Department of Environment and Conservation

Our environment, our future

DEC Nature Conservation Service

Biodiversity Monitoring Protocol

Monitoring the Effectiveness of Weed Control in Dampier Peninsula Vine Thickets Threatened Ecological Community

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Table of Contents

FIGURES

APPENDICES

1 Introduction

This monitoring protocol provides information and procedures for monitoring the effectiveness of weed control work in occurrences of the Dampier Peninsula Vine Thicket ('Monsoon (vine) thickets on coastal sand dunes of Dampier Peninsula') threatened ecological community (TEC). Condition of the community varies across its distribution and may be affected by various threats including weed infestation, clearing, inappropriate fire regimes and impacts of feral animals.

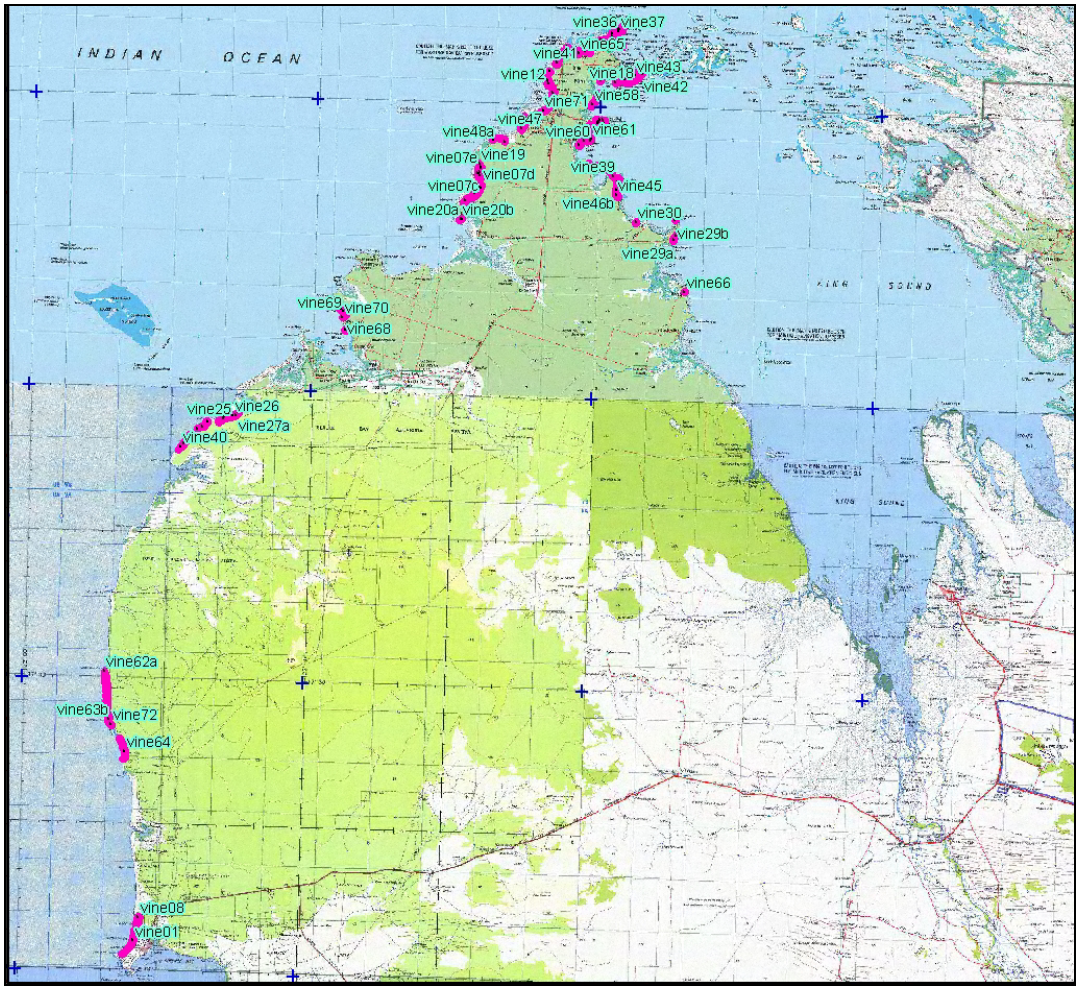

Figure 1: Dampier Peninsula Vine Thickets Threatened Ecological Community occurrence Locations

The Dampier Peninsula is located in the northwest of Western Australia, between Broome and Derby.

2 Protocol Constituents

This protocol consists of this protocol narrative and the following standard operating procedures (SOP):

SOP 4.1: Setup of the SokkiaTM Axis3 Differential GPS
SOP 6.2: Establishing Vegetation Transects

3 Background and Objectives

3.1 Background and history

The Dampier Peninsula Vine Thickets TEC is currently ranked as vulnerable (ranking endorsed by the Minister in 2001) and is proposed for re-ranking as endangered. The community is located on the Dampier Peninsula and is based on the mapping of Black *et al*. (in press) (Appendix A), which further progressed the work under undertaken by Beard and Keneally, (1993) and McKenzie *et al*. (1991).

The TEC is described as:

Semi-deciduous vine thicket communities on leeward slopes of coastal sand dunes on Dampier Peninsula. Occur as discontinuous but discrete pockets of dense vegetation, ranging from a few trees to around 60 ha in size. Patches tend to be larger with increasing dune system size, and are generally better developed in structure and higher in species diversity at the northern end of the peninsula. The principal upper-storey tree species include: Cassine melanocarpa, Celtis philippinensis, Diospyros ferrea var. humilis, Ficus virens, Melaleuca cajuputi, M. dealbata, M. viridiflora, Mimusops elengi, Pouteria sericea, and Terminalia petiolaris. The understorey comprises shrub species such as: Croton tomentellus, Dodonaea platyptera, Exocarpos latifolius, Pandanus spiralis, Plumbago zeylanica, Santalum lanceolatum, and Securinega melanthesoides. Vine species include: Abrus precatorius, Adenia heterophylla, Caesalpinia globulorum (*C. major*)*, Gymnanthera nitida, Jacquemontia paniculata, Marsdenia cinerascens, Passiflora foetida and Tinospora smilacina. Soils are deep dune sands, white except for a superficial dark grey organic layer, and covered by leaf litter up to 6 cm in depth* (Beard and Kenneally 1993).

McKenzie *et al*. (1991) differentiated the community from other rainforest communities in the Kimberley. Of the twenty-four rainforest patch groups derived by using species composition, three (groups V, W and X) are patches associated with Quaternary coastal sand dunes. Two of these (V and W) are known as the 'vine thickets on the coastal sand dunes of Dampier Peninsula'. The third Group, Group X, is located within tidal flats and is readily distinguishable from Groups V and W, and is situated over 600km away to the north east.

Threats listed for this TEC include:

- climate change and rising sea levels;
- clearing;
- groundwater drawdown;
- impacts of feral animals;
- inappropriate fire regime, (too frequent, too hot);
- altered surface drainage pattern due to road construction;
- impacts of stock;
- storm water runoff;
- disturbance due to recreational activities; and
- weed invasion.

The total area of the Dampier Peninsula Vine Thickets is thought to have reduced by around 40% since European settlement. It was also observed on a reconnaissance trip that shifting sand dunes are covering some areas of Vine Thicket (Occurrence 32) near Hunter Creek and possibly the occurrence south west of Swan Point, Karrakatta Bay (Occurrence 38).

In 2007 Rangelands NRM WA and Department of Environment and Conservation (Pilbara region) initiated a pilot project through their Biodiversity North Program to address the myriad of threats to Vine Thickets on the Dampier Peninsula. The project aimed to create a greater awareness about this TEC and implement some on-ground management activities whilst providing training and employment opportunities for remote Indigenous communities. The Environs Kimberley Community WEED Project has been collaborating with DEC Karratha to implement this project since its inception, and from July 2008, Environs Kimberley has taken the lead role with the Vine Thicket conservation project, due to their proximity to the site. The project may continue under the proposed Dampierland IBRA Project. This is to be funded under Caring for Our Country, through Rangelands NRM WA, and managed by

Environs Kimberley.

Many groups have been consulted and have thrown their support behind the above projects, including: Department of Environment and Conservation (West Kimberley), Traditional Owner groups, the Kimberley Land Council, and Kimberley TAFE. Both the Bardi Jawi Rangers and the Minyirr Park Rangers operate with extensive support from the Kimberley Land Council. The Bardi Jawi Rangers and representatives from Minyirr Park and Goolaraboolo Association have been very successfully implementing the projects on the ground.

The Bardi Jawi Rangers have been instrumental in developing and implementing management of Dampier Peninsula Vine Thickets for the Biodiversity North Program. At least 13 sites have been surveyed for vine thicket patches and weeds (see Figure 2 below). At least nine of these sites are vine thicket patches or variations of this vegetation type. At least five sites have been subject to follow up weed control activities. This includes Djoodoon, Chile Creek, Lombadina, One Arm Point School and Goorrnganggoon, Kooljamon and Marrgoon. Other sites worked on with Minyirr Park Rangers and Goolaraboolo Association include; Hidden Valley and Minyirr Park. These have been a combination of intensive weed control as well as weed survey and removal of small weed infestations.

3.2 Rationale for selecting this resource to monitor

The Dampier Peninsula Vine Thickets TEC was considered to be the highest priority for monitoring in the Kimberley Region due to the threat of clearing for development, inappropriate fire regimes and weed invasion. This TEC also provided an opportunity to work with district and regional DEC and NRM staff in the development of this monitoring protocol. In addition, as detailed in Section 3.1, weed control and fire prevention work had previously been jointly undertaken by Rangelands NRM WA, DEC, Environs Kimberley and local indigenous rangers and land managers in occurrences of this community prior to development of this protocol, the findings of which have been incorporated in this document.

The monitoring proposed in this protocol for the Dampier Peninsula Vine Thickets TEC seeks to answer the question:

- are weed control activities decreasing the cover of introduced species (weeds) in specific occurrences of the TEC?

Future monitoring of additional management activities related to effects of fire and introduced animals may be developed and implemented to answer the following question in relation to the Dampier Peninsula Vine Thickets:

- are management activities reducing the opportunity for weed incursion and establishment?

however, specific monitoring methods have not yet been developed for this purpose.

3.3 Measurable objectives

The objective of this monitoring proposal is to monitor the effectiveness of weed control measures on decreasing the cover of weed species in occurrences of the Dampier Peninsula Vine Thickets TEC subject to weed control measures.

4 Sampling Design

4.1 Rationale for selecting this sampling design over others

A report from surveys undertaken by Black *et al.* (in press.) indicated that many occurrences of this TEC are under threat from several factors including increasing development and disturbance. The report provided recommendations that weed control work be undertaken at a number of occurrences of the TEC referred to in the section below.

4.2 Site Selection

4.2.1 Criteria for selection

Recommendations were made (Black *et al*. in press) for weed control work within the Dampier Peninsula Vine Thickets (see below) and have been considered when prioritising sites for the weed control works that have been undertaken to date.

It was also important to take into account the need for cooperation and assistance from local communities when selecting sites. The Biodiversity North Program pilot project initially required considerable investment in building local awareness and developing the capacity for local groups to undertake weed surveys and control activities. The sites needed to be in close proximity to townships so they could be easily accessible as well as visible to community members. It was also important to discuss potential target sites with Traditional Owners and select places that were outside of culturally significant areas.

Recommendations from Black *et al*. (in press) are as follows:

- Survey and map weed infestations, and as a matter of urgency, implement control of very high and high priority weeds in vine thickets and in settlements/town sites (particularly those adjacent to vine thickets, One Arm Point, Lombadina-Djarindjin and Broome, but also at Beagle Bay as people travel between there and vine thickets). Monitor weed infestations (species present, species abundance, and extent of area of infestation) and their response to management regimes. While the seeds of many weed species are wind and bird dispersed, they can also be transported by water so catchment areas draining into vine thickets should be surveyed for weeds.

- The highest priority weed to target for vine thicket conservation is Siratro or Black Pea *Macroptilium atropurpureum* (vine), which currently occurs at Broome, James Price Point, and in two patches near One Arm Point. New infestations are a higher priority than those in the already severely degraded Gubinge Road vine thicket (Patch 01).

- High priority weeds are: Darwin Pea *Clitoria ternatea* (vine) at Broome and One Arm Point; Hairy Morning Glory *Merremia dissecta* (vine) at Broome and Quandong Point; Coffee bush *Leucaena leucocephala* (tree) in two localized stands at James Price Point and north of Quondong Point; Neem trees *Azadirachta indica*; Rubber vine *Cryptostegia madagascariensis* (declared) recorded in Lombadina-Djarindjin; Horehound *Hyptis suaveolens* (herb) at Broome and in one patch near One Arm Point; and Yellow Poinciana *Peltophorum pterocarpum* (tree) at Broome only. Note that Neem trees have so far only been recorded in one vine thicket at Broome. However, the species has been planted in gardens at some Peninsula outstations from where it has the potential to spread into vine thickets.

4.2.2 Procedures for selecting sampling locations

Sites were selected for weed control works and in some instances fire risk reduction works based on recommendations from the Black *et al.* report (*in press*). Important preparation for selecting sampling locations included discussions between the Department of Environment and Conservation (DEC), the Kimberley Land Council (KLC) and local land managers such as Environs Kimberley, Bardi Jawi Rangers and Minyirr Park Rangers. This liaison was required well in advance of field work to ensure that landowners were consulted prior to planned field work and to identify whether any proposed weed control sites had restricted access.

4.3 Sampling frequency and replication

Five (Vine 62a near James Price Point, Vine 10a near Chile Creek, Vine 12 near Gulmunon Point, Vine 41 near Djulbard Njamakoon and Vine 43 near One Arm Point) occurrences of the Dampier Peninsula Vine Thickets TEC have had weed control measures (weed mapping and control) undertaken within the TEC boundary prior to the compilation of this protocol (Figure 2). Monitoring of these occurrences should occur one year, two years and five years after the initial weed control work. Additional monitoring should be undertaken before and after any changes in management (for example if fencing is established).

Weed control works have also been undertaken in close proximity to several occurrences of this TEC (near Vine 13 near Djoodoon, near Vine 04 near Cape Leveque, and near Vine 71 near Lombadina). The Minyirr Park Rangers and Goolarabooloo have assisted in weed control at three Vine Thicket sites; Hidden Valley, Walmadan Camp and James Price Point.

4.4 Recommended number and location of sampling sites

Seventy two occurrences of this TEC are currently known. The locations shown in the figure below are currently subject to weed mapping and control activities. Over time and with increased resources, the number of Dampier Peninsula Vine Thicket TEC occurrences that are subject to weed control works and monitoring may be able to be increased.

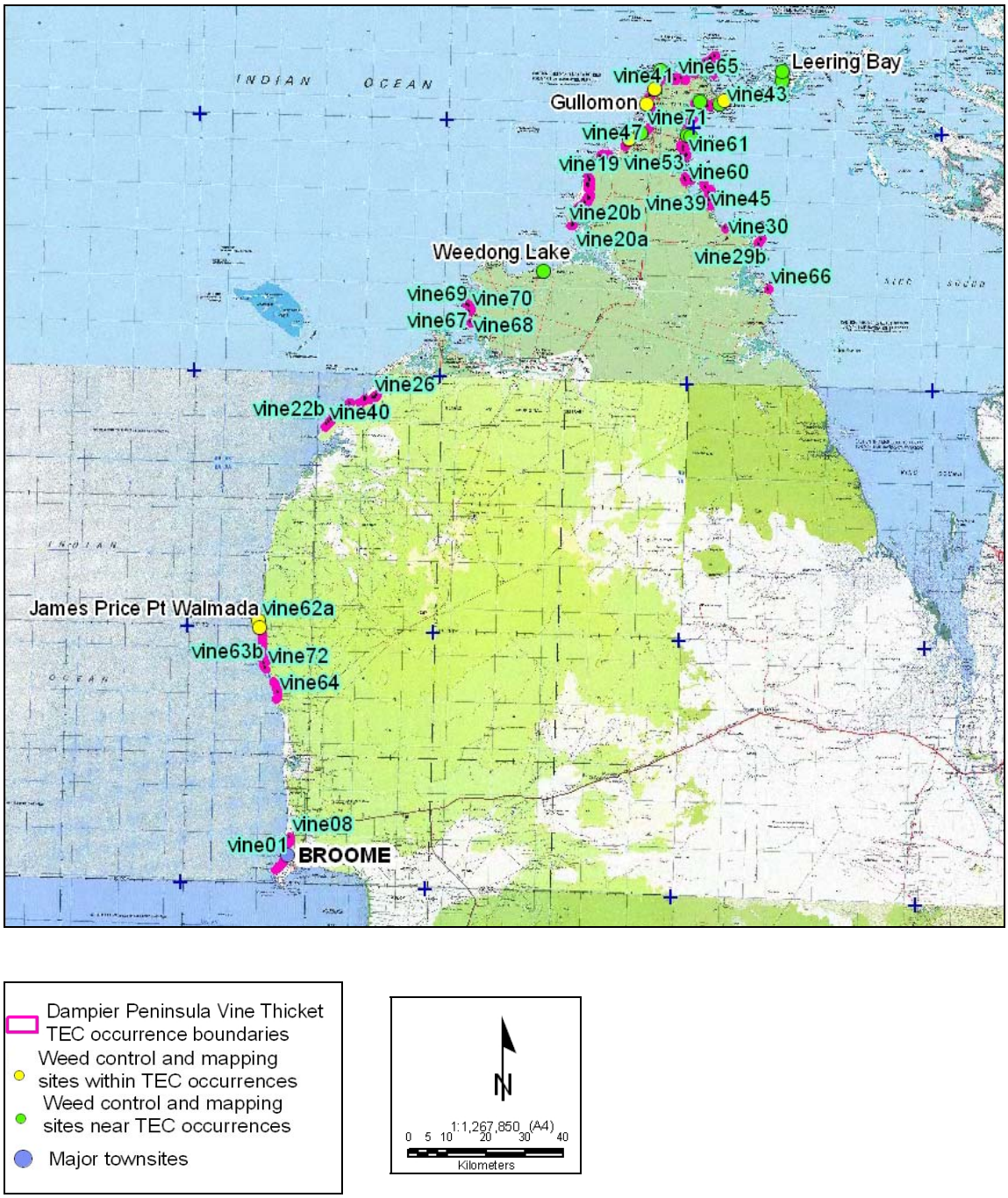

Figure 2: Weed mapping and control sites and Dampier Peninsula Vine Thickets TEC occurrences

4.5 Recommended frequency and timing of sampling

Monitoring of weed control sites will begin about two months after the initial weed control work and be undertaken again after one year, two years and five years. Although it is recommended that monitoring be undertaking on this rotation, it is possible that resources may only permit monitoring every three to five years. Monitoring dates and actions should be documented, and entered into the monitoring database.

Monitoring will ideally also occur before and after any additional management action is initiated, such as establishment of fencing, or after events such as fire. The frequency of monitoring will be determined depending on the specific management action implemented.

In terms of timing, each monitoring occasion should be consistent with the previous monitoring in terms of season and month of the year.

4.6 Level of change that can be detected for the amount/type of sampling being instituted

No quantitative data are currently available to predict the percentage of change we will be able to detect. It is envisaged that data collected from the project will allow determination of the detectable level of change in the future. Target % reduction of weed cover in transects subject to weed control work need to be discussed by participants in the weed control program early in the weed control program, to determine the % decrease in weed cover at which weed control will be deemed to have been effective. If this target is reached within a predetermined period of time, all areas of weed infestation (including those transects within infestations, but not subject to weed control) can be included in the weed control program. If the determined target is not met by a predetermined time, it will be deemed that the weed control methods being applied are not effective, and alternative management will need to be implemented.

5 Field Methods

5.1 Field season preparations and equipment setup

Field work should be scheduled and organised prior to the start of each field season. Contact should be made between DEC Regional and District staff, regional NRM staff and local indigenous groups (for example Kimberley Land Council) and local land manager and ranger groups (including Bardi Jawi Ranger Group, and Minyirr Park Ranger Group and Beagle Bay Ranger Group) to schedule field trip dates and discuss access arrangements. Partner groups such as Environs Kimberley, Kimberley TAFE and Kullarri Regional CDEP may also need to be contacted. Prior to working in the field, staff must complete relevant field advice forms and review safety protocols and this protocol.

5.2 Sequence of events during field season

Desktop study

The following equipment is required for the desktop study prior to field reconnaissance:

- digital data including aerial photography;
- cadastral information;
- TEC boundary map;
- weed map.

The same equipment will be required for all subsequent monitoring surveys.

Field reconnaissance

Field reconnaissance should be undertaken to allow relevant staff to assess the monitoring requirements and determine the most suitable monitoring methods.

The following equipment was required to undertake the field component of the monitoring:

- GPS
- DGPS if available
- Clipboards
- Camera
- Measuring tapes
- Mallets (when establishing transects)
- Metal pegs (when establishing transects).

The same equipment will be required for all subsequent monitoring surveys.

Preliminary preparations

Where plant specimens are to be collected, plant collection licences (including Permit to Take Declared Rare Flora (DRF) if necessary) should be organised at least one month prior to field reconnaissance. Accommodation preferably close to the monitoring sites will be organised as soon as field dates are determined and a full list of groceries and meal planning will be prepared prior to field reconnaissance. Shared vehicles and equipment should be booked in advance on the relevant field equipment booking sheets. If mobilising from Perth, some equipment may need to be freighted in advance.

5.3 Details of taking measurements, with example field forms

Weed Control Monitoring

The following species are a priority for weed control work for several occurrences in the Dampier Peninsula Vine Thickets (Environs Kimberley (2009):

• Coffee Bush	*Leucaena leucocephala*	
• Buffel Grass	*Cenchrus ciliaris*	
• Morning Glory	*Ipomoea quamoclit*	
• Lantana	*Lantana camara*	WONS^/Declared Weed
• White Convolvulus Creeper	*Merremia dissecta*	
• Hairy Merremia	*Merremia aegyptia*	
• Bellyache Bush	*Jatropha gossyipifolia*	Declared Weed
• Mint Weed	*Hyptis suaveolens*	Declared Weed
• Gallon's Curse	*Cenchrus biflorus*	
• Neem	*Azadirachta indica*	
• Siratro	*Macroptilium atropurpureum*	
• Kapok	*Aerva javanica*	

Cryptostegia madagascariensis has not been found but there is a high likelihood of occurrence of this species.

The following species are a secondary priority for weed control work:

• Passion Vine	*Passiflora foetida*
• Butterfly Pea	*Clitoria ternatea*
• Caltrop	*Tribulus terrestris*
• Snakeweed	*Stachytarpheta cayennensis*
• Pie Melon	*Citrullus lanatus*
• Vinca	*Vinca major*
• Rubber Tree	*Calotropis procera*

^WONS: Weeds of National Significance

Accurate mapping of boundaries of weed infestations should be undertaken using a GPS or where possible DGPS for submetre accuracy (see SOP 4.1). GPS points will be collected in GDA94 Datum or WGS84 Datum only. If using a DGPS for mapping, aerial photography should be loaded onto Nomad PDA (Personal Data Assistant) or similar to assist in on-ground mapping. The vegetation

condition scale provided in Bush Forever (Government of Western Australia, 2000) may be used for allocating vegetation condition rankings for mapped weed infestation areas.

Six ten-metre long monitoring transects should be placed within the mapped weed infestation areas for each occurrence subject to weed control work; three in areas subject to weed control within the infestation, and three in areas not subject to weed control within the infestation. The start and end points of each transect should be permanently marked (with a metal stake or peg). The transect start and finish locations should also be recorded using a differential GPS or DGPS in order to locate them again for future monitoring.

The transects that are established in infested areas but are not subject to weed control serve as comparisons for the monitoring and should remain free of weed control until such time as the monitoring of weed controlled transects shows that the weed control has been effective within a predetermined period. Scattered outbreaks of weeds, and areas outside the area containing the weed control-free transects can continue to have weed control applied during this time. Once it is determined that the weed control has been effective in reducing weeds to target levels along weed controlled transects within a predetermined period, all areas of weed infestation should be sprayed. However, if weed control methods are found not to be effective within this period of time, alternate weed control treatment will need to be sought.

All species, both native and introduced should be recorded at 10 cm intervals along the transect length, beginning at 0 cm and continuing until 1000 cm. At each 10 cm sampling point along the transect a point intercept device (such as a car aerial) will be placed vertically along the measuring tape and each plant that comes into contact with the pointer will be recorded for that distance along the transect. This will allow changes in presence of weed species to be monitored over time. Point intercept recordings should be undertaken on these transects before and after any weed control works are undertaken within the TEC occurrence, and after significant events such as fire. Data should be recorded either on an electronic form if using a PDA, or on a transect recording sheet (Appendix A).

This monitoring will help determine whether the weed control work being undertaken is effective in reducing weed cover. If it is determined that such work is effective, further transects may then be established in other areas of the occurrence that don't contain weed species, for monitoring weed encroachment in these areas.

TEC Occurrence Report Forms should be filled out at each occurrence visited (Appendix B). Specimens may be collected for a field herbarium book, if plant collection licences are held. Unusual specimens should be collected for submission to the WA Herbarium.

Photographs should be taken at each end of the monitoring transect, and photo numbers recorded.

5.4 Post-collection processing of samples

If any plant samples are collected, the procedure for post-collection of plant specimens includes:

- newspaper to be changed after two to three days, depending on the level of moisture in the plants;
- plants are to be taken to regional herbariums or sent to the WA Herbarium and stored in freezers or microwaved;
- preliminary plant identifications to be undertaken using reference collection and keys;
- additional identification assistance to be sought from WA Herbarium staff;
- Rare Flora Report Forms to be completed for Declared Rare Flora and priority taxa;
- plant collection labels produced and sorted with specimens; and
- plant specimens and photographs lodged with the herbarium.

The WA herbarium should be contacted to discuss lodgement of specimens and possible costs and timing for identifications.

5.5 End-of-season procedures

- data storage
- clean/repair/replace & store field equipment

- plant specimens lodged
- report preparation.

6 Data Handling, Analysis and Reporting

6.1 Metadata procedures

Metadata is "data about data". That is, a statement about a dataset which describes the content, quality, currency and location and custodianship of the data.

The Australia New Zealand Land Information Council has developed guidelines for the collection of metadata (ANZLIC 2001). Metadata collection under this protocol will be compliant with these guidelines.

The data custodian should develop the original metadata record. Metadata records can be created in a Word document or text file and should be saved in the same directory as the dataset. See Appendix C for a template for metadata collection.

Metadata for this project will be for the data collected from both the survey and monitoring components of this protocol. The DEC TEC Database is the repository for the TEC metadata statements, and partner groups for the project will also save metadata statements.

6.2 Overview of database design

DeBacker *et al*. (2004) recognise that biodiversity monitoring creates large numbers of files and folders to store various databases, reports, GIS data, etc. and the organisation and linkages increase in complexity as data accumulates through time. The authors also note that foresight in database design is integral to ensuring data quality.

The DEC Threatened Ecological Communities Database (Microsoft Access) is the primary software environment for threatened ecological community data. ESRI ArcGIS 9 serves as a tool for viewing spatial data residing in this Microsoft Access database. The Microsoft Access database Site Species (by T.Griffin) has been designed on "a vision that through using an organised and standardised system, data can be compiled across the botanical sector to benefit the sector and the community. It is designed to manage the capture of, manipulation of, and reporting on information related to collections of plants in a systematic manner." Monitoring data collected according to this and other monitoring protocols can therefore be stored in Site Species, with monitoring partner groups and with DEC regional/district offices also storing collected data within their databases.

6.3 Data entry, verification and editing

Data entry involves transporting raw data from field sheets/notebooks into an electronic form such as a database. Quality assurance and control are important during the data entry process. DeBacker *et al*. (2004) suggest that where electronic data forms and databases are used for data entry, features such as drop-down lists and value limits may ensure minimal errors. Only valid names or measures should be allowed to be entered and spelling mistakes must be eliminated. Databases should be capable of receiving updates from the WA Herbarium to ensure name changes are addressed.

Data collected according to this protocol should be entered as soon as possible after collection into databases (for example TEC database, Site Species database and monitoring partner group databases) by people familiar with the data. This will help to minimise errors as familiarity with the data allows errors to be detected and easily corrected. Where edits to data are required, information can be replaced with the correct detail on hardcopy datasheets, in order to document decisions made about the data.

GPS points for quadrat and transects locations should be entered into the databases and converted into a GIS layer for use (for example in ArcMap9) using available linking tools. Location data can be verified for accuracy in relation to survey area boundaries. The WA specialist TEC group with the Species and Communities Branch in Kensington may be able to provide support in terms of storage of

shapefiles, metadata and data for ongoing monitoring.

As noted in DeBacker *et al*. (2004), data verification should immediately follow data entry and involve checking the accuracy of electronic records against the original source (eg. paper field records). Once the electronic data have been verified as accurately reflecting the original field data, the paper forms can be archived (according to section 6.7 of this monitoring protocol) and the electronic version used for all subsequent data activities.

6.4 Recommendations for routine data summaries and statistical analyses to detect change

'A critical component of any long-term monitoring protocol is a consistent and systematic way of analyzing (*sic*) and reporting on information (data) collected' (DeBacker *et al*., 2004, p. 33). DeBacker *et al*. (2004) also note that data summaries and statistical analyses need to describe the current condition, or status, of the subject being monitored and be robust enough to detect community changes through time. The information provided in data summaries must be complete, descriptive and easily interpretable.

Data summaries and statistical analyses need to detail information regarding native and introduced species diversity. Any management interventions (for example fencing) that may influence these indicators need to be noted in the data summaries.

Data summaries should be undertaken at the end of each monitoring occasion. Given that monitoring is recommended at lengthy intervals on a long term basis, data summaries at such intervals should not be too laborious. Statistical analyses will focus on changes in introduced plant taxa cover. As additional data are collected, appropriate analyses as discussed with a biometrician will be undertaken to detect temporal trends in the monitoring data, and benchmarks for management action.

6.5 Recommended reporting schedule

Reports should be prepared and distributed within the same year as data collection and include maps, graphs, figures and other relevant visuals to facilitate comprehension of findings. DeBacker *et al*. (2004) suggest that more extensive summary reports, including trend analysis, should be completed every five to ten years depending on the rate of change in the monitoring data and the need for summary information to guide resource management. Summary reports may be used in place of annual reports for that year.

6.6 Recommended methods for long-term trend analysis

Methods for long term trend analysis should be discussed with a biometrician. Analyses offered through Primer (Clarke, KR, Gorley, RN, 2006. PRIMER v6: User Manual/Tutorial. PRIMER-E, Plymouth) are currently being considered.

6.7 Data archival procedures

The *Natural Resource Management - Regional Spatial Information Management Toolkit* (2008) states that data must be copied and stored separately from the original dataset to ensure availability for other uses such as on-going monitoring, natural resource assessments or as agreed by the data custodian. The NRM toolkit also emphasises the importance of appropriate security and continuing recoverability of archived data as well as the inclusion of metadata and/or other relevant supporting documentation to enable use of that data and other information.

Long-term archives of TEC monitoring data (both electronic and hardcopy materials) are currently stored at the DEC Species and Communities Branch headquarters in Kensington. Data is stored on the DEC server and the TEC/PEC database. Data for this monitoring project should be stored with the TEC specialist group, with monitoring partner groups and with DEC region/district headquarters. Hard copy materials may also be stored.

7 Personnel Requirements and Training

For safety considerations it is recommended that a minimum of two people undertake the monitoring for each transect. Setup of transects includes running tapes out, taking photographs and recording information. Recording is also made easier with at least two people.

7.1 Roles and responsibilities

A weed monitoring team leader is required to:

- liaise with managers and other stakeholders;
- co-ordinate field visits;
- team logistics (delegation);
- oversee data collection and data entry;
- analysing and interpreting findings in liaison with a statistician; and
- participate in finalising/updating monitoring protocols.

A project/field officer is required to:

- have the ability to identify plant specimens;
- use GIS applications such as ArcMap 9;
- enter data into the relevant database applications;
- organise and participate in field visits (accommodation, equipment etc);
- undertake field work; and
- write up reports in liaison with botanist/ecologist and statistician.

A Biometrician is required to:

- assist in statistical design;
- run analyses; and

assist in interpretation of findings.

7.2 Qualifications

Knowledge required for weed control monitoring work includes some basic plant identification skills.

It is important to notes that where monitoring programs include vegetation surveys; the following EPA *Guidance for the Assessment of Environmental Factors Western Australia* (2004 recommendation is relevant;

> Flora and vegetation surveys should be coordinated and led by botanists who have had training, mentoring and experience in flora and vegetation survey. It is expected that they will have specific training and/or experience in ecology and taxonomy of the Australian flora and would normally have had a wide exposure to WA's flora and vegetation, preferably with knowledge and experience in the region being surveyed.
>
> It is recognised that some surveys may be done by survey teams that include members with less experience. These members should be supervised and mentored by the specialists mentioned above. This is seen as useful in training new practitioners. (p. 12)

7.3 Training procedures

Training is essential for developing competent observers. Refreshment of skills including species identification, GPS navigation, compass use, and estimation of foliage cover may be necessary for observers. Observers should be trained in the use of SOPs relevant to this protocol and discussions in the field regarding techniques are recommended.

Training of project managers in how to fill in data sheets and in methodologies for relevant tasks should be undertaken, so that project managers can then demonstrate these tasks to working groups.

8 Operational Requirements

8.1 Annual workload and field schedule

Monitoring will require at least one team of two people for each site visit. One visit to monitoring transects in several TEC occurrences may take up to one week to complete and the time required may vary depending on logistics, weather and team skill level.

The field schedules for site visits need to be prepared in consultation with district DEC staff, local land managers and landholders several months prior to field work.

8.2 Facility and equipment needs

Aside from general office facilities and equipment requirements, a range of computer hardware and software for data capture and storage are required. Considerations include:

- Meals and accommodation in close proximity to the TEC need to be organised for field staff if monitoring staff do not live close to the sites.
- The equipment listed in this document under “Field season preparations and equipment setup” needs to be gathered, and missing items borrowed or purchased. Equipment requirements will need to be amended accordingly if more than one team undertake monitoring during a field visit.
- If using field computers, appropriate computer hardware and software need to be purchased and/or loaded onto field computers. PCs with Microsoft Office and programs such as ArcMap9, may need to be purchased.
- Storage space for equipment needs to be organised.

8.3 Startup costs and budget considerations

Field equipment, accommodation and vehicle hire are the three major budgetary considerations for this project. Monitoring staff are employed by Rangelands NRM WA, DEC, the KLC, Environs Kimberley and Ranger groups. The use of consultants for monitoring work was not required.

The following costs need to be considered in the budget for this monitoring project:

- staff wages;
- purchase and hire of field equipment ;
- travel costs, accommodation and meals during field trips; and
- vehicle hire and running costs.

Limitations such as project duration and financial year constraints need to be considered.

9 References

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10 Appendix

Forms for recording field data are shown in Appendix A and B. These forms should be copied onto write-in-the-rain paper and taken into the field. Databases should have data entry screens that mimic these forms. Appendix C contains a template for metadata statement.

Appendix A: Example transect data recording sheet

TEC Name:		
Transect Id:		
Location:		**Date:**
		Notes:
Recorders		
Photos:		**Time:**
Datum:		
	Latitude	**Longitude**
Start of transect:		
End of transect		

Point	**Field name**	**Ht**	**Voucher No.**
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Appendix B: Threatened Ecological Community Occurrence Report Form

Department of Environment and Conservation
Our environment, our future

Threatened Ecological Community (TEC) Occurrence Report Form

Page 1

Version 5.2 June 2009

Community: _____ **OBSERVATION DATE:** ___/___/___

New occurrence ☐ **Site ID:** _____ **CONS CODE:** _____

OBSERVERS: _____ **ORGANISATION:** _____

ROLE: _____ **DISTRICT:** _____ **SHIRE:** _____

DESCRIPTION OF LOCATION: _____

_____

_____

DATUM:	**COORDINATES:**	**METHOD USED:**	**SURVEY EFFORT:**
GDA94 ☐		GPS/ Differential GPS/ MAP	Edge survey ☐
AGD84 ☐	**LAT/Northing:** _____	**No. Sats:** _____	Partial survey ☐
WGS84 ☐	**LONG/Easting:** _____	**Map Used:** _____	Full survey ☐
Unknown ☐	**MGA ZONE:** __	**Map Scale:**	Area surveyed (ha):

LAND TENURE:

Nature Reserve ☐ Timber Reserve ☐ Private Property ☐ Rail Reserve ☐ Shire Rd Res ☐

National Park ☐ State Forest ☐ Pastoral Lease ☐ MRWA Rd Res ☐ Shire Reserve ☐

Cons. Park ☐ Water Reserve ☐ UCL ☐ SLK/Pole ____ to ____ Other (Specify) _____

Landowners permission sought: ☐ Landowner present: ☐ Reserve: _____

Threat type and supporting information: Eg clearing, recreation, too frequent fire, grazing, weeds, disease, fragmentation, hydrological change. • Rate current and potential threat impact: 1=LOW, 2=MEDIUM, 3=HIGH, 4=EXTREME.	Current Impact (1-4)	Area affected	Potential Impact (1-4)	Onset: Imminent	Onset: Long Term
•	____	____%	____	☐	☐
•	____	____%	____	☐	☐
•	____	____%	____	☐	☐
•	____	____%	____	☐	☐
•	____	____%	____	☐	☐
•	____	____%	____	☐	☐

CONDITION OF SOIL: Moist ☐ Waterlogged ☐ Inundated ☐ Mud ☐

Dry ☐ Cracked ☐ Saline ☐ Other: _____

CONDITION OF OCCURRENCE
(Bush Forever Scale)
(estimate % of area in each):

Pristine ☐ ____%

Excellent ☐ ____%

Very Good ☐ ____%

Good ☐ ____%

Degraded ☐ ____%

Completely Degraded ☐ ____%

RECOMMENDED MANAGEMENT ACTIONS: eg. roadside markers required, weed control, etc.

_____

_____

_____

_____

ACTIONS IMPLEMENTED (include date):

_____

_____

_____

Submitter of Record:_____ Role: _____ Signed:_____ Date:____/____/____

Please return completed form to, DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **TEC Database Administrator**, SCB. **Record Entered in Database** ☐ Date:____/____/____

Department of Environment and Conservation
Our environment, our future

Threatened Ecological Community (TEC) Occurrence Report Form

Version 5.2 June 2009

HABITAT INFORMATION:

LANDFORM:	ROCK FORM:	ROCK TYPE:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest ☐	Bedrock ☐	Granite ☐	Sand ☐	Red ☐	Well drained ☐
Hillock ☐	Boulder ☐	Dolerite ☐	Sandy loam ☐	Brown ☐	Mod. drained ☐
Ridge ☐	Cobble ☐	Laterite ☐	Clay loam ☐	Yellow ☐	Seasonally inundated ☐
Slope ☐	Coarse gravel ☐	Ironstone ☐	Light clay ☐	White ☐	
Flat ☐	Medium gravel ☐	Limestone ☐	>20% Gravel ☐	Grey ☐	Permanently inundated ☐
Outcrop ☐	Fine gravel ☐		Peat ☐	Black ☐	Tidal ☐
Closed depression ☐		Specify other:	Specify other:	Specify other	
Open depression ☐					
Wetland ☐					
Drainage line ☐					

Specific Landform Element:

VEGETATION CLASSIFICATION:

1.
2.
3.
4.

FIRE HISTORY: **Last Fire:** Season/Month:_____ Year: _____ **Fire Intensity:** High/Medium/Low Long unburnt ☐

LANDUSES: **SITE:**

ADJACENT:

OTHER COMMENTS (include recommended management actions and/or implemented actions (include date):	**Associated Species:**

ATTACHED: Map ☐ Mudmap ☐ GIS data ☐ Photo ☐ Field notes ☐ Other: _____

Submitter of Record:_____ Role: _____ Signed:_____ Date:____/____/____

Please return completed form to, DEC, Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **TEC Database Administrator**, SCB. **Record Entered in Database** ❑ Date:____/____/____

Appendix C. Metadata statement template

Category	Element	Comments
Dataset	**Title**	The ordinary name of the dataset.
	Custodian	The organisation responsible for the dataset.
Description	**Abstract**	A short description of the contents of the dataset.
	Search Word(s)	Words likely to be used by a non expert to look for the dataset.
	Geographic Extent Name(s) **OR**	A list of geographic extents such as • map sheets; • local government areas; • catchments; • IBRA regions; and • latitude/longitude co-ordinates for the top left and bottom right corners of the area covered, that reasonably indicate the spatial coverage of the dataset.
	Geographic Extent Polygon(s)	An alternate way of describing geographic extent if no pre-defined area is satisfactory. Provide polygon title and location/directory address.
Date Currency	**Commencement date**	Commencement date (of field work/data collection)
	Completion date	Last date of information in the dataset.
Dataset Status	**Status**	What is the current status of the database? Ongoing/Completed/Under development/Planned.
	Maintenance and Update Frequency Daily Weekly Fortnightly Monthly Annually Irregular	Frequency of changes or additions made to the dataset

Access	**Stored Data Format**	The format or formats in which the dataset is stored by the custodian. Eg. Microsoft Access database, Microsoft Excel Spreadsheets, ESRI shapefiles etc.
	Location/Directory address	Where can the data be found
	Available Format Types	The formats in which the dataset is available, showing at least, whether the dataset is available in digital or non digital form.
	Reports/Publications	What reports and publications have been produced using the dataset?
	Access Constraint	Any restrictions or legal prerequisites applying to the use of the dataset, eg. Licence required. Access and reliability.
Data Quality	**Lineage**	A brief history of the source and processing steps used to produce the dataset.
	Positional Accuracy	A brief assessment of the closeness of the location of spatial objects in the dataset in relation to their true position on the Earth.
	Attribute Accuracy	How accurate are the values in the Attribute Table of this spatial data in respect to the real world values? Eg. 'complete' = all tables are correctly labelled in the dataset.
	Logical Consistency	A brief assessment of the logical relationships between attributes and spatial objects in the dataset. Eg. 'consistent' = attribute values have been checked and validated for consistency; logic checked in relation to attribute names; and all attributes that require values have values assigned.
	Completeness	A brief assessment of the completeness of coverage, classification and verification.

Contact Information	**Contact Organisation**	Ordinary name of the organisation from which the dataset may be obtained.
	Contact Position	The relevant position in the Contact Organisation.
	Postal Address	Postal address of the Contact Position.
	Telephone Number	Telephone of the Contact Position.
	Facsimile	Facsimile of the Contact Position.
	Electronic Mail Address	Electronic Mail Address of the Contact Position.