Department of Sustainability and Environment

Action Statement

Flora and Fauna Guarantee Act 1988 No. 243

Chariot Wheels

Maireana cheelii

This revised Action Statement is based on the Recovery Plan prepared for this species by DSE under contract to the Commonwealth Department of the Environment, Water, Heritage and the Arts.

Description

Chariot Wheels (*Maireana cheelii*) is a small, tufted hemicryptophyte of the saltbush family Chenopodiaceae. It grows to 20 cm in height, and has slender, woolly, erect branches arising from a swollen taproot. The alternate leaves are fleshy, linear and 5 - 9 cm long. Chariot Wheels flowers and fruits in the spring, producing tiny (~1 mm wide), green flowers in the leaf axils. The flowers are bisexual and have five anthers and two stigmas. The distinctive fan-shaped woolly fruits consist of five spreading wings and are 5 - 6 mm in diameter. Chariot Wheels is perennial and semi-deciduous: during the harsher summer months it dies back to sub-surface buds (description from Walsh & Entwhistle 1996 and Foreman 1995a).

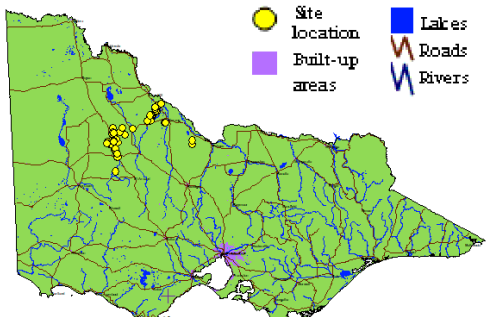
Chariot Wheels
(Photo: Enviro Images/Stimson)

Distribution

Chariot Wheels occurs at numerous sites in north west Victoria, the majority of which are roadsides or on private property. Populations have been recorded near Kerang, Budgerum, Birchip, Warmur, Mitiamo, Lake Tutchwap and Lake Buloke. Other populations occur on the Morton Plains and Avon Plains, and at the Terrrick Terrick East Grassland Reserve and Terrick Terrick National Park.

There are records of Chariot Wheels around Lake Murphy (to the east) from the 1970s and mid-1980s. It is unclear, however, whether Chariot Wheels still exist around Lake Murphy as this area has been extensively grazed and cleared for cropping.

Chariot Wheels also occurs across the Western Riverina of NSW. It is now probably extinct in Queensland.



Distribution in Victoria
(Flora Information System DSE 2007)

A Victorian Government Project

Victoria The Place To Be

Habitat

Chariot Wheels usually occurs on non-friable strongly duplex clay soils with a loamy A-horizon. These heavy clays frequently become waterlogged during the winter months. Sites are typically sparsely vegetated and have a high proportion of bare scalded ground (often as a result of over-grazing and subsequent wind erosion). Extant populations are confined to areas that have not been cropped, such as roadsides and lightly- to moderately-grazed paddocks. Average annual rainfall ranges from 325 – 400 mm. At many sites, Chariot Wheels can be seasonally dominant.

It is unclear whether the commonly observed habitat of Chariot Wheels (heavy clay scalds) is actually sub-optimal habitat for the species. It seems likely that its current occupation of a relatively hostile environmental niche is influenced by inter-specific competition and habitat loss (due to extensive land clearance for cropping).

Chariot Wheels is found in chenopod shrubland and grassland communities dominated by various native and exotic shrubs, grasses and herbs. Notable species include Hairy Bluebush (*Maireana pentagona*), Bottle Bluebush (*M. excavata*), Nitre-bush (*Nitraria billardierei*), Knotty Spear-grass (*Austrostipa nodosa*), Rough Spear-grass (*A. scabra*), Blue Heron's-bill (*Erodium crinitum*), Paper Sunray (*Rhodanthe corymbiflorum*), Orange Sunray (*Hyalosperma semisterile*) and Golden Sunray (*H. glutinosa*). Perennial saltbush and grass/herb dominated communities once covered vast areas of north west and north central Victoria and the Riverina Plain in NSW. Since European settlement, these communities have suffered significant depletion due to grazing and clearing for cropping. It is likely that Chariot Wheels was once more common throughout this region.

Life history and ecology

There are very few published studies on the biology and ecology of Chariot Wheels. The species is a hemicryptophyte which enters a dormancy phase in late summer and autumn. In late autumn or winter, adult plants resprout from ground level or aerially, and seeds germinate in response to the first significant rainfall. Vegetative growth is rapid and is followed by flowering in spring. Seeds are dispersed by wind or ants in the early summer. It is unclear whether Chariot Wheels forms a long-term soil seed bank, but it seems unlikely (Foreman 2005).

A preliminary demographic study of Chariot Wheels was conducted at three sites in north west Victoria (Foreman 2005). Recruitment of Chariot Wheels was uncommon and patchy – this is typical of many perennial grassland plants. Fecundity was correlated with plant size and was spatially patchy within sites. Seed production between sites was correlated with habitat condition, population size and isolation. Preliminary data suggested that plants may take up to five years to begin contributing to population fecundity, and that plants may live for approximately ten years (Foreman 2005).

Foreman (2005) found that grazing appeared to elevate the 'natural' rate of mortality, and speculated that germination may be triggered by small flooding events. In the dry summer of 2003/4, recruitment did not compensate for grazing-related mortality, and two of the three studied populations were declining. Foreman recommended, however, that existing grazing regimes should be maintained in the absence of more comprehensive data.

A study by Dimech *et al.* (2001) investigated the biological and reproductive characteristics of several *Maireana* species including Chariot Wheels. Germination rates of Chariot Wheels were slow relative to other *Maireana* species. Although several other species, including *M. brevifolia* and *M. enchylaenoides*, recorded 80 - 100% germination within ten days, *M. cheelii* only showed 30 – 70% germination within 21 days (Dimech *et al.* 2001). A germination inhibitor may be present in the seed of Chariot Wheels (Dimech *et al.* 2001; Foreman 2005). Further study is required to fully explore Chariot Wheels' germination requirements.

Dimech *et al.* (2001) showed that applications of sodium chloride (NaCl) at 1% concentration did not inhibit germination of Chariot Wheels under greenhouse conditions. At 2% NaCl concentration, however, virtually no germination was recorded. It appears, therefore, that Chariot Wheels can tolerate slightly elevated levels of salinity but that higher levels may affect germination success. Dryland salinity is occurring at increasing rates across Australia. This poses an extreme threat to Australian flora that occur in agricultural regions, particularly species such as Chariot Wheels that inhabit saline low-lying areas.

Vegetation clearing for agriculture is likely to have been the major cause of habitat destruction and population demise of Chariot Wheels. Cropping and grazing have significantly depleted the perennial saltbush and grassy vegetation communities currently occupied by the taxon. Future habitat clearance is a major threat to the species.

Changes to disturbance and grazing regimes may threaten the persistence of the species' habitat. Chariot Wheels often dominates open scalded areas in grassy communities. It is unclear whether disturbance is required to maintain such habitat and prevent vegetation growing in scalded areas.

Further research is also required to determine whether the preferred habitat of Chariot Wheels is mainly scalded open 'patches' within grassland communities, or if the species has retreated to this niche through competitive interactions. Changes to local hydrology combined with soil compaction from grazing may lead to soil pugging and alterations to local water flow. This may result in habitat degradation and/or changes to the disturbance regimes that are required to maintain suitable habitat for Chariot Wheels.

It is important to consider climate change when examining potential threats. Although few studies have investigated the possible impacts of climate change on vegetation, one recent study (Newell *et al.* 2003) estimates the impact of different greenhouse scenarios on various species. Further studies are required to examine this topic in greater detail. Climate change remains a very real and potentially harmful threat to threatened plant species.

Conservation status

Chariot Wheels is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Chariot Wheels is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988.*

It is considered vulnerable in Victoria according to the Department of Sustainability and Environment's *Advisory List of Rare or Threatened Vascular Plants in Victoria – 2005* (DSE 2005).

Important populations

There are approximately 500 000 plants remaining in more than 35 wild populations in Victoria (B. Thomas pers. comm.). Populations necessary for the long term survival and recovery of Chariot Wheels occur in the following locations:

Reserves

Terrick Terrick National Park

- A population of ~300 plants in the Creek Paddock was discovered by D. Marshall and N. Wong.
- Another population was discovered in the Yarran Paddock by E. O'Brien in 2008.

Terrick Terrick East Nature Conservation Reserve

- 1998: a Flora Information System record exists for the species at the site but does not give an estimate of the number of individuals. Discussions with a Trust for Nature employee indicate that a small and scattered population of a few dozen plants was sighted in the winter of 1998.
- January 2004: a survey found no individuals.
- It is likely that a small stand of Chariot Wheels exists at the site. The reserve is considered an important grassland remnant.

Yassom Swamp Flora and Fauna Reserve

- 1981: approximately 375 plants.
- 2004: approximately 100 - 150 plants (J. Mavromihalis).
- The site was originally freehold land used predominantly for sheep grazing. The site became a reserve in the 1990s, after the Government purchased the site.

Tatchera Bushland Reserve

- April 2007: scattered individuals across the grassland area and on the edge of the Black Box (*Eucalyptus largiflorens*) woodland areas. The sparse distribution made it difficult to estimate population size, but the conservative estimate was 500 - 1000 plants (B. Thomas).

Watchem Bushland Reserve

- September 2007: more than 10 000 plants occur in the east of the reserve in open areas of the Black Box woodland, growing on low lying grey clays soils (B. Thomas).

Towma Bushland Reserve

- December 2004: scattered patches of *M. cheelii* are present in the open, low-lying areas off Black Box woodland. The number of individuals at the site varies between 5000 and 15 000 depending on seasonal conditions (B.Thomas).

Korrak Korrak Nature Conservation Reserve

- 2004: approximately 100 000 plants.
- This site was purchased by the Department of Sustainability & Environment in 2006 and is managed by Parks Victoria as a nature conservation reserve. The grassland area of the reserve was partially cultivated prior to purchase, but is now recovering quite well.

Carapugna Bushland Reserve

- December 2004: 600 – 1000 plants present in the western end of the reserve (B. Thomas).
- This site is a small ten hectare reserve to the east of Birchip. This site is dominated by Black Box but does have some small open areas containing depressions which support populations of *M. cheelii*.

Roadsides

East Hill Road, Morton Plains (Shire of Buloke) and nearby railway reserve, South of Birchip

- 2002: approximately 10 000 – 50 000 plants.

Echuca-Serpentine Road, Patho West

- 2003: 500 - 2000 plants across approximately 60 m^2 (E. O'Brien).
- December 2004: 1600 - 2000 plants (B. Thomas).

Edwards Road, Morton Plains (Shire of Buloke)

- February 2005: 5000 – 10 000 plants, predominantly on the northern side of the road. (B. Thomas).

M. cheelii also occurs in small populations on many other roadsides in the Birchip and Quambatook districts.

State Forest

Mystic Park State Forest

- 1981: 50 plants.
- December 2004: 5000 – 10 000 plants to the east of the entrance to the reserve off the Tresco-Mystic Park Road (B. Thomas).

Bael Bael State Forest (also known as Koorangie Wildlife Reserve)

- 1981: 100 plants.
- January 2005: surveys did not find any plants (B. Thomas).
- *M. cheelii* may still persist in the open grassy areas opposite the Yassom Swamp Flora and Fauna Reserve.

Private Land

Private Property, Budgerum

- 2003: it has been suggested that hundreds of thousands of plants may be present on the property, but an accurate estimate could not be obtained. A broad, yet possibly conservative, estimate is 50 000 – 200 000 individuals (DSE threatened species project).
- The stand is one of three populations which were monitored as part of the Victorian Government's Ecologically Sustainable Agriculture Initiative (ESAI) Threatened Species Project in 2003/2004 to examine aspects of the species' reproductive biology, disturbance ecology, and habitat and niche characteristics.
- This property was purchased by Trust for Nature in May 2007. The property will remain with the Trust for one to two years before being resold as part of Trust for Nature's revolving fund (Elvyne Hogan pers. comm.).

Private Property, Birchip

- 2003: 10 000 – 50 000 individuals, located in a paddock on the property (DSE threatened species project).
- The stand is one of three populations which were monitored as part of Victorian Government's ESAI Threatened Species Project in 2003/2004 to examine aspects of the species' reproductive biology, disturbance ecology, and habitat and niche characteristics.

Note: There are many more important sites on private property in the Birchip district. These sites cannot be included in the Action Statement until extensive consultation with the landholders has taken place.

Other

Korrak Korrak Grassland Reserve, Trust for Nature property

- February 2004: 25 000 – 110 000 plants (J. Mavromihalis).

Glassons Grassland (east of Mitiamo township), Trust for Nature property

- 2003: 10 000 – 50 000 plants (J. Mavromihalis, P. Foreman and D. Marshall).
- The stand is one of three populations which were monitored as part of Victorian Government's ESAI Threatened Species Project in 2003/2004 to examine aspects of the species' reproductive biology, disturbance ecology, and habitat and niche characteristics.

Potentially threatening processes

Weed Invasion

Moderate: Weed invasion is considered a threat on private property and along roadsides. Exotic species considered a threat include Oat (*Avena* spp.) and Fescue (*Vulpia* spp). Weeds may hinder seedling establishment and compete with *M. cheelii* for local resources such as nutrients, water and space.

Salinity

Low: Elevated saline groundwater (as a consequence of irrigation and cropping) is a threat to *M. cheelii*. At this stage, however, it is difficult to determine the current degree of impact. Dryland salinity has already affected large areas of arid and semi-arid Australia. Although Chariot Wheels is generally found in low-lying areas and tolerates low levels of salinity, it will be adversely affected if salinity levels increase beyond its tolerance point (Dimech *et al.* 2001). In the future, dryland salinity is likely to become one of Australia's biggest environmental concerns, and the potential impacts are particularly high for plant communities and species that occur in low-lying areas.

Damage/ destruction

Moderate: Road works and maintenance are an on-going threat to *M. cheelii* populations, and several populations have been already adversely affected

these activities. Clearing of populations on private land for cropping and the ploughing of roadsides by adjacent landholders pose a serious current and future threat to the species.

Grazing/ inappropriate grazing regimes

Moderate: Grazing by stock is considered a serious threat to *M. cheelii* populations on private property. Opportunistic grazing by stock on roadsides is also considered a threat to certain populations. Grazing during peak flowering and seeding periods in spring and summer may affect rates of recruitment and establishment. Heavy grazing may eliminate adult individuals from the site. Chariot Wheels does not persist under heavy grazing pressure or where major soil disturbance has taken place for cropping or pasture improvements (Foreman 2005). The species has survived for long periods, however, under light or rotational grazing regimes.

Site security

High: The majority of populations are located on roadsides and private land.

Habitat Degradation

Moderate: Alterations to local hydrology combined with soil compaction may degrade the habitat at some sites due to soil pugging and changes in water flow. Widespread clearing, increased water usage and changes in vegetation cover (including an increase in the cover of annuals) may lead to the loss of ideal habitat or changes to the disturbance regimes which are required to maintain suitable habitat. Climate change and the subsequent environmental changes are also considered a threat.

Previous Management Action

Not site-specific

- National Recovery Plan is currently (2009) in the final stages of preparation.
- Seed was collected from Mt Terrick Road and private property for the Millenium Seed Bank in 2004.
- Fact sheets on the species were prepared, printed and circulated in 2006/07.
- Roadsides in the Shires of Buloke and Northern Grampians have been searched for additional populations 2004 - 2009. A site at Watchem was located (population size is estimated as more than 10 000 plants).
- DSE and local Landcare groups have liaised with private property owners to locate, monitor and manage additional populations on private property.

Bael Bael State Forest

- The site is periodically monitored, and the data entered into VROTPop.

East Hill Road, Morton Plains

- Survey of Chariot Wheels recorded in the Flora Information System.

Echuca-Serpentine Road, South of Patho West

- A 'significant vegetation' sign has been erected.
- A section of the stand was cleared for cultivation in 2000.
- Site has been visited and the population surveyed.

Edward's/Peverill/Birchup-Corak Roads

- Signs have been erected to prevent accidental damage to roadside populations.

Glassons Grassland Reserve (TFN)

- Site was acquired by Trust for Nature in 2000. Conservation now plays a major role in management.
- Grazed by sheep (light-moderate).
- Demographic study of the species as part of an ESAI Project (DSE Project).
- A management plan has been prepared for the site.
- Populations mapped and size estimated in 2004/05.

Korrak Korrak Grassland Reserve (TFN)

- Acquired by Trust for Nature in 2001, conservation now plays a major role in management.
- The site is fenced.
- A draft management plan has been prepared.
- Stock grazing is closely monitored. The site is not currently grazed by stock.

Mount Terrick Road

- Population was mapped in 2004/05. Approximately 1200 plants were recorded. Map is stored at DSE Epsom office.
- Threats were monitored in 2007, no significant threats were found.

Mystic Park State Forest

- The site is periodically monitored, and the data entered into VROTPop.

Private Property, Birchip

- The landholder is aware of the population. Due to the presence of trees near and around the

stand, DSE staff (Birchip) have commented that it is currently unlikely that approval would be given to clear this vegetation.

- Demographic study of the species as part of an ESAI Project (DSE Project).
- The Birchup Landcare group has conducted extensive surveys of Chariot Wheels in this area.
- Seed was collected and is being cultivated by Narram Seeds, Horsham.
- DSE staff work with the landholder and Birchup Landcare group to monitor the site.
- Plants are growing well and do not appear to be affected by nearby grazing.

Private Property, Budgerum

- Currently grazed by stock.
- Demographic study of the species as part of an ESAI Project (DSE Project).
- Site purchased by Trust for Nature in May 2007.

Tatchera Bushland Reserve

- Population confirmed and size estimated in 2007.
- DSE has liaised with Parks Victoria about the location of the species and its significance.

Terrick Terrick East Grassland

- Declared a reserve in 2001.
- Currently grazed by sheep.
- Site is fenced.

Three Chain Road (west)

- Signs have been erected to alert roadwork crews etc. to the location of the species.
- Site surveyed in 2005 – approximately 500 plants were located.

Towma Bushland Reserve

- Population size assessed 2004/05.
- A fence has been erected to prevent stock entering site from private property.
- Parks Victoria has been alerted to the presence and significance of the species.
- Parks Victoria controlled rabbits in 2005/06.

Yassom Swamp Flora & Fauna Reserve

- Reserve sign is present.
- Sheep grazing occurs depending on site conditions.
- Area is fenced and gates are regularly chained to prevent vehicles entering the reserve. On occasion, however, members of the public have removed chains and driven through the reserve.
- No threats were observed when site was inspected by DSE staff (2006 – 2008).

Watchem Bushland Reserve

- Site visit in 2008/09 found that the site was under few external threats.
- Site has been fenced to exclude rabbits and sheep.

Conservation Objectives and Intended Management Actions

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

Long term objective

To ensure that Chariot Wheels (*Maireana cheelii*) can survive, flourish and retain its potential for evolutionary development in the wild.

Specific Objectives, Actions and Targets

Objective I To improve knowledge of biology, ecology and management requirements

Action	*Targets*	*Responsible*
1. Acquire baseline population data by conducting detailed field and desktop surveys including (a) identification of the area and extent of populations; (b) estimates of the number, size and structure of populations; (c) inference or estimation of population change.	▪ Baseline data collected. ▪ Conservation status reassessed. ▪ Populations accurately mapped.	DSE

2.	Assess habitat characteristics and/or condition. Accurately survey known habitat and collect floristic and environmental information relevant to community ecology and condition.	▪ Habitat data collected and analysed. ▪ Important habitat mapped.	DSE
3.	Conduct survey to identify and search suitable habitat. Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.	▪ Predictive model for potential habitat developed and tested. ▪ Potential habitat searched.	DSE
4.	Undertake research to identify key biological functions. Investigate and assess the threat of salinity.	▪ Critical life history stages identified. ▪ Recruitment and dispersal identified at known sites. ▪ Seed bank/regenerative potential quantified for each/target population. ▪ Stimuli for recruitment/regeneration identified. ▪ Dryland salinity threat assessed.	DSE
5.	Undertake detailed population monitoring and collect demographic information.	▪ Techniques for monitoring developed and established. ▪ Census data for target populations collected.	DSE
6.	Analyse population trends.	▪ Population growth rates determined and Population Viability Analysis completed for target populations.	DSE

Objective II To secure populations, community occurrences or habitat from potentially incompatible use

Action		*Targets*	*Responsible*
7.	Negotiate management agreement with land manager(s).	▪ All known public land sites identified and protected by agreement. ▪ Fencing and signposting completed.	DSE
8.	Negotiate voluntary management agreements with private landholder(s).	▪ Negotiations undertaken with all landholders. ▪ All known private land sites protected through planning processes and/or agreements. ▪ Work with Trust for Nature to manage private properties for conservation.	DSE
9.	Incorporate actions in relevant park or reserve management plan.	▪ Park management plans identify species and provide for its protection and active management.	Parks Victoria
10.	Provide information and advice to local government authorities for inclusion in planning processes.	▪ All known sites are identified and protected through planning processes. ▪ Fencing and signposting completed.	DSE
11.	Collect and store reproductive material as a safeguard against catastrophic loss.	▪ Reproductive material securely stored. ▪ Seed viability tested.	Royal Botanic Gardens

Objective III To improve the extent and/or condition of habitat

Action	*Targets*	*Responsible*
12. Identify disturbance regimes to maintain habitat.	▪ Management strategies identified and documented.	DSE
13. Manage stock grazing regimes.	▪ Measurable reduction in grazing damage or loss on public land.	DSE
14. Prevent accidental damage to roadside populations from roadworks etc.	▪ Signs erected at relevant roadside sites to prevent accidental damage.	Buloke Shire Council

Objective IV To increase community awareness and support

Action	*Targets*	*Responsible*
15. Involve community groups and volunteers in recovery activities.	▪ Opportunities for involvement identified, promoted and supported.	DSE

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