INTERIM RECOVERY PLAN NO. 105

Plant assemblages of the Moonagin System

Interim Recovery Plan

2002-2007

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Photograph: Sheila Hamilton-Brown

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Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management Policy Statements Nos 44 and 50.

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.

The Department is committed to ensuring that Critically Endangered, and where appropriate and feasible, other threatened ecological communities are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans. The Department will also ensure that conservation action commences as soon as possible and always within three years of endorsement of the Vulnerable rank.

This IRP will operate from May 2002 to May 2007 but will remain in force until withdrawn or replaced.

The provision of funds identified in this IRP is dependent on budgetary and other constraints affecting the Department, as well as the need to address other priorities.

Information in this IRP was accurate at 3 May 2002.

SUMMARY

Name: Plant assemblages of the Moonagin System.

Description: Plant assemblages of the Moonagin System (Beard 1976) cover the fine-grained Archaean rocks of the Moonagin and Milhun Ranges. The overall ecological community of the Beard system comprises *Acacia* spp. scrub on red soil on the summits and slopes of the hills; *Acacia* spp. scrub with scattered *Eucalyptus loxophleba* and *Eucalyptus oleosa* on red loam flats on the foothills; and *E. loxophleba* woodland on red loam flats of the pediments.

IBRA Bioregion: Geraldton Sandplains

Department Region: Midwest Region

Department District: Geraldton work centre

Shire: Morawa

Recovery Team: Geraldton District Threatened Flora Recovery Team

Current status: Assessed by the Threatened Ecological Community (TEC) Scientific Advisory Committee on 29 October 1999 as Vulnerable. The ranking was endorsed by the Department's Director of Nature Conservation on 24 November 1999, and by the Minister for the Environment and Heritage on 6 November 2001.

IRP Objective(s): To maintain the overall health of the community and reduce the level of threat to ensure the community does not move to the Endangered category.

Critical Habitat: The area of occupancy of the occurrences corresponding to the rounded hills of Archaean metamorphic rock as expressed in the Moonagin and Milhun Ranges.

Criteria for success: Maintenance of the diversity and composition of the native species in the community and of the full range of its occurrences.

Criteria for failure: An increased level of modification of the occurrences of the community as measured by a decline in the diversity and composition of the native species and increase in weed diversity or extent.

Summary of Recovery Actions

1. Map the components of the community	7.Study the fire ecology of the community
2. Liaise with current owners and land managers to fence occurrences and restrict grazing by domestic stock	8. Design and implement appropriate fire management plans
3. Monitor the extent and boundaries of the community	9. Investigate the effects of kangaroo grazing on the Threatened Ecological Community
4. Design and implement a program for flora monitoring	10. Design and implement a management program for kangaroos
5. Design and implement weed control strategy	11. Seek to acquire occurrences for the conservation estate when available
6. Implement replanting and rehabilitation where necessary	

1 BACKGROUND

History, defining characteristics of ecological community, and conservation significance

The Moonagin and Milhun Ranges, north-east of Morawa, comprise a group of low rounded granite hills formed from Archaean metamorphic rock (Baxter and Lipple 1985). They have a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features. This catenary sequence or 'system' (herein known as the Moonagin System) has a distinctive geology, topography and plant community, different from land surrounding it and from that of any other comparable system (eg. Koolanooka and Billeranga Systems; Beard 1976).

Beard (1976) describes the plant community on the Moonagin System as *Acacia* spp. scrub (*A. ramulosa* subsp. *ramulosa* and *A. acuminata*, with the occasional *A. tetragonophylla* and *A. quadrimarginea*) on red soil of the summits and slopes of the hills; *Acacia* spp. (*A. ramulosa* subsp. *ramulosa*, *A. acuminata* and *A. tetragonophylla* scrub with scattered *Eucalyptus oleosa* and *E. loxophleba;* and *E. loxophleba* woodland on red loam flats of the pediments. There are also areas of *Melaleuca uncinata* thickets along creeklines, and *E. salmonophloia* on clay patches on the summits of the lower hills (L. North, personal communication[1]). An *Acacia anuera* over herbs assemblage is also thought to exist (J. North, personal communication [2]), and investigations to confirm this are given high priority in this Interim Recovery Plan (IRP).

Very little survey work has occurred on the hills and hence there is very little documentation of other plant species associated with each plant assemblage. Consequently, the author established a 10 m x 10 m quadrant in each of the *Acacia ramulosa* subsp. *ramulosa* scrub on the hill summits, and the *Melaleuca uncinata* on creeklines assemblages on occurrence 1 in October 2000 (Appendix 1).

Description of occurrences

The Moonagin Range – located 18 km north west of Morawa - has been fragmented into two smaller and one large occurrences as a result of clearing (for agricultural purposes) of the lower-lying areas. The Milhun Range – located two km south east of the Moonagin Range – comprises two occurrences, originally one, but fragmented at the lower-lying area of the southern portion for a road access.

All the occurrences are privately owned, none are fenced and all are currently threatened by grazing, weed invasion and inappropriate fire regimes (Table 1).

Table 1: Summary of occurrence information and threats

Range	Occ.	Land Status	Area (ha)	Condition*	Threats
Moonagin	1	Private land and Trig point	675	Slightly to moderately modified	Grazing, clearing, weed invasion and inappropriate fire regimes
	4	Private land	47.5	Highly modified	Grazing, weed invasion and inappropriate fire regimes
	5	Private land	52.5	Highly modified	Grazing, weed invasion and inappropriate fire regimes
Milhun	2	Private land	594	Highly modified	Grazing, clearing, weed invasion and inappropriate fire regimes
	3	Private land	66.25	Moderately modified	Grazing, weed invasion and inappropriate fire regimes

*NB: Only occurrences 1 and 2 have been surveyed to date. The condition of other occurrences has been estimated from aerial photographs, roadside observations and landowner assessments.

[1] Laurie North – Nursery Proprietor, Morawa.
[2] Joe North – Landowner, Morawa.

Critical Habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media (a) occupied (continuously, periodically or occasionally) by an organism or group of organisms; or (b) once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind that the potential to be reintroduced (sections 207A and 528 of Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat for the plant assemblage of the Moonagin System comprises the area of occupancy of the known occurrences as expressed in the rounded granite hills of the Moonagin and Milhun Ranges and encompasses:

- red soil on the summit and slopes of the granite hills
- red alluvial clay loam on the pediments.

Biological and ecological characteristics

Important factors affecting community composition and structure are aspect, soil/substrata types and depths, fire history and moisture regimes. There has been no study of any of these aspects of the community's ecological characteristics, and such investigations are given high priority in this IRP.

Threatening processes

It is estimated that sixty per cent of the Moonagin System remains and that much of the plant assemblages have been modified. Threatening processes include:

Grazing

None of the occurrences are fenced and all sites are grazed by sheep. This has caused alterations to the species composition by the selective grazing of edible species, the introduction of weeds and nutrients, trampling and general disturbance.

A decrease in the proportion of remnant vegetation, an increase in the availability of water and the palatability of agricultural crops has led to a huge increase in the number of Western Grey Kangaroo (*Macropus fuliginosus*) residing in the ranges. If and when the occurrences are fenced, and accessibility to domestic stock is restricted, there may still be considerable grazing pressure exerted by kangaroos on the threatened ecological community (TEC).

Weed invasion

Weeds can have significant impacts on a community through competition with the native species, prevention of regeneration and alteration to fire regimes (Hobbs and Mooney 1993). Combined disturbances such as fires and grazing can predispose areas to weed invasion if weed propagules are present. All occurrences of this community are adjacent to agricultural areas that act as weed sources, and are vulnerable to weed invasion following any disturbance.

Altered fire regimes

Fire can cause alterations to the species composition by increasing the number of weeds. As well, an increase in the frequency of fire can prevent species from completing growth and reproductive cycles.

Clearing

Clearing for agriculture in the Shire of Morawa has been extensive but approximately 20% of the original vegetation remains (D. Shepherd, personal communication[3]). Any proposals to clear the TEC would be subject to assessment in accordance with the Memorandum of Understanding for the

[3] Damian Shepherd - Research Officer, Department of Agriculture.

protection of remnant vegetation on private land in the agricultural region of Western Australia (Government of Western Australia 1997).

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the occurrences require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the ecological community.

Current status

The 'Plant assemblages of the Moonagin System' community meets the following criterion for Vulnerable (VU):

> *B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.*

Recovery strategy

In close liaison with landowners, devise recovery actions for all occurrences and promote and assist their conservation.

To conduct appropriate research into the ecology of the community and develop further understanding about the management actions required to maintain or improve its condition.

2 RECOVERY AIM AND CRITERIA

Aim

- To improve the long term security of the plant community by protecting and maintaining the known occurrences, and reducing the level of threat so that the community will not move into a higher category of threat.

Criteria for success

- Improvement in the condition of known occurrences of the community measured by a reduction in grazing pressure, weed invasion and inappropriate fire regime by encouraging landholders to fence occurrences, reduce grazing where necessary, implement weed control strategies and fire management plans.
- No further loss of area covered by the community.

Criterion for failure

- Significant clearing of the community and/or sustained or increased level of modification of occurrences of the community as measured by a decline in the diversity and composition of the native species and increase in weed diversity or extent.

3 RECOVERY ACTIONS

3.1 Existing Recovery Actions

All land managers and owners have been notified of the importance of the TEC. Their cooperation will continue to be sought to ensure that on-farm activities do not affect the occurrences. As well, permission and cooperation will be sought prior to any recovery actions.

The Geraldton District Threatened Flora Recovery Team (GDTFRT) is the recovery team for this ecological community and is responsible for overseeing Recovery Actions. The Recovery Team will continue to report annually to the Department's Corporate Executive.

3.2 Required Recovery Actions

The following recovery actions are roughly in order of descending priority. However this should not constrain addressing any of the other priorities if specific opportunities arise.

3.2.1 Map the components of the community

A vegetation map demarcating the boundaries of each plant assemblage, and the species associated with each assemblage should be produced using aerial photography and ground survey. This information will be added to the Department's TEC database as recommended in English and Blyth (1999).

Responsibility: Western Australian Threatened Species and Communities Unit (WATSCU) and Geraldton work centre through the GDTFRT
Estimated cost: $10,000
Completion date: Year 5.

3.2.2 Liaise with current owners and managers to fence occurrences

Liaise with landowners/managers and seek to fence occurrences to ensure stock is excluded and vehicle access can be limited to management needs, as well as take into account any recreational needs. This may include seeking funds on behalf of the landowners. At the same time, landowners will be encouraged to seek long-term protection for the community through covenants or management agreements that may include fencing grants.

Responsibility: WATSCU, Geraldton work centre and Covenanting Section through the GDTFRT
Estimated cost: $575 p.a.
Completion date: On-going.

3.2.3 Monitor the extent and boundaries of the community

The extent and condition of known occurrences should be determined and monitored. The boundary of the occurrences should be monitored regularly (approximately every three years or after a disturbance event such as fire) and can be defined from aerial photographs and annual ground-truthing. This information will be added to the TEC database.

Responsibility: WATSCU and Geraldton work centre through the GDTFRT
Estimated cost: $3,000 for the establishment of baseline information, $1,000 for subsequent monitoring
Completion date: On-going.

3.2.4 Design and implement a program for flora monitoring

Data collected will include plant species diversity and weed levels. Occurrences will be monitored regularly to provide information on condition. Some baseline data has been gathered from quadrats established in October 2000, and an ongoing program will include the establishment of additional permanent quadrats on other occurrences, including areas that may have been burnt or otherwise disturbed. It will also entail taking photopoints and photoplots annually (Elzinga *et al*. 2001). Information gathered will be added to the TEC database.

Responsibility: WATSCU and Geraldton work centre through the GDTFRT
Estimated cost: $1500 per year
Completion date: On-going.

3.2.5 Design and implement weed control strategy

All occurrences are surrounded by agricultural land, subjected to varying grazing intensities and varying degrees of weed infestation. A weed control strategy is required that takes into account the nature of the community and the need for continuing maintenance. The weed control program should include:

1. Determining which weeds and native species are present and prioritising the weed threats (recovery action 3.2.4).
2. The selection of the appropriate herbicide, application technique and the setting of priorities for treatment.
3. The control of invasive weeds by hand or spot spraying as soon as the weeds emerge.

Responsibility: Geraldton work centre through the GDTFRT
Estimated cost: WATSCU and Geraldton work centre to determine costs and seek funds
Completion date: On-going.

3.2.6 Study the fire ecology of the community

Seek funds for research into recovery of the community from fire, and to determine the implications of findings for management (eg. preservation of seed for future re-introduction in case of too frequent wild fires or prescribed burning). This would also include developing a fire history map of the occurrences, to be updated regularly.

Responsibility: Geraldton work centre and Science Division WATSCU and Geraldton work centre through the GDTFRT
Estimated cost: WATSCU and Geraldton work centre to determine costs and seek funds
Completion date: Ongoing.

3.2.7 Design and apply appropriate fire management plans

Fire management plans will be developed with landowners and the relevant authorities. Each plan should deal with issues such as knowledge of the recovery of the community and its component species from fire (derived from information in recovery action 3.2.6); minimising wildfires; the need for, design and position of firebreaks/fire-fighting access tracks; and fire management including the need for and design of prescribed fire and fire suppression. Each plan should include an annual fire monitoring and reporting schedule.

Responsibility: Geraldton work centre through the GDTFRT in conjunction with landowners
Estimated cost: Geraldton work centre to determine costs and seek funds through other sources
Completion date: Ongoing.

3.2.8 Implement replanting and rehabilitation where necessary

Seek to replant and rehabilitate the occurrences on degraded areas (eg. edges, heavily stocked areas), or where native species are no longer capable of regenerating following weed control or considerable soil disturbance, particularly if they are prone on the same sub-communities. The appropriate species can be identified from existing and proposed quadrat data (recovery action 3.2.4). These should then be propagated from seed collections taken from elsewhere in the community (ensuring that reserves are not depleted) or stock from surrounding areas.

Responsibility: Geraldton work centre through the GDTFRT
Estimated cost: WATSCU and Geraldton work centre to determine costs and seek funds
Completion date: On-going.

3.2.9 Investigate the effects of kangaroo grazing on the TEC

This will include determining the current population (index of abundance) size of the kangaroos using spotlighting and dung pellet techniques (Arnold and Maller 1987) and determining an acceptable level of grazing.

Responsibility: Geraldton work centre and Nature Protection Branch through the GDTFRT in conjunction with landowners
Estimated cost: Geraldton work centre and Nature Protection Branch to determine costs
Completion date: Ongoing.

3.2.10 Design and implement a management program for kangaroos

Design and implement a management program for kangaroos if investigations (recovery action 3.2.9) show it to be necessary to protect the TEC.

Responsibility: Geraldton work centre and Wildlife Conservation Section through the GDTFRT in conjunction with landowners
Estimated cost: Geraldton work centre and Wildlife Conservation Section to determine costs
Completion date: Ongoing.

3.2.11 Seek to acquire occurrences for the conservation estate when available

To secure the long-term recovery of this community, the Department of Conservation and Land Management will, consistent with other priorities for acquisition, seek funds for purchase of freehold land, and negotiate with landowners to acquire land if and when they become available. Such areas should then be declared Class A reserves for the purpose of 'Conservation of Flora and Fauna' and vested in the Conservation Commission.

Responsibility: WATSCU, Midwest Region and Land Administration Section
Estimated cost: Market/valuation basis.

4 TERM OF PLAN

This Interim Recovery Plan (IRP) will operate from May 2002 for five years but will remain in force until withdrawn or replaced.

5 ACKNOWLEDGMENTS

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

John Blyth	Principal Ecologist, Department of Conservation and Land Management
Anthony Desmond	Regional Leader Nature Conservation Midwest Region, Department of Conservation and Land Management
Robert Gomer	Volunteer, Perth
Max Johnson	Landholder, Morawa
Joe and Lynn North	Landholders, Morawa
Peter Mawson	Senior Zoologist, Department of Conservation and Land Management

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Appendix 1: List of species found on selected occurrences of the Moonagin System (NB: List is not exhaustive)

	Occurrence		
Species	**1** (quadrant plot)	**2** (ground survey)	**3** (roadside view)
Acacia acuminata subsp. *acuminata*	+	+	+
Acacia blakelyi	+		
Acacia colletioides	+		
Acacia exocarpoides	+		
Acacia kochii	+	+	
Acacia quadrimarginea	+	+	+
Acacia ramulosa var. *ramulosa*	+	+	+
Acacia spathulifolia	+		
Acacia tetragonophylla	+	+	+
Allocasuarina huegeliana		+	
Austrostipa elegantissima	+		
Austrostipa trichophylla	+		
**Avena barbata*	+	+	+
Borya sphaerocephala		+	
Calycopeplus paucifolius		+	
Cephalipterum drummondii	+	+	+
Cheilanthes sieberi subsp. *sieberi*	+		
Dichopogon capillipes		+	
Dioscorea hastifolia		+	
Dodonaea inaequifolia	+	+	+
Dodonaea microzyga	+	+	
Eucalyptus loxophleba	+	+	+
Eucalyptus oleosa		+	+
Eucalyptus salmonophloia	+		
Goodenia pinnatifida	+		
Grevillea levis	+		
Melaleuca uncinata	+		+
Mirbelia trichocalyx	+	+	
Podolepis canescens	+		
Ptilotus obovatus var. *obovatus*	+	+	+
Santalum acuminatum	+	+	
Schoenia cassiniana	+		
Senna artemisioides	+	+	+
**Sisymbrium orientale*	+	+	+
**Solanum hoplopetalum*		+	+
Waitzia acuminata	+		
Waitzia nitida	+	+	+

* weed species

Summary of costs for each Recovery Action

	Year				
Recovery action	**1**	**2**	**3**	**4**	**5**
1. Map the components of the community	$10,000	-	-	-	-
2. Liaise with current owners and land managers to fence occurrences	$575	$575	$575	$575	$575
3. Monitor the extent and boundaries of the community	$3,000	$1,000	$1,000	$1,000	$1,000
4. Design and implement a program for flora monitoring	$1500	$1500	$1500	$1500	$1500
5. Design and implement weed control strategy	*	*	*	*	*
6. Implement replanting and rehabilitation where necessary	*	*	*	*	*
7. Determine the fire ecology of the community					
8. Design and apply appropriate fire management plans	*	*	*	*	*
9. Investigate the effects of kangaroo grazing on the TEC					
10. Design and implement a management program for kangaroos	*	*	*	*	*
11. Seek to acquire occurrences for the conservation estate	Market/valuation				

* WATSCU and other parties within the Department to calculate costs and obtain funding.