GOVERNMENT OF WESTERN AUSTRALIA

Department of Primary Industries and Regional Development

Coordinated Cactus Campaign Summary Report

2016-2018.

March 2019

Contents

Front page photo credit: Geoffrey Brooks, Meekatharra Rangelands Biosecurity Association Inc.

This Summary Report was commenced by Kate Detchon, substantially prepared by Rebecca Clarke and completed by Kay Bailey using information supplied by the contacts for each of the Coordinating Cactus Campaign projects.

A. Introduction

In June 2016 an agreement between the Commonwealth and DPIRD (then DAFWA) under the Agricultural White Paper initiative was signed by both the Commonwealth Minister (then Barnaby Joyce) and the WA Minister for Agriculture (then Dean Nalder), provided funding for 'management of established pest animals and weeds as part of a national response over 4 years'. One of the six approved projects was entitled '*Accelerating capacity for Western Weeds of National Significance (WoNS) control through collaboration and innovation'* (Short title: Western WoNS). This project was managed by DPIRD Invasive Species Priority Weed Response. The anticipated outcomes and benefits of the Western WoNS project were:

Outcomes:

- To build landholder capacity to manage High Priority WoNS in Western Australia thereby accelerating the achievement of regional eradication of some species and sustained control of key infestations of others.

Benefits:

- Increased knowledge by land managers of the best techniques available to manage gamba grass, rubber vine, mesquite, mimosa, prickly acacia, lantana and Opuntioid cactus.
- Greater involvement of land managers in strategic management of these WoNS species.
- Increased pool of trained weed contractors in best practice techniques.
- Increased capacity for community groups, including RBGs, to undertake appropriate, ongoing weed management.
- Accelerated and cost-effective management of the seven western WoNS bringing them closer to local, regional or State eradication.

The three components of the Western WoNS project were identified as:

1. Northern WoNS.
2. Coordinated Cactus Campaign.
3. Cactus Best Practice Knowledge.

Of these, DPIRD identified an opportunity for a planned, coordinated, well-publicised Coordinated Cactus Campaign (CCC). The campaign aimed to map, treat and monitor a number of key cactus infestations using the most recent methodologies available in Australia to prevent further spread and to raise the profile of cacti with farmers, other landholders and biodiversity groups throughout Western Australia. The planned outcome included increasing the capacity for the ongoing management of these WoNS that had also been identified by DPIRD as 5 of the 15 top High Priority species in Western Australia due to their impact on agriculture. The species identified as High Priority were Devil's Rope (*Cylindropuntia imbricata), Hudson's Pear (Cylindropuntia rosea), Coral Cactus (Cylindropuntia fulgida* var. *mamillata)*, Prickly Pear (*Opuntia spp.),* and Cane or Snake Cactus (*Austrocylindropuntia cylindrical).* These WoNS had been identified in the broader rangelands, goldfields and wheat-belt regions of Western Australia.

A total of $200,000 of the Western WoNS funding was identified for expenditure on the Coordinated Cactus Campaign which had a target objective of delivering $20,000 to each of ten cactus control groups in different areas representing a variety of cacti species, control treatments and geographic spread.

A list of potential collaborators/recipients/organisations was collated by DPIRD Invasive Species and Biosecurity Officers, based on understanding of infestations of the identified cacti WoNS across Western Australia. An invite was sent to 26 identified parties. These included Biodiversity groups, Shires, Recognised Biosecurity Groups (RBGs), and other community or government organisations involved in weed control activities.

Each group was invited to submit an Expression of Interest (EOI) by the end of June 2016 to become a partner in the Coordinated Cactus Campaign project and to nominate a site of cactus infestation. A total of ten EOIs were received from the following groups, with the identified cactus species shown:

1. Shire of Dowerin; Cactus Control Patrol. Velvet Tree Pear (*Opuntia tormentosa*), Wheel Cactus (*Opuntia robusta*), Devil's Rope (*Cylindropuntia imbricata*), Riverina Pear (*Opuntia elata*), and Indian Fig (*Opuntia ficus-indica*).
2. Esperance Weed Action Group (EWAG); Using a two pronged approach to Prickly Pear Management. Prickly Pear (*Opuntia stricta*).
3. North Mallee Farm Improvement Group (NMFIG); Chemical and biological control of Prickly Pear at Salmon Gums. Prickly Pear (*Opuntia stricta*).
4. Shire of Kellerberrin; Control of priority Wheel Cactus in Kellerberrin. Wheel Cactus (*Opuntia robusta*) and Prickly Pear (*Opuntia stricta*).
5. Meekatharra Rangelands and Biosecurity Association (MRBA); Coordinated Cactus Herbicide Trials at Jingemarra Station. Engelmann's Prickly Pear (*Opuntia engelmannii*).
6. Southern Biosecurity Group (SBG); Drooping Tree Pear along Oldfield River, Ravensthorpe. Drooping Tree Pear (*Opuntia monacantha*).
7. Shire of Goomalling; Project Prickle. Velvet Tree Pear (*Opuntia tomentosa*).
8. Pilbara Mesquite Management Committee (PMMC); Pilbara Island Cactus Removal. Prickly Pear (*Opuntia stricta*).
9. Lyndon LCDC; West Gascoyne WoNS: Capacity to manage Coral Cactus. Coral Cactus (*Cylindropuntia fulgida* var. *mamillata*).
10. Carnarvon LCDC; Building landholder capacity to eradicate cactus on North Shore of Gascoyne River. *Opuntia dejecta*.

Figure 1: Locations of the 11 CCC projects

All ten EOI projects were accepted with a Memorandum of Understanding (MOU) developed which set out the aim, activities, milestones, budget and reporting. A Cactus Task Force (CTF) of a representative from each of the partner organisations was formed to provide a forum for discussion and dissemination of information.

Not all projects requested the full $20,000, and hence remaining funds were able to be directed into an additional project, namely:

11. Perth Metro; Building Cactus Capacity in the Perth Metro – Various Shires. Various cactus species were included.

Each project is summarised within the following Project Review Summaries.

Project Review Summaries

1. Shire of Dowerin

Cactus Control Patrol

Situation & Target species	
Infestations of Velvet Tree Pear (*Opuntia tormentosa),* Wheel Cactus *(Opuntia robusta),* Devil's Rope *(Cylindropuntia imbricata),* Riverina Pear *(Opuntia elata),* and Indian Fig *(Opuntia ficus-indica)* across the Dowerin shire town site required management and collaborative control programs. Aims of the CCC project included: • Chemically control cactus infestations using Glyphosate, Grazon Daconate, and Access. • Trial different chemical application rates and techniques, including stem injection, top dressing on juvenile plants, and surface spraying. • Rear and release biological control agent Cochineal scale insects *Dactylopius opuntiae*. • Use of sensor cameras to monitor vectors feeding on cactus fruits.	 Wheel Cactus following effective control by foliar herbicide spray.

Partners	Building capacity
• Shire of Dowerin • DPIRD • Dowerin District High School • Cactus Task Force	• Best Practice: Increased knowledge gained from DPIRD training on best practice techniques for chemical spraying and stem injection, and physical removal via deep burial. • Location management/Weed distribution: DPIRD provided cactus location map data to Shire of Dowerin to enable more updated and localised database development. Eight key sites of cactus infestation targeted in Shire. • Use of tools and field equipment: Motion sensor to monitor use, application; • Bio-control: Methods for DPIRD-reared Cochineal scale onto shire land at Minnivale together with DPIRD assistance. • Extension: to landholders for identification of cacti in all stages of its life cycle. • Extension: Window displays in town of Dowerin engaged private landholders. • Extension: A talk was given at Dowerin District High School • Identification: Time spent with DPIRD in field work allowed identification of other cactus species on roadsides, such as Devil's Rope *(Cylindropuntia imbricata*) and Chickendance Cactus (*Opuntia schickendantzii*). • Resource materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- A display stand at Dowerin Field Day helped in gaining information from landholders on cactus locations.
- A cactus information mail-out was provided to all residents in the shire.
- 2 residents responded to the window display notice and collaborated in control of Prickly Pear Cactus on their properties. The window display in the main street during Cactus Month campaign also resulted in more reports of Prickly Pear cacti in the township of Dowerin and bushland at Minnivale.
- Mapping of over a dozen cactus sites within the Dowerin town site and all cactus sites mapped at a volunteer event in the small township of Minnivale.
- Participation in 2 Cactus Task Force meetings.
- Biocontrol agent *Dactylopius opuntiae* effectively established on Velvet Pear plants at Minnivale.

- More than 90% of Wheel Cactus infestations in the Dowerin Shire have been treated using neat Glyphosate stem injections combined with broadcast Tordon granules around the base of plants.

Lessons Learnt

- Previous Glyphosate stem injection treatment of Wheel Cactus was not fully effective, with smaller juvenile pads developing post-treatment.
- Site monitoring after treatment is essential to learning effective control methods for different scenarios and cactus species: follow-up treatment is almost always required.
- Greenwaste tip areas can be a source of weed spread.
- The most effective control method for the Prickly Pear was foliar spray or deep burial.
- Cochineal scale insects established in the field however the scale of cactus infestation is large, and the biocontrol process is slow and more effective on a smaller number of plants.

Maintaining momentum

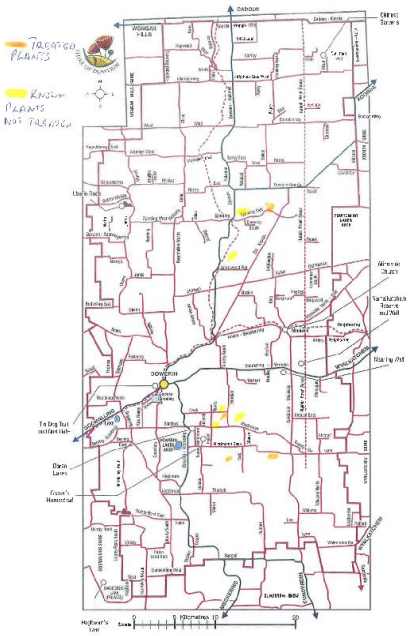
- Dowerin Shire will update cactus location data and share data with DPIRD.
- Dowerin Shire to work together with DPIRD to continue rearing and release of Cochineal scale to additional cactus infestations.

Photos

Observations from Ejanding tip site in Dec 2016: Glyphosate stem injections didn't effectively kill Wheel Cactus, with the stem continuing to produce smaller juveniles.

Fruiting Wheel Cactus plant in Ejanding. Public education programs led to this type of cactus being reported by private landholders and being collaboratively controlled together with DPIRD.

Key cactus locations within Dowerin Shire



2. Esperance Weed Action Group (EWAG)

Using a two pronged approach to Prickly Pear Management

Situation & Target species

Both chemical and biological control methods had been used to try to control a 26 hectare infestation of Prickly Pear (*Opuntia stricta)* within the Shire of Esperance since 2014, however further management was needed.

Aims of the CCC project included:

- Further chemical control with herbicide combinations including Garlon, Tordon and Ally.
- Raise and spread additional Cactoblastis insects for biological control.
- Raise and release of Cochineal for biological control.
- Trial the release methodology of biological agents using varying quantities of infected cactus pads.
- Observe efficacy of control methods - using photo monitoring points.
- Promote community involvement in Prickly Pear control.

Cochineal scale-infected pads were placed at the Prickly Pear infestation on Griggs Road over 7 occasions.
Photo coutesy of Darren Dixon.

Partners

- Shire of Esperance
- DPIRD
- Ngadju Rangers – Gondwana Link
- Karingal Pastoral Company
- Cactus Task Force
- Main roads
- Rail and Gas maintenance contractors
- Salmon Gums Farm Improvement group
- Esperance Weeds Action Group
- South Coast NRM

Building capacity

- Best Practice: Testing, monitoring and sharing reports on effective control techniques between private landowners, Indigenous Rangers, government (DPIRD), and with other Cactus Control groups (NMFIG).
- Extension: Working with private landowners to establish 'priority' spray control sites.
- Bio-control: 4 Ngadju Rangers spot sprayed cactus plants and were educated on methods and reasons for release of Cochineal scale insects.
- Best Practice: DPIRD shared expertise on methods of wiring Cochineal scale-infected cactus pads to target cactus weeds low in the plant where they are sheltered.
- Bio-control and Identification: Mike Jones (DPIRD) shared knowledge on how to identify the presence of Cactoblastis within pads via observation of orange/clear frass.
- Best Practice and Extension: Rory Graham's (NMFIG) chemical recipe for killing cactus was shared among stakeholders: Triclopyr (Garlon) 3 L/100 L water + Picloram (Tordon) 1 L/100 L water + Metsulfuron (Ally) + Ammonium sulphate + Uptake oil + Red dye.
- Resources/materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- More than 5 spray activities were conducted during the project, including repeat applications by the Rangers, Rory Graham and contractors at both Griggs Road and Circle Valley infestations.
- A total of 694 Cochineal scale-infected cactus pads were distributed over seven releases at the Griggs Road Prickly Pear infestation.
- Biological control insects were provided to Rory Graham and David Campbell (private landholders) to start new rearing colonies.
- Participation in 3 Cactus Task Force meetings.
- Community education was achieved via an article in WA Local Government Association (WALGA) EnviroNews; a Facebook post by EWAG and an interview with ABC Esperance Radio.
- Photo monitoring sites clearly showed post-spray effects.

Lessons Learnt

- Logistically, large infestations sites (26ha) are difficult to spray effectively, highlighting the importance of targeting small infestations early.

- Previous Cactoblastis efforts had been effective in spreading up to 2km over 2 years from the release site, however numbers were too low to have an impact on Cactus weeds. The time required for biological control to be effective appears to span at least several years.
- A mix of Garlon, Tordon and Ally herbicides, combined with Ammonium sulphate was most effective for Prickly Pear control in the region.
- A hot wildfire was effective in significantly reducing the volume and number of Prickly Pear plants at another nearby infestation at Scaddan Townsite, however follow-up spraying is also required when using wildfire as a cactus reduction tool.

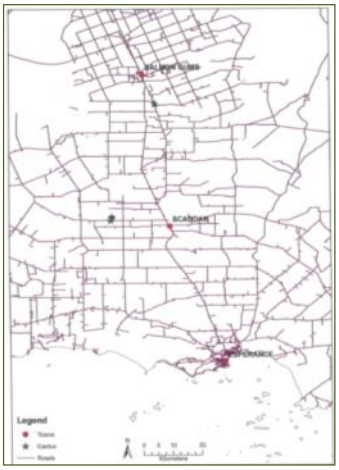
Maintaining momentum

- Funding and in-kind contributions from other land management agencies (Main Roads, Rail Authority, Shire of Esperance) significantly added to the effectiveness of the project, and will continue to do so in the future with EWAG requesting and receiving additional funding for Prickly Pear control.
- During surveillance activities with DPIRD at an old tip reserve, another cactus species was identified; Devil's Rope (*Cylindropuntia imbricata*). EWAG have gained permission to release a new biotype of Cochineal (*Dactylopius tomentosus 'cylindropuntia sp'*), sourced from Queensland, to test opportunity for biocontrol of the Devil's Rope.
- Opportunistic surveillance of photo monitoring sites will continue to be done by EWAG.

Location maps

EWAG mapped roadside infestations in 2016.

Grigg Road Spray activity map.



Map showing the release sites of Cactoblastis in May 2014. The Grigg Road site is located directly west of the Scaddan town site.

Cochineal Scale release sites on Grigg Road, Scaddan, in October 2016, November 2016, January 2017, November 2017 and March 2018.

Photos

A Prickly Pear infestation on a private property at Griggs Road before (November 2015) and after herbicide spray treatment (November 2017).

3. North Mallee Farm Improvement Group (NMFIG)

Chemical and biological control of Prickly Pear at Salmon Gums

Situation & Target species
Historic efforts to control a 20ha Prickly Pear (*Opuntia stricta)* infestation with Cactoblastis insects on a private Salmon Gums property had been somewhat positive, with establishment of the organisms observed several months after release. Spray control activity has also been implemented using contractors and Ngadju Rangers, however needs exceeded physical and economical capacities and cacti continued to grow and disperse. Aims of the CCC project included: • Re-contract Ngadju Rangers for spray control activity. • Conduct farm walks with local farmers to increase awareness of Prickly Pear. • Use GPS and photo monitoring points to measure progress of treatment activities. • Release Cochineal scale biocontrol insects at varying densities. • Develop a long term management plan for Prickly Pear. • Bolster biological control efforts with further Cochineal scale and Cactoblastis sp releases.

Rory Graham in November 2017 after Prickly Pear spraying activity.
Photo taken by Kay Bailey.

Partners	Building capacity
• NMFIG • John Holland Group • Main Roads WA • Esperance Weed Action Group • Ngadju Rangers • Shire of Esperance • DPIRD • Cactus Task Force	• Best Practice: Engagement of Ngadju Rangers for spray-control of Prickly Pear on repeat occasions allowed up-skilling of rangers in the most effective spray methods for this species. • Resources/materials: Knowledge and resource sharing with EWAG cactus control group strengthened shared achievements. • Best Practice: Shared knowledge between DPIRD and private landowners enabled more targeted timings for spray efficacy, particularly after rainfall when plants were not moisture-stressed. • Extension: The Cactus Task Force was a valuable inclusion in the whole campaign to control Prickly Pear, helping to give the project a public and community focus. • Resources/materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements
• Ngadju Rangers and private landholders together achieved chemical spray treatment over the majority of the Prickly Pear 20ha infestation area. • Information distribution to advise farmers how and when to spray was achieved via word of mouth and networking. • Establishment of a cacti nursery for rearing of biological control organisms (Cochineal). • Participation in 4 Cactus Task Force meetings. • Community awareness: The cactus project site has been included in NMFIG field walks. • Birds such as crows have been observed to assist with cactus seed distribution, with fruits eaten by birds seen lying in the vicinity of fruiting cactus plants. • Successful control of the 'mother' fruiting infestation of Prickly Pear was achieved at Salmon Gums, with repeat spray activities resulting in no more fruiting plants in the area.

Lessons Learnt
• The Triclopyr/Tordon herbicide mix proved highly effective against Prickly Pear in the area. • Cactoblastis and Cochineal scale insects proved to be very slow in damaging cacti and appear to have had little effect visually until near the end of the project. • The 3l Triclopyr (Garlon) + 1l Picloram (Tordon) + 20g Metsulfuron (Ally) per 100l water +1% Ammonium sulphate + 1% uptake oil + 1% wetter + red dye herbicide mix (sprayed) appears effective on established cacti,

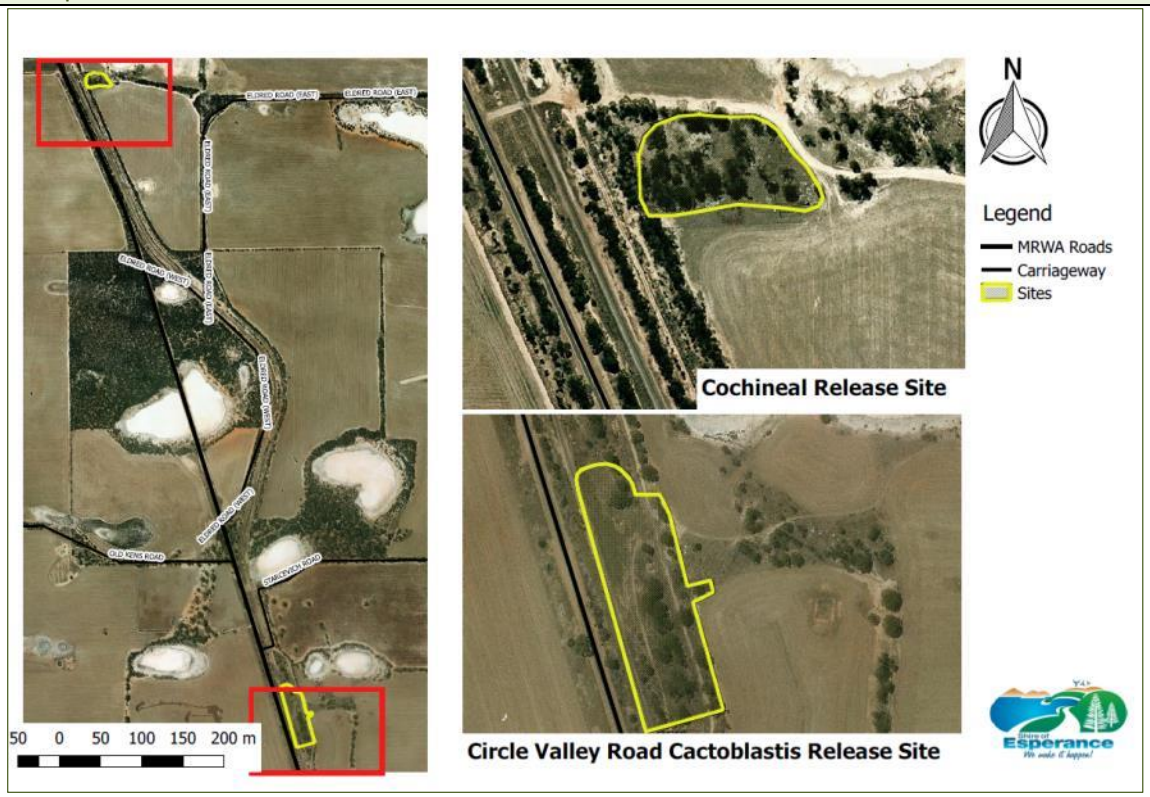
even during extreme winter conditions. However, close monitoring and follow-up is always required as a number of plants will always re-shoot.

- Physical Prickly Pear removal works only if no residual plant parts are allowed to remain.
- Spring appeared to be the most effective time to spray. Winter sprays were slower in killing Prickly Pear.
- Crows appeared to be the main distributor of seed however foxes, bobtail lizards and emus are also suspected to also play a role in seed distribution.
- Cautionary use of Tordon herbicide is required; it has residual properties which may affect native Mallee plants such as eucalypts.
- Nursery cacti used for raising of biological control organisms need fruit to be manually removed so as not to contribute to dispersal of cactus seed.
- Prickly Pear has been observed to spread into cropping paddocks and is difficult to control in this situation.
- Dehydrated cactus plants are not capable of absorbing and translocating herbicides effectively.

Maintaining momentum

- Private landowners have and will continue to use their own finances to maintain spray control programs in the area.
- Funding of $5000 from the Gas Pipeline Co was attained via DPIRD and contributed towards continued control efforts.

Location map



Release sites of Cochineal (2016) and Cactoblastis (2014) within Rory Grahams property. The two areas are directly adjacent to the Kalgoorlie-Esperance Highway.

Before and after photos

A Prickly Pear infestation treated by NMFIG at Circle Valley October 2016 (left) and after spraying activity in December 2016 (right).

4. Shire of Kellerberrin

Control of priority Wheel Cactus in Kellerberrin

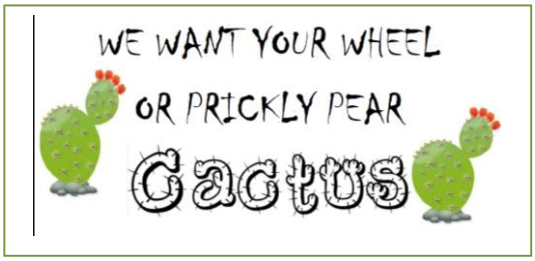
Situation & Target species
The Shire of Kellerberrin had found several years of Roundup and Garlon spray activity to have been ineffective in managing prolific infestations of Wheel Cactus *(Opuntia robusta)* & Prickly Pear *(Opuntia stricta)*. Aims of the CCC project included: • Excavate a large hole at the Shire waste disposal area to allow deep burial of manually controlled Wheel Cactus and Prickly Pear. • Advertise the deep burial opportunity via local newspapers to advise all residents that they can dispose of cactus. • Monitor and spray any new or re-growing infestations. • Establish a trial to mass breed Cochineal biocontrol insects and release these into cactus observation zones. • Purchase a drone and conduct monthly survey of infestation areas to monitor impacts of Cochineal insects. • Follow-up with herbicide spray activity if and when biocontrol organisms are ineffective or insufficient to reduce the infestation area.

A Wheel Cactus infestation at a previous tip location.

Partners	Building capacity
• Shire of Kellerberrin • DPIRD • Cactus Task Force	• Use of tools/field equipment: The drone was effectively used to scan large areas between the deep burial holes for dropped cactus fragments. It was also able to be used to monitor post-spray activity. • Location management/Weed Distribution: Initial mapping was conducted by DPIRD in June 2016; subsequent mapping done by Shire officers in collaboration with DPIRD in November 2017 and again in October 2018. • Extension and Identification: DPIRD Merredin provided documents; "How to Kill Wheel Cactus" and Wheel Cactus Information Sheets for distribution to Kellerberrin residents. The "How to Kill Wheel Cactus" pamphlet was also placed in the Kellerberrin Pipeline/Newsletter to educate residents on identification and management. Public notifications from the shire (including a letterbox drop) led to private land owners reporting and identifying an additional cactus species (Coral Cactus) for management. • Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program. The Management Guide was also made available from the Shire office.

Achievements

- A cactus pad infected with Cochineal insect was placed as a trial onto a Wheel Cactus. Although the Cochineal established, all surrounding plants had been manually removed or sprayed so the trial was discontinued in March 2018.
- Participation in 2 Cactus Task Force meetings.
- Drone monthly surveillance was conducted and will continue into the future.
- Cactus weed disposal information was delivered in a mail drop to all residents, with residents using the existing shire waste disposal hole, and another needing to be excavated.
- Two new areas of infestation were reported in Doodlakine and Baandee, and resulted in identification of an additional Coral Cactus infestation (*Cylindropuntia fulgida*). A treatment plan was agreed upon.



- Approximately 200 plants were mapped at the former waste site, and cactus and top soil were buried to a depth of 1m below the surface. Six months following this control, there has been no observed cactus re-emergence at the site.
- Manual collection of cacti from the airstrip was undertaken by Shire officers and local volunteers.

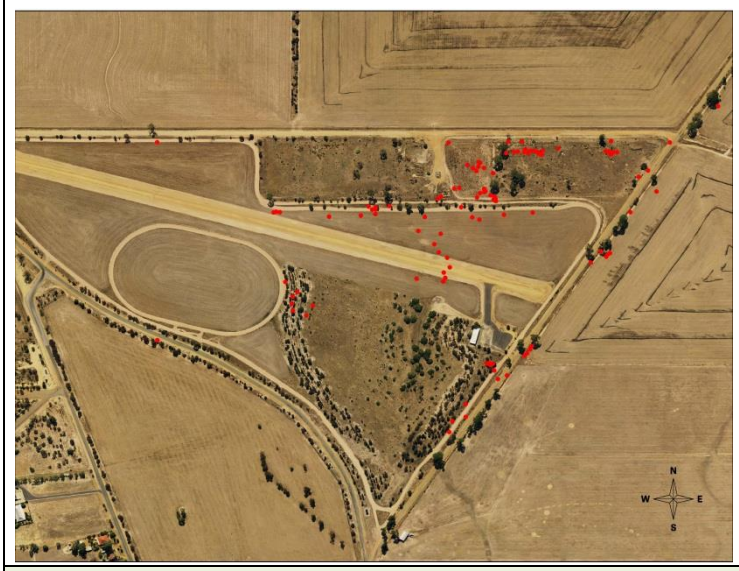
Lessons Learnt

- Shire of Kellerberrin land management staff described almost 'no knowledge of Wheel Cactus and Prickly Pear' prior to the project.
- The thick waxy skin of Wheel Cactus makes herbicide sprays ineffective.
- The use of drones makes surveillance easier and quicker.
- Manual removal hastened the achievement of the control targets.

Maintaining momentum

- Monthly drone surveillance will continue after the CCC project is finished.
- DPIRD assistance for management of Doodalkine infestation.

Location map



A map of Wheel Cactus at the former rubbish tip, prepared by Kelly Manning (DPIRD), June 2016.

Photos

The Wheel Cactus burial site at the Kellerberrin former rubbish tip, March 2017.

5. Meekatharra Rangelands and Biosecurity Association (MRBA)

Coordinated Cactus Herbicide Trials at Jingemarra Station

Situation & Target species

An Engelmann's Prickly Pear (*Opuntia engelmannii)* infestation at the site of the abandoned Woogalong Homestead on Jingemarra Station, north of the town of Yalgoo, had spread into the upper catchment of the Greenough River over 1km from the original location and had received no previous significant control treatment. The original aim of the project was to:

- Determine the most effective herbicide combination by conducting trials of different mixes based on advice from DPIRD and experience gained in treating cactus on nearby Wydgee Station.
- Spray the existing infestations with the aim of preventing further downstream spread.

Through learning during the project, variations were sought modifying the aims to include:

- Hire of a drone and the design/building of a camera + software capable of detecting the cactus and thus enabling the mapping of the extent of the infestation.
- Deep burial of the core infestation site, then follow-up spraying of the most effective herbicide treatment over outliers.

The various trial herbicide mixtures were identified using different coloured masking tape on star pickets at the infestation sites.

Partners

- MRBA
- Jingemarra Station Lessee
- Wydgee Station Lessee
- Cactus Task Force
- DPIRD Biosecurity staff

Building capacity

- Best Practice: Wydgee Station lessee successfully controlled a Red Flower Prickly Pear (*Opuntia elatior*) infestation on their property approximately 200km south east of Jingemarra Station. The herbicide combination used at Wydgee was the starting point for determining the most effective herbicide for the Jingemarra infestation.
- Extension: Jingemarra Station will use their situation as a demonstration site for the Murchison communities which all have cactus infestations and will benefit from knowledge learnt at Jingemarra.
- Resources/Materials: Hire of drone for aerial mapping and 3D photography of the survey area. The design and building of a camera capable of detecting very small outlying infestations.
- Extension: The project has been the subject of articles in regular MRBA newsletters and a media release in December 2016. The MRBA Executive Officer took part in an interview on the project on ABC Rural Radio in April 2018. The interview was reported on the ABC Radio Facebook page where interest from the community was significant.
- Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- Deep burial of approximately 0.5 ha of Engelmann's Prickly Pear at the site of the abandoned Woogalong homestead.
- 10.5 days of spraying in the upper catchment of the Greenough River.
- Participation in 5 Cactus Task Force meetings.
- Determination of the most effective herbicide mixture for long-term residual Engelmann's Prickly Pear control.
- Detailed map of location (with coordinates) of cactus (with differentiation of live and dead clumps) developed through use of drone.

Lessons Learnt

- Correct identification of the Jingemarra cactus species as *Opuntia engelmannii*. At the time of application submission the species was thought to be the same as the Wydgee Station species *Opuntia elatior*.
- Engelmann's Prickly Pear had spread by water approximately 1km downstream into the upper catchment of the Greenough River from the original homestead infestation site.
- Early herbicide trial observations over a period of nine months suggested the most effective spray mixture on the Engelmann's Prickly Pear to be 3% Garlon Fallowmaster + 4% Uptake Oil + ½ cup Urea/100 litres + 2 tablespoons Metsulphurin/100 litres. However, later observations after approximately 15 months indicated the 1% Grazon Extra with 4% uptake oil to be most effective. Grazon is slower acting than Garlon but has residual activity. The cacti in the trial treated with Garlon were observed to be growing through what appeared initially to be a highly effective treatment.
- The spraying effort required to remove the dense and broad-spread cactus infestations appeared uneconomical, so a change in method was identified and approved, allowing deep burial of the core of the cactus infestation, with follow-up and fringe herbicide-spraying activities complimenting the burial.
- Engelmann's Prickly Pear is relatively uncommon in WA and only known to exist in a few other locations in WA.

Maintaining momentum

- A State NRM grant was sought and has been approved which involved the use of drone technology to conduct a grid search of the area to enable further mapping and treatment of outlying infestations.
- A drone was deployed in mid-August 2018 following development of the camera and software funded by the Jingemarra lessee. An extension of the CCC project assisted with data analysis and development of a map in early 2019.

Location map

The location of cacti in the area of the abandoned Woogalong Homestead.

Photos

Untreated

Engelmann's Prickly Pear plants with substantial volumes of fruit.

Early post-spray

observations suggested the most effective spray mixture on the Engalmann's Prickly Pear cacti was Garlon Fallowmaster, Uptake Oil, Urea and Metsulphuron (photo above). However, later observations indicated plants had regenerated after spraying, and the Grazon + Uptake treatment was more effective for long-term eradication.

6. Southern Biosecurity Group (SBG)

Drooping Tree Pear along Oldfield River, Ravensthorpe

Situation & Target species

The establishment of Drooping Tree Pear (*Opuntia monacantha)* infestations along the Oldfield River near the town of Munglinup had damaged native plant habitat and threatened downstream agricultural enterprises. Aims of the CCC project included:

- To receive training from DPIRD on breeding and use of Cochineal biocontrol agents.
- To trial Cochineal biocontrol mechanisms on the main body of the cactus infestation.
- To trial herbicides which have been short-listed by DBCA and DPIRD for cactus control, and test efficacy of spraying against stem injection methods.
- To establish photo points for observation of the infestation over time.
- To conduct 2 field walks with land holders.
- To have an independent contractor audit the project trials.

Approximately 400kg of Drooping Tree Pear fragments were manually collected and deep buried as part of many different control efforts.
Photo provided by M Cronin.

Partners

- SBG
- DPIRD
- Cactus Task Force
- Ravensthorpe Agricultural Initiative Network Inc (RAIN)
- DBCA
- Independent Landscape Ecologist
- Precision Agronomics Australia
- Southcoast NRM
- Munglinup Community Group

Building capacity

- Resources/Materials: A personal safety device was purchased for staff working in remote locations, and enabled spot-tracking of contractors in remote locations. A hydroponic tent for breeding cochineal in the cooler months was also purchased. Additional backpacks and stem injector items were also purchased with project funds and are now available for ongoing work.
- Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.
- Extension: The Biosecurity Forum in Ravensthorpe was used to disseminate information on identification of cactus weeds. Flyers were also placed at bulk handling receival points to educate handlers, and at Ravensthorpe and Hopetoun CRCs to educate the general public. SBG newsletters were also used to share results of research trials for Drooping Tree Pear control.
- Best Practice: A number of different control methods were tested and monitored, and most successful methods implemented in a collaborative approach to weed control.

Achievements

- Survey of a 2ha area south of the Oldfield River traffic bridge identified approximately 20 Drooping Tree Pear plants, and 50 loose cactus fruits which had been dislodged during flooding.
- Purchase and use of Spot Gen 3 personal safety device.
- Participation in 5 Cactus Task Force meetings.
- Seeding of 6 Drooping Pear Cactus plants with biocontrol organism Cochineal (*Dactylopius ceylonicus*) in the Oldfield River valley in March 2018.

Keep an eye out for cactus

SOUTHERN BIOSECURITY GROUP

CACTUS that has spread onto agricultural land—something we wish to avoid.

- Testing of various methods of cactus control: herbicide stem injections, black plastic coverage, chemical-soaked dowel inserts, basal barking, foliar herbicide spray, and placement of Cochineal biocontrol insects.
- Manual collection of loose cactus segments along the river shores resulted in approx 400kg of material removed from the river and disposed of via deep burial.
- Contractor engaged to undertake trials and ongoing control.
- Use of a drone mounted camera to trial mapping the cactus plants.

- Project extension in 2019 enabled implementation of proven chemical methods (stem injection & foliar spray) of control as well as manual removal of loose pads.

Lessons Learnt

- Flooding events during the project resulted in broken cactus parts moving downstream and getting caught up on debris in riverbanks, highlighting importance of removing plants prior to typical flooding seasons.
- The remote sensor camera wasn't able to identify vectors of cactus.
- It is necessary to be able to advise home gardeners of the difference in weed species and ornamental cactus species, or to be able to reference materials for identification.
- Stem injection appeared to be most effective of herbicide treatments. It is labour intensive but may be most suited to use with scattered plants in areas where access is difficult. Spraying was effective however plants were observed to be regrowing after a period of time.
- Manual removal, although extremely labour intensive, was the most effective management tool.
- Drone imaging pictures were not detailed enough to distinguish smaller plants.

Maintaining momentum

- Monitoring of the spread of the Cochineal insects continues following the end of the project by SBG & DPIRD.
- SBG have been successful with other funding applications and have partnered with Ravensthorpe Agricultural Initiative Network (RAIN) which has allowed a continuation of control work in the river system.
- SBG have also sought and obtained further funding from state NRM and the National Landcare Program.

Location map

The location of a Cochineal biocontrol release site in March 2018. Cochineal pads were placed on seven host plants for the trial.
In May 2018 the cochineal had spread out by one metre from the centre host plant.
Cochineal continues to be bread and released however the population is too spread out for effective self spread.

Before and after photos

Stem injection trial with neat Glyphosate appeared to be the most effective herbicide treatment.
After photo 37 days post injection.
After 6 months all five plants in trial had completely disappeared with no regrowth since.

7. Shire of Goomalling

Project Prickle

Situation & Target species
A 100ha infestation of Velvet Tree Pear (*Opuntia tomentosa)* at various locations within the Shire of Goomalling had been the target of numerous control efforts, however the Shire aimed to stimulate deeper community engagement and management in order to move towards total eradication. Aims of the CCC project included: • Promote the possibility of eradicating Velvet Tree Pear within the Shire by engaging the whole community, and in particular by educating school children. • Increase mapping the distribution of Velvet Tree Pear on private properties and collate various sources of cacti location data. • Learn from experienced DPIRD and Greening Australia staff about best practice control techniques such as stem injection, pad injection and mechanical removal. • Work with private landowners to develop cactus management plans. • Provide community members access to the Shire deep burial pit. • Use a motion sensor to determine what animals are acting as vectors for spread of Velvet Tree Pear seeds.

Some established Velvet Tree Pear plants in the Shire of Goomalling were too large to enable effective chemical treament, making manual removal and deep burial essential.

Photo taken by Les Tanner.

Partners	Building capacity
• Shire of Goomalling • DPIRD • Goomalling CRC • Greening Australia • Cactus Task Force • Goomalling Primary School • Sacred Heart Goomalling • Shire of Dowerin	• Location management/Weed Distribution: Partner networks and community groups were contacted and shared over 70 locations of Velvet Tree Pear. • Extension: A town window display was constructed, two articles were published in the local paper, a Spring Field Day promotion was held, and 200 information postcards were distributed to PO Boxes in Goomalling Shire to raise awareness and encourage cactus reporting, treatment and removal. • Best Practice: The Shire of Dowerin officer monitored herbicide control trial sites to view efficient Velvet Tree Pear techniques. A 'go to' 10L herbicide spray recipe (as determined by field trial tests) was also promoted in the Shire of Goomalling March 2018 newsletter; Glean (Triclopyr) 300ml + Tordon (Picloram) 130ml + adjuvant. • Resources/Materials: Motion sensor camera, safety equipment and loppers.

Achievements

- Manual removal of more than 5 tonnes of Velvet Tree Pear from the Shire.
- Location data from onsite surveys and 40 public sources was combined, with a total of 73 sites recorded.
- Stem injection of 4 Velvet Tree Pear plants proved largely ineffective. 68 of the 73 sites were subsequently treated with foliar spray or manually removed.
- Placement of Cochineal biocontrol organisms onto Velvet Tree Pear plants in Goomalling.
- Participation in 5 Cactus Task Force meetings.
- Herbicide trials tested foliar sprays, basal barking, and stem and pad injection, using Garlon, Glyphosate, Amitrole and Daconate.
- 10 different chemical trials were monitored monthly via cameras over a period of 15+ months.
- Local school students assisted with cactus distribution mapping, displaying cactus information at a school fair, and with the shop window information display.

Lessons Learnt

- Promotional activities led to increased reports of infestation sites; the anticipated herbicide quantities required and deep burial pit holes sizes became insufficient to meet requirements.
- The shire dug a large pit for deep burial of cactus, however it became flooded and enabled cactus fragments to start growing and establishing. Learnt that it would have been better to start at one end of the pit and semi-fill it as cacti were dumped along it.
- A 3% Garlon + wetter herbicide spray treatment was observed to be very effective in initial post-treatment evaluations. At 2 years after the treatment the plants had re-shot and seedlings had emerged at the spray site, highlighting the need for follow-up spraying/control.
- A Yellow Throated Miner Bird was observed feeding on Velvet Tree Pear fruits and may be a seed vector.
- Ongoing monitoring for seedlings required due to bird spread seed.

Maintaining momentum

- Funding was sought and gained for additional Velvet Tree Pear control through the State NRM program.

Location map

Before and after photos

Various methods of herbicide application were tested before and during the project.

Stem injection using neat Roundup was observed to be largely ineffective on all but the smallest of Velvet Tree Pear plants.

8. Pilbara Mesquite Management Committee (PMMC)

Pilbara Island Cactus Removal

Situation & Target species	
Prickly Pear (*Opuntia stricta)* had been a naturalised weed on East Lewis Island, West Lewis Island, Jarman Island and Intercourse Island in the Pilbara for some decades. Sporadic attempts at chemical and biological control had no long term benefit. Aims of the CCC project included: • To undertake surveillance for Cactus on islands where the biological control agent *Dactylopius opuntiae* (Cochineal Scale Insect) had been previously introduced including West Lewis Island; • To raise awareness among locals and seek locations of other cactus infestations in the area; • Develop maps of current infestations; • Chemically control cactus infestations.	 Jo Kuiper, Project Manager of PMMC, Dr Tim Hunt, DBCA Marine Science Manager for the Pilbara Region, and Lara Martin of DPIRD on Sam's Island. *Photo taken by Tom Zaunmayr, Pilbara News.*

Partners	Building capacity
• PMMC • DPIRD • DBCA: Marine and Nature Conservation teams • City of Karratha • Cactus Task Force	• Location management/Weed Distribution: Partner networks with land holders (City of Karratha and DBCA) enabled shared knowledge of infestations. • Resources/Materials: By undertaking the work in a collaborative effort, cost efficiencies in human and surveillance and resources were achieved. • Location management/Weed Distribution: Improved knowledge of the current extent of the Prickly Pear infestations has allowed for better planning of future control efforts. • Extension & Best Practice: Participation the Cactus Task Force has allowed all participants to exchange ideas and experiences with control techniques such as foliar herbicide spray mixes, thus increasing knowledge of management options and effectiveness. • Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- 24 patches of cactus were treated with Diesel and Garlon (3% mix) during the project, with some patches containing over 150 plants.
- 10 surveillance events before and after control activities
- Discovery of a previously unknown cactus patch on Enderby Island; this island was previously considered to be clear of cactus.
- GPS mapping of 24 Prickly Pear locations on 5 islands.
- Participation in 5 Cactus Task Force meetings.
- Surveillance identified no evidence of Cochineal establishment on any island.
- Discovery (and subsequent control) of a new record for a Declared weed species (*Parkinsonia*) and Mesquite on DPaW island Nature Reserves
- Community engagement: 1 local newspaper article was published. Multiple community groups (Dampier Yacht Club, Indigenous Ranger teams, Station Mangers, PMMC membership and various partners) were made aware of the current management works in order to raise capacity for identification and reporting of any unknown locations.


Quick action wipes out invasive weed

Lessons Learnt

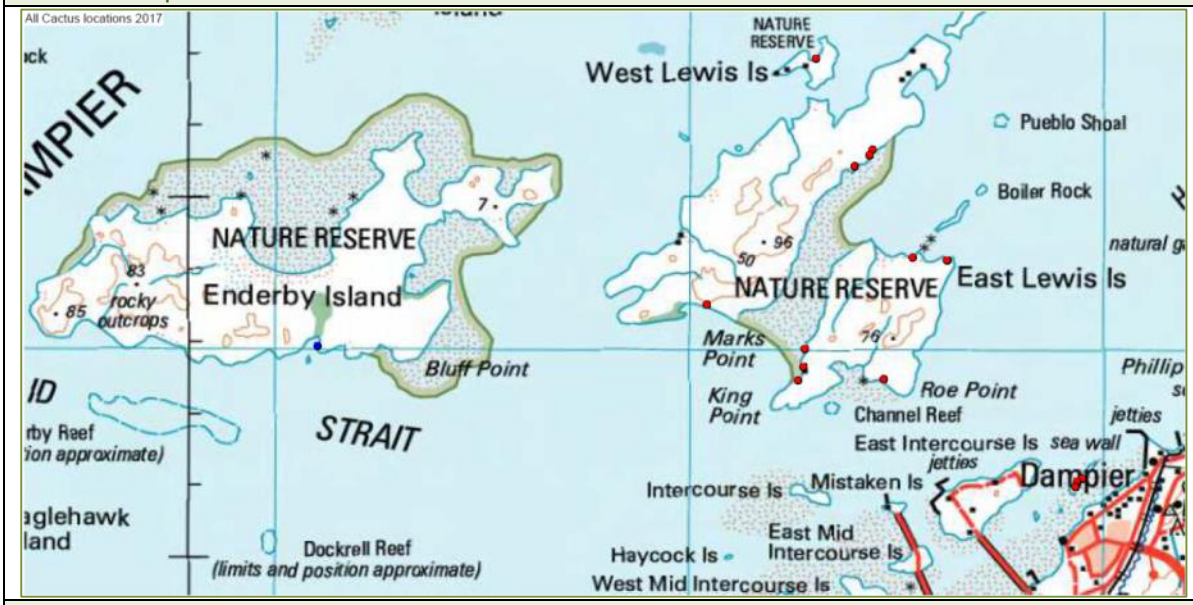
- All partners have increased knowledge of the cactus distribution on the islands.
- Cactus infestations are restricted to the fore-dune and are very close to the beach.
- Cactus infestation areas are associated with coastal geological formations (gullies, inlets and wash up points) which appear to trap higher amounts of debris.
- Cactus plants are scattered along drainage lines or erosion channels, suggesting dispersion by water.

- The coastal environment appears to limit capacity of the plant to grow taller than 1m.
- Difficult logistics of chemical loading and transport in a marine environment.
- The most effective control method for the Prickly Pear on these islands was foliar spray using a 3% mix of Garlon with Diesel.
- No biocontrol organisms were present on the Prickly Pear infestations.

Maintaining momentum

- DBCA committed to ongoing surveillance of Prickly Pear on these islands.
- PMMC has continued to coordinate a project extension to undertake follow up survey and control (if required) at all known locations and extend survey to additional islands in the Dampier Archipelago.

Location map



Photos

Cactus on the shore line/ high tide mark of West Lewis Islands, and two Prickly Pear patches on Jarman Island.

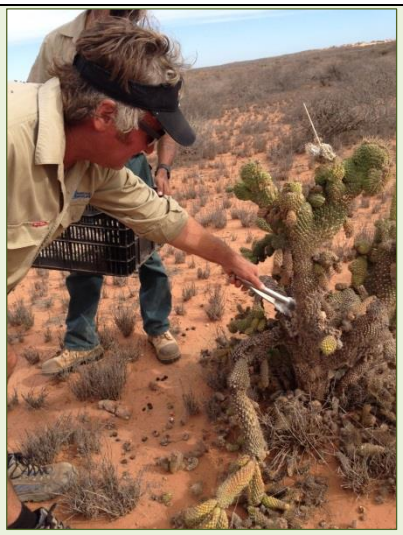
9. Lyndon LCDC

West Gascoyne WoNS: Capacity to manage Coral Cactus

Situation & Target species

Infestations of Coral Cactus (*Cylindropuntia fulgida var. mamillata)* across three cattle and sheep stations in the north west coast of Western Australia have been the target of proactive pastoralists who have a desire to eradicate weeds in their region. Aims of the CCC project included:

- Combine resources to identify, spray and monitor affected sites.
- Obtain expertise from DPIRD on effective chemical treatment options.
- Trial spray Garlon with Ammonium Nitrate, a wetting agent, and good quality rain water.
- Test residual herbicide efficacy of Garlon when rain water is used as a carrier rather than diesel.
- Engage and train spray contractors to assist with broad-scale control.
- Use a drone to collect images of before and after site treatment.
- Equip each station with a 1000L portable plastic pod with spray fittings for ongoing cactus control.



Placing Cochineal biological control insects.

Partners

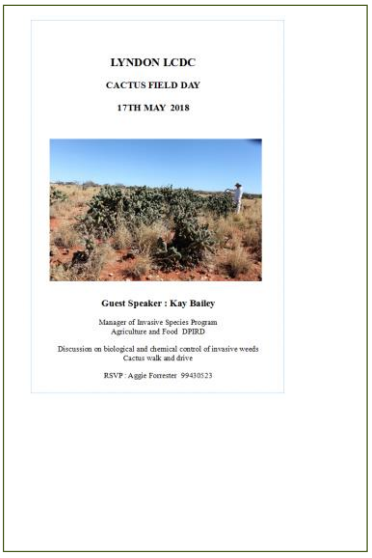
- Rangelands NRM
- Lyndon LCDC
- DPIRD
- Warroora Station
- Quobba Station
- Mardathuna Station
- Forrester Drone Services
- CRBA
- Cactus Task Force
- DBCA

Building capacity

- Resources/Materials: Portable spray units were procured for each station.
- Extension: A weed identification training session was held by a Rangelands NRM regional Landcare Facilitator to enable station owners to identify weeds on their stations. A NRM article was written and distributed.
- Best Practice: A cactus field day was held May 2018 whereby DPIRD shared expertise on best practice management for treating and monitoring chemical and biological control methods. Participation in the Cactus Task Force has also allowed participants to exchange ideas and experiences with control techniques, as well as best practice training being provided to weed spraying contractors.
- Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- Equipping 3 stations with portable cactus spray units and safe chemical application skills through training and practice.
- Drone surveillance was conducted over the three stations to assist with location mapping of Coral Cactus infestations. However, further use of drones was not feasible due to expense.
- Pastoralists commented that working together with DPIRD, Rangelands NRM and DBCA has developed 'much better relations between government and pastoral stakeholders'.
- Acquisition and use of rainwater as a carrier for Garlon (rather than diesel) was both a cheaper option and proved more effective on the cacti.
- Three rounds of spraying were conducted.
- Cochineal biocontrol insects were provided by DPIRD and released at all three stations. By November 2018 the cochineal had spread up to 1 km and were significantly impacting on the cactus.
- Participation in 4 Cactus Task Force meetings.
- A Cactus Field Day was held May 2018 with guest speaker Kay Bailey, Manager Priority Weed Response - Invasive Species Program (DPRID), and involved discussion of biological and chemical control of cacti.
- Identification and destruction of an ornamental *Opuntia schickendantzii* at a hotel in Carnarvon, and release of a batch of Cochineal on the adjacent coastal reserve in conjunction with DBCA.



LYNDON LCDC

CACTUS FIELD DAY

17TH MAY 2018

Guest Speaker : Kay Bailey

Manager of Invasive Species Program
Agriculture and Food DPIRD

Discussion on biological and chemical control of invasive weeds
Cactus walk and drive

RSVP: Aggie Forrester 9943523

Lessons Learnt

- The amount of chemical which could be sprayed in one day with many volunteers was underestimated.
- Foot traverses across the stations identified significantly larger areas of cacti than originally thought by landowners.
- It was vital to use follow-up spraying for control efforts to succeed.
- Historical mapping data showed that a 2-plant Coral Cactus infestation starting in a home garden developed into a 50ha+ area of infestation 15 years later at one station.
- It is essential to get 100% spray coverage of plants for effective control.
- Vegetative cactus remnants have been dispersed via service vehicles, through spines lodging in vehicle tyres (vehicle hygiene is important).
- Wind was observed to be responsible for distribution of small cactus segments.
- Cochineal spread & impact on the coral cactus was so successful that nursery breeding has been discontinued and spraying regime reduced.
- "We found the three stations responded very positively and were inspired to eradicate the cactus by having LCDC support and encouragement. They responded so much more with community effort."
- "The affected stations were very happy with the kill rate, walking through the dying cactus in Nov 2017, it was pleasing to see results."

Maintaining momentum

- Lyndon LCDC successfully lobbied Carnavon Rangelands Biosecurity Association for further funding for ongoing spray control.
- Involvement of DBCA using biocontrol agents extended the in-kind contribution to the project.
- The Lyndon LCDC coordinator for this project gained so much knowledge and interest from the project that she has undertaken the training and is now a Licenced Pest Management Technician and plans to continue weed management work in the area.

Photos

Substantial spread of cochineal in six months (to May 2018) from placement of nursery breed population, Quobba Station.

Landholder, weed contractor and DPIRD staff during field day, May 2018, Quobba Station.

10. Carnarvon LCDC

Building landholder capacity to eradicate cactus on North Shore of Gascoyne River

Situation & Target species	
A large infestation of *Opuntia dejecta* existed on the northern banks of Burnt Tree Gully, a tributary to the Gascoyne River. The location of the infestation posed a significant risk for cactus dispersal into the Gascoyne. Aims of the CCC project included: • To eliminate the established infestation of *Opuntia dejecta*, removing propagation material which could be available for distribution via flooding. • Employ contract weed sprayers to train in best practice methods then treat and follow up spray various patches of cactus weeds across 6 horticultural properties which abut the Burnt Tree Gully. • Engage a district biosecurity officer to assist with ongoing management and planning for eradication.	 Caption: Initial spray efforts were effective in signficantly reducing plant biomass however regeneration of plants made follow-up spray activity essential. *Photo credit: Helen Bumbak.*

Partners	Building capacity
• Carnarvon LCDC • DPIRD • Cactus Task Force • Lyndon LCDC	• Location management/Weed Distribution: The main area of infestation in Burnt Tree Gully was measured and mapped at over 500m^2. • Extension & Best Practice: DPIRD Technical Officer shared herbicide mix rates and experience treating Coral Cactus with Tordon herbicide, and advised necessity for plants to have received a minimum of 20mm summer rainfall for optimum herbicide efficacy. • Extension: A local spray contractor was informed of best practice control methods, and was able to implement and observe effective spray control techniques on more than three occasions. • Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all members of the control program.

Achievements

- Mapping and photographing over ten locations, including the dense 500m^2 patch of *Opuntia dejecta.*
- Participation in 2 Cactus Task Force meetings.
- During the project other species of Cactus such as Prickly Pear (*Opuntia stricta*) and Coral Cactus (*Cylindropuntia fulgida var. mamillata*) were identified and treated opportunistically.
- Local spray contractor Westerley Contractors was employed on 3 occasions to undertake control of *Opuntia dejecta* and is now skilled in management of this species.

Lessons Learnt

- It is important to wait until there has been a minimum of 15mm rainfall before undertaking chemical treatment work to ensure effective herbicide uptake in cactus.
- Repeat spray activities are essential for achieving complete plant death of *Opuntia dejecta*.

Maintaining momentum

- During surveillance work for *Opuntia dejecta* an infestation of Indian Fig (*Opuntia ficus-indica*), an invasive species, was identified on the riverside of a public track and was flagged for treatment. A patch of Prickly Pear (*Opuntia stricta*) was also located and treated. These were expansions of the original project and examples of the flow-on increase in awareness and willingness to actively undertake some management of additional cactus species. The cochineal biotype specific to coral cactus (*Dactylopius tomentosa*) was also released at a number of sites during the project.

Location map

Westerley Contractors worked closely with Carnarvon LCDC to map and photograph cactus locations for treatemnt. This location was mapped in June 2018.

Before and after photos

A patch of the *Opuntia dejecta* infestation in May 2017 prior to spray treatment.

August 2017.Eight days after application of TRICLOPYR 600 (Garlon). Plants showing signs of distress and buds drying out.

Part of *Opuntia dejecta* infestation in May 2018. The site had received Tordon herbicide treatment over three consecutive occasions which achieved >95% control and significantly reduced the volume of vegetative matter which could propagate via movement into the Gascoyne River. The photo shows a small branch regenerating, highlighting the importance of repeat follow-up sprays in order to achieve 100% control.

11. Metro

Building Cactus Capacity in the Perth metropolitan area

Situation & Target species

A number of declared opuntioid cacti species are present as naturalised infestations or garden plants in the Perth Metropolitan area. The aim of the project was to:

- Work with one of the shires in the Perth Hills to coordinate the project (thereby increasing their awareness and capacity to manage cacti in their shire).
- Provide information on cacti species identification, impacts and best practice management to metropolitan shires, nurseries and the Cacti and Succulent Society.
- Increase awareness of the Perth metropolitan community of cacti species identification, impacts and best practice management methods.
- Train weed contractors in the best practice management of cactus.
- Provide demonstrations in the best practice management methods for a number of high priority cacti species.

A mix of succulents, declared cacti and non-declared species in a Perth suburban garden.

Partners

- Shire of Mundaring
- City of Swan
- Western envirapest & weed solutions
- Ian Martin Garden Maintenance
- Swan View residents
- Cactus Task Force

Building capacity

- Best Practice: A one day Tackling Prickly Pests Forum included a presentation on the known best methods of chemical, mechanical and biological treatment for the most common cacti species in the metro area. This was followed by demonstrations of these methods at a suburban location.
- Extension: Presentations at the Forum on identification of the 10 most common cacti species found in the Perth metropolitan area as well as the impacts of cacti.
- Training (increasing capability): Two weed / garden maintenance contractors were trained in chemical and mechanical methods of cactus treatment and best practice disposal. Mundaring Shire and City of Swan workers were trained in safely removing and correctly disposing of hazardous cactus plant material.
- Resources/Materials: DPIRD distribution of the Opuntioid Cacti Management Guide, Best Practice Control Manual, and Field Identification Guide to all participants of the Forum.
- Awareness raising: Articles on the Forum and the impacts of cactus were published in 4 local / regional newspapers in the two weeks following. The Minister for Agriculture launched the Forum and the Opuntioid Cacti Best Practice Manual.

Achievements

- 36 participants attended the Tacking Prickly Pests Forum at Henley Brook on 1 November 2018 – presentations; launch of Cactus Month and the national Opuntiod Cacti Best Practice Management Manual; and practical demonstration of species identification and treatment methods.
- Individuals from a wide range of organisations were present at the Forum – Shires of Mundaring , Goomalling and Cities of Wanneroo and Swan; Parks and Wildlife Service; Cacti & Succulent Society of WA; weed contractors; a "Richgro" representative; DPIRD Invasive Species staff; City of Swan Mayor; Minister for Agriculture and staff.
- A total of 10 newspaper and radio media articles were generated from the Forum and the launch of the best practice manual.
- Chemical (foliar spray); mechanical (manual and mechanical) and biological control (cactoblastis moth) demonstrations with participants "having a go".
- Weed contractors trained in best methods of both treatment and disposal to prevent spread. The knowledge held by these contractors is available to assist manage cactus in the metro area.
- C1 (Prevention) species (*Opuntia schickendantzii* and *Opuntia robusta)* were removed from suburban garden. A number of C3 (Management) species with the nastiest spines were also removed – *Austrocylindropuntia*

subulata; Cylindropuntia imbricata; C. tunicata and C. *pallida.* Manual removal and biological control were demonstrated for the most common species in the Perth area – *Opuntia stricta* and *O. ficus-indica.*

- The involvement of the Cactus and Succulent Society resulted in the clear message that a good proportion of serious cactus collectors / growers are aware of their potential impact and the declaration status.

Lessons Learnt

- Lack of staff resources can impede local government participation in active weed management.
- Demonstrating methods of control is more effective than just "informing".
- There is a significant benefit to effectiveness of awareness raising with the involvement of a high profile individual (eg the Minister) as the media is more likely to be interested.
- From the weed contractor "we learnt a few things for the next time" and "we appreciated the challenge".
- The perception that "cactus is just a garden plant and doesn't cause any problems" is widespread in suburban communities.

Maintaining momentum

- Links with the Shires and the Cactus and Succulent Society will be maintained.

Photos

DPIRD Biosecurity Officer, Darryl Stewart, provided Forum participants with information on the current cactus management activities by DPIRD in the Perth metropolitan area.

Forum participants had a go at all methods of cactus treatment including manual removal.

Department of Primary Industries and Regional Development

In collaboration with city of swan, Shire of MUNDARING

Tackling Prickly Pests

Cactus Information and Demonstration Forum

You are invited to the cactus information and control demonstration forum on Wednesday 1 November 2017.

Location: . **West Swan Hall**. Henley Brook
(Corner of West Swan Road and Henley Street, Henley Brook, Perth WA).

Time: . **9:00am to 3:00pm**

The forum is designed to

- Raise awareness of weedy cactus.
- Increase the reporting of cactus.
- Encourage active and best practice control of declared cactus.

During the forum we will be launching "November Cactus Month" and the national Opuntioid Cacti Management Manual.

The forum will include presentations to increase your ability to identify different species and to understand the impacts as well as a live cactus display collection.

After lunch demonstrations of best control options have been planned at a location in Swan View, approximately 15 minutes' drive from West Swan Hall.

You will have to provide your own transport to the demonstration site in the afternoon.

Morning tea and lunch will be provided. Please indicate dietary requirement.

Please RSVP to
Glen Coupar Biosecurity Officer
Department of Primary Industries and Regional Development
9368 3956, 0438 905 125, glen.coupar@dpird.wa.gov.au

B. Summary of projects and achievements

Species identified and treated

A total of 15 species of cacti were treated as part of the eleven Coordinated Cactus Campaign projects. All cacti were Weeds of National Significances (WoNS) with most being classified as C3 Management Species in Western Australia and two species classified as C1 Prevention Species.

1. Coral Cactus (*Cylindropuntia fulgida var. mamillata*). C3 (Management) species.
2. Devil's Rope (*Cylindropuntia imbricata*). C3 (Management) species.
3. Drooping Tree Pear (*Opuntia monacantha*). C3 (Management) species.
4. Engelmann's Prickly Pear (*Opuntia engelmannii*) C3 (Management) species.
5. Indian Fig (*Opuntia ficus-indica*). C3 (Management) species.
6. *Opuntia dejecta*. C3 (Management) species.
7. Prickly Pear (*Opuntia stricta*). C3 (Management) species.
8. Red Flower Prickly Pear (*Opuntia elatior*). C3 (Management) species.
9. Riverina Pear (*Opuntia elata*). C3 (Management) species.
10. Velvet Tree Pear (*Opuntia tormentosa*). C3 (Management) species.
11. Wheel Cactus (*Opuntia robusta*) C1 (Prevention) species.
12. Chickendance Cactus *(Opuntia schickendantzii*). C1 (Prevention) species.
13. Eve's Pin Cactus *(Austrocylindropuntia subulata)* C3 (Management) species.
14. Brown-Spined Hudson Pear *(Cylindropuntia tunicata)* C3 (Management) species.
15. White-Spined Hudson Pear *(Cylindropuntia pallida).* C3 (Management) species.

Summary of general achievements

All bar one CCC projects used either herbicide spray or herbicide injection for treatment of cactus weeds. More than 20 individual herbicide treatment activities were recorded across projects. Areas treated ranged from single plants to several hectares of land. All results were shared and discussed at the Cactus Task Force meetings and via email in minutes and additional information provided to the projects.

Four CCC projects used the deep burial method for cactus disposal, with more than six tonnes of cacti buried in total across projects.

Three projects used regular drone surveillance activities for cactus monitoring and mapping, and all projects recorded cactus locations via mapping of some form.

Eight CCC projects released biocontrol organisms in one or more sites, with a total of 17 biocontrol releases across all projects.

Three Extension Projects for CCC were undertaken in the period July 2018 to April 2019 implementing the learnings from the CCC projects.

Funds acquitted and in-kind contributions

$195,163 of the total $200,000 was expended and acquitted by the eleven CCC projects. Project funds were spent predominantly on herbicide trials, herbicide cactus treatment, mechanical removal and deep burial, and aerial survey and mapping. Awareness-raising activities and provision of best practice knowledge was achieved largely through in kind contributions and involved little expenditure of project funds.

The project funds were complimented by significant amounts of in-kind contributions by project partners. The total amount of recorded in-kind contribution amounted to $219,876 across the eleven projects. The Extension Projects utilised $28,000 of CCC funding with in-kind contributions of $65,385. It is noted that the actual in-kind contribution was significantly higher than this but not fully recorded or accounted for.

Additional outcomes

A Cactus Task Force was formed with members of each CCC project participating in 3-5 CFT meetings during the course of the project. Two of these meetings were face-to-face and three were held via teleconference or video conference.

In feedback received, the CTF meetings were considered by all project participants to be highly useful in sharing best practice cactus control methodologies. Stem injection, basal barking, spray, mechanical removal, and use of granulated residual herbicides methodologies were discussed. Participants discussed the importance of water pH, different herbicide carriers such as diesel and water, and waiting until after rainfall before treating cacti with herbicide. Participants shared information on the cost-efficiencies of different control treatments and shared advice on their experiences with residual effects of different herbicides.

As an outcome of one CTF meeting, a session on the use of drones and UAVs for use in surveillance was organised. CTF members participated in this session, sharing the experience of three of the CCC projects. Both benefits and issues/challenges were outlined with a presentation by a company Sensorem.

Another outcome was DPIRD providing information in response to requests at a CTF meeting for information on registered herbicide application patterns, label interpretation, and Minor Use Permits. DPIRD collated and circulated information on how chemicals are registered and how Dangerous Goods are classified and handled. A presentation by DPIRD expert on Chemical Permits was provided at a CTF meeting.

Participants in the CCC projects commented on the benefits of the CTF. Rory Graham of North Mallee Farm Improvement Group stated:
'the Cactus Task Force has been a valuable inclusion in the whole campaign to control this invasive weed. It has helped to give it a public/community focus as it is proving to be a problem for all the community out there. It has been especially useful for all participants in the task force by galvanizing all group leaders to the cause. It's great to hear of other project leaders relating their experiences and activities, showing each of us we are not alone in the campaign. It also shows all areas are different ie. in cactus species, environments, climate and response to control measures'.

Jo Kuiper of Pilbara Mesquite Management Committee also commented:
'a key lesson learnt during this project is that once there is a driving catalyst for action, in this case the funding for cactus management, then other associated tasks become more readily achievable; the PMMC tries to value-add and identify other opportunities that can be achieved in association with its projects. During this project other weed species were identified on islands through direct observation (Kapok and Buffle grass mapping, Parkinsonia on West Lewis) and community reports were received about Mesquite on an island near the Mouth of the Fortescue River, along with several other land management tasks on the islands'.

Generating forward momentum

In addition to the CCC project funds and in-kind contributions, a number of the CCC projects actively sought and successfully obtained during the CCC project, additional funding grants through other sources to assist in continuation of cactus control efforts. These included small grants from both Commonwealth and State funding schemes to enable continued cactus herbicide sprays and funds to assist with deploy of drones to map, monitor and report on wide-spread cactus infestations.

In all projects community members and biosecurity groups are now better linked with landowners and DPIRD staff and will continue to communicate cactus infestation locations and control efforts being carried out.

The release of biocontrol organisms such as Cochineal scale and Cactoblastis moth was conducted in eight out of the eleven CCC projects. The ongoing monitoring of the biocontrol organisms will continue to be collaboratively managed between community groups and government biosecurity staff.