Mirima National Park (MNP)
Draft Weed Control Plan

Date: February 2006
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1. Background

Mirima National Park is situated within an eroding Devonian sandstone plateau, creating a 'fractured gully' landscape. The sandstone 'hillocks' are a feature of the park with their distinctive multicoloured horizontal sedimentary bedding.
Lilly creek cuts through the centre of the park, supporting pools of permanent water. Permanent water can be found at 'Bull', 'Middle' and 'Top' Springs on the edge of the plateau. Other creeks within the park are seasonal.
Drainage across the sand plain is poor. During the wet season mush of the sand plain becomes boggy.
Today the park.
The park occurs entirely within the gazetted boundaries of Kununurra, only 2km from the centre of town and is frequently visited by local residents and visitors. No camping is permitted. Infrastructure and tourist visitation is concentrated around the bitumised entrance road.

Size: 2 068 ha

Vegetation

- Plateau: Savanna of sparse trees and shrubs over a virtually pure *Triodia sp.* grass layer.
- Gullies and Creeks: Diverse variety of trees, shrubs, grasses and herbs.
- Sand plain: Savanna woodland over mixed grasses; predominantly *Triodia sp.* and *Sorghum sp.*

Land Systems

- Weaber
- Cockatoo

Past Use

- Prior to National Park vesting in 1968, sites such as creeks and springs were used for recreation.
- Cattle and donkeys also used the water points in the past.

2. Strategic Priorities for Action

Objective	Action	Time frame	Responsibility	Priority H=High M=Moderate L=Low
Build on experience	Evaluate weed control actions to date	Feb 06	RNC Officer NC Officer Senior Ranger	H
Weed control plan for MNP	Finalise weed control plan with maps and rolling works program	Apr 06	RNC Officer NC Officer Senior Ranger	H
Good record keeping and data accessibility	Cooperate in development of standardised record keeping and database. Training in use of database and access of data.	ongoing	RNC Officer RLNCO NC Officers Senior Ranger All Park staff	H
A certified and well prepared work team	Identify gaps in training, materials and equipment. Support and train staff in control methods, record keeping and monitoring and evaluation.	ongoing	Senior Ranger RLNCO RNC Officer NC Officers	H
Develop and implement works programs	Develop and implement works programs to control weeds in MNP	ongoing	Senior Ranger	H
Eradicate new, recent and low density incursions	Identify and implement achievable eradication projects for Hyptis suaevolens, Macroptilium atropurpureum, Merremia aegyptia and Pennisetum pedicellatum.	ongoing	Senior Ranger All Park staff RNC Officer NC Officers	H
Prevent entry and further spread of weeds in MNP	Remove weeds from all visitor access areas to prevent weed spread within Park. Control weeds along creek lines to prevent further spread.	ongoing	Senior Ranger All Park staff RNC Officer NC Officers	H
Education and Awareness for Park visitors	Establish a notice board dedicated to enhance weed awareness among visitors, focusing on how they can help. Include tour operators to enhance education and awareness.	ongoing	Senior Ranger All Park staff	M
Cooperate with community in weed control.	Work in cooperation with community, environmental groups and volunteers.	ongoing	Senior Ranger All Park staff	M
Facilitate weed identification on Park.	Develop park specific field guide for weed identification.		RNC Officer Senior Ranger All Park staff	M

Objective	Action	Time frame	Responsibility	Priority H=High M=Moderate L=Low
Monitoring and evaluation of weed status, control activities and effectiveness	Revisit and monitor control sites and high risk invasion sites. Increase knowledge on weed status and effectiveness of control methodologies. Annual review of weed control plan.	ongoing	RNC Officer RLNCO NC Officers Senior Ranger All Park staff	H
Confirm current status of old flora base records.	Utilise Flora Base resource to determine collection locations		Park Rangers NC Officer	L

3. Rolling Works Program Guidelines

Month	Action	Location	Priority H=High M=Moderate L=Low
January	Control Hyptis and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H
February	Control Hyptis, Pennisetum and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H
March	Control Hyptis, Pennisetum and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H
April	Control Hyptis, Pennisetum and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H
March-June	Weed survey and monitoring		H
March-June	Cortol of *Azadirachta indica* Control of other known infestations	All known infestations	M
November	Control Hyptis and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H
December	Control Hyptis and Bidens Survey visitor use areas	Lily Creek and visitor use areas	H

4. Weed Profile

Weeds recorded/observed on site by CALM staff		
LATIN NAME	**COMMON NAME**	**OCCURRANCE**
Azadirachta indica	Neem	Widespread
Bidens pilosa	Cobblers Peg	Common along creek
Calotropis procera	Rubber bush	Sparsely distributed
Cenchrus ciliaris	Buffel Grass	Localised – visitor areas
Hibiscus sabdariffa	Rosella	Sand plain – single plants
Hyptis suaevolens	Mint Bush	Lily Creek and car park
Lantana camara	Lantana	Single plant (removed)
Macroptilum atropurpureum	Purple Bean, Siratro	Creek lines and car park
Merremia aegyptia	Hairy Merremia	Localised – entrance road
Passiflora foetida	Passionfruit vine	Localised – moist areas
Pennisetum pedicellatum	Deenanth Grass	Lily Creek and car park

Potential weeds (not limited to these species.)	
LATIN NAME	**COMMON NAME**
Aerva javanica	Kapok Bush
Bidens bipinnata	Cobbles Peg
Cenchrus biflorus	Gallon's Curse
Cenchrus echinatus	Mossman river Grass
Chloris inflata	Purple Top Chloris
Echinochloa colona	Awnless Barnyard grass
Euphorbia hirta	Asthma Plant
Gomphrena celosiodes	Gomphrena weed
Jatropha gossypifolia	Bellyache Bush
Leuceana leucocephala	Leuceana
Merremia dissecta	White Convolvulus creeper
Tribulus terrestris	Caltrop

5. Past and Current Control Actions

Species	Location	Past & Current control techniques	Notes (including response to disturbance, dispersal and infestation issues.
Azadirachta indica	Common in Lily Creek, western and southern side of park on sand plain and fractured gullies	Lily Creek, visitor area and entrance road grubbed and sprayed	Seed spread by fruigivores. Constant reinfestation from Kununurra town site Community initiative to remove from Kununurra
Bidens pilosa	Lily Creek (entire length) visitor areas	Grubbed & sprayed.	Easily spread, can complete a life cycle in 4-6 weeks. Constant reinfection from external sources.
Calotropis procera	Uncommon, sparsely distributed on sand plain and fractured gullies	Individuals grubbed	Favours disturbed areas e.g. annual fire, grazing. Removal of disturbance achieved eradication at Point Springs NR. 'fluffy' seeds pread over vast distances by wind.
Cenchrus ciliaris	Lily Creek and visitor areas	Sprayed & grubbed in visitor areas	Easily spread by burrs, favours disturbed sites (fires and grazing)
Hibiscus sabdariffa	Uncommon, occasionally on sand plain	None	
Hyptis suaevolens	Lily Creek (entire length) and end car park	Grubbed and sprayed in Lily Creek and visitor areas.	Annual to perennial. Seed burr easily spread. Can germinate and set seed in only four weeks. Multiple germination when moisture available. 3-4 year seed viability. Reinfection from townsite. Disturbance opportunist Constant reinfection from external sources
Lantana camara	End carpark (boab)	Single plant removed	One off occurrence. Under large boab adjacent to shade shelter, end carpark. Single specimen also found on Kelly's Knob.
Macroptilium atropurpureum	Lily Creek and end car park	Sprayed, but control in Lily Creek ineffective	Resistant to Glyphosate, trial other herbicides.
Merremia aegyptia	Entrance road	Grubbed and sprayed	Spot infestation. Continual reinfestation from town site.
Passiflora foetida	Lily Creek, end car park, moist areas	Some grubbing and spraying	Widespread, continual reinfestation from birds. Responds well to natural flood events.
Pennisetum pedicellatum	Lily Creek, end car park entrance road	Spraying?	Small area Difficult to identify in the field when not near maturity stage.

6. Species by Species Priorities for Action

Species	Impact	Objective	Actions	Priority H=High M=Moderate L=Low
Azadirachta indica	Competes with native shrubs and trees, especially those in riparian areas	Minimise impact	Annual grubbing and/or herbicide application. Survey and monitor Community education in cooperation with Ord Land and Water	M
Bidens pilosa	Competes with native herbs and can form monoculture, especially in riparian and damp areas.	Minimise Impact	Survey and treat when soil is moist- at least once a month from November to May. Monitor	H
Calotropis procera	Low environmental impact	Remove	Grubb or herbicide as part of other operations	L
Cenchrus ciliaris	Nuisance to visitors Negligible environmental impact	Remove	Apply herbicide as part of higher priority operations	L
Hibiscus sabdariffa	Negligible environmental impact	Remove	Remove during other operations	L
Hyptis suaevolens	Can form monocultures in riparian and wet areas	Eradicate on upper creek. Control on lower creek	Survey and treat when soil is moist, at least once a month from November to May Monitor	H
Lantana camara	Displaces shrubs	Monitor	Inspect site at least once per year	M
Macroptilium atropurpureum	Smothering vine that can dominate site	Eradicate	Grub and spray Monitor	H
Merremia aegyptia	Displace natives and alters flammability	Eradicate	Spray Monitor	H
Passiflora foetida	Smothering vine that can totally dominate sites, particularly riparian areas	Ameliorate smothering effects	Grub and spray as part of other operations	M
Pennisetum pedicellatum	Displace native grasses and alters natural fire behaviour	Eradicate	Spray Monitor	H

7. Species Characteristics

Species recorded	Type	Life Cycle	Flowering / Fruiting (not necessarily local conditions)	Dispersal
Azadirachta indica	Tree	perennial	October-January	Bird and animal faeces
Bidens pilosa	Herb	annual	April-May	Adheres, water
Calotropis procera	Shrub/small tree	perennial	April-August	Wind, water
Cenchrus ciliaris	Grass	perennial	February-October	Wind, adheres, water
Hibiscus sabdariffa	Shrub/herb	annual	May- June	Bird and animal faeces
Hyptis suaevolens	Shrub/herb	annual	March-August or when moist	Adheres, water
Lantana camara	Shrub	perennial	Throughout the year	Bird and animal faeces
Macroptilum atropurpureum	Vine	perennial	March-July	Seed and stolons
Merremia aegyptia	Vine	perennial	May-June	Shattering capsules
Passiflora foetida	Vine	perennial	February-August	Bird and animal faeces
Pennisetum pedicellatum	Grass	annual	May-July	Wind, adheres, water

Species with potential to occur	Type	Life Cycle	Flowering / Fruiting (not necessarily local conditions)	Dispersal
Aerva javanica	Shrub	perennial	February-October	Wind, water
Bidens bipinnata	Herb	annual	March-May	Adheres, water
Cenchrus biflorus	Grass	annual	November-May	Adheres, water
Cenchrus echinatus	Grass	annual or perennial	November-May	Adheres, water
Chloris inflata	Grass	annual	April (when moist)	Wind, water
Echinochloa colona	Grass	perennial	November-May	Wind, water
Euphorbia hirta	Herb	annual or perennial	April-October, January	Wind, water
Gomphrena celosiodes	Herb	annual or perennial	March, April, November	Wind, water
Jatropha gossypifolia	Shrub/small tree	perennial	February-May	Shattering capsules
Leuceana leucocephala	Small tree	perennial	Throughout the year	Stock, wind, water
Merremia dissecta	Vine	perennial	May-June	Shattering capsules
Tribulus terrestris	Herb	annual or biannual	February-August	Adheres, water

8. Control Methods

This list is not to be considered exhaustive, nor is the chemical status to be considered static. **Ongoing research is required to update and maintain this list.**

ALWAYS REFER TO THE PROCUCT LABEL AND MATERIAL SAFETY DATA SHEET (MSDS) BEFORE PURCHASING AND USING HERBICIDES.

MSDS and Product labels contain information essential information on chemical behaviour in the environment and guide in the environmentally and personally safe application of herbicide products. NOTE: some chemicals will not be appropriate, under any circumstances, for application on CALM managed lands.

Species	Source	Recommended Control	Plant Status Recommended spraying conditions	On/off* label
Aerva javanica	Rod O'Donnell (CALM)	0.2% 2,4-D + surfactant ?		off
		Grub and burn	Include seed bank in burn	
Azadirachta indica	Dept Env. (Scott Goodson)	Access:diesel,	Basal bark, 1m of trunk (360).	
		Grub seedlings and smaller plants.	Easier under moist conditions	
Bidens sp		0.2% 2,4-D + surfactant		
Calotropis procera	DAWA 2002	Access:Diesel. 1:60	Cut Stump or Basal Bark on larger trees	on
	DAWA 2002	Tordon: water 1:50	Foliar spray seedlings and small trees actively growing.	on
	DAWA 2002	Grazon: water 1:200	Foliar spray to seedlings and small trees	on
		Grub individual plants		
Cenchrus biflorus		1% Glyphosphate + surfactant + ph buffer	Be aware that this is *Non Selective*	on
Cenchrus echinatus		1% Glyphosphate + surfactant + ph buffer	Be aware that this is *Non Selective*	on
Chloris inflata		1% Glyphosphate + surfactant + ph buffer	Be aware that this is *Non Selective*	on
Echinochloa colona		1% Glyphosphate + surfactant + ph buffer	Be aware that this is *Non Selective*	on

Euphorbia hirta		1% Glyphosphate + surfactant + ph buffer		
Gomphrena celosiodes		1% Glyphosphate + surfactant + ph buffer		
Hyptis suaevolens	A. Thompson (CALM) and A. Mitchell (AQIS)	0.2% 2,4-D with surfactant.	Use fine mist spray and 'waft' over plant.	
Leuceana leucocephala	QLD Government Natural Resources and Mines	Access:Diesel 1:60	Cut stump or basal bark	on
Macroptilum atropurpureum		0.2% 2,4-D + surfactant	If resistant trial other herbicides.	
Passiflora foetida	Rod O'Donnell	0.2% 2,4-D + surfactant	Foliar spray	
		Grub tap root	Easier under moist conditions	
Pennisetum sp.	Charles Darwin University (NT) (Kristine Brooks)	1% Glyphosphate + surfactant + ph buffer	Be aware that this is *Non Selective*	on
Merremia sp		0.2% 2,4-D + surfactant	Foliar spray	
		Grub tap root	Easier under moist conditions	
Hibiscus sabdariffa		Grub single plants		
Hyptis suaveolens	QLD Dept Primary Industries 1977	2% 2,4-D		off (QLD only?
	East Kimb. NCO	0.2% 2,4-D + surfactant.		
		Grub single plants		
Tribulus terrestris	Dow Agro Sciences	Starane:Water 500mL/100L + 'Uptake' Spraying Oil.	Seedlings and up to 30cm diameter.	off (QLD, NSW only)
	Nufarm	Roundup 360:water 90mL/15L	Be aware that this is *Non Selective*	on
	Summit Agro	2,4-D 625, 1.1L/ha	Foliar application	

*Anybody wishing to use chemicals which have not been registered for specific weed use is required to apply for the appropriate permit through the respective chemical company.

9. Environmental Impact Assessment

Weed survey and control operations must be mindful of potentially detrimental environmental impacts which occur as a result of these actions.
The following issues must be taken into consideration during the planning process. Impacts must be defined as manageable and therefore acceptable, or non acceptable. The management of the former must be determined and planning put in place prior to the outset of any field operations.

POTENTIAL IMPACT	POTENTIAL CAUSE	SUGGESTED MANAGEMENT
Erosion	Removal of weed cover exposes soil and un-consolidates soil.	Undertake weed control in manageable areas. Avoid large scale weed remove immediately prior to the wet season when winds and rain will exacerbate erosion. Where possible use selective herbicide.
Damage to non target species	Inappropriate herbicide selection. Nature of herbicide (residual, non selective, volatile, soil and aquatic half life, mobility etc) not understood.	Read herbicide label and MSDS carefully. Understand the terminology and the implications. Eg, do not apply highly mobile chemicals in the wet season. Understand soil type environmental which will effect the herbicide reaction. Also be aware of 'at risk' fauna species (terrestrial & aquatic).
Pollution of water courses	Inappropriate herbicide selection or herbicide applied at an inappropriate time.	Read herbicide label and MSDS carefully. Understand the terminology and the implications. Eg, do not apply highly mobile chemicals in the wet season. Do not apply water toxic chemicals near water. Be aware of wind direction, rain forecasts, chemical drift and volatility.
Spread of weed	Inadequate clean down efforts and/or facilities after weed control work.	Awareness. Know of all weeds in control area, even those which are not target weeds. Wear gaiters to limit burrs attaching to socks. Check vehicle for seeds before moving into and out of control area. Burn weed waste on site where realistic. Cover weed waste completely before transporting.
Visual amenity non favourable	Dead and dying vegetation, flagging tap, chemical dye…	Provide visitor interpretation. Explain, what, why and anticipated outcome – and how they can help.
Disturbance to habitat	Vehicle activity, chemical dispersal, general human activity.	Try to be aware of the sensitivity of area which is being entered. If it is known significant flora or fauna habitat, walk into site and as much as possible 'tread-softly'. Determine if your impact will be greater than that of the weed.
Encouraging weed recruitment and destruction of native habitat.	Fire as a weed control tool. In some instances, fire at an inappropriate intensity will promote weed recruitment and germination.	Apply fire as a control tool (in the case of woody weeds this typically requires intense heat generation) only where long term damage to native flora and fauna will be negligible. Understand the level of fire intensity required to create desired outcome and the on ground conditions which will achieve this.
Encouraging weed recruitment (2)	Hand removal of weeds/grubbing turning soil over and creating seed bed. Slashing or canopy reduction.	Recognize the possible outcome and factor follow up into works programme until recruitment has ceased. Such an option has limited merit at the end of the dry season, where access during the wet season may prevent follow up.

10. Monitoring and Evaluation

Monitor for:

- Weed prevalence and distribution
- Outcomes/level of success of control measures
- Rate of weed establishment and recruitment
- Weed invasion at weed free sites.

Regular monitoring will be integrated into the works programme to determine the effectiveness of chemical and manual weed control. This may be achieved with monitoring areas using digital photographs and a monitoring checklist at strategic sites.

Annual survey program will be carried out in late wet/early dry season when weeds are identifiably by fruits or flowers and when weeds have had the opportunity to germinate and new infestations can be identified early in the establishment phase.

Record keeping

To facilitate 'useful' outcomes, general *survey* work should record (at minimum) the following information:

- Date
- Location and GPS reading and extent of survey
- Species name
- Extent of infestation (approximate number of plants or area in ha)
- Density
- Status of plants (eg. healthy, sick, dormant, flowering, fruiting, juvenile, mature etc)
- General habitat (eg. riparian, woodland, outcrop etc) and condition (dry, wet)
- Photo record with site information board (site No and date)

Control work (eg, spraying, grubbing, slashing, burning), in addition to the above, should also record (at minimum) the following information:

- Control conditions (humid, dry, windy, soil status etc…)
- Time of day
- Where relevant: Chemical dilution, application method
- Where relevant: Slashing height, burning conditions, grubbing technology.

11. Resource Requirements for weed related projects.

Requirement	Frequency	Estimated cost per event or financial year	No. staff involved
Chemcert Training	Once	(depends if training undertaken in Perth or NW)	All field staff not currently with update qualifications
Mapping/GPS/database training	Annual	(depends if training undertaken in Perth or NW)	All field staff
Hand spray units (chapin and Hardi) + replacement parts.	Initial outlay (each subsequent year)	$1000 ($250)	~ 6
Vehicle mounted spray units	Annual	$400	~ 6
Chemicals	Annual	$1500	~ 6
PPE + first aid	Annual	$400	~ 6
Volunteer co-ordination and set up	Annual	$1500	~ 3
Weed interpretation and education	Annual	$1000	~ 2
Equipment (GPS, Cameras etc)	Annual	$1000	3
Vehicle and quad bike maintenance and fuel	Annual	$	~ 6
Dedicated staff hours	Monthly	XXX hours @ $XXX/hr = $XXX	~ 5
Data base set-up	Once	Regional Cost	n/a
Aerial photography for mapping (?)	Once every 5 years?	$	~ 2

Total cost year 1 (2005/2006 Financial Year): $

Costs annually thereafter: $

Signed off by

- Regional Manger .....

Date .....

- Regional Leader Nature Conservation .....

Date .....

- District Manager .....

Date .....