PARKS AND WILDLIFE COMMISSION OF THE NORTHERN TERRITORY

BULLWADDY CONSERVATION RESERVE

PLAN OF MANAGEMENT
2005

Northern Territory Government

celebrating 50 years of Territory parks 1955-2005

Parks and Wildlife Commission of the Northern Territory
PO Box 344
Katherine NT 0851

BULLWADDY CONSERVATION RESERVE
Plan of Management
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Bullwaddy Conservation Reserve Plan of Management

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MANAGEMENT OF BULLWADDY CONSERVATION RESERVE

1 BACKGROUND

1.1 Location and Tenure

Northern Australia has one of the last great tracts of undisturbed tropical savanna left on earth, an area that extends across one-quarter of our continental landmass. This area is characterised by extreme weather conditions with distinct wet and dry seasons. Pastoralism is the dominant land use, Aboriginal, mining, tourism, nature conservation and military use are also prominent (Karfs *et al*., 2000).

The tropical savanna of the Northern Territory's Top End is divided into a number of distinct regions. Within the Katherine region, wedged between the Victoria River District to the west and the Gulf region to the east lies the Sturt Plateau, a predominantly flat erosional plain dominated by savanna woodlands of mixed eucalypts with a perennial grass understorey and open woodlands on clay soil floodplains. The region is primarily involved in agricultural production and is considered to have reasonable economic potential (Karfs *et al*., 2000).

Eucalypt forests and woodlands, which dominate about 95% of Australia, are by far the most extensive plant communities throughout the Sturt Plateau, followed by *Acacia* woodlands which are dominated primarily by *Acacia shirleyi* (lancewood). Compared to eucalypt savanna woodlands, which typically have a sparse canopy, a dense tall grass understorey supporting seed-eating birds and exposure to frequent fire, *Acacia* woodlands vary markedly. Within the Sturt Plateau these woodlands often occur with the restricted, Northern Territory endemic plant, *Macropteranthes kekwickii* (bullwaddy) interspersed as either a co-dominant or dominant species. These woodlands typically have a dense shady shrub layer, a few vines and creepers and little in the way of grass understorey (Figure One).

The conservation of *Acacia* woodlands is severely under represented with less than 1% conserved in the Territory and 3% nationally (Bureau of Rural Sciences, 2004). Bullwaddy Conservation Reserve represents the only declared conservation area within the Sturt Plateau region of the lancewood/bullwaddy vegetation type. Although the southern portion of Elsey National Park falls within the Sturt Plateau region, it does not contain representative samples of the *Acacia* woodlands found in Bullwaddy Conservation Reserve. As such the Reserve is alone in its protection of this unique vegetation type. Bullwaddy Conservation Reserve (NT Portion 5680) is located approximately 100 kms east of Daly Waters along the Carpentaria Highway (Map One). The Reserve is approximately 115 square kilometres and was relinquished from Amungee Mungee Station in May 1999. The Reserve was declared under section 12 of the *Territory Parks and Wildlife Conservation Act* on November 2, 2000. The tenure of Bullwaddy Conservation Reserve is freehold land held by the Northern Territory.

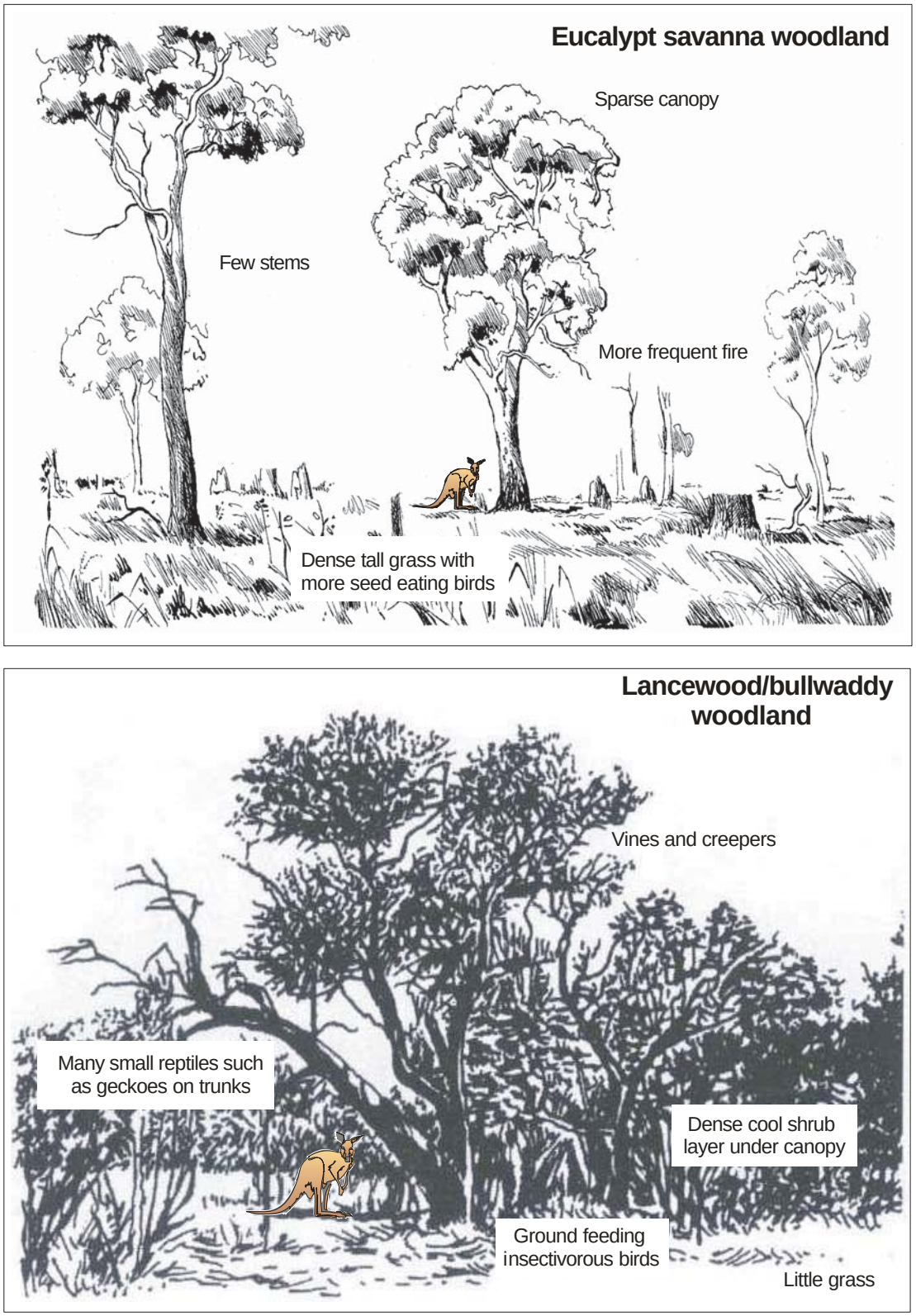
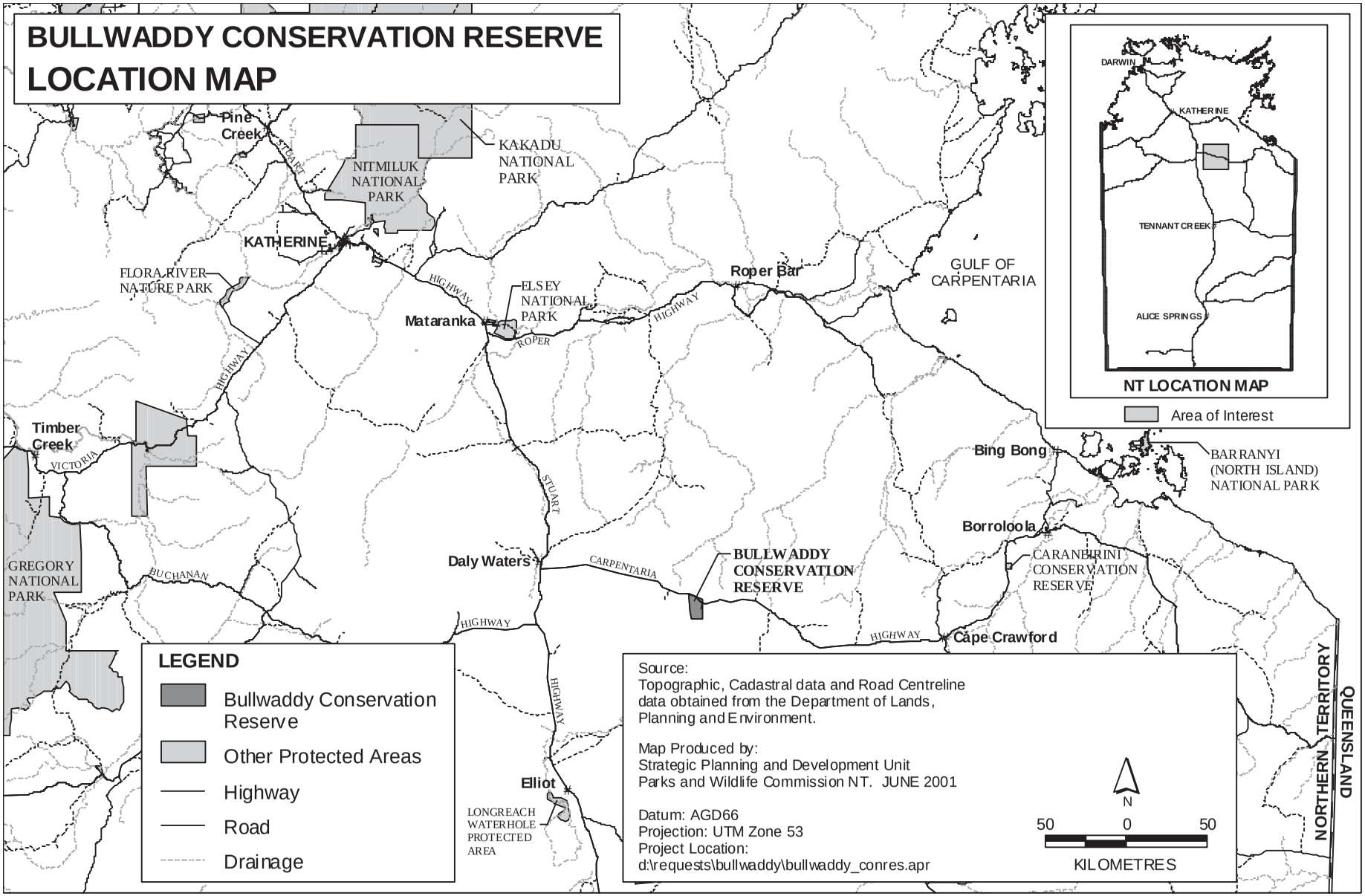


Figure One: Comparison between a eucalypt savanna and lancewood/ bullwaddy woodland



Map One: Location of Bullwaddy Conservation Reserve

Surrounding land tenure includes Amungee Mungee Station (NT Portion 1079) to the north, south and west, and Tanumbirini Station (NT Portion 701) to the east (Map Two).

For visitors travelling along the Carpentaria Highway, which links the Stuart Highway near the township of Daly Waters with Borroloola, roadside reserves managed by the Parks and Wildlife Commission of the Northern Territory, such as Bullwaddy and Caranbirini Conservation Reserve provide welcome respite.

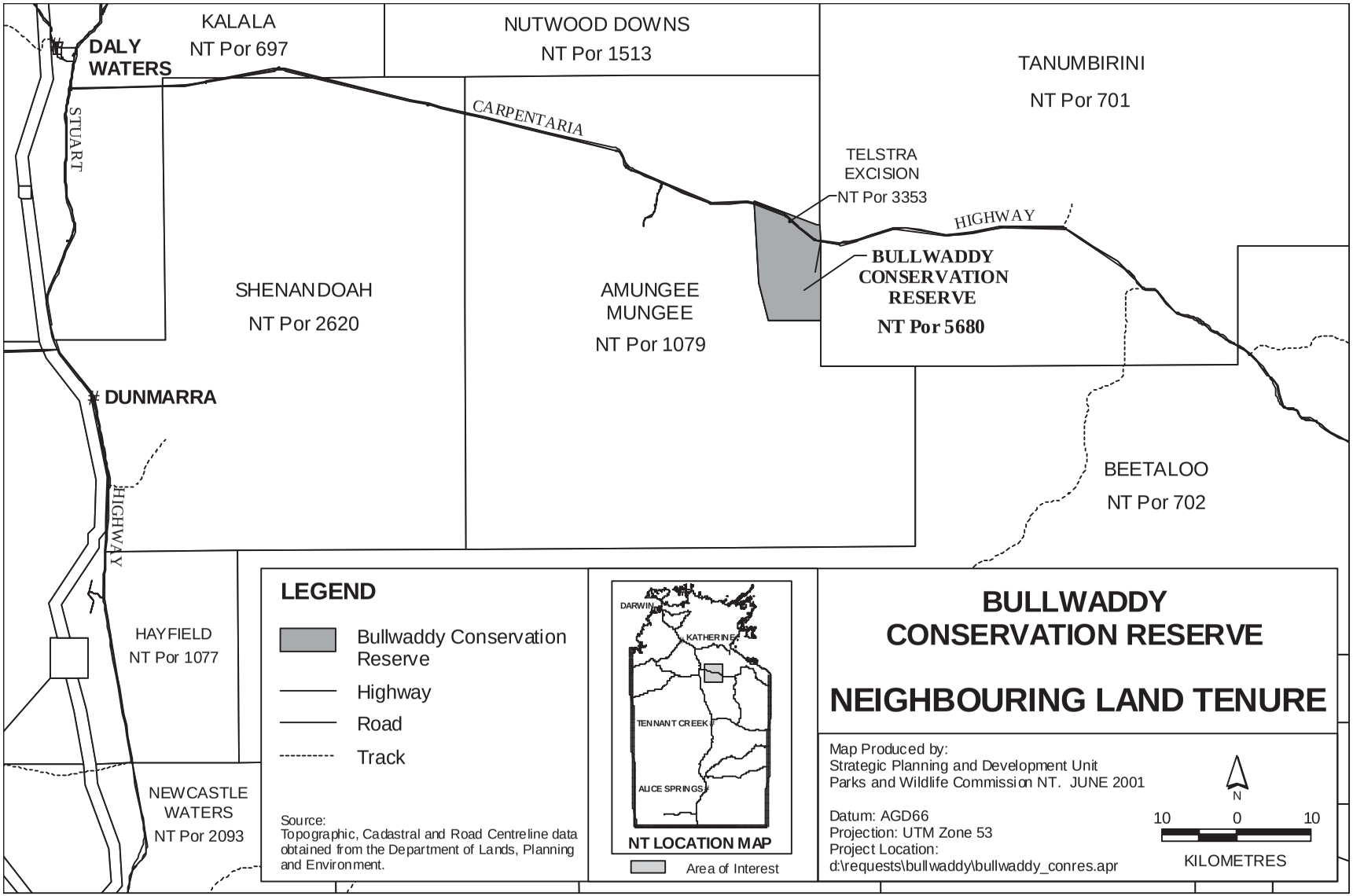
These Conservation Reserves have been primarily established for the protection of specific habitat and for scientific study and as such are equipped only with infrastructure for day use activities such as short walks, picnic lunches and wildlife appreciation. The majority of visitors to Bullwaddy Conservation Reserve are embarking on a trip through the Gulf region, perhaps continuing on to Queensland or travelling from the Gulf region through the Top End, having entered the Northern Territory from Queensland.

1.2 General description

The average rainfall for the Sturt Plateau is 640 mm, although annual falls fluctuate between 500 mm and 800 mm. Nearly all the rainfall occurs in the months between November and March. The Sturt Plateau is characterised by shallow infertile soils on a lateritic land surface. The majority of the area, particularly the areas supporting lancewood/bullwaddy communities, is comprised of a remnant Tertiary lateritic plateau: an ancient Tertiary landscape that has been eroded away almost everywhere else in the Northern Territory. This remnant plateau serves as a reminder of how the Northern Territory would have appeared in the past. The area supports large fragmented stands of bullwaddy (*M. kekwickii*), which favours the lateritic soils, often dominated by lancewood (*A. shirleyi*).

Acacia woodlands were identified in the Parks and Wildlife Commission Masterplan (1996) as areas of high priority due to their poor representation in the park estate. The Masterplan identified the need to acquire more of this vegetation type due to current inadequate representation. Although stands of lancewood are currently marginally conserved in Gregory National Park to the west, Bullwaddy Conservation Reserve which also conserves lancewood, is primarily targeted at the protection of bullwaddy stands. The Reserve is an area of high conservation value and represents a major stronghold for this restricted, Northern Territory endemic plant species.

In order to meet national and Territory standards regarding the conservation of representative natural areas, the acquisition of a variety of *Acacia* woodland communities is imperative. Although the ecology of *Acacia* woodlands is quite well known, the majority of scientific investigation has been conducted in the Territory's south where *Acacia* communities are dominated by mulga (*A. aneura*) (Fisher, 1997).



Map Two: Neighbouring Land Tenure

The ecology of lancewood/bullwaddy woodlands

With an increase in the frequency of fire and aridity in Australia during the late Tertiary period, fast growing species such as grasses started to colonise the landscape, dominating the existing rainforests in the large open areas created by changed fire regimes. These grasses in turn increased the fuel loads generating more fire and the gradual selection of fire-resistant species. Prior to the dominance of eucalypts, acacias and grasses, vegetation which is now represented by fire-sensitive communities in fire shadows and as remnant patches, dominated the landscape (Figure Two) (Murray and Vickers-Rich, 2004).

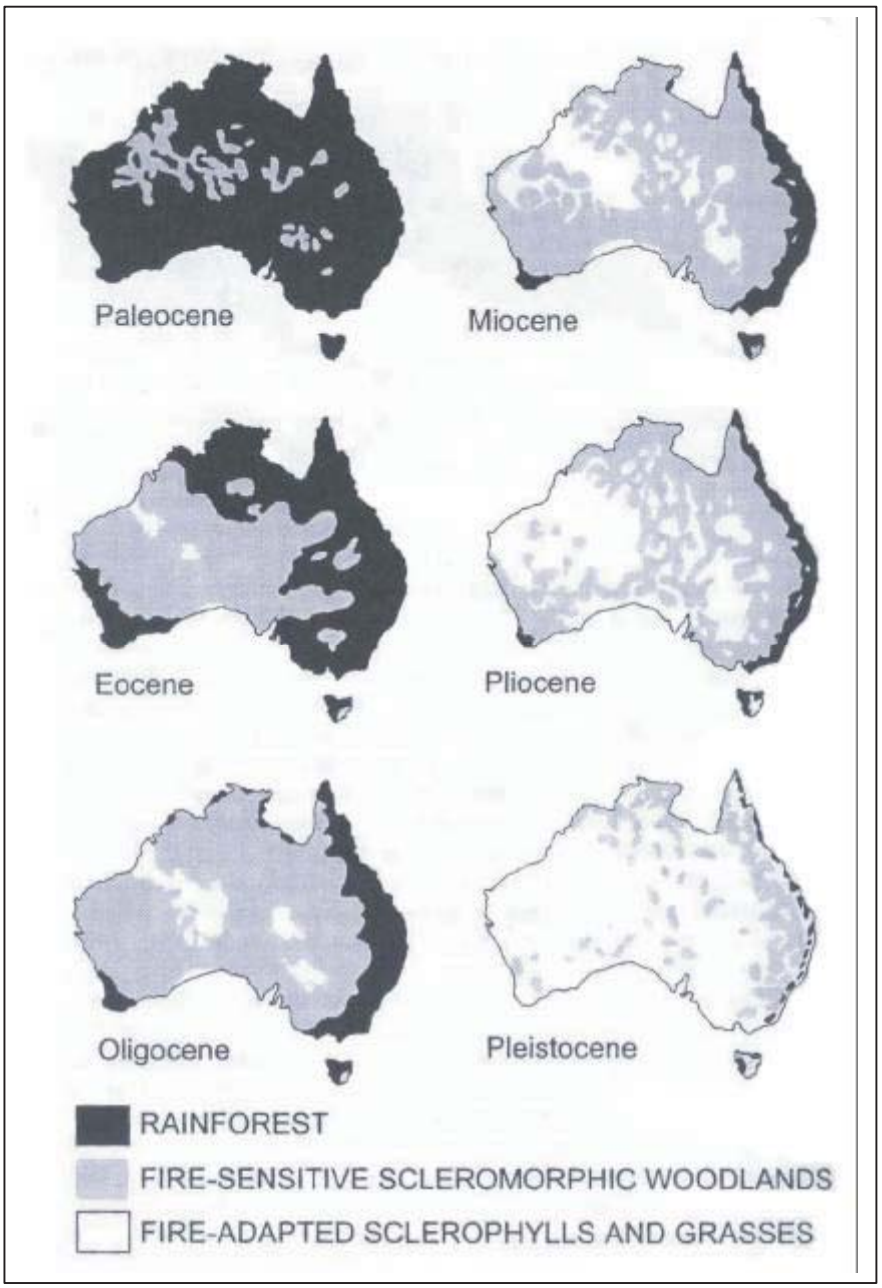
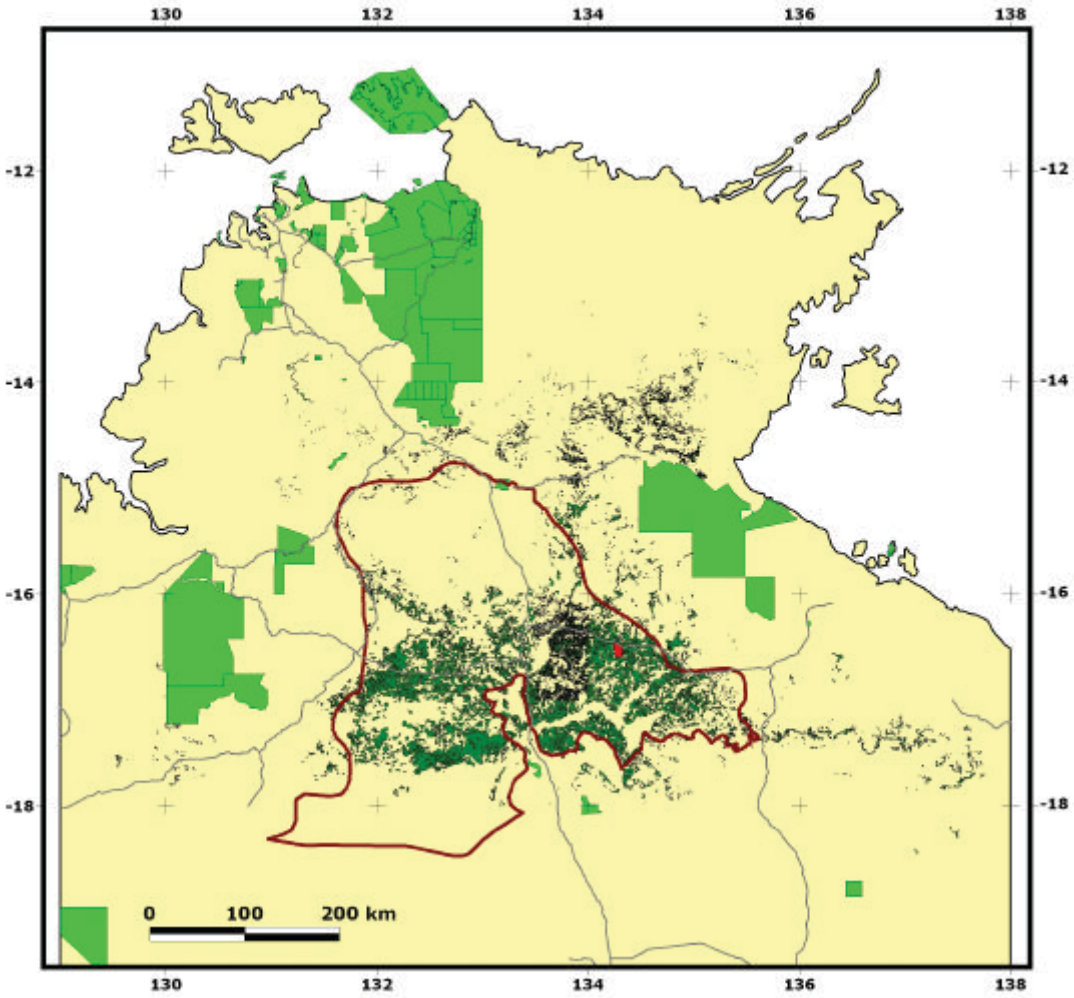


Figure Two: Suggested trends in vegetation cover over time (taken from Adams, 1999).

These fire-sensitive thicket and vine forest communities, such as the lancewood/ bullwaddy woodlands are a unique Gondwanan remnant, descendents of the once dominant rainforests of the Australian Tertiary period. Bullwaddy communities are often referred to as dry jungles or rainforests, because of this association. They are extremely well adapted to the uncertain rainfall of the dry tropics, surviving in run-on areas (depressions or lower slopes) and tolerating floods (Latz, 1995).

Within Australia, bullwaddy communities are found in a patchy, disjunct belt across the southern part of the semi-arid zone. The species is primarily restricted to the Sturt Plateau but is also represented in the Gulf region to the east and eastern fringe of the Victoria River District to the west (Map Three). Bullwaddy typically occurs in association with various species of forbs, twiners, vines, dry ferns and mosses, generally from the Convolvulaceae, Fabaceae and Malvaceae families (Brocklehust, 1991).



Map Three: Distribution of lancewood (*Acacia shirleyi*) and bullwaddy (*Macropteranthes kekwickii*) vegetation communities in the northern NT. The map shows the outline of the Sturt Plateau bioregion. Bullwaddy Conservation Reserve and other major conservation areas managed by the Parks and Wildlife Commission are also represented (from Fisher, unpublished data).

Fossil evidence suggests that during the period when fire sensitive communities such as bullwaddy were more widespread, these communities co-evolved with now extinct large, highly mobile vertebrates. Some of these vertebrates were members of the extinct giant flightless bird family, Dromornithidae. These birds, named Mihirungs, were goose-like herbivores, more than likely subsisting on foliage and fruits, and were endemic to Australia (Figure Three). These species became extinct due to their extreme specialisation, changes in the continent's fire regime leading to a contraction of the forests which sustained them and increased aridity, which affected all large browsers by increasing the distance between food resources (Murray and Vickers-Rich, 2004). Conversely, increased fire favoured the grass lovers, such as macropods and emus.

The Mihirungs may have been the key dispersal agents for the seeds of many species within these relict communities due to their large dispersal range. These "missing herbivores" may be responsible for what is now considered to be "haphazard and anachronistic" seed dispersal within these communities. Today, many of these edible fruit and seed bearing species such as *Marsdenia australis*, *Carissa lanceolata* and *Capparis lasiantha* appear to have inadequate dispersal mechanisms with many seeds simply accumulating at the base of the parent tree or rotting on the ground (Murray and Vickers-Rich, 2004).

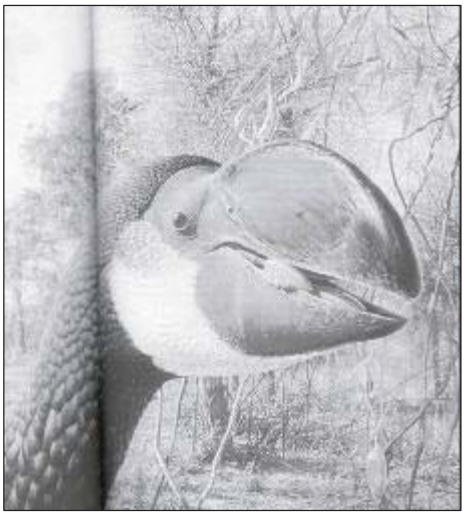


Figure Three: Mihirung (from Murray and Vickers-Rich, 2004)

Flora

The genus Macropteranthes

The genus *Macropteranthes* belongs in the family Combretaceae, which is composed of twenty genera, encompassing around 500 species. The majority of species are trees, shrubs and lianes. Within Australia there are five genera and over 30 species, including the more commonly known genus *Terminalia* (Pedley, 1990 and Watson and Dallwitz, 1992).

The name *Macropteranthes* comes from the Greek words *macros*, *pteron* and *anthos* meaning large, wing and flower respectively, referring to the two large wing-like bracteoles at the base of the calyx, and persisting on the fruit. Within the genus there are five species all of which are found in northern Australia. Only one species, *M. kekwickii*, is found in the Northern Territory, the four remaining species *M. fitzalanii*, *M. leichhardtii*, *M. leiocaulis* and *M. montana* are all found in Queensland, predominantly along the northeastern coastline.

Macropteranthes kekwickii was first described from plants growing near Newcastle Waters in the Northern Territory in the early 1860s. The species name was assigned to honour William Kekwick who was employed on a number of expeditions to help John McDouall Stuart with his survey work in southern and northern Australia. The species is classified as a deciduous small-leaved tree, growing to six metres, with short branchlets. The appearance of bullwaddy thickets during the dry season has been equated to "a bunch of dead sticks" as the leaves fall from the branchlets, giving the impression the plant has died (Latz, 1995). During the wet season as the leaves return, the foliage and growth create almost impenetrable thickets that are

difficult to traverse. The leaves are spirally arranged and usually densely crowded. Flowers are often paired (Figure Four).

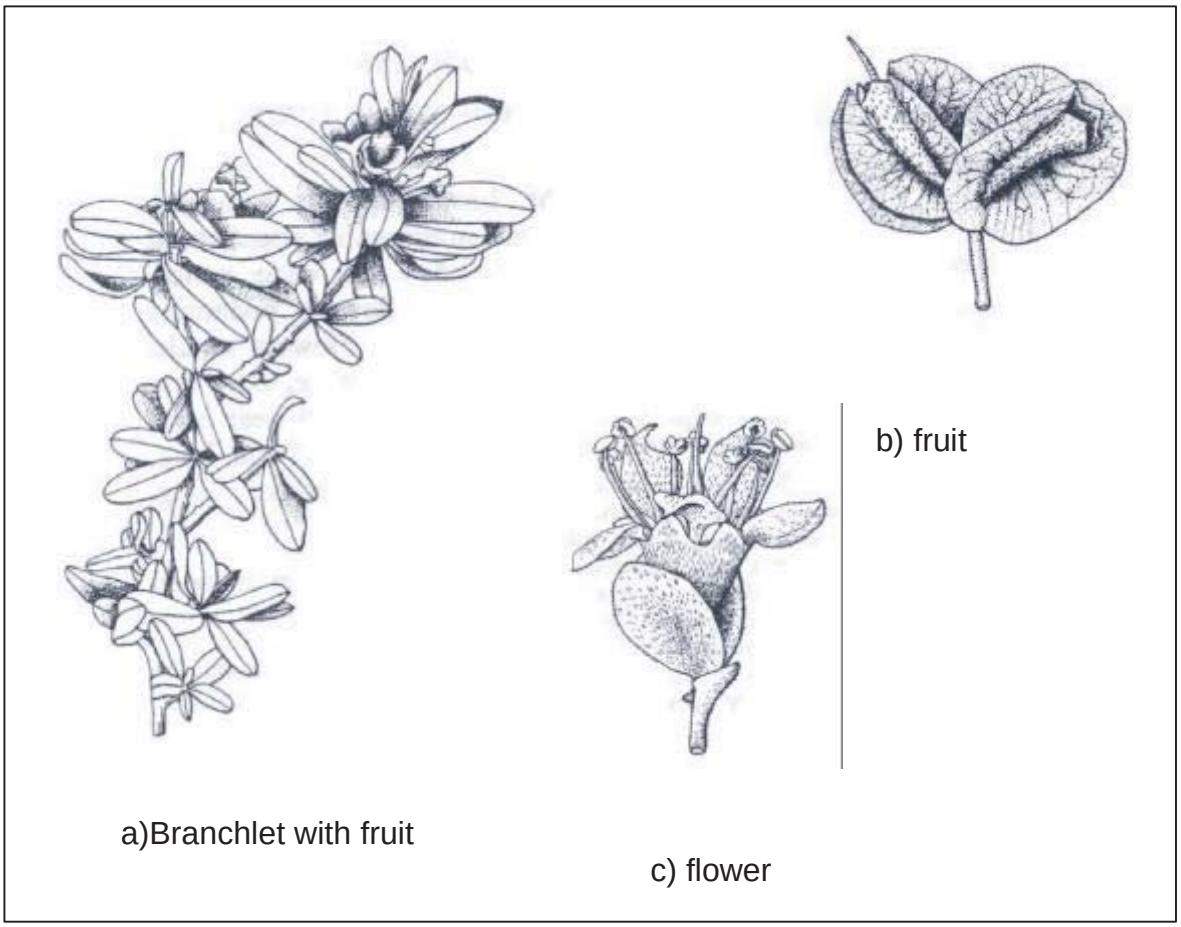


Figure Four: *Macropteranthes kekwickii* (from Pedley, 1990)

Bullwaddy is listed under section 29 of the *Territory Parks and Wildlife Conservation Act 2000* as of 'least concern'. The classifications used under this Act follow the IUCN coding of species under threat. The category of 'least concern' is reserved for all species that are either widespread or common and cannot be categorised as critically endangered, endangered, vulnerable, near threatened or data deficient.

Fauna

Although Russell-Smith (1991) links the lancewood/bullwaddy vegetation type to monsoon rainforest communities further north, the vertebrate species that have been recorded within lancewood/bullwaddy communities do not reflect this linkage. There is also no apparent specific vertebrate community associated with this vegetation type. It has been noted though, that when greater percentages of bullwaddy are found in association with lancewood the occurrence of certain vertebrate species increases as does the diversity (Brocklehurst, 1991).

Three ground-foraging birds have shown a clear association with lancewood and bullwaddy thickets in this region – the apostlebird (*Struthidea cinerea*), hooded robin (*Melanodryas cucullata picata*) and grey-crowned babbler (*Pomatostomus temporalis*). Lancewood/bullwaddy communities can form dense forests, with little

understorey aside from ferns and mosses allowing these three bird species to forage specifically for invertebrates in associated leaf litter and bare ground. This foraging behaviour is quite unique, as the dense grass understorey found in most other forests and woodland communities of the Top End prevents species from foraging in this way. Not one of these species is currently of conservation concern in the Northern Territory (Woinarski and Fisher, 1995).

The spectacled hare-wallaby (*Lagorchestes conspicillatus leichardtii*) is unusually abundant in bullwaddy thickets. This species uses the stands to shelter in during the day and feeds around the edges at night.

Other vertebrate groups such as frogs and bats have not been comprehensively surveyed to date and further investigation is warranted.

Vegetation mapping

Vegetation mapping was undertaken by the Parks and Wildlife Commission in 2001 using satellite imagery and floristic information collected during survey work within Bullwaddy Conservation Reserve. Seven broad community types were mapped according to topography, soil type, dominant species and structure (see Appendix One for description of map units):

Bullwaddy/lancewood thickets
Dense bullwaddy/lancewood forest
Open bullwaddy/lancewood forest
Corymbia dichromophloia woodlands
Marginal mixed woodland
High cover woodland
Drainage areas

(Fisher, unpublished data)

Detailed mapping of areas of high conservation value and land types, based on landform, nature of the soil surface, vegetation type, structure, density and evidence of fire has been undertaken in the Sturt Plateau area.

Day *et al* (1985) also mapped 19 land units for the area. Eight of the 19 land units identified comprise gently sloping to almost level plains and four comprise alluvial plains on the Sturt Plateau itself. The remaining seven described dissected high plateau remnants, southern margins and undulating terrain below the Sturt Plateau.

Day *et al* (1985) classified Bullwaddy Conservation Reserve under the Bulwaddy (By) and Lancewood (Ld) land units, both of which contain varying amounts of bullwaddy/lancewood vegetation complexes. These vegetation units are predominantly found on shallow lithosols, gravelly red and yellow earths and lateritic podzolic soils.

Pastoral and Aboriginal history

Aboriginal history

There are two Aboriginal groups associated with the area surrounding Bullwaddy Conservation Reserve. The Alawa people traditionally lived in the areas now known as Nutwood Downs, Tanumbirini, Hodgson River and Hodgson Downs (Minyerri). The Jingili people were found further south-west, incorporating Beetaloo Station to the north and Helen Springs/Renner Springs to the south.

Aboriginal people were heavily involved in the work undertaken on nearby cattle stations during the first half of the 1900s. Many Aboriginal people showed great skill in the horse arena and were valued members of the station community. Areas such as OT Downs and Amungee Mungee (which were historically part of Beetaloo Station) and Tanumbirini Station housed substantial numbers of Aboriginal families. Many station owners provided work, food and shelter for Aboriginal people and were much respected (Raymond, pers.comm).

Although there was a great amount of bush tucker to be found in the area, Aboriginal people did not venture deeply into the area now known as Bullwaddy Conservation Reserve. The dense vegetation may have provided protection from the weather and opportunistic hunting, but in terms of nutrition, bullwaddy has little value. Amungee Mungee waterhole which lies just outside the current Reserve boundary was a valued food source providing Aboriginal people with ducks and other waterfowl. Spears were used for hunting around and within the waterhole. This area also lies in a flood plain and was accessed mainly during the dry season.

Aboriginal people had a variety of uses for bullwaddy stems and trunks. It has historically been used for the production of clap sticks, nulla nullas, boomerangs and heads for hooked or barbed spears. The heavy, dense wood is also valued as firewood as it burns slowly and evenly and produces lasting coals (Wightman *et al*, 1992).

Further to the west of Amungee Mungee waterhole is an area of great significance to the local Jingili people. The area is a sacred site and may form part of a dreaming trail which travels from Amungee Mungee waterhole then further west to Hayfield Station, east to Sandy Lagoon and Cow Lagoon (on Billengarah) to Anamaloon and back to Beetaloo. The area around Amungee Mungee waterhole was used to sing initiation songs for young men. Unfortunately there are no traditional elders left to speak for this country and dreaming trail (Raymond, pers.comm).

Pastoral history

Following the completion of the Overland Telegraph Line in 1873, land speculation was rife in the area now known as the Northern Territory. The area of land around Daly Waters was taken up but never improved or stocked. This was in main due to the bands of impenetrable lancewood and bullwaddy thickets that crossed the area. This along with a lack of permanent surface waterholes made the country a tenuous prospect for pastoralists. By 1889 all of the blocks which had been taken up were surrendered due to cancellation or non payment of rent (SAGG, 1889).

Harold Murray Bathern alias ‘Bullwaddy Bates’ had come to the Northern Territory in 1883 as a drover bringing cattle to establish Brunette Downs. George Bostock managed Eva Downs to the north west with Harry Bates as head stockman. Seasons were hard due to the lack of water which necessitated the walking of cattle to OT waterhole on the head of the Limmen Bight River on an annual basis (Chambers, 1998).

Bates and Bostock moved north to Beetaloo which surrounded a large permanent waterhole known as Aramangu. As was the practice of the time Bates and Bostock mustered wherever there were cattle in a vast land without fences and very few people. Bostock grew tired of the continual shortage of water and walked off leaving the property to Bates (Chambers, 1998). By the early 1930s Bates had permanently moved to the head of the Limmen Bight River forming OT Downs.

On Harry Bates' death, Peter Bostock, son of George Bostock ran the property for a time with workers contracting out to individual stations across the Gulf and Barkly Tablelands (Raymond, pers comm.). OT Downs pastoral lease lapsed and people gradually moved back to the regional center of Elliot.

Nutwood Downs to the north was formed by John and Phoebe Farrar, from north of the Roper River where they had been part of John Costello's vast pastoral empire Valley of the Springs between 1883- 1890 (James, 1989). Tanumbirini was one of the next areas to be taken up and in 1906 Dan O'Mara, whose name would later be corrupted to form the name Dunmarra, came over from Camooweal and took over management of Tanumbirini. In 1933 Noel Healy purchased Milner's Lagoon Station and established Dunmarra and the Dunmarra Roadhouse (Miller, 1984).

In 1968, the block of land now known as Amungee Mungee Station was offered under a ballot system that was won by Jeff and Cooee Hill. At that stage, Jeff Hill was working at Elizabeth Station near the township of Litchfield. In 1971 Jeff and Cooee Hill took up the Amungee Mungee lease which he renamed Cooee Hills after his wife. Jeff Hill fenced, dug bores and stocked the property with 1250 head of cattle, but after the death of his son in 1977, he and his wife moved back to Queensland (Hill, 2003).

Ownership then moved to Molly and Reg Hartig, until Reg's death in 1981. Together with his wife who died in 2000, Reg Hartwig was buried on Amungee Mungee Station.

The station is currently used as an alternative, more reliable transit route out of the Gulf region for cattle during and post wet season. Approval has been granted for the present owner to commence land clearing for the introduction of improved pasture to increase carrying capacity.

1.3 Key Values of the Park

The primary value of the Reserve is natural/scientific and to a lesser extent educational/recreational. Specific management objectives will be identified for each value (see sections 3, 9 and 10).

Natural/scientific value

The Reserve's most significant natural values lie in the flora and associated fauna. Of particular interest is furthering the Parks and Wildlife Commission's knowledge of the ecology of bullwaddy (*M. kekwickii*). Survey work undertaken in 2001 has developed a fine scale vegetation map, provided an inventory of the Reserve's fauna and flora, and established a baseline to consider the effects of fire on bullwaddy.

Flora

Within Bullwaddy Conservation Reserve there are five plant species listed under section 29 of the *Territory Parks and Wildlife Conservation Act 2000* as 'data deficient'. Data deficient is a term reserved for species known from few locations for which there is currently not enough information on population sizes, trends and threats for accurate classification. These species are:

- *Lepturus xerophilus* a delicate annual grass, growing to 20cm, occurring occasionally under bullwaddy. This species is conserved only in Bullwaddy Conservation Reserve and known from only four locations which all fall within the Sturt Plateau;

- *Centipeda nidiformis* an annual daisy, growing to 15cm. Although this species occurs in all mainland Australian states, its distribution is disjunct in the Northern Territory. *Centipeda nidiformis* is conserved only in Bullwaddy Conservation Reserve (also conserved in the federally managed Kakadu National Park);

- *Paspalidium gracile* a fine annual grass, growing to 20cm. It is conserved only in Bullwaddy Conservation Reserve and known from only five locations which all fall within the north east Sturt Plateau region;

- *Yakirra muelleri* a slender grass, growing to 25 cm. This species is conserved also in Nitmiluk National Park, and

- *Panicum latzii* an erect annual grass which grows on clay soils. This species is conserved only in Bullwaddy Conservation Reserve and known from only two NT locations.

The prostrate, herbaceous vine, *Ipomoea argillicola* is listed as 'near threatened' under the *Territory Parks and Wildlife Conservation Act.* This category is reserved for those situations where a species, in both abundance and number of populations, falls outside the threatened categories but would need to suffer only a minimum loss to qualify. This loss need not be considered pending. *Ipomoea argillicola* is also conserved in Connells Lagoon Conservation Reserve east of Tennant Creek (Fisher, unpublished data).

<u>*Fauna*</u>

There are three animal species listed under section 29 of the *Territory Parks and Wildlife Conservation Act 2000* as 'near threatened'. These species are:

Burhinus grallarius	Bush stone-curlew;
Lagorchestes conspicillatus	Spectacled hare-wallaby;
Onychogalea unguifera	Northern nailtail wallaby.

Two species are listed as 'data deficient' under section 29 of the *Territory Parks and Wildlife Conservation Act 2000*:

Varanus tristis	Black tailed goanna;
Cyclorana australis	Giant frog.

These two species are listed because of uncertainty regarding the impacts of the introduced cane toad, *Bufo marinus*.

The Australian bustard (*Ardeotis australis*) is the only species listed as 'vulnerable' within the Reserve. This category is used to list species that are threatened in the wild. Best evidence indicates that these species are facing a high risk of extinction if present trends continue (IUCN, 2001). The highly mobile habits of the Australian bustard mean although this species has been recorded in a number of parks and reserves, very few of these contain breeding populations or populations that are permanent throughout the year.

Educational/recreational value

Although the main focus of the Reserve will be the continued research and monitoring of bullwaddy communities, the Reserve will also provide a road-side stop featuring interpretation panels, picnic tables and a short walk to identify vegetation of conservation significance. The Reserve provides an opportunity to inform and educate visitors about the significance of various vegetation units and the reason for the establishment of the Reserve.

1.4 Concept of the Park and its Purposes

The declaration of Bullwaddy Conservation Reserve complies with the Parks and Wildlife Commission's aim to:

- conserve representative natural areas;
- protect all species of native flora and fauna, and
- maintain biodiversity within the Northern Territory.

One measure of the significance of individual parks, and the resilience of the Commission's park system as a whole, is the extent to which parks uniquely represent any of the Territory's 13 broad and 112 fine vegetation groups mapped for the Northern Territory. Of these, 71 are included within the Commission's reserve system, but 32 of these 71 are represented in one park only. Hence these parks can be considered to have special value; without them the Northern Territory would have no formal protection for these environments.

Bullwaddy Conservation Reserve is the only place where vegetation type 20 (low woodland with grassland understorey, represented by bloodwoods, grasses and spinifex) and vegetation type 55 (*Acacia* open-forest with open grassland understorey, represented by lancewood/bullwaddy communities) are protected. This small Reserve therefore has Territory-wide conservation significance as it protects part of the largest and least fragmented stand of bullwaddy in the Sturt Plateau region (Figure Five). At the time of writing, this species was not represented elsewhere in the Northern Territory park estate.

These woodlands provide habitat for some of the Territory's characteristic fauna such as the spectacled hare-wallaby (*L. conspicillatus*), giant frog (*Cyclorana australis*) and northern nailtail wallaby (*Onychogalea unguifera*). The declaration of Bullwaddy Conservation Reserve was given further impetus after a recommendation in the 1996 Action Plan for Australian Marsupials and Monotremes (Wildlife Australia, 1996) for the increased protection of lancewood/bullwaddy communities of the Northern Territory specifically in relation to the spectacled hare-wallaby.

The Reserve will have a scientific focus aimed at improving knowledge of the flora and associated fauna and the processes acting on this environment. During the life

of this Plan the Commission aims to encourage and promote scientific research and monitoring within the Reserve. Extensive field work to increase the species list for both plants and animals will be undertaken.

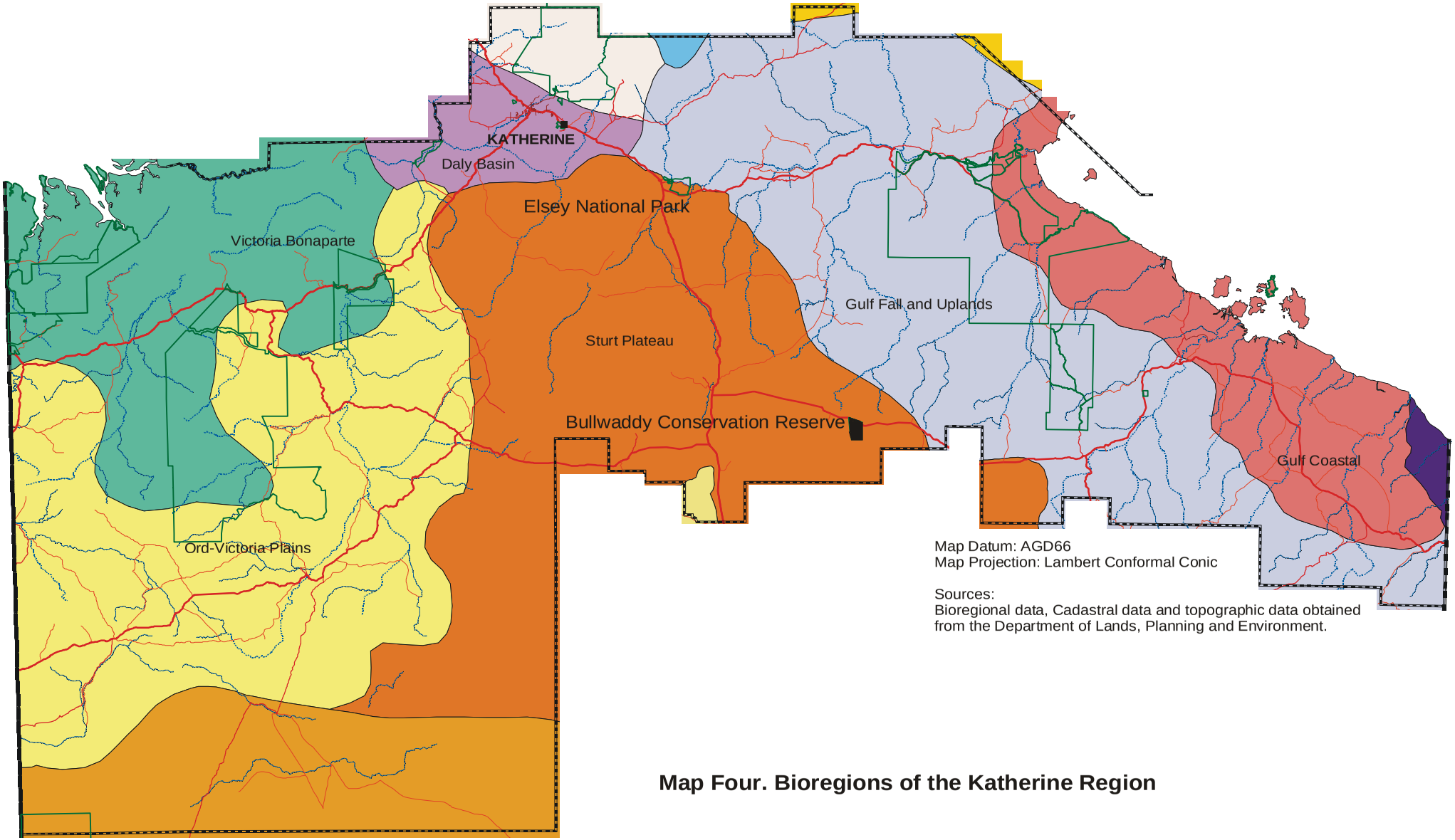
The Reserve will not be developed or managed to cater for tourism. The provision of interpretation panels for day use visitors will aim to educate the public regarding this significant tract of vegetation and outline the management objectives of the Parks and Wildlife Commission.

Figure Five: Bullwaddy thicket (taken from Adam, 1999)

1.5 Regional Context

The National Reserves System developed by the Commonwealth Government in the early 1990s aims at "establishing a comprehensive, adequate and representative system of protected areas to conserve Australia's biodiversity" (Thackway and Cresswell, 1995). As an aid in the achievement of this Australia has been divided into 80 biogeographical regions (bioregions). These regions are classified according to recognisable similarities in landform, geology, flora and fauna.

Eight of Australia's ten least protected bioregions lie entirely or partly within the Northern Territory. Lack of, or inadequate reservation within these bioregions can be primarily attributed to the development of pastoralism as an enterprise more viable in the area than conservation or because the area is Aboriginal land for which no formal reservation agreement has been negotiated. Amongst these unreserved or poorly reserved bioregions is the Sturt Plateau bioregion, encompassing Bullwaddy Conservation Reserve (Map Four).



Map Four. Bioregions of the Katherine Region

The Sturt Plateau bioregion comprises 99 719 km^2 and falls solely within the Northern Territory. Previous to the declaration of Bullwaddy Conservation Reserve, 0.09% of this bioregion had been reserved, represented by the south-western section of Elsey National Park. The current reserve system does not include representations of the range of environments within the bioregion. With the declaration of Bullwaddy Conservation Reserve this figure increased to 0.12%.

Although suitable habitat for a number of species of conservation interest occurs within the bioregion, the establishment of baseline studies would be necessary to determine the distribution and abundance of these species and to determine the overall conservation significance of the Sturt Plateau. The Sturt Plateau bioregion is listed as a high priority conservation area in the Interim Bioregionalisation of Australia Report 5.1 due to its under-representation and potential biodiversity.

If the pastoral focus in the areas surrounding the Reserve changes or becomes more intensive in its nature, the relative importance of Bullwaddy Conservation Reserve will increase. For some of its plant and animal species, Bullwaddy Conservation Reserve may not be sufficient to maintain viable population

2. MANAGEMENT OF NATURAL VALUES

2.1 Flora

2.1.1 Value

The lancewood/bullwaddy vegetation communities of Bullwaddy Conservation Reserve are of scientific interest.

2.1.2 Management Objective

1. To ensure the protection of the Reserve from fire, feral animals and weeds and to better understand the effects of fire on lancewood/bullwaddy communities.

2.1.3 Background

The Northern Territory is represented by 13 broad vegetation types and 112 fine vegetation types. Lancewood/bullwaddy communities are classified under the broad vegetation type of *Acacia* woodland which can be dominated by a number of species depending on location. These woodlands are dominated by lancewood and bullwaddy in the Sturt Plateau, Gulf Falls and Victoria River District of the Top End. Less than 1% of this broad vegetation type is reserved in the Park estate.

The fine vegetation types within *Acacia* woodlands are also poorly reserved. The vegetation types represented in Bullwaddy Conservation Reserve were previously unreserved in the Northern Territory.

Lancewood forests and woodlands are by far the most extensive *Acacia* dominated communities in the northern NT. They occur in regions with between 500mm and 700mm of annual rainfall on clay soil plains, and on laterite breakaways. In the Sturt Plateau, groves of lancewood form a mosaic with eucalypt open woodlands. The lancewood stands are often very dense, with a few shrubs growing below the upper storey and a generally sparse ground layer dominated by annual grasses. Lancewood is believed to be obligate seeders and therefore sensitive to frequent burning (Fisher, unpublished data).

Patches of lancewood in the Victoria River and Gulf District appear to be declining (Latz, 1989), although there is little evidence of rapid decline in the Sturt Plateau area. Lancewood stands are relatively species poor for both associated plants and vertebrates (Woinarski and Fisher, 1995).

Bullwaddy is an unusual plant, with a multi-stemmed habit and very small leaves densely crowded along the branches. It is technically a shrub, although plants can grow to around 6 metres tall and individual stems are quite massive. The wood is very dense and heavy.

Within Bullwaddy Conservation Reserve, bullwaddy stands seem to occur in run-on locations (depressions or lower slopes) where soils are more clayey.

Bullwaddy is also found as scattered trees throughout lancewood woodlands, and extensive stands occur on red sandy soils. A variety of twiners and annual herbs

with rainforest affinities grow in and under the shady bullwaddy canopies. Bullwaddy thickets appear to be a favoured habitat for Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardtii*) and the dead stems also provide habitat for a number of lizard species.

Bullwaddy communities are extremely sensitive to frequent, intensive fires. Managed fire regimes are imperative if the integrity of the stands is to be maintained. Inappropriate fire regimes may lead to community succession from bullwaddy through lancewood to a eucalypt dominated woodland. This process may be accelerated or exacerbated by the invasion of exotic pasture grasses such as buffel grass.

Although it is a very distinctive shrub and one of the dominant plant species in the area, virtually nothing is known about the ecology of bullwaddy. Young (small) plants seem to be very rare, despite the fact that the trees flower and seed prolifically, suggesting that recruitment of new individuals is infrequent and maybe episodic. Many of the plants give the appearance of great age, although there are no data to support this (Fisher, unpublished data).

The other major vegetation types in the Reserve are eucalypt woodlands or open woodlands. On the higher gravelly areas *Corymbia dichromophloia* dominates, with a spinifex (*Triodia bitextura*) or perennial tussock grass (*Chrysopogon fallax*) understorey.

There are currently 243 species of plants recorded in the Reserve. One species found within the Reserve (*Ipomoea argillicola*) is listed as near threatened and another five species are listed as data deficient. Lancewood/bullwaddy communities, although not listed as of conservation interest, are of significance as they are restricted in distribution and representation.

Further surveying in 2001 uncovered an additional seven taxa that were previously unreserved in the Park estate. These species are: *Goodenia viscidula, Dodonaea stenophylla, Aristida calycina, A. queenslandica, Lepturus xerophilus, Panicum latzii* and *Paspalidium gracile* (Fisher,unpublished data). Continued research during the life of this plan may uncover other species not currently listed for the Reserve as sampling effort has been biased to areas in the north and east of the Reserve to date.

The Reserve is not currently experiencing major pressure from weed invasion. Species that have been recorded to date: *Hyptis suaveolens* (hyptis), *Cenchrus ciliaris* (buffel grass), *Urochloa mosambicensi* (sabi grass), *Melochia pyramidata, Eragrostis amabilis, Stylosanthes hamata* (Carribean stylo), *Melinis repens* (red natal grass), *Bidens bipinnata* and *B. pilosa* (cobbler's peg).

Amungee Mungee Station which borders the Reserve is currently used as a stop over point for cattle travelling from the Gulf Region. As the weed species *Parkinsonia aculeata* (parkinsonia) and *Xanthium spinosum* (noogoora burr) are established in the Gulf Region, there is potential for these species to be transported via vehicle or beast along the Carpentaria Highway. There is potential for these weed species to become established in areas bordering the Reserve.

Mission grass (*Pennisetum pedicellatum*) is also already established along the Carpentaria Highway and may in the future become transported into the Reserve via vehicles or humans.

Approval has been granted for the present owner to commence land clearing for the introduction of improved pasture to increase carrying capacity. Under the granted approval the Commission has requested that Amungee Mungee Station retains a 1 km buffer of uncleared land around the Reserve's border.

2.1.4 Management Actions

1. Maintain a fire break around the Reserve.
2. Expand the current flora list by collecting and identifying species in conjunction with fauna surveys.
3. Implement the Reserve's fire management strategy (see 4.1).
4. Implement the Reserve's weed management strategy (see 4.2).
5. Implement the Reserve's feral animal management strategy (see 4.3).
6. Monitor for any increase cover or spread of grass, particularly exotic grasses.

2.2. Fauna

2.2.1 Value

There are a number of species associated with lancewood/bullwaddy communities which warrant further investigation.

2.2.2 Management objectives

1. To increase understanding of the Reserve's fauna.
2. To maintain the current number and type of species within the Reserve.

2.2.3 Background

The fauna of Bullwaddy Conservation Reserve is currently known to contain 78 bird, 33 reptile, 11 mammal and six frog species. Due to the recent declaration of the Reserve, fauna surveys have been limited. Survey work has also concentrated on various sectors of the Reserve, thus sampling effort over the entire Reserve is currently biased.

Birds
Of the species recorded to date, the Australian bustard (*Ardeotis australis*) is considered vulnerable and the bush stone-curlew (*Burhinus grallarius*) is classified as near threatened. Although the Australian bustard has been recorded in many parks and reserves across the Territory, its highly mobile habits mean very few parks or reserves contain breeding populations or populations that are permanent throughout the year.

Reptiles
One reptile recorded in the Reserve, the black tailed monitor (*Varanus tristis*) is listed as data deficient because of the potentially serious impacts of cane toads on its conservation status.

Mammals
Both the spectacled hare-wallaby (*Lagorchestes conspicillatus leichardtii*) and northern nailtail wallaby (*Onychogalea unguifera*) are classified as near threatened. Under the 1996 Action Plan for Australian Marsupials and Monotremes the spectacled hare-wallaby is classified as lower risk (near threatened). Preliminary research suggests an association between the hare-wallaby and bullwaddy communities. Distribution of the spectacled hare-wallaby is patchy and limited to the northern half of Australia, having previously occupied almost half of the Australian continent. In the Northern Territory, the species is listed as common in suitable habitat between 16° and 18°S.

Suitable habitat for the spectacled hare-wallaby in the Northern Territory includes lancewood/bullwaddy communities with an open understorey such as that found in Bullwaddy Conservation Reserve. This species is not currently managed under a specific regime, although the 1996 Action Plan for Australian Marsupials and Monotremes suggested the following managed actions in relation to this species:

1. Regular surveys to monitor any changes in distribution or abundance.
2. Determine factors threatening populations.
3. Detailed ecological studies (ie., habitat requirements, home range, dispersal patterns, social organisation, reproductive physiology, natural cycles in population size).
4. Study effects of introduced predators such as cats.

Frogs
Of the three species of frog currently listed for the Reserve, the giant frog (*Cyclorana australis*) is listed as data deficient because of the potentially serious impacts of cane toads on its conservation status.

Although there is no distinctive vertebrate community associated with the bullwaddy/lancewood vegetation type. Three ground-foraging birds are clearly associated with lancewood thickets in this region, the apostlebird, hooded robin and grey-crowned babbler (Woinarksi and Fisher 1995).

Feral animals
Five feral animals have been recorded for the Reserve: cane toad, donkey, horse, cat and cattle. There is potential for the cane toad to negatively affect a number of reptiles, particularly the monitor *Varanus tristis*.

There are incidental records for donkey, horse and cattle within the Reserve. The impact of these species is minimal, as numbers tend to be low and episodic.

2.2.4 Management Actions

1. To carry out fauna surveys, initially for each season, and thereafter where funds and resources allow, to establish a comprehensive species list.
2. Construct and maintain exclusion fencing around the Reserve.
3. Implement the Reserve's fire management strategy (see 4.1).
4. Implement the Reserve's weed management strategy (see 4.2).
5. Implement the Reserve's feral animal management strategy (see 4.3).

3. MANAGEMENT OF VISITOR VALUES

3.1 Visitor Use

3.1.1 Value

Providing visitors with a roadside stop between Daly Waters and Cape Crawford and providing interpretative material regarding the Reserve's value.

3.3.2 Management objectives

1. To provide appropriate, functional, well-presented facilities in accordance with the Reserve's character.
2. To provide appropriate educational interpretation material to encourage visitors' understanding of the Reserve's scientific value.
3. To ensure visitor impacts do not erode the natural values of the Reserve and are contained in the sector of the Reserve designated for visitor use.
4. Determine the most appropriate area for the installation of day use facilities and a short walking track.

3.1.3 Background

Bullwaddy Conservation Reserve provides an excellent opportunity to capture and educate visitors travelling along the Carpentaria Highway. At present, there are limited opportunities for visitors travelling along the highway to pull off the road and take a break.

Although the Reserve will not cater primarily for visitors, there is potential for the development of a road side stop within or near the Reserve, providing visitors with picnic facilities. It is envisaged that a day use area will be established on the edge of the Reserve alongside the Carpentaria Highway. This area will include picnic tables and interpretive signage, outlining the importance of the Reserve in terms of conservation and providing information to help visitors identify the dominant species of flora and fauna.

There is provision also for a short walking track.

3.1.4 Management actions

1. Finalise a concept plan for the development of the day use area.
2. Install day use facilities and interpretive signage in accordance with the concept plan.

4. KEY NATURAL RESOURCE MANAGEMENT PROGRAMS

A number of key natural resource management programs are conducted within the Reserve including the fire, weed and exotic animal species management programs. These programs form the basis of most management activities in the Bullwaddy Conservation Reserve and are conducted in accordance with annually reviewed strategies.

Development and implementation of these strategies are guided by the following general management objectives and guidelines.

4.1 Fire Management Program

4.1.1 Management Objectives

1. To protect native plants, animals and the natural environment and minimise detrimental impacts of wildfires on the environment of the Reserve.
2. To protect people, personal property and assets from harm due to fire.
3. To improve scientific understanding of the role of fire in the Reserve and to use this knowledge for improved fire management practices.
4. To establish, with respect to the management of fire, a cooperative working relationship with neighbours.

4.1.2 Management Directions

1. The management of fire will be given high priority as a key mechanism for protecting and managing native plants, animals and the natural environment in the Reserve.
2. Fire management activities will follow sound strategic planning principles with decisions and actions based on the best information available. The general direction of the fire management program for the Reserve will be established through annual review. Specific attention in planning and implementing the program will be given to:
   - Protection of native plants, animals and the natural environment;
   - Minimising impact on the recreational and aesthetic values and ensuring the protection of people, personal property and park assets;
   - Identification of cultural resources that may be damaged by fire and adoption of strategies to ensure their protection;
   - Systematic monitoring with the aim of achieving better understanding of fire-habitat relationships and more informed fire management in the future; and
   - Staff and visitor safety.
3. Efforts will be made to minimise the risk of wildfire incursions and will include cooperation with neighboring landholders.
4. Restrictions on the lighting of fires may be applied in accordance with the *Bushfires Act*.
5. Visitor access to all or part of the Reserve may be regulated or restricted in times of high to extreme fire danger.

4.2 Weed Management Program

4.2.1 Management Objective

1. To minimise the impact of weeds on the native plants, animals and natural environment of the Reserve.

4.2.2 Management Directions

1. Managers will seek to significantly reduce the impact of weeds on the native plants, animals and natural environment of the Reserve.
2. Weed control activities will be outlined in the weed management strategy and will be based on a strategic approach that gives attention to the following:
   - criteria for assessing priority such as threat to rare or sensitive habitats, aesthetic and recreational impacts, status under legislation and probability of long-term success;
   - assessment of the impact of weeds, and of a range of possible mitigation measures;
   - monitoring and maintenance of identified priority weed-free areas;
   - control options best suited to different species and conditions, including burning, slashing, physical removal and chemical methods;
   - the ecology and life cycle of target weed species;
   - education and cooperation of neighbours and visitors in minimising the risk of weed spread;
   - minimising the risk of seed spread during and after control activities;
   - staff training and safety standards; and
   - A weed monitoring program that includes the collation of data, allowing for comparisons of data across the years.

4.3 Exotic Animal Species Control Program

4.3.1 Management Objective

1. To minimise the impact of exotic animals on the native plants, animals and natural environment of the Reserve.

4.3.2 Management Directions

1. Managers will seek to reduce or eliminate the impact of exotic animals on the native plants, animals and natural environment of the Reserve.
2. Exotic animal control activities will be outlined in the Reserve's feral animal management strategy and will be based on a strategic approach to the control of exotic animals with attention being directed at:
   - the ecology and behaviour of feral animals;
   - assessment of the impact of exotic animals, and of a range of possible mitigation measures;
   - staff competencies and training requirements;

- the interests of stakeholders and neighbours;
- safety of staff and Reserve visitors; and
- Feral animal monitoring program.

5. PARK ADMINISTRATION AND STAKEHOLDER ENGAGEMENT

Bullwaddy Conservation Reserve is an 'unmanned' reserve managed by the Gulf District staff based in the Mataranka Office. The Reserve has limited facilities however this plan provides for the establishment of a day use area with picnic tables and interpretive signs. The main visitor safety issues include potential dehydration and sunburn. In implementing natural resource management programs in the Reserve Parks and Wildlife work closely with neighbours. Such cooperation is an essential element of the Reserve's fire, weed and feral animal management strategies.

The administration of the Bullwaddy Conservation Reserve will be guided by the following set of general principles:

General Principles

- Park management should be conducted within a framework of effective and efficient use of resources, and should be outcome oriented.
- Effective park management is dependent upon the selection of competent staff and their continued professional development and training.
- Park management benefits substantially from the involvement of stakeholders and the general public.
- Volunteers can make a major contribution to park management and assist in making scarce resources go further.
- The safety of visitors is of paramount importance in the management of the Reserve.

Within the Reserve, the application of the above principles is focussed on the following areas:

5.1. General Administration

5.1.1 Management Objectives

1. To provide responsible management and appropriate and efficient administration of the Reserve.
2. To maximise the safety of visitors and staff.

5.1.2 Management Directions

1. Wherever appropriate contract services will be used for general visitor facility maintenance and visitor services.

2. Essential natural resource management programs will be carried out with close cooperation and liaison with surrounding landholders and managers.
3. All major facility developments for both visitors and park administration will be subject to environmental assessment to ensure appropriate siting and to minimise damage to the natural and cultural resources of the park. Such developments will be in accordance with the *Northern Territory Aboriginal Sacred Sites Act*.
4. Emergency Response Procedures will be carried out in accordance with the Service's Emergency Response Standard Operating Procedures.
5. Visitor information, including signs and interpretation material will inform visitors of potential safety hazards and appropriate precautions.
6. Operations for the exploration and recovery of minerals may be permitted in accordance with the *Territory Parks and Wildlife Conservation Act* and *Mining Act*, and current administrative arrangements between the Parks and Wildlife Commission, the Department of Lands, Planning and Environment and the Department of Mines and Energy. These arrangements will be monitored to ensure that they provide for protection of key park values.

5.2 Stakeholder Engagement

5.2.1 Management Objectives

1. To ensure adequate and appropriate consultation and representation of stakeholders interests in the management of the Reserve.
2. To foster the involvement of stakeholders in relevant areas of park management.
3. To establish effective mechanisms for consultation with the key stakeholders.
4. To engender a positive community attitude to the Reserve.

5.2.2 Management Directions

1. The Parks and Wildlife Commission will be mindful of the need to keep the community and park stakeholders involved and informed with regard to all issues and proposed developments of mutual interest. Any community involvement initiatives that will assist achievement of the park's management objectives will be supported.
2. Park staff will regularly liaise with its neighbours in relation to cooperative management in the use and control of fire, control of stock and feral animals, weed control, soil conservation, fences, aspects of Aboriginal interest, visitor access and tourism development.
3. Annual assessment of stakeholder liaison will be undertaken for the Reserve.
4. Aboriginal people and others with traditional affiliations with the Reserve will be invited to take part in management advisory activities.
5. Stakeholder engagement and will be a consultative process that is ongoing, open, accountable and accessible to the parties involved. Effective consultation and involvement will also be facilitated with ongoing education of park staff of the need to consult.

6. IMPLEMENTATION PROGRAM

VALUE	MANAGEMENT ACTIONS	YEAR 1	2	3	4	5	6	7	8	9	10
2. Management of Natural Values											
2.1 Flora	1. Maintain a fire break around the Reserve.	→	→	→	→	→	→	→	→	→	→
	2. Expand the current flora list by collecting and identifying species in conjunction with fauna surveys.										→
	3. Implement the Reserve's fire management strategy.	→	→	→	→	→	→	→	→	→	→
	4. Implement the Reserve's weed management strategy.	→	→	→	→	→	→	→	→	→	→
	5. Implement the Reserve's feral animal management strategy.	→	→	→	→	→	→	→	→	→	→
	6. Monitor for any increase cover or spread of grass, particularly exotic grass.	→	→	→	→	→	→	→	→	→	→
2.2 Fauna	1. Carry out fauna surveys during each season for the first year, and thereafter as funds and resources allow, to establish a comprehensive species list.										→
	2. Construct and maintain stock exclusion fencing.	→	→	→	→	→	→	→	→	→	→
	3. Implement the Reserve's fire management strategy.	→	→	→	→	→	→	→	→	→	→
	4. Implement the Reserve's weed management strategy.	→	→	→	→	→	→	→	→	→	→
	5. Implement the Reserve's feral animal management strategy.	→	→	→	→	→	→	→	→	→	→
3. Management of Visitor Values											
3.1 Visitor Use	1. Finalise a concept plan for the development of the day use area.	→	→	→	→	→					
	2. Install day use facilities and interpretive signage in accordance with the concept plan.						→	→	→	→	→

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APPENDIX ONE

Vegetation mapping for Bullwaddy Conservation Reserve
(Fisher, unpublished data)

1. Bullwaddy/Lancewood Thickets

Bullwaddy and Lancewood form either dense or open monospecific thickets as well as combine to form stands with a range of typically rainforest species per Liddle *et al.* (1994). These three examples are represented here by two communities based on the density of vegetation cover observable on both satellite and aerial photo images. Whilst the topography of the region is generally uniform this habitat favours higher ground. Soils are generally pale to dark brown loam to sandy loam soils. Typical species for the Bullwaddy/Lancewood thickets include *Macropteranthes kekwickii* (Bullwaddy)*, Acacia shirleyi* (Lancewood)*, Margitaria dubium-traceyi, Capparis lasiantha, Secamone elliptica, Galactia tenuifolia, Hyposestes floribunda, Ipomoea plebia, Cheilanthes nudiscula, Scleria brownii, Rosetellularia ascendens* and the annual and slender perennial grasses *Digitaria nematostachya, Digitaria ctenantha, Perotis rara and Enneapogon lindleyanus.*

2. Dense Bullwaddy/Lancewood Forest (4 Plots)

Mid high open forests dominated by either Bullwaddy, Lancewood or a mixture of the two. This habitat has little to no midstorey and a sparse understorey of predominantly grasses, ferns and annual herbs. Additional to the above mentioned species *Paspalidium rarum* is particular to the closed bullwaddy/lancewood community.

3. Open Bullwaddy/Lancewood Forest (5 Plots)

Mid high to tall open forest dominated by Bullwaddy, Lancewood or a mixture of the two, often with other savannah and rainforest species present in the canopy and mid layers. This community differs from closed forest with greater numbers of shrub and tree species, many of which are listed below for the *Corymbia dichromophloia* woodland.

4. Corymbia dichromophloia Woodland

This community contains two distinct sub-habitats that are not easily distinguished by the satellite imagery. These are mid high *Corymbia dichromophloia* open woodland over hummock grassland of *Triodia bitextura* and mid high *C. dichromophloia* open woodland over mixed perennial grasses. This community occurs on higher ground on sandy loam. The two sub-habitats differ in soil colour with the woodland over hummock grassland favouring pale brown to grey soils whilst the woodland over mixed perennial grasses occurs on red brown soils. Plants characteristic to the *C. dichromophloia* woodland community as a whole include *C. dichromophloia, Grevillea parallela, Terminalia canescens, Hibiscus sturtii, Secamone elliptica, Waltheria indica, Chrysopogon fallax, Sehima nervosum, Setaria surgens, Schizachyrium fragile* and *Zornia muriculata.*

The two sub-habitats differ in a number of ways most notably in species richness, composition and structure.

4.1 Open *Corymbia dichromophloia* Woodland over hummock grassland

Mid high *C. dichromophloia* open woodland over *Triodia bitextura* with a high number of annual grass and herb species. The presence of these annuals results in a higher biodiversity and lower overall cover of this sub-habitat. Some characteristic species differentiating the two *C. dichromophloia* woodlands include *Triodia bitextura, Panicum effusum, Spermacoce brachystema, Polygala longifolia* and *Murdannia graminea.*

4.2 Open *C. dichromophloia* Woodland over mixed perennial grasses

Mid high *C. dichromophloia* open woodland over mixed perennial grasses with a greater cover over all strata in particular the tall mid storey and ground layers. *Bauhinia cunninghamii* and *Carissa lanceolata* are characteristic of this sub-habitat and contribute to the mid storey. The presence of a number of perennial grasses that also occur in other woodland communities results in the high ground cover of this sub-habitat.

5. Marginal mixed woodland

Mid high woodland to open woodland with no defined dominant species. This community borders Bullwaddy and lancewood thickets in lower elevation areas and contains a mixture of species from neighbouring communities. It is unique in its combination of thicket, open woodland and seasonally waterlogged plant species. A few species only recorded in this habitat include the box *Eucalyptus chlorophylla*, a swamp grass *Eriachne obtusa* and the sundew, *Drosera indica*. It is likely that these species also occur elsewhere within the reserve. The soils recorded for this habitat also vary from the grey clays of lower elevations to brown sandy loam of higher elevation communities.

6. High Cover Woodland

Mid high open woodland of higher elevation areas. This community also comprises of plant species from neighbouring communities but differs from the marginal mixed woodlands by having more plants of thickets and *Corymbia dichromophloia* woodlands than seasonally inundated areas. Again it is the combination of species rather than any individual plant species that characterises this community. Soils recorded are grey brown loam to sandy loams.

7. Drainage Areas

Mid high to low isolated trees of *Eucalyptus microtheca* on predominantly heavy soil plains dominated by the perennial grasses *Eulalia aurea*, *Eriachne glauca*, *Dicanthium sericeum* subsp. *humilius* and *Iseilema macrantherum*. This community represents the lowest elevation areas. The drainage plains also contain the following plants typical of seasonally inundated clay soil areas *Ipomoea argillicola, Neptunia gracilis*, *Flemengia pauciflora*, *Rhynchospora subtenuifolia*, *Schizachyrium pseudeulalia* and *Scleria novae-hollandiae.* All these plants with the exception of the *Ipomoea argillicola* were exclusively found in this community.

APPENDIX TWO.

List of vertebrate species recorded from Bullwaddy Conservation Reserve.

Scientific name	Common name	NT Conservation Status
FROGS		
Cyclorana australis	Giant Frog	Data deficient
Cyclorana platycephala	Water-holding Frog	
Litoria bicolor	Northern Dwarf Tree Frog	
Litoria caerulea	Green Tree Frog	
Litoria rubella	Desert Tree Frog	
Litoria pallida	Pale Frog	
BIRDS		
Coturnix ypsilophora	Brown Quail	
Turnix maculosa	Red-backed Button-quail	
Turnix velox	Little Button-quail	
Geopelia striata	Peaceful Dove	
Geopelia cuneata	Diamond Dove	
Geopelia humeralis	Bar-shouldered Dove	
Phaps chalcoptera	Common Bronzewing	
Ocyphaps lophotes	Crested Pigeon	
Burhinus grallarius	Bush Stone-curlew	Near threatened
Ardeotis australis	Australian Bustard	Vulnerable
Accipiter fasciatus	Brown Goshawk	
Aquila audax	Wedge-tailed Eagle	
Haliastur sphenurus	Whistling Kite	
Milvus migrans	Black Kite	
Lophoictinia isura	Square-tailed Kite	
Hamirostra melanosternon	Black-breasted Buzzard	
Elanus axillaris	Black-shouldered Kite	
Elanus scriptus	Letter-winged Kite	
Falco berigora	Brown Falcon	
Ninox novaeseelandiae	Southern Boobook	
Psitteuteles versicolor	Varied Lorikeet	
Calyptorhynchus banksii	Red-tailed Black-Cockatoo	
Cacatua roseicapilla	Galah	
Nymphicus hollandicus	Cockatiel	
Aprosmictus erythropterus	Red-winged Parrot	
Melopsittacus undulatus	Budgerigar	
Podargus strigoides	Tawny Frogmouth	
Aegotheles cristatus	Australian Owlet-nightjar	
Eurystomus orientalis	Dollarbird	
Dacelo leachii	Blue-winged Kookaburra	
Todiramphus pyrrhopygia	Red-backed Kingfisher	
Merops ornatus	Rainbow Bee-eater	JAMBA
Eurostopodus argus	Spotted Nightjar	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	
Centropus phasianinus	Pheasant Coucal	
Rhipidura leucophrys	Willie Wagtail	
Myiagra inquieta	Restless Flycatcher	Bonn Convention
Microeca fascinans	Jacky Winter	
Melanodryas cucullata	Hooded Robin	

Scientific name	Common name	NT Conservation Status
Pachycephala rufiventris	Rufous Whistler	
Colluricincla harmonica	Grey Shrike-thrush	
Grallina cyanoleuca	Magpie-lark	
Oreoica gutturalis	Crested Bellbird	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	
Coracina papuensis	White-bellied Cuckoo-shrike	
Lalage sueurii	White-winged Triller	
Pomatostomus temporalis	Grey-crowned Babbler	
Gerygone olivacea	White-throated Gerygone	
Gerygone fusca	Western Gerygone	
Smicrornis brevirostris	Weebill	
Cincloramphus mathewsi	Rufous Songlark	
Malurus lamberti	Variegated Fairy-wren	
Malurus melanocephalus	Red-backed Fairy-wren	
Artamus superciliosus	White-browed Woodswallow	
Artamus leucorynchus	White-breasted Woodswallow	
Artamus personatus	Masked Woodswallow	
Artamus cinereus	Black-faced Woodswallow	
Artamus minor	Little Woodswallow	
Daphoenositta chrysoptera	Varied Sittella	
Climacteris melanura	Black-tailed Treecreeper	
Dicaeum hirundinaceum	Mistletoebird	
Pardalotus rubricatus	Red-browed Pardalote	
Certhionyx pectoralis	Banded Honeyeater	
Lichmera indistincta	Brown Honeyeater	
Conopophila rufogularis	Rufous-throated Honeyeater	
Lichenostomus virescens	Singing Honeyeater	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	
Philemon argenticeps	Silver-crowned Friarbird	
Philemon citreogularis	Little Friarbird	
Taeniopygia bichenovii	Double-barred Finch	
Heteromunia pectoralis	Pictorella Mannikin	
Poephila acuticauda	Long-tailed Finch	
Struthidea cinerea	Apostlebird	
Chlamydera nuchalis	Great Bowerbird	
Corvus orru	Torresian Crow	
Cracticus nigrogularis	Pied Butcherbird	
Cracticus torquatus	Grey Butcherbird	
Pardalotus striatus	Striated Pardalote	
MAMMALS		
Lagorchestes conspicillatus leichardtii	Spectacled Hare-wallaby	Near threatened
Onychogalea unguifera	Northern Nailtail Wallaby	Near threatened
Macropus agilis	Agile Wallaby	
Macropus robustus	Euro	
Pteropus scapulatus	Little Red Flying-fox	
Nyctophilus geoffroyi	Lesser Long-eared Bat	
Chalinolobus nigrogriseus	Hoary Bat	
Leggadina lakedownensis	Lakeland Downs Mouse	
Pseudomys delicatulus	Delicate Mouse	
Pseudomys nanus	Western Chestnut Mouse	
Canis familiaris	Dingo	

Scientific name	Common name	NT Conservation Status
REPTILES		
Diplodactylus ciliaris	Spiny-tailed Gecko	
Diplodactylus conspicillatus	Fat-tailed Gecko	
Diplodactylus stenodactylus	Crowned Gecko	
Gehyra australis	Northern Dtella	
Heteronotia binoei	Bynoe's Gecko	
Oedura rhombifer	Zigzag Velvet Gecko	
Rhynchoedura ornata	Beaked Gecko	
Chlamydosaurus kingii	Frilled Lizard	
Diporiphora bilineata	Two-lined Dragon	
Diporiphora magna	Yellow Two-lined Dragon	
Lophognathus gilberti	Gilbert's Dragon	
Varanus gouldii	Sand Goanna	
Varanus tristis	Black tailed Goanna	Data deficient
Carlia amax	Two-spined Rainbow Skink	
Cryptoblepharus carnabyi	Carnaby's Snake-eyed Skink	
Ctenotus inornatus	Plain Ctenotus	
Ctenotus militaris	Military Ctenotus	
Ctenotus pantherinus	Leopard Ctenotus	
Ctenotus pulchellus	Pretty Ctenotus	
Ctenotus robustus	Robust Ctenotus	
Ctenotus schomburgkii	Schomburgk's Ctenotus	
Ctenotus spaldingi	Spalding's Ctenotus	
Egernia striata	Striated Egernia	
Lerista bipes	Two-toed Lerista	
Lerista griffini	Griffin's Lerista	
Lerista orientalis	Eastern Lerista	
Menetia greyii	Grey's Menetia	
Menetia maini	Main's Menetia	
Morethia storri	Storr's Snake-eyed Skink	
Glaphyromorphus darwiniensis	Darwin Skink	
Glaphyromorphus isolepis	Smooth-scaled Skink	
Ramphotyphlops unguirostris	Blind Snake	
Liasis childreni	Children's Python	
INTRODUCED SPECIES		
Bufo marinus	Cane toad	
Bos taurus	Cattle	
Equus caballus	Horse	
Felis catus	Cat	
Equus asinus	Donkey	

Source: Bullwaddy Conservation Reserve survey (Fisher, unpublished data);
Lancewood fauna survey in Woinarski and Fisher (1995);
Biological Record Scheme (PWCNT database, 2003);
Specimens held by the NT Museum (Darwin, 2003).

APPENDIX THREE.

Flora recorded from Bullwaddy Conservation Reserve

Family	Species	NT Conservation Status
ACANTHACEAE	*Brunoniella australis*	
	Hypoestes floribunda	
	Rostellularia adscendens	
ADIANTACEAE	*Cheilanthes nudiuscula*	
	Cheilanthes tenuifolia	
AMARANTHACEAE	*Gomphrena canescens*	
	Ptilotus exaltatus	
	Ptilotus fusiformis	
	Ptilotus polystachyus	
APOCYNACEAE	*Carissa lanceolata*	
ASCLEPIADACEAE	*Marsdenia australis*	
	Marsdenia geminata	
	Marsdenia viridiflora	
	Sarcostemma viminale	
	Secamone elliptica	
ASTERACEAE	*Blumea saxatilis*	
	Centipeda nidiformis	Data deficient
	Pterocaulon serrulatum	
BIGNONIACEAE	*Dolichandrone heterophylla*	
BIXACEAE	*Cochlospermum gregorii*	
BORAGINACEAE	*Ehretia saligna*	
	Heliotropium sp.	
BRUNONIACEAE	*Brunonia australis*	
CAESALPINIACEAE	*Bauhinia cunninghamii*	
	Chamaecrista absus	
	Chamaecrista nomame	
	Erythrophleum chlorostachys	
	Senna costata	
CAPPARACEAE	*Capparis lasiantha*	
	Capparis umbonata	
	Cleome viscosa	
CARYOPHYLLACEAE	*Polycarpaea breviflora*	
	Polycarpaea corymbosa	
CELASTRACEAE	*Denhamia obscura*	
	Maytenus cunninghamii	
COMBRETACEAE	*Macropteranthes kekwickii*	
	Terminalia canescens	
	Terminalia volucris	
COMMELINACEAE	*Murdannia graminea*	
CONVOLVULACEAE	*Bonamia brevifolia*	
	Bonamia media	
	Evolvulus alsinoides	
	Ipomoea argillicola	Near threatened
	Ipomoea eriocarpa	
	Ipomoea incisa	
	Ipomoea nil	
	Ipomoea plebeia	
	Ipomoea polymorpha	
	Jacquemontia paniculata	
	Xenostegia tridentata	
CUCURBITACEAE	*Cucumis melo*	
CYPERACEAE	*Bulbostylis barbata*	
	Fimbristylis dichotoma	
	Fimbristylis microcarya	
	Rhynchospora subtenuifolia	
	Scleria brownii	
	Scleria novae-hollandiae	
DROSERACEAE	*Drosera indica*	
EBENACEAE	*Diospyros cordifolia*	
	Diospyros humilis	

Family	Species	NT Conservation Status
ERYTHROXYLACEAE	*Erythroxylum ellipticum*	
EUPHORBIACEAE	*Breynia cernua*	
	Euphorbia biconvexa	
	Euphorbia comans	
	Flueggea virosa	
	Margaritaria dubium-traceyi	
	Petalostigma pubescens	
	Phyllanthus carpentariae	
	Phyllanthus exilis	
	Phyllanthus fuernrohrii	
	Phyllanthus hebecarpus	
	Phyllanthus maderaspatensis	
	Phyllanthus virgatus	
	Sauropus trachyspermus	
FABACEAE	*Abrus precatorius*	
	Crotalaria brevis	
	Crotalaria medicaginea	
	Crotalaria montana	
	Cullen plumosum	
	Desmodium brachypodum	
	Desmodium campylocaulon	
	Flemingia pauciflora	
	Galactia muelleri	
	Galactia tenuiflora	
	Glycine tomentella	
	Indigofera colutea	
	Indigofera linifolia	
	Indigofera trita	
	Rhynchosia minima	
	Sesbania sp.	
	Tephrosia brachyodon	
	Tephrosia leptoclada	
	Tephrosia simplicifolia	
	Uraria lagopodioides	
	Vigna lanceolata ssp. filiformis	
	Vigna lanceolata ssp. lanceolata	
	Zornia muriculata	
GOODENIACEAE	*Goodenia hispida*	
	Goodenia leiosperma	
	Goodenia viscidula	
LAURACEAE	*Cassytha filiformis*	
LILIACEAE	*Iphigenia indica*	
LOGANIACEAE	*Mitrasacme micrantha*	
MALVACEAE	*Abutilon andrewsianum*	
MALVACEAE	*Abutilon otocarpum*	
	Gossypium australe	
	Herissantia crispa	
	Hibiscus meraukensis	
	Hibiscus pentaphyllus	
	Hibiscus sturtii	
	Sida brachypoda	
	Sida D40121 Mt Bundey	
	Sida fibulifera	
	Sida rohlenae	
	Sida subspicata	
MENISPERMACEAE	*Tinospora smilacina*	
MIMOSACEAE	*Acacia difficilis*	
	Acacia galioides	
	Acacia gonoclada	
	Acacia hammondii	
	Acacia lysiphloia	
	Acacia oncinocarpa	
	Acacia shirleyi	
	Acacia wickhamii	
	Neptunia gracilis	

Family	Species	NT Conservation Status
MYRTACEAE	*Calytrix exstipulata*	
	Corymbia dichromophloia	
	Corymbia ferruginea	
	Corymbia flavescens	
	Eucalyptus camaldulensis	
	Eucalyptus chlorophylla	
	Eucalyptus distans	
	Eucalyptus leucophloia	
	Eucalyptus microtheca	
	Lophostemon grandiflorus	
OLEACEAE	*Jasminum molle*	
POACEAE	*Alloteropsis semialata*	
	Aristida calycina	
	Aristida holathera	
	Aristida hygrometrica	
	Aristida inaequiglumis	
	Aristida latifolia	
	Aristida pruinosa	
	Aristida queenslandica	
	Brachyachne tenella	
	Chrysopogon fallax	
	Cymbopogon bombycinus	
	Dichanthium sericeum	
	Digitaria brownii	
	Digitaria ctenantha	
	Digitaria gibbosa	
	Digitaria nematostachya	
	Enneapogon lindleyanus	
	Enneapogon polyphyllus	
	Enneapogon purpurascens	
	Eragrostis cumingii	
	Eragrostis fallax	
	Eriachne armittii	
POACEAE	*Eriachne ciliata*	
	Eriachne glauca	
	Eriachne nodosa	
	Eriachne obtusa	
	Eulalia aurea	
	Heteropogon contortus	
	Iseilema macratherum	
	Lepturus xerophilus	Data deficient
	Mnesithea formosa	
	Panicum decompositum	
	Panicum effusum	
	Panicum latzii	Data deficient
	Panicum mindanaense	
	Panicum trichoides	
	Paspalidium gracile	Data deficient
	Paspalidium rarum	
	Perotis rara	
	Pseudoraphis spinescens	
	Schizachyrium fragile	
	Schizachyrium pseudeulalia	
	Sehima nervosum	
	Setaria apiculata	
	Setaria surgens	
	Sorghum intrans	
	Sorghum matarankense	
	Sorghum plumosum	
	Sorghum timorense	
	Sporobolus australasicus	
	Themeda triandra	
	Triodia bitextura	
	Urochloa holosericea	
	Urochloa pubigera	

Family	Species	NT Conservation Status
	Whiteochloa airoides	
	Whiteochloa capillipes	
	Yakirra majuscula	
	Yakirra muelleri	Data deficient
POLYGALACEAE	*Polygala D25064 Mudginberri*	
	Polygala longifolia	
PORTULACACEAE	*Portulaca bicolor*	
PROTEACEAE	*Grevillea parallela*	
	Grevillea pteridifolia	
RHAMNACEAE	*Alphitonia excelsa*	
	Ventilago viminalis	
RUBIACEAE	*Gardenia ewartii*	
	Oldenlandia mitrasacmoides	
	Spermacoce brachystema	
	Spermacoce stenophylla	
SANTALACEAE	*Santalum lanceolatum*	
SAPINDACEAE	*Atalaya hemiglauca*	
	Distichostemon hispidulus	
	Dodonaea lanceolata	
	Dodonaea physocarpa	
	Dodonaea stenophylla	
SCROPHULARIACEAE	*Buchnera linearis*	
	Stemodia lythrifolia	
SOLANACEAE	*Solanum echinatum*	
	Solanum ferocissimum	
STERCULIACEAE	*Brachychiton diversifolius*	
	Brachychiton paradoxus	
	Melhania oblongifolia	
	Waltheria indica	
THYMELAEACEAE	*Thecanthes punicea*	
TILIACEAE	*Corchorus aestuans*	
	Corchorus sidoides	
	Corchorus tridens	
	Grewia breviflora	
	Grewia retusifolia	
VERBENACEAE	*Premna acuminata*	
VIOLACEAE	*Hybanthus enneaspermus*	
VITACEAE	*Cayratia trifolia*	
WEED SPECIES		
ASTERACEAE	*Bidens bipinnata*	
	Bidens pilosa	
FABACEAE	Stylosanthes hamata	
POACEAE	Eragrostis amabilis	
	Urochloa mosambicensis	
	Cenchrus ciliaris	
STERCULIACEAE	*Melochia pyramidata*	
LAMIACEAE	*Hyptis suaveolens*	

Source: Bullwaddy Conservation Reserve survey (Fisher, unpublished data)