

Prostrate Flame Flower

(Chorizema humile)

RECOVERY PLAN



Department of Environment and Conservation
Kensington

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP, which results from a review of, and replaces, IRP No. 31. *Chorizema humile* (Stack and English 1999) will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked Critically Endangered this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on 30 April 2008. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate as at April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

IRP PREPARATION

This Interim Recovery Plan was prepared by Kathy Himbeck¹

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ACKNOWLEDGEMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Andrew Brown	Threatened Flora Coordinator, Species Communities Branch, DEC, Locked Bag 104, Bentley Delivery Centre, 6983.
John Riley	Administrative Officer (Flora), Species and Communities Branch, DEC, Locked Bag 104, Bentley Delivery Centre, 6983.

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information. Thanks also to DEC's Species and Communities Branch and the private land holders who provided information on altered contact details, new land divisions and assistance in locating new and old populations in the field.

Cover photograph by Kathy Himbeck.

CITATION

Department of Environment and Conservation (2009) Prostrate flame flower (*Chorizema humile*) Recovery Plan. Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra

SUMMARY

Scientific Name:	<i>Chorizema humile</i>	Common Name:	Prostrate flame flower
Family:	PAPILIONACEAE	Flowering Period:	July - September
DEC Region:	Midwest	DEC District:	Moora
Shires:	Coorow, Carnamah, Moora	Recovery Team:	Moora District Threatened Flora Recovery Team
NRM Region:	Northern Agricultural		

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Marchant, N. (eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; DEC (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora* (Accessed 2007) Department of Environment and Conservation, Western Australia. <http://www.calm.wa.gov.au/science/>; Taylor, J. M. and Crisp, M.D. (1992) A Revision of *Chorizema* (Leguminosae: Mirbelieae). *Australian Systematic Botany* 5(3): 249-335.

Analysis of outputs and effectiveness of IRP 31 (1999-2002): This IRP replaces IRP No. 31, prepared by Gillian Stack and Val English.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) has been met, as the number of known populations in the wild has increased from three to thirteen, after extensive searches. This species is heavily influenced by environmental stress and grazing, affecting population numbers from year to year. In 1998 the number of plants was 82 but in 2006, even though the number of populations increased significantly (from three to thirteen), the number of mature plants was only 99. During this time frame the number of individual plants climbed to 1001. In 2003 when Population 8 was surveyed 740 plants were recorded but in 2006 only 3 plants could be found.

Actions carried out through the previous plan include:

- Action 3. Monitor populations
- Action 4. Conduct further surveys
- Action 5. Obtain biological and ecological information
- Action 6. Preserve genetic diversity of the taxon
- Action 7. Disseminate information
- Action 8. Start translocation process

All recovery actions included in the previous plan are either ongoing or have not yet been completed and have been included in this revised plan. New recovery actions included in this plan are to map critical habitat, liaise with relevant land managers and Indigenous groups, and seek security of tenure for populations.

Current Status: *Chorizema humile* was declared as Rare Flora in October 1996, and ranked as Critically Endangered (CR) in 1998 under the *Western Australian Wildlife Conservation Act 1950*. It currently meets World Conservation Union (IUCN 2001) Red List Criteria Critical (CR) under criteria B1 + 2c as the thirteen populations are severely fragmented and habitat quality is poor. *C. humile* is listed as Endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The main threats are grazing, trampling, road maintenance activities, weed competition and inappropriate fire regimes.

Description: *Chorizema humile* is a small, prostrate shrub to approximately 60 cm in diameter. The many slender stems are rigid with scattered hairs and radiate from a central root. The leaves are obovate and are up to 16 mm long and up to 5 mm wide, tapering at the base into a short petiole. They are arranged alternately along the stem and have a short awn-like projection at the apex. The flowers occur at the ends of the stems in racemes up to 18 cm long with up to 30 flowers in each and on stalks up to 2.5 mm long. The petals are yellow with red-brown markings. The standard petal is up to 9 mm long, the wing petals are gently curved to 8 mm long and the keel tapers to a protracted point and is almost as long as the wings. The upper lobes of the calyx join to form a lip with free tips. The calyx is hairy and tapered at the base. The style curves gently inwards.

Habitat requirements: *Chorizema humile* is found in red loam, brown sandy clay with decomposing granite or in clay soils, on plains in scrub or open tree mallee. Associated species include *Allocasuarina campestris*, *Hypocalymma angustifolium* and several *Acacia* species.

Habitat critical to the survival of the species, and important populations: Given that *Chorizema humile* is ranked as CR (WA), it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *C. humile* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations, additional occurrences of similar habitat that may

contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Chorizema humile* will also improve the status of associated native vegetation, other Declared Rare and Priority Flora, and Threatened Ecological Communities (TECs). At Population 7 the species occurs in association with the Endangered taxa *Darwinia* sp. Carnamah (also Endangered under EPBC Act) and the Vulnerable Plant Assemblages of the Inering Hills TEC.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Chorizema humile* is not listed under any specific international treaty however, and this recovery plan does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people: The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of populations of *Chorizema humile* and no Indigenous communities that may be interested or involved in the area affected by this plan have been identified. However, not all significant sites are listed on the Register. The involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for Indigenous communities in the recovery of this species, opportunities may exist through cultural interpretation and awareness of the species.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential Indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for threatened species conservation.

Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts: The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. However, as all *Chorizema humile* populations occur on private property and road and Shire reserves, the protection of the species at these sites may potentially affect development and asset protection measures. Recovery actions refer to continued liaison between stakeholders with regard to populations located on private property and Shire managed lands.

Affected interests: The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of *Chorizema humile* populations on private property will have implications for the property owners. Where it occurs on road reserves under the care, control and management of the local Shire, the authority will be required to ensure protection of those populations. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance: DEC, in conjunction with the Moora District Threatened Flora Recovery Team, will evaluate the performance of this recovery plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following four years of implementation.

Completed Recovery Actions

1. Populations 1, 4 and 5 and Subpopulations 3A and 3B were monitored in 2000. Roadside DRF markers were moved at Population 4 and Subpopulation 3a to include the plants occurring outside the current boundary.
2. To prevent damage to plants from grazing and trampling, cages were installed over a number of individual plants at Populations 1 and 3.
3. A stock-exclusion fence was erected around Subpopulation 3a in 1997. Wire netting cages were also installed over all seven *Chorizema humile* plants. Plants in Subpopulation 3b were also fitted with steel mesh cages.
4. A five day survey for new populations of *Chorizema humile* was conducted in Dowerin, Goomalling and Dalwallinu, in September 2000. Nine new populations were found in the Coorow area, all on private property.
5. As part of a Bachelor of Environmental Science degree at Murdoch University, a study was completed by Melanie Clinch in November 2002 entitled "The population structure of the rare plant *Chorizema humile* in relation to its conservation".
6. Approximately 400 seeds were collected from Population 6 in November 1999, and are being stored at -18° C in DEC's Threatened Flora Seed Centre (TFSC). The initial germination rate of this seed was found to vary from 50% to 80%, and after one year in storage was 100%. In November 2004, a further collection of 450 seeds was made from Population 3.
7. An information sheet for *Chorizema humile* was produced in a joint effort with the Natural Heritage Trust and DEC.

8. *Chorizema humile* is one of the species described in a DEC bush book entitled 'Threatened Wildflowers of the Mid-West' (Chant 2002).

Ongoing and future recovery actions

1. Funding was acquired in 2006 through the Biodiversity Conservation Initiative scheme to support a translocation for *Chorizema humile*. A Translocation Proposal is currently being prepared.
2. The MDTFRT will oversee the implementation of this recovery plan and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.
3. Staff from DEC's Moora District Office regularly monitor known populations.

Recovery plan objective: The objective of this recovery plan is to abate identified threats and maintain viable *in situ* populations to ensure the long-term preservation of the species in the wild.

Recovery criteria

Criteria for success: The number of populations has increased and/or the number of mature individuals in populations has increased by ten percent or more over the term of the plan.

Criteria for failure: The number of populations has decreased and/or the number of mature individuals in populations has decreased by ten percent or more over the term of the plan.

Recovery Actions

- | | |
|--|---|
| 1. Coordinate recovery actions | 8. Obtain biological and ecological information |
| 2. Undertake and monitor translocation | 9. Promote awareness |
| 3. Undertake weed control and follow-up with regular monitoring and additional control if required | 10. Collect seed for long term storage and future translocation |
| 4. Monitor populations | 11. Develop and implement a fire management strategy |
| 5. Map habitat critical to the survival of the species | 12. Seek security of tenure for populations |
| 6. Conduct further field surveys | 13. Review this plan and assess the need for further recovery actions |
| 7. Liaise with relevant land managers and Indigenous groups | |

1. BACKGROUND

Analysis of outputs and effectiveness of IRP 31 (1999-2002): This IRP replaces IRP No. 31, prepared by Gillian Stack and Val English.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) has been met, as the number of known populations in the wild has increased from three to thirteen, after extensive searches in 2000.

This species is heavily influenced by environmental stress and grazing, affecting population numbers from year to year. In 1998 the number of plants was 82 but in 2006, even though the number of populations increased significantly (from three to thirteen), the number of mature plants was only 99. During this time frame the number of individual plants climbed to 1001. In 2003 when Population 8 was surveyed 740 plants were recorded but in 2006 only 3 plants could be found.

Actions carried out through the previous plan include:

- Action 3. Monitor populations
- Action 4. Conduct further surveys
- Action 5. Obtain biological and ecological information
- Action 6. Preserve genetic diversity of the taxon
- Action 7. Disseminate information
- Action 8. Start translocation process (A translocation proposal has been prepared and plants have been grown and planted out at Waddington and Coorow)
- Action 9. Write full Recovery Plan

All of the recovery actions included in the previous plan are either ongoing or have not been completed, and therefore have been included in this revised plan. New recovery actions included in this plan are to map critical habitat, liaise with relevant land managers and Indigenous groups, and seek security of tenure for populations.

History

William Blackall collected the first specimen of *Chorizema humile* in 1931 from Cue, with other specimens found east of Geraldton (Kojareena) in 1967 and east of Dongara (Strawberry) in 1970. In August 1995, the species received intensive and specific survey work by Diana Papenfus in and around these localities, but none of the previously recorded populations were relocated. However during this survey a new population was found in the Coorow area. Further surveys in 1996 and 2000 found several more new populations with most occurring on road verges in the area between Coorow and Carnamah, and one east of Bindi Bindi (Moora Shire).

Description

Chorizema humile is a small, prostrate shrub that spreads to approximately 60 cm in diameter, with many slender stems radiating from a central root that are ridged with scattered hairs. It has obovate leaves that are 4 – 16 mm long and 2.5 – 5 mm wide, are arranged alternately along the stem and have a short awn-like projection. They taper at the base into a short petiole which has a pair of persistent stipules about 1 mm long. The pea flowers occur at the ends of the branchlets in racemes up to 18 cm long with up to 30 flowers in each on stalks up to 2.5 mm long. The petals are yellow with red-brown markings. The two upper lobes of the calyx join to form a lip with free tips. The calyx is hairy and tapered at the base. The standard petal is up to 9 mm long, the wing petals are gently curved to 8 mm long and the keel tapers to a protracted point and is almost as long as the wings. The style curves gently inward. The flowers appear between July and September.

Chorizema humile shows an affinity to three other species that have small yellow flowers with dull red markings and these are *C. parviflorum*, *C. racemosum* and *C. genistoides*. *C. parviflorum* can be distinguished from *C. humile* by its narrow to linear leaves. *C. racemosum* differs in its spinescent branchlets and linear leaves with revolute margins. *C. genistoides* is superficially similar to *C. humile*, but it differs in having erect or spreading spinescent branchlets, sparse leaves at flowering and keel petals much shorter than the wing petals.

Distribution and habitat

Chorizema humile is endemic to Western Australia and has historically been collected from Cue to Dowerin. Some doubt has been cast on historical collections (Davies 2000) as this species has been misidentified in the past. In addition a search for rare plants in the Cue area conducted in 1999 discovered a *Mirbelia* species of similar resemblance to *C. humile*. *C. humile* is currently known from 13 populations, all of which occur in the Coorow and Moora areas.

Table 1. Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. ESE of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
2. E of Carnamah	Moora	Carnamah	Shire of Carnamah	Road reserve	Shire
3A. NE of Bindi Bindi	Moora	Moora	Shire of Moora	Road reserve	Shire
3B. NE of Bindi Bindi	Moora	Moora	Freehold	Private Property	Landowners
4A. E of Bindi Bindi	Moora	Moora	Shire of Moora	Road reserve	Shire
4B. E of Bindi Bindi	Moora	Moora	Freehold	Private Property	Landowners
5A. E of Bindi Bindi	Moora	Moora	Shire of Moora	Road reserve	Shire
5B. E of Bindi Bindi	Moora	Moora	Freehold	Private Property	Landowners
5C. E of Bindi Bindi	Moora	Moora	Shire of Moora	Road reserve	Shire
6A. NE of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
6B. NE of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
7. NNE of Carnamah	Moora	Carnamah	Freehold	Private Property	Landowners
8. Coorow	Moora	Coorow	Shire of Coorow	Recreation	Shire
9. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
10A. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
10B. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
10C. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
10D. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
11. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
12. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners
13. E of Coorow	Moora	Coorow	Freehold	Private Property	Landowners

Populations in **bold text** are considered to be Important Populations.

Biology and ecology

Clinch (2002) showed that *Chorizema humile* is able to survive even after heavy grazing because it can reproduce through shoots, the individuals are long lived and the plants produce enough offspring over time to enable the population to recover. This study also showed that grazing greatly reduces the amount of flower and fruit produced but there are also other intrinsic, environmental or climatic factors affecting the efficiency of seed set. Apart from this study little is known about the biology and ecology of *C. humile*. It is thought that it may be pollinated by bull ants. This species is known to be easily propagated from cuttings.

A research project, conducted by staff of DEC's Threatened Flora Seed Centre (TFSC), is investigating possible causes for an observed low seed set at Population 1. After cages were installed in 1998, seed numbers have shown some improvement, but are still not as high as in Population 3.

A lack of recruitment has been observed at most populations. There are a number of possible causes including: low seed production; high flower, seed and/or seedling predation; and a lack of disturbance events to stimulate germination.

Little is known about the effects of fire on *Chorizema humile*. It is likely that the species requires occasional fire for the recruitment from soil-stored seed, but fire will destroy the plant and depending on the frequency of fires the plants may not reach reproductive maturity, leading to a depletion of the seed bank.

Threatening processes

Chorizema humile was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in October 1996, and ranked as Critically Endangered (CR) in 1998. It currently meets World Conservation Union (IUCN 2001) Red List Criteria Critical (CR) under criteria B1 + 2c as the thirteen populations are severely fragmented and habitat quality is poor. *C. humile* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The main threats are grazing, trampling, road maintenance activities, weed competition and inappropriate fire regimes.

- **Grazing and trampling** of road reserves by sheep being driven along roads is causing damage to Population 3a. The prostrate habit and delicate foliage of this species makes it particularly vulnerable. Not only are the *Chorizema humile* plants being damaged but the sheep are degrading the surround habitat by compacting the soil and their droppings are increasing nutrient levels and introducing weed species. Kangaroos (*Macropus fuliginosus*) and rabbits (*Oryctolagus cuniculus*) have had a major impact on most populations, even when the population has been fenced off, e.g. Population 1, 6, 10 and 13. Flowering and fruiting shoots are grazed affecting the amount of seed set for that year. In addition to the effect on adult *C. humile* plants, grazing is likely to impact on the establishment of *C. humile* seedlings, thus limiting the natural recruitment of the species.
- **Road maintenance activities** such as grading and construction of drainage channels pose a threat to Populations 2, 3, 4 and 5. Mowing of road verge vegetation could also impact on the habitat of this species. These disturbance events can stimulate seed germination, but also generally encourage weed invasion.
- **Weed competition** is a threat to Populations 2, 3, 4, 5, and 8 where dense areas of introduced grasses compete for soil moisture, nutrients and light. Weeds also exacerbate the risk of fire by increasing the fuel loads, and increase the threat of grazing by providing more green feed palatable to herbivores.
- **Inappropriate fire regimes** could adversely affect the viability of populations. Seeds of *Chorizema humile* probably germinate following fire and the soil seed bank would rapidly be depleted if fires recurred before regenerating or juvenile plants reached maturity and replenished the soil seed bank. However, it is likely that occasional fires are needed for reproduction of this species.

The intent of this plan is to provide actions that will deal with immediate threats to *Chorizema humile*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. No. & Location	Land Status	Year/No plants	Condition	Threats
1. ESE of Coorow	Private property	1995 17 1996 11 1998 47 2000 51 2006 20	Moderate	Grazing and trampling, inappropriate fire regime
2. E of Carnamah	Road Reserve	1996 1 1998 0	Extinct	Road maintenance activities, weed competition, inappropriate fire regime
3A. NE of Bindi Bindi	Road Reserve	1996 15 1998 16 (May) 1998 28 (Oct) 1999 37 2000 28 2006 37	Moderate	Road maintenance activities, grazing and trampling, weed competition, inappropriate fire regime
3B. NE of Bindi Bindi	Private property	1996 4 1998 7 1999 8 2000 5 2006 7	Moderate	Grazing and trampling, inappropriate fire regime

4A. E of Bindi Bindi	Road Reserve	1999 18 2000 3 2006 3	Poor	Road maintenance activities, grazing and trampling, weed competition, inappropriate fire regime
4B. E of Bindi Bindi	Private Property	2006 2	Poor	Grazing and trampling, inappropriate fire regime
5A. E of Bindi Bindi	Road Reserve	1999 ? 2000 0 2006 7	Poor	Road maintenance activities, grazing and trampling, weed competition, inappropriate fire regime
5B. E of Bindi Bindi	Private Property	2006 6	Poor	Grazing and trampling, inappropriate fire regime
5C. E of Bindi Bindi	Road Reserve	2006 1	Poor	Road maintenance activities, grazing and trampling, weed competition, inappropriate fire regime
6A. NE of Coorow	Private property	1999 76 2006 1	Poor	Grazing and trampling, inappropriate fire regime
6B. NE of Coorow	Private property	1999 24 2006 3	Poor	Grazing and trampling, inappropriate fire regime
7. NNE of Carnamah	Private property	2002 3	Poor	Grazing and trampling, inappropriate fire regime
8. Coorow	Shire Reserve	2003 740 2006 3	Poor	Grazing and trampling, inappropriate fire regime, lack of recruitment
9. E of Coorow	Private Property	2000 8 2006 10	Poor	Grazing and trampling, inappropriate fire regime
10A. E of Coorow	Private Property	2000 2 2006 1	Poor	Grazing and trampling, inappropriate fire regime
10B. E of Coorow	Private Property	2000 18 2006 1	Poor	Grazing and trampling, inappropriate fire regime
10C. E of Coorow	Private Property	2000 8 2006 0	Poor	Grazing and trampling, inappropriate fire regime
10D. E of Coorow	Private Property	2000 1 2006 0	Poor	Grazing and trampling, inappropriate fire regime
11. E of Coorow	Private Property	2000 5 2006 1	Poor	Grazing and trampling, inappropriate fire regime
12. E of Coorow	Private Property	2000 2 2006 1	Poor	Grazing and trampling, inappropriate fire regime
13. E of Coorow	Private Property	2006 9	Poor	Grazing and trampling, inappropriate fire regime

Note: All populations are considered to be important populations

Guide for decision-makers

Table 2 provides details of current and possible future threats. Developments in the immediate vicinity of the populations or within the defined habitat critical to the survival of *Chorizema humile* require assessment for the potential for a significant level of impact.

Habitat critical to the survival of *Chorizema humile* and important populations

Given that *Chorizema humile* is ranked as CR (WA), it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *C. humile* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Chorizema humile* will also improve the status of associated native vegetation. Population 7 of *C. humile* occurs in association with an Endangered taxa, which is listed in the table below:

Conservation-listed flora species occurring in habitat of *Chorizema humile*

Species name	Conservation Status (Western Australia)	Conservation Status (EPBC Act)
<i>Darwinia</i> sp. Carnamah (J.Coleby-Williams 148)	DRF, Endangered	Endangered

For a description of the priority categories see Atkins (2008)

Threatened Ecological Community (TEC) in which *Chorizema humile* occurs in association

Community Name	Conservation status (WA)
Plant Assemblages of the Inering Hills	Vulnerable

For a description of the TEC categories see DEC (2007)

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993 and will assist in implementing Australia's responsibilities under that Convention. *Chorizema humile* is not listed under any specific international treaty however, and this recovery plan does not affect Australia's obligations under any other international agreements.

Indigenous consultation

The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of populations of *Chorizema humile* and no Indigenous communities that may be interested or involved in the area affected by this plan have been identified. However, not all significant sites are listed on the Register. The involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for Indigenous communities in the recovery of this species, opportunities may exist through cultural interpretation and awareness of the species.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and the Department of Indigenous Affairs is being sought to assist in the identification of potential Indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for threatened species conservation.

Continued liaison between DEC and the Indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. However, as all *Chorizema humile* populations occur on private property and road and Shire reserves, the protection of the species at these sites may potentially affect development and asset protection measures. Recovery actions refer to continued liaison between stakeholders with regard to populations located on private property and Shire managed lands.

Affected interests

The implementation of this plan has some implications for land managers, particularly where populations occur on lands not specifically managed for conservation. The occurrence of *Chorizema humile* populations on private property will have implications for the property owners. Where it occurs on road reserves under the care, control and management of the local Shire, the authority will be required to ensure protection of those populations. Recovery actions refer to continued liaison between stakeholders with regard to all of these areas.

Evaluation of the plan's performance

DEC, in conjunction with the Moora District Threatened Flora Recovery Team, will evaluate the performance of this recovery plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following four years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this recovery plan is to continue to abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the species in the wild.

Criteria for success: The number of populations has increased or number of individuals within populations has increased by ten percent or more over the term of the plan.

Criteria for failure: The number of populations has decreased or number of individuals within populations has decreased by ten percent or more over the term of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

Populations 1, 4 and 5 and Subpopulations 3a, 3b, were monitored in 2000. Roadside Declared Rare Flora (DRF) markers were moved at Population 3a and 4 to include the plants occurring outside the current boundary.

To prevent damage to plants from grazing and trampling, cages were installed over a number of individual plants at Populations 1 and 3.

A stock-exclusion fence was erected around Subpopulation 3a in 1997. Subsequent monitoring found the subpopulation was still sustaining damage from kangaroos so wire netting cages were installed over all seven *Chorizema humile* plants. Plants in Subpopulation 3b were also fitted with steel mesh cages to prevent grazing and trampling damage to the *C. humile* during stock movement activities.

Stephen Davies¹ conducted a five day survey for new populations of *Chorizema humile* in areas around Dowerin, Goomalling and Dalwallinu, in September 2000. The areas searched were sites where herbarium specimens were originally collected 20 years ago and have not been relocated. Although no plants were found in these areas, nine new populations were found in the Coorow area, all on private property. A voucher specimen was not submitted to the herbarium for these new populations and the description and coordinates for each of the populations was not detailed enough to be added to the DEC threatened flora database (DEFL). All nine populations need to be revisited to obtain a specimen, a more accurate GPS location and information to complete a Rare Flora Report Form.

As part of a Bachelor of Environmental Science degree at Murdoch University, a study was completed by Melanie Clinch in November 2002 entitled "The population structure of the rare plant *Chorizema humile* in relation to its conservation". The study examined the population structure and reproductive biology of *C. humile* and found the level of bud, flower and fruit production of plants was closely related to the level of grazing experienced. The study concluded the conservation status of this species could be improved if the plants were protected from grazing.

Seed was collected from 20 plants from Population 6 in November 1999, resulting in just fewer than 400 seeds being stored at -18° C in DEC's Threatened Flora Seed Centre (TFSC). The TFSC test the viability of the seed initially, after one year in storage, and again after five years. The initial germination rate of this seed was found to vary from 50% to 80%, and after one year in storage the germination rate was 100%. In November 2004, a

¹ Consultant

further collection of 450 seeds was made from eight plants from Population 3 and is also currently stored at the TFSC. This material is still being processed so the germination rate is not yet known.

An information sheet for *Chorizema humile* was produced in a joint effort with the Natural Heritage Trust and DEC. It contains colour photographs, a description of the plant, its habitat type, threats and management actions. The information sheets are available to anyone or group interested in threatened flora management and have been distributed to landholders whose lands contain the species or are in the area of the known populations.

Chorizema humile is one of the species described in a DEC bush book entitled 'Threatened Wildflowers of the Mid-West' (Chant 2002). This popular small book series is available to the general public for purchase from bookstores and several other outlets throughout Western Australia.

Ongoing and future recovery actions

Funding was acquired in 2006 through the Biodiversity Conservation Initiative scheme to support a translocation for *Chorizema humile*. A Translocation Proposal is currently being prepared.

The Moora District Threatened Flora Recovery Team (MDTFRT) will oversee the implementation of this recovery plan and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Staff from DEC's Moora District Office regularly monitor known populations.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The MDTFRT will coordinate recovery actions for *Chorizema humile* and other DRF in the Moora District. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	DEC (Moora District) through the MDTFRT
Cost:	\$900 per year

2. Undertake and monitor translocation

Translocation is essential for the conservation of this species, as the road verges and private property on which all populations occur are not secure from threats including weeds, fire and physical destruction. Information on the translocation of threatened animals and plants in the wild is provided in CALM Policy Statement No 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require approval by the Director of Nature Conservation.

Action:	Undertake and monitor translocation
Responsibility:	DEC (Science Division, Moora District) through the MDTFRT
Cost:	\$13,000 in years 1 and 2; \$1,600 per year thereafter

3. Undertake weed control and follow-up with regular monitoring and additional control if required

Weeds are a major threat to Populations 2, 3, 4, 5 and 8 of *Chorizema humile*. The following actions will be implemented in consultation with relevant land managers.

1. Select an appropriate herbicide after determining which weeds are present.

2. Control invasive weeds by hand removal or spot spraying around *Chorizema humile* plants when weeds first emerge.
3. Schedule weed control to include spraying at other threatened flora populations within the District.
4. Regularly monitor weeds and implement additional weed control if required.

The tolerance of associated native plant species to herbicides at the site of *Chorizema humile* is not known and weed control programs will be undertaken in conjunction with research following Adaptive Management principles.

Action: Undertake weed control and follow-up with regular monitoring and additional control if required
Responsibility: DEC (Moora District, Science Division) through the MDTFRT
Cost: \$1,200 per year

4. Monitor populations

Monitoring factors such as weed densities, habitat degradation, fence integrity, population stability (expansion or decline), pollination activity, seed production, recruitment and longevity needs to be undertaken on a regular basis. The visibility of the DRF markers will be monitored and maintenance will be conducted when required. Individual plants that are not protected with a mesh cage will be fitted with one during the monitoring trips.

Action: Monitor populations
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$1,150 per year

5. Conduct further field surveys

Further surveys for the taxon will be undertaken during its flowering period (July to September) on a systematic basis in areas of suitable habitat. Appropriate habitat on private lands will be surveyed where possible. Volunteers from the local community, Wildflower Societies, Naturalist Clubs and other community-based groups will be invited to participate in surveys supervised by DEC staff.

Action: Conduct further field surveys
Responsibility: DEC (Moora District) through MDTFRT
Cost: \$3,500 in years 1, 3 and 5

6. Seek security of tenure for populations

The conservation status of private and other non conserved land that supports populations will be reviewed and the possibility of purchase and/or a change of land tenure investigated. Protecting important populations on private land through conservation covenants or registration with the Land for Wildlife or other private land conservation schemes will also be investigated. This action will secure habitat on which *Chorizema humile* can be managed and promote conditions that will result in an increase in the size and health of populations.

Action: Seek security of tenure for populations
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$1,900 in year 1, \$400 in subsequent years

7. Map habitat critical to the survival of the species

Although habitat critical to the survival of the species is described in Section 1, all the areas described have not yet been accurately mapped and will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of the species
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$2,500 in year 1

8. Liaise with relevant land managers and Indigenous groups

As all of the populations occur on lands not managed by DEC, close liaison with land managers is essential in ensuring good and cooperative management of the species. Input and involvement will also be sought from any Noongar groups that have an active interest in areas that are habitat for *Chorizema humile*.

Action: Liaise with relevant land managers and Indigenous groups
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$1,200 per year

9. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Chorizema humile* will provide a better scientific basis for management of wild populations. An understanding of the following is particularly necessary for effective management:

1. Investigate the species response to disturbance, including fire, following Adaptive Management principles.
2. Investigate the species pollination biology.
3. Investigate the levels of flower and fruit production.
4. Investigate seed longevity and viability.
5. Investigate conditions necessary for germination.
6. Determine longevity of plants and time taken to reach maturity.
7. Investigate genetic diversity.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Moora District) through the MDTFRT
Cost: \$13,000 in years 1 to 3 and \$18,000 in year 4

10. Promote awareness

While some public awareness material has been produced for *Chorizema humile* other avenues such as a poster and media articles would also be highly beneficial. Given that this species is quite cryptic until it flowers, especially if heavily grazed, a poster containing this plant and other Critically Endangered species for the area and what CR means will be produced and displayed in the local shire offices and libraries.

Action: Disseminate information
Responsibility: DEC (Moora District, Species and Communities Branch) through the MDTFRT
Cost: \$1,500 in year 1 and \$1,000 in years 2 to 5

11. Collect seed for long term storage and future translocation

It is important to preserve an *ex situ* genetic 'blueprint' of a rare taxon and to store germplasm as a genetic resource that can be available for translocation purposes. *Chorizema humile* germinates adequately from seed and this is the preferred method and storage option. Vegetated material is only used when seed can not be propagated. Seed has been collected from Populations 1, 3 and 6 so collections from the remaining populations are required.

Action: Collect seed for long term storage and future translocation
Responsibility: DEC (Moora District, Threatened Flora Seed Centre) through the MDTFRT
Cost: \$1,550 per year in years 1 and 5

12. Develop and implement a fire management strategy

Little is known about the effects of fire on *Chorizema humile*. It is likely that the species requires occasional fire for recruitment from soil-stored seed, but frequent fires may be detrimental to its long-term survival. Fire also promotes the introduction and proliferation of weed species which will compete with this species.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$2,500 in year 1 and \$1,500 per year thereafter

13. Review this plan and assess the need for further recovery actions

If *Chorizema humile* is still ranked Critically Endangered (WA) at the end of the five-year term of this recovery plan, the need for further recovery actions, or a review of this recovery plan will be assessed and a revised plan prepared if necessary.

Action: Review this plan and assess the need for further recovery actions
Responsibility: DEC (Moora District) through the MDTFRT
Cost: \$1,500 in year 5

Table 3. Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	MDTFRT	Ongoing
Undertake and monitor translocation	High	DEC (Science Division, Moora District) through the MDTFRT	2013
Undertake weed control and follow-up with regular monitoring and additional control if required	High	DEC (Moora District, Science Division) through the MDTFRT	Ongoing
Monitor populations	High	DEC (Moora District) through the MDTFRT	Ongoing
Conduct further field surveys	High	DEC (Moora District) through the MDTFRT	2013
Seek security of tenure for populations	High	DEC (Moora District) through the MDTFRT	Ongoing
Map habitat critical to the survival of the species	Medium	DEC (Moora District) through the MDTFRT	2009
Liaise with relevant land managers and Indigenous groups	Medium	DEC (Moora District) through the MDTFRT	Ongoing
Obtain biological and ecological information	Medium	DEC (Moora District, Science Division) through the MDTFRT	2013
Promote awareness	Medium	DEC (Moora District, Species and Communities Branch (SCB)) through the MDTFRT	2013
Collect seed for long term storage and future translocation	Medium	DEC (Moora District, Threatened Flora Seed Centre) through the MDTFRT	2013
Develop and implement a fire management strategy	Medium	DEC (Moora District) through the MDTFRT and relevant authorities	Develop by 2009 with implementation ongoing
Review the need for further recovery actions	Medium	DEC (Moora District, SCB) through the MDTFRT	2013

4. TERM OF PLAN

Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If *Chorizema humile* is still ranked CR (WA) after five years, this IRP will be reviewed and, if necessary, further recovery actions put in place.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

- Taylor, J. M. and Crisp, M. D. (1992) A Revision of *Chorizema* (Leguminosae: Mirbelieae). *Australian Systematic Botany* 5(3): 249-335.

Chorizema humile

Small *shrub*; *branches* sprawling, prostrate or decumbent, c. 35 cm long, striate or ridged, with scattered, peltate, fusiform hairs. *Leaves* alternate, obovate, obtuse, emarginate or rarely acute at the apex, mucronate, tapered into the petiole, 4-16 x 2.5-5 mm, ± complicate, with appressed hairs or almost glabrous; margins slightly recurved; venation brochidodromous, midrib raised on the underside; *petioles* 0.5-1.5 mm long; *stipules* subulate, c. 1 mm long, persistent. *Racemes* terminal, 7-18 cm long with up to 30 flowers. *Pedicels* 2-2.5 mm long; *bracts* narrow-ovate, 1.5-2mm long, persistent; *bracteoles* very narrow-ovate, c. 0.75 mm long, attached to the pedicel close to the calyx, persistent. *Calyx* tapered at the base, 3.5-4.5 mm long, with peltate, fusiform hairs; upper two lobes united into a truncate emarginate lip, the tips free c. 0.75 mm; lower three lobes a little shorter, acute, c. 1.75 mm long. *Corolla* dull yellow with red-brown markings: *standard* depressed ovate, shallowly emarginate, 7-9 x 7-9 mm including 3.5-4 mm long claw; *wings* oblong-obovate, curved, scarcely auriculate, 7-8 x 2-2.5 mm including 2-2.5 mm claw; *keel* almost as long as the wings, ± ovate, acuminate or attenuate at the apex, rarely acute, partly inflated, auriculate, 6-7.5 x 1.5-2.5 mm including 2-3 mm claw. *Stamens* with filaments 4-6 mm long; *anthers* versatile, c. 0.4 mm long. *Gynoecium* 6-7 mm long including 1-1.5 mm stipe and gently incurved style 1.75-2.5 mm; stigma capitate, very small; ovary with dense, appressed hairs; *ovules* 14-21. *Pod* and *seed* not seen.

Flowering period. July to September. *Fruiting period.* Unknown.

Distribution. Western Australia: Irwin and Austin Districts. *Chorizema humile* has been collected from a small area which includes Kojarena, east of Geraldton, and Strawberry, Carnamah and Coorow to the south-east. As this species has been collected infrequently, further field work may extend the known distribution.

Habitat. *Chorizema humile* has been observed growing on sandy clay or red loam. Composites are the only associated flora recorded.

Affinity. *Chorizema humile* shows an affinity to three other species which have small yellow flowers with dull red markings, viz. *C. parviflorum*, *C. racemosum* and *C. genistoides*. *C. parviflorum* has leaves narrow to linear, and usually elliptic, with recurved margins. *Chorizema racemosum* has branchlets which are usually spinescent and leaves linear with revolute margins. *C. genistoides* although superficially similar to *C. humile* differs in having erect or spreading spinescent branches, leaves sparse at flowering, stipules minute and caducous, bracts caducous, calyx rounded at the base, keel much shorter than the wings, and the style abruptly incurved.

SUMMARY OF RECOVERY ACTIONS AND COSTS

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	DEC	Other	Ext.	DEC	Other	Ext.	DEC	Other	Ext.	DEC	Other	Ext.	DEC	Other	Ext.
Coordinate recovery actions	650		250	650		250	650		250	650		250	650		250
Undertake and monitor translocation	5000		8000	5000		8000	700		900	700		900	700		900
Undertake weed control and follow-up with regular monitoring and additional control if required	1000		200	1000		200	1000		200	1000		200	1000		200
Monitor populations	650		500	650		500	650		500	650		500	650		500
Map habitat critical to the survival of the species	500		2000												
Conduct further field surveys	1000	1200	1300				1000	1200	1300				1000	1200	1300
Liaise with relevant land managers and Indigenous groups	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Obtain biological and ecological information	500	2500	10000	5500	2500	5000	5500	2500	5000	13000	0	5000			
Promote awareness	1000		500	500		500	500		500	500		500	500		500
Collect seed for long term storage and future translocation	600		950										600		950
Develop and implement a fire management strategy	550		1950	550		950	550		950	550		950	550		950
Seek security of tenure for populations	800	800	300	200		200	200		200	200		200	200		200
Review this plan and assess the need for further recovery actions													1500		
Total	12650	4900	26350	14450	2900	16000	11150	4100	10200	17650	400	8900	7750	1600	6150
Yearly Total	43,900			33,350			25,450			26,950			15,500		

Ext. = External funding (funding to be sought), Other = in kind contribution by landholders, local government etc, DEC = in kind contribution by various DEC divisions.

Total DEC: \$63,650
 Total Other: \$13,900
 Total External Funding: \$67,600
Total costs: \$145,150