WEED CONTROL STRATEGY FOR LANDS MANAGED BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

KIMBERLEY REGION











Western Australia Department of Conservation and Land Mangement (2005)

Contents

| 1. Acknowledgments | 3 |
|--|----|
| 2. Background | 4 |
| 3. Guiding Documentation | 5 |
| 4. Operational Objectives | 6 |
| 5. Key Outcomes | 7 |
| 6. Regional Requirements | 7 |
| 7. Environmental Impacts of Weed Species in Northern Australia | 8 |
| 8. Weeds of Regional Significance on Conservation Estate | 12 |
| 9. Establishing Priorities for Action | 14 |
| 10. Weed prioritisation on CALM managed lands in the Kimberley | 16 |
| 11. Environmental Impact Assessment | 18 |
| 12. Monitoring and Evaluation | 19 |
| 13. Resource Allocation | 21 |
| 14. Individual Conservation Estate Guidelines | 22 |
| 15. Case Study – Mirima National Park | 25 |

References

Appendix:

- 1. A reserve based account of weed presence.
- 2. The status of weeds occurring on, and with the potential to occur on, CALM managed lands.
- 3. The habitat and environmental impact of Kimberley weed species.

Acknowledgments

This Strategy was compiled by Kirsten Pearce, Nature Conservation Officer - Kimberley Region.

With invaluable input and advice:

<u>Department of Conservation and Land Management (CALM):</u>
Gordon Graham, Lindsay Baker, John Hayward, Lindsay Brown, Allan Thomson, Rod O'Donnell, John Abbott and Renae Dingo

<u>Department of Agriculture Western Australia (DAWA):</u>
Mick Everett (Derby) Noel Wilson (Kununurra) and Derek Goddard (Kununurra).

<u>Australian Quarantine and Inspection Service (AQIS)</u> Andrew Mitchell (Darwin, Northern Territory)

Cover Page Photos (left to right):

Cenchrus ciliaris - Adele Island Nature Reserve
Parkinsonia aculeata - Parry Lagoons Nature Reserve
Passiflora foetida - Geikie Gorge National Park
Jatropha gossypifolia - Parry Lagoons Nature Reserve
Calotropis procera - King Leopold Range Conservation Park

(Photos: Kirsten Pearce)

BACKGROUND

Since the first settlers arrived in Australia, weed introduction has been a persistent and serious issue. Although plant invasions do occur naturally, the frequency has increased as weeds have been introduced either accidentally or purposefully for agriculture, horticulture or garden aesthetics. Many species are now naturalized in our environment - successfully reproducing without human interference. Environmental weeds threaten natural biodiversity and ecosystem function. Weeds also impact upon environmental aesthetics and restrict our recreational pursuits.

As defined in the CALM Environmental Weed Strategy for Western Australia: "A weed is a plant that is not native to the area it occurs in and modifies adversely the environment it occupies" (CALM, 1999). As weeds have been recently introduced to Australia they lack the natural constrains (such as pathogens, climate or grazing or browsing herbivores) which would normally modify their growth and reproduction so to achieve a natural equilibrium. Weeds are typically rated according to their invasiveness, distribution and environmental impact (CALM 1999; Wainger and King, 2001; Groves, Panetta and Virtue, 2001; Thorp and Lynch, 2000).

This strategy refers to lands in the Kimberley region that are vested in the Conservation Commission of Western Australia, are held by the Executive Director or are covered by management agreements (See map XX).

The principles and components of this strategy can also be applied to proposed conservation estate (Eg. those defined in the 2015 pastoral lease renewal process) and areas covered under other conventions (Eg. Wetlands of International Importance) where a problem is identified or could be avoided by early intervention.

A large proportion of weeds proliferate in disturbed environments. Pastoral, agricultural and ornamental industries, combined with our increasing mobility (especially with the advent of the 4WD) and infrastructure demands, are causing new and existing weeds to colonise our natural landscape faster than ever before.

Environmental weed control demands long-term initiatives and resources. The requirement to undertake structured weed control programs can be overlooked because of the complexity of the task This strategy aims to ensure there is commitment and attention to a process which threatens intrinsic values of biodiversity – ultimately our well being.

The content of this strategy is intended to facilitate the development of reserve based weed control plans. The requirement for details specific to reserves will be met in these plans. CALM district officers and rangers are encouraged to request regional assistance and liaison in all weed management planning and control.

GUIDING DOCUMENTATION

The Environmental Weed Strategy of Western Australia

This document identifies the role of CALM as "[pivotal] in achieving the necessary degree of intra and inter-agency coordination" and as "the main coordinating agency in the response to the environmental weed problem due to its statutory responsibility for protection of flora and fauna in WA" (CALM. 1999:33).

CALM Policy statement #14 Weeds on CALM Land

CALM's operational objective is "to take preventative measures to avoid the introduction and to achieve the systematic and safe control of weeds on CALM land". Its strategic approach recommends that all regions/districts "shall survey weed infestations on CALM lands", "record details of weed treatments undertaken" and shall "prepare and maintain a weed control management plan" from which work programs will be structured

The Department of CALM's Strategic Planning and Forward Estimates Process:

Each year the Corporate Executive agrees on priority areas for action under six identified key result areas (KRA's). Whilst a commitment to the KRA's remains constant from one year to the next the priorities may change. For example the list below is inclusive of the priorities for 2005-2006. This document will be updated on an annual basis to reflect this.

Nature Conservation Output

KRA 2

NC 2A – Expand and enhance invasive species control programs on all conservation reserves under Departmental management as a major focus of our conservation management ethic and proposed good neighbour policy.

NC 2B – Management of the conservation reserve system with the primary goal of maintaining and recovering biodiversity...

NC 2D - Management of 12 Wetlands of International Importance in WA...

Special emphasis for 2005/6

Increase emphasis on core management of parks and reserves including control of threatening processes (feral animals, weeds, ...)

☐ Good Neighbour Policy (under development)

3.9 "CALM views weed control as a partnership, and works wherever possible with the community, and especially neighbours to CALM managed land, to shard the control burden and optimise the benefits from weed control works that are undertaken."

Agriculture and Related Resources Protection (ARRP) Act 1976

Section 39 - Department to control declared plants and animals

A Government department shall control declared plants and declared animals on and in relation to public land under its control.

This is subject to the Agricultural Protection Board Act 1950, which overrides the ARRP Act. This 'allows CALM, in carrying out its responsibilities unde the ARRP Act, to reserve the right to decide priorities and the level of control in accordance with availability of funds'.

OPERATIONAL OBJECTIVES

- Consistent with region-wide priorities and with Departmental objectives and regulations, undertake weed control on CALM managed land in the Kimberley region.
- Protect the ecological values of the Kimberley region. Restore ecosystem diversity and manage sources of disturbance to encourage a natural resilience to weed invasion.
- Prevent the introduction of weed species into the region. Foster relations with the Department of Agriculture, Western Australia (DAWA) and AQIS to promote an interdepartmental approach to weed risk assessment, research and quarantine nominations.
- Manage weeds with indigenous, community and stakeholder support and, preferably, participation.
- In the local context, to undertake weed control based on the following principles:
 - Strategic Develop plans giving consideration to, catchment trends, fire history, visitor behaviour, vehicle access and feral fauna activity.
 - Integrated Integrate weed control programs with recreational, fire and feral animal management programs. Integrate also with control programs of landholders within the catchment area.
 - Ecological Control weed invasions in accordance with regard for environmental impact and ecosystem dynamics.
- Continue to monitor and document the status, distribution and management of weeds across CALM managed land in the Kimberley region.
- Prepare reserve-based weed control plans for all CALM managed land in the Kimberley region to facilitate the prioritisation and management process.
 From initial implementation at strategically nominated sites, successful models will be extrapolated across the region.

KEY OUTCOMES

This strategy is stage one of a long-term commitment to weed control. Its primary objective is to improve the co-ordination and planning of weed control on conservation estate.

This document:

- Defines weed species and locations across the CALM estate in the Kimberley region that should be targeted for management actions.
- Establishes criteria that prioritise resource allocations.
- Ensures a consistent and comparable approach across the region.
- Guides the development of specific weed control plans for individual conservation estate.
- Establishes criteria for site prioritisation, monitoring and evaluation.

REGIONAL REQUIREMENTS

- Survey and document the status of weed species on CALM managed lands. Consistently patrol all reserves, including those in remote areas.
- Secure long term funding commitment for weed control to foster a sense of regional commitment and to ensure a sustained approach.
- Establish an effective and long term weed control budget plan.
- Provide training for staff (to be identified in work programs and IDAPES), community and volunteers in regionally consistent, weed control techniques, monitoring methodology, weed identification and chemical handling and safety.
- Provide staff with appropriate weed control and safety equipment to facilitate
 effective and safe weed control. Requirements for new equipment and
 equipment maintenance to be identified in works program budgets.
- Foster relations with the community and with external agencies, such as DAWA, AQIS and Ord Land and Water in order to promote understanding and involvement of weed control and the threatening processes and activities that contribute to weed spread and proliferation.

- Set seasonal weed control objectives in work programs for CALM staff.
 Ensure staff availability and mobilisation of equipment during the wet season prior to seed set of weed species.
- Establish a 'wash-down' protocol that is applicable to CALM officers and road working crews.
- Facilitate the exchange of information between regional staff with on-site jointly operative control, monitoring and evaluation sessions.

ENVIRONMENTAL IMPACTS OF WEED SPECIES IN NORTHERN AUSTRALIA

Northern Australia's weed infestations are characterized by 'broad scale single species infestations' which are regarded as a response to our extensive, rather than intensive, land use patterns (Humphries, Groves, Mitchell, 1991). For example as the practice of intensive irrigated agriculture becomes increasingly common, it must be considered that the threat of localized multi species infestations will increase.

Appendix 3 summarizes the environmental impact of weed species that occur, or have the potential to occur, in the Kimberley region. The establishment rate and impact of weeds may exhibit some variation from site to site, dependent on variables such as soil, moisture and climate.

Weeds are recognised as inducing environmental change on a genetic, species and ecosystem level by means of (CALM, 1999):

- resource competition
- prevention of regeneration/seedling recruitment
- alteration of geomorphological processes
- alteration of hydrological cycles
- alteration of soil composition and nutrient status
- alteration of native flora and fauna diversity and abundance
- alteration of natural fire regimes
- causing genetic change

Impact by Vegetation Community

(Humphries, Groves and Mitchell, 1991).

Riparian and Wetland Systems

These systems are regarded as being at greatest risk based on their natural vulnerability to weed invasion and their high ecological value. The intensive activity of introduced hoofed animals, rich soils, the seed dispersal capacity of waterways, and the natural disturbance of flood events create an ideal weed habitat. A number of species identified in this strategy as being of regional significance, such as Parkinsonia aculeata and Jatropha gossypifolia, can be found along watercourses, floodplains and wetlands on CALM reserves including Parry Lagoon's Nature Reserve and Purnululu National Park.



Hyptis suaevolens and Passilora foetida Lily Creek, Mirima National Park. Photos: Kirsten Pearce



Parkinsonia aculeata Parry Lagoons Nature Reserve

Savannah Woodland

Weeds of the northern savannas are typically broad scale infestations. The common use of savannas for grazing cattle has benefited those weed species which respond favourably to disturbance. Introduced pasture species (See Appendix 1) such as *Cenchrus ciliaris* has proliferated throughout the grass layer and is gradually altering savannah ecosystem. Woody shrubs such as *Calotropis procera* and *Acacia farnesiana* are both disturbance opportunist which occupy savannah vegetation.



Calotropis procera – King Leopold Range Conservation Park Photo: Kirsten Pearce

Rainforests

The fragmentation of sub tropical and tropical rainforests since human occupation has created a 'high edge effect', causing the combined effect of increased light, weeds and fire penetration. Introduced vines including *Passiflora foetia* (and potentially *Cryptostegia grandiflora*) pose a major threat to sites such as Point Springs Nature Reserve.

Impact by growth type:

(Humphries, Groves, Mitchell 1991)

Aquatic and Semi Aquatic Weeds

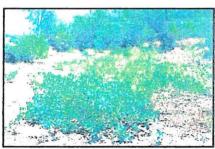
Floating weeds such as *Salvinia molesta* and *Eichhornia crassipes* are capable of rapid vegetative growth. Readily dispersed by wind and floods and avifauna, they are extremely difficult to contain or eradicate. A single outbreak of *Salvinia Molesta* at Lake Kununurra (Ramsar wetland) remains a threat despite 2years of interdepartmental management. Rooted aquatic weeds spread more slowly, but in the long term may be more persistent. Aquatic weeds affect, water flow, light penetration, hydrological chemical and biological values, water nutrient levels and space availability.



Salvinia molesta in Lake Kununurra Photo – Allan Thomson

Herbs

Herbaceous weed species typically occupy disturbed sites, particularly where nutrient status has been enhanced. Given early peak growth periods, they out compete native species in nutrient and water consumption and are typified by high growth rates.



Datura inoxia at Geikie Gorge National Park.
Photos – Kirsten Pearce



Regneration of *Hyptis suaveolens* at King Leopold Range Conservation Park

Grasses

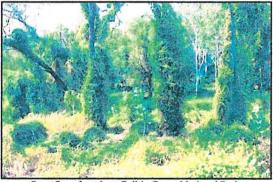
Grass species are capable of invading and altering a site rapidly. Grass weeds readily displace native ground covers and remove an essential food source for native fauna. Many species, particularly *Cenchrus ciliaris* and *Pennisetum spp.* alter fuel load characteristics, curing later in the dry season and resulting in, later, hotter and larger fires.



Pennisetum pedicillatum in Mirima National Park Photo: Kirsten Pearce

Vines

Vine weeds are vigorous and destructive growth forms, smothering and preventing the regeneration of vegetation from ground cover to canopy. Occurrences of *Passiflora foetida* are common throughout the region, most notably along the riparian zone, at sites such as Geikie Gorge National Park.



Passiflora foetida at Geikie Gorge National Park.
Photo – Kirsten Pearce

Shrubs and Trees

Shrub and tree weed species often prevent a ground level vegetation layer, leaving bare earth that is subject to erosion. They occupy a variety of habitats, from wetland, to mesic, to dry land sites; and are capable of occurring at a broad scale, at monoculture levels. Seed productivity is typically high and viability can be several years.



Jatropha gossipifolia at Parry Lagoons Nature Reserve Photo: Kirsten Pearce



Parkinsonia aculeata Photo: Kirsten Pearce

WEEDS OF *REGIONAL* SIGNIFICANCE ON CONSERVATION ESTATE

Weeds of Regional Significance - Kimberley Region

It is estimated that within the Kimberley Region there are between approximately 100 'naturalised alien species' (Wheeler, 2002) to approximately 220 'naturalised vascular plants; of which approximately 120 are defined as environmental weeds (Keighery, unpublished). The flexible interpretation of 'weed species' causes considerable discrepancy in weed census results. Appendix 1 lists those species recognized to occur on conservation estate and those with the potential to occur on conservation estate. Appendix 2 lists those species which are currently recognized to occur on conservation estate, on a reserve-by-reserve basis.

<u>Table One</u> lists those species that are considered to constitute the greatest risk to the Kimberley Region and have been recorded on conservation estate. This list does not presume that each of these weeds should automatically be targeted for control and allocation of resources. Their significance should be considered equally with on site conditions and the principles of prioritisation and weed risk assessment.

<u>Table 2</u> lists those weeds that have not been recorded on conservation estate, but are considered to pose a significant future threat. Where these species can be detected at their initial stages of establishment, they are *priorities for eradication measures*.

These species have not been further ranked in order of significance. In each weed's respective habitat, each is capable of a significant level of environmental impact.

Both lists have been compiled with the benefit of recognized expertise; including that of CALM, AQIS and DAWA officers. The Weeds Of National Significance (WONS) and 'Alert' Weed listings (CRC Weed Management, 2003) and 'Part 1 – Plant Invasions of Australian Ecosystems' (Humphries, Groves and Mitchell, 1991) also contributed to the final lists.

| Species | Common Name | |
|-------------------------|-------------------------|--|
| Azadirachta indica | Neem | |
| Calotropis procera | Rubberbush | |
| Cenchrus ciliaris | Buffel Grass | |
| Hyptis suaevolens | Mint Weed | |
| Jatropha gossypifolia | Bellyache Bush | |
| Leucaena leucocephala | Leucaena | |
| Parkinsonia aculeata | Parkinsonia | |
| Passiflora foetida | Stinking Passion Flower | |
| Pennisetum pedicellatum | Deenanth grass | |
| Prosposis spp. | Mesquite | |
| Themeda quadrivalis | Grader Grass | |
| Xanthium strumarium | Noogoora Burr | |

Table 1

| Species | Common Name |
|--------------------------|----------------|
| | |
| Acacia nilotica | Prickly Acacia |
| Andropogon gayanus | Gamba Grass |
| Bracharia mutica | Para Grass |
| Cabomba carolina | Cabomba |
| Cryptostegia grandiflora | Rubber vine |
| Echinochloa polystachya | Aleman Grass |
| Eichhornia crassipes | Water Hyacinth |
| Hymenachne amplixicaulis | Hymenachne |
| Mimosa pigra | Mimosa |
| Pennisetum polystachion | Mission grass |
| Salvinia molesta | Salvinia |
| Martynia annua | Devil's Claw |

Table 2

ESTABLISHING PRIORITIES FOR ACTION

In a weed control strategy preferable operational priorities are (Rejmanek, 2001; DOC,1998):

- 1. To prevent new weed incursions at regional, state or nation wide borders.
- 2. To identify and eradicate new incursions.
- 3. To control, contain or eradicate, existing infestations.

Early detection of weed incursions places operators on the offensive. With the exception of preventative measures, this is the most cost effective tool in weed control, offering a high probability for eradication (Rejmanek, 2001).

Any weed identified as new to a site, which is in the initial stages of establishment should be an immediate target for the allocation of resources for an eradication program (CALM, 1999) If eradication cannot be achieved, a long term control strategy must be developed and implemented.

Once weeds have become established, it becomes more complex to nominate priorities for action. Determining if a weed control program is *site-led* or *weed-led* is vital to create a sense of focus. This also provides a mechanism with which to justify weed control actions (Owen, 1998; CALM, 1999).

<u>Weed – led control programs</u> involve a species by species approach to weed control. Managing a species at the earliest possible stage of invasion is the most time and cost effective form of management with the highest probability of success.

<u>Site-led control programs</u> are implemented where a site is identified as having valuable ecological functions and services placed at risk by weed incursions. This approach is typically more effective when carried out as an integrated threat management plan, as often weed management alone is insufficient to restore natural vigour to a site. Sites that are recognised to be in good natural ecological condition should be emphasised for weed control to maintain their status (CALM, 1999).

Weed and Site Risk Assessment

Prioritising a site or weed for control should take into consideration a variety of variables to ensure that weed control is conducted on a site that presents the highest probability for successful outcomes. These variables are: (Wainger, 2001; Thorpe, 1999; Groves, Panetta, Virtue, 2001):

- Weed abundance and
- o Invasiveness.
- o Environmental and social impacts.
- o Practicality of control (human and financial resources & risk of re infestation)
- Cause/Source of infestation

And of the site's:

- o Ecological characteristics
- Biophysical processes
- Services to community
- Risk assessment.

Abundance

This includes both current and potential weed occurrence on a geographic scale. Potential weed range may be theorized based on, climate, land use and its existing ecological range and that which it occupies in its native home (Reichard, 2001, Groves, Pannetta, Virtue, 2001). Weeds existing on a broad scale may not be cost effective to target. Weed surveys and mapping of weed populations must be an ongoing priority in order to justify abundance based prioritisation criteria.

Invasiveness

A weed's "ability to establish, reproduce and disperse in an eco system" can be termed as invasiveness (Groves, Panetta, Virtue, 2001). The condition of the landscape will also affect a weed's invasive tendencies.

Environmental and Social Impacts

Weed infestation can alter ecological characteristics and processes. Weeds may have a detrimental effect on human health. They can reduce the recreational and aesthetic appeal of a site and may affect the resources we rely upon, including clean drinking water, fish resources and tourism income. Environmental impact assessment of weed control actions should also be addressed. Appendix 3 summarizes the environmental impact of current and potential weed species.

Practicality of Control

Strategies for control should be based on available funding and human resources in both the short and long term at an appropriate scale. "Spending decisions need to be based on reliable, replicable criteria for choosing sites... to distinguish between sites these criteria need to be based on the expected levels of both cost effectiveness and realisable benefits from a given level of treatment." (Waigner, 2001, p.35).

An important first principle to apply is that it is more effective to target a strategically selected; less affected area or outlying population rather than aiming beyond the limits of financial and human resources. Location, stage of invasion, invasive potential, risk of re infestation, weed biology (seed production, dispersal etc) and control options must be included in assessments in order to determine levels of practicality and to maximise the possibility of successful outcomes (Groves, Pannetta, Virtue, 2001).

"It is necessary to recognize that 'natural' systems are dynamic. Irreversible alterations may have occurred, and modified systems may have become or are in the process of becoming established".

Cause and Source of Infestation

A large number of weeds are disturbance opportunists; occupying the habitat niche created by road works, feral animal activity, erosion, camp grounds, grazing lands or burnt areas. The identification of sites where levels of weed incursion can be attributed to disturbance or controllable dispersal mechanisms is crucial to being able

to develop an integrated management approach; where managing the cause is a key component of the plan.

A Common Challenge

Wetlands, riparian and mesic zones are all of high ecological value. Concurrently they often provide the greatest challenges for weed control, given high frequency of feral fauna and natural disturbance, efficient natural dispersal mechanisms, high social and recreational values and high relative nutrient status. Further consultation and survey is required at these sites to determine those that realistically can be advantaged by a weed control program. Selection of sites that can be targeted on a catchment level, and can be managed in an integrated long-term approach is essential to this prioritisation process.

It is important to acknowledge that conservation reserves in the Kimberley do not stand alone. They are part of an un fragmented landscape, so consideration needs to be given to their place in that landscape.

PRIORITISATION OF CALM MANAGED LAND IN THE KIMBERLEY REGION

National Parks, Nature Reserves and Conservation Parks all face a variety of threatening processes. Limited financial and human resources over vast areas of often poorly accessible land has historically meant that resources have been either unavailable or stretched to a point that has resulted in unsuccessful short-term management outcomes.

It is a recommendation of this strategy that one or two reserves are selected for the development of an intensive weed control program. These then become the 'models' for the region and through this process issues and options can be defined that feed into the adaptive management cycle. A model will then be extrapolated out to other areas of conservation estate as determined by the process of prioritisation.

Reserves that will be potentially be focused on in the first instance are discussed below. The development of reserve based weed plans will help to highlight which reserves should be selected for the development of an intensive weed control program.

o The Mitchell River National Park, Laterite Conservation Park, Lawley River National Park and Camp Creek Conservation Park.

These reserves have only recently been added to the conservation estate and are within the IBRA subregion that is identified as being largely weed free. It is anticipated that there will be increased numbers of visitors to the area, along with the possible establishment of communities and potential mining exploration and other activities. Increased activity in the area, also including anticipated improved road maintenance and infrastructure development (eg ranger stations) must be recognised as escalating the risk of weed invasion and establishment into the area. At their present status, weed populations in these reserves present an achievable and practical opportunity for sustained management. The river systems, rainforest patches, and populations of native mammals all contribute to the high ecological values of the

reserves. Given the remote nature of these reserves and the limited opportunities to assess their condition, a weed management plan on these reserves would prioritize equally survey and control actions.

o Mirima National Park

Mirima National Park is a small reserve located within the Kununurra townsite boundary. Given its manageable size, history of persistent weed control and weed risk assessment it is a good candidate for an intensive weed control program in which eradication objectives could potentially be met for some species (such as *Azadirachta indica*). The majority of weeds in the park are confined to a small creek system that is readily traversed by foot. The recent focus of the Shire of Wyndham East Kimberley on *Azadirachta indica* also provides a strategic opportunity for an integrated management approach to a weed that is of growing concern in the region.

o Other sites

Priority locations can potentially be confined to sites or land systems within a reserve to target a specific weed occurrence for eradication or containment.



Azadirachta indica at Mirima National Park Photo: Kirsten Pearc

ENVIRONMENTAL IMPACT ASSESMENT

Deciding which weed or site to prioritise in a weed management program must not only take into consideration weed impact, but also the environmental impact of control actions and the implications of weed removal.

Weed control can be a disruptive and environmentally damaging process, sometimes requiring significant vehicular, machine and human activity. Vehicles, quad bikes or machinery taken into weed-infested sites must be subject to strict wash-down procedures before and following entry. This helps to ensure that no new weeds are introduced to the site and that existing weeds are not transported beyond the site of infestation.

A number of weeds are disturbance opportunists. Control measures must minimize disturbance to the landscape. Use of heavy machinery will often promote the recolonization of weed species at a site.

In sites dominated by weed occurrence, fauna may rely on a weed assemblage for refuge and food. At sites where weed species are responsible for the consolidation of soil, removal of these weeds could pose a high erosion risk.

Non-selective and/or residual chemicals incorrectly applied may damage native flora causing a proliferation in weed occurrence. The use of selective chemicals such as 2, 4-D, against broad leaf herbs will protect grasses, on which it has no effect. Chemicals not recommended for catchment or aquatic weed application may impact upon aquatic flora, fauna and consumable water quality.

Weeds 'controlled' with the regular application of fire may conversely have a deleterious impact on native flora and fauna. Equally, sites fenced to reduce the disturbance caused by human or feral fauna activities, such as at Point Springs Nature Reserve, require a fire management plan and ongoing monitoring of fuel levels.



Bulldozed Calotropis procera. Impacts such as this must be assessed for their environmental impact.

MONITORING AND EVALUATION

The development of a consistent weed management approach for conservation estate across the Kimberley region will ensure and facilitate optimal results in management objectives.

Central to the success of survey and monitoring operations and outcomes is the confident on-ground identification seedling, juvenile and adult weed species and an understanding of weed biology and ecology.

Monitoring

Monitoring allows for the recognition and assessment of change. Monitoring can reveal; weed biology and ecology, rate of spread, changes in weed density, new species incursions, changes in the condition of native vegetation, the status of threatening processes, environmental impact of control operations, and control success or failure. Monitoring techniques are variable and will be relative to the information required from the site. (DEH, CRC (Module 1)).

A multipurpose and simple monitoring technique is to develop photo-monitoring points. Identify and GPS reference two 'points', either existing naturally or by placing posts at chosen sites. At regular intervals, from one post, photograph the second post, maintaining a constant compass direction and photo height. Record data including; personnel, date, time, weather conditions, recent site history, treatment methods, and plant status. A simple process such as this can monitor changes including; weed density and scope, impacts on native vegetation and weed response to flood and fire events and vehicle and feral animal disturbances.

Monitoring sites can only provide useful information if they are visited consistently to build up a picture of weed behaviour and the result of control measures. Monitoring should be repeated at the same time or under similar conditions each year to prevent seasonal discrepancies from confusing the evaluation process (DEH, CRC (Module

1)). Resources and site accessibility will primarily influence the simplicity or complexity of a monitoring programme

This development of this strategy has highlighted a deficiency in weed data within remote reserves that do not have a live-in ranger or ranger station. This does not suggest a need for live in rangers, but does demand the need for regular patrols on *all* CALM managed land, even those most remote.

Documentation

Documentation at each stage of planning, implementing and monitoring is *essential*. It allows the evaluation process to be justified and it provides a valuable guide for weed control across the region. The documentation of threatening processes that contribute to weed invasion will support highly desirable integrated management plans.

Comprehensive documented results, which can justify a weed control approach are more likely to attract funding. Equally, documentation that disproves a control theory will provide other officers with invaluable lessons and will prevent similar mistakes that exhaust resources and motivation.

Documentation must be:

- o Available to all staff
- o In a user friendly format
- Archived in a retrievable manner.

Evaluation

The evaluation process requires consideration of approaches that did, or did not, work. Understanding the reason behind success or failure places operators in an advantaged in the development of future plans. Weed planning demands continual reassessment and plan modification as know-how develops and new initiatives and techniques are revealed.



Chemical control (basal bark) of Calotropis procera at Windjana Gorge National Park.



Chemical control (cut stump) of Parkinsonia aculeata at Geikie Gorge National Park



Chemical control (foliar) of Jatropha gossypifolia at Parry Lagoons Nature Reserve

RESOURCE ALLOCATION

Distribution of finances must satisfy three elements:

- i. Long term financial commitment to weed control and containment at prioritised locations
- ii. Long term financial commitment to the repeat process of site survey, treatment monitoring and site evaluation
- iii. Immediate 'non specific' funding to target new weed incursions which can be eradicated.

| TASK | COORDINATOR | RESOURCES | COSTS | COMPLETION DATE |
|---|-----------------|---|--|-----------------|
| Document the status and distribution of significant weed species across the conservation estate | RNCO | Vehicle GIS RIC's | \$40,000 | June 2006 |
| Develop and implement weed plans for recommended focus estate | RIC's | Work programs, vehicles, spraying equipment, chemicals, dilutants and surfactants, safety requirements. | By reserve (in excess of figures listed below) | October 2005 |
| Continue targeted work on priority species for other estate | RIC | As above. | By reserve (eg. Derby Work Zone ~ \$35, 000 (MRNP ~ \$10,000, Geikie Gorge ~ \$20,000) | On-going |
| Continue development of reserve based strategies | | | By reserve | June 2007 |
| Continue research into the impact and control of weeds | RLNC, RNCO | CALM Research, AQIS, DAWA | | Ongoing |
| Monitoring and documentation | RNCO, RIC's | GPS, Camera, binoculars | By reserve ~ \$ | On going |
| CALM Officer Training | RIC's, DM, RLNC | | By reserve ~ \$ 10,000 | June 2007 |
| Wet season mobilization for priority reserves | RIC's, RNCO | Quad bikes mobilization and fuel, flights into sites, chemical drops. | By reserve ~ \$ 10,000 | On going |

INDIVIDUAL CONSERVATION ESTATE GUIDELINES

PLANNING

A weed control plan will ensure that priority weeds are targeted at the right time, at the right scale, in an appropriate manner, achieving the best possible results. Plans set objectives that are measurable, achievable and justifiable, and create an operational environment that supports logical monitoring and follow-up treatments. Plans support funding allocations and direct work programs.

The level of detail to be included in the plans is dependant on the extent of readily available information. If there is data lacking then this should be acknowledged in the plan.

OUTLINE OF WEED CONTROL PLAN FOR INDIVIDUAL ESTATE

Background:

- Estate name
- o Size (ha)
- o Landscape features
- o Vegetation
- o Past and current use
- o Cultural Significance
- Stakeholders
- o Access

Weed Profile (In table format)

| Weeds | Recorded | on Site | Potential | Weeds |
|-------|----------|---------|-----------|-------|

Weed Status (In table Format)

| Species | Location | Impact | Past control | Notes (including response to disturbance, dispersal and infestation issues) |
|---------|----------|--------|--------------|---|
|---------|----------|--------|--------------|---|

Strategic Priorities for Action (In table Format)

| Priority | Objective | Stratogy | Action | Responsibility |
|---------------------|-----------|----------|--------|----------------|
| (high/low/moderate) | Objective | Strategy | Action | Responsibility |

Species by Species Priorities for Action (In table Format)

| Priority (high/moderate/low) | Species | location | Objective | Actions | Notes |
|------------------------------|---------|----------|-----------|---------|-------|
|------------------------------|---------|----------|-----------|---------|-------|

Weed Control (In table Format)

| Species | Legal Status | Source | Recommended Control | On/off label |
|---------|--------------|--------|---------------------|--------------|

Environmental Impact Assessment O Potential impact of control work.

Monitoring and Evaluation

- O Locations where monitoring has not been undertaken
- Cost approximations for the short and long term
- Time frames
- Documentation style
- Standard/uniform documentation style
- Record keeping custodianship

Resource Requirements

Resource nomination must be considered with realistic consideration of resource availability and work programs design.

Consider:

- Staff availability
- o Budget for short and long term
- o Training requirements
- o Materials, equipment, vehicle costs and maintenance
- o Safety procedures regulation storage, personal protective equipment and first aid
- Aerial photos
- o GIS expertise
- o Public education
- Documentation
- Monitoring
- Wet season mobilization (for priority sites)

Signed off by

- o Regional Manger
- o Regional Leader Nature Conservation
- o District Manager

CASE STUDY MIRIMA NATIONAL PARK

Allan Thomson, District Conservation Officer, East Kimberley District, CALM Kununurra Kirsten Pearce, Nature Conservation Officer, Kimberley Region, CALM

Notes:

- o This document relates only to weed control for conservation purposes, not for visitor services activities.
- o Survey is defined as searching for weeds, both on new areas and previously treated areas.
- o Monitoring is defined as measuring impacts of weeds.

Name: Mirima National Park

Size: 2068 hectares

Landscape Features

- Eroding Devonian sandstone plateau surrounded by Quaternary sandplain.
- The eroding plateau has created a 'fractured gully' landscape incorporating sandstone 'hillocks' which are a feature of the park with their distinctive multicoloured horizontal sedimentary bedding.
- The plateau, hillocks and gullies are part of the Weaber Land System and the sandplain part of the Cockatoo Land System.
- Lily 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.

Vegetation

- The plateau has savannah of sparse trees and shrubs over a virtually pure *Triodia sp.* grass layer.
- The gullies and creeks support a diverse variety of trees, shrubs, grasses and herbs.
- The sand plain supports savannah woodland over mixed grasses; predominantly Triodia sp. and Sorghum sp.

Past and current 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.
- Today the park occurs entirely within the gazetted boundaries of Kununurra, only 2km from the centre of town.
- The park is frequently visited by locals and visitors to Kununurra.
- No camping is permitted. Infrastructure and tourist visitation is concentrated around the bitumised entrance road. Structures include, a toilet, day shelters, short walk trails, picnic tables and interpretation panels.

• Primary activity in the park include, walking, picnicking, bird watching and photography. Over the wet season locals frequent the permanent springs.

Cultural significance

• Mirima National Park is of cultural significance to the Mirriuwung Gajjerong Traditional Owners. Ceremonial activities still occur within the park.

WEED PROFILE

| Weeds Recorded on site | Weeds with potential to exist on site | | |
|---------------------------|---------------------------------------|--|--|
| Hyptis suaevolens | Pennisetum polystachion | | |
| Passiflora foetida | Bidens bipinnata | | |
| Macroptilum atropurpureum | Aerva javanica | | |
| Azadirachta indica | Gomphrena celosiodes | | |
| Hibiscus sabdariffa | Chloris inflata | | |
| Pennisetum pedicellatum | Euphorbia hirta | | |
| Lantana sp. | Echinochloa colona | | |
| Leuceana leucocephala | Andropogon gayanus | | |
| Calotropis procera | Aerva javanica | | |
| Merremia spp. | | | |
| Bidens pilosa | | | |
| Cenchrus ciliaris | | | |



KNOWN WEEDS IN MIRIMA NATIONAL PARK

Impact and past control actions

| | | | | |
|----------------------------|---|--|--|---|
| SPECIES | LOCATION | IMPACT | PAST CONTROL | NOTES |
| Azadirachta indica | Common in Lily Creek, western and southern side of park on sand plain and fractured gullies | Competes with native shrubs and trees, especially those in riparian areas | 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 | Competes with native herbs, can form monoculture, especially in riparian and damp areas can form monocultures on wet season herb fields. | Grubbed & sprayed. | Easily spread, can complete a life cycle in 4-6 weeks. |
| Calotropis procera | Uncommon, sparsely distributed on sand plain and fractured gullies | Low environmental impact | 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 | Nuisance to visitors Negligible environmental impact | Sprayed & grubbed in visitor areas | Easily spread by burrs, favours disturbed sites (fires and grazing) |
| Hibiscus sabdariffa | Uncommon, occasionally on sand plain | Negligible environmental impact | None | |
| Hyptis suaevolens | Lily Creek (entire length) and end car park | Can form monocultures in riparian and wet areas | 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 |
| Lantana camara | End carpark (boab) | Displaces shrubs | Single plant removed | One off occurrence. Single specimen also found on Kelly's Knob |
| Leuceana leucocephala | | Displaces vegetation, especially in riparian zone. massive seedling recruitment. | | |
| Macroptilium atropurpureum | Lily Creek and end car park | Smothering vine that can dominate site | Sprayed, but control in Lily Creek ineffective | |
| Merremia aegyptia | Entrance road | Displace natives and alters flammability | Grubbed and sprayed | Continual reinfestation from town site |
| Passiflora foetida | Lily Creek, end car park, moist areas | Smothering vine that can totally dominate sites, particularly riparian 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 | Displace native grasses and alters natural fire behaviour | Spraying? | |
| | | | | |

Mirima National Park is well surveyed. Most of the park has been visited by staff in the past 15 years. See Figure 1

Weed locations are shown on Figures 2 and 3.

STRATEGIC PRIORITIES FOR ACTION

Priority = high, moderate, low

| PRIORITY | OBJECTIVE | STRATEGY | ACTION | RESPONSIBILITY |
|-----------------|-------------------------|-----------------------|--------------------------------|---|
| High | Evaluate weed control | Prepare Weed | Write Strategy | Strategy– District Conservation Officer (DCO) |
| | actions to date in | Control Strategy | Meet to evaluate report | & Regional Nature Conservation Officer |
| | Mirima | and evaluate past | | (RNCO) |
| | | control to strategy | | Meeting - above plus Regional Leader Nature |
| | | | | Conservation (RLNC) . |
| High | Readily accessible | Electronic Database | Create Access data base and | DCO to modify and train nominated others |
| | records of weed control | | instruct relevant staff on its | |
| | operations | | use | |
| High | Minimise impact of | Use Strategy to | Undertake control operations | DCO |
| | weeds in Mirima | prioritise works and | | |
| | National Park | create works | | |
| | | program | | |
| High | Evaluate efficacy of | Monitoring Program | Implement monitoring | DCO |
| | weed control strategy | to feed into adaptive | program and annually | RNCO |
| | | management | evaluate Mirima Weed | RLNC |
| | | | Control Strategy | |

SPECIES BY SPECIES PRIORITIES FOR ACTION

| | SPECIES | LOCATION | OBJECTIVE | ACTION | NOTES |
|----------|----------------------------|---|---|--|---|
| Moderate | Azadirachta indica | Western and southern edges on sand plain and in fractured | Minimise impact | Annual grubbing or herbicide application. Survey and monitor | Constant reinfestation from trees in Kununurra townsite. |
| | | gullies | | Community education with Ord Land and Water | Utilise community volunteers |
| High | Bidens pilosa | Lily Creek Walk trails | Minimise Impact | Survey and treat when soil is moist- at least once a month from November to May. Monitor | Constant reinfection from external sources |
| Low | Calotropis procera | Sandplain Visitor areas Fractured gullies | Remove | Grubb or herbicide as part of other operations | |
| Low | Cenchrus ciliaris | Walk trails Visitor areas Lily Creek | Remove | Apply herbicide as part of higher priority operations | |
| Low | Hibiscus sabdariffa | Sandplain Fractured gullies | Remove | Remove during other operations | |
| High | Hyptis suaevolens | Lily Creek End carpark | 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 | Constant reinfection from external sources |
| Moderate | Lantana camara | End car park | Monitor | Inspect site at least once per year | Under large boab adjacent to shade shelter, end carpark |
| Low | Leuceana leucocephala | | | | |
| High | Macroptilium atropurpureum | Lily Creek End car park roundabout | Eradicate | Grub and spray Monitor | Resistant to Glyphosate, trial other herbicides |
| High | Merremia aegyptia | Entrance Road | Eradicate | Spray Monitor | Spot infection |
| Moderate | Passiflora foetida | Lily Creek | Ameliorate smothering effects | Grub and spray as part of other operations | |
| High | Pennisetum pedicellatum | Lily Creek Entrance road | Eradicate | Spray Monitor | Small area Field id only near |

WEED CONTROL

NB For use of a chemical that is not registered for a particular weed, an application must be made for species/site registration.

| Species in Mirima | Source | control method | On or off label |
|---------------------------|--|---|--|
| | Scott Goodson | Access (triclopyr + picloram): diesel (1:60) basal bark, 1m of | |
| Azadirachta indica | (DOE) | trunk (360°). | |
| | Allan Thomson (CALM) | 50 - 80% Roundup (Glyphosphate) – Cut stump. | |
| Bidens pilos | Allan Thomson (CALM) | 1% Roundup:water + 0.3% wetting agent. Or, hand pull. | On Roundup is registered for use on 'broadleaf herbs'. |
| O. International Control | DAWA Declared Plant Control Handbook. | Access:Diesel 1:60 (cut stump or basal bark) Grazon (triclopyr + picloram):Water 1:200 (foliar,seedlings) Tordon (picloram + 2,4-D):water 1:50 (cut stump seedlings only) | |
| Calotropis procera | A Thomas (CALM) | Dig out small plants. | on |
| Hyptis suaevolens | A. Thomson (CALM) and Andrew. Mitchell (AQIS) | 2,4-D:water <1:100, + 1% wetting agent. Use fine mist spray and 'waft' over plant. Hand pull | |
| Leuceana leucocephala | QLD Government Natural Resources and Mines | Access:Diesel 1;60 (cut stump or basal bark) | on |
| Macroptilum atropurpureum | | ? glyphosphate | |
| Passiflora foetida | Rod O'Donnell (CALM) | ? glyphosphate (foliar), pull by by tap root. | |
| Pennisetum sp. | Kristine Brooks (CDU, NT) and A Thomson (CALM) | glyphophate:water 1:100 + 0.2% wetting agent. Spray before seeding (approx March) (proven effective on <i>P. polystachion</i>) | Off |
| Merremia spp. | A Thomson (CALM) | Roundup:water (1:100) + 0.3% wetting agent. | |
| Potential weeds | | | |
| Aerva javanica | Rod O'Donnell (CALM) | Hand grubb and burn (including seed bank beneath), Glyphosphate (%?) and burn (to remove seed bank) | |
| Andropogon gayanus | | Glyphophate:water 1:100 + wetting agent when plant actively growing. Use 2:100 if plant is stressed. | |
| Bidens bipinnata | | ?glyphosphate | |
| Echinochloa colona | | ?glyphosphate | |
| Euphorbia hirta | | ?glyphosphate | |
| Gomphrena celosiodes | | ?glyphosphate | |
| | | | |
| | | | |

ENVIRONMENTAL IMPACT ASSESSMENT

Specific weed control operations should be assessed as to any negative impact on the conservation values of Mirima National Park before commencement.

Items to consider include

- Erosion will removal of weed cover expose soil to erosion, especially in Lily Creek
- Non-target species misidentification, specificity of herbicide, residual properties, application rates.
- Pollution of watercourses careful, specific use of herbicide or alternately grub near watercourses
- Spread of weed seed ensure operations do not themselves spread seed

MONITORING AND EVALUATION PROGRAM

Procedures should be developed whereby the efficacy of weed control operations in Mirima National Park can be assessed.

To facilitate this:

- The existing database should be modified to become include a user friendly "form".
- Every weed control activity should be entered in this database, (including a GPS location).
- Staff need to be made aware of the database and instruction given on its relatively simple use.
- Flexfields need to created and used identifying weed control operations in Mirima National Park.
- A monitoring program established to determine rate of weed spread, and the effectiveness of chemical and manual weed control. This may initially be achieved with annual photographic monitoring points at strategic sites along Lilly Creek and walk trails.
- Annual survey program. This should be considered for late the wet season when weeds have had the opportunity to germinate and new infestations can be identified early in the establishment phase. Many weeds will also flower and fruit following rain events, improving the opportunities for accurate species identification.
- Maintain records of local fruiting and flowering periods and of seedling habit (to improve opportunities for successful monitoring).

Weed control operations in Mirima have mostly finished by the end of the Wet season, which coincides with the annual budget preparation cycle. A report of previous works should be prepared, noting especially what outcomes were achieved by those works. The report should be reviewed by the Regional Leader, Nature Conservation and staff involved in the works. Outcomes, strategies and operations should be reviewed and where necessary modified.

RESOURCE REQUIREMENTS

| ACTION | DAYS | STAFF | VEHICLE | MATERIALS |
|--------------------|--------------|----------------------|--------------------|-----------|
| Modify Database | 2 | DCO & RLNC | | |
| Control Activities | Unknown unti | il priorities have b | een set | |
| Monitoring | Unknown unti | il methodology de | veloped and priori | ities set |
| Evaluate efficacy | 1 | DCO | | |
| of strategy | | NCO | | |
| | | RLNC | | |

Days allocated to chemical control = ?? = \$?? by RIC and NCO....

Chemicals + diesel + wetting agent \$7000/yr

Training \$5000 for first 2 years

Library \$200/year

Equipment maintenance \$1,500/yr

First Aid and Safety gear \$200/yr

Volunteer costs (food, safety gear, spray units) (relative to project size)

Spray units and maintenance \$500/yr

Quad Bike \$??? /3 years

Aerial photos and mapping expertise \$1000 year 1

Wet season mobilization of equipment and persons: n/a

SIGNED OFF BY:

Ranger In Charge: District Manager:

Regional Leader Nature Conservation:

Regional Manager:

MIRIMA NATIONAL PARK WEED AND SURVEY LOCATION MAPS

Maps produced by Allan Thomson

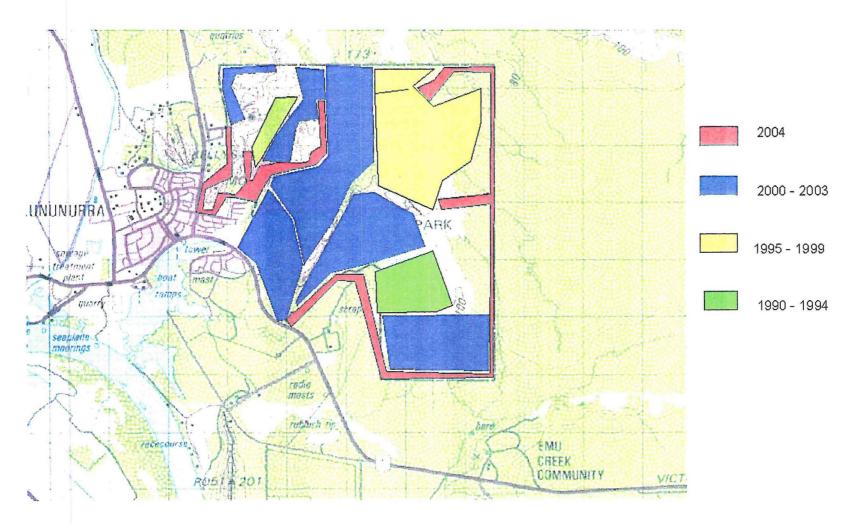


Figure 1 – Locations surveyed and years surveyed – Mirima National Park.

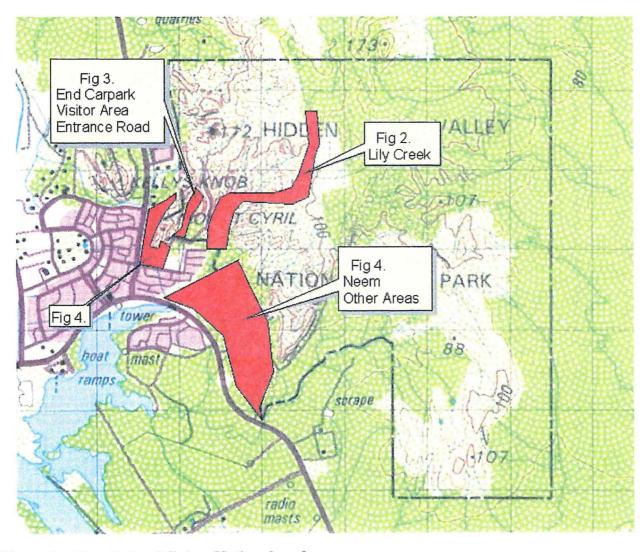


Figure 2 – Map Index, Mirima National park

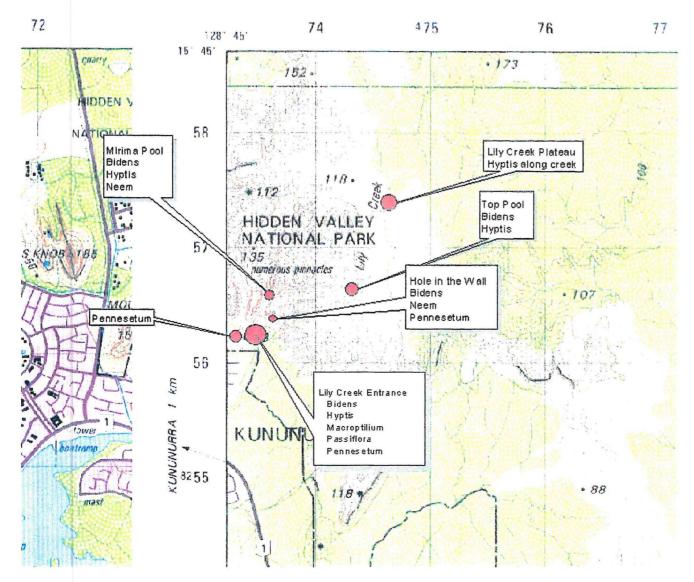


Figure 3 – Lily Creek

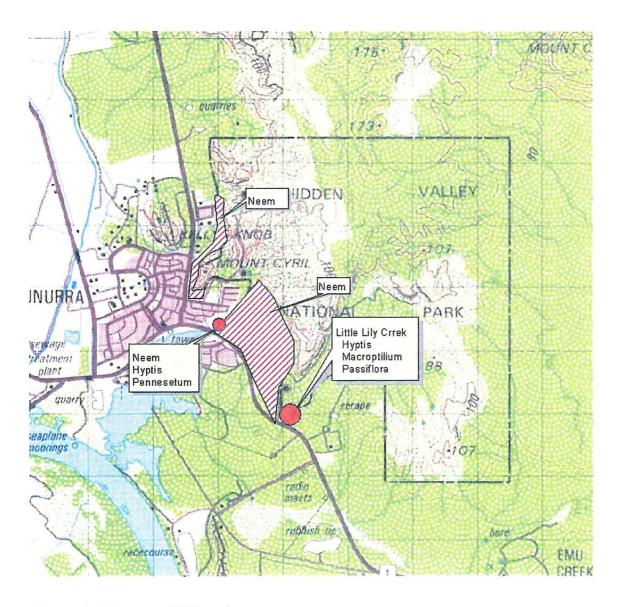


Figure 4 – Neem and Other Areas

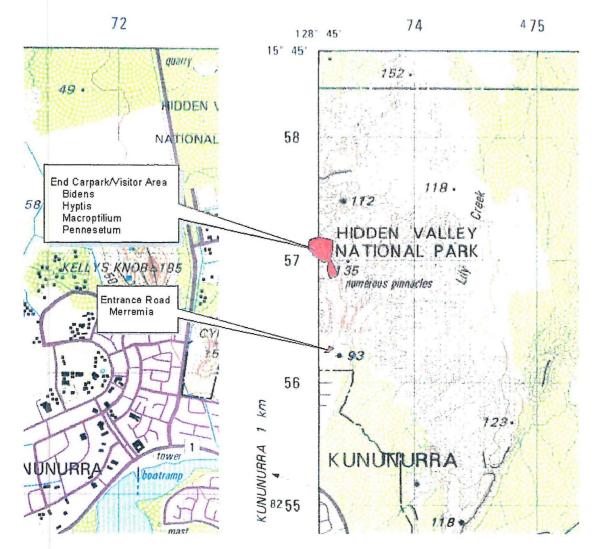


Figure 5 - End carpark, visitor area and entrance road

REFERENCES

Agriculture and Resource Mgmt Council of Australia and NZ, Australian and NZ Environment and Conservation Council & Forestry Ministers (1997) A Strategic Approach to weed problems of National Significance, Commonwealth of Australia, Canberra Brisbane City Council, Draft Pest Management Plan July 1999 to June 2002. Brown, K & Brooks, C (2002) Bushland Weeds - A practical guide to their management. Environmental Weeds Action Network (Inc), Western Australia Charles Sturt University unit (CSU): BIO327 Vegetation and Disturbance Management (Course notes) CRC for Australian Weed Management (?) What kind of Australia do you want to leave your children? (brochure) CRC Weed Management (2003) Alert List For Environmental Weeds (brochure) CRC Weed Management (2003) Weeds of National Significance (brochure) Department of Agriculture Western Australia (1999) Discussion Draft 1 - Kimberley Weeds Strategy, Kununurra, WA Department of Conservation and Land Management (CALM) (2004) Good Neighbour Policy - Internal Draft for Comment Department of CALM (1999) Environmental Weed Strategy for Western Australia CALM, Western Australia. Department of CALM (1998) Lower Ord Ramsar Site - Draft Management Report, 1998, Kununurra, WA. Department of CALM (1998) Internal - Draft Kimberley Region Management Plan Department of CALM (1992) A Survey of the Wildlife and Vegetation of Purnululu, Research Bulletin No.6, CALM. Department of CALM (1986) CALM Statement Policy 14, Weeds on CALM Land URL: http://calmweb.calm.wa.gov.au/drb/edo/mab/pol.htm Accessed September 2004. Department of CALM (1981) Biological Survey of Mitchell Plateau and Admiralty Gulf, Kimberley, WA. Western Australian Museum, Perth. Department of CALM Weed and Feral Animal Survey (unpublished) with contributions by, Lindsay Brown, Alan Thompson, Lindsay Baker, John Hayward (CALM, Kununurra) Rod O'Donnell, (CALM Derby) John Abbott and Renae Dingo (CALM, Fitzroy Crossing) Department of Conservation (DOC), New Zealand (last modified 2000/1) The Standard Operating Procedure for Monitoring Weed Control - QP Code: NH 1234 Department of Conservation, New Zealand (DOC) (1998) Space Invaders: A summary of the Department of Conservation's strategic plan for managing invasive weeds', DOC, Wellington, NZ URL: www.doc.govt.nz/conservatoin/003~weeds/004~space-invaders Accessed: September 2004 Department of Environment and Heritage (DEH) and CRC Weed Management, Introductory Weed Management Manual Forbes, S.J., Kenneally, K.F., A botanical survey of Bungle Bungle and Osmond Range, south eastern Kimberley, Western Australia in: The Western Australian Naturalist, Vol. 16, No. 5-7, April 30th, 1986. Groves, R.H., Panetta, F.D., Virtue, J.G., Towards a System to determine the national significance of weeds in Australia. P.124 - 152. In: Groves, R.H., Pannetta, F.D., Virtue, J.G. (Eds) (2001) Weed Risk Assessment, CSIRO Publishing, Victoria.

Groves, G.H., (convener) (1997) Recent Incursions of weeds to Australia 1871 - 1995 - CRC for weed management

Groves, R.H., Hosking, J.R., Batianoff, G.N., Cooke, D.A., Cowie, I.D., Keighery, G.J., Lepschi, A.C., Rozefelds, A.C.,

Walsh, N.G. The naturalized flora of Australia: Its categorization and threat to native plant biodiversity.

systems, Technical Series No. 3. Co-operative Research Committee (CRC), Australia

Heard, Tim. Workshop report-Bellyache Bush, (Jatropha gossypiifolia) Held at: CSIRO Long Pocket Laboratories, Brisbane, 2002.

Hobbs, R., Invasive Weeds, prevention is the key. In: Invasive Weeds and Regenerating ecosystems in Western Australia – Conference Proceedings. Murdoch University, Western Australia.

Humpries, S.E., Groves, R.H., Mitchell, D.S. (1991) Plant Invasions of Australian Ecosystems – A status review and management directions. Australian National Parks and Wildlife Service, Canberra.

Martin, Peter (CRC for Australian Weed Management) (2003) A 2020 Vision Statement: Killing Us Softly – Australia's Green Stalkers – a call to action on invasive plants and a way forward

Humpries, S., Weeds – Insidious Threats to Biological Diversity (1995) In: Invasive Weeds and Regenerating ecosystems in Western Australia – Conference Proceedings. Murdoch University, Western Australia.

Hussey, B.M.J., Deighery, G.J., Cousens R.D., Dodd, J., Lloyd, S.G., (1997) Western Weeds – A Guide to the Weeds of Western Australia

Keighery, G. (unpublished) Naturalized Vascular Plants of the Kimberley

Martin, P., (2003) Killing Us Softly – Australia's Green Stalkers, a call to action on invasive plants, and a way forward. CRC for Australian Weed Management, SA.

Moerkerk, M, Identification of Agricultural Weeds in CRC Weed Management & Department of Agriculture in Moore, J; Peltzer, S; Douglas, A (Eds) Weed Identification Course

National Weed Management Facilitator (Updated January 2005) Weeds of National Significance, URL: www.weeds.org.au/natsig.htm Accessed: November 2004.

Navie, S. (2004) Declared Plants of Australia – An Identification and Information System (CD ROM) Centre for Biological Information Technology.

Owen, S.J. (DOC) (1998), Department of Conservation Strategic Plan for Managing Invasive Weeds, Department of Conservation, New Zealand.

Peirce, J.R., & Pratt, R.A., (2002) Declared Plant Control Handbook (6th edition). Dept of Agriculture, Western Australia.

URL:http://agspsrv38.agric.wa.gov.au/pls/portal3o/docs/FOLDER/IKMP/PW/WEED/DECP/DECPLANTS HANDB OOK.pdf Accessed: September 2004

Reichard, S., The search for patterns that enable prediction of invasion p.10 –19. In: Groves, R.H., Pannetta, F.D., Virtue, J.G. (Eds) (2001) Weed Risk Assessment, CSIRO Publishing, Victoria.

Rejmanek, M., What tools do we have to detect invasive species? p. 3-9. In: Groves, R.H., Pannetta, F.D., Virtue, J.G. (Eds) (2001) Weed Risk Assessment, CSIRO Publishing, Victoria.

Smith, N.N., (2002) Weeds of the Wet/Dry Tropics, Environment Centre NT, Darwin.

Thorpe, J.R., National Weeds Strategy Executive Committee (1999) Weeds of National Significance: Guidelines for Developing Weed Strategies. URL: www.weeds.org.au/docs/wonsstrategyguidelines.pdf Accessed: November 2004

Thorp, J.R. and Lynch, R, (2000) The Determination of Weeds of National Significance. URL: www.weeds.org.au/docs/WONS/ Accessed: January 2005.

Waigner, L.A., King, D.M., Priorities for weed risk assessment: using a landscape context to assess indicators of functions, services and values. P.34 –51. In: Groves, R.H., Pannetta, F.D., Virtue, J.G. (Eds) (2001) Weed Risk Assessment, CSIRO Publishing, Victoria.

Walton, C.S. Leuceana in Queensland (Pest Status Review Series – Land Protection) QLD Government Natural Resources and Minerals.

www.nrm.qld.au/pests/psas/pdfs/leuacena.pdf Access: Feb 2005.

Williamson, M., Can the impacts of Invasive Species be predicted. 20 – 33. In: Groves, R.H., Pannetta, F.D., Virtue, J.G. (Eds) (2001) Weed Risk Assessment, CSIRO Publishing, Victoria.

Wheeler, J.R. (Ed), (1992) Flora of the Kimberley Region WA Herbarium (CALM), WA.

Personal Communication

Derek Goddard – Department of Agriculture WA, Kununurra (December 2004) Noel Wilson – Department of Agriculture WA, Kununurra (December 2004 and January 2005)

Allan Thompson – Department of CALM, Conservation officer Kununurra (December 2004) Gordon Graham – Department of CALM, Regional Nature Conservation Leader (November to January 2004/5)

Andrew Mitchell - Australian Quarantine Inspection Service, Darwin (December and January 2004/5)

| entire to projection | Exiting and potential w | ENDIX 1 | nservatio | n octato | | E DAG |
|--|-----------------------------------|-------------------|-----------|-----------------------------|---------------------|----------------------------------|
| Weed Species | Common Name | Declared In WA | wons*** | of Regional Significance | Future Threats** | Introduced Pasture Species |
| Acacia nilotica | Prickly Acacia | P1/2 | Yes | Yes | Yes | Yes |
| Acacia famesiana | Mimosa Bush | | | | | |
| Acanthospermum hispidium | | Prohibited | | | | |
| Achyeranthes aspera Althemanthera pungens | Chaff Flower Khaki Burr | + | | | | |
| Amaranthus viridis | Green Amaranth | | | | | |
| Antigonon leptopus | Coral Vine | | | | | |
| Aerva javanica | Kapok Bush | | | | | |
| Andropogon gayanus * | Gamba Grass | 5 17 11 1 | | Yes | Yes | Yes |
| Annona glabra Azadirachta Indica | Pond Apple Neem | Prohibited | Yes | Yes | Yes | |
| Barleria prionitis | Porcupine Flower | | (Alert) | 103 | Yes | |
| Bidens bipinnata | Cobbles Peg | | (| | | |
| Bidens pilosa | Cobblers Peg | | | | | |
| Brachiaria mutica | Mission Grass | | | Yes | Yes | Yes |
| Cabomba caroliniana | Cabomba Rubber bush | P1/2 | Yes | Yes | Yes | |
| Calotropis procera Cardiospermum halicacabum | Small Balloon Creeper | - | - | Yes | | |
| Cassia fistula | Golden Shower Tree | 1 | | | | |
| Cenchrus biflorus | Gallon's Curse | | | | | |
| Cenchrus ciliaris | Buffel Grass | | | Yes | | Yes |
| Cenchrus echinatus | Mossman river Grass | Prohibited | | | | |
| Cenchrus setiger | Birdwood Grass | | | | | |
| Chloris inflata Citrullus colocynthis | Purple Top Chloris Pie Melon | - | | | | |
| Citrullus Ianatus | Pie Melon | | | | | |
| Clitoria ternata | Butterfly Pea | | | | | |
| Cryptostegia grandiflora | Rubber Vine | P1/2 | Yes | Yes | Yes | |
| Datura inoxia | Downy Thomapple | | | | | |
| Echinochloa colona | Awnless Barnyard grass | | | | V | Van |
| Echinochloa polystachya Eichhomia crassipes | Aleman Grass Water Hyacinth | P1/2 | | Yes Yes | Yes Yes | Yes |
| Euphorbia hirta | Asthma Plant | 1 1/2 | | 103 | 100 | |
| Grewia asiatica | Phassa | | | | | |
| Heliotropium indicum | | | | | | |
| Hibiscus sabdariffa | Rosella | | | | | |
| Hymenache amplixicaulis Hyptis capitata? | Hymenachne | Prohibited | Yes | Yes | Yes | Yes |
| Hyptis suaevolens | Mint Bush | Prohibited | | Yes | | |
| Jatropha gossypifolia | Bellyache Bush | P1/3 | | Yes | | |
| Lantana spp. | Lantana | | Yes | | | |
| Leucaena leucocephala | Leuceana | Prohibited | | Yes | | Yes |
| Limnocharis flava | Yellow Burrhead | Prohibited | | | | |
| Macroptilium atropurureum Martynia annua | Siratro Devil's Claw | P1/2 | | Yes | | |
| Merremia aegyptia | Hairy Merremia | 1- 1/2 | | 169 | | |
| Merremia dissecta | | | | | | |
| Mimosa pigra | Giant Sensitive Plant | P1 | Yes | Yes | Yes | |
| Parkinsonia aculeata | Parkinsonia | P1/4 | Yes | Yes | | |
| Parthenium hysterophorus | Parthenium Weed | P1 | Yes | ? Voc | Yes | |
| Passiflora foetida Pennisetum polystachlon | Passionfruit vine Mission Grass | Prohibited | | Yes Yes | Yes | Yes |
| Pennisetum pedicellatum | Deenanth Grass | . rombitou | | Yes | 100 | 163 |
| Physalis minima | Wild Goosberry | | | | | |
| Prosopis spp. | Mesquite | P1/2 | Yes | Yes | | Yes |
| Salvinia molesta | Salvinia | P1/2 | Yes | Yes | Yes | |
| Senna obtusifolia | Sicklepod Senna Spinyhead Sida | P1/2 | | | | |
| Sida acuta Stylosanthese spp. | Stylo Sida | 171 | | | | Yes |
| Tamarix aphylla | Athel Pine | Prohibited | Yes | | | 163 |
| Themeda quadrivalvis | Grader Grass | Prohibited | | Yes | | |
| Thunbergia grandiflora | Blue Trumpet Vine | Prohibited | | | | |
| Thunbergia laurifolia | Laurel Clock Vine | | (Alert) | | | |
| Tribulus terrestris | Caltrop | P4* | | Ves | | |
| Xanthium strumarium Ziziphus mauritiana | Noogoora Burr Chinee Apple | P1/P5* | | Yes | | |
| maprice macinalia | CIOO / Ippio | 5 | | | | |
| * Declared only in Rmome, Der | by Most Kimeday Halls Cree | k and Mand | om Foot V | imb aday | | |

This table was compiled with the assistance of: N Wilson (AgWA Kununurra) and A Mitchell (AQIS)

Smith, 2002; Humpries, Groves and Mitchell, 1991; Wilson, N.; Mitchell, A., Goddard, D., pers comm. WONS and ALERT lists www.weeds.org.au, www.agric.wa.gov.au.

^{*} Declared only in Broome, Derby West Kimerley, Halls Creek and Wyndham East Kimberley

** These species are weeds which have the potential to establish in the Kimberley region on conservation estate.

*** Weeds of National Significance (WONS) and ALERT weeds(potential threats) were nominated by researchers and scientists to foster an Australia-wide, focused approach to weed control.

P1 Prevention of trade, sale or m
P2 Plants to be erradicated from the state
P4 Plants that should be prevented from spreading from that area of the state
P5 Infestations on public lands should be controlled.

| | Gelkie | Brooking | | V-AUT | King | | Windjana | | | | | 175,2 | THE AT | | Prince | 15. 161 | Point | | Dragon | Wolf Creek | | 1 | | Lacepede | | Rowley | TE SEE | 1 |
|---|------------------|-----------------|---|---|--|--------------------|--------------|----------------------|--|----------------|--|---|--|----------------------|-----------------|----------------------|-------------------|---|--------------------|--|---------------------|---------------------|--------------------|---------------|-------------------|--------|------------------|------------|
| Introduced Weed Species | Gorge NP & CP | Gorge | Reef CP | Purnulutu NP & GR | Leopold Ranges CP | Tunnel Creek NP | Cours | Ord River NR | Parry Lagoons NR | Mirima NP | Creek CP | River CP | Laterite CP | Milchell River NP | Regent NR | Drysdale River NP | District Co. | Arboretum | Tree Soak NR | Crater | Coutomb Point NR | Browse Island NR | Adele Island NR | Islands NR | Swan Island NR | Chanle | Soott Reef NR | Pe Isla |
| ceata nilotica | | | | threat | | | | | | | | | | | | | | | | | | | | | | | | F |
| ació famestano | | REMARKS NO. | Redura/Nata | direct | AND HOUSE | 0.0000000000 | AND REPORTED | (fill of the letter) | - TO TO TO TO | 9708technick | Significations. | a di pasumena | NEW THEFT | DINESSON IN | VELECO NI STATE | 200030000 | Habuto é se | | 10/10/20/20 | shub bledh | MERCER COLD | | _ | | - | | | + |
| hyerenthes aspera | | AND DESCRIPTION | CONTRACTOR OF THE PARTY OF THE | | 2000 | threat | - | AREA HOUSE | | U.S. CONTROL | and the latest the lat | GOTPS STORA | 2.5.5.00 | SOUTH CONTRACTOR | AATAP BULLEY | C2000000000 | VCD0002538 | | 28 PERRIE | Charles and Charles | HILLY WATER | | | | | | | + |
| anthospermum hispidum | | | _ | -STATE | and the same in case | Dittat | | - | 200-1 | 1/700 | | | | | | | _ | | | | | | | | _ | - | | + |
| hemonthera pungens | | | | | 100 | March of S | | | | | | | | ********** | | _ | | | | | | - | | | | | | + |
| prenthus viridis | | | - | - | - | August Martin | | | | | | | | - | | | | | | | | - | | | | | | + |
| dgonan leplopus ? | - | | _ | | _ | - | | | - | | | | | | | _ | | | | | | | | | | | | + |
| nva javanica | | | | 5-14-50-0 FE | | | - | | | threat | - | | | | | - | | | | | - | | | | | _ | - | ┿ |
| dropogon gayanus * | | | | | | | | | threat | threat | threat | threat | threat | threat | - | threat | threat | | | | | | | | | | | + |
| tedirachta Indica | | | | | | | | | uncat | unest | unear | Undat | uncar | useat | | PHART | Uneat | | | | | | | | | | | +- |
| | | | | - | | | | | | | | | | _ | | | | | | | | | | | | | | + |
| dena bipinnota | | | | - | | | | | Contract to the last | | | | | | | | Contract Contract | | | | | | | | | | | + |
| tens pliose | | | | | | | | _ | | | | | | _ | | | district the same | - | | | | | | | | | | + |
| achlaria mutica | | | | _ | | | | | threat | | | | _ | | | | | | | | | | | | | | | + |
| abomba ceroliniana | | | | | | 45 | - | | threat | | | | | | | | | | | | | | | | | | | + |
| elotropia procera | | | | | CONTRACT OF THE PARTY OF THE PA | threat | | | - | | | | | | - | - | ASSESSED OF | | | | | | | | | | | + |
| ardiooparmum hallcaceburn | | | | | - | | | | | | | | | | - | | | | - | | | | | | | | | + |
| osola fiztula | | | | | - | | - | | | | | | | | | | | | | | | | | | | | | + |
| enchrus billorus | | | | | | threat | | | threat | throat | | | | | | | | | | | | | | | | | | + |
| enchrus citieris | | | | | threat | threat | threat | | | | | | | | | | | - | - | | | | | | | | | + |
| enchrus echinatus | | | | ar Mactic | threat | threat | threat | | threat | threat | | | | | | | | | | | | | | | | | | + |
| enchrus setiger | | | | | | | | | | | | | | | | | | | | | | | | | | | | _ |
| Norts Inflats | 1967年日 | 100 | 359999 | THE CORPORATION | 7000 A 1000 | 58.44.58.15.15.15 | 9786459 | 04975,3158 | edillas ur | Plana Part | State Holder | 经证据代别 | 10.3 51.3 | | 别没有意识。 | 1980年2月前6 | 相互使用自己 | ST45 2955 | 类对的证法 | | 等。 伊斯特特 | | | | | | | 4 |
| Institut colocynthis | | | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| rullus lonatus | | | | (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) | | | | | | | | | | | | | | | | | | | | | | | | _ |
| Roria terneta | | | | | - | | | 1.000 | | | | | | | | | | | | | | | | | | | | |
| yplostepia grandiflora | threat? | | | threat | | | | | threat | | | | 100 | | | | threat | | | | | | | | | | | |
| stura inoxia | | | | ALC: U | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| chinochtoa colona | SUPPRIME | 100000000 | 74.27475 | 100000 | A TABLE OF SE | 1884 | | THE SEC | e a compare | Francis | | F-11083 | 學是別提 | | 新田田田 | 第 5月17日 司 | 學學院開 | 201975 | 建多数形式 | SERVING SE | 音位建步即 | | | | | | | L |
| chlnochloa polystachya | | | | | | | | | | | | | | | | | | | | | | | | | | | | T |
| Ichhomia crassipes | | | | | | | | | | | | | | | | | | | | | | | | | | | | T |
| uphorbla hirta | | | SPAKES SE | 5.57 | 新班被 等 | 是到了多种 | 极限抗症的 | ill to the same | 40000000000000000000000000000000000000 | 10012000 | 80000 | 20万分的1000 | | | Figure 1 | STREET, | 190 431 65 | 在新規提出計(日 | \$100 E E E E E | 5万分(1)建筑 | 語語語用數 | | | | | | | T |
| omphrena celostodes | | 推步等原始 | 6%的2000年 | 特別能力推 | 2000052 | BURETINE | | 開始的流 | 100 | THE WAY | 3.2000000000000000000000000000000000000 | 時期開始 | (819) Table 11 | Bell Tine | 智能的现在形式 | 新新的 | 00-12/24/33 | 100000000000000000000000000000000000000 | (\$50000) | 和 机全流分裂 经 | 建设用的压缩 | | | | | | | T |
| rawla asiatica | | | | | | | | | | | 1 | *************************************** | | | | | | | | | | | | | | | | Т |
| ellotropium indicum | | | | | | | | | | | - | | | | | | | | | | | | | | | | | T |
| libiscus sabdarilla | | | | | 712 476 | | | | | | | | | | | | | | | | | | | | | | | T |
| lymonacha amplixicaulta | | | | | | | | | threat | | | | | | | | | | | | | | | | | | | 1 |
| yptis capitata ? | - | | | | | | | | | - | | | | | | | | | | | | | | | | | | \top |
| yptis sueevolens | threat | | | No. of Control of Control | 7 | threat | | | REAL PROPERTY. | | | | | A THE PARTY | | | STEP ST | | | | | | | | | | | \top |
| | threat? | | | 1111 | | | | | | | | | | | | | | | | | | | | | | | | + |
| anlane sp. | | - | | | | - | | | | | | | | | | - | | | | | | | | | | | - | + |
| sucaena leucocephala | threat | | | | - | | | - | threat | | - | - | | | | | | | | | | | | _ | | | | + |
| scroptilium etropururoum | инові | | _ | | | threat | threat | | Unout | - | | | | - | | | | - | | | - | - | | | | | | + |
| artynia annua | | | _ | - | - | 23000 | | threat | - | | threat | threat | threat | threat | threat | | | Selected to the later | | | threat | - | | | | | | + |
| | | | - | _ | | | | Unical | | _ | uneat | - unent | иноас | uweat | uneat | | | | | | Uncat | - | | - | | | | + |
| orremia spp | - | | - | threat | | - | - | | threat | - | - | | | | | | | | | | | - | - | | - | | | + |
| limosa pigra erkinsonia aculeata | | _ | | undat | - | | | threat | uncal | | | | - | - | - | | _ | | | | | _ | | | | | | + |
| aronsonia acuiesta assiflora foetida | | NESSEGNAS | DESERVATION | | S 15 12 1 | 8500000 | | ASSOCIATE | STEEL ST | | 0.08923222 | OCH BURNE | With Bill took | AND REAL PROPERTY. | Will Bridge | | SERVICE STATE | The Depth and | 679553321 | STATE OF THE PARTY | ESTERNATURE CON | | | | | | | + |
| | | 020000000 | e change of the | threat | | Definition of the | | PRINCES OF | 0.00 March 1997 | | 108/2000 | B10. 52.000529 | VEST - 100 - | | 194777597 | - | | - | PERSONAL PROPERTY. | 1 - 0750 VOLGE | PROPERTY. | - | | | | | - | + |
| arthenium hysterophorus | there and | thenat | 45 | | there at | thenet | threat | | thear | thron' | three: | three of | theon't | thron* | thene | lbean' | throat. | | | | threat | - | - | _ | | | | + |
| | | | | | threat | threat | threat | | threat | threat | threat | threat | threat | threat | threat | threat | threat | | | | threat | | | | | | - | + |
| | threat | threat | threat | threat | threat | threat | threat | | | | threat | threat | threat | threat | threat | threat | threat | | | | threat | | | | - | | | + |
| ysalla minima | 7 | | - | | | | | | | | | | | | | | - | | - | | | | | | | | | + |
| osopis app. | | | | | | | | | | | | | | | | | | | | | | | | | | | - | + |
| Ivinia molesta | | | | | | | | | threat | | | | | | | | | | | | | | | | | | | + |
| anna obtusifolia | | | | | | | | | | | | | | | | - | | | | | | | | | | | | + |
| kla acuta | | | | A COLUMN | The state of the s | threat | | | | | | | | | | | | | | | | | | | | | | 1 |
| tylosanthes app. | | | | Man real | | | | | 100 | | | | threat | threat | | | threat | | | threat | | | | | | | | 1 |
| | | | | threat | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| amartx sphylla | | | | | | | 11 | | | | | | | | | | | | | | | | | | | | | 1 |
| amarix sphylla | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| amarix sphylla hemeda quadrivolvis | | | | F-1, 1 (4.5) | theat | threat | | | threat | threat | | | | | | | THE REPORT OF THE | | | | | | | | | | | 1 |
| amarix sphylla hemeda quadrivolvis ribulus terrestris | | | | - 1 to 100 | theat | threat | | | threat | threat | - | | | A CONTRACTOR | | | TENNENDAL | | - | | | EA CON | | | | | | \pm |
| amarix sphylla nemeda quadrivalvis ribulus torrastris ridax procumbens | threat | | | threat | theat | threat | | ? | threat | threat | | | | NO STOR | | | TEACH SUND | | | | | | | | | | | + |

Conservation Park (CP), National Park (NP), Nature Reserve (NR), Marine Park (AP)

Exceptions of the Septiment Septiment (NP), Nature Reserve (NR), Marine Park (AP)

Exceptions of the Septiment Septiment (NP), Nature Reserve (NR), Marine Park (AP)

Exceptions of the Septiment Septiment Septiment (NP)

Alain Thomson, John Hayward, Lindsay Baker, Lindsay Brown (CALM Officers, East Kimberley District) and Rod O'Donnell, Renae Dingo and John Abbott (CALM Officers, West Kimberley District),

CALM 1982; CALM 1981; Humphries, Grove and Mitchell, 1991).

This weed summary is not conclusive Identification of new weed species and new or previously unrecognised weed populations is an ongoing process. Threat predictions are neither complete nor conclusive.

| | APPENDIX 3 | |
|--|--|--|
| WEED SPECIES | EINYRONMENTAL MARGT OF WRIED EPECIES | WEED HABITAT |
| Acecia nilotica | Repidly forms yest thanny thickets, outcompeting notive species and converting grass tend to should lend. Being spread by cettle, road trains and flood events | Mitchell Grass downs, on natural or man-made water sources. |
| Acecia famestana | Occuring to verying densities. Capable of creating thomy uncentrable thickets, outcompeting native species. | Disturbance opportunist of overarizzed rendelands |
| | Q.Acompetes native apecies, loxic large seed bank | Disturbed elles, sun lowing |
| Achyeranthes aspera | Flowers/seeds problically and disbands lines of eged upon disparsal epents (people, animals, vehicles) at aligntest contact. Forms monocultures which preclude any movement. | nver banks, general riparien zone end disturbed aftes. |
| Althomenthere pungens | Nulsance weed of growing concern; occurring participants - thus readily discerned to new sites. | Dry preza in disturbed situations. |
| Amerenthus viridita | Impact pringrity on secretural pursuits. Approximate woody weed, forming repet thickets and eutcomnettes notive species. Tolorance to flood conditions and salt water. Threat to Metalleura vertiands and management. | Osturbed alics Fresh and brackish awarnos, creeks and rivers, coasts, rainforests and roadsides (OLD, NT) |
| Antioonon leptopus | The property many prints outside to some and outside to the property of the pr | Sites with high victer table, such as edges of Lake Kununuma. |
| Aerva Javanico | Embry colonization of distruption elters, mass producer of wind discovered seed (fluff) which can cause plents to occur in hard to access locations. Seriousness of impact debatable | An afkeline soil specialist at disturbed sites such as roadedes. |
| Andropogon gayanus | Capable of filtering natural fire regimes and causing very hot fires. Aftered fire regime and outcompeting of native apecies can cause an afteration in natural vegetation assemblages. | Typically sites with over 500ml of rainfall. Potential habitat in the east and west North Kimbertey area |
| Asystosia gengetica | | |
| Azadirachta indice | Potential for perious, widespread occurrence in Kimberlay, Capable of outcompeting native species, Seeds spread readily by birds | Appears to have varied tolerances. Citen occurs under trees (as dispersed by birds) |
| Barleria prionitts | Highly Invesive, forming dense thickots, a porticular risk to ricerian zone | Waterways, open woodland, disturbed sites (roadsides and overgrazed rangeland) (in WA) |
| | Nutsance weed, which should be controlled where possible | Disturbance coportunist, Typicatly of riverine areas Disturbed riverine areas and wetlands |
| Bidone pilose Brachiarie mutice | Outcompetes native vegetation, destroys water bird breeding habitat, chokes streams - forms dense mats and traps are counting infit of wettend | eems aquatic in watlands and shallow streams. Grows in water 2m deep and on dry land. |
| Cabomba caroliniana | A major gouldowed capable of choixing our latest water ways. Stapmins and deteriorates water quality | submerged aquatic, rooted to substrate or free floating, takes and slow moving water ways. |
| Calotropia procera | Astituboolly unattractive. Recarded by some as having reached magnitum levels in East Kimberley Concern for continued establishment, especially in costal vectation. | disturbance opportunist of overdrazing and fleodolains. Habitat variable. |
| Cerdiospermum haficecabum | Gengrafit minor | Flood plains |
| Cassio fistula | Woody weed of moderate impact | Reinforest and over margins. |
| Cenahrus biflarus | Nuisance weed, seeds readily attaching to objects of dispensal. Can infest campgrounds thus should be controlled to prevent further dispersal. | Disturbance opportunist in dry areas. Widespread on river systems |
| Cenchrus cillaris | Outcompeting netive vegetation systems and heving a dramatic effect on natural fire regimes and thus natural vegetation composition and netive feuna resources in mesic areas. Pesture species occuping large areas. | moist eress and flood plains, also in semi and landscapes (not desert). |
| Conchrus echinatus | Nuisance weed, seeds reedily attaching to objects of discernal. Can infest comporounds, thus should be controlled to prevent further discernal. | Widespread on river systems, generally occupying hebitat with higher water occurance than that of C. biflorus, water courses |
| Cenchrus setiger | Outcompiètes native crassée! Wildcarpered, consept-lynive controller native grassées (incle: «listihing or crazing recorded as instituctive control) | disturbed areas (roadsides), river banks |
| Chloris inflata Chromolaena odoreta | Tradestree, Bayespart occurrence accepts your easy and occupy recording a remove occupy. Rapid Indiatr Tools, | coastal in N QLD. neglected rangelands, woodland and disturbed rainforest |
| Citrultus colocynthis | | veltands and crepks |
| Citrullus lenatus | | rangelands, roadsides, distrubed water courses |
| Citoria lemeta | Capable of choking out native vegetation and occupying large areas. Becoming more widespread. | |
| Cryptostegie grandiflore | Smothers from ground layer to canopy (to 40m). Destroys noarian vegetation and native enimal habitat. Provides habitat for feral animals. Blocks water way access monoculture forming. | Riparian communities in tropics and vine thicket assemblaces. Fire disturbance opportunist. |
| Distura Inoxia | potsonous, forming menoculines. | disturbed sites (roadsides, waste dumps) inparitin zones. |
| Echinophion colons | A perious weed of periodulus. Displaces native grispes. Quicompetes native vegetation, displaces water bir offereding habital, chokes streams - forms deres mats and traps sit causing inflid of watland. Considered more senous than Brachleria mulca. | Creeks and swamps Semi aquatic, in watter to 2m deep and on dry land |
| Echhorilos polystachys Elchhornia crassibes | Objection facilities from the proposition of the pr | Floating equatic. High nutrient levels, standing surface water. |
| Euphorbia hirta | Generally regarded as a lawn weed. Potential for serious impact minimal | Riverine press |
| Growia estatica | Forms dense thickots Resistent to fire and drought. | Variable (riparian, vine thickel, woodland, coastal) |
| Heliotropium Indioum | | Widespread in disturbed riverine areas |
| Hibiscus sabderiila | Potential for impact in teolated gress Capable of forming dense thickets along waterways. | Generally sites disturbed by stock, creekines |
| | Caseble of cholding out waterways. | Cominguistic in wellands and strange and water up to 7m days and or day land |
| | Cassable of cholding out wetlands and modify status by forming derise mets and trapping ear. Potentially a very scripus weed in the Kimboriev | Semi aquetic. In wettands and streams and water up to 2m deep and on dry land. Disturbance concrunist. Often near creeks, rivers etc. |
| Hyptis suesvolens | Widespread, monoculture forming, outcompeting native species, removing native fauna habitat. | |
| | | |
| Jatropha gossypifolia | Cutcompetes native species, especially along water ways, Propving difficult to remove | Semi and disturbed areas and water ways |
| | Outcompetes native spooses, especially atom water wave. Propoving difficult to remove Forms denter bitches and is apposite of outcompetion native spooles in Not Indicating very review landericles in Klimbarter recipio. | Semi and disturbed areas and water wava coestal margins, wetlands, riceners sites (distrubed and undisturbed) waste sites |
| Jatropha gossypifolia Lantana spp. Leucaena leucocephala Limnocharla flaya | Outcoments native access a specially atom water uses. Procure difficult to remove Forms given piloties and a special of outcoments native superior sequels had indicated view necessaries. Forms dense piloties and a special of outcoments native sequels had indicated view necessaries indicated in timberity region. Forms dense thickets and composite native appears. Produces large amounts of seed. Potential throat to monotenids and invente stress. Obtained to finish reportation. | Semi siru disturbed areas and voter veys coestal minorine, vettends, recense sites (asin, bed and undashurbed) waste sites coestal minorine, vettends, recense sites (asin, bed and undashurbed) waste sites contract acquisite (Still fresh water withouts awarmos, sites moving waterways, impassion channels (OLD) |
| Jatropha gossypifolia Lantana app. Leuceana leucocephala Limnocharla flaya Macrophilium etropurureum | Outcomeds native secrets expecially along water ways. Proporting difficult to remove Forms dense Plokstet and is apposled of automostion native species Not Indication view invested landering reproducts to the Competent profession of the Competent of the Competent profession of the Competent of the Com | Semis and disturbed areas and water ways coestal marains, wettends, incomen sites (distructed and undashubed) waste sites corrected apactes. Still legal water, withouts watered, story moving valenteers, impation channels, (OLD) Obstructures opportunits, however for board in serial with braticax. |
| Jatropha gossypifolia Lantana spp. Leuceana kuucocephala Limnocharis flaya Macroptilum etropurureum Marhynia annua | Outcoments native access, successful atom water uses. Procure difficult to remove Forms dense Publishes and a speciate of outcoments native supecies Not indicative varieties in Kimberter region. Forms dense Publishes and accession plant accesses. Produces large amounts of seed. Potential through to manufacture and inventors accesses. Forms dense builders and composing matter approach produces large amounts of seed. Potential through to manufacture and inventors are seed. Webserval of Nimberter, Capability of surpheron all verystation levers. Moreoughes Termin, Outcomposing matter seeders. | Semis and disfutured stress and voider vers constal mixture, voidends, roomen sites (distribude and undeshubed) veide sites constal mixture, voidends, roomen sites (distribude and undeshubed) veide sites emergerii aputici, bil first hiveter, veiderds severinos, sitem movino voidenveirs, impation chemnels, (OLD) Chitubrane apportunist, however not found in areas with Avestock Distributories apportunist. |
| Jatropha gossypifolia Lantena spp. Leucanna kuccoephala Limnocharia flava Mecropitium ptropurureum Martynia annua Merrenia peryptia | Outcommotes native apposes seposally atoms under using. Proposing difficult to remove Forms direar plicities and a apposite of disconnection native apposites had indication view investments indicated in the indication of the indication of the indication in the indication of the indication in the indication of the indication in the indication of the in | Semis and disturbed areas and water ways coestal marains, wettends, incomen sites (distructed and undashubed) waste sites corrected apactes. Still legal water, withouts watered, story moving valenteers, impation channels, (OLD) Obstructures opportunits, however for board in serial with braticax. |
| Jatropha gosyypifolia Lantang app. Lescaena keucoophala Limnocharia flava Mecropitian etropururaum Marynia annua Merronia sectypitia Merrenia dissecta | Outcometes native access, successful atom water uses. Procure difficult to remove Forms dense histories and a speciate of outcomenter native species. Pollutaria travel indennies in Kimberter report. Forms dense histories and composing mathe appears. Produces large amounts of seed. Potential through to manufacture outcomes matters. Outcomes thistories and composing mathe appears. Produces large amounts of seed. Potential through to manufacture and memorial appears. Webserved in Kimberter, Capable of amothering all subgettion levers. Mesocrated in Kimberter, Capable of semination and eventation levers. Mesocrated of histories, Outcompletes install seconds: Capable of dryslang out mather ventilation and eventation upstermay. Recognized as more invasive than Marrema dissects! Webserved amount of Roman and Kimurum. Capable of derivation and inventional underworks. Difficult to control when webserved. | Semi and dirturced areas and voigit vers constal misroirs, voicines, incerno rikes (distribude and undebuted) vesite sides constal misroirs, voicines, incerno rikes (distribude and undebuted) vesite sides emergeri aputici. Bill file mis veter, verificate severines, abov movino voicineses, impation chemnets, (OLD) Chitubrate apportunist. Incernor not found in areas with Avestock Distributiones apportunist. reportunist (Substitution) |
| Jahropha gessypifolia Lantana spo. Lantana spo. Limocharia Riyea Macrophilum ptropuureum Marynnia annua Merremia perypita Merremia dissecta Mirrosa plura. | Outcoments native secrets seposally story well-army. Promying difficult to remove From dense Proletas and a speciate of outcomertion native species Not indication view measure jurisdencies in Kimberter report. Forms dense Divident and composite native segrets. Produces large secrets of seed. Potential threat to remove the segrets. Produces large secrets of seed. Potential threat to remove stress. Widescreet in Kimberter, Capable of amothering all inspetition lives. Capable of professor out an about the secrets of the secret secrets of the secret secret secrets. Widescreet in Capable of a darker ventilation and overtibing visitionsy. Recarded as more involved strand discovered around Browns and Kurzururs. Capable of dividence out an about the secret secrets. Widescreet all strand Browns and Kurzururs. Capable of dividence out makes well allowed secrets without where removed. | Sems and dirturbed areas and voter vers coestal marines, verticals, ricenses sites (disrupted and unseabuted) versite sites coestal marines, verticals, ricenses sites (disrupted and unseabuted) versite sites contracted apacted. Still fresh voter, verticans average, abov movino verticanses, incastion channels, (QLD) Chilumbook apactharistic Roverier and found in areas with healtices. Chilumbook apactharistic Roverier and Apacte sites with healtices. Chilumbook apacted (size Kurins) Ropodolinis, sweapos, vetter courses and verticands. |
| Jalropha gearmifolia Lartaria son. Leizeioria Isuccepnala Leizeioria Isuccepnala Liminocharia Rigira Macropilikun etropurureum Maryrisia arrius Merremia eteoptala Merremia dissecta Mirrosia pitra Partansonia eculeata Partansonia requesta | Outcoments native secrets sepocially atoms where ways. Proposing difficult to remove Forms dense Proleties and a specialist of obtomeration native species Not indication was invasive landeroids in Kimberter region. Forms dense Proleties and a specialist of obtomeration native species Not indication was invasive landeroids and invanish stress. Outcome thickets and composite native appears. Produces large smouths of seed. Putertial threat to removate region. Wedescreat in Kimberter, Capability of anothery and veletifion layer. Wedescreat in Kimberter, Capability of another speciality. Wedescreat in Kimberter, Capability of another speciality of the s | Semi and dirturbed areas and voider vers coestal marriers, verticate, recens sites (dirturbed and undeshubed) verida sites corrected assertion. Self freque voider, verticated area undeshubed verticated self-self-self-self-self-self-self-self- |
| Jahropha possypifolia Lantana geo Leruseina leruscoephala Limnootharia filina Macropistum ptroprurerum Marhnis annua Marmis asvipta Merrenia porpota Merrenia pisror Parinsonia edeletia Partinonia edeletia Partinonia niterochorus Passifica feotohorus | Outcoments as the apposes appealed atting used a very. Proposing difficult to remove Form disress holded and a apposite of discremotion rather species had indicated with remove the remove | Sem and dirturned areas and voter vers content marries, writteners, recent sites (single-deal and uncashubed) versit sites content marries, writteners, recent sites (single-deal and uncashubed) versit sites content marries, writteners, recent sites when the sites content marries (C.C.) Contributes appoint site (single-deal areas) with healtings recent sites appoint sites Contributes appoint sites (C.C.) Contributes appoint |
| Jahropha possypifola Lenana soo. Leusena kuucoophala Leusena kuucoophala Leusena kuucoophala Lenoodhari hirva Macroolikum ehrourureum Machina annua Marromia annua Marromia daseuta Marromia daseuta Marromia daseuta Parlaman misterooherus Passiliara foetida Parnisatum pohitainia Parnisatum pohitainia | Outcoments native secrets sepocially story well-are well. Promoting difficult to remove Forms denies (Index and we packed and a secolated of chromotine native species Not indectation were measure jundencies in Kimberter region. Forms denies (Index and a secolated of chromotine native species Not indectation were measure jundencies in Kimberter region. Forms denies (Index and index an | Semi and dirturbed areas and voider vers coestal marriors, verticates, recens sites (distructed and undesturbed) variet sites coestal marriors, verticates, foreman sites (distructed and undesturbed) variet sites control sites (Still fresh voider, verticate) exemps a sites movino verticeness, incession channels, (QLE) Centrolarea coordinate). Reviewer not found in ereas with heatlook Centrolarea coordinates. reportion zero (Bala Kourins) Sociolarias, severan valter courses and verticands rechnerally verticated and most in vertication associations. Distributed sites (comparated (consistent) verodations, grasslends Most incurren in portion, zone Most incurren in portion, zone |
| Jatropha gosynyfola Lonhana spo- Lerseana kucocephala Lerseana kucocephala Lerseana kucocephala Lerseana kucocephala Maeropikum stropurureum Maeropikum stropurureum Maeropikum stropurureum Maeropikum stropurureum Maeropikum Maeropikum Maeropikum Maeropikum Partrisonika eudvala Part | Outcoments as nitre species specielly story well-bring story to the control of th | Sem and philured areas and voter vers coestal marriers, writings, ricenses sites idealinified and undeshabeted waste sites constalled in the control of the |
| Jahropha posymptola Loninan sop. Leyseans leyseophala Leyseans leyseophala Leyseans leyseophala Leyseans leyseophala Macropidum phopurusum Purusum parterophorus Passalinan feetidum Physalia minima Physopala sop. Physalia minima Physopals sop. | Outcoments native secone sepocially storius under using. Process difficult to remove From dense Divides and a sepocial of deformation native secoles. Secoles and secones of deformation native secones and secones of deformation native secones. Produces large encounts of secones and | Semi and dirturbed areas and voice vers coestal marriors, verticals, recens rates (districted and undesturbed versite sizes coestal marriors, verticals, fictions rates (districted and undesturbed) versite sizes constructed operations. Bit first vertice, verticals eventures above vertically installed or constructions. Confluence apportunist, however not found in eversive with heatlook Confluence apportunist. Inconfluence apportunist. Confluence apportunist. Confluence sizes (ask Kurtra) Spoodlands, several rates Kurtra) Spoodlands, several rates Kurtra) Spoodlands, several verticals care districts vertication associations. Centre of the sizes of the |
| Jatropha gosymfola Lonhana spo. Leriseana kuccoophala Leriseana kuccoophala Leriseana kuccoophala Leriseana kuccoophala Misercapitum stropurureum Misercapitum stropurureum Misercapitum stropurureum Misercapitum Misercapitum Misercapitum Misercapitum Misercapitum Misercapitum Perintenana misercapharus Parintenana misercapharus Parintenana misercapharus Parintenana povisteana Prospositum polysteanana Prospositum | Outcoments as native secosis seposally storic wells are very provinced filling at the remove forms greatly below and secosis and secosists of decimentary response buildings and secosists of decimentary response buildings and secosists of decimentary response buildings and remove storic buildings and remove st | Semi and dirturbed areas and voter vers coestal marriers, verticals, ricenses sites identificate and unsalautated versite sites coestal marriers, verticals, ricenses sites identificate and unsalautated versites sites consequent position. Self-injury versites in words in excellent individual control of controls. Control of the Control of Controls. Controls areas (table Control). Controls areas (table Controls). Controls areas (table |
| Jefroph possyndola Lardrand 800. Lardrand 800. Lardrand 800. Lardrand Naccophida Lardrand Naccophida Memoral Magnetia Memoral desetta Memoral | Outcomeda native secoses seposally storic valet ways. Process difficult to remove From direct problems and a special of disconnection native special set indications was measure landencies in Kimbertin reson. Forms derives thickets and a secositie of disconnection native special set indications was measure landencies in Kimbertin reson. Forms derives thickets and comments resonant to resonant landencies and measure in the secondary of the second | Sem and diffusions areas and voter vers present praction, surfaces that (principled and unsolutived) versis sizes conserved approximately received that (principled and unsolutived) versis sizes conserved applicable for the principled and unsolutived versions and the property of the |
| Jelecoha possyarida Larinaria sio. Larinaria sio. Larinaria sio. Larinaria sio. Larinaria sio. Larinaria sio. Memma persipia Memma disecto Memma disecto Memma disecto Memma disecto Memma disecto Memma disecto Memma disecto Memma disecto Partinosia posta Partinosia posta Partinosia posta Partinosia posta Partinosia posta Partinosia posta Partinosia posta Sarvisia mosta Sarvisia mosta | Outcoments native secrets specially story well-are well-proving difficult to remove From dense Proleted and a special of outcomertion native species Not indication very measure jundencies in Kimberite report. Form dense Proleted and secretion of conformation native species in Notice and Intervent adjacents Webserved in Notice Properties. Webserved in Notice Properties of Intervent and Intervent and Intervent adjacents Webserved in Notice Intervent and Intervent adjacents Webserved in Notice Intervent and Intervent adjacents Webserved and Intervent Annual Intervent Annual Intervent adjacents Intervent Intervent Annual Intervention Interv | Sem and dirturned areas and voter vers coested marriers - writtendy, recens alea (dishipded and uncalculated) vesta alea coested marriers - writtendy, recens alea (dishipded and uncalculated) vesta alea coested marriers - writtendy, recens alea (dishipded and uncalculated) Coested and the first writtendy awards, show the healthcat Contributes about the first and the regist with healthcat Contributes about the furnity Contributes and the furnity Contributes and the furnity Contributes and votes and the furnity of the |
| Jelropha possyndria Jedropha possyndria Jedropha possyndria Jedopha propulation Jedoph | Outcoments as second a secondary serior water were. Process difficult to remove From derive Divides and a secondar deliveration of developments and the secondary of developments and the secondary of developments and the secondary of the seconda | Sem and diffusioned areas and votes verso serial marriams varieties, factions in that footstands and unsalushed verials after constructing parties. But from variety verbinds awarened above monitor underwords, invasion channels, (OLD). Chithabene apposition, the event red found in erges with herations. Chithabene apposition is received and the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the event of the event of the event of the even of the event of the even of the even of the event of the even o |
| Jelicoha possynidola Larinera son Larinera son Lacocenta ilina con Lacocenta il ma Lacocenta il ma Martinia annua Martinia annua Martinia annua Martinia annua Martinia diseascia Martinia diseascia Martinia diseascia Martinia di Partinia di Martinia di Partinia d | Outcoments as nitre secrets secretally service secretally service were. Proporting difficult to remove From district hidders and a speciate of outcoments make species but indication were means benefative report. Form district hidders and a speciate of outcoments make species but indication were means benefative and memorial special but indicated in the property of the prop | Semi and dirturbed areas and voter vers coestal marriers - vertices, ricenses sites idealished and undestuded vesta after construction bould. Self literal vertice, vertices awards, a their moved vesteries. Incation dhemmels, (OLD) constructions are sites and construction of board in entitle with healtices. Centracture accordurat. Constructives accordinat. Constructives accordurat. Constructives accordinat. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Co |
| Jelinocha possyndola Lantens seo. Lantens seo. Lantens seo. Latosten successivalia Latosten successivalia Latosten successivalia Mercepilium serouturusum Materiosia serusia Mercepilium serouturusum Materiosia serusia Mercenia serusia Mercenia serusia Mercenia piesetei Partinocela serusia Serina colonalia Sela color Sela color Latoste servita Lantensia servit | Outcoments native secoses sepocially storic value ways. Process difficult to remove From direct problets and a special of disconnection native special set indications was measure landersite in Comments. From direct problets and a special of disconnection native special set indications was measure landersite in Comments. From direct problets and comments in Comments. From direct problets and comments in Comments. Horocoultus Emmin. Outcompeter native special and directions levers. Horocoultus Emmin. Outcompeter native special and directions levers. Horocoultus Emmin. Outcompeter native special and directions and emmines. Horocoultus Emmin. Outcompeter native special and directions of emmines. Horocoultus Emmin. Outcompeter native special and directions of emmines. Horocoultus Emmin. Outcompeter native special and directions of emmines. Horocoultus Emmin. Outcompeter native special seconds in the special seconds of emmines. Horocoultus Emmin. Outcompeter native special seconds in the special second in the special seconds of emmines. Horocoultus Emmin. Outcompeter native special seconds in the liganous native site of emmines. Horocoultus Emmin. Outcompeter native special seconds in the liganous native site of emmines in the special seconds of emmines. Horocoultus Emmin. In the special seconds in the liganous native site of emmines in the special seconds in the liganous native site of emmines in the special seconds in the liganous native site of emmines. Horocoultus Emmines. Horoco | Sem and offunded areas and voter vers cereal marriam varieties, forces in that policitude and unsafulated versit sides cereal marriam varieties. But from huster verificated and unsafulated versit sides cereal marriam varieties. But from huster verificated and unsafulated versions. Incation channels. (OLD). Child-borne appoorulation. Child-borne appoorulation. Special provides and provides of the provides |
| Jelicoha possynidola Larinera son Larinera son Lacocenta ilina con Lacocenta il ma Lacocenta il ma Martinia annua Martinia annua Martinia annua Martinia annua Martinia diseascia Martinia diseascia Martinia diseascia Martinia di Partinia di Martinia di Partinia d | Outcoments as nitre secrets secretally service secretally service were. Proporting difficult to remove From district hidders and a speciate of outcoments make species but indication were means benefative report. Form district hidders and a speciate of outcoments make species but indication were means benefative and memorial special but indicated in the property of the prop | Semi and dirturbed areas and voter vers coestal marriers - vertices, ricenses sites idealished and undestuded vesta after construction bould. Self literal vertice, vertices awards, a their moved vesteries. Incation dhemmels, (OLD) constructions are sites and construction of board in entitle with healtices. Centracture accordurat. Constructives accordinat. Constructives accordurat. Constructives accordinat. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Constructives accordinate. Co |

This lable was complied with the assistance of Nool Wilson (DAWA) and Andrew Milstell (ACIS)
Humpries, Gross and Milstell, 1991, Smith, 2002, Wheeler, 1992, Hussey, Kelphorey, G.J., Cousena, R.D., Dodd, J., Lloyd, S.G., 1997
Noted, 9, 2004.
Not all weeks represented on this table currently occur in the Kimberley region, however they have been represented if they have the potential to do to