between Lake Torrens and Port Augusta including along the Stuart Highway.
Current District distribution:	There is a core infestation of African Rue at Yerelina Creek on the Strzelecki Track as well as other smaller infestations at various locations around the district.
Potential distribution:	African Rue has the potential to become widespread throughout the arid lands region in disturbed areas such as roadsides and areas receiving run-on water such as flood outs and depressions. The zone of potential distribution has been described as between 175mm and 350mm annual rainfall.

Policy

National Strategy:	African Rue is not classified as a Weed of National Significance, therefore there is no National Strategy for this species.
State Policy:	African Rue is a declared species under the Natural Resources Management Act, 2004. To prevent establishment in uninfested pastoral lands Under the *Natural Resources Management Act*, 2004: ▪ Prohibiting movement of African Rue on roads ▪ Prohibiting the sale of African Rue or contaminated produce ▪ Requiring landholders to control African Rue on their properties ▪ Allowing recovery of roadside control costs of African Rue from adjoining landholders
SA Arid Lands NRM Policy:	The SAAL NRM regional management strategy for African Rue is to PROTECT sites Aim: To prevent spread of African Rue to key sites/assets of high economic, environmental and/or social value.
Marree - Innamincka NRM District management strategy:	Marree - Innamincka NRM District management strategy is to PROTECT sites from the spread of African Rue Aim: To prevent spread of African Rue to key sites/assets of high economic, environmental and/or social value.

Marree - Innamincka NRM District Strategy for management of African Rue

Recommended Actions
Support land manager education in identification, monitoring and control of African Rue.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of African Rue in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of key sites for control of African Rue infestations.
Marree - Innamincka NRM District group to assist in identifying and coordinating African Rue control programs using integrated weed management (combination of recommended best practices), especially in areas where key sites are threatened.
Land managers are encouraged to monitor success, following control of African Rue, and carry out follow up control as necessary.

Best Practice Control

African Rue can be a difficult plant to kill due to its deep roots. On-going monitoring and repeated applications of herbicide will be required annually and after rainfall events.

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Foliar Spray			
Useful on all sized plants. African Rue has very deep roots and glyphosate may not effectively translocate to kill established plants. Repeated application over successive seasons is required. Spray the entire plant until run off. Better results will occur on plants that have dust free foliage. Spot spraying with a knap sack or quad/ute mounted spray unit can be used for scattered occurrences. Boom spray can be used for dense infestations where no native vegetation exists between African Rue plants e.g. along roads.	When actively growing, before flower.	Glyphosate (450g/L) e.g. Roundup®	1L/100L water + penetrant e.g. Pulse®
Cut stump			
Cut off close to the ground and apply herbicide to stump surface immediately.	When actively growing.	Glyphosate (450g/L) e.g. Roundup®	Undiluted
Physical			
Due to its deep roots, African Rue cannot be successfully controlled through hand-pulling or grubbing (it will regrow from the broken root). Organic properties - To provide long term suppression and reduce African Rue proliferation, increasing competition from native plants, by reducing grazing pressure from livestock, rabbits and kangaroos, in areas where African Rue is present, is the best option.			

Surveys/ Monitoring

General method: Undertake targeted surveys and/or opportunistic monitoring of African Rue during pastoral management activities. Prevalent along roadsides, drainage lines and disturbed areas. Targeted surveys and control activities should occur annually and/or after rainfall.

Best time of year for surveys: Anytime of year and especially 2-3 weeks after rainfall.

Athel Pine

Common name(s): Athel Pine

Scientific name: *Tamarix aphylla*

Plant description: Tree to 15 m high, with branchlets which appear jointed but are small leaves (1-2 mm long) surrounding the stem.
Flowers are pink-white, with bell shaped fruit containing numerous seeds.

Photo 3: Mature Athel Pine (Photo B Shepherd)

Photo 4: Athel Pine in riparian zones (Photo B Shepherd)

Photo 5: Pink-white flowers of Athel Pine (Photo B Shepherd)

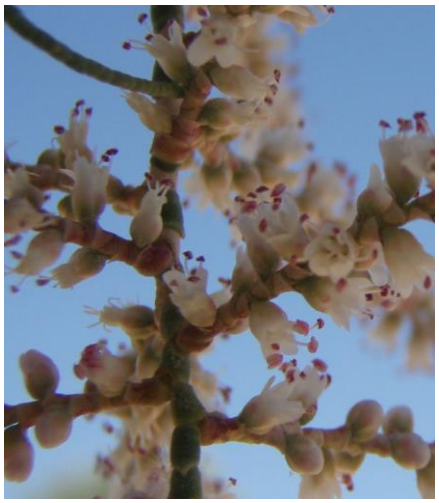

Photo 6: Athel Pine flowers (Photo B Shepherd)

Flowering: Summer

Origin: Mediterranean region, northern Africa and India

When introduced: 1930-40s

Why introduced: Introduced to arid and semi-arid areas for shade, shelter and erosion control

Other information: Tamarisk or Salt Cedar (*Tamarix ramosissima*), is a plant similar to Athel Pine which has also shown weedy tendencies in SA, NSW and WA

Threats and Impacts

Invasiveness

Seeds of Athel Pine require a moist environment to germinate, but the main period of germination is in Autumn.

Seed is easily moved by flood waters and wind, but also by animals, including birds.

Athel Pine also has the ability to reproduce from pieces of stem and root and therefore has the capability spread easily.

Impacts

Athel Pines may form dense stands which compete with native species, both other trees and understorey plants. Athel Pines may also alter the flow of watercourses, lower water tables, decrease pasture production and make mustering more difficult.

The leaves of Athel Pine excrete salt which leads to high salinity levels in leaf litter.

Persistence

Athel Pine is tolerant to drought and fire resistant, and has the ability to sucker.

Athel Pine commonly reshoots following chemical and mechanical control, therefore follow up control is imperative.

Distribution

Current Australian distribution:

Semi arid and arid areas of SA, NT, Qld, WA and NSW. Plantings occur across Australia.

Current South Australian distribution:

In the South Australian arid lands planted Athel Pines are common and there are 18 known locations where Athel Pine has gone wild (naturalised).

The largest population of wild Athel Pine occurs in the eastern area of the South Australian arid lands where approximately 50 km of river and lake environment are infested.

Current District distribution:

Athel Pines are common throughout the District and were planted in station gardens, community areas and around waters for shade and shelter trees. Since 2008, control has been carried out on three properties and landholders at another five properties have sites they are monitoring.

Potential distribution:

Athel Pine has the potential to infest all rivers, creeks and waterways in arid areas. Where Athel Pines are located close to drainage lines the lower reaches of the water course are at risk of invasion.

Policy

National Strategy:

Athel Pine is classified as a Weed of National Significance (WONS).

- Non-riparian - Locate, map and remove all high risk Tamarix spp. plantings adjacent to ephemeral lakes and streams in arid and semi-arid areas.
- Riparian - Eradicate all infestations in riparian areas.

State Policy:

To protect native vegetation from invasion by preventing further plantings of this species and by removing existing Athel Pine from high risk areas.

Under the *Natural Resources Management Act*, 2004:

- Prohibiting sale of Athel Pine or contaminated material; and
- Landowners are required to control Athel Pine on their properties where it is within 100m of a watercourse.

SA Arid Lands NRM Policy:	The SAAL NRM regional management strategy for Athel Pine is to PROTECT sites. Aim: To prevent spread of Athel Pine to key sites/assets of high economic, environmental and/or social value
Marree - Innamincka NRM District management strategy:	Marree - Innamincka NRM District management strategy is to PROTECT sites from the spread of Athel Pine Aim: To prevent spread of Athel Pine to key sites/assets of high economic, environmental and/or social value.

Marree - Innamincka NRM District Strategy for management of Athel Pine

Recommended Actions
Support land manager education in identification, monitoring and control of Athel Pine.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Athel Pine in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of high priority areas such as significant rivers, creeks and waterholes and coordinate control programs to protect identified priority sites.
Land managers are required to undertake control of Athel Pine plants within 100m of rivers, creeks and waterholes.
Land managers are encouraged to monitor success, following control of Athel Pine, and carry out follow up control as necessary.
Introductions and movement of Athel Pine are to be restricted within SAAL NRM Region.

Best Practice Control

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Cut stump			
Useful for medium to larger trees. The main stem(s) are cut off by chainsaw and the stump immediately (within 10 seconds) painted or sprayed with the recommended herbicide mixture. The stump should be cut as close to the ground as possible. Remove all cut material from moist environments to prevent root growth from tree sections. On organic properties, tree guards, made out of star droppers and chicken wire, can be erected around each stump. Barbed wire can be threaded through the top of the tree guards to prevent any access (by cattle) to the treated stump.	Any time of year	Picloram (43 g/kg) e.g. *Vigilant® Herbicide Gel®* Triclopyr (600 g/L) e.g. *Garlon®* Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access®*	Ready to use 35 ml/L mixed in diesel 17 ml/L mixed in diesel
Basal bark			
Useful for smaller trees that have not developed rough bark. Remove all debris from around the base of the tree prior to applying the herbicide. Spray all sides of stems with the herbicide mix, to a height of between 250 – 750 mm above soil level.	Any time of year	Triclopyr (600 g/L) e.g. *Garlon®* Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access®*	25 mls/L mixed in diesel 17 mls/L mixed in diesel

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Foliar spray			
Useful when plants are smaller than 2 m. Spray the entire plant with the recommended herbicide mix.	Any time of year	Triclopyr (600 g/L) e.g. *Garlon*®	17 to 35 mls/L mixed in diesel or 10 mls/L water
Physical			
Useful for very large trees, dense infestations and broad scale germination or regrowth. The entire plant is removed from the ground using a suitably sized bull dozer or loader. Roots must be cut 30-50 cm below the soil surface to reduce the incidence of regrowth. This is best done with a blade plough. Branch and root fragments of Athel Pine can take root, therefore woody material must be moved out of creek lines and moist areas. Ongoing inspections and hand-pulling of seedlings will additionally be required where recruitment is occurring, until the seedbank is exhausted.			

Surveys/ Monitoring

General method: Regular searches along rivers for new occurrences of wild Athel Pine, especially in areas downstream from planted Athel Pine, is important to detect and control Athel Pine before it becomes a problem.

Best time of year for surveys: Athel Pine is a perennial plant and will be detected anytime of the year.

Look for grey, green pine looking leaves growing within river beds in swamps and around water holes.

Bathurst Burr

Common name(s): Bathurst Burr

Scientific name: Xanthium spinosum

Plant description: Bathurst Burr is an erect, multi-branched annual herb, growing up to 1 m high (but usually 30–60 cm).

Leaves are dark green on the upper surface, a paler green on the under surface, up to 7 cm long and usually three-lobed.

Stems are branched with one or two three-pronged yellow spines at the base of each leaf stalk.

Flowers are creamy green and small, developing into straw-coloured burrs, 1–1.5 cm long, with numerous yellow hooked spines. Each burr contains two seeds.

Photo 7: Bathurst Burr with seed pods (Photo: Biosecurity Queensland)

Photo 8: Bathurst Burr close-up (Photo: Biosecurity Queensland)

Flowering: Summer generally but opportunistic when moisture is available.

Origin: South America

When introduced: Early 1800's

Why introduced: Accidently in contaminated grain or livestock imports

Threats and Impacts

Invasiveness Heavy infestations occur where the ground has been disturbed, such as on roadsides, old cultivation paddocks and irrigated pastures or watercourses. It does not tolerate dense competition from other weeds or dense pasture. It has been widespread in the more marginal pasture areas for over a century, rarely incurring into areas of higher rainfall.

The hooked spines of Bathurst Burr will readily attach to the fur or wool of animals and other fibrous material (such as clothing), making burrs easy to disperse. Burrs are also able to float and can spread along watercourses.

Impacts Its burrs are a major contaminant of fleeces in some years, especially when summer rainfall has been high. Seedlings are poisonous to domestic stock animals, especially horses and pigs, causing death in some circumstances.

Persistence	Of the two seeds present in each burr, only one will germinate in a single season. The other seed will remain dormant for two or three years (sometimes longer). The registered chemical control methods are highly effective on growing plants, but Bathurst Burr will survive as a seed bank for several years.

Distribution

Current Australian distribution:	Bathurst Burr is widespread in Australia, occurring in all states and the Northern Territory. It is particularly widespread in Queensland, occurring in southern, western and central areas, but is seldom important in the tropics. It prefers drier areas, such as well-drained contour banks and lighter soils.
Current South Australian distribution:	The distribution of Bathurst Burr is disjunct due to its habitat requirements, but extends from eastern Eyre Peninsula through the North East Pastoral, mid North, Yorke Peninsula, Riverland, South East and parts of the mallee.
Current District distribution:	Around dams, along drains and the flood-out areas associated with ephemeral creeks, mainly after summer rains.
Potential distribution:	Potential distribution of Bathurst Burr extends across the agricultural zone from western Eyre Peninsula to the South East, and also in suitable microhabitats in the Alinytjara Wilurara and SA Arid Lands regions. The main sites open to infestation are around dams, along drains and the flood-out areas associated with creeks and rivers.

Policy

National Strategy:	Bathurst Burr is not classified as a Weed of National Significance, therefore there is no National Strategy for this species.
State Policy:	To minimise losses to the wool industry due to hardhead burr contamination. Under the Natural Resources Management Act, 2004: ▪ Prohibiting movement of Bathurst Burr on public roads. ▪ Prohibiting sale of Bathurst Burr. ▪ Prohibiting sale of goods contaminated with Bathurst Burr. ▪ Landowners to control Bathurst Burr on their properties. ▪ Landowners to comply with regulations or instructions. ▪ Allowing NRM authorities to recover costs from landholders for control of Bathurst Burr on adjoining road reserves.
SA Arid Lands NRM Policy:	SAAL NRM regional management strategy for Bathurst Burr is to MANAGE sites. Aim: To reduce the overall economic and/or social impacts of this weed through targeted management.
Marree - Innamincka NRM District management strategy	Marree - Innamincka NRM District management strategy for Bathurst Burr is to MANAGE sites. Aim: To reduce the overall economic and/or social impacts of this weed through targeted management.

Marree - Innamincka NRM District Strategy for management of Bathurst Burr

Recommended Actions
Support land manager education in identification, monitoring and control of Bathurst Burr.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Bathurst Burr in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of key sites for control of Bathurst Burr infestations.
Marree - Innamincka NRM District group to assist in identifying and coordinating Bathurst Burr control programs using integrated weed management (combination of recommended best practices), especially in areas where key sites are threatened.
Land managers are encouraged to monitor success, following control of Bathurst Burr, and carry out follow up control as necessary.

Best Practice Control

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Foliar Spray			
Spot spraying with a knap sack or quad/ute mounted spray unit can be used Spray the entire plant with the recommended herbicide mix.	Before flower and burr formation	Glyphosate (450g/L) e.g. Roundup®	1L/100L water + Surfactant e.g. Pulse®
Spot spraying with a knap sack or quad/ute mounted spray unit can be used Spray the entire plant with the recommended herbicide mix Soil active herbicide, may damage desirable vegetation.	Before flower and burr formation	Glyphosate (450g/L) + metsulfuron-methyl (600g/L) e.g. Roundup® +Ally®	1L + 7g/100L water + Surfactant e.g. Pulse®
Hormone type treatment – use with caution near sensitive crops. Refer to drift warnings on label. Grass pastures – Spray seedlings, use higher rates on larger plants or plants in late flower.	Before flower and burr formation	MCPA (340g/L) + dicamba (80g/L) e.g. Banvil®M	190-270ml/100L water
Physical			
Ground can be cultivated in suitable areas during seedling stage.			

Surveys/ Monitoring

General method:	Keep an eye out for Bathurst Burr during routine pastoral management activities, especially along drainage lines, and record locations using a GPS or farm map.
Best time of year for surveys:	Late spring through to late autumn, especially after summer rains.

Buffel Grass

Common name(s): Buffel Grass

Scientific name: *Cenchrus ciliaris*

Plant description: Buffel Grass is a perennial grass to approximately 1 m high, with very strong root stock.

Leaves bluish- green, 3-25 cm long, 1-6 mm wide. Leaf blade base with a rig of short hairs (0.2-2 mm).

Flower heads form dense hairy cylindrical spikes 2-15 cm long, pale or purplish.

Photo 9: Buffel Grass seed head (Photo B Shepherd)

Photo 10: Buffel Grass infestation (Photo B Shepherd)

Photo 11: Buffel Grass plant (Photo B Shepherd)

Flowering: Summer

Origin: Native to Africa and south western Asia

When introduced: 1840s

Why introduced: Pasture species in areas with long dry season and for erosion control.

Other information: Can withstand heavy grazing and is the most drought tolerant introduced grass species in Australia.

Threats and Impacts

Invasiveness Buffel Grass is easily distributed by wind, water, stock and machinery. High levels of disturbance, such as flood, fire and heavy grazing, can assist the establishment. Buffel Grass can also root from lower nodes.

The species requires summer rain for growth, and is not frost tolerant.

Impacts

Buffel Grass competes with and displaces native species. It forms monospecific stands, out-competing native grasses.

Plants are fire resistant but can carry fire in areas where fire is not normally part of the ecosystem. Buffel Grass aids fire by increasing the intensity and frequency of natural fire regimes to the point of removing competing shrubs and trees.

Persistence

Buffel Grass is the most drought tolerant introduced grass species in Australia. Buffel Grass is highly persistent on lightly textured soils and is quick to respond to small amounts of rainfall.

Distribution

Current Australian distribution:

Buffel Grass is common throughout central Australia. It was (and continues to be) widely cultivated by pastoralists as a preferred pasture species for cattle. In some outback towns, namely Alice Springs it was cultivated for dust control and has since successfully naturalised and overrun large tracts of land.

Current South Australian distribution:

Large areas in the far north west of South Australia are infested with Buffel Grass and it is common along the Stuart Highway (from the Northern Territory border down to Port Pirie) and the Tarcoola Road. Buffel Grass also occurs along selective creeks of the region with infestations ranging from scattered single occurrences to dense patches. It also occurs in other areas including around townships and as isolated patches along secondary roads.

Current District distribution:

Buffel Grass infestations have occurred along the Strzelecki and Birdsville Tracks. There have also been other reports of infestations along roadsides and drainage lines across the District.

Potential distribution:

Buffel Grass establishes readily and has the capacity to expand across a large proportion of northern to central South Australia. It has recently been found close to Port Pirie, which suggests it is continuing to move south.

Policy

National Strategy:

Buffel Grass is not classified as a Weed of National Significance, therefore there is no National Strategy for this species.

State Policy:

Buffel Grass is a declared species under the *Natural Resources Management Act,* 2004.

Buffel grass contained and its impacts on native vegetation, grazing systems, remote communities and infrastructure in South Australia minimised.

Objectives:

• Vulnerable sites currently uninfested with buffel grass protected from invasion.

• Buffel grass contained within its present range in South Australia, and this range incrementally reduced where possible.

• Buffel grass infestations are removed from key dispersal nodes and pathways.

• Natural and built assets protected from the fire risk associated with buffel grass infestations.

Regional Implementation:

See NRM Act, 2004 or *SA Buffel Grass Strategic Plan 2012-2017* for details.

SA Arid Lands NRM Policy:	The SAAL NRM Board management strategy, based on the SA Buffel Grass Strategic Plan, is to MANAGE the impacts of Buffel Grass in the Marla-Oodnadatta NRM Region and CONTAIN SPREAD in the rest of the SAAL region
Marree - Innamincka NRM District Risk management strategy:	Marree - Innamincka NRM District management strategy is to CONTAIN SPREAD of Buffel Grass Aim: To prevent ongoing spread through control of all infestations, aiming for a significant reduction in weed density.

Marree - Innamincka NRM District Strategy for management of Buffel Grass

Recommended Actions
Support land manager education in identification, monitoring and control of Buffel Grass.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Buffel Grass in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of key sites requiring control of Buffel Grass.
Marree - Innamincka NRM District group to assist in identifying and coordinating Buffel Grass control programs using integrated weed management (combination of recommended best practices), especially in areas where key sites are threatened.
Land managers are encouraged to monitor success, following control of Buffel Grass, and carry out follow up control as necessary.
Introductions and movement of Buffel Grass are to be restricted within SAAL NRM Region.

Best Practice Control

Control method and description	**Best time to control**	**Active ingredients and example trade names**	**Herbicide rates and carrier**
Foliar Spray			
Spray all sides of the entire plant. Ensure the entire plant is covered in the herbicide mix. Spot spraying with a knap sack or quad/ute mounted spray unit can be used for scattered occurrences. Boom spray can be used for dense infestations where no native vegetation exists between Buffel Grass plants e.g. along roads. Follow up monitoring and spraying will be required around 4 weeks after the initial spray. Buffel Grass can quickly regenerate from seed and ongoing monitoring and control is required annually.	Between 1-3 weeks after summer rain	Glyphosate (360g/L) e.g. *Roundup*® + Flupropanate e.g. *Tussock*	300 mL + 1L / 100L water with a penetrant e.g. *Pulse*® It is also recommended that a dye is used with the herbicide mix to show which plants have and have not been sprayed.
Physical			
Grubbing can be used for isolated occurrences or small infestations. Dig the entire plant out of the ground. Ongoing monitoring and follow up hand pulling/grubbing will be required after each significant rainfall event.			

Surveys/ Monitoring

General method:	Look for Buffel Grass during routine pastoral management activities and record locations using a GPS. Especially look in areas adjacent to roads where the soil has been disturbed.
Best time of year for surveys:	In the weeks following rainfall, look for a large clumpy grass with often purple or black seed heads.

Mexican Poppy

Common name(s): Mexican Poppy

Scientific name: Argemone ochroleuca

Plant description:
(Photos)

Mexican Poppy is stiff bluish-green prickly plant that grows up to 1m in height.

The leaves are up to 20cm long, silvery green with white veining and deep regular lobes. The upper surface of the leaf is smooth while the underside has a few prickles along the midrib. The stem leaves (in contrast to the rosette leaves) are stalkless and clasp onto the plant's stem.

The flowers are about 6cm across. They have four light yellow or cream petals, and the ovary at the centre of the flower is topped with a dark red three or six lobed stigma.

The fruits are spiny, oblong seed capsules. They are up to 3.5cm in length with three to six openings at the top. The capsule contains up to 400 seeds. The seeds are oval-shaped, blackish brown, about 1.5mm long with a pitted seed coat and a ridge along one side.

Photo: 12 Light yellow flower and seed pod of Mexican Poppy (Photo WA Dept of Agriculture and Food)

Photo 13: Flower and spiny leaves (Photo: WA Dept of Agriculture and Food)

Flowering: Generally November to February, but is opportunistic in arid areas and can flower outside these times when moisture available.

Origin: Mexico, Central America and Texas and Florida, USA.

When introduced: First reported near Sydney in 1845.

Why introduced: Probably imported as a contaminant of wheat seed.

Other information: Argemone ochroleuca is similar in appearance and far more widespread than A. mexicana. To confuse matters further, both species are referred to as Mexican Poppy. Argemone mexicana differs from A. ochroleuca in that it has bright yellow flowers as opposed to cream or pale-yellow flowers, and globular flower buds as opposed to the egg-shaped buds of Argemone ochroleuca (Auld & Medd 1987).

Threats and Impacts

Invasiveness It establishes readily on disturbed ground, overgrazed pastures, river beds and roadsides. Seed is readily dispersed by moving water, especially where plants grow in riparian habitats and on terrain where erosion and runoff occurs. Contaminated soil, fodder, vehicles and the fur and hooves of livestock are vectors for transport of Mexican Poppy seed (Parsons & Cuthbertson 2001).

Impacts	The prickly fruits can become entangled in wool, reducing its value considerably. It is suspected of being toxic to animals and humans due to the presence of alkaloids in all parts of the plant. However, reported cases of poisoning are rare because livestock tend to avoid it in the field, due to the presence of a bitter sap that makes it unpalatable. Poisonings may occur as a result of hay and chaff containing traces of the plant. Poisonings in humans have occurred by the consumption of oils contaminated with the plant (Parsons & Cuthbertson 2001).
Persistence	It is estimated that a single plant can produce up to 30 000 seeds per year. The seed can stay dormant for many years, making control difficult.

Distribution

Current Australian distribution:	All Australian states and territories, except Tasmania.
Current South Australian distribution:	Anecdotal reports from across rangelands.
Current District distribution:	Anecdotal reports in Marree – Innamincka District – no recorded voucher specimens.
Potential distribution:	Potential distribution of Mexican Poppy extends across the range lands mainly in drainage lines and along roadsides.

Policy

National Strategy:	Mexican Poppy is not classified as a Weed of National Significance, therefore there is no national strategy for this species.
State Policy:	No State policy exists for Mexican Poppy.
SA Arid Lands NRM Policy:	SAAL NRM regional management strategy for Mexican Poppy is to MONITOR for any changes in the species weed risk. Aim: To detect any significant changes in Mexican Poppy's weed risk and monitor the spread of the species and review any changes in weediness.
Marree - Innamincka NRM District management strategy	Marree - Innamincka NRM District management strategy for Mexican Poppy is to MONITOR for any changes in the species weed risk. Aim: To detect any significant changes in Mexican Poppy's weed risk and monitor the spread of the species and review any changes in weediness. If any negative changes occur, carry out control to prevent spread.

Marree - Innamincka NRM District Strategy for management of Mexican Poppy

Recommended Actions
Support land manager education in identification, monitoring and control of Mexican Poppy.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Mexican Poppy in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Monitor distributions of Mexican Poppy in Marree - Innamincka NRM District over time (through the use of surveillance and mapping) and advise NR SAAL if species weediness increases.
Marree - Innamincka NRM District group to provide input into identification of key sites requiring control of Mexican Poppy.
Land managers are encouraged to monitor success, following control of Mexican Poppy, and carry out follow up control as necessary.

Best Practice Control

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Foliar Spray			
There are no herbicides registered for use in SA.			
Physical			
Hand pulling or grubbing using a mattock/hoe for immature plants that haven't seeded. If you locate a plant with mature seeds, apart from removing plant, collect seeds and burn them (e.g. campfire).			

Surveys/ Monitoring

General method:	Keep an eye out for Mexican Poppy during routine pastoral management activities, especially along roadsides and drainage lines, and record locations using a GPS or property map.
Best time of year for surveys:	Late spring through to late autumn, especially after summer rains.

Mimosa Bush

Common name(s): Mimosa Bush

Scientific name: *Acacia farnesiana synonym Vachellia farnesiana*

Plant description: Spreading shrub mostly less than 3 m high (rarely a small tree to 7 m high). Bark smooth or fissured, grey-brown. Seedpod almost cylindrical, thick, straight to curved, 4–6 cm long, 0.9–1.2 cm wide, pithy inside between seeds, not opening at maturity. Seeds black, oblique to transverse in the pod.

Distinguished by young stems with raised corky areas (lenticels) through which gas is exchanged; straight spines 1–2.5 cm long at base of leaves; mature leaves bi-pinnate, leaf axis 2–6 cm long, green, pinnae in 3–7 pairs, leaflets 4–9 mm long, 1–2 mm wide in 8–20 pairs; a small gland is usually found on the leaf stalk; heads of 40–80 flowers, 1–3 per leaf axil, golden yellow, globular; fruit maturing black and remaining on plant.

Photo 14: Golden flowers and bipinnate leaves of the Mimosa Bush (Photo: Emily Fatchen, DEWNR)

Photo 15: Seed pod and thorns of the Mimosa Bush (Photo: Emily Fatchen, DEWNR)

Photo 16: Mimosa Bush infestation (Photo: Rob Murphy, DEWNR)

Photo 17: Mimosa Bush seeds and pod (Photo: LRT, North West Weeds, NSW)

Flowering: Autumn to early summer

Origin: Central and South America

When introduced: Naturalised in Australia – thought to have been introduced prior to European settlement

Why introduced: Unknown

Threats and Impacts

Invasiveness

Mimosa Bush can spread readily and grow quickly. It often forms thorny thickets. Seeds sprout readily and plants grow rapidly. It does well in dry localities and on loamy or sandy soils, forming thickets and spreading along watercourses.

Seeds are primarily dispersed when livestock and feral animals eat the fruit and pass the seeds intact. Seeds may also be dispersed along water courses, when they are flowing.

Impacts

The thorny thickets cause considerable nuisance during mustering and can also hinder stock access to water. The thorns may also cause eye injuries to stock and native fauna. The thickets may provide harbour for rabbits. Biodiversity issues exist with native species being out-competed and becoming displaced.

Persistence

Mimosa Bush withstands drought well, is readily eaten by stock, and has good regrowth after grazing. This species reproduces by seed, and also produces suckers when its above-ground parts are damaged.

Apart from chemical control, there are no other effective means of controlling this species. This is a very real problem on organic properties.

Distribution

Current Australian distribution:

Widespread throughout northern Australia (though absent from extreme north), north-eastern S.A. and the North Coast to western N.S.W. as far S as Jerilderie.

Current South Australian distribution:

Watercourses and disturbed roadsides in the north of the State. Channel Country and Neales-Peake catchments.

Current District distribution:

Mimosa Bush is currently found in the north east area of the District in the Channel Country.

Potential distribution:

Watercourses and disturbed roadsides across the northern half of the State.

Policy

National Strategy:

Mimosa Bush is not classified as a Weed of National Significance, therefore there is no national strategy for this species.

State Policy:

No State policy exists for Mimosa Bush.

SA Arid Lands NRM Policy:

The SAAL NRM regional management strategy for Mimosa Bush is to CONTAIN SPREAD.

Aim: To prevent ongoing spread through control of all infestations.

Marree - Innamincka NRM District management strategy:

The Marree - Innamincka NRM District management strategy for Mimosa Bush is to CONTAIN SPREAD

Aim: To prevent ongoing spread through control of all infestations in the Marree - Innamincka NRM District.

Marree - Innamincka NRM District Strategy for management of Mimosa Bush

Recommended Actions
Support land manager education in identification, monitoring and control of Mimosa Bush.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Mimosa Bush in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of key sites requiring control of Mimosa Bush.
Marree - Innamincka NRM District group to assist in identifying and coordinating Mimosa Bush control programs using integrated weed management (combination of recommended best practices), especially in areas where key sites are threatened.
Land managers are encouraged to monitor success, following control of Mimosa Bush, and carry out follow up control as necessary.

Best Practice Control

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Cut stump			
Cut trunk off horizontally as close to the ground as possible. Immediately, within 15 seconds, swab cut surface with herbicide mixture. On organic properties, where scattered trees are not located close to water, tree guards, made out of star droppers and chicken wire, can be erected around each stump. Barbed wire can be threaded through the top of the tree guards to prevent any access (by cattle) to the treated stump.	Any time of year	Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access*®	17 ml/L diesel (solvent included in chemical – Liquid Hydrocarbon 389g/L)
Basal bark			
For stems up to 5 cm diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Thoroughly spray into all crevices. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level.	Autumn, when plants are actively growing and soil moisture is good (providing summer rains have occurred).	Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access*®	17 ml/L diesel (solvent included in chemical – Liquid Hydrocarbon 389g/L)
Foliar spray			
Useful when plants are smaller than 2 m. Spray the entire plant with the recommended herbicide mix.	Any time of year – but best when actively growing.	Triclopyr (600 g/L) e.g. *Garlon*®	16 to 32 mls/10L water
Physical			
Useful for very large trees, dense infestations and broad scale germination or regrowth.			
The entire plant is removed from the ground using a suitably sized bull dozer or loader.			
Roots must be cut about 30-50 cm below the soil surface to reduce the incidence of regrowth. This is best done with a blade plough.			
Branch and root fragments of Mimosa Bush can take root, therefore woody material must be moved out of creek lines and moist areas.			
Ongoing inspections and hand-pulling of seedlings will additionally be required, where recruitment is occurring, until the seedbank is exhausted.			
Subject to fire restrictions, controlled burning (minimum 2 subsequent burns) can also be effective.			

Surveys/ Monitoring

General method:	Keep an eye out for Mimosa Bush during routine pastoral management activities, especially along roadsides and drainage lines, and record locations using a GPS or farm map.
Best time of year for surveys:	Autumn to early summer when plants are flowering.

Neurada procumbens

Common name(s): Neurada

Scientific name: *Neurada procumbens*

Plant description: A distinctive low-lying annual herb that is adapted to dry, sandy environments, spreading up to 1m in diameter. Stems are branching and lie flat on the ground with dense hairs that give a woolly appearance. Neurada also has an obvious tap root.

Leaves are a distinctive blue-green colour and are lobed, covered in fine hairs and reach 6-25mm in length. They are borne on woody stems that radiate from the base of the plant.

Flowers are inconspicuous, usually solitary, small, and generally off-white in colour and have five petals.

The fruit is star shaped, smooth on the underside but has spines on the upper surface that become sharp when dry. The fruit turns hard and woody at maturity.

Photo 18: Neurada procumbens with flowers and seed (immature) (Photo: www.lrm.nt.gov.au)

Photo 19: Neurada procumbens prickly seeds (Photo: www.lrm.nt.gov.au)

Flowering: Within 2-4 weeks after rain

Origin: Native to arid regions of Africa, India and the Middle East.

When introduced: First identified in Australia in 2000 in north-west corner of Simpson Desert

Why introduced: Unknown

Threats and Impacts

Invasiveness Prickly fruit catches in animal fur and feet, vehicle tyres, shoes and camping gear and is easily transported to new areas. This species grows well in sandy soil and harsh climates and has the potential to spread across the arid lands.

Impacts The major concern with *Neurada procumbens* is as a contaminant of wool. The burrs contribute to hardheads, which damage shearing machinery. Wool processors generally reject infested wool. Spines of this plant also cause physical damage to stock and people.

Persistence	There are several seeds in each fruit. At a rainfall event only one seed germinates and quickly establishes a fine tap root in the moist sand. If no further rain occurs and the soil dries out, this individual dies but the other seeds remain viable. After subsequent showers, further seeds germinate until at last one of them grows successfully. This system works as an insurance policy to ensure the plant has the best possible chance of reproducing in such a harsh environment.

Distribution

Current Australian distribution:	North-west corner of the Simpson Desert and in some campgrounds in southern Central Australia in Northern Territory. Far north of South Australia.
Current South Australian distribution:	Simpson Desert and other scattered populations in northern South Australia.
Current District distribution:	Simpson Desert along French Line to west of Rig Road Junction.
Potential distribution:	Across the SA Arid Lands, especially in the sandy dunefields in the north. Also a threat throughout Central Australia.

Policy

National Strategy:	*Neurada procumbens* is not classified as a Weed of National Significance, therefore there is no national strategy for this species.
State Policy:	No State policy exists for *Neurada procumbens.*
SA Arid Lands NRM Policy:	SAAL NRM regional management strategy for *Neurada procumbens* is to MONITOR for any changes in the species weed risk. Aim: To detect any significant changes in *Neurada procumbens* weed risk and monitor the spread of the species and review any changes in weediness.
Marree - Innamincka NRM District management strategy:	Marree - Innamincka NRM District management strategy for *Neurada procumbens* is to MONITOR for any changes in the species weed risk. Aim: To detect any significant changes in *Neurada procumbens* weed risk and monitor the spread of the species and review any changes in weediness. If any negative changes occur, carry out control to prevent spread.

Marree - Innamincka NRM District Strategy for management of *Neurada procumbens*

Recommended Actions
Support land manager education in identification, monitoring and control of *Neurada procumbens*.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of *Neurada procumbens* in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Monitor distributions of *Neurada procumbens* in Marree - Innamincka NRM District over time (through the use of surveillance and mapping) and advise NR SAAL if species weediness increases.
Marree - Innamincka NRM District group to assist in identifying and coordinating *Neurada procumbens* control programs, using current best practice, if the need arises.

Best Practice Control

Control method and description
Foliar Spray
There are no herbicides registered for use in SA.
Physical
Hand pulling or grubbing using a mattock/hoe. If you locate a plant with mature seeds, apart from removing plant, collect seeds and burn them (e.g. campfire).

Surveys/ Monitoring

General method:	Keep an eye out for *Neurada procumbens* during routine pastoral management activities, especially along roadsides and record locations using a GPS or farm map. Also keep an eye out for it if using campgrounds in the far north of SA or Central Australia.
Best time of year for surveys:	Within 2 months after rainfall event.

Noogoora Burr

Common name(s): Noogoora Burr

Scientific name: Xanthium strumarium sp. agg.

Plant description: A single or multi stemmed herb growing up to 2m high. Its stems are hairy but without spines.

The leaves are broad-ovate to triangular, 50-150mm wide, 3 or 5 lobed, with a lobed base and toothed margins. The upper leaf surface is darker green than the under surface and prominently 3-veined with purplish veins. The leaf stalk (petiole) is 20-120 mm long (modified from Cross et al., unpublished).

The flowers are unisexual with separate male and female flowers on the same plant. The cream or creamy green male flowers are clustered at the end of the branches, or in the upper leaf axils while the yellowish green to brown female flower heads occur in the leaf junctions.

The burrs are ellipsoid, 15-25 mm long, with glandular & non-glandular hairs, covered with numerous hooked spines and with 2 longer stout and straight spines (or 'beaks'). Two seeds formed in each burr, one larger than the other (modified from Cross et al., unpublished).

Photo 20: Noogoora Burr with seed pods
(Photo depi.vic.gov.au)

Photo 21: Dry Noogoora Burrs on plant
(Photo lrm.nt.gov.au)

Flowering: Seeds may germinate in response to late spring/summer rain. Flowering occurs from mid-summer to autumn with burrs forming from February to May.

Origin: North America

When introduced: 1860's into Australia. Recorded in South Australia in 1916 and eradicated, but reinfested in 1959 when large numbers or sheep were imported that had Noogoora Burr in their wool.

Why introduced: Probably introduced to Australia at Noogoora station, in Queensland, in the 1860's as a contaminant of cotton seed.

Other information: Noogoora Burr, Xanthium strumarium is a group of species including X. occidentale (Noogoora Burr) and X. californicum (Californian burr). Both weeds are annual plants that have been introduced from North America. They are very similar in appearance and ecology and can be described together.

Threats and Impacts

Invasiveness

Large dense infestations are dependent on periodic wet summers. The seed must be in good contact with water to germinate. Low temperatures are lethal to Noogoora Burr.

Noogoora Burr is dispersed by burrs attached to stock, and also along watercourses by floodwaters. To establish it requires a year with summer rains to provide adequate water to break seed dormancy.

Impacts

The major concern with Noogoora Burr is as a contaminant of wool. The burrs contribute to hardheads, which damage shearing machinery. Spines of this plant also cause physical damage to stock and people. Wool processors generally reject infested wool.

Although Noogoora Burr seedlings are poisonous, the main toxin (carboxyatratyloside) is found only in the cotyledons. Cases of stock poisoning are very rare in Australia.

Noogoora Burr competes strongly with pastures due to its extensive root system and rapid growth.

Persistence

In SA most infestations of the Noogoora Burr group have been eradicated easily. This is probably due to unsuitable environments or by controlling the few plants surviving after many dry years.

There are few areas of SA suitable for Noogoora Burrs to persist. In the pastoral lands, these areas are often the most productive, as they are the accumulation areas for runoff.

There are 2 seed in each burr and the upper one germinates in the following season while the lower one remains dormant for 2 or more years. It has several types of dormancy (enforced, innate and induced) making control difficult.

Distribution

Current Australian distribution:

Noogoora Burr is widespread throughout most parts of New South Wales and Queensland, extending across into the Northern Territory, particularly around the Katherine, Daly Waters and Darwin regions and also the river systems flowing into the Gulf of Carpentaria. A few collections have been recorded from around the Alice Springs region. It also has a scattered distribution through northern Victoria and eastern South Australia, particularly around the Murray River and some tributaries. A few infestations have been recorded from the Kimberley region and the Perth region of Western Australia. One infestation was recorded in Tasmania but has since been eradicated (Parsons & Cuthbertson 2001).

Current South Australian distribution:

Two species of the Xanthium strumarium complex are known to occur in SA.

The Californian burr (Xanthium californicum) is distributed along the River Murray from the Victorian border to Swan Reach, with occasional plants and small patches downstream from Swan Reach. It is also established on the Gawler River.

The true Noogoora Burr (Xanthium occidentale) is also found with Californian burr adjacent to the River Murray from Lyrup ferry upstream to the Victorian/NSW border. Other areas include 5500 ha at Kallioota Swamp on Lake Torrens, small isolated infestations along the Coopers Creek system, and in the Mingary-Cockburn area.

Occasional plants are found throughout the state, especially adjacent to dams, waterholes, saleyards, transport depots and stock holding areas.

Current District distribution:

Isolated infestations along the Cooper Creek system.

Potential distribution

In South Australia suitable habitats are restricted to wetlands, adjacent to rivers, some flood irrigation areas, drains, creeks and flood outs, which may be inundated during summer.

Policy

National Strategy: Noogoora Burr is not classified as a Weed of National Significance, therefore there is no national strategy for this species.

State Policy: For Grazing Rangelands the State Policy is to Monitor.

Under the *Natural Resources Management Act*, 2004:

- Prohibiting entry to area of Noogoora Burr.
- Prohibiting movement of Noogoora Burr on public roads.
- Prohibiting sale of Noogoora Burr, or produce or goods carrying Noogoora Burr.
- Requiring notification of Noogoora Burr infestations to NRM authorities.
- Requiring landholders to control Noogoora Burr on their properties.
- Allowing recovery of control costs on adjoining road reserves of Noogoora Burr.

SA Arid Lands NRM Policy: SAAL NRM regional management strategy for Noogoora Burr is to MONITOR for any changes in the species weed risk.

Aim: To detect any significant changes in Noogoora Burr's weed risk and monitor the spread of the species and review any changes in weediness.

Marree - Innamincka NRM District management strategy Marree - Innamincka NRM District management strategy for Noogoora Burr is to MONITOR for any changes in the species weed risk.

Aim: To detect any significant changes in Noogoora Burr's weed risk and monitor the spread of the species and review any changes in weediness. If any negative changes occur, carry out control to prevent spread.

Marree - Innamincka NRM District Strategy for management of Noogoora Burr

Recommended Actions
Support land manager education in identification, monitoring and control of Noogoora Burr.
Marree - Innamincka NRM District Group to encourage landholders to provide data on distribution of Noogoora Burr in Marree - Innamincka NRM District to NRSAAL, so that it can be surveyed and mapped.
Marree - Innamincka NRM District group to provide input into identification of key sites requiring control of Noogoora Burr.
Marree - Innamincka NRM District group to assist in identifying and coordinating Noogoora Burr control programs using integrated weed management (combination of recommended best practices), especially in areas where key sites are threatened.
Land managers are encouraged to monitor success, following control of Noogoora Burr, and carry out follow up control as necessary.

Best Practice Control

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Foliar spray			
Spot spray - Hormone type treatment – use with caution near sensitive crops. Refer to drift warnings on label. Spray seedlings only.	When actively growing and before flower and burr formation.	2,4-D amine (625g/L) e.g. 2,4-D Amine 625	17-22ml/10L water + Surfactant e.g. Pulse®
Spot spray – Do not add surfactants if using near aquatic areas. Suitable for use near waterways – refer to label. Non-selective, avoid contact with desirable plants.	When actively growing and before flower and burr formation.	Glyphosate bioactive (360g/kg) e.g. Roundup Biactive®	1L/100L water
Boom spray - Non-selective, avoid contact with desirable plants.	When actively	Glyphosate (450g/L) e.g. Roundup®	1.5-2.5L/ha + Surfactant e.g.

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Fallow or prior to planting a crop or pasture.	growing and before flower and burr formation.		Pulse®
Spot spray - Non-selective, avoid contact with desirable plants. Soil active herbicide, may damage desirable vegetation.	When actively growing and before flower and burr formation.	Glyphosate (450g/L) + metsulfuron-methyl (600g/L) e.g. Roundup® + Ally	1L + 7g/100L water + Surfactant e.g. Pulse®
Spot spray - Hormone type treatment – use with caution near sensitive crops. Refer to drift warnings on label. Grass pastures. Use higher rate on late flowering or larger plants.	When actively growing and before flower and burr formation.	MCPA (340g/L) + dicamba (80g/L) e.g. Banvil®M	190-270ml/100L water
Physical			
Seedlings and individual plants can often be pulled up by hand (In large infestations this may not be practical). Manual hoeing or slashing should occur before burr formation. Plants with burrs should be collected and burned.			

Surveys/ Monitoring

General method: Look for Noogoora Burr during routine pastoral management activities, especially along drainage lines, and record locations using a GPS or farm map.

Best time of year for surveys: Summer through to late autumn, especially after summer rains.

Prickly Acacia

Common name(s): Prickly Acacia

Scientific name: *Acacia nilotica*

Plant description:

Prickly Acacia is a deep-rooted thorny shrub or small tree that usually grows to 5 m but occasionally to 10 m. The tree has an umbrella-shaped canopy and is usually single-stemmed but may be multi-stemmed at the base, particularly if damaged by fire or frost.

Bark on the saplings often has an orange and/or green tinge. Mature trees have a rough, brown to black bark. The tree has a very deep taproot and several branching lateral roots close to the soil surface.

Leaves are finely divided and fern-like with pairs of stout thorns growing at the base.

The flowers, which are ball-shaped, golden-yellow and about 1 cm across, grow on the stems with two to six flowers per group. The grey-green pods are a very good distinguishing feature—they are flat, 6–25 cm long, with narrow constrictions between the seeds. They usually contain 8–15 brown, rounded seeds with a very hard seed coat.

Photo 22: Prickly Acacia beside dam in Northeast South Australia (Photo: G Patrick)

Photo 23: Prickly Acacia seed pods are distinctly constricted between seeds (Photo: DAFF, Qld)

Photo 24: Flowers with spines protruding from base (Photo: DAFF, Qld)

Photo 25: Prickly Acacia in full fruit near Hughenden, Qld (Photo: Weed Management Guide, CRC)

Flowering: Autumn and winter

Origin: Southern Asia Minor to Burma

When introduced:	Introduced to Queensland in 1890's
Why introduced:	Shade and fodder
Other information:	During a good season one tree can produce 175,000 seeds.

Threats and Impacts

Invasiveness	Prickly Acacia can spread readily and grow quickly. It often forms thorny thickets. Seeds sprout readily and plants grow rapidly. It does well in dry localities and on loamy or sandy soils, forming thickets and spreading along watercourses. Seeds are primarily dispersed when livestock and feral animals eat the fruit and pass the seeds intact. Seeds may also be dispersed along water courses, when they are flowing.
Impacts	The thorny thickets cause considerable nuisance during mustering and can also hinder stock access to water. Infestations can drastically alter the ecological balance of grasslands and threaten biodiversity. The thorns may also cause eye injuries to stock and native fauna. The thickets may provide harbour for rabbits. Biodiversity issues exist with native species being out-competed and becoming displaced.
Persistence	Prickly Acacia withstands drought well, is readily eaten by stock, and has good regrowth after grazing. It reproduces by seed, and also produces suckers when its above-ground parts are damaged. The hard coating on the seeds allows them to persist in the environment for a long time and they don't all germinate at the same time.

Distribution

Current Australian distribution:	Over 6.6 million ha of arid and semi-arid land in central and western Queensland is infested. Smaller infestations have also been found in central eastern Queensland, the Barkly Tablelands and Arnhem Land in NT, north-east SA and the south-eastern Kimberley Ranges in WA.
Current South Australian distribution:	Recorded infestation on Cordillo Downs that was initially treated in 2010.
Current District distribution:	Apart from Cordillo Downs, not a lot is known of distribution in the District. There have been occurrences where initial reports of Prickly Acacia have turned out to be Acacia farnesiana.
Potential distribution:	Prickly Acacia has the potential to invade most of northern Australia, including the majority of Queensland and the Northern Territory and a significant area of Western Australia.

Policy

National Strategy:	Prickly Acacia is a weed of national significance (WONS). The National Strategy states: Prickly Acacia is eradicated outside of core infestations within Queensland and national impacts reduced to a minimum.
State Policy:	To protect the northern rangelands and their native vegetation from invasion by Prickly Acacia. Under the *Natural Resources Management Act*, 2004: ▪ Prohibiting sale of Prickly Acacia or of goods contaminated with the plant (Statewide); and ▪ Landowners are required to destroy the plant on their properties (SA Arid Lands NRM region).

SA Arid Lands NRM Policy:	SAAL NRM regional management strategy for Prickly Acacia is to DESTROY INFESTATIONS Aim: To significantly reduce the extent of Prickly Acacia in the SA Arid Lands.
Marree - Innamincka NRM District management strategy:	Marree - Innamincka NRM District management strategy for Prickly Acacia is to DESTROY INFESTATIONS Aim: To significantly reduce the extent of Prickly Acacia in the Marree – Innamincka District.

Marree - Innamincka NRM District Strategy for management of Prickly Acacia

Recommended Actions
Support land manager education in identification, monitoring and control of Prickly Acacia.
Infestations of Prickly Acacia discovered in Marree - Innamincka NRM District to be immediately reported to Natural Resources SA Arid Lands and destroyed.
Sale and movement of Prickly Acacia is not allowed within SAAL NRM Region.
Land managers are required to destroy any Prickly Acacia they find on their property.
Land managers are encouraged to monitor success, following control of Prickly Acacia, and carry out follow up control as necessary.

Best Practice Control

Control method and description	**Best time to control**	**Active ingredients and example trade names**	**Herbicide rates and carrier**
Cut stump			
Cut trunk off horizontally as close to the ground as possible. Immediately, within 15 seconds, swab cut surface with herbicide mixture. On organic properties, where scattered trees are not near water, tree guards, made from star droppers and chicken wire, can be put around each stump. Barbed wire can be threaded through the top of tree guards to prevent any access (by cattle) to the treated stump.	Any time of year	Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access*®	17 ml/L diesel (solvent included in chemical – Liquid Hydrocarbon 389g/L)
Basal bark			
For stems up to 10 cm basal diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Thoroughly spray into all crevices. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level.	Autumn, when plants are actively growing (providing summer rains have occurred).	Triclopyr (240 g/L) + Picloram (120 g/L) e.g. *Access*®	17 ml/L diesel (solvent included in chemical – Liquid Hydrocarbon 389g/L)
Foliar spray			
Useful when plants are smaller than 2 m. Spray the entire plant with the recommended herbicide mix.	Any time– best when actively growing.	Triclopyr (600 g/L) e.g. *Garlon*®	16 to 32 mls/10L water
Physical			
Useful for very large trees, dense infestations and broad scale germination or regrowth. The entire plant is removed from the ground using a suitably sized bull dozer or loader. Roots must be cut about 30-50 cm below the soil surface to reduce the incidence of regrowth. This is best done with a blade plough. Branch and root fragments of Prickly Acacia can take root, therefore woody material must be moved out of creek lines and moist areas.			

Control method and description	Best time to control	Active ingredients and example trade names	Herbicide rates and carrier
Ongoing inspections and hand-pulling of seedlings will additionally be required, where recruitment is occurring, until the seedbank is exhausted. Subject to fire restrictions, controlled burning (minimum 2 subsequent burns) can also be effective.			

Surveys/ Monitoring

General method:	Keep an eye out for Prickly Acacia during routine pastoral management activities, especially along drainage lines, and record locations using a GPS or farm map.
Best time of year for surveys:	Autumn to winter, when plants are flowering.

Appendix 1 – Alert Weeds

The weeds identified in this section have not been sighted in the Marree – Innamincka District. However, there have been infestations of them in neighbouring District(s) and the threat they pose are significant. They are included here to provide a reference for identification. If you discover any of these plants in the Marree - Innamincka District please contact Natural Resources SA Arid Lands immediately on 8648 5300 and report the location.

Cactus species

The major weed species of Cactus in South Australia are Coral Cactus (*Austrocylindropuntia* cylindrica), Devil's Rope cactus (*Cylindropuntia imbricata*), Drooping Prickly Pear (*Opuntia vulgaris/monacantha*) [not discussed], Hudson Pear (*Cylindropuntia rosea*), Jumping Cholla (*Cylindropuntia prolifera*), Engelmann's Prickly Pear (*Opuntia engelmannii*), Prickly Pear (*Opuntia stricta*) and Wheel Cactus (*Opuntia robusta*).

Common name(s):	**Coral Cactus**
Scientific name:	*Cylindropuntia fulgida var. mamillata*
Plant description:	Cactus, 1-1.5 m high (occasionally 3 m). Upper segments are smooth greyish to dark green, 6-70 cm long x 1-5 cm wide. Segments resemble coral as they mature. Spines (1-6) emerge from depressions, with white woolly hairs and minute bristles. Flowers, dull red 2-3.5 cm diameter. Fruit of Coral Cactus is yellow-green, spiny, barrel shaped.

Photo 26: Coral Cactus (Photo B Shepherd)

Photo 27: Coral Cactus (Photo B Shepherd)

Flowering:	Late spring - summer
Origin:	Ecuador and Peru
When introduced:	Unknown
Why introduced:	Unknown
Other information:	Floodwaters may damage plants, and also disperse segments resulting in new infestations.

Common name(s):	**Devil's Rope cactus**
Scientific name:	*Cylindropuntia imbricata*
Plant description:	Cactus, 1-2 m high (occasionally 3 m) often with a woody trunk. The plant is made up of strong woody segments dark to grey-green which are rope like in appearance. Sharp spines (2-30) emerge from depressions in segments, spines, 2-3 cm long, enclosed in yellow bristles. Flowers are 3-7.5 cm diameter, purple or purplish-red. The fruit of Devil's Rope cactus is usually spineless, barrel shaped and matures to a yellow colour.

Photo 28: Rope like appearance of Devil's Rope cactus (Photo J Pitt)

Photo 29: Purple flowers of Devil's Rope cactus (Photo J Pitt)

Flowering:	Late spring - summer
Origin:	Southern USA and Mexico
When introduced:	Unknown
Why introduced:	As an ornamental garden plant
Other information:	Previously called *Opuntia imbricata*

Common name(s):	**Jumping Cholla**
Scientific name:	*Cylindropuntia prolifera*
	Cactus to 2m high. Segments are grey-green up to 15 cm long and 5 cm wide. Segment depressions contain 6-12 spines up to 2 cm. Flowers rose to magenta, to 4 cm diameter. Fruit 2–4 cm long, 2–3 cm wide, spineless occasionally in short chains.

Photo 30: Jumping Cholla plant (Photo R Holtkamp)

Photo 31: Magenta flower of Jumping Cholla (Photo R Holtkamp)

Flowering:	Spring–early summer
Origin:	USA and Mexico
When introduced:	1993 (1st record in NSW)
Why introduced:	Unknown

Common name(s):	**Hudson Pear**
Scientific name:	*Cylindropuntia rosea*
Plant description:	Much branched Cactus, 1.5 m high, to 3 m wide. Segments are cylindrical up to 90 cm long and 4 cm wide. Segment depressions contain clusters of 4-8 spines, up to 3.5 cm Pink flowers to 5 cm diameter The fruit of Hudson Pear is wider towards the tip, 2–4.5 cm long.

Photo 32: Hudson Pear plant (Photo G Patrick)

Photo 33: Pink flowers of Hudson Pear (Photo brisbanetimes.com.au)

Flowering:	Late spring and summer
Origin:	Mexico
When introduced:	1960s
Why introduced:	As an ornamental garden plant

Common name(s):	**Engelmann's Prickly Pear**
Scientific name:	*Opuntia engelmannii*
Plant description:	Cactus, 2m tall. Upper segments are dull mid to grey-green and oval to circular shaped (9-26 cm long). Segment depressions contain 1-12 spines, with brown woolly hairs and short yellow-brown bristles. Yellow flowers. The fruit is pear to barrel shaped, spiny, and maturing to reddish-purple.

Photo 34: Engelmann's Prickly Pear (Photo B Shepherd)

Photo 35: Oval to circular segments of Engelmann's Prickly Pear (Photo B Shepherd)

Flowering:	Unknown
Origin:	Mexico and USA
When introduced:	Unknown
Why introduced:	Unknown

Common name(s): **Wheel Cactus**

Scientific name: *Opuntia robusta*

Plant description: Cactus, usually 1-2 m tall, occasionally to 4 m generally with a well-developed trunk. Segments are circular, bluish green to bluish grey to 40 cm diameter. Segment depressions are widely spaced containing 1-12 spines, 5 cm long with brown woolly hairs and yellow to brown bristles.

Flowers are yellow ageing to white, 5-8cm diameter.

The fruit is pink to purple, barrel shaped to 8 cm long and 6cm diameter.

Photo 36: Wheel Cactus plants (Photo J Pitt)

Photo 37: Oval to circular segments of Wheel Cactus (Photo J Pitt)

Flowering: Unknown

Origin: Mexico

When introduced: unknown

Why introduced: As an ornamental or botanical curiosity

Other information: The native habitat of Wheel Cactus is rare and endangered and is listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

Common name(s): **Prickly Pear**

Scientific name: *Opuntia stricta*

Plant description: Cactus, 0.5-1m tall, 0.5-5m across. The basal stem segments often thicken and form a trunk. The upper stem segments are dull mid to grey-green and oval shaped. Segment depressions are usually spineless or contain 1-11 spines (1-6 cm long) with brownish woolly hairs and short yellow bristles.

Flowers are yellow, 5-8 cm wide

The pear shaped fruit is smooth and purple at maturity.

Photo 38: Prickly Pear (Photo G. Patrick)

Photo 25: Yellow flowers of Prickly Pear (Photo T Bowman)

Photo 39: Yellow flowers of Prickly Pear (Photo T. Bowman)

Flowering: Summer

Origin: Drier tropical and sub-tropical America

When introduced: Prior to 1839

Why introduced:	As an ornamental garden plant or for use as food for cochineal insects which were used to produce dye for soldiers' coats.
Other information:	Plants may still establish from segments of Prickly Pear following disposal of garden waste unless buried to a depth of greater than 1 metre.

Threats and Impacts

Invasiveness

Wheel Cactus and Prickly Pear are highly invasive. They have high seed production, reproduce vegetatively, seeds are dispersed by birds and other animals and seedlings establish easily. Flood events have also been observed to promote spread of cacti species.

Other cacti species in the District are also invasive, well adapted for vegetative spread and able to withstand drought conditions.

Impacts

At high density, infestations of cacti species can render land unsuitable for grazing as thickets exclude livestock and can degrade biodiversity, as the infestations out-compete native plants and reduce habitat for native fauna.

Persistence

The ability of cacti to recover from control is very high. Re-establishment is assisted by the longevity of seed stored in the soil and the fact that new plants can grow from untreated or dropped pads. Follow up control is essential.

Distribution

Current Australian distribution:

Cacti species are common throughout Australia, both in gardens and as naturalised plants. In most states one or several Cactus species are declared weeds.

Current South Australian distribution:

There are significant infestations of Prickly Pear and Wheel Cactus near Peterborough, Terowie, along the River Murray cliffs, in the Blinman Parachilna area of the Flinders Ranges and around Port Augusta.

There is an infestation of Engelmann's Prickly Pear in the Flinders Ranges north of Quorn which is often confused with Wheel Cactus.

Devil's Rope cactus occurs to a lesser extent in these areas as well as in other areas around northern South Australia, primarily in the mid north agricultural district, the Flinders Ranges and the Olary Ranges.

There are three sites – two east of Coober Pedy and one in the North East Pastoral - where Coral Cactus and/or Jumping Cholla have naturalised and are spreading, however these populations are small and manageable. It is likely that these are not the only occurrences Coral Cactus and Jumping Cholla in northern South Australia and that others exist possibly in abandoned gardens or around ruins.

Hudson Pear occurs near Port Augusta and Whyalla.

Current District distribution:

There are no known cactus infestations in the Marree – Innamincka District.

Potential distribution:

Cacti species have the potential to establish across most of the arid and semi-arid areas of South Australia.

Policy

National Strategy:

Opuntia (Cacti) species are classified as Weeds of National Significance. The Strategic Plan aims to deliver the following goals and objectives:

- New infestations are prevented from establishing.
- Established infestations are under strategic management.
- Greater capability and commitment to manage opuntioid cacti.

State Policy:	To prevent Opuntia[1] species from competing with more desirable plants and restricting access in the pastoral areas of the State. Under the *Natural Resources Management Act*, 2004: ▪ Prohibiting movement of Opuntia species on public roads and entry into SA; ▪ Prohibiting sale of Opuntia species or their seeds, or contaminated material; ▪ Requiring landowners to destroy Opuntia species on their properties; and ▪ Allowing recovery of costs of Opuntia species control on road reserves.
SA Arid Lands NRM Policy:	The SAAL NRM regional management strategy for Opuntia species is to CONTAIN SPREAD Aim: To prevent the spread of Opuntia through control of all infestations. The SAAL NRM regional management strategy for Cylindropuntia species is to DESTROY INFESTATIONS Aim: To significantly reduce the extent of Cylindropuntia spp. in the SA Arid Lands.
Marree - Innamincka NRM District management strategy:	Marree – Innamincka NRM District management strategy for all Opuntia[1] species is ALERT Aim: Entry into the region should be prevented – any Opuntia[1] species found should be reported and destroyed.

Marree - Innamincka NRM District Strategy for management of Opuntia species

Recommended Actions
Support land manager education in identification, monitoring and control of Opuntia[1] species.
Infestations of all Opuntia[1] species discovered in Marree - Innamincka NRM District to be immediately reported to Natural Resources SA Arid Lands and destroyed.
Land managers are encouraged to monitor success, following control of Opuntia[1] species, and carry out follow up control as necessary.
Sale and movement of all Opuntia[1] species not allowed within SAAL NRM Region.

Photo 40: Control of Coral Cactus using foliar spray
(Photo B Shepherd)

[1] The author of this report interpret '*Opuntia* species' to collectively refer to the weedy Cactus species including *Austrocylindropuntia*, *Cylindropuntia* and *Opuntia*.

Best Practice Control

Following initial control of mature cactus plants, cactus seeds deposited under mature plants and pads that were missed or dropped off during treatment will germinate and grow, therefore follow up monitoring and control around mature plants is required for several years.

Control method and description	Best time to control	Active ingredient and example herbicide	Herbicide rates and carrier
Foliar spray			
Useful for all cacti species. Suitable for larger infestations. Spray all sides of every cactus pad until chemical runs off. Spray only when cacti are green and healthy.	Any time of year providing plants are not stressed	Triclopyr (600g/L) e.g. *Garlon*®	33 ml/L water with Spray oil e.g. Hotwire® or 33 ml/L diesel
		Triclopyr (240g/L) + Picloram (120g/L) e.g. *Access*®	17 ml/L diesel
		Triclopyr (240g/L) + Picloram (120g/L) e.g. Grazon	50ml/10L water
	Apply in summer above 30^{o}	*MSMA (800g/L MSMA) e.g. Daconate*	1 L/40L water
Stem inject			
Useful for most cactus species. Suitable for isolated plants or small infestations. Inject a measure of herbicide into each cactus stem or in at least every 4th pad utilising a Velpar® gun and injecting lance. Following initial control of mature cactus plants, cactus seeds deposited under mature plants and pads that were missed or dropped off during treatment will germinate and grow, therefore follow up monitoring and control around mature plants is required for several years.	Any time of year	Glyphosate e.g. *Roundup*®	Inject 2-4ml of neat Glyphosate into each stem or every 4th pad.
Biological			
Cochineal scale (Dactylopius spp.) may be used as a biological control for various Opuntia and Cylindropuntia species including Engelmann's Prickly Pear, Hudson Pear, Prickly Pear, Wheel Cactus and Devil's rope. The scale appears as small white cotton wool spots across the cactus pads. Juvenile and adult females suck fluid from plant tissues and in high enough densities energy production may be impacted and the plant's growth is restricted or the plant may die. Pads from infected plants may be removed and wedged low on a new host plant, protected from rain where possible, with the most heavily infested surface as close as possible to the surface of the new host plant. This will allow for movement of wingless cochineals to the new host plant.			
Physical			
It is possible to dig out cacti but care must be taken due to their spines. This is only practical for small isolated plants. Care must be taken not to drop any segments, as these may grow and develop into new plants. Material must be disposed of via deep burial. This method may be used all year round.			
Fire			
Hot fires may kill plants but regrowth may occur, requiring follow-up control. Burning can assist in gaining access to large infestations allowing use of other control activities. This method may not be practical where cacti are growing amongst native vegetation. Note: Do not burn on high fire danger days.			

Surveys/ Monitoring

General method:	Look for cactus plants during routine pastoral management activities and record location using a GPS. Look for old plantings of cactus in historic gardens around ruins and other areas associated with human settlement.
Best time of year for surveys:	Any time of year

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