

Supplementary ecology survey report for the Rum Jungle EIS

DEPARTMENT OF PRIMARY INDUSTRY & RESOURCES



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Authors	Jenny Lewis, David van den Hoek & Glen Ewers

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EcOz Pty Ltd. ABN: 81 143 989 039 Level 1, 70 Cavenagh Street DARWIN NT 0800 GPO Box 381, Darwin NT 0800 Telephone: +61 8 8981 1100 Facsimile: +61 8 8981 1102 Email: <u>ecoz@ecoz.com.au</u> Internet: <u>www.ecoz.com.au</u>

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EXECUTIVE SUMMARY

The Department of Primary Industries and Resources (DPIR) has proposed the rehabilitation of the former Rum Jungle mine site. This project requires assessment under the *Environmental Assessment Act* (Northern Territory) at the level of an Environmental Impact Statement (EIS). EcOz Environmental Consultants (EcOz) were engaged to respond to the terrestrial ecology information requirements of the EIS Terms of Reference. These include descriptions of the fauna, flora and vegetation communities, with a focus on threatened species and significant vegetation types.

In preparation for this project, ecological surveys have been undertaken in, and surrounding, the mine site. In 2019, DPIR identified some additional areas of remnant bushland that may be the subject of disturbance due to the project activities covered in the EIS. Consequently, EcOz undertook vegetation mapping and targeted fauna surveying (for threatened species) across three survey areas: gravel borrow areas, a clay borrow area, and the waste rock dump areas.

Much of the area consists of Eucalypt woodlands to open forests, with *Eucalyptus miniata* and *E. tetrodonta* often dominant. The waste rock dump areas and gravel borrow areas are relatively weed free. The clay borrow area is heavily infested with Gamba Grass. Consequently, neither a detailed vegetation mapping survey nor any threatened species surveys were undertaken at that site.

Two threatened species were recorded during the survey: Black-footed Tree-rat (*Mesembriomys gouldii* gouldii) in both the gravel borrow and waste rock dump areas; Partridge Pigeon (*Geophaps, smithii smithii* in the gravel borrow areas only.



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1 INTRODUCTION

The Department of Primary Industries and Resources (DPIR) has proposed the rehabilitation of the former Rum Jungle mine site, located 6 km north of Batchelor, Northern Territory.

This project requires assessment under the *Environmental Assessment Act* (Northern Territory) at the level of an Environmental Impact Statement (EIS). EcOz Environmental Consultants (EcOz) were engaged to respond to the terrestrial ecology information requirements of the EIS Terms of Reference. These include descriptions of the fauna, flora and vegetation communities, with a focus on threatened species and significant vegetation types.

In preparation for this project, ecological surveys have been undertaken in, and surrounding, the mine site. In 2019, DPIR identified some additional areas of remnant bushland that may be the subject of disturbance due to the project activities covered in the EIS. Consequently, EcOz undertook vegetation mapping and targeted fauna surveying (for threatened species) across the areas in question. Depicted in Figure 1-1, these areas are collectively referred to as the *survey area* and are individually referred to throughout this report as:

- Gravel borrow areas
- Clay borrow area
- Waste rock dump (WRD).



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Supplementary\Figure 1-1. Survey areas.mxd



2 ENVIRONMENTAL CONTEXT

2.1 Land use

The gravel borrow areas are located within the Finniss River Aboriginal Land Trust. Much of the area surveyed within the borrow area is remnant bushland that is only accessed intermittently by Traditional Owners. In the centre of that area, there is evidence of previous extractive activity. This occurred at least few decades ago, as evidenced by the fact that the revegetation of the borrow areas is by Turkey Bush – which, prior to weed invasions, naturally established in disturbed areas – instead of a weed species.

The clay borrow area was once a buffalo farm, but is now land owned by Coomalie Council. The area is not under any use at present.

The WRD survey area is predominantly the site that was Borrow Area 5 for the old Rum Jungle Mine, but includes a small area of surrounding remnant bushland. Borrow Area 5 was the subject of a weed eradication and revegetation trial between 2012 and 2015 which had limited success.

2.2 Previous ecology surveys

Eco Logical (2014 & 2015) extensively surveyed vegetation and fauna across the Rum Jungle mine site, including sites in the vicinity of the WRD. Also covered were previously proposed extraction areas in the surrounds of the Rum Jungle mine site, including a few vegetation and fauna sites in the northern end of the gravel borrow areas. That survey did not record any threatened species in the gravel borrow areas, nor in the main Rum Jungle site. There have not been any vegetation surveys of the remainder of the gravel borrow areas.

The clay borrow area has not been the subject of a previous ecology survey.

2.3 Surface water

The gravel borrow areas were designed with an indicative buffer from watercourses to minimise impacts to riparian vegetation and aquatic ecosystems; however, there are three first-order intermittent streams in proximity. The clay borrow area is also buffered from a second-order watercourse – Meneling Creek – to the south. There are no drainage lines relevant to the WRD survey area.

2.4 Land systems

Christian and Stewart (1968) define a land system as 'an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation'. As such, each land system has a characteristic pattern on aerial imagery. Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units. However, there is no land unit mapping for the survey area.

The three survey areas are covered by the Bend, Gully and Woodcutter land systems. These systems are mapped in Figure 2-1, and the characteristics are outlined in Table 2-1.



Name	Class	Landform	Soil	Vegetation*
Gully	Granite plains and rises	Undulating terrain developed on granite, schist, and gneiss	Kandosols and chromosols Red massive earths and mottled yellow duplex soils	Woodland of <i>C. confertiflora</i> , <i>C. foelscheana</i> , <i>E. chlorostachys</i> , <i>Terminalia canescens</i> , and <i>Petalostigma</i> species over perennial grasses (<i>Heteropogon triticeus</i> , <i>Themeda</i> <i>australis</i> , <i>Sorghum plumosum</i>)
Baker	Sandstone hills	Rugged hills and strike ridges with intervening narrow valleys and short lower slopes on folded Burrels Creek greywacke, sandstone and siltstone.	Rudosols and kandosols Skeletal soils and outcrop with minor sandy red and yellow gradational soils	Mid-high woodland of <i>C. dichromophloia, E. miniata,</i> <i>C. bleeseri, E. tectifica</i> and <i>C. terminalis</i> over Sorghum spp., <i>Themeda triandra</i> and <i>Chrysopogon spp.</i>
Bend	Sandstone plains and rises	Undulating low strike ridges and rises on folded Burrels Creek greywacke, sandstone and siltstone	Kandosols and rudosols Skeletal soils and shallow gravelly loams	Mid-high woodland of <i>C. latifolia,</i> <i>C. foelscheana, E. polysciada,</i> <i>E. tectifica, Erythrophleum</i> <i>chlorostachys</i> over tropical tall grass (Sorghum spp., <i>Heteropogon spp., Chrysopogon</i> <i>spp.</i>)
Woodcutters		Very gently upland surface; probably developed on Tertiary sediments overlying carbonate- rich Lower Proterozoic rocks	Kandosols Deep red massive earths and yellow massive earths	Mid-high woodland of <i>Erythrophleum chlorostachys, E.</i> <i>miniata, C. confertiflora, C.</i> <i>papuana</i> and <i>Petalostigma</i> species over perennial grasses (<i>Heteropogon triticeus,</i> <i>Chrysopogon latifolius</i> and <i>Imperata cylindricus</i>)

Table 2-1. Land	d system characteri	stics relevant to	the survey area
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* C. = Corymbia, E. = Eucalyptus

2.5 Fire

Fires are a regular occurrence in the bioregion and, depending on timing and frequency, can have a considerable impact on habitat condition, and therefore biodiversity. Regional fire history and fire scar mapping was obtained through the <u>Northern Australia and Rangelands Fire Information</u> (NAFI) website.

In the past ten years, the majority of the project footprint has been burnt over ten times, with the exception of a small patch of monsoon vine forest on the eastern border of Rum Jungle mine site that has burnt seven times, and Mt Burton, which has only burnt once or twice (with the wet vine forest to its south remaining unburnt) (see Figure 2-2). According to NAFI, the entire extent of the gravel borrow areas was burnt in 2018. The western half of the clay borrow area was most recently burnt in 2017, but the eastern half not since 2013. Late burn fires are typically hotter than those occurring earlier in the Dry season. They are often anthropogenic in origin and their effect on native flora and fauna is usually more detrimental because of their intensity. In the last ten years, the gravel borrow areas B and C have experienced late burns between two and three times; D and the eastern half of A only once; and the western half of A (along the rocky ridge) and the clay borrow area not at all. Of all the fires across Rum Jungle mine site, there has been only one that occurred late in the Dry season.



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Figure 2-1. Map of land systems relevant to the survey areas



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Figure 2-2. Map of fire frequency within the region



3 VEGETATION MAPPING

Vegetation communities have previously been mapped in the WRD site by Eco Logical (2014), but never within the gravel and clay borrow areas. To fill this information gap, vegetation mapping was undertaken in those areas in this survey. Due to the extent and density of Gamba Grass within the clay borrow area, vegetation mapping was undertaken primarily using a drone. The lower survey effort for that site is considered justifiable because it has low ecological value due to the very high level of weed infestation across that site.

3.1 Methods

A desktop review of available aerial imagery and existing land resource mapping was undertaken to inform the field survey. Field maps were produced for use as a reference for the vegetation surveys.

Vegetation surveys were undertaken to ground-truth the vegetation communities on the following dates:

- Gravel borrow area 1 to 3 May 2019
- Clay borrow area 29 May 2019

The surveys were undertaken by EcOz's senior botanist David van den Hoek, with the assistance of a cultural monitor for the gravel borrow areas. Vegetation community assessments and mapping techniques were undertaken in accordance with the *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst et al. 2007).

Both surveys were completed at the end of the wet season prior to any burning.

Gravel borrow areas

For the gravel borrow areas, the field survey involved collecting flora composition and structural data of vegetation communities at 19 survey sites across the survey area; with at least three sites located within each the larger vegetation communities. That survey was conducted to NVIS level 5 (Association) – whereby up to three dominants are recorded in each strata. The sites were based on 20 x 20 m quadrats, within which floristic and structural information was collected (see Brocklehurst et al. 2007).

A drone (Mavic Pro) was also deployed to measure the cover of the upper vegetation strata. The drone flew 20 m above upper strata, with the camera facing directly down. The resultant aerial plot photo was referenced in the field to confirm the percentage cover of the upper strata.

Clay borrow area

Due to the extent and density of Gamba Grass within the clay borrow area, it was not possible to safely access that site to undertake standard vegetation mapping. Instead, apart from a few check sites accessed along drilling lines, the survey was undertaken primarily using drone imagery.

The model used was a Phantom 4 Pro, which flew 95 m above ground level. The resultant ortho-mosaics were exported. The program DroneDeploy was used to create an ortho-mosaic by stitching together the sequence of overlapping photos collected during the drone survey to create a single spatially-rectified aerial image at 5 cm pixels resolution. A vegetation map was then created based on that imagery, together with notes collected during the site visit.



3.2 Results

3.2.1 Gravel borrow areas

Seven distinct native vegetation communities and two disturbance communities were described within the gravel borrow area at a scale of 1:10,000 – see Table 3-1 and Figure 3-1. Full vegetation community descriptions are provided in Appendix A.

Much of the area consists of Eucalypt woodlands to open forests, with *Eucalyptus miniata* and *E. tetrodonta* often dominant. These vegetation communities support a moderately diverse mid-storey typical of northern savannas with *Terminalia ferdinandiana* and *Livistona humilis* widespread (Table 3-1). In the mid-northern part of the survey area, the vegetation community is dominated by *Corymbia confertiflora* with *Erythrophleum chlorostachys*, but has a similar mid-storey to the other Eucalypt-dominated communities.

Drainage areas occupy a relatively small proportion of the survey area along minor drainage lines (Figure 3-1). These vegetation communities are dominated by *Melaleuca viridiflora*, with *Pandanus spiralis* and *Lophostemon grandiflorus* forming a riparian strip (Figure 3-3), or are open sites with a grassland dominated by *Eriachne burkittii* and with scattered trees. Some sites have been partially invaded by Gamba Grass (*Andropogon gayanus*).

Previously-disturbed areas supported two community types (1a and 2a), corresponding to the reference communities 1 and 2 respectively, with strips of remnant (native) vegetation amongst the revegetation (Figure 3-2). These areas have developed into a low open woodland, with coloniser species that are able to grow on gravelly and stony substrates such as *Calytrix exstipulata, Acacia oncinocarpa* and *Livistona humilis* beneath a (low) over-storey of *Eucalyptus phoenicea*. The ground layer is dominated by *Sorghum* spp., with the low grass *Eriachne ciliata* on stonier soils.

Gamba Grass (*Andropogon gayanus*) occurs in the riparian areas and drainage lines – sometimes in dense patches. There are also some isolated patches of Gamba Grass in woodland, as well as along the tracks in the vicinity of the revegetated borrow areas in the centre of the survey area. Creek lines also contain patches of Hyptis (*Hyptis suaveolens*).

One threatened species was recorded – Darwin Cycad (*Cycas armstrongii*) – which is present in low densities in the remnant vegetation communities that are dominated by *Eucalyptus miniata / E. tetrodonta*. No other threatened flora species are considered likely to be present, given the lack of records in similar vegetation types in the region.



	Vegetation community	Area
Wood	Iland communities	
1	Eucalyptus tetrodonta +/- Eucalyptus miniata, Erythrophleum chlorostachys mid woodland over Livistona humilis, Terminalia ferdinandiana mid open shrubland over Heteropogon triticeus, Sorghum intrans mid open tussock grassland	383.5 ha (45%)
1a	Previously-disturbed area: Buchanania obovata, Acacia difficilis, Terminalia ferdinandiana low open woodland over Acacia oncinocarpa, Livistona humilis, Cycas armstrongii mid sparse shrubland over Eriachne ciliata, Heteropogon triticeus, Sorghum intrans mid open tussock grassland	11.0 ha (1%)
2	Eucalyptus miniata, Erythrophleum chlorostachys mid open woodland over Eucalyptus phoenicea, Terminalia ferdinandiana, Livistona humilis mid open woodland over Chrysopogon latifolius, Sorghum intrans, Sorghum plumosum mid tussock grassland	129.5 ha (15%)
2a	Previously-disturbed area: <i>Eucalyptus phoenicea</i> low open woodland over <i>Livistona humilis, Calytrix exstipulata, Acacia oncinocarpa</i> mid open shrubland over <i>Sorghum plumosum, Eriachne ciliata, Sorghum intrans</i> mid open tussock grassland	60.4 ha (7%)
3	Eucalyptus tetrodonta, Eucalyptus miniata mid open forest over Acacia oncinocarpa, Petalostigma pubescens, Xanthostemon paradoxus mid open shrubland over Heteropogon triticeus, Sorghum plumosum, Sorghum intrans mid open tussock grassland	114.2 ha (13%)
4	Corymbia confertiflora, Erythrophleum chlorostachys mid open woodland over Terminalia ferdinandiana, Xanthostemon paradoxus, Livistona humilis mid open shrubland over Eriachne ciliata, Acacia gonocarpa, Heteropogon triticeus mid open tussock grassland	47.2 ha (6%)
Drain	age communities	
5	Melaleuca viridiflora, Corymbia polycarpa +/- Lophostemon grandiflorus mid woodland over Lophostemon grandiflorus, Pandanus spiralis, Melaleuca viridiflora mid shrubland over Andropogon gayanus, Sorghum intrans, Eriachne burkittii mid closed tussock grassland	85.6 ha (10%)
6	Pandanus spiralis low isolated trees over Eriachne burkittii, Sorghum intrans mid closed tussock grassland	7.6 ha (1%)
7	Melaleuca nervosa low isolated trees over Livistona humilis low isolated shrubs over Eriachne burkittii, Andropogon gayanus, Pseudopogonatherum contortum mid closed tussock grassland	9.7 ha (1%)

Table 3-1. List of vegetation communities in the gravel borrow survey area



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Supplementary\Figure 3-1. Veg in gravel.mxd

Figure 3-1. Map of vegetation communities and survey sites within the gravel borrow areas





Figure 3-2. Aerial view (drone image) of rehabilitated area and remnant native vegetation (vegetation community 2a)



Figure 3-3. Aerial view (drone image) of drainage line (vegetation community 5)



3.2.2 Clay borrow area

Four broad vegetation types were identified (and are mapped in Figure 3-7):

- Corymbia species open woodland (60.6 ha)
- Eucalyptus miniata woodland (9.0 ha)
- Eucalyptus tetrodonta woodland (4.3 ha)
- *Melaleuca* species closed forest (18.5 ha).

The environmental weed species Guinea Grass (*Megathyrsus maximus*) is abundant within riparian vegetation (i.e. the *Melaleuca* species closed forest) – see Figure 3-4. All non-riparian vegetation is heavily-infested by Gamba Grass (*Andropogon gayanus*) – see Figure 3-5 and Figure 3-6 for examples of aerial views.

There were no threatened plants noted from the drone imagery or site visit, nor are any likely given the vegetation types and level of Gamba Grass infestation.



Figure 3-4. Aerial photograph showing transition line between Gamba Grass (top) and Guinea Grass (bottom) infestations of the clay borrow area





Figure 3-5. Photograph of the clay borrow area taken from the northern boundary towards the east

Note: The photographer was standing in the tray of a Hilux in order to get above the Gamba Grass



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Figure 3-6. Aerial photograph showing Gamba Grass infestation of the clay borrow area



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4 FAUNA SURVEY

As discussed in Section 2.2, previously there has been very little fauna survey activity within the gravel borrow areas. Moreover, the WRD site had not been surveyed for five years. Therefore, a survey was undertaken to determine whether any threatened fauna species occur within those areas. Because of the severely compromised habitat quality within the clay borrow area due to high levels of Gamba Grass infestation, it was agreed upon with the Flora and Fauna Division of the NT Department of the Environment and Natural Resources that a fauna survey was not necessary at that site.

4.1 Target species

The fauna survey plan was developed with input from Brydie Hill and Alaric Fisher of the Flora and Fauna Division of the NT Department of the Environment and Natural Resources. A desktop assessment of the types and quality of habitat within the survey area led to the decision to target the species presented in Table 4-1.

Sojontifio nomo	Common nome	Class	Status	
Scientific fiame	Common name	Class	NT	Cth
Geophaps smithii smithii	Partridge Pigeon (eastern subspecies)	Bird	VU	VU
Antechinus bellus	Fawn Antechinus		EN	VU
Dasyurus hallucatus	Northern Quoll	Mammal		EN
Mesembriomys gouldii gouldii	Black-footed Tree-rat (Kimberley and mainland NT subspecies)		VU	EN

Table 4-1.	Threatened	species	targeted	in the	fauna	survev
		000000	un gotoù		laana	

CR = Critically Endangered, EN = Endangered, VU = Vulnerable.

4.2 Survey method

This section presents and justifies the survey methods used to target different groups or species. The survey was performed under Parks and Wildlife permit #62714 and Animal Ethics Committee permit approval #A12005. EcOz had permission from the Northern Land Council to access the Finniss River Aboriginal Land Trust (permits #86077 and 87878), and were accompanied by cultural monitors throughout the survey.

Camera trap methodology used in this survey was based on the draft *Camera Trapping Standing Operating Procedure for the Top End Long-Term Monitoring Program* developed by Flora and Fauna Division of the NT Department of the Environment and Natural Resources. A survey design based around a three-camera array was negotiated with the Flora and Fauna Division. The number of sites was based on those negotiations and camera availability.

Installation of cameras was led by Jenny Lewis (who is highly experienced using camera traps, including with the Australian Wildlife Conservancy) and Glen Ewers (who has extensive experience deploying camera traps in the greater Darwin region at sites such as Noonamah Ridge, East Point, Lee Point, Darwin International Airport and Middle Arm).



Site locations

Camera sites were located such as to maximise spatial coverage, but also to ensure that all habitat types were suitably covered. Details of the site locations are listed in Table 4-2. Locations of sites in the gravel borrow areas are mapped in Figure 4-4 and those in Rum Jungle mine site in Figure 4-5.

The camera site locations within the Rum Jungle mine site are in remnant bushland adjacent to the proposed WRD. Within the gravel borrow areas, more sites and/or more camera per site were placed in locations more likely to be used as borrow areas (i.e. closer to the Rum Jungle mine site). Within those areas, the priority was given to patches of higher quality habitat (e.g. nearby water sources, hollow-bearing trees and absence of weeds). Originally there were to be more sites in the southernmost proposed borrow area. However, during camera deployment, it was decided through discussions with the client that that area is not likely to be disturbed, and so those cameras were re-assigned to the WRD site. One camera site (D01) was retained in the southernmost area for context. This site contains the largest trees across all the gravel borrow survey area.

The clay borrow area was not subjected to a fauna survey. It was agreed, in discussions with the Executive Director of the Flora and Fauna Division of DENR – Dr Alaric Fisher, that the high abundance and density of Gamba Grass across the clay borrow area meant it was inherently unlikely to support threatened species.

Site no.	Latitude	Longitude	Vegetation community	Times burnt (past 10 years)
A01	-13.0141	130.9932	Eucalyptus low open to mid woodland	5
A02	-13.0105	130.9961	Eucalyptus mid open woodland	4
A03	-13.0147	130.9979	Eucalyptus mid open woodland	7
A04	-13.0125	131.0031	Drainage woodland	6-7
B05	-13.0019	131.0069	Eucalyptus mid woodland	6
B06	-13.0046	131.0122	Drainage woodland	7
B07	-13.0045	131.0084	Eucalyptus mid woodland	9
B08	-13.0063	131.0045	Eucalyptus mid woodland	9
C09	-13.0046	131.0144	Corymbia and Erythrophleum open woodland	8
C10	-13.0067	131.0173	Corymbia and Erythrophleum open woodland	9-10
C11	-13.0091	131.0159	Corymbia and Erythrophleum open woodland	10
C12	-13.0116	131.0097	<i>Eucalyptus</i> low open woodland (previously- disturbed)	8
C13	-13.0175	131.0098	Eucalyptus mid woodland	7
D15	-13.0268	131.0183	Eucalyptus mid open forest	8
RJ01	-12.9780	131.0123	* Eucalyptus woodland to open forest	9
RJ02	-12.9780	131.0172	* Eucalyptus woodland to open forest	10
RJ03	-12.9803	131.0215	* <i>Eucalyptus</i> woodland to open forest and <i>Melaleuca viridiflora/Pandanus spiralis/Grevillea pteridifolia</i> open woodland	10
RJ04	-12.9832	131.0186	* Eucalyptus woodland to open forest	10

Table 4-2. List of camera survey site details

* Vegetation communities described by Eco Logical (2014)



Site design

Camera trap methodology used in this survey employed the vertical camera set-up described in the draft *Camera Trapping Standing Operating Procedure for the Top End Long-Term Monitoring Program* developed by Flora and Fauna Division of DENR.

Camera traps were baited using a mix of peanut butter, sardines and oats in a canister positioned within the camera field of view. Cameras were set to a high sensitivity and to take three photographs (with 1 second interval) per trigger, with a 10 second interval between triggers.

They were deployed for between 36 and 38 nights, from 14 - 16 May to 20 - 21 June 2019.

Each site had a minimum three cameras (two Reconyx HP2W and one KeepGuard KG690) set in a linear arrangement over approximately 100 m, with a minimum of 30 m between each camera. There was a vertically-set camera at each end (one with bait station positioned 1 m in front of camera, the other 2 m in front), and a horizontally-set camera (i.e. the camera was turned sideways) overlooking a cork board – see Figure 4-1. The cork board creates a cooler background than bare ground would, allowing for greater temperature contrast and therefore improved detectability of small mammals in hot environments. A drift fence was set in front of the horizontally-set cameras (4 m on either side) to further corral small mammals toward the corkboard and bait.

Sites A01, C10, C11, D15 and RJ01 to 04 were judged to have the best habitat quality and so at each a fourth camera was deployed (vertically-set with bait at 2 m). These sites were generally set in a quadrilateral arrangement; however, C10-11 and RJ03 were linear because they were adjacent to creek lines.

The rationale behind each site having a camera set at 2 m was to increase the chances of detecting the Partridge Pigeon – a recommendation made by the Flora and Fauna Division during correspondence about survey design.



Figure 4-1. Diagrams of camera set-up

(Left: horizontal camera; right: vertical camera with 1 m distance to bait station)



4.3 Survey results

Conditions

The survey ran from mid-May to mid-June, during which there was dry and warm weather, typical of the dry season in the Top End. Throughout that period, the Batchelor climate station (number 14272, located approximately two kilometres from the southern end of the gravel borrow areas) recorded only 0.4 mm of rain on 19 May. Average daily temperatures ranged from a minimum of 15.5°C to a maximum of 32.0°C. The wet season preceding this survey was one of the driest on record.

Habitat condition for most sites were good, with relatively few weeds. Gamba Grass was the most commonly observed weed species, but for these survey sites was largely restricted to alongside tracks and drainage lines. Note that for all sites, there was only an emerging mid-story layer, dominated by *Livistona humilis*. According to NAFI, all sites were last burnt in 2018.

On 6 June, a fire burnt through much the south-eastern parts of the gravel borrow areas. This affected three camera sites (C10, C11 and D15). Fortunately, when deploying the cameras, surrounding vegetation was cleared to create a small fire break, which was successful in protecting most cameras. However, the drift fences for each horizontally-set camera at these sites were destroyed in the fire, and two cameras at D15 were burnt from their positions (with the data collected prior to the fire still retrievable).

General results

The camera survey had a total effort of 2,167 trap nights. Five camera traps only recorded images for 21-22 nights (two due to being burnt off the posts – both at D15, three due to programming issues – B06, C12, RJ04), and one camera for only 15 nights (at B06, due to camera failure).

The identification of twenty-six native species was confirmed: seven mammals, fifteen birds and five reptiles. These are listed in Appendix B. The species most commonly detected across all sites were the Common Brushtail Possum (*Trichosurus vulpecula*) and Agile Wallaby (*Macropus agilis*). Red-cheeked Dunnart (*Sminthopsis virginiae*) was recorded at RJ04, and Short-beaked Echidna (*Tachyglossus aculeatus*) at both RJ03 and RJ04. Notably absent during this survey were Northern Brown Bandicoot (*Isoodon macrourus*), a Near Threatened species commonly captured during the 2014 camera survey by Eco Logical. Furthermore, neither diggings nor burrows typical of the species were observed by EcOz ecologists during the field visits. Reasons for their absence in this survey are unclear, but maybe related to burn history and/or the predominantly gravelly substrate.

Threatened species

Two threatened species were recorded during the survey:

- Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) listed as Vulnerable in the NT and Endangered federally.
- Partridge Pigeon (Geophaps, smithii smithii) listed as Vulnerable in the NT and federally

Sample images of these species are at Figure 4-2 and Figure 4-3.

Black-footed Tree-rat were recorded at sites A01, B06, C09, C10 and RJ01 – see Figure 4-4 and Figure 4-5 – and only during the first two weeks of the survey. Site A01 is in a *Eucalyptus* woodland atop a steep rocky ridge. Site B06 is also in *Eucalyptus* woodland, but proximate to a stream with riparian vegetation. Sites C09 and C10 are in a *Corymbia* and *Erythrophleum* mid open woodland, each within 100 m of a stream with riparian vegetation. RJ01 is also in the only patch of remnant *Eucalyptus* woodland within the Rum Jungle mine site that is largely free of Gamba Grass.

Although ostensibly weed-free, these sites would not normally be considered optimal habitat for the Blackfooted Tree-rat based on the frequent fire regime and absence of a dense understory. However, proximity to waterways may provide sanctuary and alternative habitat types during and after fires.



Partridge Pigeon were recorded twice at the same site, B05, and a pair were also incidentally observed on a track approximately 300 m north of C12 – see Figure 4-4. Both of these areas were previously disturbed – the location of the incidental record heavily so, with the regenerated shrub layer dominated by Turkey Bush (*Calytrix exstipulata*) and proximate to a thick Gamba Grass infestation. Neither of these factors, nor the high fire frequency of the region, are optimal for Partridge Pigeons, and thus the incidental sighting was somewhat unexpected.



Figure 4-2. Camera trap images of Black-footed Tree-rats at site B06 (left) and C10 (right)



Figure 4-3. Camera trap images of Partridge Pigeons at site B05



Path: Z\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17175 - Rum Jungle EIS - ecology\01 Project Files\Report maps\September 2019 V2\Supplementary\Figure 4-4. Thr species in gravel borrow area.mxd

Figure 4-4. Map showing fauna survey sites and resultant threatened species records in the gravel borrow areas



Figure 4-5. Map showing fauna survey sites and resultant threatened species records in the Rum Jungle mine site



Pest species

Five introduced species were recorded – Wild Pig (*Sus scrofa*) at thirteen sites, Cane Toad (*Rhinella marina*) and Feral Cat (*Felis catus*) each at eleven sites, Black Rat (*Rattus rattus*) at two sites, feral Cattle (*Bos taurus*) at three sites and Buffalo (*Bubalus bubalis*) at one site. Example images of Feral Cats and Wild Pigs are at Figure 4-6.



Figure 4-6. Camera trap images of Feral Cats (top) and Feral Pigs (bottom)



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APPENDIX A VEGETATION COMMUNITY DESCRIPTIONS

Note: percentages (in brackets) are frequencies of sites in which a particular flora species was recorded for the given vegetation community

Community 1 – Eucalyptus tetrodonta +/- Eucalyptus miniata, Erythrophleum chlorostachys mid woodland over Livistona humilis, Terminalia ferdinandiana mid open shrubland over Heteropogon triticeus, Sorghum intrans mid open tussock grassland					
NVIS Code: T7i	No. of sites: 5 (Sites	SVS1, 6, 7, 8, 15)	Mapped area: 383.5 ha	(45%)	
Upper 1: Mid wo chlorostachys (4	oodland dominated by <i>Eucal</i> y 0%)	/ptus tetrodonta (80%) ·	+/- Eucalyptus miniata (40%	%), Erythrophleum	
Mid 1: Mid open	shrubland dominated by Liv	istona humilis (100%), [*]	Terminalia ferdinandiana (8	30%)	
Ground 1: Mid of grass sp. (insuffi	open tussock grassland domi cient fertile material for ident	nated by <i>Heteropogon</i> ification) (60%)	triticeus (80%), Sorghum ir	ntrans (80%), unknown	
No. Carlos	March March		Other common specie	S	
		Ac	Upper stratum (U1): - Mid stratum (M1): Aca Corymbia bleeseri, Peta	cia oncinocarpa, alostigma pubescens,	
	de Sala		Ground stratum (G1): Chrysopogon latifolius,	Sorghum plumosum, Eriachne ciliata	
Soils: Kandosols, some surface gravel and roc exposures					
Drainage: Well drained					
		Structural summa	ary		
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code	
Upper U1	Tree	23.4	15.2	T7i	
Mid M1	Shrub	12.4	7.6	S3i	

30

1

G2i

Tussock grass

Ground G1



Community 1a – Rehabilitated area: Buchanania obovata, Acacia difficilis, Terminalia ferdinandiana low open woodland over Acacia oncinocarpa, Livistona humilis, Cycas armstrongii mid sparse shrubland over Eriachne ciliata, Heteropogon triticeus, Sorghum intrans mid open tussock grassland

NVIS Code: T6rNo. of sites: 1 (Site VS5)Mapped area: 11.0 ha (1%)

Upper 1: Low open woodland dominated by *Buchanania obovata* (100%), *Acacia difficilis* (100%), *Terminalia ferdinandiana* (100%)

Mid 1: Mid sparse shrubland dominated by Acacia oncinocarpa (100%), Livistona humilis (100%), Cycas armstrongii (100%)

Ground 1: Mid open tussock grassland dominated by *Eriachne ciliata* (100%), *Heteropogon triticeus* (100%), *Sorghum intrans* (100%)



Upper U1	Tree	8	6	T6r
Mid M1	Shrub	6	4	S3r
Ground G1	Tussock grass	20	1	G2i



Community 2 – Eucalyptus miniata, Erythrophleum chlorostachys mid open woodland over Eucalyptus phoenicea, Terminalia ferdinandiana, Livistona humilis mid open shrubland over Chrysopogon latifolius, Sorghum intrans, Sorghum plumosum mid tussock grassland

 NVIS Code: T7r
 No. of sites: 2 (Sites VS2, 3)
 Mapped area: 129.5 ha (15%)

Upper 1: Mid open woodland dominated by Eucalyptus miniata (100%), Erythrophleum chlorostachys (100%)

Mid 1: Mid open shrubland dominated by *Eucalyptus phoenicea* (100%), *Terminalia ferdinandiana* (100%), *Livistona humilis* (100%)

Ground 1: Mid tussock grassland dominated by *Chrysopogon latifolius* (100%), *Sorghum intrans* (100%), *Sorghum plumosum* (50%)





Structural summary				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	11.5	14	T7r
Mid M1	Shrub	23.5	8	S3i
Ground G1	Tussock grass	32.5	1	G2c



Community 2a – Rehabilitated area: *Eucalyptus phoenicea* low open woodland over *Livistona humilis, Calytrix exstipulata, Acacia oncinocarpa* mid open shrubland over *Sorghum plumosum, Eriachne ciliata, Sorghum intrans* mid open tussock grassland

NVIS Code: T6r No	. of sites: 1 (Site VS11)	Mapped area: 60.4 ha (7%)
-------------------	---------------------------	---------------------------

Upper 1: Low open woodland dominated by *Eucalyptus phoenicea* (100%) Mid 1: Mid open shrubland dominated by *Livistona humilis* (100%), *Calytrix exstipulata* (100%), *Acacia oncinocarpa* (100%),

Ground 1: Mid open tussock grassland dominated by *Sorghum plumosum* (100%), *Eriachne ciliata* (100%), *Sorghum intrans* (100%)





,				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	5	7	T6r
Mid M1	Shrub	20	4	S3i
Ground G1	Tussock grass	20	1	G2i



Community 3 – Eucalyptus tetrodonta, Eucalyptus miniata mid open forest over Acacia oncinocarpa, Petalostigma pubescens, Xanthostemon paradoxus mid open shrubland over Heteropogon triticeus, Sorghum plumosum, Sorghum intrans mid open tussock grassland

 NVIS Code: T7c
 No. of sites: 2 (Sites VS14, 16)
 Mapped area: 114.2 ha (13%)

Upper 1: Mid open woodland dominated by Eucalyptus tetrodonta (100%), Eucalyptus miniata (100%)

Mid 1: Mid open shrubland dominated by Acacia oncinocarpa (100%), Petalostigma pubescens (50%), Xanthostemon paradoxus (50%)

Ground 1: Mid open tussock grassland dominated by *Heteropogon triticeus* (100%), *Sorghum plumosum* (100%), *Sorghum intrans* (50%)





Other common species

Upper stratum (U1): -Mid stratum (M1): Grevillea decurrens, Livistona humilis, Cycas armstrongii Ground stratum (G1): -

Soils: Kandosols

Drainage: Well drained

Structural summary				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	57.5	17	T7c
Mid M1	Shrub	13	8	S3i
Ground G1	Tussock grass	25	1	G2i



Community 4 – Corymbia confertiflora, Erythrophleum chlorostachys mid open woodland over Terminalia ferdinandiana, Xanthostemon paradoxus, Livistona humilis mid open shrubland over Eriachne ciliata, Acacia gonocarpa, Heteropogon triticeus mid open tussock grassland

Upper 1: Mid open woodland dominated by Corymbia confertiflora (100%), Erythrophleum chlorostachys (100%)

Mid 1: Mid open shrubland dominated by Terminalia ferdinandiana (100%), Xanthostemon paradoxus (100%), Livistona humilis (100%)

Ground 1: Mid open tussock grassland dominated by *Eriachne ciliata* (100%), *Acacia gonocarpa* (100%), *Heteropogon triticeus* (100%)





Structural Summary				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	12	11	T7r
Mid M1	Shrub	20	6	S3i
Ground G1	Tussock grass	30	1	G2i



Community 5 – Melaleuca viridiflora, Corymbia polycarpa +/- Lophostemon grandiflorus mid woodland over Lophostemon grandiflorus, Pandanus spiralis, Melaleuca viridiflora mid shrubland over Andropogon gayanus, Sorghum intrans, Eriachne burkittii mid closed tussock grassland

NVIS Code: T7i **No. of sites:** 5 (Sites VS4, 10, 12, 13, 18) **Mapped area:** 85.6 ha (10%)

Upper 1: Mid woodland dominated by *Melaleuca viridiflora* (80%), *Corymbia polycarpa* (60%) +/- *Lophostemon grandiflorus* (20%)

Mid 1: Mid shrubland dominated by *Lophostemon grandiflorus* (100%), *Pandanus spiralis* (100%), *Melaleuca viridiflora* (20%)

Ground 1: Mid closed tussock grassland dominated by *Andropogon gayanus* (60%), *Sorghum intrans* (60%), *Eriachne burkittii* (40%)





Other common species

Upper stratum (U1): Erythrophleum chlorostachys, Brachychiton diversifolius Mid stratum (M1): Eucalyptus alba, Acacia difficilis, Acacia latescens

Ground stratum (G1): *Germainia grandiflora, Eriachne triseta, Mnesithea rottboellioides*

Soils: Hydrosols

Drainage: Poorly to very poorly drained

Structural summary				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	39.4	16.4	T7i (T7r, T7c)
Mid M1	Shrub	31.4	8.2	S3c
Ground G1	Tussock grass	72	1.2	G2d



Community 6 – Pane tussock grassland	lanus spiralis low isolated trees o	over Eriachne burkittii, Sorghum intrans mid closed		
NVIS Code: G2d	No. of sites: 1 (Site VS17)	Mapped area: 7.6 ha (1%)		
Upper 1: Low isolated trees of Pandanus spiralis (100%)				
Mid 1: -				
Ground 1: Mid closed	tussock grassland dominated by En	riachne burkittii (100%), Sorghum intrans (100%)		
		<image/>		
	Contraction of the second	Upper stratum (U1): -		
		Mid stratum (M1): -		
		Ground stratum (G1): -		
	Carl Carl Carl	Soils: Hydrosols		
		Drainage: Poorly to very poorly drained		

Structural summary				
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code
Upper U1	Tree	2	6	G2d
Mid M1	Shrub	-	-	-
Ground G1	Tussock grass	90	1	G2d



Community 7 – <i>Mela</i> Eriachne burkittii, Ar	nleuca nervosa low isolated trees ov ndropogon gayanus, Pseudopogona	er <i>Livistona humilis</i> low isolated shrubs over atherum contortum mid closed tussock grassland
NVIS Code: G2d	No. of sites: 1 (Site VS19)	Mapped area: 9.7 ha (1%)
Upper 1: Low isolated	trees of Melaleuca nervosa (100%)	
Mid 1: Low isolated sh	nrubs of <i>Livistona humilis</i> (100%)	
Ground 1: Mid closed Pseudopogonatherum	tussock grassland dominated by Eria contortum (100%)	chne burkittii (100%), Andropogon gayanus (100%),
	and the second second	Other common species
		Upper stratum (U1): - Mid stratum (M1): - Ground stratum (G1): -
ALL AND ALL ALL	A Part of the A	Soils: Hydrosols
		Drainage: Poorly to very poorly drained

Structural summary					
Strata	Modal growth form	Mean cover %	Mean height (m)	NVIS code	
Upper U1	Tree	1	6	G2d	
Mid M1	Shrub	1	3	G2d	
Ground G1	Tussock grass	95	1	G2d	



APPENDIX B LIST OF SPECIES RECORDED ON CAMERA TRAPS

Group	Species	Common name
	Chlamydosaurus kingii	Frilled-neck Lizard
	Diporiphora bilineata	Two-lined Dragon
Reptiles	Scincidae sp.	-
	Varanus scalaris	Spotted Tree Monitor
	Varanus tristis	Black-headed Monitor
	Accipiter cirrhocephalus	Collard Sparrowhawk
	Aegotheles cristatus	Owlet Nightjar
	Burhinus grallarius	Bush Stone-curlew
	Centropus phasianinus	Pheasant Coucal
	Corvus orru	Torresian Crow
	Coturnix ypsilophora	Brown Quail
	Cracticus nigrogularis	Pied Butcherbird
Birds	Cracticus torquatus	Grey Butcherbird
	Dacelo leachii	Blue-winged Kookaburra
	Geopelia humeralis	Bar-shouldered Dove
	Geopelia placida	Peaceful Dove
	Geophaps smithii	Partridge pigeon
	Podargus strigoides	Tawny frogmouth
	Rhipidura leucophrys	Willie Wagtail
	Threskiornis spinicollis	Straw-necked Ibis
	Canis lupus dingo	Dingo
	Macropus agilis	Agile Wallaby
	Macropus antilopinus	Antilopine Wallaroo
Mammals	Mesembriomys gouldii	Black-footed Tree-rat
Mannais	Sminthopsis virginiae	Red-cheeked Dunnart
	Tachyglossus aculeatus	Short-beaked Echidna
	Trichosurus vulpecula	Common Brushtail Possum
	Zyzomys argurus	Common Rock-rat
	Rhinella marina	Cane Toad
	Bubalus bubalis	Buffalo
Introduced	Bos taurus	Cattle
species	Felis catus	Cat
	Sus scrofa	Pig
	Rattus	Black Rat



EcOz Environmental Consultants

EcOz Pty Ltd. ABN 81 143 989 039

Level 1, 70 Cavenagh St, T: +61 8 8981 1100 GPO Box 381, Darwin, NT 0801

E: ecoz@ecoz.com.au

www.ecoz.com.au





Appendix F ECOZ WEED SURVEY REPORT



Weed Survey Report Former Rum Jungle Mine Site Department of Primary Industry and Resources



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EcOz Pty Ltd. ABN: 81 143 989 039 Winlow House, 3rd Floor 75 Woods Street DARWIN NT 0800 GPO Box 381, Darwin NT 0800 Telephone: +61 8 8981 1100 Facsimile: +61 8 8981 1102 Email: <u>ecoz@ecoz.com.au</u> Internet: <u>www.ecoz.com.au</u>



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ACRONYMS

NTNorthern TerritoryWoNSWeeds of National SignificanceDPIRDepartment of Primary Industry and Resources



1 INTRODUCTION

This report outlines the findings of a survey of weeds within the former Rum Jungle Mine Site in April 2018. The intent of the survey was to map the weeds within the mine area to inform the Former Rum Jungle Mine Site Weed Management Plan 2018 – 2023.

1.1 Objectives and scope

The objective of the weed survey is to determine the current occurrence of weeds within the survey area through the collection of spatially accurate weed data.

The scope of this report is to outline the survey design, field methods and results of the former Rum Jungle mine site weed survey.

1.2 Weed classification

1.2.1 Northern Territory Weed Management Act

In the Northern Territory, the management of weeds is governed by the *Weeds Management Act*. This Act declares undesirable species of plants as 'weeds', and requires these species to be controlled, eradicated or prevented from entering the NT depending on their classification. Weeds are classified into one of three classes:

- Class A declared plant: to be eradicated
- Class B declared plant: growth and spread to be controlled
- Class C declared plant: not to be introduced into the NT.

All Class A and Class B weeds are also considered Class C.

The Act specifies how weeds in each of the classes must be treated. Weed management plans for specific weeds are endorsed under this Act. The Act stipulates general duties for the owner or occupier of the land to take all reasonable measures to prevent land being infested with a declared weed, to prevent a declared weed spreading to other land. The Act also requires that a land owner or occupier reports to a Weed Management Officer, within 14 days of first becoming aware of a declared weed that has not been previously known in an area is identified.

1.2.2 Weeds of National Significance

Weeds of National Significance (WoNS) are weeds that have been given priority for management by the Australian Government. Management of WoNS weeds in the NT comes under the *Weeds Management Act*.



2 METHOD

2.1 Survey area

This survey was undertaken at the former Rum Jungle Mine Site is located 105 km by road, south of Darwin, near Batchelor in the Northern Territory. The former Rum Jungle Site, Section 2968 Hundred of Goyder, comprises of an area of approximately 655 ha. The survey avoided areas marked as No-Go areas, see Figure 3-1.

2.2 Development of survey method

The weed survey was developed with reference to the Northern Territory Weed Data Collection Manual (WMB 2015). This document provides a procedure for the collection of weed data that is compatible with the NT Weed Dataset. The method was also planned in consultation with Department of Primary Industry and Resources (DPIR).

2.2.1 Survey approach

The survey was undertaken across the Rum Jungle site in early April, with the site accessed using a four wheel drive, ATV, quads and on foot. The first two days of the survey was undertaken with two teams of two surveyors traversing the site using a vehicle and ATV. Teams were led by EcOz environmental consultants with experience in weed survey and identification in Northern Australia. Each team also included a field trainee from the Kungarakan Culture and Education Association. An additional three days of survey was undertaken by the two EcOz environmental consultants using quads to access the remainder to the site.

The entire site was surveyed at a 100 m scale. This was done by creating a field map displaying a 100 m grid of numbered weed points within the survey boundary. Each of these points was located during the survey using a moving map loaded into a handheld GPS. Weed densities observed while traveling between each point was entered into the Cybertracker device and applied to each weed point number. In areas containing large areas of Gamba Grass with a density greater than 50% cover, the boundaries of patches were traversed and weed records within the patch were projected onto the associated weed points. This method was mainly used to record Gamba Grass on waste rock dumps and in dense patches in the north west corner of the former Rum Jungle Mine Site.

2.3 Weed data collection

Weed data was collected using a GPS-enabled Android device running the Cybertracker program. Weed attributes recorded were according to those outlined in the NT Weed Data Collection Manual (WMB 2015) and included the following:

- Weed point number (100 m grid within the survey area)
- Weed species name
- Infestation size 100 m
- Infestation density:
 - o 1 = Absent
 - o 2 = < 1%
 - 3 = 1 − 10%
 - 4 = 11 − 50%
 - 5 = > 50%



- Presence of seedling juvenile and adult plants
- Seed occurrence

A geo-referenced map of the survey area with survey points in a 100 m x 100 m grid was loaded to the GPS device, and weed survey tracks were recorded using a handheld GPS. Weed identification photos were recorded using a GPS-enabled digital camera. Cybertracker projects, survey tracks and photos were backed-up daily on a laptop computer to provide maximum security of digital field data.

2.4 Record accuracy

A record was collected for each weed occurrence observed and applied to the nearby weed point. This results in a 100 m accuracy of weed data across the survey site.

2.5 Data presentation

Weed data recorded during the survey was exported from Cybertracker into an Excel spreadsheet. Records were then submitted to the Weeds Branch to be included within the NT Weeds Dataset.

Weed record attributes have been stored as GIS shapefiles and used to produce the weed maps that inform the Weed Management Plan associated with this report.

2.6 Survey team

The weed survey was undertaken by David van den Hoek, who has 12 years of local experience undertaking both weed and native vegetation surveys in the Northern Territory. In his botanical career, he has led a number of weeds surveys, and has consequently acquired the field equipment and developed the skills required to produce reliably accurate field data, for the production of weed databases and maps. Nicole Clark, an EcOz environmental consultant, assisted with the ground survey data collection. Two Indigenous field hands (Tony Bishop and Aristides Avlonitis) from the Kungarakan people were also involved in the project for two days.





3 RESULTS

A total of 978 weed occurrences were recorded during surveys for 22 species (Table 1 and Table 2). Of the 978 weed occurrences 738 are declared weeds (of which four are Weeds of National Significance (WoNS)) and 240 are considered environmental weeds. There were 11 species of declared weeds recorded and 11 species of environmental weeds. There were no class A weeds and 12 class B weeds.

Gamba grass (*Andropogon gayanus*) was the most abundant weed recorded with 484 records (Table 1.) Rattle pod (*Crotalaria sp.*) an environmental weed (i.e. not declared in the NT) was the second most abundant weed with 67 records.

Common name	Weed class	Scientific Name	No. of survey records
Gamba Grass	B, WoNS	Andropogon gayanus	484
Grader Grass	B, WoNS	Themeda quadrivalvis	34
Hyptis	В	Hyptis suaveolens	63
Mimosa	B, WoNS	Mimosa Pigra	6
Olive Hymenachne	B, WoNS	Hymenachne amplexicaulis	42
Mission Grass (Perennial)	В	Cenchrus polystachios	32
Sicklepod	В	Senna obtusifolia	9
Spinyhead sida	В	Sida acuta	16
Flannel weed	В	Sida cordifolia	48
Paddy's lucerne	В	Sida rhombifolia	1
Snakeweed	В	Stachytarpheta sp.	3
TOTAL			738

Table 2. Other undeclared environmental weeds recorded during the survey

Common name	Scientific name	No. of survey records
Mission Grass (Annual)	Cenchrus pedicellatus	39
Calopo	Calopogonium mucunoides	39
Coffee Bush	Leucaena leucocephala	3
Guinea Grass	Panicum maximum	7
Para Grass	Urochloa mutica	14
Rat's tail grass	Sporobolus sp.	10
Rattle pod	Crotalaria sp.	67
Red Natal Grass	Melinis repens	17
Rosella	Hibiscus sabdariffa	2
Stylo	Stylosanthes sp.	34
Wild Passionfruit	Passiflora foetida	8
TOTAL		240



Gamba grass (*Andropogon gayanus*) is spread across most of the survey area. 42% of Gamba grass were recorded at >50% density (Figure 3-1).

Hyptis (*Hyptis suaveolens*) is the second most abundant declared weed, with 63 records, however the density of Hyptis is less, with 48% of the records being at <1% density (Figure 3-2).

The third most abundant declared weed is Flannel weed (*Sida cordifolia*), with 48 records. 50% of Flannel weed recorded a density of 1-10% (Figure 3-3).

Rattle pod (*Crotalaria sp.*) is the most abundant environmental weed with 67 records. 46% of Rattle pod were recorded with a density of 1-10% (Figure 3-8).

Mission grass (annual) (*Cenchrus pedicellatus*) and Calopo (*Calopogonium mucunoides*) were the second most abundant environmental weeds with 39 records. 69% of annual Mission grass recorded a density of 1-10%, while 38% of Calopo recorded a density at 11-50% and 36% at 1-10% density (Figure 3-6 and Figure 3-9).

Stylo (*Stylosanthes sp.*) was the third most abundant environmental weed with 34 records. 47% of Stylo recorded a density of 1-10% (Figure 3-10).

Figure 3-1 to Figure 3-14 show the remaining species density and distributions.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17046 - Rum Jungle Weed Management Plan Update\01 Project Files\Weed mapping - declared.mxd







Figure 3-4. Grader grass and Snakeweed density and distribution



Figure 3-5. Mimosa and Olive Hymenachne density and distrbution



Figure 3-6. Mission grass (perrenial and annual) density and distribution





Figure 3-8. Rattlepod density and distribution



Figure 3-9. Calopo density and distribution



Figure 3-10. Stylo density and distribution



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ17046 - Rum Jungle Weed Management Plan Update\01 Project Files\Weed mapping - environmental.mxd

Figure 3-11. Coffee bush and Para grass density and distribution



Figure 3-12. Guinea grass density and distribution



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Figure 3-13. Red natal and Rat's tail grass density and distribution



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Figure 3-14. Wild Passionfruit and Rosella density and distribution



4 **REFERENCES**

- Weed Management Branch, Northern Territory Government, (2015). *Northern Territory Weed Data Collection Manual*. Darwin: Northern Territory Government of Australia.
- Weed Management Branch, Northern Territory Government. (2015b). *Northern Territory Weed Management Handbook*. Darwin: Northern Territory Government of Australia.



EcOz Pty Ltd. ABN 81 143 989 039

Winlow House, 3rd Floor 75 Woods Street Darwin NT 0800

GPO Box 381, Darwin NT 0800 T: +61 8 8981 1100 F: +61 8 8981 1102 E: ecoz@ecoz.com.au

www.ecoz.com.au

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EcOz Pty Ltd. ABN 81 143 989 039

Winlow House, 3rd Floor 75 Woods Street Darwin NT 0800

GPO Box 381, Darwin NT 0800 T: +61 8 8981 1100 F: +61 8 8981 1102 E: ecoz@ecoz.com.au

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