Rum Jungle Borrow Pit and Haul Road Investigation

Department of Mines and Energy
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Cover photo is of Eucalypt open woodland dominated by *Corymbia latifolia* in the borrow pit area.

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1 Introduction

1.1 Scope

As part of planning for the rehabilitation for the former Rum Jungle mines site the Department of mines and Energy (DME) have contracted EcOz Environmental Consultants (EcOz) to conduct a likelihood analysis for threatened flora and fauna species listed under the Northern Territory Parks and Wildlife Act (TPWC) and/or the Environment Protection and Biodiversity Conservation Act (EPBC) in the area proposed as a borrow pit and associated haul road - the project area (Figure 1).

1.2 Approach

To undertake this work EcOz has used a combination of desk-based research and field survey. This research involved:

- An EPBC Protect Matters Search of the Pine Creek bioregion (accessed on 27/5/2016). The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into units of broadly similar landform, geology and biodiversity (Baker et al. 2005). The project area lies in the Pine Creek Bioregion which covers an area of 28,520 km². Land types are mainly hilly to rugged ridges with undulating plains. Vegetation communities include eucalypt woodlands, with patches of monsoon forests. A search on the entire bioregion was used as it provides a comprehensive list of matters protected under the EPBC.
- A search of the NT Flora and Fauna Atlas Databases for all listed (EPBC and TPWC) threatened species recorded within 10 km of the project area.
- Consideration of literature on the distribution and habitat of threatened species identified in the database searches to assess the likelihood of these species occurring in the project area.
- An examination of aerial imagery of the project area with vegetation communities delineated at a 1:10,000 scale.
- A ground-truthing of vegetation communities and consideration of threatened species habitat was undertaken by ecologist Chris Brady and botanist Tony Orr between 17 and 18 May 2016. This involved:
  - visiting all of the vegetation communities identified from aerial photography, describing the vegetation and making an assessment of habitat quality considering the threatened species that are known or likely to occur in the area
  - active searching for threatened flora species in appropriate habitat in the project area.
- An assessment was then made of the likely impact upon threatened species from the proposed clearing for borrow and the haul road.
Figure 1. Map showing location of proposed borrow area and haul road route, an alternate haul road alignment and threatened species records.
2 Results and discussion

Five vegetation communities were described in the project area (Table 1, Figure 2). The value of most of this area to threatened species has been diminished by dense infestation with Gamba Grass. Without active management it seems likely that most of this area will in time be converted to grassland. The area to the north of the borrow pit through which the haul road passes supports tall Eucalypt open forest dominated by *Eucalyptus tetrodonta* and *Eucalyptus miniata*. This forest is in good condition with a well-developed mid-storey and only isolated patches of Gamba Grass.

The vegetation along the remainder of the haul road route is common in the region and widening of the existing track is not considered likely to impact on the population of threatened species.

The EPBC Protected Matters Search revealed 10 birds, 13 terrestrial mammals, three terrestrial reptiles and seven plants species. An assessment of likelihood was made for each of these species based upon their ecology and known distribution and population trends (Table 2). This assessment considered the Partridge Pigeon and Black-footed Tree-rat as likely to occur in the project area.

An additional nine species were considered to possibly occur in the region. The birds, Red Goshawk, Gouldian Finch, Masked Owl, mammals Fawn Antechinus, Northern Brush Tailed Phascogale and Bare-rumped Sheathtail Bat and the plants *Acacia praetermissa*, *Atalaya brevilata*, *Helicteres macrothrix* as possibly occurring in the area.

Of these species the majority Black-footed Tree-rat, Red Goshawk, Masked Owl, Fawn Antechinus, Northern Brush Tailed Phascogale and Bare-rumped Sheathtail Bat would be associated with the tall Eucalypt open forest to the north of the borrow area. A suggested realignment is to the west (Figure 1) would avoid this community and therefor risk to these threatened species.

Of the remaining species:

- the Partridge Pigeon may occur across a range of vegetation communities, however there was no evidence of fine scale burning favoured by this species and Gamba Grass was prevalent in the borrow pit area.
- the area is not preferred breeding habitat of the Gouldian Finch and there are no recent records of this distinctive bird in the vicinity (Figure 1).
- *Helicteres macrothrix* is known from two distinct populations in the region but was not recorded during targeted searches in this survey.
- similarly *Acacia praetermissa* is known for restricted areas and was not recorded during targeted searches in this survey.
- the area is outside the known distribution of *Atalaya brevilata*, and no habitat similar to that it is known from was recorded in the project area.

The search of the NT Flora and Fauna Atlas databases revealed records of a further four listed species (TPWC), the Pale Field-rat, and three species of goanna, the Floodplain Monitor and Merten’s and Mitchell’s Water Monitors (Figure 1).

- There are no defined creek channels in the project area that provide suitable habitat for Mitchell’s or Merten’s Water Monitors.
- No burrows or other signs of the Floodplain Monitor were recorded and it is considered unlikely to now occur in the project area as a result of interaction with Cane Toads.
- Targeted surveys would be required to determine the presence of Pale Field-rat although it is noted as above clearing is limited to a relatively small area of regionally common habitat that in the project area is heavily infested with Gamba Grass. Therefor the proposed borrowing and haul road construction is not expected to have a significant impact on any of these species.
2.1 Potential impact on threatened species

The significant threat identified to populations of threatened species is the proposed construction of the section of the haul road between the existing track and the proposed borrow pit. In particular this area is considered likely to support a population of the endangered Black-footed Tree-rat. Realigning this section of the haul road outside this habitat would mitigate this impact.

In the event the haul road cannot be realigned targeted surveys of threatened species considered likely to occur or possible occurring in this habitat would give greater certainty of their presence.

The threat to other species possibly in the area not considered significant at a population level as the disturbance will be of a relatively small scale in regionally common habitat that in the project area is heavily infested with Gamba Grass.
Figure 2. Map of vegetation communities in the proposed borrow area
Table 1. Description of vegetation communities mapped in the proposed borrow area

<table>
<thead>
<tr>
<th>Vegetation community</th>
<th>Common species</th>
<th>Habitat quality for threatened species</th>
<th>Area in clearing footprint (ha)</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low open woodland</td>
<td>Canopy: <em>Canarium australis</em>, <em>Corymbia bella</em>, <em>Corymbia confertiflora</em>, <em>Corymbia latifolia</em> (dominant), <em>Eucalyptus tectifica</em>, <em>Erythrophleum chlorostachys</em>, <em>Terminalia grandifolia</em>&lt;br&gt;Mid-storey: <em>Brachychiton diversifolius</em>, <em>Buchanania obovata</em>, <em>Cycas armstrongii</em>, <em>Ficus aculeata</em>, <em>Livistona humilis</em>, <em>Pandanus spiralis</em>, <em>Persoonia falcata</em>, <em>Petalostigma pubescens</em>, <em>Planchonia careya</em>.&lt;br&gt;Ground: <em>Andropogon gayanus</em>, <em>Brachychiton megaphyllus</em>, <em>Cartonema spicatum</em>, <em>Chrysopogon fallax</em>, <em>Chrysopogon latifolius</em>, <em>Crotalaria sp.</em>, <em>Flemingia sp.</em>, <em>Grewia retusifolia</em>, <em>Heteropogon contortus</em>, <em>Pseudopogonatherum irritans</em>, <em>Schizachyrium fragile</em>, <em>Themedia triandra</em></td>
<td>The quality of this habitat for threatened species is compromised by widespread and dense infestation with Gamba Grass</td>
<td>21.7</td>
<td><img src="image1.jpg" alt="Low open woodland" /></td>
</tr>
<tr>
<td>Eucalyptus miniata woodland/open forest</td>
<td>Canopy: <em>Corymbia confertiflora</em>, <em>Corymbia foelscheana</em>, <em>Erythrophleum chlorostachys</em>, <em>Eucalyptus miniata</em> (dominant)&lt;br&gt;Mid storey: <em>Brachychiton diversifolius</em>, <em>Buchanania obovata</em>, <em>Corymbia confertiflora</em>, <em>Corymbia latifolia</em>, <em>Cycas armstrongii</em>, <em>Ficus aculeata</em>, <em>Livistona humilis</em>, <em>Pandanus spiralis</em>, <em>Planchonia careya</em>, <em>Terminalia ferdinandiana</em>&lt;br&gt;Ground: <em>Andropogon gayanus</em>, <em>Bassiaea bossiaeoides</em>, <em>Brachychiton megaphyllus</em>, <em>Buchnera linearis</em>, <em>Cartonema spicatum</em>, <em>Chrysopogon fallax</em>, <em>Chrysopogon latifolius</em>, <em>Distichostemon hispidulus</em>, <em>Flemingia sp.</em>, <em>Gomphrena canescens</em>, <em>Grewia retusifolia</em>, <em>Premna sp.</em>, <em>Stylidium sp.</em></td>
<td>The quality of this habitat for threatened species is compromised by widespread and dense infestation with Gamba Grass</td>
<td>76.7</td>
<td><img src="image2.jpg" alt="Eucalyptus miniata woodland" /></td>
</tr>
</tbody>
</table>
| Eucalyptus miniata/Eucalyptus tetrodonta open forest | Canopy: *Corymbia bleeseri*, *Corymbia clavigera*, *Eucalyptus miniata* (co-dominant), *Eucalyptus tetrodonta* (co-dominant)  
Mid-storey: *Acacia* spp., *Buchanania obovata*, *Cycas armstrongii*, *Erythrophleum chlorostachys*, *Gardenia megasperma*, *Livistona humilis*, *Persoonia falcata*, *Terminalia ferdinandiana*  
Ground: *Bossiaeaa bossiaeoides*, *Brachychiton megaphyllus*, *Buchnera linearis*, *Cartonema spicatum*, *Chrysopogon latifolius*, *Flemingia sp.*, *Gomphrena canescens*, *Grevillea dryandri*, *Heteropogon contortus*, *Pseudopogonatherum irritans*, *Schizachyrium fragile*, *Sorghum plumosum*, *Sorghum timorense*, *Stylidium sp.* | Very large trees with large hollows, well developed shrub layer suggesting an intermediate fire history. | Haul road |

| Rainforest | Canopy: *Acacia auriculiformis*, *Canarium australianum*, *Carpentaria acuminata*, *Cassia fistula*, *Erythrophleum chlorostachys*, *Ficus virens* var. *virens*, *Litsea glutinosa*, *Maranthes corymbosa*, *Syzygium sp.*, *Tamarindus indica*, *Terminalia erythrocarpa*  
Mid-story: *Ficus aculeata*, *Trema tomentosa*  
Ground: *Acanthus sp.*, *Amorphophallus paeoniifolius*, *Calopogonium mucunoides*, *Hyptis suaveolens*, *Sida acuta*, *Triumfetta sp.* | This rainforest patch is overwhelmingly dominated by the introduced plant *Cassia fistula* and may have developed a closed canopy in relatively recent times. | 1.8 ha |

| Paperbark swamp | Canopy *Corymbia clavigera*, *Corymbia polycarpa*, *Melaleuca* spp (dominant), *Lophostemon lactifluus*, *Xanthostemon paradoxus*  
Mid-storey: *Buchanania obovata*, *Brachychiton megaphyllus*, *Livistona humilis* *Planchonia careya*, *Nauclea orientalis*, *Livistona humilis*, *Timonius timon*.  
Ground: *Andropogon gayanus*, *Chrysopogon fallax*, *Eriachne sp.*, *Imperata sp.*, *Sorghum intrans*, *Sorghum timorense*, *Themeda triandra* | 1.9 |
<table>
<thead>
<tr>
<th>Threatened Species</th>
<th>EPBC Status</th>
<th>TPWC Status</th>
<th>Habitat &amp; Distribution</th>
<th>Main Threat</th>
<th>Likelihood of Presence</th>
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<tr>
<td><strong>BIRDS</strong></td>
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<td>Amytornis woodwardi</td>
<td>VU</td>
<td>VU</td>
<td>Habitat: Confined to hummock grasslands, sometimes with open shrubland or woodland overstorey, mixed among dense boulder fields or sandstone pavements (Schodde 1982; Noske 1992a) and escarpment drainage lines. Distribution: In the NT, it is patchily distributed from Nitmiluk National Park to western Arnhem Land (Noske 1992a).</td>
<td>The main threat to this species is late dry season fires leading to substantial vegetation change and reduction in its habitat suitability (Woinarski 1992).</td>
<td>Unlikely</td>
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<td>White-throated Grasswren</td>
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<td>Ephianura crocea tunneyi</td>
<td>EN</td>
<td>EN</td>
<td>Habitat: The subspecies has been recorded in floodplain depressions and channels, concentrating around wetter areas at the end of the dry season (Armstrong 2004). Distribution: The subspecies is restricted to a small geographic area encompassing the floodplains from the Adelaide River to the East Alligator River (Schodde &amp; Mason 1999).</td>
<td>The floodplain habitat of the subspecies is being altered by invasion of exotic plant species, such as <em>Mimosa pigra</em> and gamba grass <em>Andropogon gayanus</em>, and exotic pests such as buffalo, cattle and pigs. Altered fire regimes cause vegetation changes in preferred habitats (Woinarski &amp; Armstrong 2006). Habitat degradation by pigs is considered the most serious threatening process to the subspecies (Armstrong 2004). Salt water intrusion may also have implications (Armstrong 2004).</td>
<td>Unlikely</td>
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<tr>
<td>Yellow Chat (Alligator River)</td>
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<td>Erythrotriorchis radiatas</td>
<td>VU</td>
<td>VU</td>
<td>Habitat: Occurs in coastal sub-coastal areas. Prefers tall open eucalypt forest and riparian areas. Nests in large trees, frequently the tallest in a tall stand, nest trees are invariably within 1 km of permanent water (Debus et al.1988; Aumann et al. 1991). Distribution: Occurs across much of the northern Australia, from the Kimberley to south-eastern Queensland.</td>
<td>Habitat loss - The effect fragmentation of habitat has on the Red Goshawk is yet to be determined. It has been suggested that there may be a threshold above which habitat alterations within a breeding pair’s home range will not be tolerated (Debus &amp; Czechura 1988). Application of persistent pesticides may have caused historic reductions in abundance (Olsen et al. 1993)</td>
<td>Possible</td>
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<td>Threatened Species</td>
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<td>TPWC Status</td>
<td>Habitat &amp; Distribution</td>
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<td>Likelihood of Presence</td>
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<tr>
<td><em>Erythrura gouldiae</em></td>
<td>EN</td>
<td>VU</td>
<td><strong>Habitat:</strong> Prefers open woodlands dominated by annual and perennial grasses (especially Sorghum), a nearby source of surface water and, in the breeding season, unburnt hollow-bearing <em>Eucalyptus</em> trees (especially <em>E. tintinnans</em>, <em>E. brevilolia</em> and <em>E. leucophloia</em>) (Tidemann 1996; Higgins et al. 2006). <strong>Distribution:</strong> Sparsely distributed across northern Australia from the Kimberley to north-central Queensland (Dostine 1998; Franklin 1999; Barrett et al. 2003). It is currently known to occur in significant numbers (&gt; 50 adult birds) at only 10 locations with five occurring in the Northern Territory (O'Malley 2006).</td>
<td>The main threats to the species at present are thought to be loss of habitat, grazing pressure, establishment of pastoral, agricultural and mining operations, and fire (Dostine 1998; O'Malley 2006).</td>
<td>Possible</td>
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<tr>
<td><em>Falcunculus frontatus</em></td>
<td>VU</td>
<td>NT</td>
<td><strong>Habitat:</strong> This subspecies occurs across a range of eucalypt and melaleuca woodlands (Robinson and Woinarski 1992). <strong>Distribution:</strong> In the NT, has been recorded in very low densities in many isolated subpopulations (Garnett &amp; Crowley 2000) between northeast Arnhem land to Kalkarindgi (semi-arid Victoria River District).</td>
<td>Probably adversely affected by frequent hot fires in the late dry season which prevent invertebrates from becoming established beneath bark (Robinson &amp; Woinarski 1992; Garnett &amp; Crowley 2000).</td>
<td>Unlikely – No records in the Comalile region</td>
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<td><em>Geophaps smithii</em></td>
<td>VU</td>
<td>VU</td>
<td><strong>Habitat:</strong> Occurs in open forests and woodlands with an understorey of grasses (Woinarski 2006). Prefers woodland dominated by Darwin Stringybark <em>Eucalyptus tetrodonta</em> and Darwin Woollybutt <em>E. miniata</em> (Braithwaite 1985; Garnett &amp; Crowley 2000; Higgins &amp; Davies 1996). <strong>Distribution:</strong> Occurs throughout the top end of the Northern Territory and the Kimberley region of Western Australia (Woinarski 2006).</td>
<td>The gradual decline of this species is probably related to changes in grass consumption due to frequent fires. This species is also quite susceptible to predation by feral cats, due to its habits of being on the ground (Woinarski 2006). Land use activities such as clearing, overgrazing and change in fire regime altering floristic composition (Fraser, 2002).</td>
<td>Likely</td>
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<td><em>Limosa lapponica</em></td>
<td>MIG, MAR</td>
<td>VU</td>
<td><strong>Habitat:</strong> Inhabits coasts and estuaries, especially intertidal sandflats and mudflats, and coastal lagoons. Also occurs in saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock</td>
<td>The greatest threat to migratory shorebirds in the East Asian-Australasian Flyway is indirect and direct habitat loss (Melville 1997). Staging areas used during migration through</td>
<td>Unlikely – no suitable habitat</td>
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<td>Threatened Species</td>
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<tr>
<td><strong>Rostratula benghalensis australis</strong>&lt;br&gt;Australian Painted Snipe</td>
<td>EN, MIG, MAR</td>
<td>VU</td>
<td>platforms, and coral reef-flats (Marchant &amp; Higgins 1993). May roost during high tide on nearby beaches.&lt;br&gt;&lt;br&gt;<strong>Distribution:</strong> Widespread around the Australian coast. Every year the species breeds in the northern hemisphere in the summer, and migrates to Australia for the southern hemisphere summer. Some birds remain in Australia during the winter. In the NT they have been reported all along the coastline and were one of the more frequently recorded and abundant species in shorebird surveys by Chatto (2003).&lt;br&gt;&lt;br&gt;<strong>Habitat &amp; Distribution:</strong> Inhabits fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2013). The species may occur on any shallow ephemeral wetlands in central or southern Northern Territory.&lt;br&gt;&lt;br&gt;<strong>Distribution:</strong> This species is nomadic and scattered across Australia with no predictable occurrence (Rogers 2001). In the NT it is known from a range of localities with no known resident sites (Taylor et al. 2013), as such the species is unlikely to have a population in the NT that is separate to that inhabiting other areas of Australia.</td>
<td>eastern Asia are being lost and degraded by activities which are reclaiming the mudflats for development or developing them for aquaculture (Barter 2002, 2005; Ge et al. 2007; Round 2006).&lt;br&gt;The non-breeding grounds of the species in eastern and southern Australia are threatened by habitat degradation, loss and human disturbance (Garnett et al. 2011), those in the NT are generally free of such disturbances.</td>
<td>Unlikely&lt;br&gt;No suitable habitat</td>
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<td><strong>Tyto novaehollandiae kimberli</strong>&lt;br&gt;Masked Owl (northern)</td>
<td></td>
<td></td>
<td>Habitat: Occurs mainly in eucalypt tall open forests (especially those dominated by <em>Eucalyptus miniata</em> and <em>E. tetrodonta</em>), but also roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands (Woinarski &amp; Ward 2006).&lt;br&gt;&lt;br&gt;<strong>Distribution:</strong> Very imperfectly known, with remarkably few records across its broad range in northern Australia. In the NT records known from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Atlas of Living</td>
<td>No reliable information on threats to this subspecies. It is possible that food resources may be diminishing, through broad-scale decline of small and medium-sized native mammals, possibly due to changed fire regimes (Woinarski et al. 2001; Pardon et al. 2003). The greatly increased cover and height of invasive exotic grasses (Rossiter et al. 2003) may cause a reduction in foraging efficiency for this owl.</td>
<td>Possible</td>
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<td>Australia)</td>
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<tr>
<td><strong>Mammals</strong></td>
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| *Antechinus bellus*         | VU          | EN          | **Habitat**: Occurs in tall open forest dominated by eucalypts (Friend 1985) where it was historically quite common (Watson et al. 2008). It shelters in tree hollows and fallen logs (Cole & Woinarski 2002)  
**Distribution**: Restricted to the NT with a large population confined to the mainland of the Top End (Watson et al. 2008). There is also one record of this species from the Melville Island. | At the present time it is unknown what has caused the decline in this species, but it may be related to cane toad poisoning (Woinarski et al. 2010).  
Changed fire regimes, weeds and grazing by livestock and feral animals may have changed the availability of preferred or vital food resources (e.g. particular insect species), and more frequent hot fires may have reduced the availability of hollow logs | Possible |
| *Fawn Antechinus*           |             |             |                                                                                                                                                                                                                       |                                                                                                                                                                                                           |                        |
| *Conilurus penicillatus*    | VU          | EN          | **Habitat**: Appears to have quite specific habitat requirements. Largely restricted to mixed eucalypt open forest and woodland, or on dunes with Casuarina, seeming to prefer habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to-moderate middle storey (Firth et al. 2006, Firth 2007; Kemper & Firth 2008).  
**Distribution**: Currently it is only known from Cobourg Peninsula, Tiwi Islands, Groote Eylandt, and a small area within Kakadu National Park (Woinarski 2007). There are no recent records from much of its historically recorded range between near the mouth of Victoria River and (in the west) and Pellew Islands (in east). | At the present time no single factor is known to have caused the decline in this species (Woinarski 2007). It is however thought that habitat alteration due to inappropriate fire regimes and grazing by introduced herbivores, habitat destruction resulting from forestry and mining operations and predation by Feral Cats are the causes (Woinarski 2007). | Unlikely Outside current known range |
<p>| <em>Brush-tailed Rabbit-Rat</em>   |             |             |                                                                                                                                                                                                                       |                                                                                                                                                                                                           |                        |
| <em>Dasyurus hallucatus</em>       | EN          | CR          | <strong>Habitat</strong>: Occurs in a wide range of habitats, but the most suitable habitats are rocky areas (Van Dam et al. 2002). It is commonly found in tall open eucalypt forests. Prime habitat in NT consists of rocky sandstone escarpments (Brathwaite &amp; Griffiths 1994). Often found in abundance within a 150km | Primary implications are associated with Cane toad invasion, inappropriate fire regimes, feral animals, disease and removal, degradation and fragmentation of suitable habitat. This species appears to be especially susceptible to cane toad poisoning however | Unlikely Presumed regionally extinct |</p>
<table>
<thead>
<tr>
<th>Threatened Species</th>
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</thead>
<tbody>
<tr>
<td>Hipposideros (diadema) inornata</td>
<td>EN</td>
<td>VU</td>
<td><strong>Habitat:</strong> Commonly found in caves or abandoned mine sites in cool draughty areas, close to water (Churchill 1998; Corbett and Richards 2002). It has been reported foraging in riparian areas and in eucalypt tall open forests (Woinarski &amp; Milne 2015). <strong>Distribution:</strong> Restricted to the Northern Territory, it is only known to occur on the western Arnhem Land sandstone massif (Deaf Adder Gorge and upper South Alligator River area) and from one site (Tolmer Falls) in Litchfield National Park (McKeen and Hertog 1979) where population appears to be disappearing (Woinarski &amp; Milne 2015).</td>
<td>The disappearance of the population at Litchfield National Park may have been due to disturbance from humans visiting roosting caves (Corbett and Richards 2002).</td>
<td>Unlikely No suitable roosting habitat.</td>
</tr>
<tr>
<td>Macrodroma gigas</td>
<td>VU</td>
<td></td>
<td><strong>Habitat:</strong> Large complex caves and old mineshafts. (Atlas of Living Australia 2016)</td>
<td></td>
<td>Unlikely No suitable roosting habitat.</td>
</tr>
<tr>
<td>Mesembriomys gouldii gouldii</td>
<td>VU</td>
<td>VU</td>
<td><strong>Habitat:</strong> In the NT the species is found in tropical woodlands and open forests in coastal areas. It shelters in tree hollows and Pandanus stands during the day (Hill 2012). <strong>Distribution:</strong> Occurs in the Top End of the NT, the Kimberley in Western Australia and Cape York Peninsula south to Townsville in Queensland (Hill 2012).</td>
<td>Studies have shown this species is disadvantaged by frequent fire, probably due to its requirement for tree hollows and preference for a shrubby understory (Friend 1987). This species is also significantly disadvantaged by forest fragmentation (Rankmore &amp; Price 2004). Predation by feral animals may also have an adverse impact.</td>
<td>Likely</td>
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<tr>
<td>Threatened Species</td>
<td>EPBC Status</td>
<td>TPWC Status</td>
<td>Habitat &amp; Distribution</td>
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<tr>
<td>Mesembriomys macrurus</td>
<td>VU</td>
<td>CR</td>
<td><strong>Habitat:</strong> In the Kimberley this species is known to occur in open eucalypt forests with tussock grass understorey, rainforest patches, sandstone screes, beaches, and black soil plains (Woinarski et al 2012b). &lt;br&gt;<strong>Distribution:</strong> Historically this species is known to have occurred in three localities in the Northern Territory (Parker 1973) with no new records in the last 30 years. In 1993 it was reportedly spotted in the Kakadu National Park however further surveys of suitable habitats in the NT failed to locate the species (Lee 1995). At present it is only known to occur in some areas of the north-western Kimberley and associated offshore islands (Palmer et al. 2003).</td>
<td>Habitat degradation due to increased grazing pressures, invasive weed species and cane toad invasion remain likely threats to this species (Woinarski, et.al, 2012a).</td>
<td>Unlikely&lt;br&gt;Presumed regionally extinct</td>
</tr>
<tr>
<td>Notomys aquilo</td>
<td>VU</td>
<td>VU</td>
<td><strong>Habitat:</strong> Most often found in areas with sandy substrates. It seems to favour coastal sand dunes and sand sheets with a cover of tussock grass or heath. It is also found in shrubland, eucalypt open forest, and the margins of coastal rainforest thickets (Woinarski 2004a; Woinarski &amp; Flannery 2008). &lt;br&gt;<strong>Distribution:</strong> Groote Eylandt and Central north-east Arnhem Land. There have been unconfirmed records of this species further south, west and inland and one specimen taken from inland central Arnhem Land (Dixon and Huxley 1985; Woinarski et al. 1999).</td>
<td>Due to the lack of records, there is no known cause for the decline in this species. As this species continues to survive on some offshore islands it is thought that either an exotic disease or predation by exotic predators has caused the decline on the mainland (Woinarski et al 2012b). Inappropriate fire regimes have most certainly impacted mainland species. Island subpopulations may not be at threat due to landscape mosaic and infrequent fire events (Woinarski, et.al, 2012b).</td>
<td>Unlikely&lt;br&gt;Outside known range</td>
</tr>
<tr>
<td>Petrogale concinna canescens</td>
<td>EN</td>
<td>VU</td>
<td><strong>Habitat:</strong> Restricted to the monsoonal tropics of the NT (Woinarski, et.al, 2012a) commonly found throughout isolated and rocky areas consisting of both sandstone and granite escarpments (Churchill No detailed assessment of threats to the Narblek has been undertaken to date. The species is likely to be vulnerable to predation by feral cats, but its agility within its rugged</td>
<td>No detailed assessment of threats to the Narblek has been undertaken to date. The species is likely to be vulnerable to predation by feral cats, but its agility within its rugged</td>
<td>Unlikely&lt;br&gt;No suitable habitat</td>
</tr>
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<td>Threatened Species</td>
<td>EPBC Status</td>
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<td><em>subspecies</em>)</td>
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<td></td>
<td>1997; Telfer et al. 2008). The species shelters in caves and crevices during the day (Churchill 1997). They may move from these to forage in adjacent flat areas (Sanson et al. 1985). <strong>Distribution:</strong> In the NT, a fragmented distribution of this species is known from sandstone cliffs bordering the Arafura Swamp (in the east) to the Daly River catchment (in the west) (Churchill 1997).</td>
<td>habitat would offer some protection. Changes to fire regimes probably pose a more serious threat, particularly in sandstone habitats (Russell-Smith et al. 1998). It is thought some habitat fragmentation has occurred due to mining activities. Habitat degradation due to livestock, feral herbivores and invasive weed species are also likely (Woinarski, et.al, 2012a).</td>
<td>Possible</td>
</tr>
<tr>
<td><em>Phascogale pirata</em> Northern Brush-tailed Phascogale</td>
<td>VU</td>
<td>EN</td>
<td><strong>Habitat:</strong> No detailed studies, but its ecology is probably similar to that reported for its temperate relatives (Rhind 1998). Most records are from tall open forests dominated by <em>Eucalyptus miniata</em> and <em>E. tetrodonta</em> (Woinarski, et.al, 2012). <strong>Distribution:</strong> Very few records exists however this species has been reported in West Island, east Arnhem Land, Coburg Peninsula, Kakadu, Litchfield and the Tiwi Islands. It has only been recorded in Kakadu, Coburg Peninsula and the Tiwi Islands throughout the last 10 years (Woinarski, et.al, 2012).</td>
<td>There are no empirical data available to evaluate threatening processes. Cane toads are a possible contributing factor; however decline of the species was apparent prior to their arrival in the Top End. Exotic predators (cats) or disease are considered a more likely cause. Other factors potentially involved in the decline of phascogales include vegetation change due to altered fire regimes and/or pastoralism. This species may be impacted by clearing of eucalypt forests, especially those with hollow-bearing species (Woinarski &amp; Ward 2012).</td>
<td>Possible</td>
</tr>
<tr>
<td><em>Saccolaimus saccolaimus</em> Bare-rumped Sheathtail Bat</td>
<td>CR</td>
<td>NT</td>
<td><strong>Habitat:</strong> In the NT specimens have been collected from Pandanus woodland fringing the sedgelands of the South Alligator River and eucalypt tall open forests (Friend &amp; Braithwaite 1986; Churchill 1998). Predominantly found throughout the monsoonal tropics. Most records occur within near-coastal habitats with one recent exception (Jasper Gorge) 150km inland (Woinarski, et.al, 2012a). <strong>Distribution:</strong> Widely distributes from India through south-eastern Asia to the Solomon Islands including north-eastern Queensland and the Northern Territory. The north-eastern Australian population is described as the subspecies <em>S. s. nudicluniatus</em></td>
<td>Due to its ecology threats are hard to identify. Lack of records in the NT makes its status difficult to assign. Vegetation clearance poses a threat in north-eastern Queensland (Milne &amp; Woinarski 2006). Habitat fragmentation due to urban development and horticulture, disease and inappropriate fire regime are suggested to be influencing changes in populations (Woinarski, et.al, 2012a).</td>
<td>Possible</td>
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<td>Threatened Species</td>
<td>EPBC Status</td>
<td>TPWC Status</td>
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<tr>
<td><strong>Xeromys myoides</strong> Water Mouse (False Water-rat)**</td>
<td>VU</td>
<td>NT</td>
<td><strong>Habitat:</strong> Mangrove forests, near coastal freshwater swamps, and floodplain saline grasslands (Woinarski <em>et al.</em> 2000). <strong>Distribution:</strong> In the NT it is known only from ten records at six sites, including one in East Arnhem land (Woinarski 2007). Has been recorded in a small set of coastal habitats including Daly river (west), Arafura swamp (east) and Melville island (Woinarski, <em>et al.</em>, 2012a).</td>
<td>It is presumed that removal and degradation of habitat as a result of development is a major threat (Woinarski <em>et al.</em> 2000). Predation by Wild dogs, Red foxes, feral pigs and Cats are highly likely. Inappropriate fire regimes invasive weed species and habitat degradation due to overgrazing and herbivorous animals are significantly impacting this species (Woinarski, <em>et al.</em>, 2012a).</td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td><strong>Zyzomys maini</strong> (previously Zyzomys woodwardi) Arnhem Rock-rat</td>
<td>VU</td>
<td>VU</td>
<td><strong>Habitat:</strong> Occurs in rugged sandstone environments, typically where there are many caves, crevices or boulders. This species occupies environments in association with monsoon rainfall, typically those areas which are floristically-rich and provide the fleshy fruits and seeds that form its principal food item (Begg <em>et al.</em> 1980). <strong>Distribution:</strong> Endemic to the sandstone massif of western Arnhem Land in the Northern Territory (Woinarski 2004b). Commonly found throughout parts of Kákadu National Park and Warddeken Indigenous protected area (Woinarski, <em>et al.</em>, 2012a).</td>
<td>Inappropriate fire regimes and significant habitat alteration attributed to exotic and invasive weed species are main factors. Other threats include predation by feral animals in particular the feral Cat, <em>Felis Catus</em> and disease (Woinarski, <em>et al.</em>, 2012a).</td>
<td>Unlikely No suitable habitat</td>
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<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
<td><strong>Acacia praetermissa</strong></td>
<td>Acacia praetermissa is vulnerable to population decline through earthworks to alter or widen the Stuart Highway and the excavation of borrow pits to provide materials for road works. In addition, the population occurs in an area of high mineral prospectivity, with many abandoned mines</td>
<td>Possible</td>
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<td>Threatened Species</td>
<td>EPBC Status</td>
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<td>Habitat &amp; Distribution</td>
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<tr>
<td><strong>Atalaya brevialata</strong></td>
<td>CR</td>
<td></td>
<td>Habitat: The species appears restricted to footslope sites with more open vegetation on deeper, coarser sandy soils mostly along a specific, distinct geological boundary. Atalaya brevialata grows in woodland with varying proportions of Eucalyptus tectifica and Corymbia foelscheana but also with Xanthostemon paradoxxus, Terminalia grandiflora and Acacia hemignosta in the overstorey with open layer of perennial grasses such as Eriachne avenacea. Usually it occurs on sandy soils in footslope situations, often with a surface gravel layer. (Cowie 2014) Distribution: Atalaya brevialata is endemic to the Northern Territory. The species is known from only five places near the Elizabeth River at Virginia and its tributary Amys Creek just to the south of Darwin, N.T. (Cowie 2014)</td>
<td>Atalaya brevialata occurs within Darwin rural area, and as such is under threat of habitat loss largely due to clearing and other developments for proposed urban expansion. (Cowie 2014)</td>
<td>Possible</td>
</tr>
<tr>
<td><strong>Eleocharis retroflexa</strong></td>
<td>VU</td>
<td>DD</td>
<td>Habitat: This species has been reported growing on plateaus, in shallow water on the margins of seasonal swamps. (Cowie &amp; Kerrigan 2006a) Distribution: This species is pantropical in distribution, and in Australia occurs in Queensland and the NT. In the NT, it is known only from two swamps on the Wingate Mountains plateau (Daly River/Port Keats Aboriginal Land Trust) and from a swamp on the sandstone plateau in Nitmiluk NP. (Cowie &amp; Kerrigan 2006a)</td>
<td>No threats are known. Parts of the NT where this species occurs are among the most remote and least affected by European settlement. Fire during the April-May fertile period could potentially be a threat. It is possible that high densities of feral stock may affect the species, but there is no information available to demonstrate such threat. (Cowie &amp; Kerrigan 2006a)</td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td><strong>Goodenia quadrifida</strong></td>
<td>VU</td>
<td>DD</td>
<td>Habitat: It occurs on the upper parts of estuarine floodplains, on poorly drained grey clays or silty</td>
<td>Parts of the Adelaide River where the species was recorded have been invaded by</td>
<td>Unlikely No suitable</td>
</tr>
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<td>Threatened Species</td>
<td>EPBC Status</td>
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<tr>
<td>Helicteres macrothrix (also known as Helicteres sp. Glenluckie Creek)</td>
<td>EN</td>
<td>EN</td>
<td>Habitat: Occurs in woodland dominated by Eucalyptus tectifica, E. tetrodonta and E. miniata on sandy loam and rocky siltstone slopes or granitic rocks (Cowie, et al. 2012). Distribution: Endemic to the NT. Recorded from three populations, Mt Bundey, Batchelor/Glenluckie Creek and Lake Bennett. This species has a limited geographic distribution and is restricted to the north-west of the NT (Needham &amp; Stuart-Smith 1984).</td>
<td>Threats include development pressures such as land clearing and mining. Invasive weed species such as Gamba and Mission grasses have altered fire regimes severely impacting this species (Cowie et al. 2012).</td>
<td>Possible</td>
</tr>
<tr>
<td>Hibiscus brennanii Brennan’s Native Hibiscus</td>
<td>VU</td>
<td>VU</td>
<td>Habitat: Grows on sandstone cliffs, gullies and on broken sandstone (Kerrigan, et al. 2006). Distribution: Endemic to the Northern Territory with restricted population in the Mt Brockman area to the west of Arnhem Land (Kerrigan, et al. 2006).</td>
<td>This species is particularly vulnerable to inappropriate fire regimes. It has been suggested that current fire regimes affect obligate seeders in sandstone communities (Kerrigan, et al. 2006).</td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td>Stylidium ensatum Trigger plant</td>
<td>-</td>
<td>EN</td>
<td>Habitat: Appears to occupy margins of drainage areas in damp heavy clay or peaty soil (Cowie &amp; Westaway 2012b). Distribution: known form three localities in Darwin with other historical collections recorded however the exact locality for these collections is unknown. This species has not been collected since 1974 (Cowie &amp; Westaway 2012b).</td>
<td>Invasion of habitat by exotic weeds, encroaching urban development and changed fire regimes resulting in poor regeneration (Cowie &amp; Westaway 2012b).</td>
<td>Unlikely Outside known range</td>
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<tr>
<td>Reptiles</td>
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<tr>
<td>Acanthophis hawkei Plains Death Adder</td>
<td>VU</td>
<td>VU</td>
<td>Habitat: Occurs on floodplains and flat cracking treeless black soil plains (Webb et al. 2002). Distribution: Occurs across mainland northern Australia in a disjointed pattern. In the NT, it is principally Cane toad ingestion (Phillips et al. 2010) though other studies report no changes.</td>
<td></td>
<td>Unlikely No suitable habitat</td>
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<td>Threatened Species</td>
<td>EPBC Status</td>
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<tr>
<td><em>Bellatorias obiri</em></td>
<td>EN</td>
<td>EN</td>
<td>known from floodplains of the Adelaide, Mary and Alligator Rivers as well as the Barkly Tableland on the Northern Territory (NT)/Queensland (QLD) border.</td>
<td>Potential threats are altered fire regimes, predation by cats and cane toad poisoning (Ward, et.al 2012).</td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td><em>Arnhem land Skink</em></td>
<td></td>
<td></td>
<td>Habitat: Prefers sandstone outcrops, typically with extensive fissures and cave systems (Sadlier 1990). Distribution: Restricted to the Western Arnhem Land plateau and outliers (e.g. Jabiluka), where it is patchily distributed (Armstrong et al. 2004).</td>
<td></td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td><em>Elseya lavarackorum</em></td>
<td>EN</td>
<td>LC</td>
<td>Habitat: Commonly found in large rivers, lagoons and oxbow lakes. Found in deep pools of water with muddy, sandy or rocky base. Rocky gorges with intact river banks are preferred (DOE, 2016a). Distribution: Known from the Calvert to the Nicholson River systems. Recorded in the Roper, Limmen Bight and Robinson catchments of which all discharge into the Gulf of Carpentaria (DOE, 2016a).</td>
<td>Environmental degradation as a result of overgrazing impacting river banks, water quality, food sources and nesting sites. Clearing of riparian forests and accidental entanglement in fishing nets. Other impacts include invasion of nest sites by feral animals (pigs), native monitors (<em>Varanus sp.</em>) and rats (DOE, 2016a).</td>
<td>Unlikely No suitable habitat</td>
</tr>
<tr>
<td><em>Lucasium occultum</em></td>
<td>EN</td>
<td>VU</td>
<td>Habitat: Prefers areas with well-developed leaf litter and grasses (King et al. 1982; Johansen 2006) in open forests dominated by <em>Eucalyptus miniata</em> and <em>E. tetrodonta</em>. Commonly found in sandy red-loam substrates. Has been recorded in areas consisting of moderate to sparse Gamba grass (Beggs et.al 2012). Distribution: Endemic to the Northern Territory with known populations from north-west of Kakadu National Park and the Wildman Reserve (King et al. 1982).</td>
<td>Potential threats are inappropriate fire regimes and spread of introduced pasture species such as Gamba grass (Beggs et.al 2012).</td>
<td>Unlikely Outside known range</td>
</tr>
</tbody>
</table>
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