PROFILE FOR MANAGEMENT OF THE HABITATS AND RELATED ECOLOGICAL AND CULTURAL RESOURCE VALUES OF BADU ISLAND

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EXECUTIVE SUMMARY

Badu Island, which occupies a total area of 10 467ha, is the second largest island in the Near Western Island Group and along with the other islands of Mabuiag and Mua, is formed on continental igneous basement rock. The island is characterised by numerous rocky knolls with Mt. Mulgrave forming the highest peak at 198m.

A total of 51 vegetation communities, within 20 broad vegetation groups and 32 regional ecosystems are recognised across the island, representing approximately 42% of regional ecosystems recorded across the broader Torres Strait Island landscape.

There are currently 597 plant species recorded on the island but this number is likely to fluctuate with identifications from recent surveys and future systematic surveys. This is made up of 18 ferns, 1 cycad, 1 conifer and 577 flowering plants. The flora comprises 560 (95%) native species, with 37 (5%) naturalised species. One hundred and seventeen families and 390 genera are represented. The Badu Island flora represents approximately 45% of the known flora for the Torres Strait Islands.

The 5% of naturalised species listed excludes plants of town gardens however incorporates many species which may occur on the disturbed margins of native vegetation. This figure compares with 6.7% for Iama, 30% for Boigu, 15% for Torres Strait Islands (Stanton *et al.* 2009), 7.4% for Cape York Peninsula (Neldner and Clarkson 2005) and 9.8% for Queensland (Bostock and Holland 2010).

Nine species are considered threatened according to legislation with one Endangered, four Vulnerable, and four Near-Threatened species recorded on the island. One species (*Cycad badensis*) is endemic to Torres Strait and the islands of Badu and Mua. An additional 24 species are regionally significant. One species tentatively identified as *Gnetum gnemon* (Gnetaceae) is a new record for Australia.

As for the majority of Torres Strait Islands there is a considerable lack of systematic survey of fauna habitats on the island. A desktop review of reports and databases identified 184 fauna species that have been reported on Badu Island including 8 frogs, 29 reptile, 137 bird and 10 mammal species. This can be compared with the 384 terrestrial fauna species that have been reported for the broader Torres Strait island group. Eight conservation significant species are reliably reported for the island with an additional 11 species whose occurrence is considered likely or possible on Badu Island based on knowledge of habitat suitability and regional distribution. There are also an additional 45 'Migratory' species considered to have significance at federal level that are reported or predicted to occur on the island.

Within the 20 broad vegetation groups (or management units) identified on the island, a number of issues for future management are regularly identified as necessary for the future biodiversity maintenance and ecological health of the island. These are, but not limited to:

- Maintenance of traditional burning regimes or specific requirement for protection from fire.
- Monitoring of landscapes threatened by changing burning regimes.
- Monitoring for the introduction of continued spread of a number of exotic species, both fauna and flora, throughout the landscape.
- A requirement for further survey work to document the poorly known faunal assemblage on the island.
- Continued collection of floristic information, specifically those plants that are important as a traditional resource and species significant to biodiversity.
- Further survey and documentation of the complex and diverse cultural landscape on the island.

It is important that any future surveys on Badu be undertaken as collaborative research with the Mura Badhulgau and to include study of traditional ecological knowledge and ethnotaxonomy. Furthermore all mapping and assessment work must comply with any research protocols and must be approved by the Mura Badhulgau PBC, and involve and be guided by the Land and Sea Rangers.

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1.0 Introduction

Badu Island represents one of seven islands within the broader Torres Strait Island group selected for the development of an island specific biodiversity management profile. The profile aims to document the biodiversity features, landscape processes, and cultural values (from both a landscape and site specific perspective) that are intrinsic to the island and develop management actions to ensure preservation or enhancement of those features. In the process of developing this plan, those sites and landscape features of specific cultural importance to the Badu (Badhulgau) people are recognised and the recommendations contained within are pertinent to the management of values of importance from both a traditional cultural and western scientific perspective. It is intended that the specific management recommendations detailed within this management profile will be directly incorporated into the developing 'Badu Island Working on Country Plan' for specific action.

1.1 Cultural Setting

The population of Badu at the 2006 census consists of 706 indigenous and110 non-indigenous people. Land tenure is DOGIT (Deed of Grant in Trust) with Native Title determined on 14/12/2004. The Registered Native Title Body Corporate[1] (RNTBC or PBC in shortened form) is the Mura Badhulgau (Torres Strait Islanders) Corporation who hold the title of the land on behalf of the traditional owners.The Badhulgau, the people of Badu, speak Kala Lagaw Ya (dialect of Western-Central Torres Strait Language)

1.2 Geographic Setting

Badu Island is the second largest island in the Near Western Island Group and along with the other islands of Mabuiag and Mua, is formed on continental igneous basement rock. The island, with an area of 10 467 ha, is centred 142° 09' E 10° 07' S some 46km NNE of Thursday Island, and is characterised by numerous rocky knolls with Mt. Mulgrave forming the highest peak at 198m. The Badu Island recording station is the wettest in the Torres Strait Island group with a mean annual rainfall of 1 983mm (BOM 2008a) compared to Dauan, the driest recording station at 1 082mm (BOM 2008c). The island is well watered with a number of permanent to semi-permanently flowing streams and access to abundant groundwater resources from which the islands potable water is sourced. The main settlement is located on the south-eastern portion of the island facing directly toward Mua Island, although a number of seasonal camps and residences are located on the islands western coast.

1.3 Geological Context

The coarse grained Badu Granite dominates the Badu Island landscape, forming the islands rugged interior of low rocky hillocks with massive granite boulders. The Badu Granite basement is overlain on its margins by younger unconsolidated deposits including alluvial deposits and extensive dune fields of varying age and geomorphic expression. Badu Island hosts the most extensive system of

[1] Registered Native Title Body Corporate – the organisation that is recognised as holding native title in trust for the benefit of the native title holders. It contacts native title holders and administers business between them and outsiders, such as government, industry and developers.

sand dunes of any island in the broader Torres Strait region. This includes older deeply leached and degraded dune systems, most likely of Pleistocene age (>11 000 yrs), that attenuate well into the islands interior in deeper valley enclaves; recent (Holocene Age) coastal foredune systems; and a broad aeolian sand sheet on the islands south coast that has been variably stabilised with vegetation. The latter system is represented by a gently sloping broad sand ridge that tapers to a near uniform sand sheet on the landward margins of the dune field, terminating against granite footslopes. Field evidence in this location indicates that dune sand has pushed over the top of low granite saddles and headlands in some locations, being strong evidence that the broad system is a relict feature from a period of transgressive dune building. The majority of the system is stabilised with vegetation cover ranging from sedgeland to eucalypt woodland blanketing gently undulating ridges. In the area to the south-west of the Badu township (in the vicinity of the current water bore field), a large portion of the dune field is unstable with the dominant land surface formed by exposed coarse silica sand demonstrating a range of transient morphologies which include shallow deflation basins, blowouts and low depositional mounds.

Due to the coarse nature of the granitic basement lithology, alluvial deposition typically comprises coarse granitic sand, forming deep sandy flats and terraces at points of alluvial discharge. Finer silty deposits typically occur on the outer margins of alluvial plains forming poorly drained flats hosting swamp tolerant vegetation types. Alluvial landforms are generally limited in extent with the best development to the immediate north of the Badu settlement. Extensive deposits of estuarine sediment are also found on many of the larger island embayments.

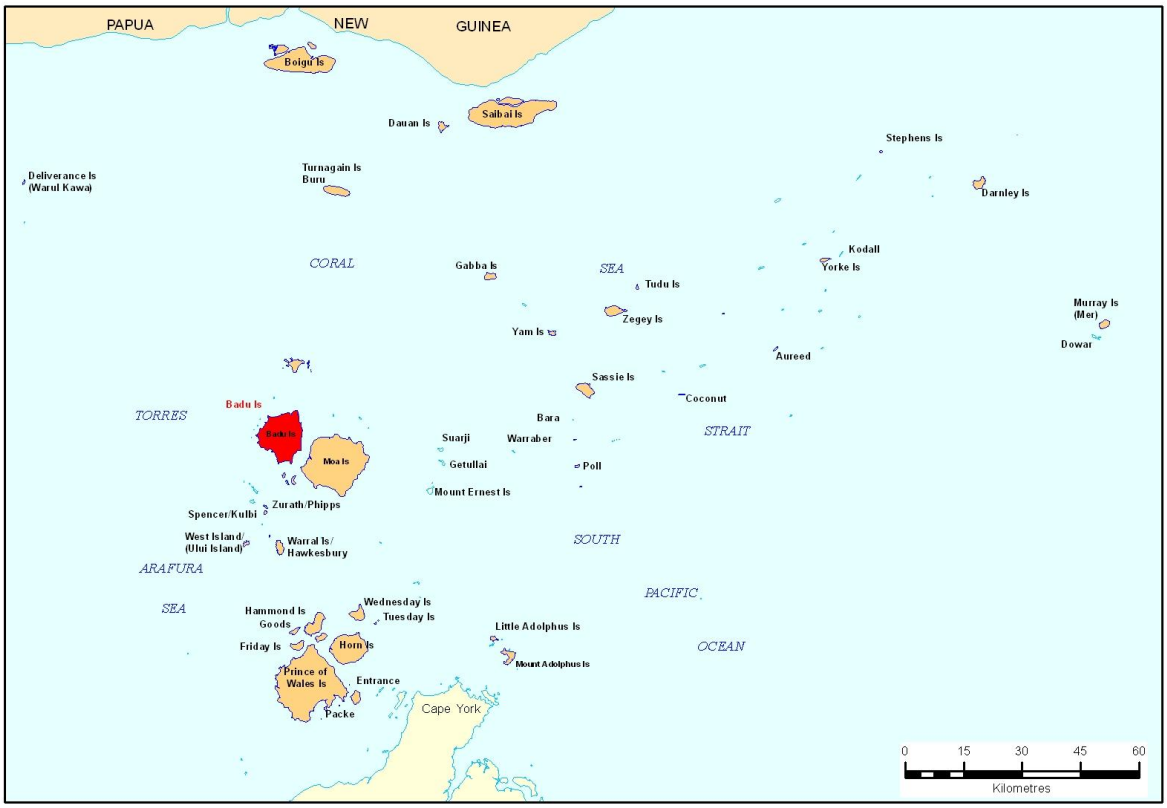


Figure 1. Location of Badu Island

2.0 Methods

This document provides a compendium of information that has been compiled from a range of sources, and supplemented with information gathered from consultation with both technical experts and the Badhulgau. Numerous surveys relevant to flora, fauna and cultural heritage matters have contributed to this document and these are referenced throughout the body of the report. In short, steps taken during preparation of this document are:

1. Compilation of desktop resources which includes but is not limited to Stanton *et al.* (2009), Queensland Herbarium's Herbrecs Database, Queensland Museum fauna record extracts, Birds Australia database extract, Wild-Net database extracts, Conics Land Use Management Plan for Badu Island (Conics 2009) and various technical papers relating to both flora and fauna (see references section).
2. Presentation of this information at a workshop in Cairns, where biodiversity information was presented to a range of technical experts for discussion and further input. A list of workshop attendees is provided in **Appendix A.**
3. An island-based consultation with Badu Island Rangers on Badu Island (8-10th November, 2010) including a consultation session with the broader island community.

3.0 Aims and Objectives

The aim of this document is to compile and annotate existing information relating to:

1. The extent, values and condition of island habitats and the plants and animals which occur in them.
2. Island-scale ecological processes, that is, the environmental and human factors which are influencing habitats, plants and animals.
3. The cultural interactions with these processes, that is, the ways that Badu people interact with the natural environment including identification of values, and
4. The establishment of management actions. Management actions are intended to be used by island rangers and managers to assist in updating Land and Sea Ranger Work Plans to facilitate effective management of the island's ecological and cultural values.

Owing to the long term occupancy of the islands (>4 000yrs) (McNiven & Wright 2008), the apparent stability of the majority of landscapes, and general lack of detailed ecological information pertaining to these landscapes, it is assumed that maintaining the existing landscape condition and process (in all but a few cases) is the safest management option. Habitat maintenance has therefore been a primary consideration during the compilation of this document. The specific actions that are adopted and the direction of island-scale ecological management will however be ultimately up to the discretion of the Mura Badhulgau Rangers and the Badhulgau, who are represented by their registered native title body corporate, the Mura Badhulgau (Torres Strait Islanders) Corporation.

4.0 Legislative and Policy Considerations

Biodiversity (plants, animals and their habitats) is regulated at state and national levels by a range of legislative mechanisms which classify animal species, plant species and habitats according to their rarity, population size, distribution and threats. The legislative classification is generally used as a way to assign significance to a particular species or ecological value. If an animal, plant or vegetation type is listed on any of the Australian or Queensland government legislation, it is subject to rules which protect it from being destroyed or harmed. For example, if a certain orchid species is listed on the legislation it would mean that the orchid could not be collected from the bush and sold at a nursery without the necessary authorisation and permits. Similarly, if an animal such as a bat species or bat colony, which was listed as threatened on the legislation, lived in a rock shelter where a housing development was proposed, then detailed studies would be required to determine how the bats would be affected by the development. A description of relevant components of the major legislation mechanisms that require consideration for Badu is provided briefly below.

Nature Conservation Act 1992: *The Nature Conservation Act* (NC Act) is a legislative mechanism of the Queensland Government that is regulated by the Department of Environment and Heritage Protection (EHP). The *Nature Conservation (Wildlife) Regulation* 2006 is subordinate to the NC Act and defines five classes that are:

- Extinct in the Wild.
- Endangered.
- Vulnerable.
- Near-Threatened.
- Least Concern.

These classes collectively relate to native species and are protected wildlife (plants and animals).

Vegetation Management Act: The *Vegetation Management Act 1999* (VMA) is a state regulated planning initiative that underpins the regional management of vegetation in Queensland. Under the VMA, conservation significance to particular vegetation groups termed regional ecosystems (REs) is assigned on a consistent state-wide basis. The classification of regional ecosystems is based on a hierarchical system with a three-part code defining bioregion, followed by land zone, and then vegetation. Thirteen bioregions are classified in Queensland with the Torres Strait Islands being a sub-province of the broader Cape York Peninsula bioregion.

Land zones are geological and geomorphic categories that describe the major geologies and landforms of Queensland. The system is based primarily on geology, with geologic age considered an important determinant. The classification of land zone generally utilises available geological information (Neldner *et al*. 2005) although field inspection is utilised as a supplementary measure where geological mapping is inadequate.

The status of REs is based on their pre-clearing and remnant extent, and is gazetted under the VMA and listed in the Regional Ecosystem Description Database (REDD) maintained by EHP. The Vegetation Management Status (VMS) of a regional ecosystem is described in accordance with the following:

Endangered regional ecosystem: a regional ecosystem that is prescribed under a regulation and has either:

- less than 10% of its pre-clearing extent remaining; or
- 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 hectares (ha).

Of Concern regional ecosystem: means a regional ecosystem that is prescribed under a regulation and has either:

- 10% to 30% of its pre-clearing extent remaining; or
- more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10 000 ha.

Least Concern regional ecosystem: means a regional ecosystem that is prescribed under a regulation and has more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10 000 ha.

Hence, the majority of vegetation scheduled under the VMA as 'of concern' on Badu (e.g. welchiodendron dominant RE3.12.4) is classified as such because on a regional level (Cape York Peninsula) more than 30% of the original habitat extent remains although the total area of the habitat is less than 10 000ha. The regional ecosystem mapping available for Badu provides accurate information on the legislative significance of vegetation on the island offering an information planning resource for the Badu community, the TSIRC and the TSRA. For example, if a radio tower was proposed for a mountain top which supported a regional ecosystem (vegetation type) that was 'Endangered' or 'Of concern', then clearing of this vegetation without authorisation is in breach of the VMA. Liaison with regulators must be undertaken to determine the conditions that must be met for clearing to be authorised. DERM also assigns a Biodiversity Status (BS) to REs, a non-statutory indicator of a regional ecosystems susceptibility to elements of degradation.

Land Protection (Pest and Stock Route Management) Act 2002: The *Land Protection (Pest and Stock Route Management) Act 2002* (LPA) provides a framework and powers for improved management of weeds, pest animals and the stock route network. The Act provides for designation of threat classes to species of plant and animal considered not native to Queensland (exotic or invasive) and which degrade natural resources, threaten conservation of biodiversity, threaten remnant vegetation, reduce rural production and interfere with human health and recreational activities. Exotic species that pose a threat are declared under one of the following three categories:

- Class 1 Pest: a pest that has potential to become a very serious pest in Queensland in the future.
- Class 2 Pest: a pest that has already spread over substantial areas of Queensland, but its impact is considered sufficiently serious to warrant control.
- Class 3 Pest: a pest that is commonly established in parts of Queensland but its control by landholders is not warranted unless the plant is impacting, or has potential to impact on a nearby environmentally sensitive area (ESA).

For example, if a Class 2 weed such as Gamba grass (*Andropogon gayanus*) was found on Badu, there is a requirement under the Act for landowners to take reasonable steps to control and manage the weed.

The Back on Track Species Prioritisation Framework: The 'Back on Track (BOT) species prioritisation framework' is a non-legislative Queensland Government initiative that prioritises Queensland's native species as a means to guide their conservation, management and recovery. The assessment method utilises multiple criteria allowing identification of those species that are threatened and facing population declines, and those species that have a high potential for recovery. The BOT methodology classifies four priority levels for action to remediate declining Queensland wildlife being 'critical priority (CR)', 'high priority (H)', 'medium priority (M)' and 'low priority (L)'.

***The Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):** The EPBC Act, an initiative of the Australian Government, provides recognition of four classes of wildlife and habitat being those which are:

- Extinct in the Wild.
- Critically Endangered.
- Endangered.
- Vulnerable.

Plant and animal species and habitats scheduled under these categories are referred to collectively as 'Threatened Wildlife'. The EPBC Act also provides for protection of those species which are considered 'Migratory' under international conventions which include:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).
- China-Australia Migratory Bird Agreement (CAMBA).
- Japan-Australia Migratory Bird Agreement (JAMBA), and
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Interference or destruction of plants, animals or areas of habitat for species listed as threatened under the EPBC Act requires specific authorisation from the regulator who is likely to provide conditions under which the interference can take place. Interference (such as removal of protected orchid species) without authorisation is in breach of the EPBC Act.

5.0 Vegetation

As described in the following sections, the classification of vegetation includes both nomenclature of individual species and the classification of groups of plants, the latter often forming unique assemblages that can be consistently recognised across islands (e.g. Badu), island groups (Near Western Torres Strait Islands) or bioregions (Cape York Peninsula Bioregion).

5.1 Vegetation Groups and Mapping

The hierarchy of vegetation classification used in the Torres Strait Islands is described below with relationships illustrated in **Figure 2.** At the highest level, the classification of plant assemblages is based on vegetation structure considering the dominant life form (tree or grass), height of the tallest strata, and canopy closure. The structural classification used by the Queensland Government is included within **Appendix B**. Vegetation structural groupings (i.e shrubland etc) are used to define ***Broad Vegetation Groups*** (BVGs) which provide the broadest level of vegetation classification recognised in vegetation mapping produced for the Torres Strait Islands (Stanton *et al.* 2009). BVGs may be an amalgamation of a number of more specific plant groupings known as ***Vegetation Communities.*** Vegetation communities (VCs) can be described as 'a unit of vegetation that demonstrates similarities in both structure and floristic composition'. VCs are useful to describe fine scale variation in floristic composition that may occur due to the consistent dominance of a particular plant species or suite of plant species. REs as described in **Section 4** comprise a group of vegetation communities, although unlike BVGs, consider regional distribution and geology within the classification. REs must be considered due to their legislative implications although in this document, for specific habitat management purposes, BVGs provide a more readily usable habitat management grouping. As such they have been used to define habitat management units within this document.

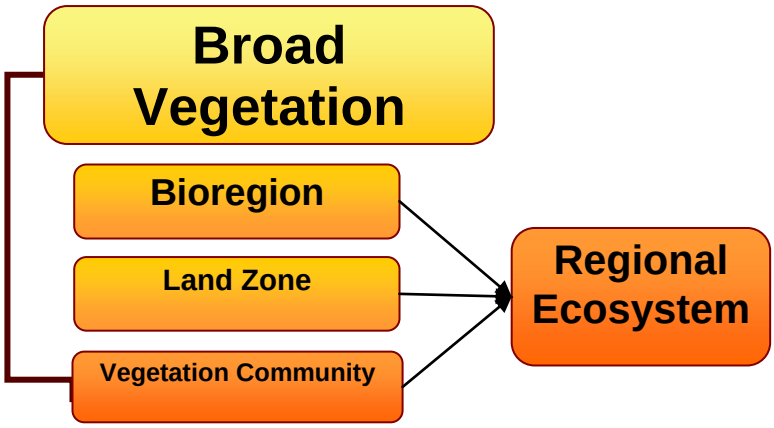


Figure 2. Diagrammatic illustration of the hierarchy and relationship between components of the vegetation classification system used in the Torres Strait Island vegetation mapping study (Stanton *et al*. 2009).

Vegetation Classification on Badu Island: For management purposes, the islands vegetation is classified into broad vegetation groups (BVGs), herein referred to as habitats, as derived from Stanton

et al. (2009). The spatial extent and relative contribution of these groupings is provided in **Table 1**, descriptions of component vegetation communities and associated regional ecosystems provided in **Table 2.** Further characterisation of habitat types is provided in the following text.

Table 1. Broad vegetation groups and relative contributions to Badu Island vegetation

Broad Vegetation Group/ Habitat**	Component Vegetation Communities**	Area	Contribution
Evergreen/semi-evergreen vine forest and thicket	1d	0.6	<0.05
Deciduous / Semi-deciduous vine forest and vine thicket	2r, 2u	96	0.9
Swamp and riparian forest and forest complexes	3b, 3h, 3c, 3f, 3g, 3e,	195	1.9
Welchiodendron dominant closed to open forests and woodlands	4a	1379	13.2
Eucalypt and Corymbia dominant open forests and woodlands	5i, 5l, 5m, 5n, 5o, 5p, 5u, 5v, 5w, 5x	3336	31.9
Acacia dominant open forests and woodlands	6c, 6g	148	1.4
Melaleuca dominant open forests	7b, 7d, 7f, 7g	109	1.1
Lophostemon dominant woodland and open forest	8a, 8b	20	0.2
Pandanus dominant woodland and shrubland	11a	35	0.3
Melaleuca dominant shrublands and woodlands	13a, 13f	1175	11.3
Shrublands and shrubland complexes	14aa, 14c, 14n, 14u, 14s, 14z	2008	19.2
Coastal dune complexes	16j, 16k	77	0.8
Grasslands and grassland complexes	17c, 17d, 17f, 17i	96	2.9
Rock pavement and pavement complexes	18a, 18c, 18d	647	6.2
Wetland complexes and mosaics	20b	4.3	0.05
Samphire grasslands	26a, 26b	45	0.5
Samphire herblands and shrublands and salt pans	25a	3	<0.05
Mangrove forest, woodland and shrubland complexes	24a	677	6.5

Broad Vegetation Group/ Habitat**	Component Vegetation Communities**	Area	Contribution
Regrowth	RE (Pre disturbance 13a)	36	0.3
Cleared Areas	Cl	178	1.7
Total		**10265**	**100**

Table 2. Descriptions of component vegetation communities and association with regional ecosystems currently recognised on Badu Island (from Stanton *et al*. 2009).

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
1d	Mesophyll/notophyll vine forest + *Endiandra glauca* + *Acacia polystachya* + *Syzygium bungadinnia* + *Canarium australianum* + *Dysoxylum oppositifolium.*	Rocky slopes and gully lines on Granite	3.12.4ab	OC	OC
2r	Semi-deciduous vine forest + *Sterculia quadrifida* + *Canarium australianum* + *Cleistanthus peninsularis* + *Terminalia subacroptera* + *Antiaris toxicaria* var. *macrophylla* +/- *Paraserianthes toona* + *Alstonia actinophylla* +/- *Zanthoxylum parviflorum* +/- *Maniltoa lenticellata* var. *lenticellata.*	Granite boulders and rocky slopes	3.12.35e	OC	OC
2u	Semi-deciduous vine forest + *Manilkara kauki* + *Terminalia* spp. + *Sterculia quadrifida* + *Premna serratifolia* + *Acacia crassicarpa* + *Drypetes deplanchei* + *Millettia pinnata.*	Coastal dunes (aeolian and parallel ridges)	3.2.2b	LC	OC
3b	Medium to tall *Melaleuca leucadendra* +/- *Melaleuca argentea* + *Syzygium forte* subsp. *forte* + *Dillenia alata* open forest.	Alluvial drainage channels	3.3.10	LC	NCAP
3h	*Syzygium angophoroides* + *Lophostemon suaveolens* + *Maranthes corymbosa* +/- *Syzygium forte* subsp. *forte* +/- *Podocarpus grayae* swamp forest.	Broad drainage channels on coarse alluvial sand	3.3.9	LC	NCAP
3c	Tall *Melaleuca dealbata* / *Melaleuca leucadendra* open forest/*Acacia* sp. open forest / Mesophyll vine forest complex.	Broad drainage channels on coarse alluvial sand	3.3.6	OC	OC
3f	*Lophostemon suaveolens* + *Melaleuca leucadendra* + *Corymbia clarksoniana* open forest.	Swampy Alluvial Plains	3.3.9	LC	NCAP
3g	Tall *Melaleuca dealbata* + *Acacia crassicarpa* + *Acmena hemilampra* subsp. *hemilampra* + *Deplanchea tetraphylla* + *Syzygium forte* subsp. *forte* swamp forest complex.	Alluvial channels in sand dune deposits	3.3.10d	LC	NCAP
3e	*Melaleuca quinquenervia* + *Pandanus sp.* +/- *Deplanchea tetraphylla* swamp forest/ *Lophostemon suaveolens* +/- *Asteromyrtus brassii* +/- *Acacia crassicarpa* +/- *Deplanchea tetraphylla* open swamp forest complex (7d/8b -50/50).	Dune Swales	3.2.4c	OC	NCAP
4a	*Welchiodendron longivalve* + *Acacia polystachya* +/- *Terminalia*	Rocky hillslopes on granitoid rocks.	3.12.4a	OC	NCAP

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	subacroptera +/- Canarium australianum +/- Bombax ceiba var. *leiocarpum* open to closed forest.				
5i	*Corymbia clarksoniana +/- Corymbia novoguinensis +/- Livistona muelleri* woodland and open forest.	Sandy alluvial deposits and stabilised sand dunes	3.3.22 3.2.7	LC	NCAP
5l	*Corymbia stockeri* subsp. *peninsularis +/- Corymbia nesophila +/- Eucalyptus tetrodonta +/- Eucalyptus cullenii* woodland.	Granitoid hillslopes	3.12.11	LC	NCAP
5m	Low *Corymbia* spp. *(C. stockeri, C. nesophila, C. clarksoniana) + Melaleuca stenostachya +/- Melaleuca viridiflora +/- Asteromyrtus symphyocarpa* woodland.	Degraded sand dunes and coarse grained alluvial deposits	3.2.8	OC	OC
5n	*Eucalyptus platyphylla +/- Erythrophloeum chlorostachys +/- Corymbia nesophila +/- Corymbia novoguinensis +/- Eucalyptus tetrodonta +/- Corymbia stockeri* subsp. *peninsularis* woodland and open forest.	Degraded aeolian dunes	3.2.8	OC	OC
5o	*Corymbia tessellaris +/- Corymbia clarksoniana* woodland and open woodland.	Rocky Granite Hillslopes	3.12.9	LC	NCAP
5p	Low *Corymbia polycarpa/Corymbia novoguinensis + Acacia crassicarpa + Terminalia subacroptera +/- Sterculia quadrifida +/- Syzygium suborbiculare* woodland and open woodland.	Parallel dunes	3.2.5b	LC	NCAP
5u	*Eucalyptus platyphylla +/- Corymbia tessellaris* woodland and open woodland.	Alluvial flats extending upslope onto granite hillslopes	3.3.28 3.12.37	LC OC	NCAP OC
5v	*Corymbia stockeri* subsp *peninsularis + Welchiodendron longivalve + Acacia polystachya +/- Corymbia tessellaris* woodland / open forest complex.	Granite Hillslopes	3.12.11	LC	NCAP
5w	*Corymbia tessellaris + Corymbia clarksoniana/ novoguinensis + Melaleuca viridiflora +/- Parinari nonda* woodland and low open woodland.	Granite hillslopes	3.12.9	LC	NCAP
5x	*Corymbia spp. + Melaleuca viridiflora + Lophostemon suaveolens + Pandanus sp* woodland and low open woodland.	Swampy alluvial plains and flats	3.3.22	LC	NCAP
6g	*Acacia crassicarpa +Asteromyrtus brassii* open forest and low open forest.	Degraded sand dunes	3.2.5c	LC	NCAP
6c	Low *Acacia crassicarpa + Terminalia subacroptera + Sterculia quadrifida + Manilkara kauki + Syzygium suborbiculare* open forest and woodland.	Chenier sand ridges	3.2.5a	LC	NCAP
7b	*Melaleuca saligna* open forest.	Coastal dunes and alluvial channels	3.2.4d 3.3.14	OC LC	OC NCAP
7d	Melaleuca *quinquenervia +/- Melaleuca saligna +/- Melaleuca cajuputi* subsp. *platyphylla +/- Lophostemon suaveolens* open forest.	Coastal dune fields	3.2.4b	OC	OC

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
7f	*Melaleuca leucadendra* open forest.	Dune swales and alluvial channels	3.2.4a 3.3.10b	OC LC	OC NCAP
7g	*Melaleuca dealbata* woodland and open forest.	Degraded sand dune	3.2.3	OC	OC
8b	Low *Lophostemon suaveolens +/- Asteromyrtus brassii +/- Acacia crassicarpa +/- Melaleuca saligna +/- Deplanchea tetraphylla* open forest and swamp forest.	Degraded sand dunes	3.2.4c	OC	OC
11a	*Pandanus* sp. *+/- Melaleuca cajuputi* subsp. *platyphylla +/- Acacia leptocarpa +/- Melaleuca acacioides* shrubland and low woodland.	Alluvial Plains	3.3.62	OC	OC
13a	*Melaleuca viridiflora +/- Pandanus* sp. shrubland and low woodland.	Alluvial plains and degraded sand dunes	3.3.42a 3.2.15	LC	NCAP
13f	Low *Melaleuca viridiflora + Corymbia clarksoniana* woodland.	Alluvial plains and degraded sand dunes	3.3.42a 3.2.15	LC	NCAP
14aa	*Grevillea parallela + Syzygium suborbiculare + Cycas badensis + Acacia crassicarpa + Planchonia careya + Premna serratifolia* shrubland.	Coastal foredunes	3.2.5c	LC	NCAP
14c	*Welchiodendron longivalve* shrubland.	Rocky granite hillslopes and knolls	3.12.20	OC	OC
14n	*Acacia crassicarpa + Leucopogon ruscifolius +/- Neofabricia myrtifolia +/- Pouteria sericea +/- Psydrax banksii +/- Halfordia kendack shrubland* and open shrubland.	Leached relict dune systems	3.2.19a	OC	E
14u	Low *Corymbia stockeri* subsp. *peninsularis + Welchiodendron longivalve* open forest / *Welchiodendron longivalve* closed scrub/ Deciduous shrubland/rock pavement complex (5v/4a/18a/18d – 30/40/20/10).	Rocky granite hillslopes and knolls	3.12.11/ 3.12.20 / 3.12.34	LC/OC/ OC	NCAP/ OC/O C
14s	Low sparse *Leucopogon ruscifolius + Acacia crassicarpa + Syzygium suborbiculare* shrubland with *Corymbia novoguinensis* emergents.	Aeolian dune systems	3.2.26	LC	NCAP
14z	*Grevillea parallela + Cochlospermum gillivraei + Parinari nonda +/- Syzygium suborbiculare +/- Pandanus* sp. shrubland and open shrubland.	Rocky headlands	3.12.9	LC	NCAP
16j	Low groved notophyll vine thicket/ grassland and herbland complex (2z/17j - 80/20).	Prograding beach ridges	3.2.2a/ 3.2.25	LC	OC
16k	Coastal foredune grassland, herbland, woodland and vine thicket complex (17j/17d/10b/2aa – 50/20/20/10).	Coastal foredunes	3.2.24/3.2.6 a/3.2.2a	OC/OC /LC	OC
17c	Open to closed tussock grassland with emergent shrubs.	Rocky headlands	3.12.29	OC	OC
17d	Medium to tall *Mnesithea rottboellioides + Heteropogon triticeus + Cymbopogon* spp. *+/- Imperata cylindrica +/- Themeda triandra* grassland.	Coastal dunes and foredunes	3.2.24	OC	OC
17f	*Imperata cylindrica* dominant grassland.	Backdune situations	3.2.24	OC	OC
17i	Low sedgeland with emergent shrubs	Degraded sand	3.2.15	LC	NCAP

Vegetation Community	Description	Geological Association	Regional Ecosystem	VMS*	BDS**
	and trees.	sheets			
18a	Deciduous shrubland / Rock pavement complex.	Rocky granite slopes and knolls	3.12.34c	OC	OC
18c	*Welchiodendron longivalve +/- Acacia polystachya* closed shrubland / Low deciduous shrubland/rock pavement complex (18a/14c – 50/50).	Rocky granite slopes and knolls	3.12.34c	OC	OC
18d	*Corymbia stockeri* subsp. *peninsularis* + *Welchiodendron longivalve* + *Psydrax banksii* + *Dodonaea polyandra* + *Ficus* sp. rock pavement complex.	Rocky granite slopes and knolls	3.12.34c	OC	OC
20b	Open wetland complex.	Dune depression	3.2.27	OC	OC
24a	Mangrove closed and open forest, woodland and shrubland complexes (24d/24c – 80/20).	Estuarine muds (periodically inundated)	3.1.1/ 3.1.2	LC/OC	NCAP
25a	Dwarf halophytic shrubland and saltpan.	Hypersaline Alluvium	3.1.6	LC	NCAP
25b	Salt pan.	Hypersaline Alluvium	3.1.6	LC	NCAP
26a	Closed *Sporobolus sp.* grassland.	Saline Alluvial Plains	3.1.5	LC	NCAP
26b	*Sporobolus sp. Grassland / Chenopod forbland and herbland complex (26a/25a - 50/50).*	Saline Alluvial Plains	3.1.5/ 3.1.6	LC	NCAP

** VMS =Vegetation Management Status. ** BDS = Biodiversity Status: OC = Of Concern Regional Ecosystem, LC = Least Concern Regional Ecosystem, NCAP = regional ecosystem with a biodiversity status that is considered to be 'No Concern at Present'*

5.2 Flora Species

An overview of the Badu flora has been compiled from analysis of; Garnett & Jackes (1985), Queensland Herbarium data (Herbrecs 2008, 2011), 3D Environmental survey data (Stanton *et al*. 2009), and flora field survey data of Fell (2009, 2010).

As of January 2011, the total known flora is represented by 597 species however this number is likely to be increased with additional systematic surveys. This comprises 18 ferns, 1 cycad, 1 conifer and 577 flowering plants with 560 (95%) native species, with 37 (5%) naturalised species. The Badu flora supports one-hundred and thirty families and 390 genera representing approximately 45% of the known flora for the Torres Strait Islands.

Five percent (5%) of the species listed are naturalised. This percentage excludes plants of town gardens although it incorporates many species occurring on the disturbed margins of native vegetation. This figure compares with 6.7% naturalised species for Iama, 30% for Boigu, 15% for the broader Torres Strait Islands (Stanton *et al.* 2009), 7.4% for Cape York Peninsula (Neldner and Clarkson 2005) and 15.6% for Queensland (Bostock and Holland 2007). A comparison of the island flora in relation to other Torres Strait Islands and regional floras is provided in **Table 3**.

Table 3. Native vascular flora of Badu Island in relation to Boigu, Mabuiag and Iama Islands (Fell 2010), Torres Strait Islands (Stanton *et al.* 2009), Cape York Peninsula (Neldner & Clarkson 1995 in Neldner 1998), Great Barrier Reef Continental Islands (Batianoff & Dilleward 1997) and the Queensland Flora (Bostock & Holland 2010).

Islands/Regions	Families Species	Ferns	Pines & Cycads	Flowering Plants	Total
Badu is.	Families	11	2	117	130
	Species	18	2	572	592
Mabuiag Is.	Families	2	1	101	104
	Species	4	1	429	434
Boigu Is	Families	3	0	62	65
	Species	4	0	226	230
Iama Is.	Families	2	0	78	80
	Species	2	0	266	268
Torres Strait Is. (Combined)	Families	5	1	158	174
	Species	39	2	1,289	1,331
Cape York Peninsula	Families[2]	30	5	183	218
	Species	157	6	3,173	3,338
GBR Continental Islands[3]	Families	25	5	165	195
	Species	97	7	2,091	2,195
Qld Flora[4]	Species	392	68	9,246	9,706

5.2.1 Flora Species with Biodiversity Significance

An assessment of significant flora species draws from the data sources identified above. The assessment seeks to provide details sufficient to document additional flora and habitats which should be considered a priority and focus for management actions. With consideration of the existing Torres Strait Region Back on Track Species Prioritisation program (DERM 2009) and ongoing assessments of the status of Queensland flora by the Queensland Herbarium, additional and complementary species management criteria have been assessed. Species have been categorised into broad significance categories (i.e. National, State, Regional and Cultural) based on criteria which include legislative status, keystone/focal, threatened or sensitive, restricted, otherwise noteworthy or of cultural interest. Culturally significant species are assessed in a separate section.

The nine species considered threatened under Commonwealth (EPBC Act) and State (NC Act) legislation comprise one Endangered, five Vulnerable, and three Near-Threatened species (**Table 4**). One species (*Cycad badensis*) is endemic to the islands of Badu and Mua, with an additional population recently recorded on Mabuiag. An additional 24 species are regionally significant.

Table 4. Endangered, Vulnerable and Near-Threatened flora species reported or predicted to occur on Badu Island.

Species	National EPBC	State NCA	Broad Habitat	Source
Known to Occur				
*Costus potierae (*Costaceae*)*	-	E	3, 5	3D survey
*Cycas badensis (*Cycadaceae*)*	-	V	3, 4, 5, 14, 18	Herbrecs
*Germainia capitata (*Poaceae*)*	V	V	3, 5	Herbrecs
Psydrax reticulata (Rubiaceae)	-	V	2, 4, 14, 18	3D Survey
Diospyros sp. (Bamaga BP Hyland 2517) (Ebenaceae)	-	V	1, 4	3D Survey
Carmona retusa (Boraginaceae)	-	V	18	3D Survey

[2] Cape York flora utilises Henderson (2002).
[3] Batianoff and Dilleward (1997) identify 552 continental islands along the east coast of Queensland within the Great Barrier Reef Marine Park (GBRMP), a total land area of about 1,627 km2.
[4] Bostock and Holland (2010).

Species	National EPBC	State NCA	Broad Habitat	Source
Archidendron hirsutum (Mimosaceae)	-	NT	1, 3	3D Survey
*Neolebra atra (*Poaceae*)*	-	NT	1, 2, 3, 4	3D Survey
Eremochloa ciliaris (Poaceae)	-	NT	5, 13, 17	Herbrecs
Predicted to Occur				
Dendrobium x superbiens (Orchidaceae)	V	V	18	EPBC Search
Dendrobium johannis	V	V	13	3D Survey - Suitable Habitat

E = Endangered, V = Vulnerable, NT = Near-Threatened

National Significance

One listed on the EPBC Act is known to occur.

***Germainia capitata* (Poaceae):** A perennial, tufted grass to 90 cm tall known in Australia from two disjunct localities north of Bundaberg and Torres Strait. Torres Strait populations are known from Mua (Wannan & Bousi 2006) and Badu where it inhabits situations experiencing seasonal inundation supporting *Eucalyptus* and *Melaleuca* dominant woodlands and open forests. These habitats are widespread and in good condition indicating that the Vulnerable status may be a reflection of threatening processes in the disjunct southern populations. The grass also is reported to be widespread in Papua New Guinea, Malaya, Thailand, Vietnam, and China (Sharp & Simon 2002).

State Significance

Nine species are listed on the Amended Regulations of the *Queensland Nature Conservation Act (NC Act) 1992.*

***Costus potierae* (Costaceae) - Endangered:** A multi-stemmed shrub with multiple cane like stems arising from a ginger like underground rhizome, and red cone like flowers. The species is endemic to Queensland being known from small populations in the Wet Tropics and Torres Strait. It is known in the Torres Strait from two main populations on Badu and on Mua where it is common in its habitat. It is associated with the interface between grassy woodland and riparian swamp forests. Populations appear stable however they may be impacted by feral pig foraging and it may be threatened by lantana invasion should this weed be introduced into its habitat. The appropriate fire regime required to maintain existing populations requires further clarification although species stability may be affected by excessively hot fires or long term fire exclusion. .

Photograph 1 & 2. Flowering specimen showing red bracts (left); Typical population in grassy woodland on alluvium (right).

***Cycas badensis* (Cycadaceae)- Vulnerable:** *Cycas badensis* is endemic to the Torres Strait and is listed as Vulnerable under both federal and state legislation. This species is restricted to Mua and Badu Islands where it is locally known as *busamargh*. A small population has also been recently found on Mabuiag Island. The cycad genus is restricted in the islands although Mer Island hosts a disjunct population of the Papua New Guinea species (*Cycas scratchlyeana*) and a population recently recorded on Prince of Wales that has been confirmed as *Cycas papuana,* the only record of what is otherwise a species endemic to Papua New Guinea. Traditional use of Cycads as a food resource is documented from other northern Australian regions and Papua New Guinea (Bradley 2005). The species has been recorded from the following habitats (3D Environmental field survey data):

- Old dunes: Shrublands and Woodlands (14aa, 14q, 5i, 5n).
- Granite /rhyolite slopes: Shrublands and woodlands (18a, 5s, 5x).
- Granite /rhyolite slopes: Closed forest, woodlands (4a, 5b, 5i, 5v, 5w).
- Alluvium: Open forest (3g).
- Poorly drained alluvium: Woodland (5u).
- Sandy alluvial plain: Grassland (17d).

Photograph 3 & 4. Fire affected cycad on dune surface (left); Senior Ranger Troy Stow beside a male cycad showing typical robust regeneration of fronds after fire (right).

***Carmona retusa* (Boraginaceae) - Vulnerable:** A much-branched tall shrub to small tree, 1-4m in height. It has small rough leaves with small white flowers. Carmona occurs in southern Asia from India to Taiwan and the Philippines, and in New Guinea, northern Australia and the Solomon Islands. In Australia, it occurs on Christmas Island (Butz 2004), Cape York Peninsula, and Torres Strait. Its occurrence on the Australian mainland is considered a relict from the period when the Peninsula area was linked by land to New Guinea (Butz 2004). On Badu it occurs as an uncommon shrub in shrubby vine thickets on dry rocky hills and headlands. The species is otherwise poorly known in Torres Strait with records from Prince of Wales (Fell pers. obs). The species habitat is in good condition with no known threats.


Photograph 5 & 6. *Carmona retusa* with characteristic small scabrous leaves (left); and typical habit on Badu.

***Germainia capitata* (Poaceae):** see above

***Psydrax reticulata* (Rubiaceae)**: A shrub to small tree to 6m. Common throughout vine thickets, shrublands and rock pavements on the majority of continental islands of Torres Strait and also occurring near the tip of Cape York Peninsula. The species is a bioregional endemic reaching its northern limits of distribution on Torres Strait continental islands with records from Mua, Badu, Dauan, Zuna, Warral, Prince of Wales, Wednesday, and Naghir. On Badu, the plant is a common component of shrublands occurring on exposed rhyolite hills and rock pavements which are in good condition. Despite the need for a reassessment of its conservation status (toward possible delisting), it should be considered a regionally significant taxon given that it is endemic to the bioregion and at the limit of its geographical range.


Photograph 7. Typical habitat and form of *Psydrax reticulata* on exposed rocky pavements.
Photograph 8. Leathery glossy green opposite leaves with distinct venation.

***Diospyros* sp. (Bamaga BP Hyland 2517) (Ebenaceae)**: A low shrub of 1-3m restricted to evergreen and semi-deciduous vine forest and thicket which is a bioregional endemic reaching its northern limits of distribution on Torres Strait continental islands. Its occurrence on Mua, Badu, Dauan, Prince of Wales, and Naghir Islands is limited to restricted pockets of suitable habitat where the plant may be locally common. As for *Psydrax reticulata*, despite a need for a reassessment of its conservation status, it should be considered a regionally significant taxon given that it is endemic to the bioregion and at the limit of its geographical range. The species habitat is restricted but in good condition.

Photograph 9. *Diospyros* sp. (Bamaga BP Hyland 2517).

Cape Laceflower*, Archidendron hirsutum* (Mimosaceae) – Near-Threatened: A partly deciduous tree to 25m inhabiting rainforest as a canopy or subcanopy associate. The populations on Badu are restricted to footslope rainforest (1d) and Welchiodendron dominant forests where the optimum development of vine forest understorey occurs (4a) and habitat condition is high. The tree is more common on Mua where the rainforest habitat is better developed on footslope and upland granite situations (1e, 1f, 2o, 3d, 4a). Cape Laceflower is endemic to the Cape York Peninsula bioregion where it occurs between Lockerbie and the McIlwraith Range. The Badu populations are disjunct and represent the northern limit of species distribution.

Photograph 10. Sapling of *Archidendron hirsutum*

Native Bamboo*, Neolebra atra* (Poaceae) – Near-Threatened: A native bamboo known from Torres Strait, Cape York Peninsula and NE Queensland in the understorey of rainforest habitats. The species also occurs in New Guinea, the Moluccas, northern Sulawesi and the Philippines. On Badu, it is typically associated with the understorey of Welchiodendron dominant forest (4a) and vine forests. It is known also in the Torres Strait from Mua (1i, 2o, 3d), Badu (4a), Dauan (7a), Mer (2j), Iama, Erub, and Naghir. Populations on Badu are considered restricted but robust with no apparent threatening processes.

Photograph 11. The native Bamboo *Neolebra atra*

Fringed Centipede Grass, *Eremochloa ciliaris* (Poaceae): A slender grass inhabiting eucalyptus woodland habitats. Known from a number of collections on Badu and on Mua where is occurs in woodland and shrubland habitats on alluvial outwash. It also occurs in far northern Cape York Peninsula. The species is poorly known and targeted survey is required to assess its abundance and distribution. The habitat for this species is in good condition.

Regional Significance

The classification of regionally significant species takes into account factors such as disjunct occurrence, endemism (at the bioregional, bioprovince, and island scales), limits of geographic distribution, and local rarity in the landscape. The 24 species recognised are summarised below in **Table 5.** One species tentatively identified as *Gnetum gnemon* (Gnetaceae) is a new record for Australia.

Table 5. Summary of Regionally Significant Flora Species, Badu Island.

Species	Comments
Acmena hemilampra subsp. *hemilampra* (Myrtaceae)	A large tree to 25m. In Torres Strait the occurrences are disjunct representing northern limit of Australian distribution. Occurs in riverine and swamp forest habitats on Badu (3e, 3g, 6g) and on Mua (1i, 1j, 3a, 9a). Also known from eastern Australian rainforests and in southern Papua New Guinea (PNG).
Actephila venusta (Euphorbiaceae)	A low understorey shrub 1-2m. A northern Australian endemic known from Northern Territory (NT) and Cape York Peninsula (CYP). Disjunct occurrences on a number of Torres Strait continental islands i.e. Mabuiag, Badu, Mua, Prince of Wales (PoW), and Dauan represent the northern limit of distribution.
Aglaia tomentosa (Meliaceae)	A small tree inhabiting the understorey of well developed rainforests. Rare on Badu and restricted to the best development of rainforest (1d) and Welchiodendron forest with robust thicket species understorey (4a). Also recorded in Torres Strait from PoW (2q), Mua (1e, 2o, 3c), Dauan (1a) and Hammond (2r, 4a). Occurs in rainforests from between Cooktown and Innisfail and north to PNG, Solomons, Malesia and SE Asia. Badu populations are highly disjunct representing northern limit of Australian distribution.
Atalaya sericopetala (Sapindaceae)	A shrub or small tree to 10m inhabiting vine thicket understorey and margins of Welchiodendron forests on rhyolite hills (4a). A Qld endemic known from Iron Range to Chillagoe in vine thickets and open forests. Known elsewhere in Torres Strait from Gebar, Naghir (2t, 2u), Erub (2k, 17b), Mua (2o, 4a), Muralug (16d) and Friday (16e). Badu population are disjunct and representing part of northern limits of distribution.
Atalaya variifolia	A small often single stemmed tree to 8m, rare on Badu in Welchiodendron

Species	Comments
*(*Sapindaceae*)*	open forests and margins (4a). The Badu occurrence is highly disjunct representing a new record for Torres Strait and a northern limit of geographical range for the species. It is a northern Australian endemic known otherwise from scattered localities in western CYP south to the Einasleigh Uplands, and in the NT and WA.
Cupaniopsis flagelliformis var. *flagelliformis* *(Sapindaceae)*	A small tree to 8m recorded as an occasional sapling shrub in the vine thicket species understorey of Welchiodendron forests on rhyolite (4a). The species is endemic to the CYP and Wet Tropics Bioregions occurring south to the Tully River. The Badu occurrence is disjunct representing part of the northern limit of distribution. Other disjunct Torres strait occurrences are from Hammond (2r, 4b, 6e), Iama (2h), and PoW (2q, 4b).
Erythroxylon sp. (Mosquito Creek J.R. Clarkson 9991+) (Erythroxylaceae)	A shrub to 2-5m in height. Found on Badu within shrublands and rock pavements on rhyolite hills. Endemic to the CYP Bioregion and known from the north-eastern coast of CYP. Reaching its northern limit of distribution on Mabuiag. Other disjunct occurrences in Torres Strait include PoW, Hammond and Friday Islands.
Euphorbia plumerioides (Euphorbiaceae)	Shrub 1-4m known from shrubby thickets on coastal headlands. A disjunct population otherwise recorded from Torres Strait on PoW Island (Fell pers. obs. 2010) and Mer (DGF10871+DJS). Occurs in NE CYP.
Everistia vaccinifolia (sens. lat.) (Rubiaceae)	A compact shrub 2-4m with rigid stems and small leaves. Rare on the island where it is restricted to understorey of Welchiodendron forests on rhyolite hills. Also observed on Mua.
Euonymus australiana *(*Celastraceae*)*	A shrub 2-4m. Uncommon in understorey of better developed examples of vine forest. The Badu population is restricted to vine forest on Mt Mulgrave. In the Torres Strait it is also known from Mua, Dauan and Mabuiag. The occurrence is highly disjunct and represents the most northern limit of distribution of a bioregional endemic.
Gnetum gnemon (DGF10206 + DJS) (Gnetaceae)	An evergreen tree to 20m recorded from a small patch of swamp forest on poorly drained alluvium. The species is awaiting formal identification at the Qld Herbarium however it has been tentatively identified as gnemon (*Gnetum gnemon*) (R. Jensen pers. comm. May 2011). It has also been observed on Mua (DGF10803 + DJS). Based on the tentative identification the Badu and Mua records represent a new record for Australia. *Gnetum gnemon* is a gymnosperm (seed plants with naked ovules), whose origin and relationships to angiosperms are not completely understood. Gnemon is native to Southeast Asia and islands in the western Pacific including Fiji, Indonesia, Malaysia, Papua New Guinea, the Philippines, and Vanuatu, and is known from rainforest up to 1700m (Manner *et al*. 2006). It is utilized for a variety of purposes including food (leaves and seeds), timber (poles for house construction), fibre (string bags), agroforestry (intercropping for Rambutan and Breadfruit) and is cultivated in home gardens and orchards throughout its distribution (Manner *et al.* 2006). Its Badu habitat is impacted by feral pig digging however the extent of impact is not known.
Gossia retusa *(*Myrtaceae*)*	This compact shrub 1-3m in height was recorded in vine thicket on dunes. The Badu population represents a new record for Torres Strait being more widely known from coastal vine thickets on dune fields on eastern CYP.
Gunnesia pepo (Apocynaceae)	An uncommon slender understorey vine with opposite leaves. The genus is monotypic and endemic to the CYP Bioregion. Its occurrence in Welchiodendron open forests of rhyolite foothills on Badu (4a) is disjunct and represents part of its northern most limit of distribution. It has also been recorded from similar habitat on Mua Island (Fell pers. obs. 2010) and occurs in northern CYP in seasonally dry forests and vine thickets.
Haplostichanthus fruticosus (Annonaceae)	A shrub to 2m found in the understorey of vine thicket and forest, and Welchiodendron forests on rhyolite slopes (4a). The species is endemic to the CYP Bioregion with a distribution from the McIllwraith Range in the south to Mabuiag Island in the north. The Badu occurrence is disjunct representing part of its northernmost limit of distribution. In Torres Strait it was previously known from Mua Island (Jessup 2007), however it also occurs on Dauan (Stanton *et al.* 2009). The fruits are globular and red 7-8mm diameter and bird dispersed.
Horsfieldia australiana (Myristicaceae)	A tree to 30m with strongly perfumed flowers. Disjunct populations on Badu restricted to moist alluvial situations in melaleuca open forests and evergreen rainforests (3e, 3g). Also known from Mua (1i, 3c, 3d), in CYP from Lockerbie south to the McIlwraith Range and in the NT and PNG. Badu populations are disjunct and representing northern limit of Australian distribution.
Licuala ramsayi var. tuckeri (Arecaceae)	The licuala fan palm is rare in Torres Strait being restricted to the understorey of well developed swampy riparian forests on alluvium on Badu

Species	Comments
	and Mua, and to upland evergreen rainforest Mua. It is the northern variety of *Licuala ramsayi* endemic to northern CYP and the Torres Strait. The Badu occurrence is disjunct representing the northern limit of Australian distribution.
Maniltoa lenticellata var. lenticellata (Caesalpiniaceae)	A tree with compound alternate leaves. On Badu it is rare and only known from vine forest understorey of closed forest. Occurs north from the Nesbit River in north-east CYP to Papua New Guinea. Disjunct occurrences are known on well-developed evergreen and semi-deciduous vine forest on rhyolite and granite substrates on Mua, Dauan, PoW and Mabuiag Islands.
Miliusa traceyi (Annonaceae)	A shrub to tree to 8m. On Badu it occurs in Welchiodendron forests and vine thickets. Endemic to northern Australia where it is known from seasonal vine thickets and forests in the NT and CYP. This species is a common component of Welchiodendron forests and vine thickets on the majority of the continental islands of Torres Strait. These occurrences are disjunct and in combination represent the species northern limits of distribution. The habitat is in good condition and self-maintaining.
Podocarpus grayae (Podocarpaceae)	A tree 10-25m inhabiting the subcanopy and occasionally the canopy of riparian rainforest on alluvium. The habitat is restricted in Torres Strait being only found on Badu, and on Mua where it is more extensive. The species also occurs in CYP where it is restricted to well developed rainforest of the north east. The distribution extends to PNG. The disjunct populations on Badu represent the northern limit of Australian distribution of a relict species. The riparian habitat on Badu is linear with sharp transition to adjoining woodlands maintained by fire. These margins appear stable however high intensity fires have the potential to impact on the habitat of Podocarpus. Damage by feral pigs may impact on seedling regeneration.
Rhodamnia australis (Myrtaceae)	An understorey shrub to small tree 3-6m. A northern Australian endemic known from CYP and the NT. The occurrence on Badu in the understorey of welchiodendron forests (4a) is disjunct and represents part of its northern limit of geographical range. In Torres Strait it also occurs on Mabuiag (1d, 2x), and Mua (3a) and Iama.
Syzygium bungadinnia (Myrtaceae)	A tree to 20m restricted on Badu to evergreen notophyll vine forest on sheltered gullies and slopes. An endemic to the CYP bioregion occurring from Iron Range in the south to the Torres Strait Islands. The Badu occurrence is part of a number of highly disjunct populations in Torres strait, which represent the northern limits of distribution. Known also from Mabuiag, Mua, Mer, and Dauan. Fruit is edible.
Triflorensia australis (Rubiaceae)	An understorey shrub 2-4m found on Badu in notophyll vine forest on sheltered gullies and slopes and in Welchiodendron dominant forests. Known from Mabuiag, Mua, Mer, Dauan, and PoW Islands. The Badu occurrence is part of a number of highly disjunct populations which represent the northern limit of distribution. Also occurs in the NT.
Uvaria rufa (Annonaceae)	A scrambling shrub or liana known from vine forest and thicket habitats between Coen and Thailand. Occurrences on Badu (4a) as well as Mer, Mabuiag, Mua, PoW and Iama are disjunct and restricted. Fruit is edible.
Voacanga grandiflora (Apocynaceae)	A shrub to small tree with large leaves and a copious milky sap. In Torres Strait it is restricted to vine forest habitats on Badu (4a) and Mua (2v, 3d). Occurs on the north eastern part of CYP and in PNG and Malesia. Badu occurrence is disjunct.
Unknown sp. (DGF10206 + DJS)	A tree to 20m recorded from a patch of swamp forest on poorly drained alluvium. The species which is awaiting identification at the Qld Herbarium has also been observed on Mua (DGF10803 + DJS) and in the Lake Kutubu area of the PNG southern highlands on limestone karst (Fell pers. obs. Feb 2011). Its Badu habitat is impacted by feral pig digging.

5.2.2 Introduced Plants

Information on weed species has been sourced from Stanton *et al.* (2009), Queensland Herbarium specimen data, field data of Fell (2009, 2010), and personal communication with Barbara Waterhouse from AQIS. With reference to **Table 6**, a total of 37 naturalised species occur on the island which represents 5% of the islands total flora assemblage. The majority of species are associated with heavily disturbed and developed areas within and surrounding the Badu community and fringing disturbed sites such as major roads and tracks, dumps, airfield, recreation areas and old settlement

sites. Remnant vegetation throughout the island is generally free of weeds however a number of species pose potential threats.

Declared Weeds

Three species declared under the LPA that are known from Badu have the potential to degrade the islands natural and cultural resources.

Singapore daisy - *Sphagneticola trilobata* (Class 3): Singapore daisy is a vigorous creeping ground cover that has become established on Badu in a number of locations in and around the community. The plant will out-compete native species in natural habit and is a significant threat to riparian, swamp and foredune habitats across the island. Control of existing populations is the highest priority management action.

Bellyache bush - *Jatropha gossypiifolia* (Class 2): Bellyache bush has been recorded from the town area. It has not been observed in remnant vegetation however it poses a serious threat to grassland, shrubland and vine thicket habitats.

Yellow Bells – *Tecoma stans* (Class 3)

A shrub or small tree to 5 m high native of tropical America, but now present through the Americas to south-western Argentina, and in northern and eastern Australia. Seeds are wind dispersed with papery wings. It is an ornamental which is widespread on numerous islands in the Torres Strait that threatens a range of natural communities, particularly open grassland and shrubland habitats on sand dunes and other areas of more fertile soils. On Badu, the species is largely restricted to the main settlement.

Environmental Weeds Present

Remnant vegetation throughout the island is generally free of environmental weeds although species such as stinking passionflower (*Passiflora foetida*), mint weed (*Hyptis suaveolens)*, red Natal grass (*Melinis repens*) and Townsville stylo (*Stylosanthes spp.*) are established along access tracks and any disturbed sites.

Praxelis is a highly invasive erect, branched, unpleasant-smelling herb first observed on Badu in 1999 by Barbara Waterhouse who notes that it is thought to have been introduced as a contaminant of building materials or equipment (DERM 2011). It is a native of South America, and known to spread rapidly by wind-blown seeds along roadsides. It can spread into native bushland forming dense mono-specific stands that exclude other vegetation. Praxelis is known to invade grasslands, woodlands and rock pavements in the Mareeba and Mt Molloy districts (Dry Tropics marginal areas) and therefore is considered a serious threat to similar habitats on Badu. Specimen notes of Waterhouse and Hucks (DERM 2011) indicate that post 1999 the species is becoming established on the margins of the community (e.g. sandy crest adjacent to 'Poison Lagoon' on the western side of

village in the vicinity of the sports stadium, roadside drains near sports stadium, around the hydroponic nursery and on vacant land adjacent to a permanent lagoon).

Other common leguminous weeds which are prominent around the community area include siratro (*Macroptileum atropurpureum),* phasey bean (*Macroptileum lathryioides*), beggar weed (*Desmodium tortuosum*), velvet bean (*Mucuna pruriens* var*. utilis*), centro (*Centrosema molle*), streaked rattlepod (*Crotalaria pallida* var. *obovata*), sensitive weed (*Mimosa pudica* var*. unijuga*), Alyce clover (*Alysicarpus vaginalis*), coffee bush (*Senna occidentalis*) and ringworm shrub (*Senna alata*).

Species such as tridax daisy (*Tridax procumbens*), sida (*Sida acuta*), snake weed (*Stachytarpheta jamaicensis*), and Rangoon creeper (*Quisqualis indica)* may occur throughout disturbed areas and, in combination with the aforementioned, may be rapid colonizers of disturbed areas.

Grassy weeds are widespread throughout the disturbed areas of Badu Island and some species pose a threat to grassland and grassy woodland habitats. Introduced grasses which may occur in the community area include Indian couch (*Bothriochloa pertusa*), Mossman River grass *(Cenchrus echinatus*), Rhodes grass *(Chloris gayana*), purpletop Rhodes grass *(Chloris virgata*), couch *(Cynodon dactylon*), crowsfoot *(Eleusine indica*), red Natal grass *(Melinis repens*), button grass *(Dactyloctenium aegyptium*), Sabi grass *(Urochloa mosambicensis*), and itchgrass *(Rottboellia cochinchinensis*).

Table 6. Introduced plants recorded from Badu (as of April 2011)

Family	Species	Broad Vegetation Group								
		2	3	5	7	14	16	17	18	Cl
Amaranthaceae	*Alternanthera brasiliana cv. Rubiginosa**									1
	*Alternanthera brasiliana **									1
	*Alternanthera ficoidea **									1
	*Amaranthus blitum **									1
	*Celosia argentea **									1
Anacardiaceae	*Anacardium occidentale**									1
	*Magnifera indica**		1							
Araceae	*Colocasia esculenta**				1					
Arecaceae	*Cocos nucifera**		1					1		
Asteraceae	*Acanthospermum hispidum **									1
	*Ageratum conyzioides**			1						
	*Bidens sp.**	2					1			
	*Praxelis clematidea **									4
	Sphagneticola trilobata (Class 3)*			1						2
	*Synedrella nodiflora**			1						
	*Tridax procumbens**					1	1			
Bignoniacea	*Tecoma stans (Class 3)*									1
Caesalpiniaceae	*Cassia fistula **									1
Combretaceae	*Quisqualis indica **									1
Cyperaceae	*Cyperus sphacelatus **									2
Euphorbiaceae	*Chamaesyce hirta **									1
	*Jatropha gossypiifolia * (Class 2)*									2
Fabaceae	*Crotalaria goreensis**									1
	*Mimosa pudica var. unijuga **									1
Lamiaceae	*Hyptis suaveolens**								1	
Malvaceae	*Sida acuta **			1						1
	*Sida cordifolia **									1

Family	Species	Broad Vegetation Group								
		2	3	5	7	14	16	17	18	Cl
Mimosaceae	*Mimosa pudica var. unijuga* *									2
Musaceae	*Musa sp.**				1					
Onagraceae	*Ludwigia hyssopifolia**									1
Passifloraceae	*Passiflora foetida**		1	1	2	2			2	
Poaceae	*Melinis repens**								1	
	*Rottboellia cochinchinensis**							1		
Rubiaceae	*Oldenlandia corymbosa var. corymbosa**									1
Scrophulariaceae	*Angelonia salicariifolia **									3
	*Scoparia dulcis **									3
Verbenaceae	*Stachytarpheta jamaicensis**									1

Table 7. Major Environmental Weeds

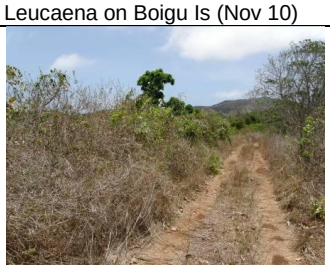
Species	Comments	Photograph[5]
Praxelis (*Praxelis clematidea*)	A highly invasive erect, branched, unpleasant-smelling herb with hairy stems and foliage. This species is known to invade rock pavements in the Mareeba and Mt Molloy districts and therefore is considered a threat to similar habitats on Badu. Known also from Mabuiag, Mua, Mer and Erub.	
Butterfly pea (*Clittoria ternatea*)	This vigorous sprawling vine is one of a number of leguminous vines and herbs which occur throughout the disturbed parts of the island. Butterfly pea is a tropical perennial legume adapted to a range of soils and climates in northern (tropical and subtropical) Australia. Current infestations are restricted to disturbed areas, however evidence from Mabuiag suggests its potential to invade native vegetation. Seeds are likely to be dispersed by vectors such as machinery, water and grazing horses. Ongoing monitoring and prompt control of any infestations outside the community area is recommended.	
Siratro (*Melinis atropurpureum*)	Siratro is widespread on Badu occurring throughout the community area and on the margins of tracks and roads. It is a vigorous sprawling leguminous climber that establishes rapidly and is considered capable of invading the groundcover of shrublands and woodlands.	
Mint weed (*Hyptis suaveolens)*	A robust annual herb forming a multi-stemmed shrub to 2m. Native of tropical America but now widespread throughout the tropics and subtropics. Naturalised in WA, NT, CYP, NE Queensland and southwards as far as south-eastern Queensland. On Badu it is widespread in and around the community. Seeds are dispersed by wind, water and horses.	

[5] All photographs D.Fell & D. Stanton unless otherwise noted.

Weed Threats

This section considers those weeds not recorded on Badu which are capable of causing long-term changes to biodiversity.

Table 8. Weed Threats

Species	Comments	Photograph[6]
Leucaena (*Leucaena leucocephala***)**	Leucaena is an exotic small tree up to about 6 m tall with fine bipinnate leaflets. The weed is present on Boigu, Saibai, Mua, Erub, Mer and Thursday Island and Horn Island with dense infestations on Boigu posing a significant threat to cultural and natural values. Ongoing monitoring and control is required for any occurrences of leucaena in the town area of Badu.	 Leucaena on Boigu Is (Nov 10)
Lantana (*Lantana camara***)**	Lantana is a Class 3 Declared Weed and listed as a Weed of National Significance (WONS). It is currently widespread on Mer, Erub and Ugar poses a potential threat to Badu. Ongoing monitoring and prompt control of any infestations is recommended.	 Lantana on Erub (late dry 07)
Gamba grass (*Andropogon gayanus***)**	Gamba grass is a Class 2 Declared Weed that has not yet been recorded in Torres Strait however, it is considered a serious potential threat. Together with annual mission grass it is listed as a Key Threatening Process under the EPBC Act. It is widespread in the Bamaga district of northern CYP (Fell *et al*. 2009). The grass is an aggressive colonist which develops a standing biomass of 5-7 times that of native species resulting in extremely intense fires (Rossiter *et al*. 2003).	 Gamba grass near Injinoo (April 09).
Annual mission grass *(Cenchrus pedicellatum* subsp. *unispiculum*)	An aggressive robust annual grass capable of inducing habitat change through altering fire behaviour. Known from Mua (St Pauls), Mabuiag, Masig, Poruma and Horn Island. The invasion of annual mission grass is listed as a Key Threatening Processes under the EPBC Act. It threatens biodiversity in northern savannas by competing with native annual grass species and rapidly occupying disturbed areas. It has the ability to remain green until the late dry season providing fuel for fires which occur later and are hotter than normal seasonal fires (DEWHA 2011).	 (source NT Govt.) http://www.nt.gov.au/nreta/ natres/weeds/find/missiongrass.html)

5.2.3 Flora with Cultural Significance

The information on useful plants of Badu Island currently available to the authors is insufficient to provide any detailed account. Nevertheless, a number of useful plant species which have been recorded on other islands are listed in **Appendix C**. Further fieldwork by the Land and Sea Rangers

[6] All photographs D.Fell & D. Stanton unless otherwise noted.

coupled with review of literature is required with the information to be incorporated into an appropriate Traditional Ecological Knowledge (TEK) system. This includes information on uses, seasonality, habitat, distribution, abundance, phenology, and most importantly the relationships to story and culture.

6.0 Fauna (Animals)

As for the majority of Torres Strait Islands there is a considerable lack of systematic survey of fauna habitats on the island. Avifauna (birds) have been the most well studied component of Torres Strait's terrestrial fauna. Other records are incidental, or part of broader regional surveys targeted towards particular groups (e.g. Draffan *et al.* 1983, Clarke 2004, Garnet *et al*. 2000, Hall 2008, Helgen 2004). Recent surveys on Badu (Conics 2009a) while limited, represent the most comprehensive data available for the island. In addition, there is little available information on the cultural significance of terrestrial fauna species. Some data on this topic can be found in the *Reports of the Cambridge Anthropological Expedition to Torres Straits* (Haddon 1901-1935). Systematic collecting across the range of habitats is however likely to greatly increase the number of known species and further contribute to the identification and development of management strategies. It is therefore recommended that surveys become an identified ranger work activity, supported by relevant specialists.

A desktop review of reports and databases identified 184 fauna species that have been reported for Badu Island (**Appendix E**). This includes 8 frog, 29 reptile, 137 bird and 10 mammal species. Of these, five mammal species are introduced. An additional seven species have been identified by the Protected Matters Search Tool as possibly occurring. This can be compared with the 384 terrestrial fauna species that have been reported for the broader Torres Strait island group (see **Appendix E**) which includes 14 frog, 67 reptile, 263 bird and 40 mammal species.

6.1 Culturally Important Fauna Species

Although the current information on useful animals of Badu Island available to the authors is insufficient to provide any detailed account, the familiarity of Torres Strait Islanders' with the natural world was noted over 100 years ago by the English anthropologist Alfred Cort Haddon (1912:230):

> *'[they] are good field naturalists and have names for a large number of plants and animals. A considerable number of plants are utilised in one way or another, more so than we have mentioned in these Reports. Although the land fauna is deficient in forms of economic importance, the natives have names for animals which are not of value to them, and are acquainted with their habits; their knowledge of the natural history of marine animals being very extensive. The uses and properties of most of the plants are known to them'.*

The region's birds, mammals and reptiles also have cultural significance for Torres Strait Islanders. Many feature in local myths and legends, and some are clan totems (*augadh*). The calls of some birds are recognised as omens, foretelling events such as weather, the arrival of a ship or the death of a relative (e.g. Haddon 1908:260-261), others are 'calendar species' which alert people to the fact that

a particular food resource is now available. Feathers from birds such as herons (*Egretta sacra* and *Ardea* spp.) and the cassowary (*Casuarius casuarius* – obtained from Papua New Guinea traders) continue to be used for traditional head dresses.

Further fieldwork by the Land and Sea Rangers coupled with review of literature is required, with incorporation of this information into an appropriate TEK system. This includes information on uses, habitat, distribution, abundance, and most importantly the relationships to story and culture. The fauna species list provided in **Appendix E** of this report provides a foundation to incorporate language names and habitats.

6.2 Fauna Habitat Values

Given the limited fauna work previously conducted on Badu Island and very few documented records of even common species (*e.g.* DERM 2010g) the faunal values of the island remain poorly known. Conics (2009a) state that fragmentation and disturbance from human development on Badu Island is localised, relatively small-scale and not considered a significant threat in the short-term. Habitats on Badu are diverse and include acacia and eucalypt dominated forest and woodland, vine forest, mangroves, grasslands, sedgelands, shrublands, rock pavements and modified areas. This range of habitat types, combined with the size of the island and the proximity of Mua Island, suggests that the presence of a number of additional species will be identified with further survey work.

The reported frog fauna is 8 species (**Appendix E**), all of which are widespread, common species. The frog fauna of the Torres Strait is somewhat depauperate based on known records, and the majority of species is confined to larger islands such as Mua and/or islands close to Cape York Peninsula. A few additional species may yet be found, particularly in the wetlands and watercourses of the island which are likely to support regionally significant frog species.

The reptile assemblage, 29 species (**Appendix E**), is considerably less than that of Mua Island (40 species) and it is likely that more species will be recorded should further survey be undertaken. The mangroves, rock pavements and vine forest are likely habitats for additional reptile species.

Most of the bird species recorded in the Torres Strait are highly mobile and many are migratory, including numerous species that are not listed as Migratory under the EPBC Act. It is likely that any additional species reported for Badu Island will be highly mobile species. Draffan *et al*. (1983) note that the number of bird species found on islands is a function of the area of forest and woodland rather than the area of the island itself. Badu Island is one of the larger of the Torres Strait islands and has a variety of habitat types and is very close to an even bigger land mass in Mua Island. Badu Island is, therefore, one of the Torres Strait islands most likely to support as yet unreported species and may harbour some less mobile species.

Thirty-four native mammal species are reported or predicted for the Torres Strait (**Appendix E**), though the likelihood of some of these species actually occurring is considered doubtful and the identification of other species recorded is questionable. Regardless, the native mammal fauna of the Torres Strait is dominated by bats, with 20 reported species. Seven rodents are reported, though only

one, grassland melomys (*Melomys burtoni*), is widespread. No dasyurids or possums and gliders are reported, and current records of macropods are limited to islands to the south.

At this stage the only ground-dwelling mammals reported from Badu Island are water-rat (*Hydromys chrysogaster*) and Cape York melomys (*Melomys capensis)* (Conics 2009a). However, Mua Island also supports short-beaked echidna (*Tachyglossus aculeatus)* (McNiven & Hitchcock 2004), bandicoots (*Isoodon* sp.) (Conics 2008b; Hitchcock *et al.* in press), grassland melomys and delicate mouse (*Pseudomys delicatulus*) (Ingram 2008). Some, or all, of these are likely to occur on Badu Island.

6.3 Fauna Species with Conservation Significance

In this report fauna of conservation significance include:

- Species listed as Critically Endangered, Endangered or Vulnerable under the Commonwealth's EPBC Act including those listed as Migratory.
- Species listed under Endangered, Vulnerable or Near-Threatened under Queensland's NC Act.
- Species considered of 'critical' or 'high' priority under the Back on Track framework (DERM 2011a).

Other species may be assessed as being significant at the regional scale (i.e. Torres Strait) by the study team based on criteria such as local rarity, state and bioregional endemism, limits of distribution and disjunct occurrences.

6.3.1 Critically Endangered, Endangered, Vulnerable and Near-Threatened Species

The following section provides an overview of those species that are known to occur, or potentially occur on Badu Island. Twenty-five of the 384 species reported or predicted for the Torres Strait are listed as Critically Endangered, Endangered, Vulnerable or Near-Threatened under the EPBC Act and/or NC Act. Fifty-eight species are listed as Migratory under the EPBC Act (see **Appendix G**). The islands of the Torres Strait have been inadequately surveyed for fauna so records and predictions from throughout the Strait are included to aid in the identification of additional likely species for Badu Island. **Table 9** lists the eight conservation significant species whose reported occurrence is considered reliable plus an additional 11 species whose occurrence is considered likely or possible on Badu Island based on habitat suitability and regional distribution. Profiles for known species are provided in **Section 6.3.2** and for likely species in **Appendix F.**

Table 9. Endangered, Vulnerable and Near-Threatened Fauna species reported or predicted to occur on Badu Island.

Scientific Name[3]	Common Name	EPBC Act	NC Act	BoT[5]	Broad Habitat & known distribution in Torres Strait	Comments[6]
SPECIES REPORTED						
Varanus prasinus	Emerald monitor	-	NT	-	Mangroves/closed forests.	Unpublished record. Also known from

Scientific Name[3]	Common Name	EPBC Act	NC Act	BoT[5]	Broad Habitat & known distribution in Torres Strait	Comments[6]
						Mua, Mer, Mabuiag, Boigu and Dauan.
Crocodylus porosus	Salt-water crocodile	M	V	-	Estuaries/shorelines/beaches. Boigu, Saibai, Mabuiag and Thursday islands.	Unpublished record.
Tadorna radjah	Radjah shelduck	-	NT	-	Estuarine margins. Mua, Boigu, Booby, Friday (Gialug), Horn (Nurupai), PoW (Muralug) & Thursday islands.	Published record.
Ephippiorhynchus asiaticus	Black necked stork	-	NT	-	Estuaries/shorelines/ beaches. Mua, Booby, Friday (Gialug), Hammond (Keriri), Horn (Nurupai), PoW (Muralug), Tuesday No 2, Thursday & Boigu islands.	Database and published records.
Accipiter novaehollandiae	Grey goshawk	-	NT	-	Closed forest and riparian woodlands. Mua & Red Wallis islands.	Published and unpublished records.
Esacus magnirostris	Beach stone-curlew	-	V	high	Estuaries/shorelines/beaches. 34 islands, including Mua, Iama, Erub, Mabuiag & Dauan islands.	Database, published and unpublished records.
Numenius madagascariensis	Eastern curlew	M	NT	-	Estuaries/shorelines/beaches. 18 islands, including Mua, Mer, Iama, Erub, Mabuiag, Boigu and Dauan islands.	Database and published records.
Sternula albifrons	Little tern	M	E	high	Estuaries/shorelines/ beaches. 16 islands, including Mua, Boigu, Mer, Iama & (Erub) Darnley islands.	Published record. Listed under the EPBC Act as *Sterna albifrons* (Bonn Convention, CAMBA, JAMBA, ROKAMBA).
SPECIES PREDICTED						
Pteropus conspicillatus	Spectacled flying-fox	V	LC	high	Mangroves, closed forests, swamp forests.	Predicted by the EPBC Protected Matters Search Tool – occurrence considered possible.
Taphozous australis	Coastal sheathtail bat	-	V	high	Open forest, grasslands, coastal shrublands, mangroves, monsoon forest and melaleuca swamp forests. Rarely found roosting more than several km from the sea. Roosts / breeds in coastal caves, rock piles / fissures.	Likely based on occurrence on Mua and potential habitat.
Hipposideros cervinus	Fawn leaf-nosed bat	-	V	High	Forests and woodlands, particularly along creeks with intact riparian vegetation.	Likely based on occurrence on Mua and potential habitat.
Nyctimene	Torresian tube-	-	NT	-	Closed forests, mangroves,	Possible

Scientific Name[3]	Common Name	EPBC Act	NC Act	BoT[5]	Broad Habitat & known distribution in Torres Strait	Comments[6]
cephalotes	nosed bat				woodlands and shrublands.	based on occurrence on Mua and potential habitat.
Dobsonia magna	Bare-backed fruit-bat	-	NT	-	Rainforest, gallery forest and woodlands.	Likely based on occurrence on Mua and potential habitat.
Xeromys myoides	Water mouse	V	V	high	Saline margins	Predicted by the EPBC Protected Matters Search Tool – occurrence considered possible[7].
Conilurus penicillatus	Brush-tailed tree-rat	V	LC	-	NA	Predicted by the EPBC Protected Matters Search Tool – not expected to occur.[8]
Lepidodactylus pumilus	Slender chained gecko	-	NT	-	Closed forests, mangroves, woodlands and shrublands.	Likely based on occurrence on Mua and potential habitat.
Emoia atrocostata	Littoral whiptail-skink	-	NT	-	Mangroves, rocky foreshores	Likely based on occurrence on Mua and potential habitat.
Emydura subglobosa	Jardine River turtle	-	NT	-	Watercourses and lagoons	Possible based on available habitat and known occurrence on CYP and southern PNG.
Haematopus fuliginosus	Sooty oystercatcher	-	NT	-	Estuaries/shorelines/beaches	Based on potential habitat.

1. Listed as Vulnerable, Near-Threatened or Migratory under the EPBC Act 1999 and/or the NC Act 1992 or of critical or high priority under the Back on Track prioritisation framework (DERM 2011a).
2. Predicted by the EPBC Protected Matters Search Tool maintained by DSEWPC (2011g). Only noted if not recorded from another source.
3. Nomenclature follows the Australian Faunal Directory (DSEWPC 2011d).
4. Status: V = Vulnerable, NT = Near-Threatened, M = Migratory, LC = Least Concern (Common).
5. BoT = Back on Track priority species.
6. Known from Museum records, published literature (eg Draffan et al. 1983, Watson & Hitchcock in press), Wild-Net database and/or reports and other grey literature (e.g. Watson 2009). These sources are not necessarily mutually exclusive.

It is very likely, given their reported occurrence on nearby Mua Island, less than 3 km away at its closest point, that slender chained gecko, littoral whiptail-skink, bare-backed fruit-bat, fawn leaf-nosed

[7] The water mouse is patchily distributed in the Northern Territory, and from the Gold Coast to Proserpine in Queensland (Menkhorst & Knight 2004). The species has been recently recorded from New Guinea (Hitchcock 1998). Water mouse is erroneously reported as being observed on Boigu Island (Conics 2008c).

[8] The only record of the Brush-tailed Tree-rat in Queensland was in 1963 from Bentinck Island in the Gulf of Carpentaria (DSEWPC 2011e).

bat and coastal sheathtail bat will also occur on Badu Island. Torresian tube-nosed bat is reported for Mua Island but doubts about the validity and identification of the species mean that it is difficult to predict its occurrence on Badu Island. There is no record of any species of tube-nosed bat for Badu Island, though this may simply be a lack of survey effort.

Freshwater turtles are reported by St Pauls community members as being present on Mua Island. There is a Queensland Museum record of Jardine River turtle for Iama Island and there is a possibility that this species is present on Mua Island. If so, there is a strong likelihood that it is also present on Badu Island.

Given its mobility, spectacled flying-fox may also occur, though a lack of actual database or published records in Torres Strait for such a readily identifiable species raises some doubts. Spectacled flying-fox does occur in New Guinea; and a number of sources, including Duncan *et al*. (1999) and Churchill (2008), state that the species occurs in the Torres Strait but no location details are provided. Conics (2008a) list spectacled flying-fox as having been recorded during field survey on Iama Island but make no mention of the species in the main body of their report. Due to the uncertainty, the record is disregarded for the purposes of this report.

Little red flying-fox is present on Badu Island (Conics 2009a) and their camps should be a focus for future surveys for spectacled flying-fox. The difficulty in detecting the presence of water mouse due to its habits and preferred habitat means that its presence cannot be discounted without substantial field survey work.

6.3.2 Profiles of Species listed as Endangered or Vulnerable under the EPBC Act and/or NC Act known from Badu Island

Emerald monitor (*Varanus prasinus*)

NC Act: Near-Threatened

The emerald monitor is an arboreal species, living in the upper canopy of rainforest and monsoon forest (Wilson 2005), in palm forest, mangroves (Greene 1986; Cogger 2000), cocoa plantations (Greene 1986), vine thickets (Schaffer 2010) and around lagoons (Cogger 2000). The species uses its prehensile tail to forage among slender branches and outer foliage (Wilson & Swan 2010) and eats mainly katydids and other small arthropods and occasionally rodents (Greene 1986). Emerald monitors lay eggs in termite mounds in trees (Greene 1986; Ehmann 1992).

The emerald monitor is widespread in Papua New Guinea. In Australia it is restricted to several islands in the Torres Strait, south to Mua Island, where it is known as wyniss (Wilson & Swan 2010). The species is known from Boigu (Clarke 2004a; Schaffer 2010); Mua (Whittier & Moeller 1993; Wilson 2005; Ingram 2008; DERM 2010f), Murray (DERM 2010d; OZCAM 2011) and Dauan islands (Wild-Net record) and there are unconfirmed records from Mabuiag Island (Conics 2009b). Conics (2009a) state that there is a record for Badu Island in Borsboom (2007) and report that the local community has reported sightings of the species, however elsewhere the same document states

'[o]ne conversation with a local resident suggests that the rare emerald monitor …. may be present on the island'. It is expected that emerald monitor is present, but clarification should be sought through Land and Sea Rangers.

Ehmann (1992) states the emerald monitor is very sparse but secure. However, this assessment includes *Varanus keithhornei* of the McIlwraith and Iron Ranges of Cape York Peninsula (Wilson & Swan 2010), which has been elevated to species status, having formerly been considered conspecific with *V. prasinus* (Covacevich & Couper 1994).

The emerald monitor is one of the most poorly known monitors (Greene 1986) and threats to the species in Australia are unknown. However, in Papua New Guinea the species is targeted by the pet trade, though the threat is considered low (Allison 2006). It is highly desired by reptile keepers and illegal collecting could become a threat in the Torres Strait. The species would be threatened by habitat clearance. Given its known diet the emerald monitor does not appear susceptible to mortality through attempted ingestion of cane toads as per many other species of varanid (e.g. Shine 2010).

Salt-water crocodile *(Crocodylus porosus)*

EPBC Act: Migratory (Bonn Convention); NC Act: Vulnerable

Listed as estuarine crocodile under the Queensland Nature Conservation (Wildlife) Regulation 2006.

The salt-water crocodile occurs in tidal rivers, coastal floodplains and swamps, extending hundreds of kilometres inland along major drainage systems, but is also seen regularly in the open ocean (Webb et al. 1983; Read *et al.* 2004; Wilson & Swan 2010). The species is found from India through south-east Asia to the western Pacific and northern Australia (Wilson & Swan 2010). In Australia the species is most common in large areas of productive wetlands and estuaries (Fukuda *et al.* 2007). In Queensland, salt-water Crocodiles are mainly found in coastal areas north of the Fitzroy River (QPWS 2007) with the highest densities in Queensland found in north-west Cape York Peninsula (Read *et al*. 2004; EPA 2007). Salt-water crocodile is known from Badu Island (T. Stow pers. comm. Nov 2010) and also known from Saibai and Thursday Islands (OZCAM 2011) and Boigu Island (Schaffer 2010). The species is likely to occur throughout the Torres Strait.

On Badu Island salt-water crocodiles are likely only in mangroves and along the shoreline. Conics (2009a) state that some low-lying sections of Badu Island, such as those covered with mangrove vegetation or within the inundation zone of tidal influence are invariably inhabited by Estuarine (Salt-water) crocodiles however make no other mention of the species in their survey results. Its presence on Badu is confirmed by Land and Sea Rangers (Troy Stow pers. comm. Nov. 2010) in estuarine habitat and in freshwater waterbodies.

The salt-water crocodile is still threatened by drowning in fishing nets (Ehmann 1992) with juveniles more likely to become entangled. This does not appear to pose a major threat to the species (EPA 2007). A lack of suitable nesting habitat appears to be the most significant limiting factor for the recovery of the species in Queensland (Read *et al.* 2004). On Badu Island the salt-water crocodile

may be threatened by clearing of mangroves, entanglement in fishing nets, and by direct human persecution. These threats are likely to be minor.

Beach stone-curlew *(Esacus magnirostris)*

NC Act: Vulnerable

Beach stone-curlew is also considered of 'Critical' priority under the Back on Track species prioritisation framework (DERM 2011a). Formerly known as Beach thick-knee and as *Burhinus neglectus*.

The beach stone-curlew generally occurs singularly or in pairs, and occasionally in small groups of up to six birds. The species is exclusively coastal, occurring on all types of beaches, especially near river mouths, on mudflats, near mangroves, and occasionally on coastal lagoons. It is typically more common on islands than the mainland (Lane 1987; Marchant & Higgins 1993). The species is mainly nocturnal or crepuscular (feeding at dawn and dusk) and adult birds appear to be sedentary. The species feeds predominately on crabs and other marine invertebrates in the intertidal zone and a single egg is laid in a scrape in the sand, often in the same area year after year (Clancy 1986; Marchant & Higgins 1993).

Beach stone-curlews are found around eastern and northern Australia from Nambucca Heads in New South Wales (and occasionally south to Victoria) to Port Cloates in Western Australia and extend into New Guinea, the Solomon Islands and Indonesia (Marchant & Higgins 1993). Draffan *et al.* (1983) report the species from 33 Torres Strait Islands in total, in every area except the north-west. The species occurs on Mabuiag Island (Conics 2009b; Watson 2009, Watson & Hitchcock in press).

This species is still found in locations where human activity is high but the lack of young birds in such areas indicates that reproduction is being affected by human disturbance (Freeman 2003). Breeding success may also be significantly reduced from predation by cats, dogs and feral pigs. Much of the species' habitat in Australia, particularly on islands, is secure. However, because beach stone-curlews occur at low densities and occupy linear habitats, the potential for local extinctions to become regional ones is increased (Garnett & Crowley 2000). On Badu Island the species may be threatened by feral species and disturbance by humans, particularly when nesting.

Little tern (*Sternula albifrons)*

EPBC Act: Migratory; **NC Act:** Endangered.

Listed under the EPBC Act as *Sterna albifrons* (Bonn Convention, CAMBA, JAMBA, ROKAMBA).

The little tern is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The little tern is found along a variety of coastal areas, including open beaches, lagoons, estuaries, river mouths, lakes, bays, harbours and inlets, especially those with exposed sandbanks. They feed primarily on small fish, crustaceans and other invertebrates and nest on open sandy beaches. Nesting occurs mainly from September to January but in northern Australia nesting also occurs from April to July. Little terns breed in small colonies (Pringle 1987; Higgins & Davies 1996).

The species occurs in Europe, Asia and Australasia and in Australia occurs along the coastal regions of eastern Australia, south to Tasmania, and across northern Australia, west to northern parts of Western Australia (Higgins & Davies 1996). The little tern is mainly a summer visitor to northern Australia, including Torres Strait, though there is a winter-breeding population in the Gulf of Carpentaria (Blakers *et al*. 1984). Draffan *et al*. (1983) reports the species from 13 islands, including Badu Island, and describes it as an uncommon summer visitor throughout the Torres Strait.

The little tern in Australia is both increasing in abundance and expanding its distribution. The species has a naturally high rate of breeding failure, with ground-nesting making it vulnerable to natural events that contribute to low success, such as loss of eggs and chicks through native predators, flooding of nesting sites (including high tides), and adverse weather conditions (Garnett & Crowley 2000). Little terns are also threatened by human disturbance at nesting colonies, encroachment of vegetation in colonies (Blakers *et al.* 1984), nest predation by rats, gulls and feral pigs, and by degradation of estuaries, pesticide residues in fish, and oil-fouling of both birds and beaches (Garnett & Crowley 2000). On Badu Island it is likely to be threatened only if breeding occurs.

Radjah shelduck (*Tadorna radjah*)

NC Act: Near-Threatened

The radjah shelduck prefers shallow brackish waters, typically coastal and including estuarine mudflats, tidal creeks and mangrove swamps (Blakers *et al*. 1984; Pringle 1985). In the dry season the species congregates on permanent swamps and lagoons and artificial waterbodies such as sewage farms (Pringle 1985; Marchant & Higgins 1990). They are rarely found more than 20 metres from a waterbody (Frith 1977; Marchant & Higgins 1990). Breeding occurs in the wet season, mostly between December and February in north-east Queensland. Nests are placed in large hollow branches in trees in, or close to, water (Frith 1977).

Radjah shelducks occur in eastern Indonesia, New Guinea and tropical Australia, with occasional records further south (Blakers *et al*. 1984; Pringle 1985). The species has disappeared from the Kimberleys and more southern Australia but remains common with no sign of decline through most of its current Australian distribution (Garnett & Crowley 2000). In the Torres Strait the radjah shelduck is known from Badu (Draffan *et al*. 1983), Mua (Draffan *et al*. 1983; Ingram 2008) and Boigu Islands (Clarke 2004b; DERM 2010a). Draffan *et al*. (1983) reports the species from a further five Torres Strait Islands, all in the south-western group of islands and including Horn and Thursday Islands.

The species is threatened by reclamation of habitat for agricultural activities and infrastructure (Marchant & Higgins 1990) as well as indiscriminate shooting (Pringle 1985) but despite the decline of

some sub-populations the species is not considered to be threatened nationally (Garnett & Crowley 2000) and may be increasing in some areas (Pringle 1985). There is no detail provided for the records of radjah shelduck for Badu Island, though Draffan *et al*. (1983) refers to the species as a nomadic visitor in the Torres Strait. Threats to the species on Badu Island are likely to be minor.

Black-necked stork *(Ephippiorhynchus asiaticus)*

NC Act: Near-Threatened

The black-necked stork occurs in swamps, estuarine mudflats and other littoral habitats and on floodplains, in irrigated crops and occasionally open grassy woodland. The species is most frequently associated with open freshwater rather than saline habitats (Pringle 1985; Marchant and Higgins 1990).

Its occurs from Pakistan through south-east Asia to New Guinea and Australia. It is widespread in northern and eastern Australia and occurs through much of Queensland (Marchant and Higgins 1990), though it is not abundant anywhere. The sparse distribution of the species is probably due to the requirement of large areas of freshwater swamps for the maintenance of even one pair (Pringle 1985).

Black-necked stork has been recorded on Badu (Draffan et al. 1983; DERM 2010g) and Boigu Islands (Draffan *et al*. 1983; Clarke 2004b; DERM 2010a) and Ingram (2008) refers to a Wild-Net record from Mua Island. Draffan *et al*. (1983) reports the species from a further seven Torres Strait Islands, all in the south-western group of islands and including Horn, Prince of Wales and Thursday Islands.

The black-necked stork feeds on a variety of aquatic prey items including crustaceans, fish, amphibians, reptiles and arthropods. The species is very sparsely distributed throughout its range and it appears that the maintenance of even one pair may require large areas of freshwater swamps. Breeding is very poorly known, although they nest in tall trees, both live and dead, in or near freshwater swamps (Pringle 1985; Marchant & Higgins 1990; Dorfman *et al*. 2001).

Although the black-necked stork is thought to be threatened by disturbance and habitat loss it has not been greatly affected by the intensification of land-use in eastern Australia (Garnett & Crowley 2000). Nonetheless, the species is threatened by the use of chemicals including herbicides and insecticides near wetlands, the loss of suitable nesting trees, disturbance of waterbodies by livestock, loss of wetlands due to agriculture and development, and possibly by ingestion of Cane Toads (Garnett & Crowley 2000; Dorfman *et al*. 2001; NSW NPWS 2002; Clancy 2010). In New South Wales collision with powerlines is the greatest known cause of mortality (Clancy 2010).

On Badu Island the black-necked stork is most likely to be found on the small freshwater swamps, in more open areas of palustrine wetlands, particularly when subjected to seasonal waterlogging, and in samphire grasslands on the edges of mangroves. Threats to the species on Badu Island are likely to be minor. Breeding is unlikely as Storr (1973) considered it a non-breeding dry season visitor to northern Cape York Peninsula.

Grey goshawk (*Accipiter novaehollandiae*)

NC Act: Near-Threatened

The grey goshawk occurs in woodland and forest in coastal and subcoastal northern and eastern Australia. It prefers areas of mature forest with dense canopy, though it will forage in open country, and also uses plantation forests and mangroves (Marchant & Higgins 1993). In northern Australia it is more typical of riverine forest (Debus 1998). Prey includes mammals, birds, reptiles, frogs and invertebrates. Breeding is poorly known but nesting occurs in wooded areas, often near permanent water. The breeding season varies with location and in Queensland mostly occurs from July to November and the nest is usually high in the canopy of a tall tree (Marchant & Higgins 1993). The species was formerly considered to extend beyond Australia through New Guinea north to the Moluccas and east to the Solomons (Marchant & Higgins 1993). The grey goshawk is now regarded as being restricted to Australia, with extralimital birds now considered to be either *A. hiogaster* or *A. griseogularis* (Christidis & Boles 2008). In the Torres Strait the grey goshawk is known from Badu (Draffan *et al.* 1983; Conics 2009a), Mua (Draffan *et al.* 1983; Conics 2008b) and Red Wallis Islands (Storr 1973). On Badu the species is most likely to be found in vine forests and the taller open forests and woodlands and is considered resident (Draffan *et al*. 1983).

The species remains common in tropical and subtropical Australia (Debus 1998) but there has been a slight decrease in populations since European settlement (Olsen 1998). The species is threatened by loss of habitat and human persecution (Blakers *et al*. 1984; Olsen 1998). On Badu Island threats to the species are currently likely to be minimal. It would be threatened by any future habitat loss.

Eastern curlew (*Numenius madagascariensis*)

EPBC Act: Migratory (Bonn Convention, CAMBA, JAMBA, ROKAMBA); **NC Act:** Near-Threatened

The eastern curlew is mostly confined to coastal habitats, particularly estuaries, harbours and coastal lagoons. They mainly forage on open intertidal mudflats, sandflats and saltmarsh, often near mangroves, and occasionally on ocean beaches. Roosting occurs on sandy spits and islets, in mangroves and saltmarsh, and along high water mark on beaches (Pringle 1987; Higgins & Davies 1996). The species usually feeds individually or in small groups (Pringle 1987), though large numbers may congregate at high tide roosts (Lane 1987).

Eastern curlews breed in eastern Siberia during the northern hemisphere summer and arrive in north-eastern Australia as early as late July, but most individuals arrive in eastern Australia by late August and September (Ueta *et al*. 2002). Birds begin to depart to return to breeding grounds around March and April (Lane 1987). However, a significant percentage of the Australian population remains through the Australian winter, particularly in northern Australia (Pringle 1987; Driscoll & Ueta 2002). In Australia, eastern curlews occur in suitable habitat on all coasts (Higgins & Davies 1996). In the Torres Strait Draffan *et al*. (1983) reported them from 18 islands, including Badu, Mua, Mer, Erub and Boigu, and there is a single Wild-Net record from Mabuiag (DERM 2010e) and an unpublished record

from Iama (Conics 2008a). The species is likely, at least on passage, on any island that has suitable foraging habitat.

Eastern curlews are easily disturbed by people at foraging and roosting sites (Higgins & Davies 1996; Taylor & Bester 1999) and are often the first species in a high-tide roost to take to flight if disturbed, relocating to alternative roosts often some considerable distance away (Lane 1987). Eastern curlews will take off when humans approach to within 30-100 m (Taylor & Bester 1999) and sometimes are disturbed within 250 m of approach (Higgins & Davies 1996). Pollution may have also reduced food availability (Higgins & Davies 1996).

Draffan *et al*. (1983) provide no detail on local numbers and the two Wild-Net records (DERM 2010g) are more likely to be a reflection of a lack of formal survey work rather than an accurate indication of their numbers on Badu Island. The species is most likely to be threatened by disturbance when foraging and such a threat would only be significant during passage to northern hemisphere breeding grounds.

6.3.3 Migratory Species

One terrestrial reptile, salt-water crocodile, and 57 bird species listed as Migratory under the EPBC Act have been recorded from the Torres Strait Islands. Salt-water crocodile is also listed as Vulnerable under the NC Act and its life history has been discussed in **Section 6.2**. Two of the birds, eastern curlew and little tern, are also listed as Near-Threatened and Endangered respectively, and their life histories have been discussed in **Appendix H**. The 57 known Migratory bird species consist of 47 non-passerines and 10 passerines. The majority (37 species) belong to the Order Charadriiformes which includes oystercatchers, stone-curlews, pratincoles, plovers, sandpipers and terns. These birds may be may separated into two groups; waders and terns.

A number of other species also migrate into or through the Torres Strait but are not listed under the EPBC Act. Unless otherwise stated it should be assumed that reference to Migratory species in this report refers only to those species listed as such under the EPBC Act. **Table 10** lists the 45 Migratory species that are known or predicted to occur on Badu Island. All species are listed as least concern under the NC Act unless otherwise noted. Further discussion of these species within groups based on behavioural traits and habitat use is provided in **Appendix I.**

Table 10. Migratory[1] species reported or predicted[2] to occur on Badu Island.

Scientific Name[3]	Common Name	Comments[4]
SPECIES REPORTED		
Hirundapus caudacutus[5]	White-throated Needletail	Published record.
Apus pacificus	Fork-tailed Swift	Published record.
Ardea modesta[6]	Eastern Great Egret	Database & published records.
Egretta sacra	Eastern Reef Egret	Database, published & unpublished records.
Ardea ibis[7]	Cattle Egret	Published record.
Plegadis falcinellus	Glossy Ibis	Published record.
Pandion cristatus[8]	Eastern Osprey	Database, published & unpublished records.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Database, published & unpublished records.
Pluvialis fulva	Pacific Golden Plover	Published record.
Pluvialis squatarola	Grey Plover	Published record.

Scientific Name[3]	Common Name	Comments[4]
Charadrius mongolus	Lesser Sand Plover	Published record.
Charadrius leschenaultii	Greater Sand Plover	Published record.
Limosa lapponica	Bar-tailed Godwit	Database & published records.
Numenius minutus	Little Curlew	Published record.
Numenius phaeopus	Whimbrel	Database, published & unpublished records.
Numenius madagascariensis[9]	Eastern Curlew	Database & published records.
Xenus cinereus	Terek Sandpiper	Database & published records.
Actitis hypoleucos[10]	Common Sandpiper	Database & published records.
Tringa brevipes[11]	Grey-tailed Tattler	Database & published records.
Tringa incana[12]	Wandering Tattler	Published record.
Tringa nebularia	Common Greenshank	Database & published records.
Tringa stagnatilis	Marsh Sandpiper	Published record.
Arenaria interpres	Ruddy Turnstone	Published record.
Calidris tenuirostris	Great Knot	Published record.
Calidris ruficollis	Red-necked Stint	Published record.
Calidris acuminata	Sharp-tailed Sandpiper	Database & published records.
Calidris ferruginea	Curlew Sandpiper	Database & published records.
Onychoprion anaethetus[13]	Bridled Tern	Database & published records.
Sternula albifrons[14]	Little Tern	Published record.
Hydroprogne caspia	Caspian Tern	Database, published & unpublished records.
Chlidonias leucopterus	White-winged Black Tern	Published record.
Sterna dougallii	Roseate Tern	Published record.
Sterna sumatrana	Black-naped Tern	Published & unpublished records.
Thalasseus bengalensis[15]	Lesser Crested Tern	Published & unpublished records.
Cuculus optatus[16]	Oriental Cuckoo	Published record.
Merops ornatus	Rainbow Bee-eater	Database, published & unpublished records.
Coracina tenuirostris melvillensis	(Melville) Cicadabird	Published record. Subspecies not recorded.
Rhipidura rufifrons	Rufous Fantail	Database & published records.
Monarcha frater	Black-winged Monarch	Published record.
Symposiarchus trivirgatus[17]	Spectacled Monarch	Database & published records.
Acrocephalus australis[18]	Australian Reed-Warbler	Published record.
Crocodylus porosus[19]	Salt-water crocodile	Predicted by the EPBC Protected Matters Search Tool – unpublished record.
SPECIES PREDICTED		
Gallinago hardwickii	Latham's Snipe	Predicted by the EPBC Protected Matters Search Tool – considered likely to occur.
Myiagra cyanoleuca	Satin Flycatcher	Predicted by the EPBC Protected Matters Search Tool – considered likely to occur.
Hirundo rustica	Barn Swallow	Predicted by the EPBC Protected Matters Search Tool – considered likely to occur.

1. Listed as Migratory under the EPBC Act 1999.
2. Predicted by the EPBC Protected Matters Search Tool maintained by DSEWPC (2011g). Only noted if not recorded from another source.
3. Nomenclature follows the Australian Faunal Directory (DSEWPC 2011d).
4. Known from Museum records, published literature (eg Storr 1973; Draffan et al. 1983; Wilson 2005), Wild-Net database and/or reports and other grey literature (eg Conics 2009a). These sources are not necessarily mutually exclusive.
5. Also listed under the EPBC Act (ROKAMBA) as *Chaetura caudacuta*.
6. Listed under the EPBC Act (CAMBA, JAMBA) as Great Egret *Ardea alba*. Australian birds elevated to full species level as *A. modesta* (Kushlan & Hancock 2005; Christidis & Boles 2008).
7. Listed under CAMBA as *Ardeola ibis*, listed under JAMBA as Bubulcus ibis.
8. Listed under the Bonn Convention as Osprey Pandion haliaetus. Australian birds have been elevated to species level as *P. cristatus* (Wink et al. 2004; Christidis & Boles 2008).
9. Listed as Near-Threatened under the NC Act.
10. Also listed under CAMBA and ROKAMBA as *Tringa hypoleucos*.
11. Also listed under the Bonn Convention and JAMBA as *Heteroscelus brevipes*.
12. Also listed under the Bonn Convention and JAMBA as *Heteroscelus incanus*.
13. Listed under the EPBC Act as *Sterna anaethetus* (CAMBA, JAMBA).
14. Listed under the EPBC Act (Bonn Convention, CAMBA, JAMBA, ROKAMBA) as *Sterna albifrons*. Listed under the NC Act as Endangered.
15. Listed under the EPBC Act (CAMBA) as *Sterna bengalensis*.
16. Listed under the EPBC Act (CAMBA, JAMBA, ROKAMBA) as *Cuculus saturatus*. Australian birds elevated to full species level as *A. optatus* (Christidis & Boles 2008).
17. Listed under the EPBC Act (Bonn Convention) as *Monarcha trivirgatus*.
18. Listed under the EPBC Act (Bonn Convention) as Clamorous Reed-warbler *Acrocephalus stentoreus*. Australian birds elevated to full species level as *A. australis* (Higgins et al. 2006b).
19. Listed as Vulnerable under the NC Act.

6.3.4 Additional Possible Migratory Species

Of the other 13 species of 'Migratory' bird known from the Torres Strait (**Appendix E**), black-tailed godwit (*Limosa limosa)*, red knot (*Calidris canutus)*, sanderling (*C. alba)*, common tern (*Sterna hirundo)* and black-faced monarch (*Monarcha melanopsis*) are expected to occur on Badu Island on a regular basis. The remaining eight species are all possible as sporadic (not annual) visitors except for double-banded plover (*Charadrius bicinctus)*, which is considered very unlikely based on known movements.

6.3.5 Species of Regional Significance

Two microhylid frog species (family Microhylidae) have been reported from Badu Island. Conics (2009a) reported slender frog (*Austrochaperina gracilipes)* during survey work and refer to an Australian Museum specimen of a *Cophixalus* species. These are the only records of microhylid frogs from any of the islands considered in this report, other than Dauan Island (see **Appendix E** for details of islands included). Slender frog is the only Australian species of microhylid found at the tip of Cape York Peninsula and it is also found in Papua New Guinea (Tyler 2009). There is a single Wild-Net record for Dauan Island, approximately 10 km from the coast of Papua New Guinea. There is no species of *Cophixalus* in Australia found north of the McIlwraith Range area (Tyler 2009) and none of the Australian species occur in New Guinea (Allison & Kraus 2006). Assuming that the location details of the *Cophixalus* specimen for Badu Island are correct this is a very interesting record and, unless it is a case of accidental human transportation with freight, is either a very substantial increase in distribution or may be an undescribed species. Future frog survey work on Badu Island should search specifically for microhylid species. Voucher specimens of any *Cophixalus* species, under permission from Mura Badughal and permit, would be beneficial to the Queensland and/or Australian Museums.

There are a number of reptile species that appear to be at their northern limits on Badu Island and/or its very close neighbour Mua Island. Zigzag velvet gecko (*Oedura rhombifer*) and dwarf mulch-skink (*Glaphyromorphus pumilus*) are known from Mua Island, though are not yet reported for Badu Island. Northern death adder (*Acanthophis praelongus)* is known from both islands. There is also a survey record of Mertens' water monitor (*Varanus mertensi*) for Badu Island (Conics 2009a), though it is described as a preliminary identification. Other than a Wild-Net record of this species for Possession Island it is otherwise unknown in the Straits. If it is present on Badu Island this would be a substantial increase in distribution. None of these species occur in New Guinea. Northern death adder was considered to extend into New Guinea (Cogger 2000) however PNG populations are now regarded as different from all Australian species (Wüster *et al*. 2005).

The scrub python (*Morelia kinghorni)*, formerly considered conspecific with amethyst python (*M. amethistina)* (and still recognised as such by the *Australian Faunal Directory* (DSEWPC 2011d), is reported by Conics (2009a) as occurring on Badu Island, from their own survey record and as a Queensland Museum record. Harvey *et al*. (2000) described *M. kinghorni* as a full species, a taxonomy that has since been accepted by others (*e.g.* Freeman & Freeman 2009; Wilson & Swan

2010). There is an Australian Museum specimen of *M. amethistina* on Mua Island, and specimens of both species are listed for Masig Island, to the north-east (OZCAM 2011). Wilson and Swan (2010) no longer include *M. amethistina* as a species occurring in Australian territory and such apparent discrepancies in distribution may be due to a delay in recognition of the changed taxonomy. The exact identification of any morelia species on Badu Island should be ascertained whenever possible in order to resolve the distributional limits of the two species. However, differentiation of the two species may be difficult in the field and specimens or precise descriptions and/or photographs may be required.

There is an Australian Museum specimen of ring-tailed gecko (*Cyrtodactylus* sp.) for Badu Island (OZCAM 2011). Until recently ring-tailed geckos in Australia were considered to be the widespread species *C. louisiadensis*, which occurs in New Guinea. They are now considered to be an endemic species *C. tuberculatus* (Wells 2002; Wilson & Swan 2010). Wells (2002) also proposed a second species *C. abrae* for the population at Iron Range on Cape York Peninsula, though this has yet to be adopted (*e.g.* Wilson & Swan 2010). The ring-tailed geckos on Badu Island, therefore, are of taxonomic interest and may prove to be of conservation significance. Any future survey work should search for possible new species such as ring-tailed gecko.

Badu and Mua Islands are the northernmost Torres Strait Islands of any size south of Boigu and Saibai islands near the Papua New Guinea coastline. Ingram (2008) considered that most of the reptile species have been present since Mua became an island and therefore Mua and Badu, given their close proximity, may have some distributional significance in terms of Australian reptiles. Although this is not considered a matter of priority, distribution is an important consideration in the assessment of conservation significance of any species and any additional information on the distribution of reptiles in Torres Strait may prove useful in the longer term.

A number of mammal species of very limited distribution in the Torres Strait have been reported for Mua Island. This includes short-beaked echidna (*Tachyglossus aculeatus)* (McNiven & Hitchcock 2004), delicate mouse (*Pseudomys delicatulus)* (Ingram 2008), bandicoot species (McNiven & Hitchcock 2004; Conics 2008b; Hitchcock *et al.* in press) and, based on archaeological evidence, Agile wallaby (*Macropus agilis)* (McNiven & Hitchcock 2004; Ingram 2008). Despite the closeness of the two islands, the only native ground-dwelling mammals reported from Badu Island are water-rat (*Hydromys chrysogaster*) (an unconfirmed survey record, Conics 2009a) and Cape York melomys (*Melomys capensis)*, an Australian Museum specimen reported in Conics (2009a) and not otherwise reported for the Strait. It is expected that additional survey work, particularly involving systematic trapping, on Badu Island will identify additional mammal species, both bats and ground-dwelling species, and this should be considered a matter of some priority. It is suggested that bandicoots and wallabies were translocated to Mua Island (McNiven & Hitchcock 2004; Ingram 2008) and should any evidence of their current or former presence be found on Badu Island this would presumably also be a possibility.

6.4 Pest Fauna Species

Exotic (introduced) fauna species reported for Badu Island are dog, cat, pig, and horse.

The exotic house gecko (*Hemidactylus frenatus*) is common on Mua Island in the community of St Pauls (Terry Reis *pers. obs*. March 2011) and, if not already on Badu Island, is likely to colonise the island. It is considered a threat to native species through competition in both natural habitats and on buildings (Case *et al*. 1994; Hoskin 2010). There are records of native arboreal geckoes on Mua Island, *Gehyra dubia*, and slender chained gecko is also expected to occur. Searches for house gecko should be combined with other, higher priority, reptile surveys.

Dogs, cats and horses are present on Badu Island (Conics 2009a, Stanton & Fell pers. obs.) although population size and impacts on fauna and habitat is not known. Evidence of pigs has been observed in riparian and swamp forest habitats and in open forest, rock pavements/shrub and modified habitats, and they are a focus for hunting using dogs.

Dogs are a threat to ground nesting birds such as beach stone-curlew and are a disturbance factor for waders, terns, radjah shelduck and black-necked stork. Cats are significant predators of native animals and have been implicated in the extinction of native species both on islands (Bloomer & Bester 1992) and on mainland Australia (Dickman *et al*. 1993). It is not just feral cats that kill native animals. Although house cats in Australian suburbs have been shown to kill mainly introduced rats and mice, native wildlife are also killed, including mammals, birds, reptiles and frogs. Cat predatory behaviour appears largely opportunistic, though small mammals are preferred. Therefore, should house cats have access to relatively undisturbed habitats it is likely that they would have a substantial impact on native fauna, particularly mammals (Barratt 1997). This would be especially relevant on Badu Island with its apparent lack of introduced rodents.

Pigs present a threat directly to frogs, reptiles and birds through predation. Ground-dwelling birds are particularly vulnerable. They also have indirect impacts through habitat destruction and degradation. The foraging activities of pigs degrade habitat through surface soil destruction and the up-rooting of plants which facilitates erosion. Most damage occurs in areas where the soil is soft, such as in and around wetlands and watercourses, or in low-lying areas after rain. Regeneration of forest and woodland plants is reduced and the invasion by both native and introduced weed species is facilitated (Alexiou 1983; Statham & Middleton 1987; Hone 1995). Foraging around wetlands by pigs means that frogs are a common prey item and pigs, through either direct predation or habitat degradation, may have contributed to the declines in some populations of Australian frogs (Richards *et al*. 1993).

Horses are known to occur on Badu Island (Conics 2009a, Stanton & Fell pers. obs. 2007) however populations and impacts are not known. Large numbers of horses are capable of substantial habitat modification and destruction, including the fouling of waterbodies (Berman 2008). Control measures may be required should the population reach levels that are damaging to the environment.

6.5 Threats to Fauna and Habitat

The major threats to fauna in any location are loss, degradation and fragmentation of habitat. These processes may be due to deliberate clearing or may be the result of inappropriate fire regimes, damage by feral and domestic herbivores, storm damage and weed invasion. Weed invasion may not

simply alter the plant species assemblage but can also choke out ground cover, reducing suitability for ground-dwelling species, and increase fire frequency and intensity, thus altering plant species composition and physical structure even further.

As indicated above exotic predators, such as dogs and cats, pose a threat to native fauna, either directly through predation or by disturbance. At this stage the most significant potential threats to native fauna on Badu Island are the possible introduction of the exotic cane toad and rats (*Rattus* species). Cane toads would have dramatic impacts on the varanid (goanna) and snake fauna and, given the small size of the island, could lead to local extinctions. Black rats (*Rattus rattus*) are an even greater potential threat given their agility and generalist diet. Should exotic rats be found to be present an extermination, or control, project is recommended.

Hunting may pose a threat to some species. Species likely to be targeted include varanids (goannas), pythons, waterfowl, pigeons and flying-foxes. Hunting should be regulated so as to be sustainable.

6.6 Future Priorities

It is important that the faunal values of Badu Island be more comprehensively identified so that the most important conservation elements are managed appropriately. In addition to general systematic survey methods for the compilation of the fauna species assemblage for the island, the following actions are recommended:

High Priority

- Trapping survey targeting ground-dwelling mammals
- Frog survey, especially microhylid species.

Medium Priority

- Micro-bat surveys
- Mega-bat surveys
- Population estimate for beach stone-curlew to allow monitoring of breeding success
- Identification of any breeding areas for terns
- Identification of the most important foraging and high roost sites for waders
- Reptile survey, with particular emphasis on Jardine River turtle, emerald monitor, littoral whiptail-skink and slender chained gecko.

Low Priority

- Trapping survey for water mouse. The *Draft Recovery Plan for the Water Mouse* (DERM 2009b) included the following key recovery actions:

    - *Identify habitats supporting populations of the water mouse and map the current distribution.*

- *Confirm current distribution of the water mouse.*
- *Conduct surveys and ecological assessments of potential water mouse habitat.*
- *Describe key biological and ecological features of the water mouse and its habitat.*
- *Determine whether genetic variation exists across populations of the water mouse*.

7.0 The Role of Fire in Savanna Landscapes

Most Cape York Peninsula, and hence Torres Strait Island plant communities will burn if enough fuel is present. The exceptions are rainforest communities, communities of rocky areas and some wetland areas such as mangroves and the deeper permanent swamps. We know from the historical record and anthropological studies that the landscape of Cape York Peninsula when Europeans arrived was the product of traditional burning practices and land use that had changed little over many thousands of years and had led to stability in the nature of the plant communities and the way they were distributed across the landscape.

The loss of traditional burning practices in recent times has led to a loss of that stability as vegetation types that had evolved under particular fire regimes were subjected to new regimes[9]. In many areas this destabilisation has led to widespread loss of plant communities and inevitably will be found to have led to serious loss of the species of plants and animals that depend upon them.

In the history of the indigenous occupation of Cape York Peninsula and Torres Strait Islands, there were dramatic changes in plant communities as the climate shifted under a rapid succession of global ice ages, but these changes happened over thousands of years. It is clear from the nature of recent changes however that they have been greater in periods of as little as fifty years than those that have occurred in those millennia prior to European arrival. It is not the change itself that is the problem but its rapidity. Species cannot evolve rapidly enough to accommodate it and the inevitable result will be the loss of species.

The reasons that the indigenous people of northern Australia used fire have been well documented (Russell Smith *et al*. 2009). They included managing to favour various species of food plants, to protect sacred places, to attract game or drive them towards the spears of hunters and to create open landscapes that made travel easy and ambush by enemies difficult. Above all however, they burnt for their own safety. As people who used fire in their daily lives they had to burn to manage the fuel around them, thus avoiding situations where a stray spark landing in heavy fuel could threaten their lives.

In Torres Strait, the ongoing use of fire is evident on the majority of islands and there is no doubt that it has been fundamental in shaping and modifying vegetation cover and influencing habitat diversity across the islands. McNiven (2008) notes the ethnographic record of Haddon (1935) where fire use formed an integral part of garden preparation and land cleaning in the late 1800's, and evidence of fire is also in the pollen and phytolith record (Rowe 2006, Parr & Carter 2003).

[9] Fire regimes are defined by the frequency of fires and their season of occurrence, both of which have relationship to their relative severity

The fire dependence of the non-rainforest communities is related largely to the regeneration strategies of the species within them. Some have woody fruits which have to be cracked by heat to release the seed and most require bare ground and sunlight for those seeds to germinate and grow. Many perennial grasses begin to decline and die after several years without fire. Some species will only generate from seed and others are capable of resprouting after fire. Of those species that will germinate and grow through heavy litter, all still require sunlight to survive and most will not persist under a wildfire regime of infrequent hot fires.

In post - European northern Australia, altered fire regimes have led to massive loss of open forest and woodland habitats in the high rainfall areas, particularly the north east-coast of Cape York Peninsula. In that area fire has disappeared completely because of the complexity of the landscape, with numerous streams and rainforest areas which have made it impossible for individual fires to spread very far. The result has been widespread development of a dense understory of shrubs and trees which is preventing the regeneration of the canopy. The end result will be the replacement of open forest areas with rainforest related vegetation. In areas of shallow soils dominated by shrubs, there has been a progressive loss of species as they reach the end of their life cycle and die without replacement.

The land management imperatives that now arise as a result of the influences discussed above are to maintain fire in those plant communities that will still support it in order to stabilise them against further change, and to ensure that the prevailing fire regime is one of numerous small cool fires rather than widespread late dry season fires.

8.0 Profiles for Badu Island Habitats

The following section presents a summary of current knowledge, management requirements and recommended management actions for the habitats that occur on Badu Island. The information presented has been derived from prior and recent field survey efforts, review of previous reports, input from experts at technical workshops, and consultation with island rangers and indigenous community members.

8.1 Evergreen/Semi-evergreen Vine Forest and Vine Thicket

8.1.1 Status of Ecological Knowledge

As per mapping of Stanton *et al.* (2009), semi-evergreen vine forest and thicket is restricted to upper slopes and gully lines on Mt Mulgrave where it is characterised by a canopy of *Acacia polystachya, Syzygium bungadinnia, S. forte subsp. forte, Endiandra glauca,* and *Maranthes corymbosa.* The forest represents a floristically more diverse and complex variant of *Welchiodendron longivalve* dominant closed forest and scattered *Welchiodendron* occur throughout the habitat. Evergreen vine forest and thicket represents the maximum development of vine forest on the island, although it has been subject to limited floristic sampling. Similarly, fauna survey in this habitat has been limited with no structured sampling indicated in previous survey efforts.

The vegetation community (1d) that forms this habitat on Badu is restricted to the near western island group occurring on Mabuiag Island and possibly an unsampled example on Gebber Island which was observed from helicopter.

Photograph 12. A large specimen of *Syzygium bungadinnia* in evergreen vine forest, Mt Mulgrave. **Photograph 13**. Typical vine thicket species understorey.

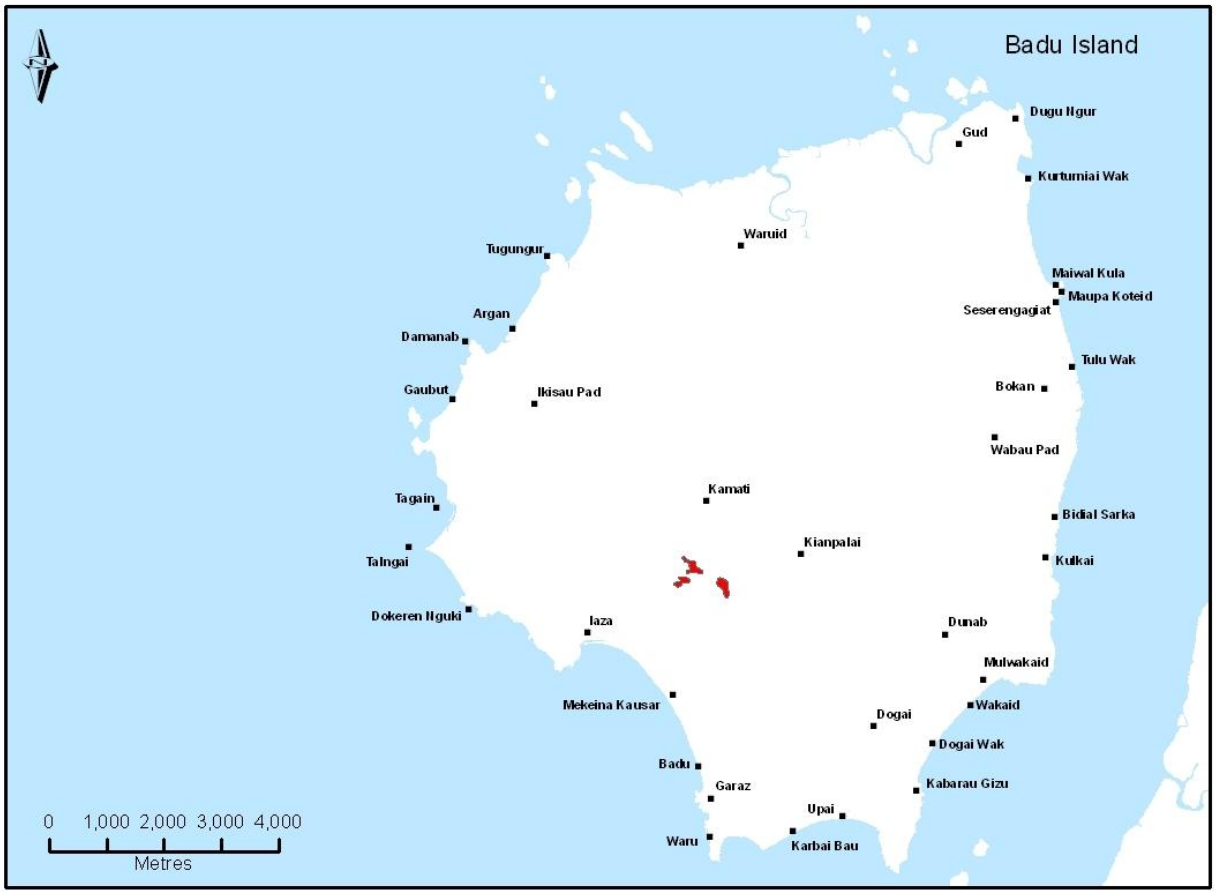


Figure 3. Distribution of Evergreen Notophyll Vine Forest (place names after Lawrie, 1970).

8.1.2 Ecological / Cultural Considerations

Habitat Condition: This habitat has been largely unaffected by human occupation due to its geographic distribution where it is restricted to areas of steep, rugged topography mostly enclosed within a broad buffer of non-flammable vegetation. The vegetation margins are stable, constrained by both topography and local edaphic condition with no evidence of anthropogenic alteration, invasion by exotic species, or incursion by fire.

Fauna: The fauna assemblage associated with this habitat is poorly sampled and as such, poorly known. Although this habitat lacks any previous fauna sampling effort, considering the restricted and limited extent of this habitat, targeted fauna sampling is considered low priority. Vine thicket provides potential habitat for the bare-backed fruit bat (*Dobsonia mollucensis,* Near-Threatened NC Act*)* reported to occur on Mua Island by Hall (1995) and the cave dwelling 'fawn leaf-nosed bat' (*Hipperosiderus cervinus,* Vulnerable NC Act*)* reported to be present in the region northwards from Coen (Cape York Peninsula) by Pavey *et al.* (1995).

Flora: The habitat supports high species diversity and provides habitat to the following significant species:

- *Diospyros sp. (Bamaga)* - Vulnerable

- *Archidendron hirsutum* – Near-Threatened
- *Aglaia tomentosa* – Regionally Significant
- *Euonymus australiana* – Regionally Significant
- *Haplostichanthus fruticosus* – Regionally Significant
- *Maniltoa lenticellata var. lenticellata* – Regionally Significant
- *Cupaniopsis flagelliformis var. flagelliformis* – Regionally Significant

Upper slopes also support a high diversity of epiphytes including orchids, dischidia and hoya species.

Cultural Perspectives: The habitat hosts an abundant array of cultural resources particularly food trees. Specific cultural significance is unknown and requires further investigation.

8.1.3 Management Implications

This habitat is relatively robust, buffered from the impacts of footslope fires and as such, requires little action in terms of active management. The habitat is limited in extent and the major recommendations for management relate to continued collection and documentation of the floristic and faunal assemblage as well as informal monitoring of habitat health through site observation. Informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, should be undertaken on a regular annual to bi-annual basis whenever the Mulgrave Peak area is accessed. Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.

This is possibly the least known habitat on the island in terms of faunal assemblage. Documentation of all animals observed (including invasive/exotic species) should be undertaken with photographs and collections (preserved in freezer) where possible for future formal identification by authorities or agencies. The habitat supports numerous cultural and regionally significant flora species some of which are poorly known. Whilst data collection, collections and pressings of plant species within this habitat can be undertaken on an opportunistic basis, it is however pertinent to ensure that such actions have relevance to the local community. As such, it is recommended that a data and specimen collection program should initially focus on plants of cultural/resource significance and local plant names compiled in an appropriately stored reference collection. Scientific names for plant species can be applied when the opportunity arises.

8.1.4 Summary of Recommended Management Actions

The information provided in **Table 11** below aims to summarise the key issues, actions and priorities so as to aid the transfer of information into the Boigu Island Working on Country Plan. Priority categories are adapted from the Draft Plan of Management for Pulu Indigenous Protected Area (Hitchcock *et al.* 2009) as follows:

Immediate Priority Actions – Actions required for management issues which have potential to significantly alter of damage the islands natural or cultural values in the short term (0-5years).

High Priority Actions – Actions required for management issues which have potential to result in significant damage of the islands natural or cultural values within the medium term (5-15 years) or where lack of knowledge significantly hampers the ability to manage a habitat effectively.

Moderate Priority Actions – Actions required for management issues which have potential to result in significant damage of the islands natural or cultural values within the long term (>15 years) or where there is a knowledge gap that does not detract significantly from the ability to manage a habitat effectively.

Table 11. Summary of Management Actions for Evergreen and Semi Evergreen Vine Forests

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Due to the limited extent of this habitat, the design and implementation of a structured fauna survey and trapping program can best be undertaken in conjunction with fauna survey in the broader closed forest habitats that occupy Mulgrave Peak. The survey needs to utilise collaborative research and maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in dry season. There is considerable potential for new records of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	No major issues identified. The habitat is mostly protected in rocky gullies and hillsides.	No specific management actions required. Management of surrounding flammable vegetation country by early dry season mosaic burning to limit impact of late season wildfires.	Moderate
Threatened Species Management	Flora: Seven significant species are known occur within this habitat. While the ecology of these species is poorly documented, the habitat is robust with no immediate threats recognised. Fauna: Composition of fauna within this habitat is poorly known.	Flora: No management actions required. Carry out ongoing surveys as identified above. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues identified however a number of species known from disturbed areas	Flora: No active weed control or management currently required. Carry out monitoring for new weed	Moderate

Management Category	Context/Issue	Actions	Priority
	pose a threat in the long term. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	infestations particularly on habitat edges and along access tracks on an annual or bi annual basis. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members.	Immediate
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, on a regular annual to bi-annual basis. Observations should be made along an established access route to ensure consistency and this access route should be mapped using GPS.	High

8.2 Deciduous / Semi-Deciduous Vine Forest and Thicket

8.2.1 Status of Ecological Knowledge

Deciduous/ Semi-deciduous vine forest is associated with rocky knolls in the islands interior, and with coastal dunes systems. Occurrences on rocky knolls are limited in extent, generally being transitional to the more extensive *Welchiodendron longivalve* dominant forest communities. Minor unmapped patches of semi-deciduous thicket may be associated with Welchiodendron forest, particularly on the sheltered (north-west) side of rocky knolls. Protection from fire is afforded by the rocky nature of the substrate, which limits penetration of fire into the forest margins.

Photograph 14 (left). Sharp boundary between a deciduous vine thicket on a rocky knoll and the surrounding woodland. The endemic and Vulnerable listed cycad (*Cycas badensis*) in foreground left. **Photograph 15.** An extensive tract of semi-deciduous vine thicket on stabilized aeolian dunes along the southern coast of Badu Island.

The canopy is typically broken, ranging in height from 10m to 28m, with ridgeline and some disturbed lower slope communities verging on vine thickets. The habitat may include *Alstonia actinophylla*, *Paraserianthes toona, Vitex acuminata, Canarium australianum, Buchanania arborescens, Sterculia*

quadrifida, Acacia polystachya and *Terminalia subacroptera* in the canopy, although it merges with Welchiodendron dominant forest types in some locations. Where it has been subject to disturbance, such as on wind-exposed ridgelines, *Acacia polystachya* may dominate the canopy. There are extensive occurrences of low vine forest and thicket (VC2u) occur on the south-eastern coast of Badu associated with aeolian dune systems, with scattered occurrences found on prograding beach ridges and foredune systems along Badu's entire coastline. Dune vine thickets are typically associated with the younger Holocene age dune systems in proximity to littoral margins, the older and more inland Pleistocene systems lacking sufficient fertility to support the habitat due to nutrient leaching. Forest stature is limited by prolonged wind and salt exposure which maintains a low wind-sheared canopy structure in the most exposed locations, and canopy height is rarely greater than 10m. Typical species include *Manilkara kauki* (d), *Acacia crassicarpa* (sd), *Drypetes deplanchei* (sd), *Celtis paniculata* (sd), *Terminalia subacroptera* (sd), *Exocarpos latifolius* (a), *Agalaia eleagnoidea* (a), *Cyclophyllum maritimum* (a), *Halfordia kendack* (a), *Psydrax banksii* (a), *Acacia polystachya* (a), *Sterculia quadrifida* (a), and *Ficus virens var. sublanceolata* (a).

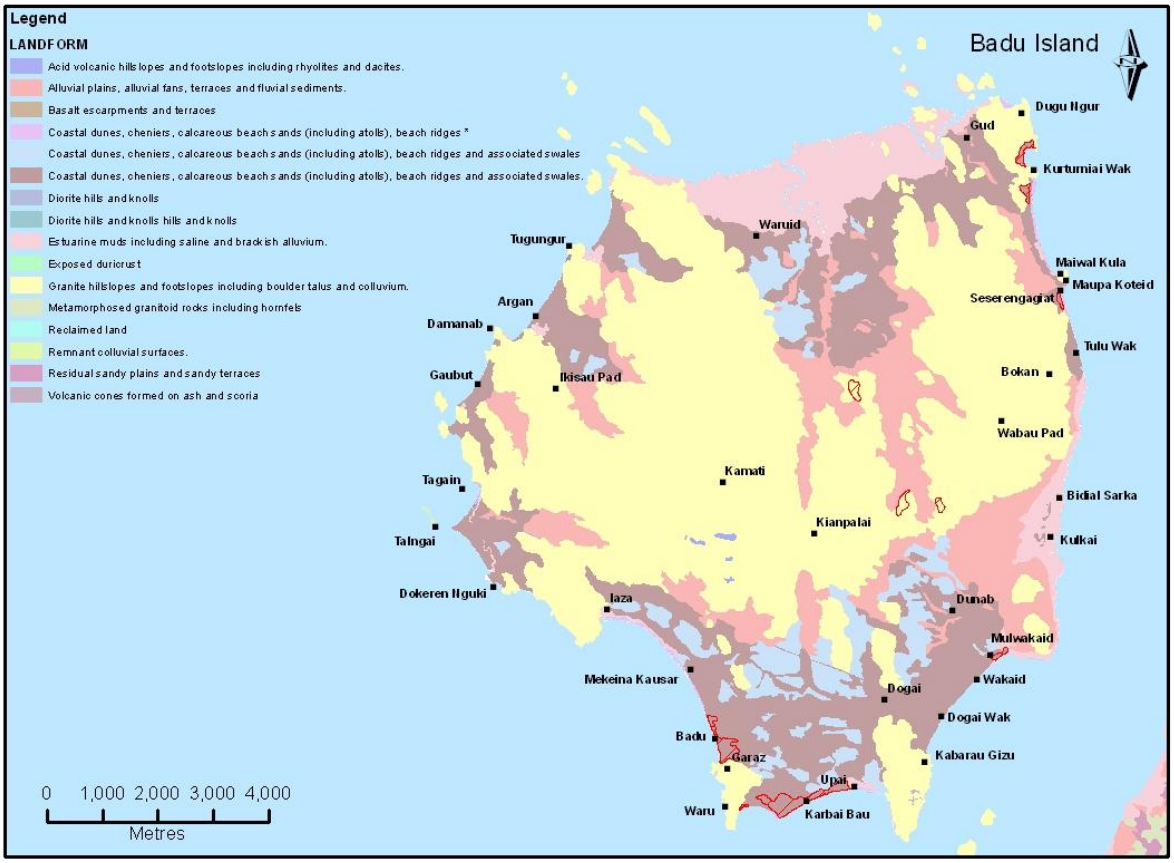


Figure 4. Location of deciduous vine thicket and forest on Badu (place names after Lawrie, 1970).

8.2.2 Ecological / Cultural Considerations

Habitat Condition: On rocky knolls, habitats are typically small and isolated, forming on foothills where they are buffered by extensive upslope tracts of Welchiodendron dominant open forest. They generally form sharp boundaries with savannah woodland communities on lower slope locations. These habitats have stable boundaries and fire protection is afforded by the rocky substrates on

which they occur. All habitats observed, although minor in extent, are in pristine condition and free from exotic weed incursion. The seasonal loss of leaf cover, facilitating light penetration to the forest floor, provides opportunities for the establishment of exotic species and the most imminent threat to habitat condition is posed by lantana (*Lantana camara),* a class 2 exotic species that is well adapted to establishing in forest canopy gaps. Lantana has yet to be recorded from the island however infestation would significantly alter the ecology of this habitat.

Littoral thickets associated with dune systems, lack the inherent stability of vine thicket habitats associated with rockier substrates. Thicket boundaries are influenced by the mobility of the sandy substrate which may be destabilised by wind, anthropogenic disturbance including access tracks, exotic animals or fire. For this reason, littoral thickets should be considered highly sensitive habitats and protected from more destructive elements of human disturbance as far as is practical. Whilst the most extensive examples are in excellent condition due to large area to edge ratios, many smaller occurrences have been degraded by inappropriate burning regimes as well as disturbance such as seasonal camps and 4WD beach access tracks.

Fauna: The fauna assemblage associated with this habitat is poorly sampled and further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of baseline fauna assemblage. Vine thicket provides potential habitat for the bare-backed fruit bat (*Dobsonia mollucensis,* Near-Threatened EBPC*)* reported to occur on Mua Island by Hall (1995) and the cave dwelling fawn leaf-nosed bat (*Hipperosiderus cervinus,* Vulnerable NC Act*)* reported to be present in the region northwards from Coen (Cape York Peninsula) by Pavey *et al.* (1995).

Flora: The habitat supports high species diversity and habitat for the following significant species:

- *Diospyros sp.* (Bamaga B.P. Hyland 2517) – Vulnerable
- *Gossia retusa* - Regionally Significant
- *Uvaria rufa* – Regionally Significant

Cultural Perspectives: This habitat, particularly littoral dune forest, provides an extensive repository of cultural resources including a number of important food trees such as Wongai (*Manilkara kauki)*, Cedar Bay cherry (*Eugenia reinwardtiana),* mipa *(Terminalia subacroptera),* yam *(Dioscorea transversa),* peanut tree *(Sterculia quadrifida),* and ballart *(Exocarpos latifolius).*

8.2.3 Management Implications

Vine thickets on rocky slopes are relatively robust although they remain at threat via introduction of exotic species, particularly lantana. Littoral thickets on dunes similarly retain natural condition over the majority of occurrences. They are however subject to a range of pressures and threats of which wildfire and recreational usage are the most problematic. There is evidence that a frequent burning regime at the seasonal camp of 'Argan' has compromised development of vine thicket on the foredune and in this location the habitat survives as a number of small contracting fragments. In the context of management of littoral foredune systems as a whole, the dunes are recent landform elements in the process of stabilisation through vegetation succession from forbland to shrubland to

vine thicket. A repetitive hot fire regime can interrupt the stabilisation process resulting in foredune erosion. Prescribed burning in early dry seasonal periods (EDS) along the vine forest edge can prevent the impact of wildfires that occur during hotter periods. Seasonal prescribed burns should be considered around all major occurrences when sufficient fuel loads have developed to allow a fire to carry under moderate seasonal conditions. Prevention of hot wildfire incursion can be considered a fundamental requirement for management of littoral rainforest and vine thicket habitats. The expansion of smaller vine thicket copses in degraded forest habitats (e.g. Argun) can similarly be facilitated by burning or fire exclusion on habitat margins.

Recreational access, and collection of timber resources for firewood or carving all have similar potential to degrade the habitat through dune destabilisation and as a potential vector for introduction of pest species.

8.2.4 Summary of Recommended Management Actions

Table 12. Summary of Management Actions for Deciduous and Semi-deciduous Vine Thickets

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known. , plus a restricted population recently found on Mabuiag Island	Design and implement a structured fauna survey and trapping program utilising collaborative research. Survey should prioritise the most extensive tracts of littoral rainforest for survey due to the extent of this habitat. Maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. There is a potential for new records for the island of significant species particularly during the wet season when canopy trees are in full foliage and when vines and herbs are robust.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	The littoral vine thicket habitats may be impacted by late season wildfires which have considerable potential to cause retreat of vine thicket margins and penetrate for some distance within ground covers. The incursion of exotic species, particularly lantana, may considerably alter the flammability of deciduous vegetation rendering it susceptible to incursion by severe	Management of surrounding country by dry season mosaic burning to limit impact of late season wildfires. Consider prescribed burning along the margins of vine thicket communities to limit impacts of late season wildfires	Immediate

Management Category	Context/Issue	Actions	Priority
	late season fires.		
Threatened Species Management	Flora: The ecology of this habitat is poorly documented, however the habitat is presently robust and self-maintaining. Threats to significant flora species are from weed infestation and late season fires. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Carry out ongoing surveys as identified above. Monitor habitat. In particular littoral rainforest communities for weed incursions (see monitoring). Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	High High
Invasive Species Management	Flora: There are few existing weed infestations within this habitat although there is a risk of introduction of a number of weed species into the habitat including praxelis, mintweed, red Natal grass and butterfly pea. Fauna: The composition of invasive fauna within this habitat requires further study. There is considerable potential for impacts on fauna by feral cats and dogs.	Flora: No active weed control is currently required. Carry out monitoring for new weed infestations particularly on habitat edges on an annual or bi-annual basis. Focus should be maintained on littoral vine thicket habitats where the risk of weed incursion is particularly high. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting consultation with community members. Develop a trapping/ structured control program based on results.	Moderate Immediate
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal monitoring of selected locations for infestation of weed species on a six monthly basis including observations taken late in the wet season at maximum growing season. Weeds such as praxelis, butterfly pea, siratro and mintweed should be a focus for monitoring. Lantana also poses a considerable threat to habitat stability. Establishment of formal monitoring and photographic sites in selected littoral (dune) vine thicket habitats that have been previously impacted or suppressed by recreational usage and fire (e.g. the small unmapped vine thicket copses on Argan). This will provide evidence for the effectiveness of imposed fire and recreational management regimes. Monitoring sites can be marked with a star picket with photographs taken towards designated directions.	High
Cultural Heritage	Inappropriate fire regimes and vehicular recreational access to littoral vine thicket habitats has considerable potential to destabilise dune landforms and lead to degradation of cultural sites and values.	Carry out cultural heritage surveys and manage sites as required.	Immediate.

Management Category	Context/Issue	Actions	Priority
Other Actions	Vehicular recreational access to littoral vine thicket habitats has considerable potential to destabilise dune landforms and lead to habitat degradation. Beach access also greatly increases the risk of exotic weed species introduction and spread.	Designate a single recreational access point for vehicles and close all alternative access points to usage. Ensure the reasons for these actions are communicated to the broader Badu Island community.	Immediate

8.3 Swamp Forest and Riparian Forest Complexes

8.3.1 Status of Ecological Knowledge

Swamp forests can be divided, based on geomorphic association, into those developed in dune swales, and those that are associated with alluvial channels. Whilst ecologically similar, hydrologic regimes may vary significantly. Habitats associated with dune swales are under the direct influence of a shallow groundwater table, typically perched on the poorly drained alluvium that underlies dune sands. Swamp forest habitats associated with alluvial systems have a dependence on seasonal water flows with replenishment of both nutrient and soil moisture levels occurring during seasonal rainfall events. Seasonal water logging of soils is an ecological control in common with all of these communities.

Swamp Forest on Dunes: On dune landscapes, swamp forest habitats are restricted to shallow swales associated with a broad deflation hollows and plains in the south-eastern portion of the island. Swamp box (*Lophostemon suaveolens*) is typically the dominant canopy tree in (VC3e) with *Deplanchea tetraphylla, Asteromyrtus brassii, Acmena hemilampra* subsp*. hemilampra* and *Acacia crassicarpa* as prominent canopy associates. The shrub layer supports *Macaranga involucrata* subsp. *mallotoides* with a groundcover dominated by *Blechnum indicum, Scleria* sp. and *Canavalia papuana.* These forests are typically found within expansive *Melaleuca viridiflora* shrubland habitats. Also included within this category are a number of restricted *Lophostemon suaveolens* dominant open forest occurrences on shallow dune swales in the vicinity of the Badu township.

Swamp Forest on Alluvial Plains: This is a diverse grouping, ranging from open forest communities dominated by *Lophostemon suaveolens* and *Melaleuca leucadendra* to closed forest with sclerophyll vine forest species mixes dominated by *Syzygium angophoroides*, *Lophostemon suaveolens, Maranthes corymbosa, Asteromyrtus brassii, Syzygium forte* subsp*. forte, Acmena hemilampra* subsp*. hemilampra, Horsfieldia australiana, Calophyllum sil* and *Podocarpus grayae.* Open forest communities with grassy ground covers (VC3f) are fire prone and will burn support very hot fires during the hottest, driest seasonal conditions. Closed forest habitats (VC3c, VC3h, VC3g) are typically characterised by vine forest shrub layers which are fire suppressing. The best development of swamp forest habitat is associated with the broad drainage enclave in the islands north, providing the islands largest drainage catchment.

Photograph 16. Swamp forest associated with a deflation hollow in a broad sand plain near the islands bore field. This habitat has been severely disturbed by fire. **Photograph 17.** Open forest of *Lophostemon suaveolens* and *Melaleuca leucadendra* form VC3f.

Photograph 18. Margins of VC3c with *Melaleuca leucadendra,* the best development of swamp forest on the island. The Endangered *Costus poteriae* forms scattered groves along the margins of riparian and swamp forests, typically in sheltered locations as shown in **Photograph 19**.

8.3.2 Ecological / Cultural Considerations

Habitat Condition and Threats: With the exception of habitats located in the vicinity of the Badu Island borefield (see **Photograph 16**), swamp forest habitats are universally in good condition. They are largely free from exotic weeds and from other most other forms of anthropogenic disturbance. There is evidence of minor disturbance by feral pigs in some locations. These habitats, particularly riparian forests, act as natural firebreaks and can be utilised as such during prescribed burning events. The greatest threat to the integrity of these habitats comes from exotic weed invasion along the community margins. In particular, the habitat provides edaphic conditions that are particularly suited to establishment of Singapore daisy (*Sphagneticola trilobata*), a highly invasive herbaceous Weed of National Significance capable of widespread conversion of groundcover. This weed is already well established in swampy habitats within and on the margins of the community. Lantana (*Lantana camara),* a species that has colonised extensive areas of similar habitat throughout much of coastal Queensland and dramatically altered habitat ecology, is also suited to the habitat and considered a potential threat if introduced.

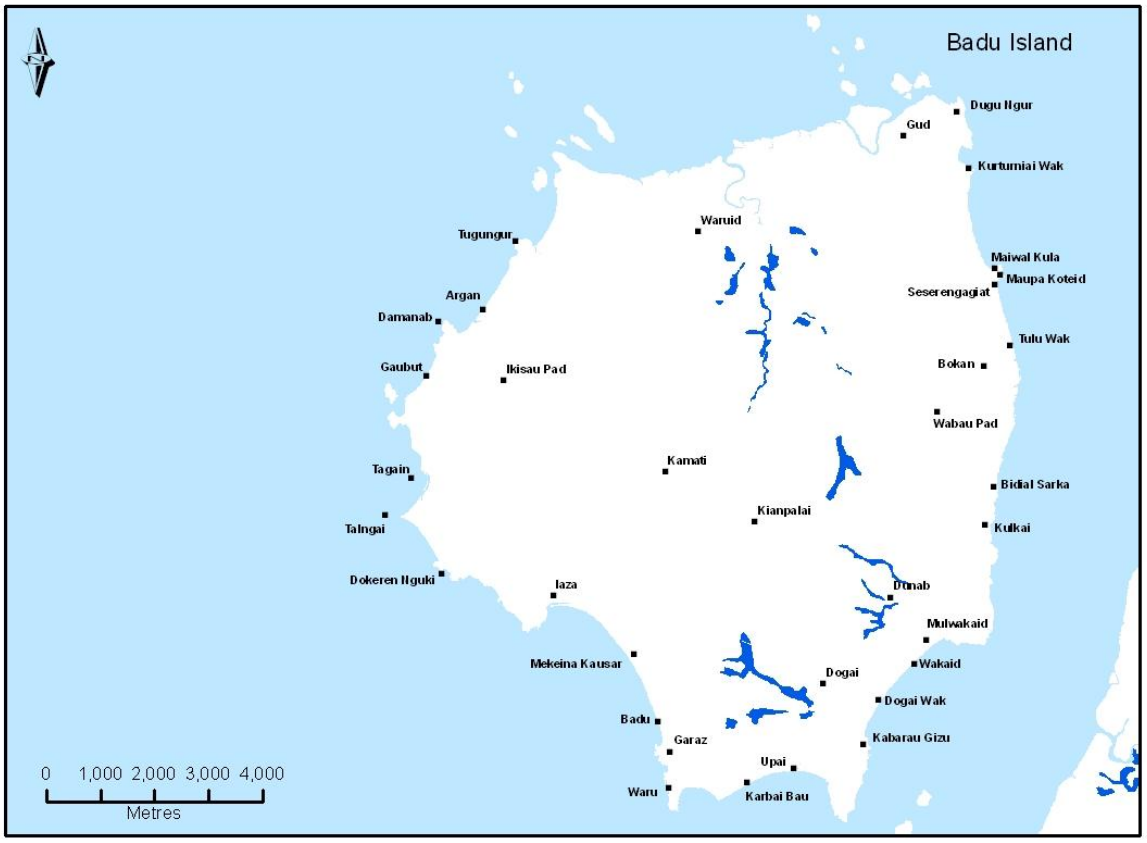


Figure 5. Location of swamp forest habitats (place names after Lawrie, 1970).

Of some concern is the extraction of groundwater from the bore field near the Badu Community. Groundwater is being extracted from an unconfined aquifer contained within a coastal dune field which is reliant directly upon rainfall for seasonal groundwater recharge. Excessive extraction of water, particularly in drier seasonal cycles may affect the hydrology of the swamp forests in the borefield vicinity by decreasing the period of seasonal water logging and surface water expression. It is not known to what degree water extraction has contributed to the degradation of swamp forest ecosystems in the vicinity of the borefield, many of which are choked by sprawling mats of the native vine canavalia.

Fauna: The fauna assemblage associated with this habitat is poorly sampled, and further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of baseline fauna assemblage. The habitat may be particularly important to a range of amphibian species and surveys undertaken across a variety of seasonal conditions would greatly expand the current knowledge base.

Flora: Two populations of the Endangered *Costus poteriae* have been observed on the island. The species relies on the habitat formed on the interface between swamp forest and adjacent woodland communities. This interface is in a meta-stable state and may respond rapidly to landscape scale changes in ecological process such as weed invasion and changing fire regimes. As such, the

islands known populations of costus are reliant on a continuation of the current ecological regimes. Recommendations for management of these populations are provided in **Section 7.3.4.** The ecology of the species is poorly known and requires further study. It appears that habitat for the species in some localities is subject to shrubby thickening, a result of long-term absence of fire.

The grass *Germainia capitata* (Vulnerable EPBC & NC Act) is likely to occur. It is known from similar habitats on Mua.

Six regionally significant species known from the habitat are:

- *Acmena hemilampra* subsp*. hemilampra (*Myrtaceae*)*
- *Horsfieldia australiana* (Myristicaceae)
- *Licuala ramsayi var. tuckeri* (Arecaceae)
- *Podocarpus grayae* (Podocarpaceae)
- *Rhodamnia australis* (Myrtaceae)
- *Gnetum gnemon* (DGF10206).

The latter species is a tree which has also been observed on Mua Island (Fell & Stanton pers. obs. March 2011).

Cultural Perspectives: The cultural values of these habitats are unknown although by nature, would host a diverse array of cultural resources including food species such as *Melastoma malabaricum.*

8.3.3 Management Implications

The prevailing edaphic conditions of high moisture content over extended seasonal periods are the primary factor controlling the distribution of these habitats. As such, they are relatively stable within their respective niches although they may be subject to a range of threatening processes such as inappropriate fire regimes, weed invasion and feral pig damage. Of these processes, weed invasion is the greatest concern with considerable potential to alter ecological function. Feral animals also have significant potential to impact these habitats and swamp forest provides a foraging resource for pigs. General observation relating to feral animal damage should be undertaken during routine ranger patrols with management actions guided by any observed increase in foraging activity. Control programs for feral pigs are warranted in the vicinity of badly impacted habitats.

Attention should be given to mapping populations of *Costus poteriae* whose distribution appears reliant on the niche created on the interface between swamp forest and adjacent woodland communities. This ecotone is unstable in the sense that it will be the first point of response to landscape scale changes in ecological process such as weed invasion, feral animal damage and changing fire regimes. The spread of Singapore daisy and introduction of lantana to the margins of these habitats may have a devastating impact on populations of the species through either direct displacement or by altering the response of the habitat to fire. Exotic weeds may also severely degrade the usefulness of these habitats as a traditional resource base. Costus habitat requires long term monitoring to gauge the effectiveness of management regimes in respect to maintenance and

possible expansion of current population sizes. Some woodland communities that provide habitat for the species appear subject to shrubby thickening, the result of long-term absence of fire. The long-term impacts of this process are unclear although as the species is intolerant of dense canopy cover, advanced thickening is likely to suppress species regeneration. An effective species conservation measure might be to back burn from the edge of costus populations during mild conditions, followed by a more severe late dry season prescribed burn to control shrubby thickening in areas where it is apparent. In any case, experimental burning regimes require some thought and specific plant responses monitored. Fire regimes in adjacent woodland habitats should be tailored to prevent accumulation of fuel levels that promote severe late dry season fires. Severe fires have the potential to degrade the margins of swamp forest habitats and their management should be considered in the context of broader landscape scale management regimes.

It is not known to what degree water extraction has contributed to the degradation of swamp forest ecosystems in the vicinity of the borefield. Photographic monitoring should be undertaken in the borefield area to determine whether or not habitat changes associated with water extraction are occurring.

8.3.4 Summary of Recommended Management Actions

Table 13. Summary recommendations for management of swamp and riparian forest habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known. The habitat may be particularly valuable to a range of frogs and reptiles. It provides specific habitat and foraging grounds for a range of bird species.	Design and implement a structured fauna survey and trapping program utilising collaborative research. General nocturnal and diurnal searches for frogs, reptiles and birds taking photographic records of those species observed. Maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. Riparian and swamp forests are productive habitats with considerable potential to host a number of significant plant species not previously recorded on the island.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the Appendices provide a foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	The majority of riparian and swamp forest habitats are fire sensitive. Repetitive hot fires burnt into the margins of fire sensitive vegetation can impact on forest structure and species diversity.	Back burning along the edges of sensitive riparian vegetation will limit impacts of severe late dry season fires. Management of surrounding	High

Management Category	Context/Issue	Actions	Priority
	Open swamp forests may possess a dense grassy ground cover which is highly flammable under severe conditions. Extremely hot fires may cause considerable damage to fragile ground cover grasses and forbs and result in canopy scorch.	country by dry season mosaic burning to limit impact of late season wildfires. Non-flammable riparian forest areas provide suitable fire breaks to compartment prescribed burns and should be used as such where appropriate. Ensure fire tolerant swamp forest areas do not burn under severe climatic conditions when the substrate is extremely dry to prevent structural damage to the forest. Early season burns may eliminate the risk of incursion by severe wildfire.	
Threatened Species Management	Flora: Populations of threatened flora species, particularly on the habitat margins, are threatened by weed infestation and severe late season fires. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Carry out ongoing surveys to identify and map populations of significant species. Maintain landscape scale mosaic burning or back burn along the edge of known *Costus poteriae* populations to prevent incursion by severe late season fires. Place monitoring sites in the vicinity of known populations to gauge the effectiveness of management actions. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	High High
Invasive Species Management	Flora: There are few existing weed infestations within this habitat although there is a high risk of introduction of a number of weed species. Brazilian joy-weed and Singapore daisy are perhaps the most imminent existing threat to the ecology of swamp forest habitats. Lantana is a potential threat if introduced. Fauna: The composition of invasive fauna within this habitat requires further study. There is considerable potential for impacts on native fauna by feral cats and dogs. Swamp forest and riparian habitats provide a favoured habitat for feral pigs which may cause significant damage to ground covers.	Flora: No active weed control is currently required. Undertake regular informal surveys of the margins of riparian habitats to check for exotic species incursion or damage. Mark informal survey locations in a track log to ensure adequate survey of all significant riparian areas is undertaken annually. Implement immediate weed control measures where infestation is identified. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat and dog activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting and consultation with community members. Develop a structured control program based on results. Undertake informal monitoring of feral pig damage and install traps	Moderate Immediate

Management Category	Context/Issue	Actions	Priority
		in areas where pig damage is noted to be severe.	
Monitoring	Permanent photographic monitoring points are required to assess the effectiveness of management measures aimed at maintaining populations of *Costus poteriae.* Swamp forests in the vicinity of the dune borefield appear to be suffering degradation through changing composition of ground covers and shrub layers.	Erect permanent photographic monitoring points at known populations of *Costus poteriae*. Undertake population counts to further supplement photographic monitoring. Erect a number of permanent photographic monitoring points in swamp forest habitats in the vicinity of the dunefield. This will allow an assessment of vegetation structure to determine if the noted floristic and structural changes have finalised.	High

8.4 Welchiodendron Dominant Closed to Open Forests and Woodlands

8.4.1 Status of Ecological Knowledge

This is an extensive closed to open forest community, occupying the lower footslopes and sheltered hillslopes of the islands granite massif. The habitat is typically associated with boulder slopes where the rocky substrate prevents incursion of fire into the forest margins. General canopy heights range from 10 to 18m with *Welchiodendron longivalve* usually dominant. Associated canopy species include *Acacia polystachya, Terminalia subacroptera, Endiandra glauca, Canarium australianum, Dysoxylum foveolata* subsp*. acutangula, Sterculia quadrifida, Drypetes deplanchei* and *Bombax ceiba* var*. leiocarpum.* In some restricted locations, welchiodendron is absent from the canopy which is dominated by *Acacia polystachya* although these areas are considered a localised ecological variation rather than a separate distinctive community.

Photograph 16. Woodland variation of *Welchiodendron longivalve* dominant open forest on Badu Island. The dense shrub layer in the background indicates the limits of fire incursion into the community.

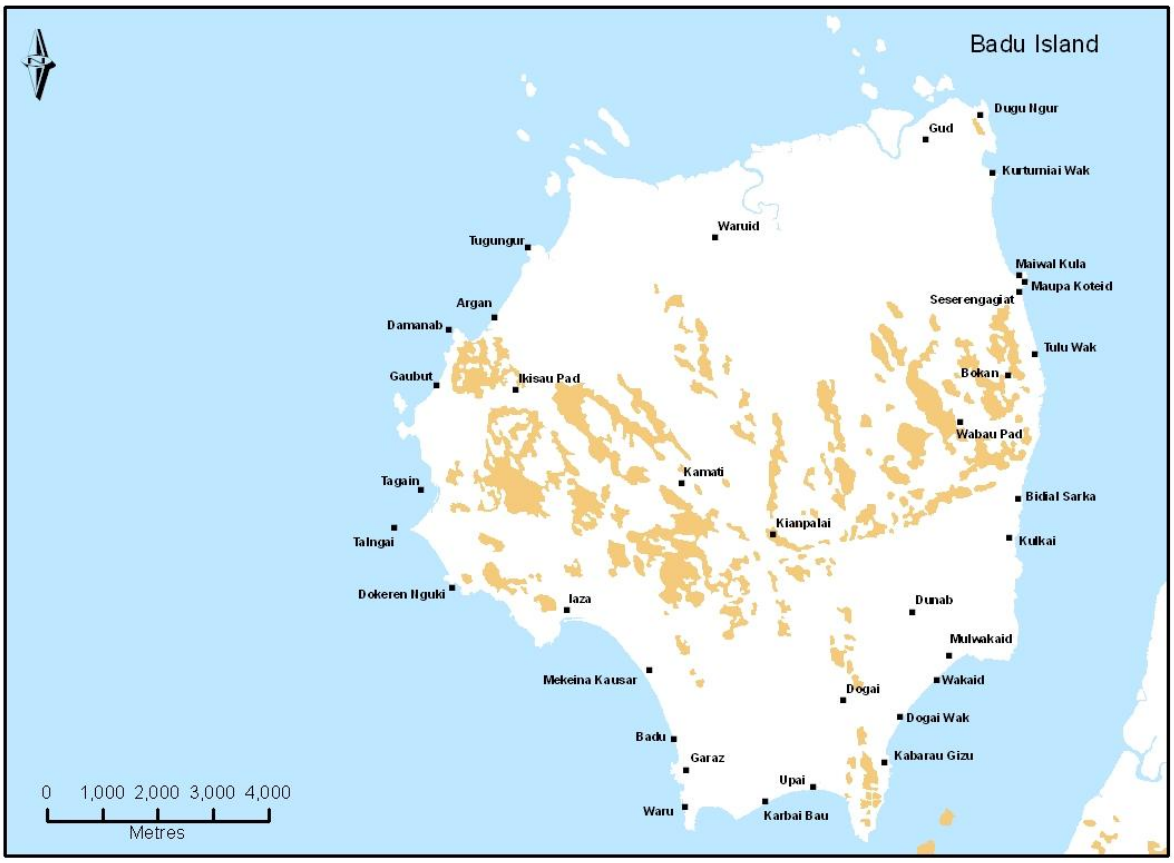


Figure 6. Occurrence of Welchiodendron dominant forest (place names after Lawrie, 1970).

8.4.2 Ecological / Cultural Considerations

Habitat Condition: A robust habitat that is resistant to incursion of intense fire events and other elements of degradation including weed infestation. All habitats observed were in pristine condition. Welchiodendron is often used for firewood although harvesting is restricted to younger trees and shrubs and the process of firewood harvesting has had limited impact on the habitat condition.

Fauna: Similar to other forest habitats on Mabuiag, the fauna assemblage associated with this habitat is poorly sampled and as such, poorly known. Further structured survey effort and opportunistic sampling/observation would greatly improve the current knowledge of the baseline fauna assemblage.

Flora: The habitat supports high species diversity particularly where a vine thicket understorey and subcanopy is well-developed. The following significant species occur:

Vulnerable: *Cycas badensis*, *Diospyros sp.* (Bamaga B.P. Hyland 2517)

Near-Threatened: *Archidendron hirsutum (*Mimosaceae*)*, *Neolebra atra* (Poaceae)

Regionally Significant: *Actephila venusta* (Euphorbiaceae)*, Aglaia tomentosa (*Meliaceae*), Atalaya sericopetala (*Sapindaceae*), Atalaya variifolia (*Sapindaceae*), Cupaniopsis flagelliformis* var.

flagelliformis (Sapindaceae), *Everistia vaccinifolia* (sens. lat.) (Rubiaceae), *Erythroxylon* sp. (Mosquito Creek J.R. Clarkson 9991+)(Erythroxylaceae), *Gunnesia pepo* (Apocynaceae), *Haplostichanthus fruticosus* (Annonaceae), *Miliusa traceyi* (Annonaceae), *Triflorensia australis* (Rubiaceae), *Uvaria rufa* (Annonaceae), *Voacanga grandiflora* (Apocynaceae).

Cultural Perspectives: This is the most extensive closed forest habitat on Badu Island occurring from footslopes to hilltops. Apart from limited use as firewood, Welchiodendron is largely unutilised as a resource. The habitat may host a range of plant and animal resources.

8.4.3 Management Implications

This is a robust habitat requiring limited active management. Its broad distribution and general habitat integrity in the face of regular anthropogenic burning indicates that fire presents little risk to habitat quality and extent. The establishment of exotic species, such as lantana (*Lantana camara),* poses the greatest risk to habitat integrity in the long term. Minimal active management is required at present. General monitoring for invasive species should be a routine component of the ranger work program and undertaken in areas in the vicinity of current disturbance, particularly around the township and dumping sites.

8.4.4 Summary of Recommended Management Actions

Table 14. Recommended management actions for Welchiodendron dominant forests and woodlands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program. The survey needs to utilise collaborative research and maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in dry season. There is considerable potential for new records of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	No major issues identified. The habitat is mostly protected in rocky gullies and hillsides although it will possibly expand if burning pressure	No specific management actions required. Management of surrounding flammable vegetation is required to maintain current	Moderate

Management Category	Context/Issue	Actions	Priority
	is taken off adjacent flammable woodland habitats.	habitat boundary position in the landscape.	
Threatened Species Management	Flora: Four threatened (or Near-Threatened) and 11 regionally significant species are known to occur within this habitat. While the ecology of these species is poorly documented, the habitat is robust with no immediate threats recognised. Fauna: Composition of fauna within this habitat is poorly known.	Flora: No management actions required. Carry out ongoing surveys as identified above. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues have been identified however a number of species, Lantana in particular, known from disturbed areas pose a threat in the long term. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: No active weed control or management currently required. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members.	Moderate Immediate
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	Carry out informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, on a regular annual to bi-annual basis. Informal monitoring locations should be recorded in the track log of a GPS to ensure adequate seasonal coverage of at risk locations (near roadsides or disturbance areas) is undertaken on an annual basis.	High

8.5 Eucalypt and Corymbia Dominant Open Forests and Woodlands

8.5.1 Status of Ecological Knowledge

Eucalypt and Corymbia dominant open forests and woodlands form the most extensive habitat type on Badu Island with 10 floristic variations recognised as occurring across a range of landforms including footslopes and hillslopes, alluvial flats and sand dunes.

Hillslope Associations: Habitats associated with hillslopes are generally open forests and occasionally woodlands with the bloodwood species Variable-barked bloodwood (*Corymbia stockeri* subsp. *peninsularis)* and Melville Island bloodwood (*Corymbia nesophila*) the dominant canopy constituents. At their maximum development, the canopy heights range from 25 to 33m with up to 50% projected canopy cover (PCC). Shrub layers are typically sparse, with *Welchiodendron*

longivalve, Cycas badensis and *Acacia spp.* being the dominant sub-canopy and shrub species. Well developed and healthy ground cover of kangaroo grass (*Themeda triandra)* is typical. Variations include woodlands of Moreton Bay Ash (*Corymbia tessellaris)* and/or Poplar Gum (*Eucalyptus platyphylla), which* occur on steep exposed footslopes, apparently subject to repetitive hot fire regimes. Blady grass (*Imperata cylindrica*) is the dominant ground cover in these locations.

Alluvial Flat Associations: Vegetation composition and structure varies markedly dependent on soil drainage conditions. Variations on swampier landforms (VC5x) are typically characterised by Clarksons Bloodwood (*Corymbia clarksoniana)* and Swamp Box (*Lophostemon suaveolens*) mixing with *Corymbia novoguinensis,* and *Corymbia stockerii* subsp*. peninsularis* in decreasing proportions. The sub-canopy layers which comprise *Melaleuca viridiflora* and *Pandanus sp.,* often merge with *Melaleuca viridiflora* dominant shrublands*.* Ground cover typically comprises a dense layer of *Ischaemum australe* and lesser amounts of *Imperata cylindrica.* On sandier, better drained locations, *Corymbia novoguinensis, Corymbia stockeri* subsp*. peninsularis* and *Corymbia clarksoniana* form tall open forests with canopy heights to 28m. Sub-canopy layers, although often sparse, are generally tall and dominated by *Parinari nonda* which occasionally reaches canopy height. Grass cover is variable although Giant Spear Grass (*Heteropogon triticeus*) and Kangaroo Grass are always present.

Associations on Sand Dunes: Woodland and open forest communities on dunes are typically dominated by *Corymbia novoguinensis* with a sub-canopy of tall *Parinari nonda, Acacia crassicarpa* and occasional *Syzygium suborbiculare*. Best development is associated with Pleistocene age dune systems which are likely to have stabilized 12 000 to 15 000 years ago with the onset of a moister, less windy climate (Thom 1994). On these older dune systems, canopy heights may reach 30m, although communities associated with sand sheets and near shore parallel dunes are typically of much lower stature. Ground cover is extremely variable, dependent on soil depth and fire history. *Lomandra banksii* is a prominent cover in deeper, free draining dune profiles with *Heteropogon triticeus* and *Themeda triandra* nearly always present. An unusual *Eucalyptus platyphylla* dominant variation occurs on relict aeolian dunes in the islands north which appears subject to a heavy burning regime.

Photograph 20. Woodland of *Corymbia novoguinensis* (VC5i) on a stabilised aeolian dune, southern coast of Badu and **Photograph 21.** Grassy woodland *Corymbia stockeri* subsp*. peninsularis* with ground cover of Kangaroo Grass.

Photograph 22. Woodland of *Corymbia clarksoniana* on a swampy alluvial flat with dense ground cover of *Ischaemum australe* and right; **Photograph 23.** The endemic *Cycas badensis* forms robust populations in eucalypt woodland.

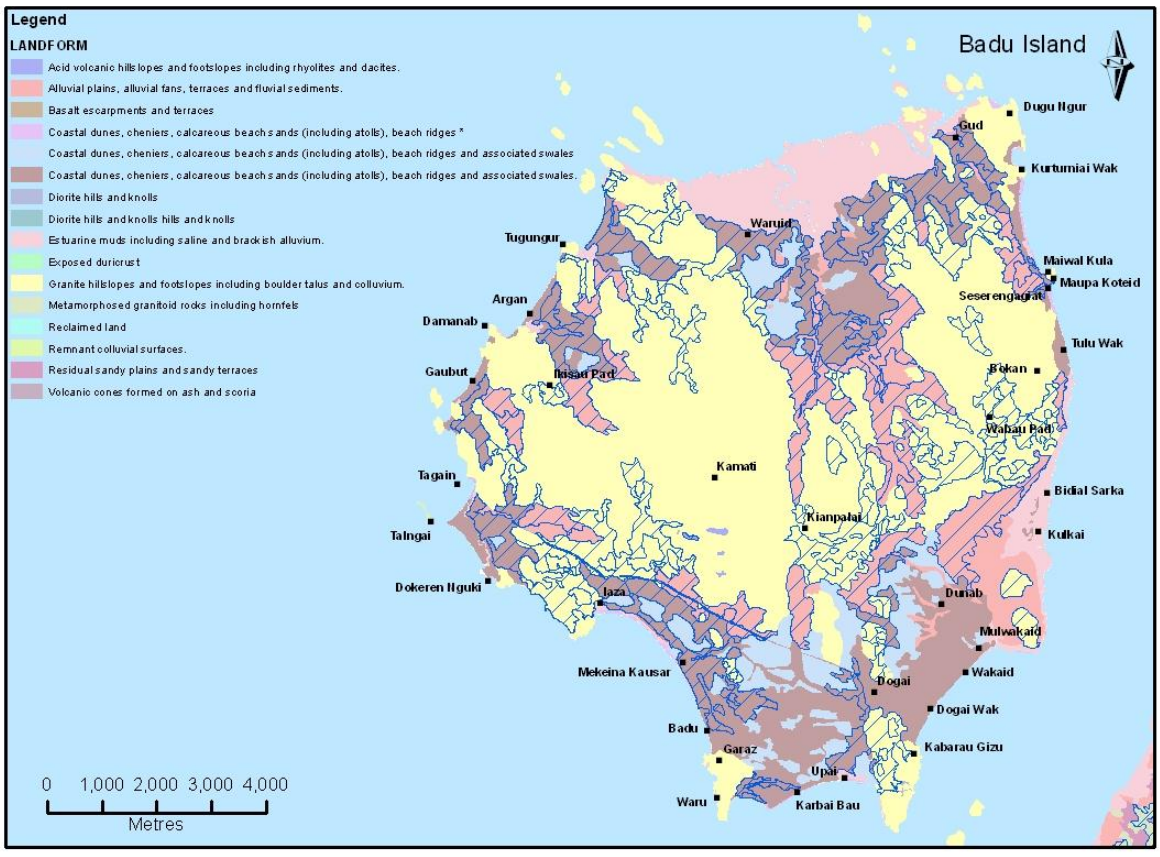


Figure 7. Occurrence of Eucalyptus and Corymbia dominant forest and woodland (place names after Lawrie, 1970).

8.5.2 Ecological / Cultural Considerations

Habitat Condition: All habitats examined are free from exotic weed species and in excellent condition. Hillslope associations are burnt frequently, evidenced by the low fuel loads and limited amount of woody debris on the ground. Associations on alluvial flats generally carry the heaviest fuel

loads and require the greatest attention in regard to active fire management. Several areas on the margins of streams were showing signs of shrubby thickening due to a long absence of fire. In one instance, thickening was threatening habitat for the Endangered plant *Costas poteriae.*

Fauna: Similar to other forest habitats on Badu, the fauna assemblage associated with this habitat is poorly known. Further structured survey effort and opportunistic sampling/ observation would greatly improve the current knowledge of the baseline fauna assemblage.

Flora: Eucalypt and Corymbia woodlands provide habitat for *Cycas badensis,* a species endemic to the Near Western Island Group. The species occurs in the shrub layers of the majority of eucalypt communities although it is most abundant in habitats associated with hillslopes, and is typically sparse in habitats associated with alluvial flats where the ground cover fuel load is highest. The habitat also supports populations of the grass *Germainia capitata* listed as Vulnerable under the EPBC and NC Act.

Cultural Perspectives: This is the most extensive habitat on Badu occurring from coastal margins and footslopes to hilltops. Apart from obvious use as a traditional source of firewood, the cultural values and resource utilisation are largely unknown. The cultural use of fire as a landscape management tool in eucalypt savannah communities is evident in the condition of ground cover. The purpose and timing of landscape burning remains unclear. The scarcity of shrubs in the lower layers of the majority of habitats is indicative of a frequent late season burning pattern, although this requires documentation.

8.5.3 Management Implications

Across the range of eucalypt woodland habitats, the major requirement for ongoing management is to maintain the current burning regimes. Woodland and open forest communities associated with fertile alluvial situations may require additional attention as some areas are subject to thickening of shrub layers. This process of shrubby thickening is likely to be extremely rapid with an irruption of shrubs across the broader habitat extent rather than gradual encroachment advancing from adjacent habitat margins, a process described by Russell-Smith *et al*. (2004). Rapid landscape scale changes in vegetation structure should be avoided as the consequences of such change are unknown, particularly when the current limited knowledge pertaining to the islands ecology is considered. Dense shrubby thickening of eucalypt woodland is considered a potential threat to at least one population of threatened species (*Costus poteriae).* Maintenance of the current burning practice is fundamental to management of eucalypt woodland communities. The location, purpose, conditions and timing (seasonal) of fire events should be documented wherever possible. This will ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as provide a knowledge base to inform future management actions. Further study on the ecology of the endemic *Cycas badensis* should also be considered as little is known with respect to its response to fire. Forster (2010) notes that factors affecting the survival of Cycads include:

- Insect pollination;

- Dispersal (seeds are large & take 12 months to become fully mature after falling to ground. Possible dispersal agents are flying foxes, rats, scrub fowls and pigs);
- Seedling survival (recruitment may be affected by pigs and fires); and,
- Adequate replacement of individuals (a constant mortality rate within size or age classes that leads to the attrition of individuals through time).

Observation of cycad growth stages in areas known to be subject to repetitive hot fire (such as on the foredune at Argan) indicates limited recruitment of established plants in the smaller size classes with the majority of plants being large individuals and a profusion of seedlings.

8.5.4 Summary of Recommended Management Actions

Table 15. Summary management recommendations for eucalyptus and corymbia dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program. The survey needs to utilise collaborative research and maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in dry season. Grasses, sedges and herbs poorly known. There is considerable potential for new records of significant species to be recorded from within this habitat.	Carry out additional flora field surveys with focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	Eucalyptus dominant habitats have evolved in response to fire and maintenance of the traditional burning practice is fundamental to management of these communities. A reduction in prescribed traditional burning practice may lead to excessive shrubby thickening or a severe wildfire regime which may have significant adverse effects on forest ecological process.	A fire maintenance and fuel reduction program should be devised in consultation with the island community. The program should identify those areas that have not been fired for extended periods supplemented with field observation to document fuel loads and evidence of shrubby encroachment. Non-flammable vegetation boundaries (riparian forests and vine forest areas) can be used as fire breaks to compartment the burning program and ensure targeted areas are burnt on a rotational basis. The location, purpose, conditions	Immediate

Management Category	Context/Issue	Actions	Priority
		(temperature, humidity and wind speed and direction) and timing (seasonal) of fire events should be documented wherever possible. It is important to ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as provide a knowledge base to inform future management actions.	
Threatened Species Management	Flora: The ecology of *Cycas badensis* should be investigated more thoroughly to determine population size, structure, health and long term population trends. Four threatened (or Near-Threatened) and 11 regionally significant species are known to occur within this habitat. While the ecology of these species is poorly documented, the habitat is robust with no immediate threats recognised. Fauna: Composition of fauna within this habitat is poorly known.	Flora: Key requirements for assessing cycad populations include: Determination of locations and size of populations; and monitor population health of known populations to ascertain long-term population trends and inform management needs. Long term monitoring plots should be erected in cycad populations subject to a range of burning regimes including 1) areas subject to fire exclusion; 2) populations subject to regular burning regime (triennial or less frequent), and; 3) populations subject to repetitive hot firing events (annual). The response of the cycad population in terms of plant recruitment to various burning regimes should be documented over a period of several years. Any burning of cycad habitat should consider fuel loads and whether populations are coning or with seed ready for dispersal. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues have been identified however a number of species (Lantana in particular, known from disturbed areas on other islands) pose a threat to long term habitat condition, particularly along riparian fringes. A range of environmental woods including Siratro, Stylo, and Urena burr will invade eucalypt habitats, particularly where disturbance has occurred. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: No active weed control or management currently required. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members.	Moderate Immediate
Monitoring	The effectiveness of implemented	Position permanent photographic	High

Management Category	Context/Issue	Actions	Priority
	burning regimes on eucalypt dominant habitats requires documentation to inform future land management initiatives. Long term monitoring plots are a fundamental tool used to assess the health of *Cycas badensis* populations.	monitoring points in areas where thickening of shrub layers is occurring to monitor the results and effectiveness of burning management regimes. Carry out informal observation of habitat condition including health of canopy (monitoring for dieback) and presence of invasive weed species, on a regular annual to bi-annual basis. Informal monitoring locations should be recorded in the track log of a GPS to ensure adequate seasonal coverage of at risk locations (near roadsides or disturbance areas) in undertaken on an annual basis. Implement long term monitoring plots to assess *Cycas badensis* populations as per previous recommendations.	

8.6 Acacia Dominant Open Forests and Woodlands

8.6.1 Status of Ecological Knowledge

Thick podded salwood *(Acacia crassicarpa*) dominant communities are a relatively restricted habitat type associated with older (Pleistocene) sand dune systems on the islands eastern and southern coastline (see **Figure 8**). The dominant form is expressed as an open forest dominated by *Acacia crassicarpa,* which is mixed with *Asteromyrtus brassii* (VC6g). Canopy heights typically range from 10 – 18m although much lower forms to 10m have been recorded. Shrub layers are typically sparse and comprise *Exocarpos latifolius, Halfordia kendack, Polyalthia nitidissima,* and *Cryptocarya brassii. Lomandra banksii* is the dominant ground cover in all situations surveyed. The derivation of this forest is unknown although it appears to be a seral stage in the succession from shrubland to eucalypt dominant woodland, or possibly regeneration following a severe disturbance event such as wildfire. The community often occurs as enclaves within, or on the margins of eucalypt dominant woodlands. This suggests that the two habitats are linked in an ecological sense although there is no evidence that fire has any significant role in the maintenance of the habitat. Also included in the habitat grouping are low shrubland communities associated with chenier ridges within mangrove habitats. The floristic composition of these habitats is inferred from survey undertaken in other areas. Habitats associated with chenier ridges are relatively depauperate communities, floristically and structurally suppressed by shallow infertile soils and salinity on the habitat margins

Photograph 24. Typical expression of *Acacia crassicarpa* and *Asteromyrtus brassii* dominant open forest on an older stabilised dune system.

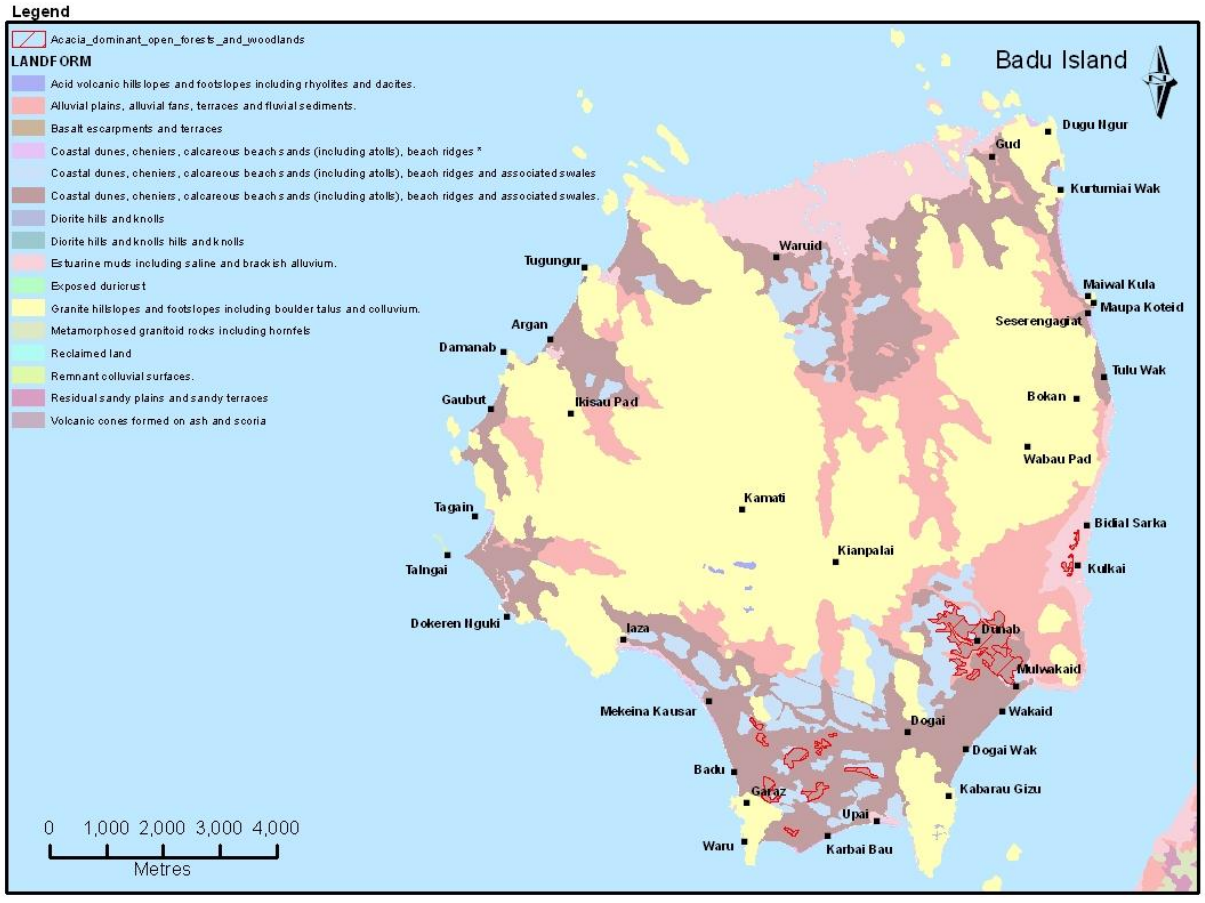


Figure 8. Distribution of *Acacia crassicarpa* dominant woodlands (Place names after Lawrie, 1970*).*

8.6.2 Ecological / Cultural Considerations

Habitat Condition: All habitats examined are free from exotic weed species and in excellent condition.

Fauna: Similar to other forest habitats on Badu Island, the fauna assemblage associated with this habitat is poorly known. Further structured survey effort and opportunistic sampling/ observation across the broader range of habitats associated with coastal dune systems would greatly improve the current knowledge of the baseline fauna assemblage.

Flora: Significant species are limited to disjunct populations of Broad leaved Lilly Pilly (*Acmena hemilampra* subsp*. hemilampra)* at the northern limit of Australian distribution.

Cultural Perspectives: These habitats are typically associated with older Pleistocene age dune systems, a landform type that has been extensively stabilised by mostly eucalypt dominant woodland types. As previously indicated, these are relatively young habitats of unclear derivation although some form of severe disturbance is an obvious initiation point for their development. It is considered possible that the disturbance relates to the introduction of fire into the landscape with the advent of human settlement, possible greater than 4 000 yrs before present.

8.6.3 Management Implications

Few recommendations can be made in regard to the management of these habitats. As they represent a transitional forest type developing in the absence of fire, current management regimes which exclude burning should be maintained.

8.6.4 Summary of Recommended Management Actions

Table 16. Summary management recommendations for acacia dominant open forests and woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat, along with other dune forest and woodland associations is poorly known.	A structured fauna survey program is warranted although due to the limited extent of this habitat, it would be best undertaken in conjunction with survey of broader dune open forest habitats.	High
Plant Surveys	Flora composition is documented although limited to rapid surveys in dry season.	Carry out opportunistic flora field surveys to record component plant species with a focus on collection of important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis.	High
Fire Management	These are transitional habitats evolved as a result of severe disturbance events. Intense fire events are likely to interrupt the process of plant succession and	Attempts should be made to exclude hot fire events from penetrating this habitat. Mosaic burning of surrounding	Moderate

Management Category	Context/Issue	Actions	Priority
	possibly result in renewed episodes of dune destabilisation.	flammable eucalypt woodlands should be undertaken during cooler seasons to limit possibility of severe fire events.	
Threatened Species Management	Flora: No threatened flora or fauna species are currently known to occupy these habitats.	Flora: Further baseline information on flora composition is required prior to management actions being formulated. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: No existing weed issues have been identified within this habitat and infestation is unlikely if the habitat remains undisturbed. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: No active weed control or management currently required. Fauna: Composition of invasive fauna to be derived from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members. As the extent of this habitat is limited, survey should be undertaken in conjunction with the broader range of dune woodland habitats.	Moderate Immediate
Monitoring	There are no immediate recommendations for monitoring within this habitat.	No action required.	No Action

8.7 Melaleuca Dominant Open Forests

8.7.1 Status of Ecological Knowledge

All habitats classified as melaleuca dominant open forests recognised on Badu Island are palustrine wetlands, being subject to seasonal waterlogging. Most extensively, these habitats comprise *Melaleuca quinquenervia* dominant open forests (VC7d) associated with relict dune fields, occupying broad deflation hollows or narrow dune swales. Soils in these locations are strongly humic and permanently waterlogged (aquasols), with ground layers dominated by aquatic sedges including *Restionaceae species* and *Baumea rubiginosa.* Water recharge comes largely from expression of shallow, unconfined aquifers within topographic depressions. Other more restricted variations include tall open forests of *Melaleuca leucadendra* and *Melaleuca dealbata* in dune swales, and *Melaleuca saligna* dominant open forests generally occurring on the margins of saline influence.

8.7.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All habitats examined retain natural condition and are free from exotic species except for some minor fragmentation of *Melaleuca leucadendra* habitats in dune swales behind the beach at Galbut. Extensive *Melaleuca quinquenervia* dominant swamplands in the vicinity of the borefield area may be threatened by depletion of ground water levels due to excessive

water extraction, particularly in drier seasons. The effect water extraction is having on ground water levels is however unknown and it would be expected that impacts might range from negligible to minor. The most significant threat to these habitats, particularly *Melaleuca quinquenervia* dominant swamp forest, is severe fire during periods when surface water level is absent. Fires under such extreme conditions may result in ignition of organic soil layers (peat) resulting in death of the forest canopy. The impacts of 'peat' combustion have been noted in similar habitats in the Wet Tropics Bioregion (Peter Stanton. pers. comm.). Pigs are observed to be having a deleterious effect on this habitat in some areas. Singapore Daisy is a potential threat to swampy margins.

Clockwise from top left - Photograph 25. A broad dune depression occupied by *Melaleuca quinquenervia* dominant wetland with associated sedgeland communities. South coast of Badu, and; **Photograph 26.** The swampy margins of *Melaleuca quinquenervia* dominant open forests shown in previous photo, and; **Photograph 27.** A tall open forest of *Melaleuca saligna* in a broad drainage depression. Margins of a saline flats on the west coast of Badu.

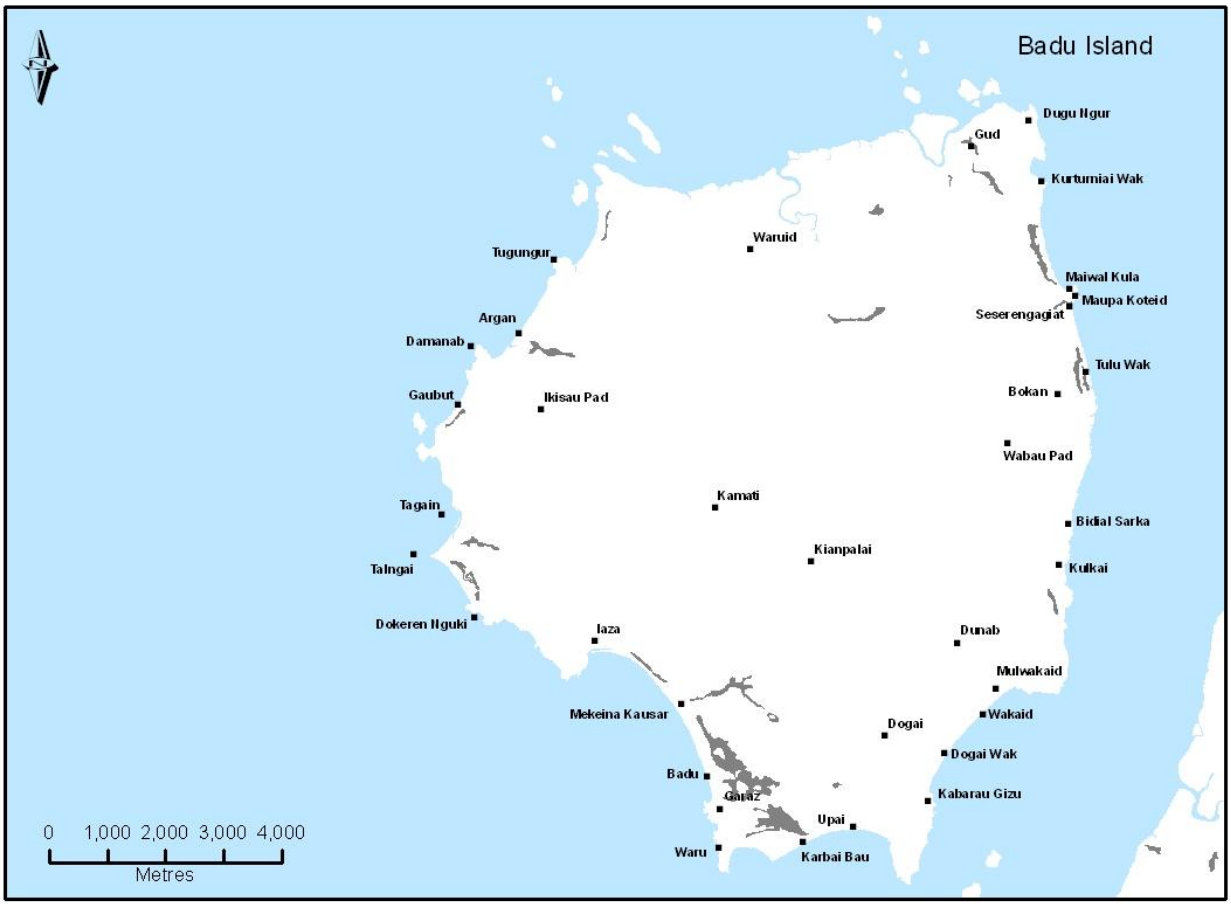


Figure 9. Distribution of Melaleuca dominant open forest (place names after Lawrie, 1970).

Fauna: The fauna assemblage associated with this habitat is poorly known although sampling within it has been extremely limited. The habitat may be particularly important to range of amphibian and aquatic reptile species and surveys undertaken across a range of seasonal conditions would greatly expand the current knowledge base. Habitats adjoining coastal sites may support breeding sites for salt water crocodiles.

Flora: The Vulnerable ginger species *Costus poteriae* is known from the margins of this habitat. Wetland species have not been subject to detailed surveys.

Cultural Perspectives: The cultural significance of this habitat is unknown although mound and ditch cultivation sites are known from the margins of this habitat in the vicinity of Markal Kasa. The habitat is likely to provide significant hunting resources in the form of freshwater turtles.

8.7.3 Management Implications

The habitat requires careful management in relation to fire with severe fires during seasonally dry conditions potentially causing forest structural damage, as well as risking damage to epiphyte populations which may include a range of significant orchid species. The potential lowering of local groundwater levels caused by excessive water extraction from the borefield greatly increases the risk

of swamp dehydration. Impacts of water extraction on local groundwater tables and broader habitat ecology are presently unknown.

8.7.4 Summary of Recommended Management Actions

Table 17. Summary recommendations for management of Melaleuca dominant swamp forests.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Fauna composition within this habitat is poorly known.	Design and implement a structured fauna survey and trapping program which considers seasonal habitat variations. Considering the size and significance of these habitats on a regional scale, survey is strongly warranted. The program needs to assess amphibian and reptile populations and survey for freshwater fish species in favourable seasonal windows should also be considered. The survey needs to utilise collaborative research and maintain focus on ethnotaxonomy to feed into TEK.	High
Plant Surveys	Flora composition is poorly documented and limited to rapid surveys in dry season. Ground covers, sedges and aquatic plants are been poorly documented.	Carry out additional floristic surveys concentrating on aquatic plants, ground and sedge covers and epiphytes across a range of seasonal conditions. Focus on collection of new records for the island and important cultural resource species. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue. Update island species list as new information becomes available.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. It is important to ensure traditional land management knowledge is available in a format that can be passed on to future generations as well as provide a knowledge base to inform future management actions.	High
Fire Management	Melaleuca dominant swamp forests have evolved with fire although they require careful management as fires under extreme conditions may result in ignition of peat soil profiles and destruction of canopy trees.	This habitat should be subject to prescribed burning in the early dry season as forest fuel levels allow. Soil conditions should be moist at the time of prescribed burning to prevent ignition of the ground layers.	Moderate
Threatened Species Management	Flora: Populations of the threatened flora species *Costus poteriae* may be associated with the habitat	Flora: Carry out ongoing surveys to identify populations of significant species, particularly	Moderate

Management Category	Context/Issue	Actions	Priority
	margins. Swamp margins may be subjected to severe fire events as well as weed infestation. Fauna: Composition of fauna within this habitat is poorly known.	epiphytes including orchids. Back burn along the edge of known *Costus poteriae* populations to prevent incursion by severe late season fires or ensure landscape scale mosaic burning of broader woodland habitats is maintained. Place monitoring sites in the vicinity of known populations to gauge the effectiveness of management actions. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	High
Invasive Species Management	Flora: No existing weed issues have been identified however a number of species, Lantana in particular, known from disturbed areas pose a threat to moist habitat margins. A range of environmental weeds including Siratro, Stylo, and Urena burr will invade the margins of these wetland habitats, particularly where disturbance has occurred. Fauna: These habitats provide a significant foraging resource for feral pigs and control programs are warranted in the habitat vicinity. General observation relating to feral animal damage should be undertaken during routine ranger patrols with management actions guided by any observed increase in foraging activity.	Flora: No active weed control or management currently required. Carry out monitoring for new weed infestations particularly on habitat edges and along access tracks on an annual or bi-annual basis. Fauna: Undertake regular assessment of feral pig numbers within these habitats and undertake a trapping program wherever problem areas are identified.	Moderate Immediate
Monitoring	No specific monitoring action required although the long terms impacts of borewater extraction on these habitats needs to be considered within the vicinity of the borefield.	Undertake informal surveys of vegetation condition in the vicinity of the borefield. Changes in canopy health or structure that cannot be readily explained should be subject to a more formal photographic monitoring program.	Moderate

8.8 Pandanus Dominant Woodland and Shrubland

8.8.1 Status of Ecological Knowledge

This habitat is restricted to a single occurrence on a broad alluvial flat to the north of the Badu Island township. It has not been subject to ground survey although it was observed during helicopter flight as well as associated aerial photographic interpretation. Its occurrence is associated with a broader mosaic of *Melaleuca viridiflora* dominant woodland and shrubland communities in the vicinity. The floristic composition of the groundcover, similar to that in other pandanus dominant habitats, is likely to be dominated by *Ischaemum australe*.

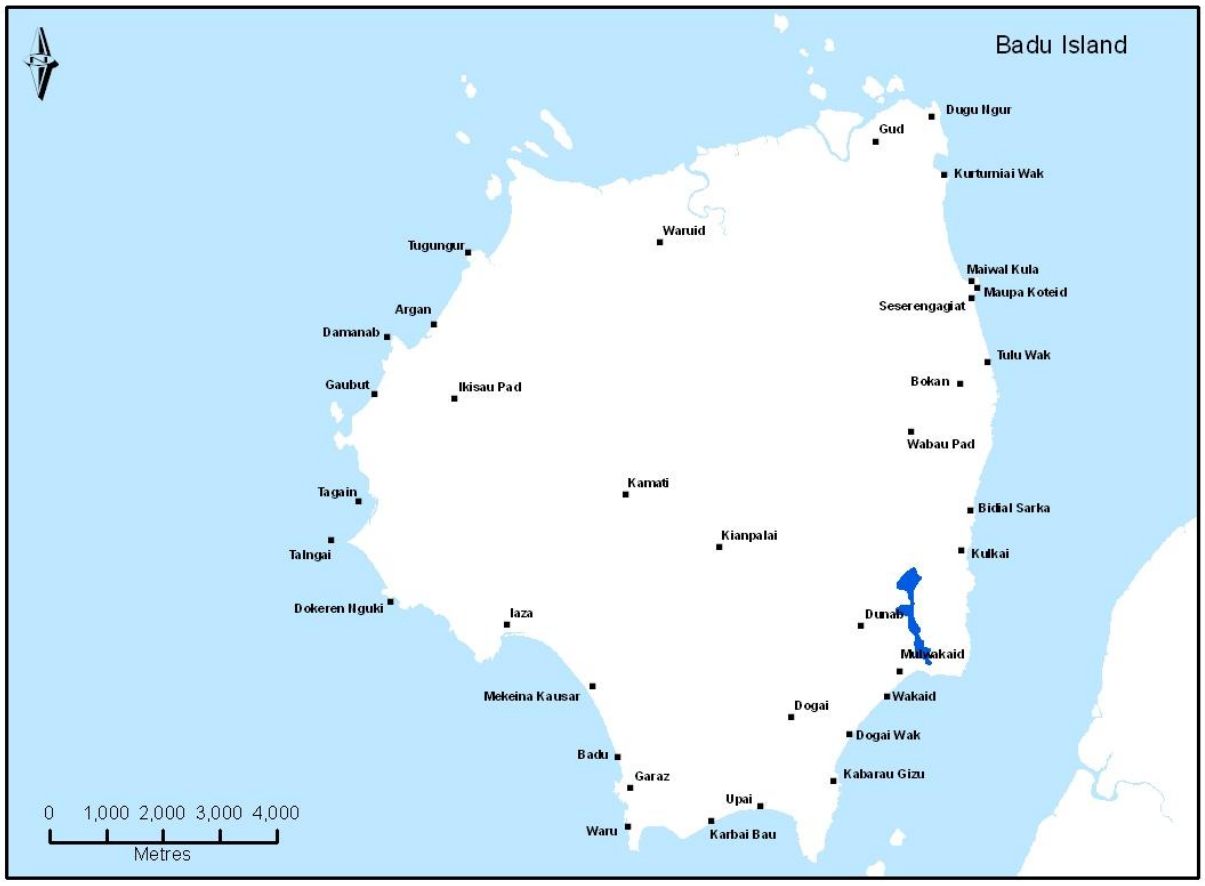


Figure 9. Distribution of Pandanus dominant habitats (place names after Lawrie, 1970).

8.8.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Habitat condition is unknown although like the majority of grassland and woodland habitats on the island, it is expected to be in excellent condition. The major threats to the habitat relate to changes in current burning regimes. Cessation of regular burning practice may lead to a build-up of fuel levels over a number of seasons resulting in the advent of a severe and damaging late dry season fire event. It may also lead to excessive development of the shrub layer causing long term change to the habitat structure. There is also considerable threat from the introduction of exotic grass species, particularly if habitat is disturbed, which may considerably change the ecology of these habitats. Gamba grass, which has spread rapidly across northern Cape York Peninsula presents the greatest threat. The grass is an aggressive colonist which develops a standing biomass of 5-7 times that of native species (Rossiter *et al*. 2003) resulting in extremely intense savanna fires, significantly altering savanna habitat ecology.

Fauna: The fauna assemblage within this habitat is unknown. Similar to grassland communities on Mabuiag, it is likely to be a significant habitat for native rodents.

Flora: No significant flora are known.

Cultural Perspectives: The grassy nature of the habitat is likely to be the product of long term anthropogenic fire practice which maintained these grassy areas for ease of access and possibly gardening. It is likely that these grassy shrubland and woodland areas have been in a relatively stable state for extended periods, possibly the length of human occupancy, which on Badu exceeds 4000 years.

8.8.3 Management Implications

It is feasible that within several years without maintenance of current burning regimes that these grassy woodland areas will thicken considerably, gradually converting to a melaleuca dominant woodland. Whilst the cultural significance of this habitat is open to conjecture, irreversible changes to community structure through shrubby thickening should be considered an element of degradation until ecological and cultural significance of these habitats is more fully considered and understood. Control of shrubby thickening can be best achieved by a late season fire regime which will destroy generating shrub layers. Burning immediately post occurrence of the first seasonal storm events (storm burning) will effectively promote grassy cover over shrubs and this should be considered as a management option. The frequency of late dry season fires can be reduced once shrubby thickening is controlled to a more consistent cycle of mid-dry season fires (August to October) completed on a 2 – 3 year cycle.

8.8.4 Summary of Recommended Management Actions

In compiling these recommendations, it is considered that any management action should aim to maintain the current landscape function which is considered important from both an ecological and cultural perspective. Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are achieving habitat maintenance objectives.

Table 18. Recommendations for management of pandanus dominant woodland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna. A structured fauna survey should be undertaken in conjunction with survey of broader grassy woodland and shrub-land habitats. Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	Flora composition of this habitat has not been documented.	Flora field surveys need to be undertaken to identify major species constituent of both ground cover and shrub layers. Collection of specimens for formal identification would be beneficial.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. No formal survey of this habitat has been undertaken.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. Documentation of traditional land management practices,	High

Management Category	Context/Issue	Actions	Priority
		particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	
Fire Management	Fire management is required to maintain current extent and condition of grassland communities and adjacent shrubland habitats.	Management should focus on maintaining current extent and occurrence of grassland habitats in the landscape although this should be guided by requirements and wishes of Badu Islanders. Concentrate on a mosaic of cool early season burns to maintain habitats that are currently in good condition. Hot fires should be a component of a broader seasonal mosaic of fire events where evidence of shrubby thickening is occurring. Timing and frequency of fires should be recorded for future reference. This will allow practice to be adjusted and refined to improve management outcomes.	High
Threatened Species Management	No threatened flora or fauna species are known to occur within or utilise these habitats for foraging.	Flora: No management actions have been identified due to lack of systematic survey. Habitat suitability for a range of potentially occurring threatened species will be informed by ongoing flora survey. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat although this may reflect the lack of floristic survey. Fauna: The extent to which feral animal utilise this is unknown.	Flora: No active weed control or management is currently required. The area should be surveyed on foot to confirm habitat condition and management recommendations formulated based on this information. Fauna: Undertake on ground surveys to identify signs of habitat disturbance by feral pigs. The extent of usage by other exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	High High
Monitoring	The area is has not been surveyed floristically and current requirements for monitoring are unknown.	Undertake on ground assessment of habitat conditions. Requirements for monitoring should be informed by onground surveys. Monitoring may be required if specific land management problems such as shrubby thickening or weed infestation are noted.	Moderate

8.9 Melaleuca Dominant Shrublands and Woodlands

8.9.1 Status of Ecological Knowledge

This habitat type is extensive on Badu Island associated with both degraded coastal dunes and alluvial flats. Landform associations are discussed separately below.

Associations on Coastal Dunes: The habitat occupies extensive areas on degraded sand dunes and sand sheets in the southern and western portions of the island where it forms a low woodland of 8 to 12m height. Whilst *Melaleuca viridiflora* dominates, *Asteromyrtus brassii*, *Corymbia novoguinensis* or *Corymbia clarksoniana* also form a component of the canopy, occasionally being sub-dominant. A sparse shrub layer is typically present composed of *Banksia dentata, Pandanus sp.,* and scattered *Acacia crassicarpa.* Ground covers are similarly sparse, dominated by *Dapsilanthus spathaceus* and a range of scattered herbs such as *Drosera spatulata*, *Eriocaulon* sp. and *Dianella* sp. On degraded sand sheets, the community forms a sparse shrubland, verging on a sedgeland in areas where deflation has scoured the overlying sand sheet to its erosional base level (ie. on the capillary fringe of the water table).

Associations on Alluvial Flats: Restricted to minor areas developed on silty alluvial outwash. Structurally, these woodlands are similar to habitats associated with sand dunes although the ground cover is considerably more variable often composed of dense mats of *Ischaemum australe* or *Themeda triandra* (kangaroo grass).

Photograph 28. *Melaleuca viridiflora* dominant woodland with sparse ground cover of *Dapsilanthus spathaceus.*

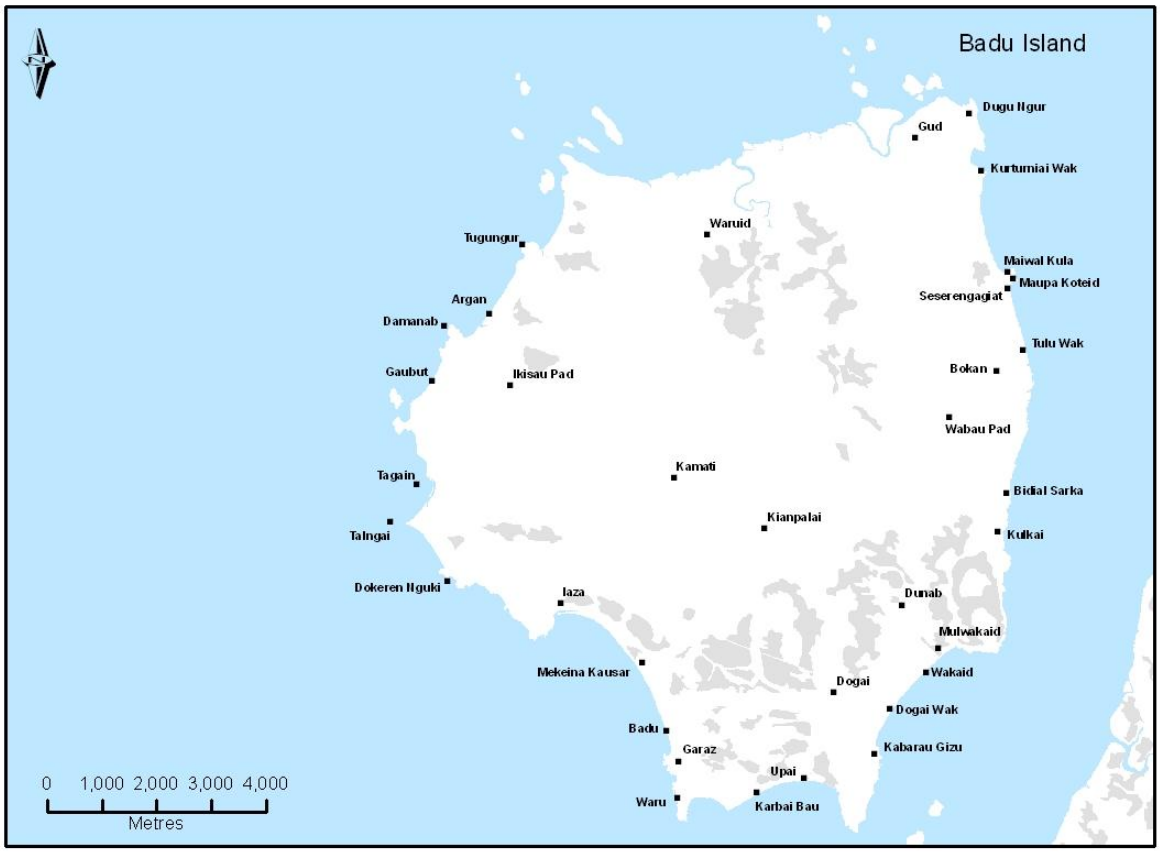


Figure 10. Distribution of melaleuca dominant habitats (place names after Lawrie, 1970).

8.9.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All communities observed are in undisturbed natural condition although considerable clearing of the habitat was associated with development of the current township as well as the old airstrip location to the townships west. No significant threats to habitat diversity are apparent. Structurally the habitat comprises mature shrubs and low trees with limited recruitment of shrubs in the lower structural layers (ie. seedlings and sub-canopy shrub classes).

***Cultural Perspectives*:** The cultural usage and significance of this habitat is largely unknown.

***Flora*:** The composition of the ground flora is poorly known. The shrubland communities provide potential habitat for *Dendrobium johannis* (Vulnerable NC Act) and contains a diverse array of orchids, other epiphytic plants and annual herbs such as Utricularia and Stylidium. A disjunct record of *Bromheadia venusta* has been recorded within this community on Mua Island.

***Fauna*:** Largely unknown although the habitat would provide a valuable seasonal nectar source for a range of birds and mammals.

8.9.3 Management Implications

The size distribution of the shrubby components suggests that the current management regime is dominated by an infrequent late season burning pattern (J. Russell-Smith, pers. comm.). The nature of the ground cover, producing only limited biomass and subsequent fuel loads, means that ignition would occur under only the most severe conditions after a number of years of burning abstinence. Whilst this late season burning pattern might not be appropriate for the majority of savannah

communities on the island, the prominence of epiphytes in the canopy and general excellent condition of the community suggest that it is appropriate for this particular habitat.

8.9.4 Summary of Recommended Management Actions

In compiling these recommendations, it is considered that any management action should aim to maintain the current landscape function which is considered important from both an ecological and cultural perspective. Recommendations for landscape maintenance are provided below although it should be considered that current management regimes, from evidence taken across the islands broader range of habitats, are satisfying habitat maintenance objectives. For future reference, acknowledging the current well managed status of these habitats, records of burning events including seasonal timing, conditions (temperature, humidity and wind speed) and interval between fire events should be undertaken, largely to inform future management decisions and directions.

Formal training in the identification of orchid species would be beneficial to all rangers. Subsequent GPS tagging of the locations of the Vulnerable orchid *Dendrobium johannis* would considerably increase ecological knowledge of this threatened species and provide information relevant to future management directions.

Table 19. Summary recommendations for management of melaleuca dominant shrublands and low woodlands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna. A structured fauna survey involving nocturnal surveys (particularly during periods of melaleuca flowering) and pitfall trapping should be undertaken within this habitat. Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	The floristic composition of the ground flora is poorly known and limited to surveys undertaken during drier seasonal periods. Epiphytic species and annual herbs have been poorly documented.	Botanical survey needs to focus on collection and identification of ground covers which may be particularly diverse at periods of peak productivity (March to May). Surveys of the diverse array of orchids and epiphytes should also be undertaken.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. No formal survey of this habitat has been undertaken.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	High
Fire Management	Current fire regimes appear to be maintaining these habitats in excellent condition.	Continuation of current burning regimes should be maintained	High

Management Category	Context/Issue	Actions	Priority
		The timing, frequency and conditions (temperature, wind and humidity) for all fires within these habitats should be recorded for future reference and maintenance of traditional habitat management knowledge.	
Threatened Species Management	Flora: Threatened flora species are limited to epiphytes which include the threatened orchid species *Dendrobium johannis.*	Flora: Formal training in the identification of orchid species would be beneficial to all rangers. Subsequent GPS tagging of the locations of the Vulnerable orchid *Dendrobium johannis* would considerably increase ecological knowledge of this threatened species and provide information relevant to future management directions. Educate the Badu community about the significance of relevant orchids in an effort to limit over-collecting.	Moderate
	Fauna: The composition of this habitat in regard to threatened fauna species is unknown	Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined.	High
Invasive Species Management	Flora: There are no existing weed issues identified in this habitat.	Flora: No active weed control or management is currently required. The relative infertility of the substrate limits the degree to which exotic flora can invade the habitat.	Moderate
	Fauna: The extent to which feral animals utilise this habitat is unknown.	Fauna: The extent of usage by other exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	Moderate
Monitoring	This habitat may be subject to broadscale structural change if current burning regimes are not maintained.	A number of permanently marked photographic monitoring points should be placed in representative habitats which are accessible. Photographic reference material should be captured on an annual to bi-annual basis to detect any broadscale changes to habitat structure or condition.	Moderate

8.10 Shrublands and Shrubland Complexes

8.10.1 Status of Ecological Knowledge

To adequately characterise the ecological controls on shrubland distribution, shrublands have been classified according to their broad landform association including those associated with coastal dunes (both recent and degraded), coastal headlands and rocky pavements. These ecosystems are described briefly below.

Associations on Coastal Dunes: Shrublands may be associated with both degraded and recent dune formations with dramatically different floristic composition and structure. Vegetation community 14aa represents the only occurrence of shrubland mapped on recent (Holocene) dune formations,

outside of those mapped within broader complexes. This habitat is found on the west coast of Badu at 'Argan' where it is associated with a broad parallel beach ridge immediately behind the foredune. The shrubland typically forms at 4-7m height and is dominated by *Syzygium suborbiculare, Grevillea parallela, Acacia crassicarpa, Parinari nonda, Barringtonia calyptrata* and *Planchonia careya. Cycas badensis* forms a prominent component of the upper and lower shrub layers in association with *Grevillea parallela* and *Acacia platycarpa.* Seaward margins of this community typically merge with littoral vine thicket species forming groves including *Manilkara kauki, Drypetes deplanchei, Terminalia subacroptera, Eugenia reinwardtiana, Argusia argentea* and *Guettarda speciosa.* Discussions with rangers indicate that this community is being burnt regularly with hot late season fires. This is not only having a limiting effect on vegetation development but may also be interfering with recruitment of *Cycas badensis.*

On the deeper enclaves, the most inland sequence of older parallel dune systems (inferred to be Pleistocene age) have often been deeply leached of nutrient, comprising coarse white sand. In these locations, shrublands may take an open structure with a low uneven canopy that is typical of VC14n. Typical canopy and shrub species include *Acacia crassicarpa, Neofabricia myrtifolia, Leucopogon ruscifolius, L. yorkensis, Cochlospermum gillivraei, Pouteria sericea, Psydrax banksii, Exocarpos latifolius, Myrsine urceolata, Alyxia spicata, Pandanus conicus* and *Syzygium suborbiculare.* Ground cover is always sparse, with large areas of bare sand interspersed with scattered clumps of *Lomandra banksii*, *Aristida* sp., *Dianella bambusifolia* and sprawling mats of *Cassytha filiformis.*

A broad unstable transgressive aeolian dune system provides a dominant landscape feature in the islands south. This dune field hosts a low, sparse shrubland type that is unique to Badu Island. The dominant shrub layer forms an uneven upper stratum ranging in height from 0.5m to 1m with a total cover rarely exceeding 10%. Typical associated species include *Leucopogon ruscifolius, Acacia crassicarpa, Leucopogon yorkensis, Syzygium suborbiculare, Exocarpos latifolius, Alyxia spicata, Melaleuca viridiflora* and *Pandanus conicus.* The groundcover forms 5% combined cover dominated by *Dapsilanthus spathaceus,* with associated species such as *Xyris complanata, Lomandra banksii, Evolvulus alsinoides, Tricoryne elatior, Cassytha filiformis, Gompholobium* sp. (DGF9707+), *Tephrosia* sp. (DGF9710+), *Lithomyrtus obtusa,* and *Drosera spatulata*. The unique shrubland type 14s is an early stage in the succession from sparse shrubland to better developed woodland and open forest communities, the development of which will ultimately result in stabilisation of the deflationary feature. The timing of the event responsible for dune destabilisation is unknown, although it is clear that it is relatively recent as the unstable area truncates well-wooded stable dunes to the immediate south. The initiation of transgressive dune development is often linked to sea level rise (Hesp and Thom 1990) and the transgressive dune building event may be linked to a sea level high stand inferred by Burne and Graham (1995) to be 6 000 yrs B.P. at sea levels 5m higher than present. As an alternative hypotheses, dune destabilisation may be linked to a dramatic change in burning regime, such as might have occurred with the advent of human occupation.

Shrublands Restricted to Coastal Headlands: Relatively restricted areas of open shrubland are located on coastal headlands on Badu's south coast. The habitat is dominated by *Grevillea parallela* with associated species including *Acacia crassicarpa, Premna serratifolia, Cochlospermum gillivraeii,*

Parinari nonda, Planchonia careya, Syzigium suborbiculare, Barringtonia racemosa and *Cycas badensis. Corymbia tessellaris* and *Corymbia novoguinensis* may be scattered throughout although eucalypt species are always sub-dominant to other shrubland species. Canopy cover ranges from sparse to mid-dense (15 – 40%) with areas of greater canopy cover restricted to locations with deeper soil and/or greater protection from fire and exposed winds. This shrubland is a result of unique geomorphology, associated with coastal headlands covered by a narrow veneer of aeolian dune sand interspersed between outcropping granite boulders. It is unclear as to whether this sand is a recent accumulation or represents the residuum of a previously more extensive dunefield that has been winnowed by prevailing winds. Observations suggest that the community is regularly burnt with evidence of fire scarring on a large number of trees, although these fires are likely to be relatively mild due to limited fuel loads.

Shrubland Associated with Rocky Pavement and Knolls: Extensive areas of shrubland occur on rocky knolls from the islands interior to exposed coastal headlands. The habitat is typically a dense low scrub, rarely exceeding 8m, with greater than 80% canopy cover. *Welchiodendron longivalve* is invariably the dominant species although mixes with *Acacia polystachya* and a range of scattered vine thicket species including *Cochlospermum gillivraei, Terminalia subacroptera* and the Vulnerable species *Psydrax reticulata.* Other significant plants are *Carmona retusa* (Vulnerable) and regionally significant and disjunct populations of *Euphorbia plumerioides and Erythroxylon* sp. The low canopy is the result of skeletal soils combined with the influence of prevailing trade winds. The habitat is generally impervious to fire incursion or human induced disturbance.

8.10.2 Ecological / Cultural Considerations

Habitat Condition and Threats: All habitats examined are free from exotic weed species and generally in excellent condition. *Cycas badensis* dominant shrubland 14aa at Argan is subjected to repetitive hot fire regime which, according to discussions with Mura Badhulgau rangers, is maintained to keep the area free from snakes. This repetitive burning regime is limiting foredune succession and stabilisation and a number of small vine forest copses on the dune are either in stages of boundary retreat or equilibrium. Burning may also be having a deleterious effect on recruitment of *Cycas badensis.* Shrubland community 14s, near the Badu Island borefield is being threatened by un-managed sand extraction adjacent to the main access track.

Fauna: No systematic survey of fauna has been undertaken in this these habitats and the nature of the fauna assemblage is largely unknown. The impact to native fauna species by feral animals (cats and dogs) needs to be ascertained.

Flora: Provides habitat for *Cycas badensis, Psydrax reticulata, Carmona retusa, Erythroxylon sp.* (Mosquito Ck), and *Euphorbia plumerioides.*






Photograph 29 (Top Left). The effect of hot fire on dune shrubland (VC14aa) on the west coast of Badu Island. **Photograph 30 (Top Right).** Typical low uneven nature of VC14n. **Photograph 31 (Mid Left).** A broad low ridge formed on an active deflationary hollow. **Photograph 32 (Mid Right).** Shrubland on Badu Islands south facing headlands with thin veneer of aeolian sand. **Photograph 33 (Bottom).** Dense thickets of Welchiodendron dominant scrub blanket coastal headlands on Badu's south coast. **Photograph 34 (bottom right)** Habitat of *Psydrax reticulata, Euphorbia plumerioides, Erythroxylon* sp. and *Carmona retusa in* low shrubland on coastal headlands.

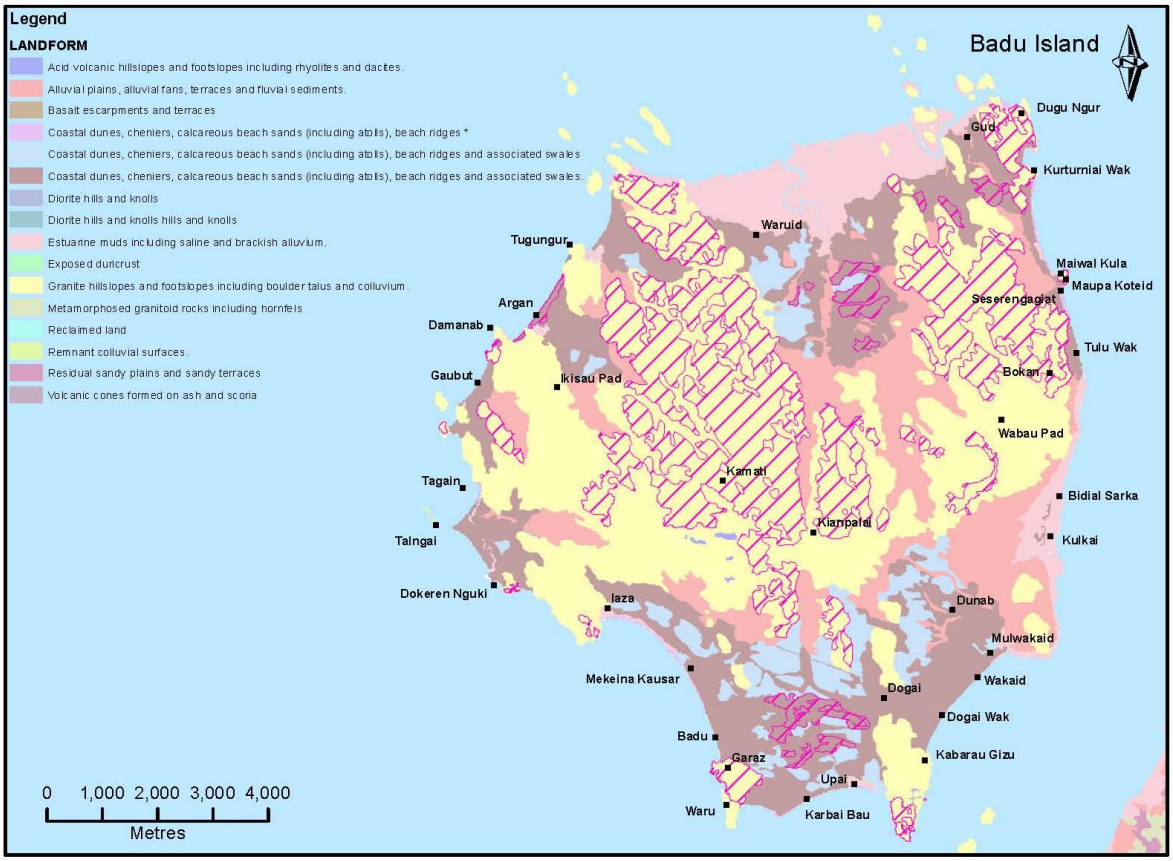


Figure 11. Distribution of shrubland habitats (place names after Lawrie, 1970).

Cultural Perspectives: Some habitats, particularly those associated with relict dune systems (14s, 14n) have a large numbers of undocumented cultural sites. Particular cultural significance can be attached to the habitats on these older dune systems.

8.10.3 Management Implications

The majority of these habitats, particularly those on rocky pavements and those associated with relict dune systems are self maintaining. Vegetation development is limited by the infertile substrate. Low fuel loads means fire will not carry for any significant distance into the community margins. The major concerns relate largely to shrublands on the coastal dune system of 'Argan' which is subject to a regime of repetitive hot fires. As vine thicket provides an abundant traditional food resource and aids stabilisation of the dune system, fire should be excluded from small vine thicket copses allowing the habitat to stabilise and ultimately expand where possible. Backburning should be undertaken around the margins of these habitats during cooler seasonal periods to prevent damage by severe fires burning late in the season.

Further research into the ecology of *Cycas badensis* should also be undertaken. Observation of cycad growth stages in areas known to be subject to repetitive hot fire indicates limited recruitment of established plants in the smaller size classes with the majority of plants being large individuals with a profusion of seedlings. As such, it is considered repetitive hot firing may result in stagnation of the

cycas population. Attention should also be paid to controlling sand extraction activities within shrubland habitat 14s which is causing damage to cultural sites.

8.10.4 Summary of Recommended Management Actions

1. Traditional knowledge base would benefit from GPS marking of all cultural sites, particularly within dune shrubland habitats 14s and 14n.
2. The ecology of *Cycas badensis* should be investigated more thoroughly on the foredune at 'Argan' with a number of permanently marked monitoring plots. Long term monitoring plots should be erected where the cycas population is subject to a range of burning regimes. The program would require designation of various levels of fire exclusion to be maintained for an extended period.
3. Back-burning may be required on the margins of vine thicket copses to prevent further habitat attrition. Back burning should be undertaken in cooler seasonal periods prior to any more severe late season burn is undertaken. Mosaic burning of the broader landscape will also prevent the development of hot late dry season fires.
4. As the fauna ecology is poorly known, documentation of all animals observed (including invasive/ exotic species) should be undertaken with photographs and possible collections (preserved in freezer) where possible for future formal identification by authorities or agencies.
5. The collection and subsequent pressing of plant species within this habitat can be undertaken on an opportunistic basis, focusing initially on plants of particular cultural/ resource significance.

Table 20. Summary management recommendations for shrubland and shrubland complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly known.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitat's fauna. A structured fauna survey involving pitfall and Elliott trapping can be undertaken dependent on the soil type, site accessibility and habitat. Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	The floristic composition of habitats on both recent and older dune formations is relatively well known although habitats on rockier, less accessible pavements have had limited survey.	Survey should focus on conservation significant species and those which are important cultural resource species.	Moderate
Traditional Ecological Knowledge	Cultural sites are scattered extensively throughout dune habitats, particularly shrubland areas associated with older dune systems.	Undertake further survey to confirm the location of cultural sites and record these by GPS for incorporation into a GIS database for future reference. Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken	High

Management Category	Context/Issue	Actions	Priority
		through collaboration with knowledgeable members of the local community.	
Fire Management	The majority of these habitats will not carry a fire although the dune shrubland behind to foredune at Argan appears to be frequently burnt under hot conditions.	Monitor burning at Argan to determine timing and purpose of current burning regime. If possible, the Argan dune shrubland should be mosaic burnt with a series of cooler low intensity fires early in the season to prevent damage to stabilising dune vegetation and facilitate expansion of the dune vine thicket which are present within the shrubland.	High
Threatened Species Management	Flora: The majority of threatened flora species found within the habitat are not threatened by existing land management regimes. The population of *Cycas badensis* on the dune shrubland at Argan appears threatened by a severe repetitive burning regime. Fauna: The composition of this habitat in regard to threatened fauna species is unknown	Flora: The ecology of *Cycas badensis* should be investigated more thoroughly on the foredune at 'Argan' with a number of permanently marked monitoring plots. Long term monitoring plots should be erected where the cycas population is subject to a range of burning regimes. The program would require designation of various levels of fire exclusion to be maintained for an extended period. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined.	High High
Invasive Species Management	Flora: There are no existing weed issues identified in these habitats. Fauna: The extent to which feral animals utilise this habitat is unknown.	Flora: No active weed control or management is currently required although shrubland habitats should be regularly inspected for invasive weeds where they occur in the vicinity of access tracks. Track logs indication areas of survey should be retained for future reference. Fauna: The extent of usage by other exotic pests will be informed by results of fauna surveys. Management actions can be formulated once major threats are identified.	Moderate Moderate
Monitoring	Monitoring of *Cycas badensis* populations should be implemented as discussed above.	Monitoring of *Cycas badensis* populations should be implemented as discussed above.	High

8.11 Coastal Dune Complexes

8.11.1 Status of Ecological Knowledge

This habitat is essentially a mosaic of grassland, shrubland and vine thicket copses located on coastal foredune and prograding dune landforms, that cannot be differentiated into individual components at the mapping scale. Major vegetation components are low vine thicket copses, dominated by species which, including *Eugenia reinwardtiana, Manilkara kauki, Guettardia speciosa, Terminalia subacroptera, Acacia crassicarpa, Premna serratifolia, Diospyros maritima* and *Psydrax banksii.* The copses are separated by grassland and forbland communities comprising *Ipomoea pes-caprae* subsp.

brasiliensis, Spinifex sericeus, Cassytha filiformis and *Mnesithea rottboellioides*. A range of transitional shrubland communities may also occur, typically dominated by *Premna serratifolia, Guettardia speciosa, Cordia dichotoma, Cordia subcordata* and *Acacia crassicarpa.* The uneven appearance is accentuated by the groved nature of the community which has scattered clumps of trees and shrubs relatively well-spaced and separated by bare sand or sparse tussock grasses and herbs.

These are colonising communities forming on recent (Holocene) dunes and foredunes with a primary ecological function of stabilising mobile dune sand. They are highly sensitive to disturbance and destruction of colonising vegetation by fire, recreation or exotic animals, may have a destabilising effect on dune morphology, leading to beach erosion. For this reason, they should be considered highly sensitive habitats and protected from elements of human disturbance as far as is practical.

Photograph 35. A low groved mosaic of dune forbland, grassland that is rapidly developing towards a vine thicket. **Photograph 36.** Vine thicket on dune surface.

8.11.2 Ecological / Cultural Considerations

Habitat Condition: Whilst large areas are in excellent condition, many of the habitats near or influenced by settlement or recreation have been degraded by inappropriate burning regimes, and recreational use which includes seasonal camps and beach access tracks. Degradation is often indicated by a predominance of grass (often *Mnesthea rottbelliodes* or *Imperata cylindrica*) over sprawling forbs, vines and shrubs, a sign of inappropriate burning regimes or gross disturbance. These areas lack significant infestations of exotic species although they are at risk of infestation by Singapore Daisy *(Sphagneticola trilobata)* which is a prominent pest in township areas. The weed has infested similar shorefront communities in the Wet Tropics Bioregion. Other threatening process include vehicle access which has the potential to both spread exotic species and initiate dune erosion, as well as fires which can both destabilise substrates and greatly simplify the nature of the ground covers. This habitat will be the initial point of impact for beachside erosion related to sea level rise.

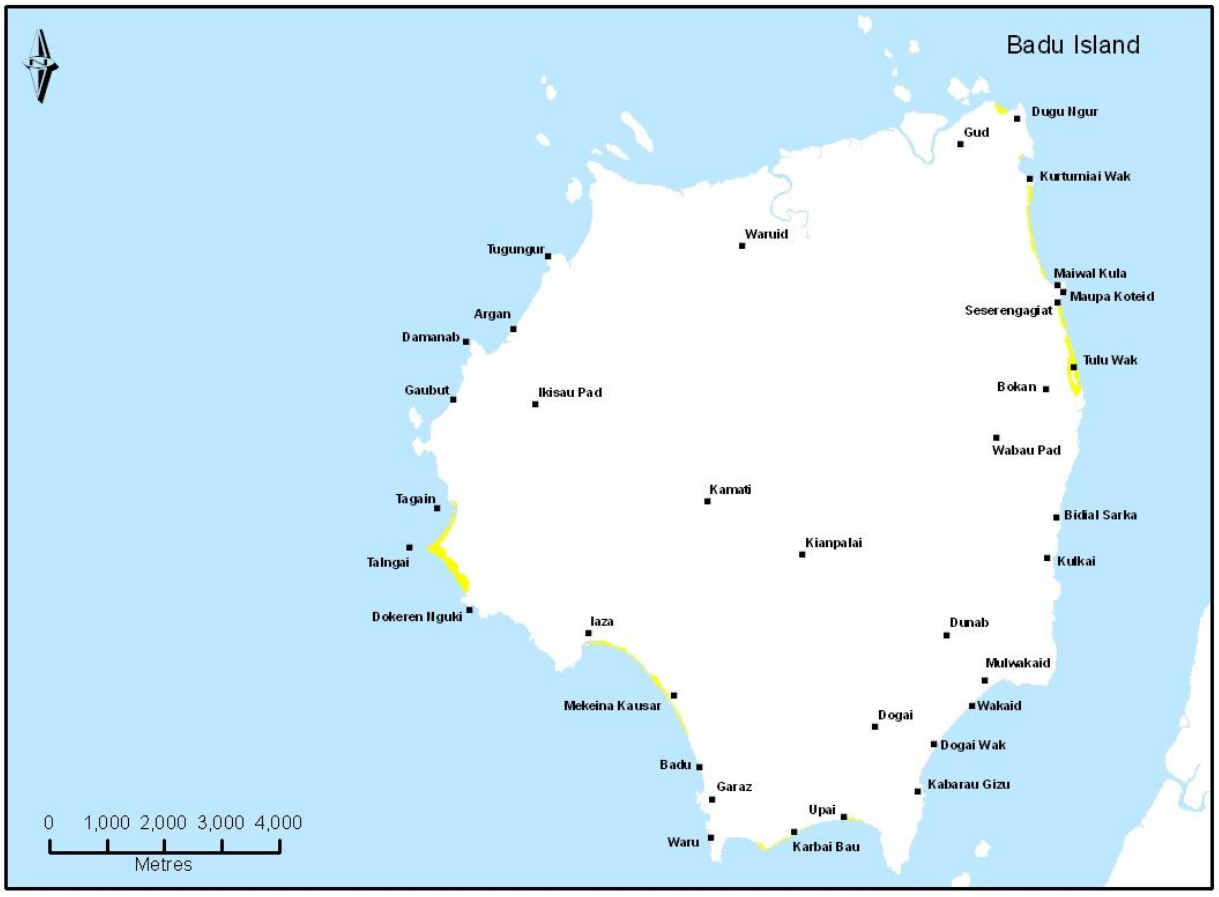


Figure 12. Distribution of coastal dune complex habitats (place names after Lawrie, 1970).

Fauna: The habitat provides an important nesting ground for marine turtles and a number of bird species including *Esacus magnirostris* (beach stone curlew) which is listed as 'Vulnerable' under state legislation.

Flora: The shrub *Gossia retusa* (regionally significant disjunct occurrence at northern limit of distribution) may occur in this habitat.

Cultural Perspectives: This habitat has been extensively utilised for a range of cultural activities, both tradition and more recent and remains a habitat that is extensively utilised for recreation and camping activities. Groved thickets dispersed throughout community provide an extensive repository of cultural resources including a number of important food trees such as wongai (*Manilkara kauki)* and Cedar Bay cherry (*Eugenia reinwardtiana),* and mipa *(Terminalia subacroptera).*

8.11.3 Management Implications

The inherent sensitivity of these habitats and importance in stabilising landforms presses the importance of appropriate management regimes. Recommendations relate largely to ensuring access points are restricted to designated locations and continued monitoring for invasion of exotic species. These are recent landform elements in the process of succession from forbland to shrubland to vine thicket. Due to their sensitive and often transitional nature, fire should be excluded from the habitat wherever possible due to its destabilising effect on landform and tendency to simplify habitat diversity.

Recreational access also has significant potential to degrade the habitat through dune destabilisation and potential vector for introduction of pest species.

8.11.4 Summary of Recommended Management Actions

Table 21. Summary management recommendations for coastal beach complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	No previous surveys.	Design and implement a structured fauna survey and trapping program supported by specialists. Maintain focus on culturally significant species and ethnotaxonomy to feed into TEK. Survey can be completed in conjunction with broader surveys of littoral vine thicket and dune grasslands utilising a range of methods including pitfall and Elliott trapping in conjunction with informal observation and photography.	High
Plant Surveys	Information of flora composition is incomplete and limited to rapid surveys in dry season.	Carry out additional flora field surveys across seasons with focus on wet season herbs and grasses. Collect specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora: No significant species known. Fauna: Dune complexes provide habitat for a range of significant fauna species including beach stone curlew, little tern as well as nesting grounds for marine turtles.	Flora: No actions. Fauna: Further baseline data is required (see fauna surveys) before discrete management actions can be fully defined. Survey should also identify the extent to which exotic predators (dogs and cats) are utilising these sites for hunting purposes. The location of nesting, and foraging sites for the beach stone curlew should be identified by GPS for incorporation within the GIS database. The community should be made aware of critical habitat areas and recreational activities within these areas should be monitored or controlled.	Moderate High
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge through fauna and flora survey actions, and from interviews with elders on an ongoing basis.	High
Fire Management	Over burning leading to the loss of species diversity and habitat structure and destruction of cultural sites.	Back burn along the margins of foredune habitats to prevent wildfire incursion, particularly where habitat for threatened species is identified. A general mosaic of cool early season fires within adjacent woodland and forest habitats will limit fire incursion within these	Immediate

Management Category	Context/Issue	Actions	Priority
		habitats. Record the timing and frequency of burning events for future reference so as to allow practice to be adjusted and refined to improve management outcomes. Identify and protect cultural sites form high intensity fire by early season burning regime where possible.	
Invasive Species Management	Flora: The habitat on Badu Island appears to be weed free in general although on other islands, similar habitats support scattered infestations of mintweed and red Natal grass. Praxelis and blue top are potential threats. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna particularly nesting birds, by feral cats and dogs.	Flora: All beachfront habitats should be monitored for infestation of exotic species, particularly Singapore daisy, during routine patrols. Any observed infestation should be documented and eradication/ control measures implemented immediately. Fauna: Invasive fauna to be determined from fauna survey results. Assess cat activity levels by installation/monitoring of sand pads, nocturnal spotlighting, and consultation with community members. Implement control where appropriate.	High Moderate
Monitoring	Observations relating to any changes to habitat condition should be documented so that the risk these changes pose to long-term habitat stability can be assessed and appropriate management responses formulated.	All generally accessible beachfront habitats should be informally monitored for infestation of exotic species, and other aspects of land degradation, routinely on a minimum 6 monthly interval during routine patrols. Less accessible habitats can be accessed by boat on an annual basis. It is important that location and track logs of informal monitoring exercises be recorded to ensure at risk habitats are not overlooked.	High
Cultural Heritage	Known cultural heritage values occur within the habitat.	Implement systematic surveys of the cultural heritage values of this habitat zone with consideration given to protecting/managing any significant sites.	Immediate
Other Management Issues	Vehicular recreational access to dune complex habitats has considerable potential to destabilise dune landforms and lead to habitat degradation. Beach access also greatly increases the risk of exotic weed species introduction and spread.	Designate a single recreational access point for vehicles and close all alternative access points to usage. Ensure the reasons for these actions are communicated to the broader Badu Island community.	Immediate

8.12 Grassland and Grassland Complexes

8.12.1 Status of Ecological Knowledge

Grassland communities are usually associated with areas under an intensive fire regime although on Badu, many examples are controlled largely by edaphic conditions and wind exposure. They range

from communities on steep granite hillslopes, communities on coastal headlands, and grassland communities on sand dunes. The latter is typically an indication of past intensive burning regimes around beachside areas of old settlement. Composition is generally dependent on fire regime with those areas exposed to frequent hot fires typically dominated by *Imperata cylindrica* and *Heteropogon triticeus.* Other common species include *Mnesithea rottboellioides* on sand dunes and *Themeda triandra* on coastal headlands and hillslopes.

An interesting variation occurs on sand dunes on the southern portion of the island where the shrub layer becomes very sparse, and the structural formation grades to a *Dapsilanthus spathaceus* dominant sedgeland, generally with scattered emergent shrubs. These areas are typically a response to elevated water tables. Contrary to previously discussed grassland communities, it would take several years of fire absence for this community to accumulate sufficient fuel for combustion.

Photograph 37 (left). A large area of grassland on a rocky coastal headland. Badu Island south coast, and; **Photograph 38.** Sedgeland dominated by *Dapsilanthus spathaceus* in foreground.

8.12.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Grasslands are generally free from exotic weeds although some communities, particularly on coastal dunes are the result of frequent hot fire. All sedgeland habitats are in pristine condition. Grassland habitats controlled by edaphic conditions are generally robust, although all are threatened by the introduction of exotic grass species including Gamba grass, which has spread rapidly across northern Cape York Peninsula. The grass is an aggressive colonist which develops a standing biomass of 5-7 times that of native species (Rossiter *et al.* 2003) resulting in extremely intense savanna fires, significantly altering habitat ecology. Praxelis is an aggressive herb which occurs in the village areas of Badu and has the potential to infest grasslands to the exclusion of native species.

Fauna: Comprehensive fauna surveys within this habitat are lacking and the fauna assemblage is largely unknown.

Flora: Grasslands on coastal headlands support populations of *Cycas badensis*. Species composition is poorly documented.

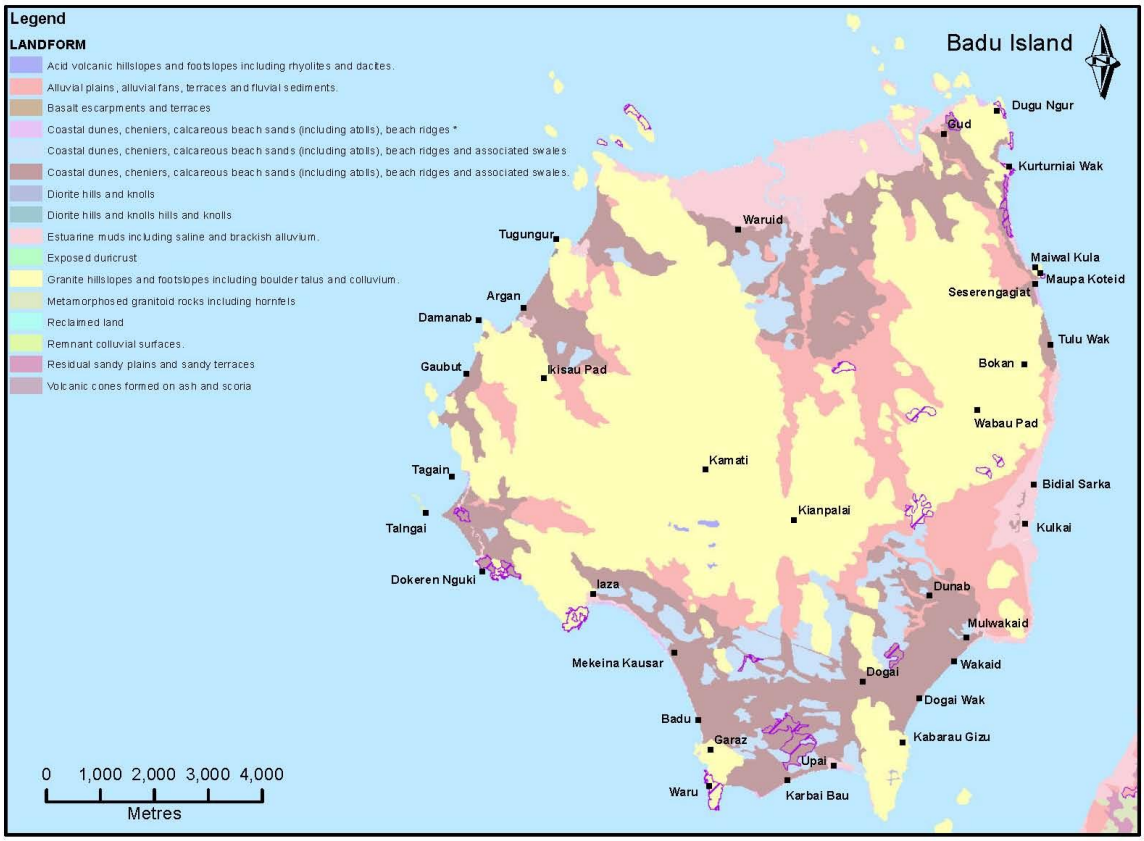


Figure 13. Location of grassland habitats (place names after Lawrie, 1970).

Cultural Perspectives: Some areas of this habitat have been maintained by cultural burning practice, most likely since the times of earliest occupation. Other areas on coastal headlands have been maintained by a combination of fire, wind exposure and edaphic conditions. The important cultural component of the landscape that these habitats represent should be acknowledged in cultural and landscape management planning.

8.12.3 Management Implications

Many of these areas, particularly on coastal headlands, are self-maintaining, and require limited active management. Whilst shrubby thickening threatens a large number of similar habitats in the bioregional sense, this process is not considered a particular habitat threat in the Badu Island context.

8.12.4 Summary of Recommended Management Actions

Management action should aim to maintain the current landscape function which is considered important from both ecological and cultural perspectives. Recommendations for landscape maintenance are provided below, although ultimately, management direction will be guided by the desires of the local community and representative rangers.

1. Selected grassland habitats should be assessed for signs of degradation on an annual basis with particular note towards evidence of invasive species or shrubby thickening. Monitoring for invasive pest species should be undertaken vigilantly on major access points and tracks. Any nucleation points should be subject to immediate eradication and plants that cannot be identified in the field collected for formal identification.
2. At the discretion of the rangers, areas subject to shrubby thickening should be considered for a prescriptive late season fire regime which will destroy generating shrubs. Burning immediately after the first storm events (storm burning) will effectively promote grassy cover over shrubs and this should be considered as a management option.
3. General burning regimes for grasslands should promote patchiness with burning conducted across a range of seasonal conditions from early to late dry season. Maintaining a patchiness of burnt and unburnt areas is important for conservation management (Russell-Smith *et al.* 2003) and stratifying fires across a range of seasonal conditions will promote patchiness. The inherent rockiness of the substrate in many of the islands grassland habitats will also promote patchiness in fire distribution.
4. Timing and frequency of fires should be recorded for future reference. This will allow practice to be adjusted and refined to improve management outcomes.
5. Monitoring for invasive pest species should be undertaken vigilantly on major access points and tracks. Any nucleation points should be subject to immediate eradication and plants that cannot be identified in the field collected for formal identification.

Table 22. Summary of Management Actions for grasslands and grassland complexes.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	These habitats have been subject to limited fauna survey and the fauna assemblage has been poorly documented.	The implementation of a structured fauna survey and trapping program will provide additional detail in regard to the islands fauna assemblage. It may however be of secondary importance to survey of the more extensive open forest and woodland habitats.	Moderate
Plant Surveys	Information on flora composition is incomplete and limited to rapid surveys in dry season.	Carry out additional flora field surveys across seasons with focus on herbs and grasses. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora; The habitat may contain populations of *Cycas badensis* although the extent and location of populations is unknown. Fauna: The extent to which this habitat is utilised by threatened species is not known.	Flora: Conduct opportunistic flora surveys within grassland habitats and mark the locations of *Cycas badensis* populations. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the	Collect and collate TEK through fauna and flora survey actions, and from interviews with elders on	High

Management Category	Context/Issue	Actions	Priority
	Appendices provide a good foundation for increasing TEK and ethnotaxonomy.	an ongoing basis. Ongoing mapping of cultural sites within this habitat should be undertaken.	
Fire Management	The habitat requires burning to retain open structure although at present, grassland habitats are generally free from shrubland encroachment. Sedgeland habitats on swampy sand plains are largely self maintaining and do not have sufficient fuel to burn regularly.	Implement a seasonal burning regime that seeks to mosaic burn all grassland habitats starting in cooler months when fire intensity is unlikely to be severe. As a general aim burning of grassland habitats should be completed over a three-year interval. Record the timing and frequency of burning events for future reference so as to allow practice to be adjusted and refined to improve management outcomes. Incorporate the management of the Cycad population into the burning program with consideration to times of seed and cone production. Incorporate the protection of cultural sites into burning plans.	Moderate
Invasive Species Management	Flora: Grasslands are currently free of major invasive species however, potential weeds are known from disturbed areas within and on the vicinity of the Badu settlement. Fauna: Composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: Monitoring for invasive pest species particularly exotic herbs and grasses should be undertaken every 6 months on major access points and tracks. Collect, record location using GPS, and photograph weeds that cannot be identified in the field so formal identification can be achieved. Any nucleation points should be subject to immediate eradication. Fauna: Composition of invasive fauna needs to be derived from fauna survey results. Assess cat and dog activity levels by installation and monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with community members. Implement control where appropriate.	High High
Monitoring	There is a requirement to observe any changes to habitat structure so that management actions can be implemented if the changes are having a negative impact on biodiversity values.	Establish permanent photographic monitoring points where grassland areas are identified as being subject to long-term habitat change. Where problem areas are identified, carry out monitoring on a six monthly basis including observations taken late in the wet season at maximum growing season.	Moderate
Cultural Heritage	Grassland areas, particularly on coastal headlands may have considerable cultural value and host a large number of culturally significant sites.	Ongoing mapping of cultural sites within this habitat should be undertaken.	Immediate

8.13 Rock Pavement Communities

8.13.1 Status of Ecological Knowledge

This habitat is extensive on Badu Island, associated with rocky knolls within the islands granite massif. The habitat comprises a complex of bare rock interspersed with shrubland, the latter typically occupying cracks and crevices where sufficient moisture and nutrient (from skeletal soil formation) is provided to allow shrubland development. The shrubland component typically comprises deciduous vine thicket species ranging in height from 1.5 to 6m dominated by species which include *Cochlospermum gillivraei, Canarium australianum, Terminalia subacroptera, Psydrax banksii, Psydrax reticulata, Dalbergia densa* var*. australis, Secamone elliptica, Carissa ovata, Acacia polystachya* and *Welchiodendron longivalve. Asteromyrtus symphyocarpa, Lithomyrtus obtusa. Cycas badensis* and *Acacia simsii* may form prominent shrubland components in some expressions. Bare pavements are generally scattered throughout the broader shrubland mosaic.

Photograph 39 (Left). Typical rock pavement habitat on the top of Mt Mulgrave; & **Photograph 40.** Granite boulder piles also form part of the rock pavement complex.

8.13.2 Ecological / Cultural Considerations

Habitat Condition and Threats: Rock pavements, due to their inherent infertility and exposure, have been unaffected by ecological changes that occur due to human influence. Major threats to the habitat include the spread and establishment of exotic weed species including grass species such as red Natal grass (*Melinis repens),* molasses grass *(Melinis minutiflora)* as well as invasive shrubs such as belly-ache bush (*Jatropha gossypifolia),* and praxelis *(Praxelis clematidea)* which occurs as a garden plant in the township area. Exotic species will most likely establish in habitats close to the vicinity of settlement areas as well as pavement areas that are regularly burnt, such as those on coastal headlands near 'Argan' which have well developed grassy cover interspersed between rocky areas.

Fauna: Fauna survey of this habitat has been undertaken by Conics (2009a) who report its high values to frugivorous bird species although no other animals were recorded. Further structured survey effort and opportunistic sampling/ observation would greatly improve the current knowledge of baseline fauna assemblage. The rocky nature of the habitat may be particularly suitable for a range of skink and gecko species including *Lepidodactylus pumilus* (NT).

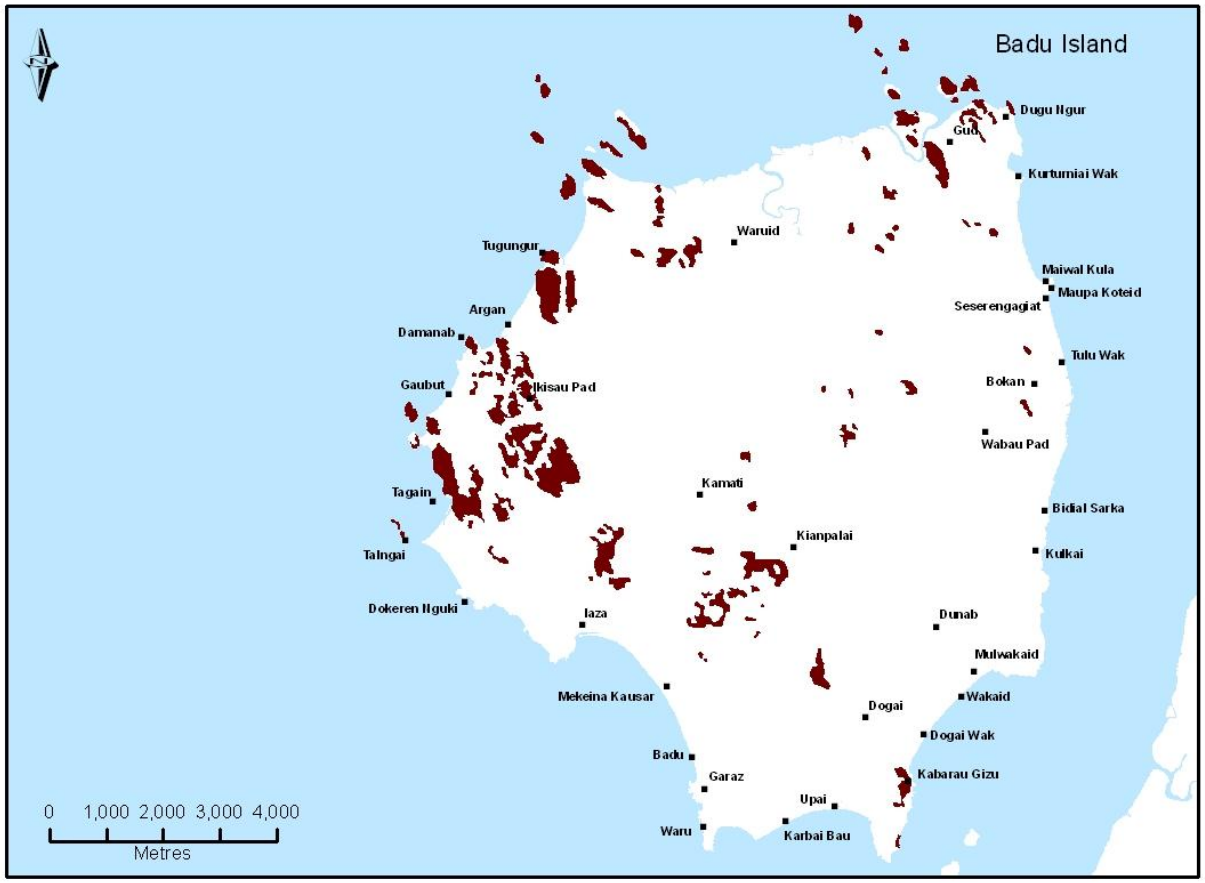


Figure 14. Location of rock pavement habitats (place names after Lawrie, 1970)

Flora: *Cycas badensis* is recorded from rock pavement on coastal headlands in the vicinity of Argan. *Psydrax reticulata (*Vulnerable*)* is widespread and common throughout the habitat with scattered occurrences of *Carmona retusa* and *Euphorbia plumerioides*.

Cultural Perspectives: The habitat is likely to contain an abundance of cultural sites such as stone piles although the degree to which these sites have been documented is unknown.

8.13.3 Management Implications

The relatively stable nature of this habitat type means that little management intervention is required. The majority of habitats are buffered from fire incursion by surrounding pyrophobic vegetation as well as their rocky nature which acts as a natural buffer to fire incursion. Rock pavements on coastal headlands often have an abundance of grass interspersed amongst rocky areas which allows fire to carry through the habitat. On headlands near 'Argan' the incursion of fire might be a necessary process in the regeneration of *Cycas badensis*. As the historic fire management regime is unknown in these areas, documentation of fire history including, size, intensity, seasonal considerations would be beneficial for long term maintenance of habitat integrity. Fire management requirements are likely to be variable within this habitat and vary from location to location. As such, fire management regimes must be tailored to specific sites depending largely upon the specific nature of the grass and shrub cover

8.13.4 Summary of Recommended Management Actions

Limited active management is required in this habitat although the following actions described within **Table 23** should be undertaken routinely.

Table 23. Summary of Management Actions for rock pavement habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	Subject to a previous fauna survey, however no comprehensive surveys across a range of seasonal conditions.	Design and implement a structured fauna survey and trapping program supported by specialists. Maintain focus on culturally significant species and ethnotaxonomy to feed into TEK.	Moderate
Plant Surveys	Information in regard to flora composition is incomplete and limited to rapid surveys in dry season.	Carry out additional flora field surveys across seasons with focus on herbs and grasses. Collect leaf specimens and photograph plants with known uses/values and that may have been used in the past, and catalogue.	Moderate
Threatened Species Management	Flora: *Cycas badensis* is known to occur within this habitat in the vicinity of Argan. *Carmona retusa* and *Psydrax reticulata* may also occur within this habitat although the latter is widespread and relatively common. Fauna: Composition of significant fauna within this habitat is poorly known.	Flora: Carry out informal field surveys to map populations of *Cycas badensis* within these habitats. The locations of observed populations should be recorded by GPS and incorporated into the ranger's database. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	Moderate High
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the Appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK through fauna and flora survey actions, and from interviews with elders on an ongoing basis.	High
Fire Management	The habitat by its physical nature generally excludes fire although it is expected that there would be some incursion during severe fire events.	Document fire history where any significant incursions are noted including size, intensity and seasonal considerations.	Immediate
Invasive Species Management	Flora: Weeds with potential to invade this habitat are known from disturbed areas in the vicinity of the Badu Island township. Fauna: The composition of invasive fauna within this habitat is poorly known. Potential for impacts on fauna by feral cats and dogs.	Flora: Undertake monitoring for invasive species particularly praxelis, belly-ache bush, lantana, *Hyptus suaveolens*, *Urena lobata* and exotic grasses in the vicinity of access tracks and seasonal camps/recreation areas. Collect, record location using GPS, and photograph weeds that cannot be identified in the field so formal identification can be achieved. Any nucleation points should be subject to immediate eradication. Fauna: The composition of invasive fauna to be derived from fauna survey results. Assess cat and dog activity levels by installation and monitoring of sand pads on nearby tracks, nocturnal spotlighting, and consultation with	High High

Management Category	Context/Issue	Actions	Priority
		community members. Implement control where appropriate.	
Monitoring	These are stable habitats controlled by infertile substrates and limited soil development. The major cause of habitat change is likely to be invasive plant species.	Undertake informal monitoring of accessible habitats as required for monitoring of invasive species.	Moderate
Cultural Heritage	Sites of specific cultural heritage are known to occur within this habitat.	In consultation with the community, and the Cultural Heritage Project incorporate survey data of cultural heritage sites in this habitat zone within the GIS and consider appropriate protection/management of sites.	Immediate

8.14 Wetland Complexes and Mosaics

8.14.1 Status of Ecological Knowledge

Badu Island hosts a number of small perennial swamps, all being associated with deflationary hollows on sand sheets. These generally form in association with *Melaleuca quinquenervia* open forest, representing areas of deeper, permanent water where shrubs cannot establish. The lagoons represent an expression of a localised water table associated with the broader dune system and hence, unless local groundwater levels are depleted significantly. Water lily (*Nymphaea sp.)* forms a prominent aquatic microphyte in the habitat examined although was not identified to species level. These are the only such examples of these habitats on the Torres Strait Islands and as such, are significant in a bio-regional sense.

8.14.2 Ecological / Cultural Considerations

Habitat Condition and Threats: This habitat appears to be in natural condition although some disturbance is noted by feral pigs on the habitat margins. The major threat to the habitat relates to degradation by feral pigs although excessive extraction of groundwater resources may lead to more regular extreme depletion during times of drought. The impact of water extraction on groundwater resources is not currently understood. Proliferation of exotic species, both water plants and exotic fish, also presents a significant threat to habitat ecology.

Fauna: The wetland habitats have not been assessed for aquatic faunal values which are unknown. It is likely to provide habitat for a number of significant birds including radjah shelduck and black-necked stork and an unknown assemblage of amphibious reptiles and freshwater fish.

Flora: The aquatic flora assemblage of this habitat has not been surveyed.

Cultural Perspectives: The habitat is likely to be important as a supply of freshwater as well as a resource for hunting of freshwater turtles.

Photograph 41. (Left). Open wetland on a degraded sand sheet, Badu Island.
Photograph 42. The same habitat viewed from the air with a mobile dune system in the foreground.

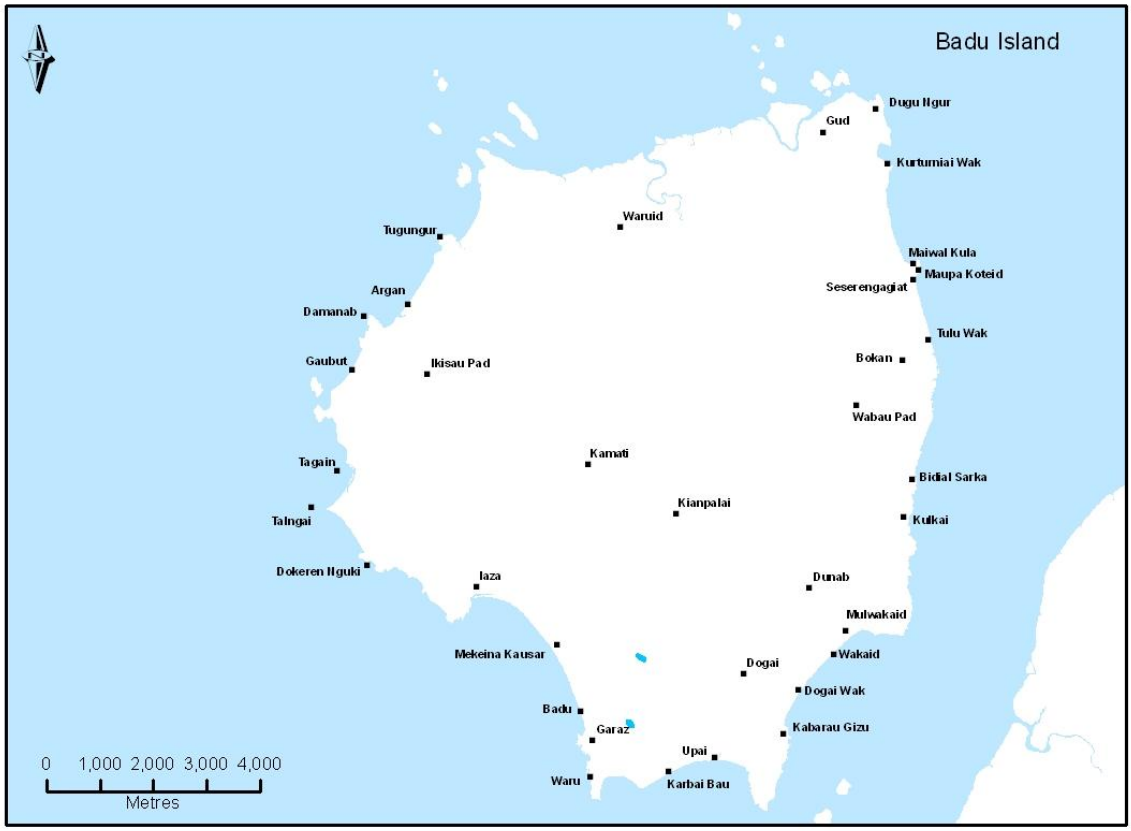


Figure 15. Location of wetland complex habitats (place names after Lawrie, 1970)

8.14.3 Management Implications

No active management of this habitat is required although monitoring for the impacts of exotic species including feral pigs and weed species should be an ongoing component of rangers patrol duties. Due to the local and regional significance of this habitat, a detailed survey of aquatic fauna and flora values is warranted.

8.14.4 Summary of Recommended Management Actions

Limited active management is required in this habitat although the actions detailed in **Table 24** should be undertaken routinely.

Table 24. Summary of recommended management actions for wetland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	No assessment of the aquatic habitat values within this habitat has been undertaken. The waterbodies are likely to host freshwater fish species, freshwater turtles and amphibians that have not been documented.	Design and implement a program to survey the aquatic values within this habitat, supervised by an experience aquatic ecologist and supported by the Mura Badhulgau Rangers.	High
Plant Surveys	The aquatic plant species within this habitat are unknown.	Undertake a survey to document the aquatic flora species present within this habitat, supervised by an experienced aquatic ecologist and supported by the Mura Badhulgau Rangers.	High
Threatened Species Management	Flora: The composition of threatened flora species within this habitat is unknown. Fauna: The composition of significant fauna species within this habitat is not known.	**Flora**: Further baseline information required (see fauna surveys) before discrete management actions can be defined. Fauna: Further baseline information required (see fauna surveys) before discrete management actions can be defined.	High High
Traditional Ecological Knowledge	The extent of TEK within this habitat is not known. Plant and animal species of traditional importance require documentation.	Collect and collate TEK through fauna and flora survey actions, and from interviews with elders on an ongoing basis.	High
Fire Management	This habitat requires no fire management although the paperbark woodland fringes will ignite during burning events.	No action is required	No Action
Invasive Species Management	There is potential for exotic aquatic plants and animals to invade this habitat. Habitat margins may be severely impacted by the foraging of feral pigs.	A baseline assessment of aquatic flora and fauna values is required before appropriate management actions can be defined. Regular inspection to monitor for the introduction of exotic species, including aquatic plants, animals as well as feral pig damage should be undertaken as a regular component of ranger patrol duties. A program of feral animal trapping is warranted to control any observed damage caused by feral pigs.	High
Monitoring	The requirements for monitoring need to be determined upon completion of baseline ecological assessment. Water levels within the lagoon may provide an indication of broader changes to the ground water levels which may be influenced by excessive borehole water extraction.	Complete baseline assessment of aquatic ecological values to identify any potential requirement for formal monitoring. Establish a permanent photographic monitoring point to be surveyed on a six-monthly interval to provide informal monitoring of lagoon water levels, habitat changes and water quality.	Moderate

Management Category	Context/Issue	Actions	Priority
		Photographic capture should be taken within a set period in the Late dry season (November) and late wet season (April –May).	
Cultural Heritage	There appears limited information on the cultural values or cultural utilisation of this habitat.	Obtain information in regard to the cultural importance of this habitat through consultation with elders and knowledgeable traditional owners and document this information.	Moderate

8.15 Samphire Grasslands

8.15.1 Status of Ecological Knowledge

Sporobolus virginicus dominant grasslands (VC26a) are restricted to the margins of Mangrove communities, occurring on both alluvium under the influence of brackish water, or on sand sheets and dune swales which are subject to infrequent tidal incursion. Associated species may also include *Cynanchum carnosum* and *Sesuvium portulacastrum* with emergent mangrove shrubs to one metre.

8.15.2 Ecological / Cultural Considerations

Habitat Condition: The habitat is universally free from exotic species, with species composition regulated by soil salinity.

Fauna: Samphire grassland provides valuable habitat for a range of significant fauna species including black-necked stork (*Ephippiorhynchus asiaticus),* radjah shelduck (*Tadorna radjah*) and false water mouse (*Xeromys myoides)*.

Flora: No significant flora species are currently known to be associated with this habitat.

Cultural Perspectives: The cultural usage of sporobolus grasslands is unknown.

8.15.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. The long-term distribution of saline grassland will be determined largely by tidal regime, trends in sea level and climatic factors such as rainfall. Documentation of all animals observed (including invasive/ exotic species) should be undertaken with photographs and possible collections (preserved in freezer) where possible for future formal identification by authorities or agencies. Particular attention should be paid to identification of the presence of the false water mouse although there is currently no record of the species on the island. Documentation of the traditional usage of this habitat should be an ongoing component of the ranger program.

Photograph 43. Sporobolus dominant grassland being consumed by dune sand. West coast of Badu Island.

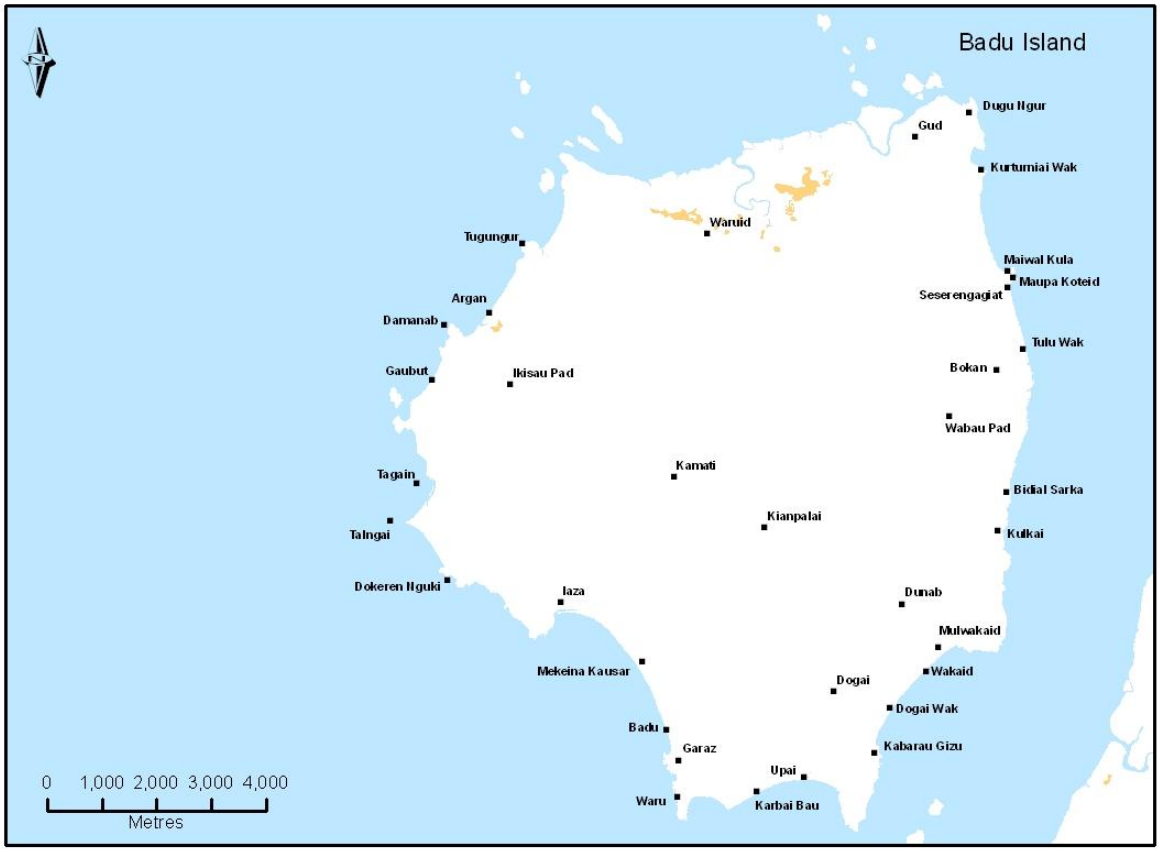


Figure 16. Location of samphire grassland habitats (place names after Lawrie, 1970).

8.15.4 Summary of Recommended Management Actions

A summary of recommended management actions is provided in **Table 25**.

Table 25. Summary of recommended management actions for saline grassland habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition within this habitat is poorly documented although the assemblage is likely to be relatively simple.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitat's fauna assemblage and utilisation.	High

Management Category	Context/Issue	Actions	Priority
		Targeted survey for false water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between mangroves and grasslands. Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	
Plant Surveys	Flora composition is well documented and comprises a simple suite of species.	No action required.	No action Required.
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. Documentation of traditional land management practices, particularly in relation to fire management practice should be undertaken through collaboration with knowledgeable members of the local community.	Moderate
Fire Management	No fire management is required within this habitat as it is regulated by salinity and occasional tidal inundation.	This habitat generally does not require fire for maintenance and hence no structured fire management planning is required.	No action required
Threatened Species Management	No threatened flora species are known to occur within this habitat. The grassland however provides habitat and foraging ground for a range of threatened fauna species.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including black - necked stork and radjah shelduck. Targeted survey for false water mouse should be considered priority and inform management requirements.	Moderate High
Invasive Species Management	Flora: This habitat is not susceptible to weed invasion due to the salinity of the soils. Fauna: The degree to which feral species are utilizing this habitat requires further investigation.	Flora: No active weed control or management is currently required. Fauna: Survey of habitat usage by exotic species including cats, feral dogs and pigs should be an ongoing component of the ranger program utilising sand pads and tracking. Indications of population expansions, particularly feral cats and dogs will require a structured eradication program.	Moderate Immediate
Monitoring	No monitoring is currently required within this habitat.	No action required.	No action required.

8.16 Samphire Herblands and Shrublands and Salt Pans

8.16.1 Status of Ecological Knowledge

The habitat is a response to hyper-saline conditions, a result of repetitive tidal wetting and subsequent surface water evaporation. The major occurrences are found on the landward fringes on mangrove forests on the islands north-west coast. No systematic floristic survey of this habitat has been undertaken.

8.16.2 Ecological / Cultural Considerations

Habitat Condition and Threats: The habitat is universally free from exotic species. This is a dynamic community, the composition of which will undoubtedly respond to cyclical variations in climate and tidal incursion.

Fauna: Samphire grassland provides habitat for a range of significant fauna species including black-necked stork (*Ephippiorhynchus asiaticus),* radjah shelduck (*Tadorna radjah*) and possibly false water mouse (*Xeromys myoides)*.

Flora: No significant flora species are known to be associated with this habitat.

Cultural Perspectives: Traditional usage is unknown.

8.16.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. The long term distribution and floristic composition of this habitat will be determined largely by tidal regime, trends in sea level and climatic factors such as rainfall.

Photograph 44. Well developed saline grassland, forbland and saltpan complex on the margins of mangroves near Waruid (north-west coast).

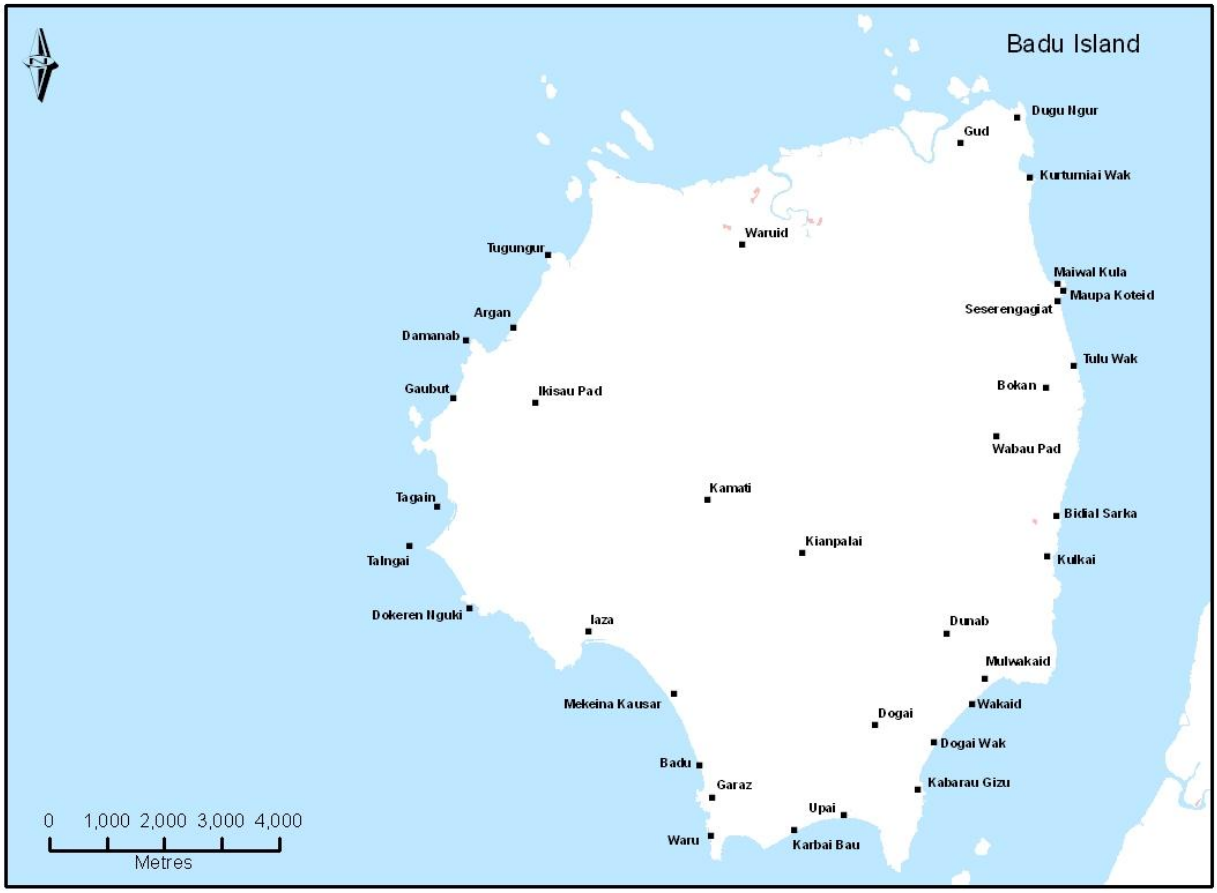


Figure 17. Distribution of Samphire Herblands and Shrublands (place names after Lawrie, 1970)

8.16.4 Summary of Recommended Management Actions

The habitat has limited extent on Badu Island and no active management is required. Actions identified in **Table 26** should be considered during the course of the rangers duties.

Table 26. Summary of recommended management actions for samphire herblands and shrublands.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within this habitat is poorly documented.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitat's fauna assemblage and utilisation. Targeted survey for false water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between wetland areas and other habitats (mangroves, samphire grasslands etc). Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	Moderate
Plant Surveys	Flora composition is relatively well documented and simple both in composition and structure.	Flora field surveys should focus on the collection and identification of important cultural resources.	Moderate

Management Category	Context/Issue	Actions	Priority
		species.	
Traditional Ecological Knowledge	The extent of TEK within this habitat is not known or documented. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey ongoing basis. Documentation of any traditional habitat utilisation is a fundamental information requirement.	Moderate
Fire Management	This habitat will not generally carry fire and there is no requirement for active fire management or monitoring.	No action required.	No Action
Threatened Species Management	No threatened flora species are known to occur within this habitat. The wetland habitats however provide habitat and foraging ground for a range of threatened fauna species.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above. Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including black- necked stork, radjah shelduck and estuarine crocodile. Targeted survey for false water mouse should be undertaken in conjunction with broader surveys within suitable habitats.	Moderate Moderate
Invasive Species Management	Flora: There are no existing weed issues identified within this habitat and weed incursions are likely to be regulated by saline incursion which limits the potential for aggressive weed invasion. Fauna: The extent to which exotic fauna species utilise this habitat is unknown.	Flora: No active weed control or management required at present. Fauna: A survey of habitat usage by exotic species should be an ongoing component of the ranger program with informal sightings of feral species recorded for future reference.	Moderate Moderate
Monitoring	No monitoring is required in this habitat.	No monitoring is required in this habitat.	No Action

8.17 Mangrove Forest, Woodland and Shrubland Complexes

8.17.1 Status of Ecological Knowledge

Broad areas of mangrove closed forest and shrub land are found on broad embayments in the islands south-east and north-west coast, with scattered occurrences associated with tidal inlets and watercourses along the islands entire coastline. The habitat has been largely unsurveyed floristically.

Photograph 45. An extensive complex of mangrove forests located in the islands north-west.

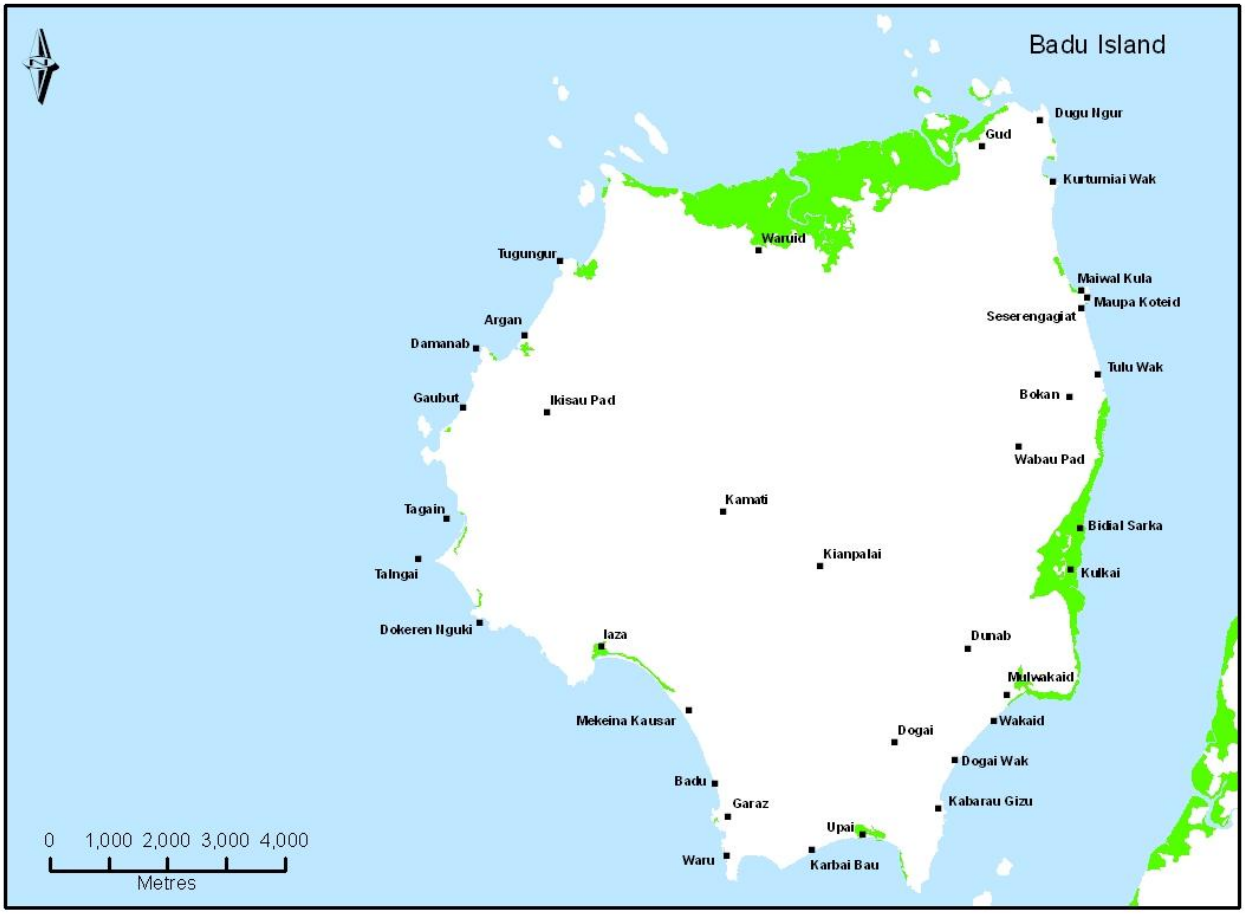


Figure 18. Distribution of Mangrove Habitats (place names after Lawrie, 1970).

8.17.2 Ecological / Cultural Considerations

Habitat Condition and threats: The habitat exhibits high integrity. Sea level rise will ultimately lead to expansion of mangrove habitats and changes to both structure and floristic composition of existing mangrove stands.

Flora: No significant species are known from mangrove habitat although the Near-Threatened *Dolichandrone spathacea* is likely to occur.

Fauna: No comprehensive survey of the fauna assemblage has been undertaken although it is known to be important habitat for estuarine crocodile and possible habitat/ foraging ground for the false water mouse.

Cultural Perspectives: Provides a cultural resource for traditional fishing and hunting. The degree and nature of resource utilisation for timber is unknown although as on other Torres Strait Islands, it is likely to provide an essential natural resource.

8.17.3 Management Implications

This is a self-regulating habitat that requires minimal input in terms of active management. Extensive recommendations for management and monitoring of mangrove ecosystems are identified by Burrows (2010). Mangroves have not been subject to any detailed floristic survey.

8.17.4 Summary of Recommended Management Actions

Actions identified in **Table 27** should be considered during the course of the rangers duties.

Table 27. Summary of recommended management actions for mangrove habitats.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within this habitat is poorly documented.	Ongoing collection and documentation of observed wildlife is critical to providing greater insight into the habitats fauna assemblage and utilisation. Targeted survey for false water mouse should be considered a priority action. This can be completed using Elliott Traps (A or B) baited with sardines placed on the interface between mangrove areas and other habitats (estuarine wetlands, samphire grasslands etc). Focus on ethnotaxonomy should be maintained throughout the process to feed into TEK.	High
Plant Surveys	Floristic composition has not been comprehensively assessed	Floristic survey should focus on the collection and identification of important cultural resource species and traditional nomenclature.	Moderate
Traditional Ecological Knowledge	Composition of TEK within this habitat is poorly known. Plant and animal lists provided in the appendices provide a good foundation for increasing TEK and ethnotaxonomy.	Collect and collate TEK knowledge within this habitat gained through fauna and flora survey actions on an ongoing basis. Documentation of traditional habitat utilisation is a fundamental information requirement.	Moderate
Fire Management	This habitat will not generally carry fire and there is no requirement for active fire management or monitoring.	No action required.	No action required
Threatened Species Management	The habitat has potential to host the 'Near-Threatened' species *Dolichandrone spathacea* on the habitat margins.	Flora: No management actions required. Carry out ongoing surveys as identified in flora and actions above.	Moderate

Management Category	Context/Issue	Actions	Priority
		Fauna: Further baseline information is required (see fauna surveys) before discrete management actions can be defined. Particular attention should be paid to recording site locations of threatened species including black- necked stork, emerald monitor and estuarine crocodile. Targeted survey for false water mouse should be considered priority and inform management requirements.	High
Invasive Species Management	Flora: There are no existing weed issues identified within this habitat and weed incursions are likely to be regulated by saline incursion which limits the potential for aggressive weed invasion. Fauna: The extent to which invasive species utilize this habitat is unknown	Flora: No active weed control or management required at present. Fauna: Incidental observations relating to usage of this habitat by exotic species should be an ongoing component of the ranger field program.	Moderate Moderate
Monitoring	Changes to mangrove condition and structure may occur due to the effects of ongoing sea level rise.	Extensive recommendations for management and monitoring of mangrove ecosystems within the Mangrove Watch program are identified by Duke (2010).	Moderate

8.18 Cleared Areas and Regrowth

8.18.1 Status of Ecological Knowledge

Cleared areas refer to areas of anthropogenic (human) disturbance, generally relating to development of the township and associated infrastructure. Management of these areas is under control of the local Council although the spread of exotic species from these areas poses a particular threat to the integrity of natural habitats across the island.

Observations from around the Badu Settlement, coupled with records made by AQIS officers indicate a number of potentially invasive weeds which include hyptis (*Hyptis suaveolens)*, belly-ache bush (*Jatropha gossypiifolia* - Class 2 under the LPA), snakeweed (*Stachytarpheta jamaicensis*) praxelis (*Praxelis clematidea*) and extensive areas of Singapore daisy (*Sphagneticola trilobata* – Class 3 under the LPA & WONS). Lantana *(Lantana camara* – Class 2 under the LPA and WONS*)* and porcupine flower (*Barleria prionitis*), considering their presence on other Torres Strait Islands are also considered potential threats to the islands habitats although they are not presently known to occur on the island.

Areas utilised for habitation and infrastructure purposes are sites for a number of processes with significant potential to degrade natural ecosystems. Of these processes, the proliferation of exotic

weed species presents by far the most serious threat to the integrity of natural habitats across the island. Whilst detailed weed management strategies are beyond the scope of this exercise, absolute priority should be given to ensure that weeds are contained within the township area and do not spread to natural habitats. A focused effort to eliminate these weeds from settlement areas should however be a preferred management option. Dispersal mechanisms into natural habitats will include natural means such as water, wind and birds as well as by human vectors including vehicles and machinery. The spread of other weeds onto the islands can be minimised by washdown of all vehicle and machinery arriving on the island. It is also very important for any plant and equipment working on Badu to be thoroughly cleaned before moving to other Torres Strait Islands.

8.18.2 Summary of Recommended Management Actions

The following actions should be considered during the course of the rangers duties. It should be noted that comprehensive weed and feral pest control in the council area is likely to be outside the scope of general ranger duties.

Table 28. Summary of recommended management actions for disturbed areas.

Management Category	Context/Issue	Actions	Priority
Fauna Surveys	The fauna composition and utilisation within cleared habitats has not been documented although these areas have concentrated populations of domestic dogs and, to a lesser extent, cats.	Maintain communications with council animal control and AQUIS officers in regard to the spread of domesticated animal into broader environs.	Moderate
Plant Surveys	The introduction of problematic pest species is most likely to occur in the vicinity of the island settlement.	No formal surveys required other than recording occurrences of problematic pest species.	High
Traditional Ecological Knowledge	No issues identified.	No Action Required	No Action
Fire Management	Fire exclusion area.	Maintain prescribed burning programs in flammable vegetation habitats on the islands fringe.	Immediate
Threatened Species Management	The extent to which threatened fauna species utilise disturbed land is unknown. Disturbed areas are generally unviable habitats for threatened flora species.	Fauna: Documentation of native fauna species utilizing cleared habitats may provide information on the degree to which disturbed areas are utilised by threatened species.	Moderate
Invasive Species Management	Cleared and disturbed areas are likely to be the focal point for introduction of exotic flora and fauna species.	Monitor disturbed areas for any suspected new arrivals of exotic plant and animal species and liaise with AQIS in regard to potential introductions. Liaise with council in regard to priorities for weed control and clean up.	High
Monitoring	No issues are identified other than those identified in regard to exotic species invasion.	Restricted largely to informal monitoring of exotic species infestation.	High.

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10.0 Glossary

Alluvium/ Alluvial: Sediments deposited by the action of flowing water, generally derived from the action of rivers or from wash of hillslopes.

Bioregion: The bioregion is forms the primary level of classification for terrestrial biodiversity values on a state and nationwide basis. Thirteen bioregions are classified in Queensland with the Torres Strait Islands being a sub-province of the broader Cape York Peninsula bioregion.

Broad Vegetation Group: The highest level of classification used to describe plant assemblages in the Torres Strait Islands, typically referring to plant habit and structure.

Deciduous: A tree species that undergoes a seasonal shedding of leaves, typically being leafless in the drier seasonal periods (e.g. Bombax ceiba).

Edaphic: Pertaining to characteristics of the soil including moisture, drainage and fertility.

Evergreen: A tree or vegetation community that retains foliage on an annual basis i.e. always has leaves.

Holocene: The period of time less than 11 thousand years to present. Less than 5 thousand years old is considered to be 'Late Holocene'.

Igneous Rock: A rock formed by cooling and solidification of molten magma or lava.

Notophyll: A category of leaf size with a leaf blade for 7.5 to 12.5 cm long.

Obligate Seeder: A plant that can only regenerate after fire from a seed or stored seed bank.

Palustrine: A wetland that is vegetated, often comprising a range of specialist and non-specialist plant species.

Pleistocene: The period of time between 11 thousand and 1.8 million years old.

Pyrophytic: In relation to vegetation, refers to a habitat which benefits or regenerates following a fire event.

Pyrophobic: In relation to vegetation, a vegetation type which is fire intolerant, or is killed or damaged by a fire event.

Quaternary: The period of time between present and 1.8 million years old, which is sub-divided into Pleistocene and Holocene ages.

Regional Ecosystem: The primary unit against which Queensland's Vegetation Management Act (1999) is regulated and as such, the classification specific legislative significance. The classification of regional ecosystems is based on a hierarchical system with a three part code defining bioregion, followed by land zone, and then vegetation.

Savanna: A habitat typified by grasses where trees do not form a closed canopy.

Semi-evergreen: A tree or forest type whose pattern of leaf loss can be related to specific periods of environmental stress. In semi-evergreen vine forest, only portions of the canopy will be subject to leaf loss at a particular time.

Semi-deciduous: A rainforest or vine thicket type in which a component of the forest canopy trees and canopy emergents are seasonally (obligate) deciduous.

Vine Thicket: A vegetation community that is formed by predominantly soft leaf (rainforest) trees and shrubs, typically with dense layers of wiry lianes (vines) growing from ground level and reaching canopy height. Thicket is in reference to canopy height with the predominant canopy forming at < 9m.

Vine Forest: A vegetation community commonly referred to as rainforest, that is formed by predominantly soft leaf (rainforest) trees and shrubs. Dense cover of lianes (vines) and epiphytes are common at all structural levels. Vine forest is differentiated from vine thicket by height, with predominant vine forest canopy being > 9m.

Appendices

Appendix A. Expert Panel Attendees

Expert	Organisation	Expertise	Inputs
David Stanton	3D Environmental	Vegetation and landscape mapping and assessment.	• Specialist knowledge of Torres Strait vegetation community distribution, condition and landscape (geology, geomorphology).
David Fell	3D Environmental	Flora survey, species identification, species distribution, and significant flora.	• Specialist knowledge of Torres Strait and Cape York Peninsula flora and habitats.
David Gooding	3D Environmental	GIS analyst	• Development and management of Torres Strait GIS.
Peter Stanton	Consultant	Landscape scale ecological and fire management.	• Specialist regional knowledge of Cape York ecology • Practical implementation of ecological management practices i.e. fire, weeds, vegetation change
Dr Jeremy Russell-Smith	Consultant - North Australian Indigenous Land & Sea Management Alliance (NAILSMA)	Sustainable ecological and cultural resource management.	• PNG and regional northern Australian context • Advice on integrated fire and cultural resource management • Emissions abatement in tropical savanna fire regimes.
Dr Garrick Hitchcock	Arafura Consulting	Environmental anthropology and cultural resource use and management Torres Strait and PNG	• Cultural landscape context • integration of cultural resource values • Cultural use of fauna, flora and habitats.
Terry Reis	Biodiversity Assessment and Management	Fauna ecology	• Identification and review of fauna values • Fauna survey methods • Management of habitat for fauna values.
Dr Paul Forster	DERM - Qld Herbarium	Taxonomy and distribution of Qld flora	• Threatened flora distribution • Conservation and listing context.
Keith Macdonald	DERM Threatened Species Unit	Fauna and flora ecology and distribution	• Back on Track methodology. • Threatened fauna and flora distribution • Conservation and listing context.
Tony O'Keeffe Michael Bradby	TSRA LMSU	Land and Sea Program and Ranger Project	• Project background, management and liaison. • Protocols and process.

Appendix B. Queensland Govt. vegetation structural classification

Structural formation classes qualified by height for Non-Rainforest Vegetation: Neldner *et al.* 2005) modified from Specht (1970).

Projective Foliage Cover	**70-100%**	**30-70%**	**10-30%**	**<10%**
Approximate Crown Cover %	**80 - 100%**	**50 - 80%**	**20 - 50%**	**< 20%**
Crown separation	**closed or dense**	**mid-dense**	**sparse**	**very sparse**
Growth Form[10]	**Structural Formation Classes (qualified by height)**			
Trees > 30m	tall closed-forest (TCF)	tall open-forest (TCF)	tall woodland (TW)	tall open-woodland (TOW)
Trees 10 – 30m	closed-forest (CF)	open-forest (OF)	woodland (W)	open-woodland (OW)
Trees < 10m	low closed-forest (LCF)	low open-forest (LOF)	low woodland (LW)	low open-woodland (LOW)
Shrubs 2 - 8m	closed-scrub (CSC)	open-scrub (OSC)	tall shrubland (TS)	tall open-shrubland (TOS)
Shrubs 1 - 2m	closed-heath (CHT)	open-heath (OHT)	shrubland (S)	open-shrubland (OS)
Shrubs <1m	-	dwarf open-heath (DOHT)	dwarf shrubland (DS)	dwarf open-shrubland (DOS)
Succulent shrub	-	-	succulent shrubland (SS)	dwarf succulent shrubland (DSS)
Hummock grasses	-	-	hummock grassland (HG)	open hummock grassland (OHG)
Tussock grasses	closed-tussock grassland (CTG)	tussock grassland (TG)	open tussock grassland (OTG)	sparse-tussock grassland (STG)
Herbs	closed-herbland (CH)	Herbland (H)	open-herbland (OH)	sparse-herbland (SH)
Forbs	closed-forbland (CFB)	Forbland (FB)	open-forbland (OFB)	sparse-forbland (SFB)
Sedges	closed-sedgeland (CV)	Sedgeland (V)	open-sedgeland (OV I)	-

[10] Growth form of the predominant layer (the ecologically dominant layer).

Appendix C. Preliminary List of Useful Wild Plants for Badu Island

- denotes introduced species
- language names derived from Mabuiag.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
bussamargh	Cycad	*Cycas badensis*	Shrub	Food	Seeds or pith once used for food after processing.	Grasslands, Vine thickets, Welchiodendron forests, eucalypt open forests and woodlands, & shrublands.
mumu	Finger Cherry	*Rhodomyrtus macrocarpa*	Shrub	Food	Edible fruit	Vine forest & thickets
abau	Noni Plum Rotten Cheesefruit	*Morinda citrifolia*	Shrub	Medicinal	Edible fruit	Vine forest & thickets, Paperbark open forests, community areas.
meke	Sea Almond	*Terminalia catappa*	Tree	Food	Outer skin of fruit eaten when ripe. Inner nut eaten when dry.	Community areas.
mipa	No Common Name	*Terminalia subacroptera*	Shrub or small tree	Food	Fleshy skin of small purplish-black fruit eaten when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
bomer	Corkscrew Palm	*Pandanus spirilis*	Palm	Food Material	Kernel of individual fruit segments hammered out when dry and eaten. Leaves used for baskets etc.	Pandanus grasslands.
yarakakur	Peanut Tree	*Sterculia quadrifida*	Tall shrub to tree	Food	Nut flavoured seeds within a woody follicle are eaten	Vine forests & thickets.
weiba	Nonda Plum	*Parinari nonda*	Tree	Food	Outer flesh of fruit is eaten when fully ripe.	Open forests & woodlands.
kuper	White Apple	*Syzygium forte* subsp. *forte*	Tree	Food	Fleshy white fruit are eaten when ripe.	Vine forests.
kaway	Red Bush Apple or Lady Apple	*Syzygium suborbiculare*	Tree	Food	Fleshy red fruit eaten when ripe. A good shade tree.	Open forests & woodlands.
ubar	Wongai	*Manilkara kauki*	Tree	Food Material	Fruit are eaten. Strong timber favoured for carving. Seeds used for necklaces.	Vine forests & thickets.
duduam	Water Lily	*Nymphaea* sp.	Aquatic	Food	Ovaries of flower eaten.	Wetlands
mergey	Black Currant Bush	*Antidesma parviflora*	Shrub	Food	Small purplish-black fruit eaten (stains hands and mouth)	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
uzu	Lockerbie Satin Ash	*Syzygium branderhorstii*	Shrub/Tree	Food	Fruit eaten. This plant grows in the wild on Mua, Erub and Dauan however is planted in domestic gardens.	Town
biiu	Mangrove	*Rhizophora apiculata or stylosa*	Tree	Food	Pod was eaten after processing (no longer consumed).	Mangroves
urgi	Yellow Plum	*Ximenia americana*	Shrub	Food	Fruit with yellowish flesh is eaten.	Edge of Mangroves
kuman	Native Grape	*Ampelocissus acetosa*	Vine	Food	Small black grape like fruits are eaten when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
dua	Tar Tree or Marking Nut Tree	*Semecarpus australiensis*	Tree	Food	Part of fruit is eaten. Part of fruit together with leaves and sap are highly toxic causing inflammation.	Vine forest & disturbed areas.
woeywi	Mango	*Mangifera indica**	Tree	Food	Fruit eaten.	Disturbed areas.
thuul	Hickory Wattle	*Acacia polystachya*	Tree	Material	Timber favoured for the making of dugong spears (whaps), building timber and firewood.	Welchiodendron forests, woodlands & shrublands.
TBD	Sandpaper Fig	*Ficus opposita*	Shrub	Food Material	Small fruit ripen black and are edible. Leaves rough and sandpapery.	Welchiodendron forests, woodlands & shrublands.
TBD	Ground Lily	*Crinum uniflorum*	Tuber	Food	The tuber is dug and is scraped tin preparation of a paste. Used like gasi.	
TBD	Dodder Laurel Devils twine	*Cassytha filiformis*	Vine	Food	Small fruit eaten as a snack when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands.
TBD	Wild Passionfruit	*Passiflora foetida**	Vine	Food	Small fruit eaten as a snack when ripe.	Welchiodendron forests, woodlands & shrublands, grasslands, Paperbark open forests, vine thickets, shrublands.
TBD	White Currant	*Flueggia virosa* subsp. *melathesoides*	Shrub	Food	Small white fruit eaten as a snack when ripe.	Vine forest & thickets, Welchiodendron forests, woodlands & shrublands, grasslands.
TBD	Cedar Bay Cherry	*Eugenia reinwardtiana*	Shrub	Food	Small black fruit eaten as a snack when ripe.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Gidee Gidee	*Abrus precatorius*	Vine	Material	Black and red seeds used for decorative purposes i.e. necklaces and bracelets.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Little Gooseberry Tree	*Buchanania arborescens*	Tree	Food	Small black fruits eaten as a snack when ripe.	Vine forests & thickets.
TBD	Coral Tree	*Erythrina variegata*	Tree	Material	Glossy red seeds used for decorative purposes i.e. necklaces and bracelets.	Vine forests and thickets.
TBD	Coral Tree	*Erythrina insularis*	Tree	Material	Glossy red seeds used for decorative purposes i.e. necklaces and bracelets.	Vine forests and thickets.
TBD	Matchbox Bean	*Entada phaselioides*	Vine	Material	Large flat glossy brown seeds used for dancing decorations and instruments in music.	Vine forests & thickets, mangroves edges.
TBD	Cottonwood Hibiscus	*Hibiscus tiliaceus*	Tree	Material	Fibrous bark used for fibre in tying and making of bags etc.	Coastal grasslands & mangrove edges.
TBD	Whip Vine	*Flagellaria indica*	Vine	Material	Cane like stems used for tying, binding and carrying fish.	Welchiodendron forests, woodlands & shrublands, vine forests & thickets, paperbark open forests.
TBD	Sisal hemp	*Agave vivipara* var. *vivipara**	Succulent shrub	Material	Leaves dried and processed for fibre used for decorative skirts.	Disturbed areas.

Language Name Kala Lagau Ya	Common Name	Scientific Name	Life Form	Broad Use	Part Used	Broad Habitat
TBD	No common name	*Sesuvium portulacastrum*	Succulent herb	Feed (fattening pigs)	Fleshy leaves used for feeding pigs and for kup mauri.	Coastal grasslands.
TBD	Cashew	*Anacardium occidentale**	Shrub	Food	Fruit eaten.	Disturbed areas.
TBD	No common name	*Tabernaemontana orientalis*	Shrub	Material (making shanghais)	Forks of small branches favoured for shanghai (slingshot) construction.	Vine forests & thickets.
TBD	Sea Trumpet	*Cordia subcordata*	Shrub/Tree	Material	Timber	Vine thickets (dunes), Coastal grasslands, edge of mangroves.
TBD	Ringworm shrub	*Senna alata**	Shrub	Medicinal	Decoction from leaves used for treatment of ringworms.	Disturbed areas.
TBD	Yam	*Dioscorea esculenta*	Vine	Food	Tuber used for food.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Yam	*Dioscorea transversa*	Vine	Food	Tuber used for food.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Cassava	*Manilhot esculenta**	Shrub	Food	Tuber used for food.	Disturbed areas.
TBD	Sea Cabbage	*Scaevola taccada*	Shrub	Spiritual	Leaves broken off plant causes wind to blow strongly.	Coastal grasslands (seashore).
TBD	Broad leaved Ballart	*Exocarpos latifolius*	Shrub	Food	Small fruit sometimes eaten when ripe.	Welchiodendron forests, woodlands & shrublands, vine thickets.
TBD	Pemphis	*Pemphis acidula*	Shrub	Material	Timber used for firewood.	Mangrove margins.
TBD	Bamboo	*Bambusa vulgaris**	Bamboo	Material	Stems used for construction and various purposes.	
TBD	Tridax	*Tridax procumbens**	Annual herb	Medicinal	Decoction of leaves used for treating cuts and sores.	Disturbed areas.
TBD	Pacific Rosewood	*Thespesia populneoides*	Shrub/Tree	Material	Round fruit used for toys.	Mangrove margins.
TBD	Pacific Rosewood	*Thespesia populnea*	Shrub/Tree	Material	Round fruit used for toys.	Mangrove margins.
TBD	Macarnaga	*Macaranga tanarius*	Shrub/Tree	Material	Leaves used for kup mauri. Sticky exude from broken stems/branches used for glue (info from Iama).	Welchiodendron forests, woodlands & shrublands, vine thickets.

Appendix D. Preliminary Flora Species List – Badu Island, Torres Strait, Queensland.

D.G. Fell & D.J. Stanton 3D Environmental_27 April 2011 Version 3

Nomenclature follows Bostock & Holland (2010) 'Census of the Queensland Flora'.
* Denotes naturalised or doubtfully naturalised taxa according to Bostock & Holland (2010).
Unnamed taxa are followed by a collection number (i.e. DGF10153) pending formal identification at Qld Herbarium.

BROAD VEGETATION GROUPS (BVG) (from Stanton, Fell & Gooding 2009)

1	Evergreen/Semi-evergreen vine forest and thicket
2	Deciduous/Semi-deciduous vine forest and thicket
3	Swamp and riparian forests and forest complexes
4	Closed forest, open forest and woodland dominated by *Welchiodendron longivalve*
5	Eucalyptus and Corymbia dominant open forests and woodlands
6	Acacia dominant open forests and woodlands
7	Open forest dominated by Paperbark (*Melaleuca*)
8	Woodland and open forest dominanted by Swamp Box (*Lophostemon*)
9	Open forests dominated by Asteromyrtus and or Neofabricia
10	Woodland and open forest dominated by Casuarina
11	Woodland and shrubland dominated by Pandanus
13	Woodland and shrubland dominated by Paperbark (*Melaleuca*)
14	Shrublands and shrubland complexes
16	Coastal dune complexes
17	Grasslands and grassland complexes
18	Rock pavement and pavement complexes
20	Wetland complexes and mosaics
24	Mangrove
26	Samphire grasslands
B	Bamboo groves
Cl	Cleared and heavily disturbed regrowth

SUMMARY
592 species (18 ferns, 1 pine, 1 cycad, 572 angiosperms)
560 native (94.5%)
32 naturalised (5.5%)
130 families
390 genera

Major families (native)
Poaceae 55 (10%)
Myrtaceae 35 (6%)
Cyperaceae 34 (6%)
Fabaceae 28 (5%)
Rubiaceae 25 (4%)
Apocynaceae 20 (4%)
Phyllanthaceae 15 (3%)
Lamiaceae 12 (2%)
Lauraceae 10 (2%)
Euphorbiaceae 9 (2%)
Mimosaceae 9 (2%)
Sapindaceae 9 (2%)

PRELIMINARY FLORA SPECIES LIST – BADU ISLAND, TORRES STRAIT, QUEENSLAND[11]

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
Ferns & Fern Allies (Pteridophytes)																					
Adiantaceae	*Adiantum philippense*	1			1																
Blechnaceae	*Blechnum indicum*			3				1													
	Stenochlaena palustris			1																	
Davalliaceae	*Davallia pyxidata*				2									1		1					
Dryopteridaceae	*Tectaria brachiata*				1																
Lindsaeaceae	*Lindsaeae ensifolia subsp. ensifolia*			4																	
Gleicheniaceae	*Dicranopteris linearis var. linearis*							1													
Parkeriaceae	*Ceratopteris thalictroides*					1															
Pteridaceae	*Acrostichum aureum*											1							1		
Polypodiaceae	*Drynaria quercifolia*	1	4		7	1							2	1		3					
	Microsorum punctatum				1																
	Pyrrosia lanceolata	1			1																
	Pyrrosia longifolia	1	1		3											1					
	Pyrrosia sp. (DGF9647)		1			1															
Schizaeaceae	*Lygodium microphyllum*			2	1	4		2													
	Schizaea dichotoma			1		1															
	Schizaea dichotoma					1		1													
Vittariaceae	*Vittaria sp. (DGF9639)*				1																
Gymnosperms (Pines)																					
Podocarpaceae	*Podocarpus grayae*			2																	
Cycads																					
Cycadaceae	*Cycas badensis (Vuln.)*			1	3	13							1			1					

[11] Species list valid up to April 2011.

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
Flowering Plants (Angiosperms)																					
Acanthaceae	*Acanthus ilicifolius*																	1			
	Brunoniella australis					1															
	Pseuderanthemum variable	1			4								1								
	Staurogyne leptocaulis subsp. decumbens					1															
Agavaceae	*Cordyline cannifolia*				1																
Amaranthaceae	*Achyranthes aspera*		1											1	1						
	*Alternanthera brasiliana cv. Rubiginosa**																				1
	*Alternanthera brasiliana **																				1
	*Alternanthera ficoidea **																				1
	*Amaranthus blitum **																				1
	*Celosia argentea **																				1
	Gomphrena flaccida			1																	
	Ptilotus distans subsp. capensis		1			1								2							
Amaryllidaceae	*Crinum angustifolium*			1																	
	Proiphys amboinensis				1																
Anacardiaceae	*Anacardium occidentale**																				1
	Buchanania arborescens	1	1	4	3																
	*Magnifera indica**			1																	1
Annonaceae	*Desmos wardianus*				2																
	Haplostichanthus fruticosus	1		3	3																
	Melodorum scabridulum															1					
	Miliusa traceyi				2								1			1					
	Polyalthia nitidissima				3		1														
	Uvaria rufa		1		7								1			1					
Apocynaceae	*Alstonia actinophylla*		1		4	1										1					
	Alyxia spicata		4	3	7	5	2						3			2					
	Brachystelma glabriflorum					1															
	Dischidia major	1		1		3						1				1					
	Dischidia nummularia	1		3	2	3		1				2									
	Dischidia ovata	1		1	2																

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Gunnesia pepo				2																
	Gymnosperma oblonga							1													
	Hoya australis subsp. sanae		1		3	1							2	1		3					
	Ichnocarpus frutescens				3								1			1					
	Parsonsia sp. (DGF9655)				2																
	Parsonsia velutina				1								1								
	Sarcostemma viminale subsp. brunonianus		1		2	1							2	1		3					
	Secamone elliptica				3	1										2					
	Tabernaemontana orientalis	1		1	7	1							2			1					
	Tabernaemontana pubescens				1																
	Voacanga grandiflora (DGF9656)				5	1															
	Wrightia pubescens subsp. penicellata (DGF10229)												1			1					
	Wrightia versicolor				5								1								
	Apocynaceae (DGF9690)						1														
Aquifoliaceae	*Ilex arnhemensis subsp. ferdinandi*			2																	
Araceae	*Colocasia esculenta**							1													
Araliaceae	*Polyscias australiana*			6	1																
	Polyscias elegans				6	1							2								
	Schefflera actinophylla				1																
Arecaceae	*Cocos nucifera**			1											1						
	Hydriastele wendlandiana			3																	
	Licuala ramsayi var. tuckeri			1																	
	Livistona benthamii			3		1															
	Livistona muelleri			1		3		1													
	Ptychosperma elegans	1																			
Aristolochiaceae	*Aristolochia sp. (DGF9651)*				1																
Asteraceae	*Acanthospermum hispidum **																				1
	*Ageratum conyzioides**					1															
	Asteraceae (DGF9675)			1																	
	*Bidens sp.**		2											1							

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Blumea saxatilis					1															
	Centipedia minima var. minima																				1
	Cyanthilleum cinereum			1		5		1								1			1		
	Epaltes australis							1													
	Glossocardia bidens			1		3															
	*Praxelis clematidea **																				4
	Pterocaulon sp. (DGF10201)							1											1		
	Sphagneticola trilobata (Class 3)*					1															2
	*Synedrella nodiflora**					1															
	*Tridax procumbens**												1	1							
Avicenniaceae	*Avicennia marina subsp. eucalyptifolia*																	1			
Bignoniaceae	*Deplanchea tetraphylla*			7		2	1	1				1	1				1				
Bombacaceae	*Bombax ceiba var. leiocarpum*				1								1								
Boraginaceae	*Carmona retusa (Vuln.)*												1			1					
	Pandorea pandorana				3											1					
Burmanniaceae	*Burmannia juncea*					2															
Burseraceae	*Canarium australianum*		2		7	1							3			1					
Byttneriaceae	*Waltheria indica*					1															
Caesalpiniaceae	*Caesalpinea erythrocarpa*				1																
	*Cassia fistula **																				1
Campanulaceae	*Lobelia sp. (DGF9681)*					1															
	Wahlenbergia caryopylloides		1	2		3		1				1	1								
Capparaceae	*Capparis canescens*					5									1						
	Capparis lucida		1		1																
	Capparis quiniflora		5		1									1		1					
Caryophyllaceae	*Polycarpaea corymbosa var. torrensis*		1			1								1							
Casuarinaceae	*Casuarina equisetifolia subsp. incana*										1			1							
Celastraceae	*Elaeodendron melanocarpum*		1																		
	Euonymus australiana	1																			
	Gymnosporia inermis		1																		
	Pleurostylia opposita		2		2								1	1							

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Salacia chinensis	1																			
	Salacia disepala				1								1								
Chrysobalancaceae	*Maranthes corymbosa*	1		4																	
	Parinari nonda			1		20	1						3								
Cleomaceae	*Cleome viscosa*					1									1						
	Cleome tetrandra var. pentata					1															
Clusiaceae	*Calophyllum sil*	1		3																	
	Garcinia warrenii			2																	
Cochlospermaceae	*Cocholospermum gillivraei*				2	7							3	1		7					
Combretaceae	*Lumnitzera littorea*																	1			
	Lumnitzera racemosa																	1			
	*Quisqualis indica **																				1
	Terminalia catappa		1																		
	Terminalia muelleri				1		1								1						
	Terminalia subacroptera		3		4		1						4	1		3					
Commelinaceae	*Aneilema siliculosum*					3															
	Cartonema baileyi					1															
	Commelina diffusa					1															
	Commelina ensifolia					1		1						1							
	Murdania graminea			1		1															
Convolvulaceae	*Evolvulus alsinoides var. decumbens*		1			1							1								
	Ipomoea mauritiana			1																	
	Ipomoea nil															1					
	Ipomoea pes capre subsp. brasiliensis		1					2						1	1				1		
	Merremia quinata			1																	
	Xenostegia tridentata				2			1													
Costaceae	*Costus potierae (Endangered)*					1		1													
Cucurbitaceae	*Muellerargia timorensis*		1																		
Cyperaceae	*Bulbostylis barbarta*		1			1							1	1							
	Cyperaceae (DGF10232)					1															
	Cyperaceae (DGF10233)					1															

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Cyperaceae (DGF9628)														1						
	Cyperaceae (DGF9673)			1								1									
	Cyperus aquatilis			1				1													
	Cyperus difformis			1				1													
	Cyperus haspan subsp. haspan			1																	
	Cyperus pedunculatus			1																	
	Cyperus polystachyos							1					1								
	Cyperus sp. (DGF10194)		1											1					1		
	*Cyperus sphacelatus **																				2
	Cyperus squarrosus							1													
	Eleocharis geniculata																1				
	Fimbristylis cinnamometorum					2															
	Fimbristylis lanceolata					1															
	Fimbristylis recta					1															
	Fimbristylis signata					1															
	Fimbristylis simplex					2															
	Fuirena ciliaris					2															
	Gahnia aspera				3																
	Hypolyptrum nemorum			2																	
	Leptocarpus sp. (DGF9679)			1								1									
	Rhynchospora pterochaeta											1									
	Schoenus calostachyus															2					
	Schoenus sp. (DGF9700)														1						
	Schoenus sparteus			1																	
	Scleria levis															1					
	Scleria lithosperma var. linearis					1															
	Scleria polycarpa			2		1						1									
	Scleria sp. (DGF9625)			1																	
	Scleria sp. (DGF9628)			4																	
	Scleria sp. (DGF9684)			5																	
	Scleria sumatrensis (DGF9702)							1													

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Tricostularia undulata							4													
Dilleniaceae	*Dillenia alata*			8		2		1				1									
Dioscoraceae	*Dioscorea bulbifera*				1																
	Dioscorea sp. (DGF9712)			1																	
	Dioscorea transversa		1		1								1			1					
Dracaenaceae	*Pleomele angustifolia*	1		2	10								1								
Droseraceae	*Drosera burmanni*											1									
	Drosera indica											1	1								
	Drosera lanata											1									
	Drosera spathulata			1									1		1						
Ebenaceae	*Diospyros calycantha*				1																
	Diospyros hebecarpa		1	2	2	1							1								
	Diospyros maritima		2																		
	Diospyros sp. (Bamaga B.P. Hyland 2517) (Vuln.)		2		3								1								
	Diospyros sp. (Kuranda L.J.Webb+ 7265A)	2			2								1								
	Diospyros sp. (Mt White P.I.Forster PIF14415)				6								2								
Elaeocarpaceae	*Elaeocarpus arnhemicus*				1								1								
Ericaceae	*Leucopogon ruscifolius*		1			1						1	6	2							
	Leucopogon yorkensis		2										6	1							
Eriocaulaceae	*Eriocaulon depressum*											2									
	Eriocaulon nanum											1									
	Eriocaulon sp. (DGF9677)			1								1									
Erythroxylaceae	*Erythroxylon sp. (DGF10213)*															1					
Euphorbiaceae	*Chamaesyce hirta **																				1
	Claoxylon tenerifolium				1																
	Croton arnhemicus		1		2											4					
	Euphorbia plumerioides												1								
	Euphorbia sp. (photo 30)					1								1							
	Excoecaria agallocha		1																1		

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	*Jatropha gossypiifolia **																				2
	Macaranga involucrata var. mallotoides			2	1																
	Macaranga tanarius				3	1															
	Mallotus ficifolius				1								1								
	Mallotus philipensis				3								1								
Fabaceae	*Abrus precatorius*				3											2					
	Aphyllodium schindleri					3															
	Canavalia cathartica					1										1					
	Canavalia papuana			1	1																
	Canavalia sp. (DGF9711)			3																	
	Crotalaria calycina			1																	
	*Crotalaria goreensis**																				1
	Dalbergia densa var. australis					1															
	Dalbergia densa var. densa		1										1			3					
	Dendrolobium umbellatum					1															
	Derris trifoliata		1															1			
	Desmodium heterocarpon var. heterocarpon					1															
	Desmodium sp. (DGF10187)				1																
	Erythrina variegata (DGF10200)															1					
	Erythrina vespertilio					1															
	Flemingia parviflora					2															
	Galactica muelleri					1															
	Galactica tenuiflora					1															
	Gompholobium sp. (DGF9709)												1								
	Indigofera hirsuta			1		1															
	Milletia pinnata		2																		
	Mucuna sp. (DGF9666)				1																
	Pycnospora lutescens					2															
	Sophora tomentosa var. australis														1						
	Tephrosia sp. (DGF10193)												1	1							

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Tephrosia sp. (DGF9710)												1								
	Vandasina retusa			1		1								1							
	Vigna vexillata var. angustifolia					1		2													
	Zornia dyctiocarpa var. filifolia					1															
Fagraceae	*Fagraea sp. (DGF10206)*			1																	
Flagellariaceae	*Flagellaria indica*	1	2	5	5			2					1								
Goodeniaceae	*Lechenaultia filiformis*					1															
	Scaevola taccada		1											1	2						
Haemodoraceae	*Haemodorum coccineum*			1		1							1		1						
Haloragaceae	*Gonocarpus acanthocarpus*					1															
	Myriophyllum muricatum							1													
	Myriophyllum sp.							1													
Helicteraceae	*Helicteres semiglabra (DGF9680)*					1										1					
Hemerocallidaceae	*Dianella caerulea var. aquilonia*	1				1															
	Dianella odorata			1		4	2					1	4								
	Dianella pavopennacea var. major				1																
	Tricoryne anceps subsp. pterocaulon					1		1					2								
Hugoniaceae	*Hugonia jenkinsii*			2	1																
Hydrocharitaceae	*Enhalus acoroides*																1				
Lamiaceae	*Callicarpa candicans*				2																
	Clerodendrum floribundum				1																
	Clerodendrum inerme		1					1							1				1		
	Clerodendrum longiflorum var. glabrum				3																
	Gmelina dalrympleana			7	2	6		2													
	*Hyptis suaveolens**															1					
	Platostoma longicorne (DGF9630)			6				2													
	Plectranthus scutellaroides			3	2	3		1						1		3					
	Plectranthus sp. (DGF9635)				1											1					
	Premna serratifolia		2					1					3	1	2						
	Vitex acuminata (DGF10237)				1																
	Vitex helogiton					1															

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Vitex sp. (DGF9649)(DGF9652)(DGF9716)				1	1															
Lauraceae	*Beilschmiedia obtusifolia*	1																			
	Cassytha filiformis						1						4	1		1					
	Cryptocarya brassii	1		6			1														
	Cryptocarya cunninghamii	1			1																
	Cryptocarya exfoliata		1		7								2								
	Cryptocarya sp. (DGF10207) poss. C. bamagana			2																	
	Cryptocarya sp. (DGF10210)			1																	
	Endiandra glauca	1		5	6		1														
	Litsea breviumbellata			5	3																
	Litsea glutinosa		2	1	7		1						3			1					
Laxmanniaceae	*Eustrephus latifolius*				3	1															
	Lomandra banksii		2	2		7	4						4								
	Lomandra multiflora subsp. multiflora			1																	
	Thysanotus tuberosus subsp. tuberosus					1															
Lecythidaceae	*Barringtonia acutangula subsp. acutangula*			2		1															
	Barringtonia calyptrata												2								
	Barringtonia racemosa							1													
	Planchonia careya					6							1								
Lentibulariaceae	*Utricularia chrysantha*							1													
	Utricularia sp. (DGF9705)							1				1									
Loranthaceae	*Amyema villiflora subsp. villiflora*					1															
	Decaisnina angustata					1															
	Dendrophthoe curvata					1															
	Diplatia tomentosa					1															
	Loranthaceae (DGF10196)													1		1					
Lythraceae	*Lagerstoemia archeriana*					1															
	Pemphis acidula		1															2			
	Sonneratia alba																	1			

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
Malvaceae	*Hibiscus meraukensis*			1		2	1	2													
	Hibiscus tiliaceus		2					1													
	*Sida acuta **					1															1
	*Sida cordifolia **																				1
Melastomataceae	*Melastoma malabathricum susp. malabathricum*			8		3		1				1									
	Osbeckia chinensis			1		1		1													
Meliaceae	*Aglaia eleagnoidea*		2												1						
	Aglaia sapindina	1																			
	Aglaia tomentosa	1			1																
	Dysoxylum oppositifolium	1		6	5																
	Turraea pubescens				1								1								
	Vavaea amicorum	1																			
	Xylocarpus granatum																	1			
Memecylaceae	*Memecylon pauciflorum var. pauciflorum*			1																	
Menispermaceae	*Hypserpa decumbens*	1		1		1	1														
	Hypserpa laurina			1																	
	Hypserpa sp. (DGF9691)			1																	
	Stephania japonica var. timorensis		1		4																
	Stephania sp. (DGF10236)				1																
	Tiliacora australiana												1								
Menyanthaceae	*Nymphoides aurantiaca*							1													
	Nymphoides sp. (DGF10231)					1															
Mimosaceae	*Acacia auriculiformis*	1		1																	
	Acacia crassicarpa		3	8		19	6	1				7	8		3						
	Acacia leptocarpa			2		22						4	1								
	Acacia platycarpa					6						1	2								
	Acacia polystachya	1	3	2	13	3							3	1		4					
	Acacia simsii					1										1					
	Archidendron grandiflorum			1	5								1								
	Archidendron hirsutum (Near-Threatened)	2			2																

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	*Mimosa pudica var. unijuga **																				2
	Paraserianthes toona		1																		
Moiminaceae	*Wilkiea rigidifolia*	1		1	2																
Moraceae	*Antiaris toxicarya var. macrophylla*	1	1		4								3								
	Ficus copiosa			1																	
	Ficus obliqua var. obliqua														1						
	Ficus obliqua var. petiolaris															2					
	Ficus opposita var. aculeata				2	1															
	Ficus virens var. sublanceolata		1		1																
	Streblus brunonianus				4								1								
	Trophis scandens subsp. scandens				3								1			1					
Musaceae	*Musa sp.**							1													
Myristicaceae	*Myristica insipida*	1																			
Myristiceae	*Horsfieldia australiana*			5																	
Myrsinaceae	*Aegiceras corniculatus*							1													
	Myrsine sp. (DGF10166)		1																		
	Myrsine urceolata				1																
Myrtaceae	*Acmena hemilampra subsp. hemilampra*			6			1			1											
	Asteromyrtus brassii			5		5	4			2		7	4		1						
	Asteromyrtus symphyocarpa			2		5		1				4				1					
	Baeckea frutescens			1				1				2	2		1						
	Corymbia clarksoniana			3		17															
	Corymbia nesophila					8															
	Corymbia novoguineensis			1		22	1					4	2								
	Corymbia sp. (DGF10204)											1									
	Corymbia stockeri subsp. peninsularis			1		19						1				1					
	Corymbia tessellaris		1			8							1								
	Eucalyptus platyphylla					9															
	Eugenia reinwardtiana		2										1	1	1						
	Gossia retusa		1																		
	Lithomyrtus obtusa		2			1	3						2	1		3					

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Lithomyrtus retusa															1					
	Lophostemon suaveolens			13		11	1	2	2			7									
	Melaleuca acacioides		1									1									
	Melaleuca cajuputi var. platyphylla			1				2													
	Melaleuca dealbata			2		1	1	1													
	Melaleuca leucadendra			5		2		2													
	Melaleuca quinquenervia			4				4									1				
	Melaleuca saligna			1		1		4				2			1						
	Melaleuca stenostachya					8										1					
	Melaleuca viridiflora			1		19		1				15	4		2		1				
	Melaleuca viridiflora (DGF10230)					1															
	Melaleuca viridiflora (thick leaf)											1									
	Osbornia octodonta																	1			
	Rhodamnia australis	1		5																	
	Rhodomyrtus macrocarpa			2	2																
	Syzygium angophoroides	1		7																	
	Syzygium bungadinnia	1																			
	Syzygium fibrosum			3																	
	Syzygium forte subsp. forte	2		6	2																
	Syzygium suborbiculare					7							4								
	Thryptomene oligandra												1								
	Welchiodendron longivalve	1	1	1	13	6							3			6					
Nymphaeaceae	*Nymphaea sp. (DGF10168)*							2													
	Nymphaea violacea							1													
Olacaceae	*Ximenia americana*																	1			
Oleaceae	*Chionanthus ramiflorus*	1		2	6	1							1								
	Jasminum aemulum subsp. aemulum				1																
	Jasminum didymum subsp. didymum		1		1																
	Jasminum sp. (DGF10225)				2																
	Notelaea longifolia				1																
Onagraceae	*Ludwigia hyssopifolia**																				1

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Ludwigia octovalvis							1													
Opiliaceae	*Cansjera leptostachya*		2	2	2								1	1							
	Opilia armentacea												1								
Orchidaceae	*Bulbophyllum sp. (DGF9638)*	1			3	1															
	Dendrobium discolor		2	2	6								1	1		2					
	Dendrobium smillieae				2																
	Dendrobium sp. (DGF 10172)		1			1															
	Dendrobium sp. (DGF 10202)							1													
	Dendrobium sp. (DGF10161)					1						1									
	Dendrobium sp. (DGF10202)							1				1									
	Dendrobium sp. (DGF10228)												1								
	Dendrobium triamellatum			1	3	1						1	2			1					
	Diplocaulobium glabrum	1																			
	Dockrillia calamiformis	1																			
	Eria fitzalanii	1																			
	Orchidaceae (DGF10161)											1									
	Orchidaceae (DGF10162)											1									
	Orchidaceae (DGF10185)				1																
	Orchidaceae (DGF9638)			1	1																
Pandanaceae	*Pandanus conicus*		1										1								
	Pandanus sp.		1	9		14		4				6	1		2		1				
Passifloraceae	*Passiflora aurantia*				1																
	*Passiflora foetida**			1		1		2					2			2					
Phylidraceae	*Philydrum lanuginosum*					1		2													
Phyllanthaceae	*Actephila venusta*				2																
	Antidesma ghaesambilla					3										1					
	Antidesma ghaesambilla (=DGF10217)					1															
	Breynia cernua				1								1								
	Breynia oblongifolia			1		8	2									1					
	Bridelia tomentosa					1															
	Cleistanthus apodus			1																	

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Cleistanthus peninsularis		1		10	1							2			3					
	Flueggea virosa subsp. melanthesoides					1															
	Glochidion apodogynum				2	1							2								
	Glochidion disparipes					2															
	Glochidion sp. (DGF9664)				1																
	Phyllanthus virgatus					1															
	Phyllanthus sp.				1																
	Phyllanthus sp. (DGF9632)				1																
Picrodendraceae	*Petalostigma pubescens*					4															
Piperaceae	*Piper caninum*	1																			
Poaceae	*Alloteropsis semialata*					1							1	1		4					
	Ancistrachne uncinulata					2															
	Aristida holathera var. holathera					1															
	Aristida sp. (DGF9676)			1		2						1			1						
	Chrysopogon setifolius					1															
	Cleistochloa subjuncea					1															
	Cymbopogon refractus					4										1					
	Dichanthium sericeum					1															
	Ectrosia leporina					3															
	Eragrostis cumingii					1															
	Eragrostis pubescens					1															
	Eragrostis sp. (DGF9678)			1								1	1								
	Eragrostis spartinoides					1															
	Eremochloa ciliaris (Near-Threatened)					4															
	Eriachne ciliata					1															
	Eriachne obtusa					2															
	Eriachne pallescens var. pallescens					5															
	Eriachne squarrosa					1															
	Eriachne triseta					1															
	Eulalia mackinlaya					2															
	Germainia capitata (Vulnerable)			2																	

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Heteropogon contortus					2															
	Heteropogon triticeus			1		18		1					1			2					
	Imperata cylindrica		1	2		17									1						
	Ischaemum australe			2																	
	Ischaemum australe var. villosum			2				1													
	Ischaemum fragile					6		3				2			1				1		
	Ischaemum muticum					1															
	Ishaemum sp. (DGF9669)			2		1						1									
	*Melinis repens**															1					
	Neolebra atra (Near-Threatened)				1																
	Oplismenus aemulus				3								1								
	Panicum seminudum var. cairnsianum					2															
	Panicum sp. (DGF9683)		2	2		8	3					1	2			3					
	Panicum trichoides					1															
	Paspalidium distans					1															
	Paspalum scrobiculatum					1															
	Phragmites australis							1													
	Phragmites karka							1													
	Poaceae (DGF9626)			3		1						1			1						
	Poaceae (DGF9630a)			1																	
	Poaceae (DGF9682)			4																	
	Poaceae (DGF9685)			1																	
	Poaceae sp. (Fine one Pulu)															1					
	Poaceae sp. (Unknown)													1							
	Pseudopogonatherum irritans					1															
	Pseudoraphis spinescens					1															
	*Rottboellia cochinchinensis **														1						
	Sacciolepis indica					2															
	Sarga angustum					1															
	Schizachyrium fragile					1										1					
	Setaria surgens					1															

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Sorghum nitidum forma nitidum					1									2						
	Spinifex longifolius		1											1							
	Sporobolus lenticularis					1															
	Sporobolus virginicus																	1	1		
	Themeda triandra					4															
	Urochloa holosericea subsp. holosericea					2															
	Urochloa piligera					1															
Polygonaceae	*Muehlenbeckia zippelii*				1																
Portulacaceae	*Portulaca australis*													1							
Proteaceae	*Banksia dentata*			3		7						7			1		1				
	Grevillea coriacea					1															
	Grevillea parallela			1		12							2			1					
	Helicia austalasica			1																	
Putrangivaceae	*Drypetes deplanchei*	1	3	1	4								3	1	1						
Restionaceae	*Dapsilanthus elatior*											1									
	Dapsilanthus ramosus												1								
	Dapsilanthus spathaceus			1								11	1				1				
	Restoniaceae (DGF10160)							3				1									
	Restoniaceae (DGF9674)			1																	
	Restoniaceae (DGF9701)							1													
Rhamnaceae	*Alphitonia excelsa*				3	5							2								
	Colubrina asiatica		2											1	2						
	Ziziphus oeniphila				5	1							1								
Rhizophoraceae	*Bruguiera gymnorhiza*																	1			
	Carallia brachiata			7	1	1															
	Ceriops tagal																	1			
	Rhizophora apiculata		1																		
Rubiaceae	*Aidia racemosa*				2																
	Antirhea ovatifolia		1		4								1								
	Atractocarpus sessilis	1		2	3																
	Cyclophyllum brevipes		1	1	1																

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Cyclophyllum maritimum		3		1																
	Cyclophyllum sp. (DGF9633)				2																
	Dentella repens					1															
	Everistia vaccinifolia (sens. lat.)				1																
	Guettarda speciosa		1											1	1						
	Hydnophytum moselyanum var. moseleyanum				2	2						2				1					
	Ixora timorensis				1																
	Morinda citrifolia							1													
	Morinda reticulata				1											1					
	Myrmecodia platytyrea var. antoinii	1		4	4	3		1				3			1	1					
	*Oldenlandia corymbosa var. corymbosa**																				1
	Pavetta brownii var. brownii				1																
	Pavetta brownii var. glabrata				2								1			1					
	Pogonolobus reticulatus					2															
	Psychotria loniceroides				1																
	Psychotria poliostemma		1		5									1							
	Psychotria sp. (DGF10190)				2																
	Psydrax banksii		2		1		2						3	1		1					
	Psydrax graciliflora				1																
	Psydrax reticulata (Vuln.)				2	1							1			3					
	Psydrax sp. (DGF10188)				1																
	Spermacoce papuana					2															
	Spermacoce sp. (Lorim Point A. Morton AM1237)					1															
Rutaceae	*Acronychia imperforata*			1																	
	Clausena brevistyla				1																
	Glycosmis trifoliata				3																
	Halfordia kendack		2	1	2		3						3								
	Melicope peninsularis				4																
	Micromelum minutum		3		9								2	1							
	Murraya ovatifoliolata				2								1								

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Murraya paniculata				1																
	Zanthoxylum rhetsa				7	1															
Santalaceae	*Exocarpos latifolius*		2	1	3	2	4						5	1							
Sapindaceae	*Arytera bifoliolata*	1	2		2																
	Atalaya sericopetala												1								
	Cupaniopsis anacardioides		1			1							1								
	Dodonaea polyandra		1		2	3	2						2			3					
	Ellatostachys microcarpa				2																
	Ganophyllum falcatum				3																
	Mischocarpus lachnocarpus	1		1	5																
Sapotaceae	*Manilkara kauki*		3										2	1	1						
	Mimusops elengi				2																
	Pouteria chartacea	1																			
	Pouteria obovata	1																			
	Pouteria sericea	1	2		4	1							5	1							
Scrophulariaceae	*Adenosma caerulea*					2															
	Angelonia salicariifolia *																				3
	Buchnera gracilis					2															
	Buchnera tetragona			1		1						2				1					
	Lindernia ciliata					1															
	Lindernia crustacea					2															
	Scoparia dulcis *																				3
Simaroubiaceae	*Brucea javanica*				1																
Smilacaceae	*Smilax australis*				4	1															
	Smilax blumei			2	1								1								
Solanaceae	*Solanum sp. (DGF10175)*				1																
Sparrmanniaceae	*Grewia oxyphylla*												1								
Sterculiaceae	*Sterculia quadrifida*		3	1	3	1							4	1		1					
Stylidiaceae	*Stylidium alsinoides*					1															
	Stylidium sp. (DGF9671)			2								1									
	Stylidium sp. (DGF9706)							1													

Family	Species	Broad Vegetation Group																			
		1	2	3	4	5	6	7	8	9	10	13	14	16	17	18	20	24	26	4a	Cl
	Stylidium tenerum							1													
Taccaceae	*Tacca leontopetaloides*		1	1																	
Thymelaeaceae	*Thecanthes cornucopiae*					1															
Ulmaceae	*Celtis paniculata*		2												1						
	Trema tomentosa var. aspera				1																
	Trema tomentosa var. tomentosa				1																
Verbenaceae	*Stachytarpheta jamaicensis**																				1
Violaceae	*Hybanthus enneaspermus*					1		2													
Vitaceae	*Ampelocissus acetosa*																			1	
	Cissus maritima															1					
	Cissus opaca					1															
	Tetrastigma sp. (DGF10183)	1			1																
Xyridaceae	*Xyris complanata*			1		1						1	3		1						
Zingiberaceae	*Curcuma australasica*			6	3	1										1					
Unknown	*Moss like (DGF9670)*			1																	
	Unknown herb (DGF10221)					1															
	Unknown herb (DGF10222)					1															
	Unknown herb (DGF10234)					1															
	Unknown herb (DGF9629)			1																	
Total Records per BVG		59	147	369	476	636	53	104	2	3	1	126	217	50	46	128	8	14	9	1	38

Appendix E. Terrestrial Fauna Species List For Badu Island and Surrounding Islets[12]

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
AMPHIBIANS						
Myobatrachidae	*Limnodynastes ornatus*	Ornate Burrowing Frog		LC		Australian Museum record.
Myobatrachidae	*Uperoleia lithomoda*	Stonemason Toadlet		LC		
Myobatrachidae	*Uperoleia mimula*	Mimic Toadlet		LC		
Hylidae	*Litoria bicolor*	Northern Dwarf Tree Frog		LC		
Hylidae	*Litoria caerulea*	Green Tree Frog		LC		Unpublished record.
Hylidae	*Litoria gracilenta*	Dainty Green Tree Frog		LC		
Hylidae	*Litoria infrafrenata*	White-lipped Tree Frog		LC		Unpublished record.
Hylidae	*Litoria nasuta*	Rocket Frog		LC		Australian Museum record.
Hylidae	*Litoria nigrofrenata*	Bridle Frog		LC		Australian Museum record.
Hylidae	*Litoria rubella*	Red Tree Frog		LC		Unpublished record.
Microhylidae	*Austrochaperina gracilipes*	Slender Frog		LC		Unpublished record.
Microhylidae	*Cophixalus* sp.					Australian Museum record.
Ranidae	*Rana daemeli*	Wood Frog		LC		
Bufonidae	*Rhinella marina*	Cane Toad		I		
REPTILES						
Crocodylidae	*Crocodylus porosus*	Salt-water crocodile	M	V		Unpublished record and Predicted by the EPBC Protected Matters Search Tool
Chelidae	*Emydura subglobosa*	Jardine River Turtle		NT		
Chelidae	*Macrochelodina rugosa*	Northern Long-necked Turtle		LC		
Gekkonidae	*Cyrtodactylus louisiadensis*	Ring-tailed Gecko		LC		Australian Museum record.
Gekkonidae	*Gehyra baliola*	Short-tailed Dtella		LC		
Gekkonidae	*Gehyra dubia*	Dubious Dtella		LC		Australian Museum & unpublished records.
Gekkonidae	*Gehyra variegata*	Tree Dtella		LC		
Gekkonidae	*Hemidactylus frenatus*	House Gecko		I		
Gekkonidae	*Heteronotia binoei*	Bynoe's Gecko		LC		

[12] Compiled by Terry Reis.

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
Gekkonidae	*Lepidodactylus lugubris*	Mourning Gecko		LC		
Gekkonidae	*Lepidodactylus pumilus*	Slender Chained Gecko		NT		
Gekkonidae	*Nactus eboracensis*	no common name		LC		
Gekkonidae	*Nactus 'pelagicus'*	Pelagic Gecko		LC		
Gekkonidae	*Nactus* sp.					Australian Museum record.
Gekkonidae	*Oedura rhombifer*	Zigzag Velvet Gecko		LC		
Gekkonidae	*Pseudothecadactylus australis*	Giant Tree Gecko		LC		
Pygopodidae	*Lialis burtonis*	Burton's Snake-lizard		LC		Australian Museum & Wild-Net records.
Scincidae	*Bellatorias frerei*	Major Skink		LC		Australian Museum record.
Scincidae	*Carlia coensis*	Coen Rainbow-skink		LC		
Scincidae	*Carlia longipes*	Closed-litter Rainbow-skink		LC		Australian Museum record. Animals from Torres Strait now known as *C. sexdentata*.
Scincidae	*Carlia quinquecarinata*	no common name		LC		
Scincidae	*Carlia sexdentata*	no common name		LC		See *Carlia longipes* above.
Scincidae	*Carlia storri*	Brown Bicarinate Rainbow-skink		LC		Australian Museum & unpublished records.
Scincidae	*Cryptoblepharus litoralis litoralis*	Supralittoral Shinning-skink		LC		Australian Museum record.
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink		LC		Australian Museum record.
Scincidae	*Ctenotus inornatus*	Bar-shouldered Ctenotus		LC		
Scincidae	*Ctenotus robustus*	Robust Ctenotus		LC		
Scincidae	*Ctenotus spaldingi*	Straight-browed Ctenotus		LC		Australian Museum record.
Scincidae	*Emoia atrocostata*	Littoral Whiptail-skink		NT		
Scincidae	*Emoia longicauda*	Shrub Whiptail-skink		LC		Australian Museum record.
Scincidae	*Eremiascincus pardalis*	Lowlands Bar-lipped Skink		LC		
Scincidae	*Eugongylus rufescens*	Bar-lipped Sheen-skink		LC		Queensland Museum record.
Scincidae	*Glaphyromorphus crassicaudus*	Cape York Mulch-skink		LC		Australian Museum & unpublished records.
Scincidae	*Glaphyromorphus nigricaudis*	Black-tailed Bar-lipped Skink		LC		
Scincidae	*Glaphyromorphus pumilus*	Dwarf Mulch-skink		LC		
Scincidae	*Lygisaurus foliorum*	Tree-base Litter-skink		LC		
Scincidae	*Lygisaurus macfarlani*	Translucent Litter-skink		LC		Australian Museum & unpublished records.
Agamidae	*Chlamydosaurus kingii*	Frilled Lizard		LC		Unpublished record.

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
Agamidae	*Diporiphora bilineata*	Two-lined Dragon		LC		Australian Museum record.
Agamidae	*Lophognathus temporalis*	Swamplands Lashtail		LC		
Varanidae	*Varanus gouldii*	Gould's Goanna		LC		
Varanidae	*Varanus indicus*	Mangrove Monitor		LC		Australian Museum record.
Varanidae	*Varanus mertensi*	Mertens' Water Monitor		LC		Unpublished record. Uncertain identification.
Varanidae	*Varanus panoptes*	Yellow-spotted Monitor		LC		
Varanidae	*Varanus prasinus*	Emerald Monitor		NT		Unpublished record.
Varanidae	*Varanus scalaris*	Spotted Tree Monitor		LC		Australian Museum & unpublished records.
Varanidae	*Varanus tristis*	Black-tailed Monitor		LC		
Typhlopidae	*Ramphotyphlops braminus*	Flowerpot Blind Snake		I		
Typhlopidae	*Ramphotyphlops leucoproctus*	Cape York Blind Snake		LC		Australian Museum & unpublished records.
Typhlopidae	*Ramphotyphlops polygrammicus*	North-eastern Blind Snake		LC		
Boidae	*Antaresia cf childreni*	Children's Python		LC		
Boidae	*Antaresia maculosa*	Spotted Python		LC		Australian Museum, Queensland Museum & unpublished records.
Boidae	*Liasis fuscus*	Water Python		LC		
Boidae	*Morelia amethistina*	Amethyst Python		LC		
Boidae	*Morelia kinghorni*	Scrub Python		LC		Queensland Museum & unpublished records.
Colubridae	*Boiga irregularis*	Brown Tree Snake		LC		Queensland Museum record.
Colubridae	*Cerberus australis*	Bockadam		LC		
Colubridae	*Dendrelaphis calligastra*	Northern Tree Snake		LC		Queensland Museum & unpublished records.
Colubridae	*Dendrelaphis punctulatus*	Common Tree Snake		LC		
Colubridae	*Stegonotus cucullatus*	Slaty-grey Snake		LC		Queensland Museum record.
Colubridae	*Stegonotus parvus*	Slate-brown Snake		LC		
Colubridae	*Tropidonophis mairii*	Freshwater Snake		LC		
Elapidae	*Acanthophis praelongus*	Northern Death Adder		LC		Australian Museum, Queensland Museum & unpublished records.
Elapidae	*Demansia papuensis*	Papuan Whipsnake		LC		
Elapidae	*Demansia vestigiata*	Black Whipsnake		LC		Australian Museum & Queensland Museum.
Elapidae	*Furina tristis*	Brown-headed Snake		LC		Queensland Museum record.
Elapidae	*Oxyuranus scutellatus*	Taipan		LC		

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
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Elapidae	*Pseudechis papuanus*	Papuan Black Snake		LC		
BIRDS						
Megapodiidae	*Alectura lathami*	Australian Brush-turkey		LC		
Megapodiidae	*Megapodius reinwardt*	Orange-Footed Scrubfowl		LC		Wild-Net, published & unpublished records.
Phasianidae	*Coturnix ypsilophora*	Brown Quail		LC		Wild-Net & published records.
Anseranatidae	*Anseranas semipalmata*	Magpie Goose		LC		Wild-Net & published records.
Anatidae	*Dendrocygna guttata*	Spotted Whistling-Duck		LC		
Anatidae	*Dendrocygna eytoni*	Plumed Whistling-Duck		LC		
Anatidae	*Dendrocygna arcuata*	Wandering Whistling-Duck		LC		
Anatidae	*Tadorna radjah*	Radjah Shelduck		NT		Published record.
Anatidae	*Chenonetta jubata*	Australian Wood Duck		LC		Published record.
Anatidae	*Nettapus pulchellus*	Green Pygmy-goose		LC		Published & unpublished records.
Anatidae	*Anas gracilis*	Grey Teal		LC		
Anatidae	*Anas superciliosa*	Pacific Black Duck		LC		Wild-Net, published & unpublished records.
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe		LC		Unpublished record.
Columbidae	*Columba livia*	Rock Dove		I		
Columbidae	*Geopelia striata papua*	Emerald Dove		LC		Published record.
Columbidae	*Geopelia striata*	Peaceful Dove		LC		Wild-Net, published & unpublished records.
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove		LC		Wild-Net, published & unpublished records.
Columbidae	*Ptilinopus magnificus*	Wompoo Fruit-Dove		LC		Wild-Net & published records.
Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove		LC		Published record.
Columbidae	*Ptilinopus regina*	Rose-crowned Fruit-Dove		LC		Published & unpublished records.
Columbidae	*Ptilinopus iozonus*	Orange-Bellied Fruit-Dove		LC		
Columbidae	*Ducula mullerii*	Collared Imperial-Pigeon		LC		
Columbidae	*Ducula bicolor*	Pied Imperial-Pigeon		LC		Wild-Net & published records.
Columbidae	*Lopholaimus antarcticus*	Topknot Pigeon		LC		
Podargidae	*Podargus strigoides*	Tawny Frogmouth		LC		
Podargidae	*Podargus papuensis*	Papuan Frogmouth		LC		
Eurostopodidae	*Eurostopodus mystacalis*	White-throated Nightjar		LC		Published & unpublished records.
Eurostopodidae	*Eurostopodus argus*	Spotted Nightjar		LC		
Caprimulgidae	*Caprimulgus macrurus*	Large-tailed Nightjar		LC		Published & unpublished records.
Apodidae	*Collocalia esculenta*	Glossy Swiftlet		LC		

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Apodidae	*Aerodramus terraereginae*	Australian Swiftlet		NT		
Apodidae	*Aerodramus vanikorensis*	Uniform Swiftlet		LC		
Apodidae	*Hirundapus caudacutus*[5]	White-throated Needletail	M	LC		Published record.
Apodidae	*Mearnsia novaeguineae*	Papuan Spine-tailed Swift		LC		
Apodidae	*Apus pacificus*	Fork-tailed Swift	M	LC		Published record.
Apodidae	*Apus affinis*	House Swift		LC		
Anhingidae	*Anhinga novaehollandiae*	Australasian Darter		LC		Wild-Net & published records.
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant		LC		Published record.
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant		LC		
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant		LC		Published record.
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant		LC		Published & unpublished records.
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		LC		Wild-Net & published records.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork		NT		Wild-Net & published records.
Ardeidae	*Ixobrychus dubius*	Australian Little Bittern		LC		
Ardeidae	*Ixobrychus flavicollis*	Black Bittern		LC		Published record.
Ardeidae	*Ardea pacifica*	White-necked Heron		LC		Published record.
Ardeidae	*Ardea modesta*[6]	Eastern Great Egret	M	LC		Wild-Net & published records.
Ardeidae	*Ardea intermedia*	Intermediate Egret		LC		Wild-Net, published & unpublished records.
Ardeidae	*Ardea sumatrana*	Great-billed Heron		LC		
Ardeidae	*Ardea ibis*[7]	Cattle Egret	M	LC		Unpublished record.
Ardeidae	*Butorides striata*	Striated Heron		LC		Wild-Net, published & unpublished records.
Ardeidae	*Egretta picata*	Pied Heron		LC		Published & unpublished records.
Ardeidae	*Egretta novaehollandiae*	White-faced Heron		LC		Wild-Net & published records.
Ardeidae	*Egretta garzetta*	Little Egret		LC		Published & unpublished records.
Ardeidae	*Egretta sacra*	Eastern Reef Egret	M	LC		Wild-Net, published & unpublished records.
Ardeidae	*Nycticorax caledonicus*	Nankeen Night-Heron		LC		Published & unpublished records.
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	M	LC		Published record.
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		LC		Wild-Net, published & unpublished records.
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis		LC		Wild-Net & published records.
Threskiornithidae	*Platalea regia*	Royal Spoonbill		LC		Published record.
Accipitridae	*Pandion cristatus*[8]	Eastern Osprey	M	LC		Wild-Net, published & unpublished records.
Accipitridae	*Elanus axillaris*	Black-shouldered Kite		LC		

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Accipitridae	*Hamirostra melanosternon*	Black-breasted Buzzard		LC		
Accipitridae	*Aviceda subcristata*	Pacific Baza		LC		
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	M	LC		Wild-Net, published & unpublished records.
Accipitridae	*Haliastur sphenurus*	Whistling Kite		LC		Wild-Net & published records.
Accipitridae	*Haliastur indus*	Brahminy Kite		LC		
Accipitridae	*Milvus migrans*	Black Kite		LC		
Accipitridae	*Accipiter fasciatus*	Brown Goshawk		LC		Published & unpublished records.
Accipitridae	*Accipiter cirrhocephalus*	Collared Sparrowhawk		LC		Unpublished record.
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk		NT		Published & unpublished records.
Accipitridae	*Circus assimilis*	Spotted Harrier		LC		
Accipitridae	*Circus approximans*	Swamp Harrier		LC		Published record.
Accipitridae	*Erythrotriorchis radiatus*	Red Goshawk	V	E	high	
Accipitridae	*Aquila gurneyi*	Gurney's Eagle		LC		
Falconidae	*Falco cenchroides*	Nankeen Kestrel		LC		Published record.
Falconidae	*Falco berigora*	Brown Falcon		LC		Published record.
Falconidae	*Falco longipennis*	Australian Hobby		LC		Published record.
Falconidae	*Falco peregrinus*	Peregrine Falcon		LC		
Gruidae	*Grus rubicunda*	Brolga		LC		
Rallidae	*Porphyrio porphyrio*	Purple Swamphen		LC		Published record.
Rallidae	*Eulabeornis castaneoventris*	Chestnut Rail		LC		
Rallidae	*Rallina tricolor*	Red-necked Crake		LC		
Rallidae	*Gallirallus philippensis*	Buff-banded Rail		LC		Published record.
Rallidae	*Porzana pusilla*	Baillon's Crake		LC		
Rallidae	*Porzana fluminea*	Australian Spotted Crake		LC		
Rallidae	*Porzana tabuensis*	Spotless Crake		LC		Wild-Net record.
Rallidae	*Amaurornis cinerea*	White-browed Crake		LC		Published record.
Rallidae	*Amaurornis moluccana*	Pale-vented Bush-hen		LC		Published record.
Otididae	*Ardeotis australis*	Australian Bustard		LC		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		LC		Published record.
Burhinidae	*Esacus magnirostris*	Beach Stone-curlew		V	high	Wild-Net, published & unpublished records.
Haematopodidae	*Haematopus longirostris*	Australian Pied Oystercatcher		LC		Wild-Net, published & unpublished records.
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher		NT		

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Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		LC		Published record.
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover	M	LC		Published record.
Charadriidae	*Pluvialis squatarola*	Grey Plover	M	LC		Published record.
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover		LC		Wild-Net & published records.
Charadriidae	*Charadrius bicinctus*	Double-banded Plover	M	LC		
Charadriidae	*Charadrius mongolus*	Lesser Sand Plover	M	LC		Published record.
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	M	LC		Published record.
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel		LC		
Charadriidae	*Vanellus miles*	Masked Lapwing		LC		Wild-Net, published & unpublished records.
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	M	LC		Predicted by the EPBC Protected Matters Search Tool
Scolopacidae	*Gallinago megala*	Swinhoe's Snipe	M	LC		
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	M	LC		
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	M	LC		Wild-Net & published records.
Scolopacidae	*Numenius minutus*	Little Curlew	M	LC		Published record.
Scolopacidae	*Numenius phaeopus*	Whimbrel	M	LC		Wild-Net, published & unpublished records.
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew	M	NT		Wild-Net & published records.
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	M	LC		Wild-Net & published records.
Scolopacidae	*Actitis hypoleucos*[9]	Common Sandpiper	M	LC		Wild-Net & published records.
Scolopacidae	*Tringa brevipes*[10]	Grey-tailed Tattler	M	LC		Wild-Net & published records.
Scolopacidae	*Tringa incana*[11]	Wandering Tattler	M	LC		Published record.
Scolopacidae	*Tringa nebularia*	Common Greenshank	M	LC		Wild-Net & published records.
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	M	LC		Published record.
Scolopacidae	*Tringa glareola*	Wood Sandpiper	M	LC		
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	M	LC		Published record.
Scolopacidae	*Calidris tenuirostris*	Great Knot	M	LC		Published record.
Scolopacidae	*Calidris canutus*	Red Knot	M	LC		
Scolopacidae	*Calidris alba*[12]	Sanderling	M	LC		
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	M	LC		Published record.
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper	M	LC		
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	M	LC		Wild-Net & published records.
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	M	LC		Wild-Net & published records.
Turnicidae	*Turnix maculosus*	Red-backed Button-quail		LC		Published record.

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Turnicidae	*Turnix pyrrhothorax*	Red-chested Button-quail		LC		
Glareolidae	*Glareola maldivarum*	Oriental Pratincole	M	LC		
Glareolidae	*Stiltia isabella*	Australian Pratincole		LC		Published & unpublished records.
Laridae	*Anous stolidus*	Common Noddy	M	LC		Published & unpublished records.
Laridae	*Anous minutus*	Black Noddy		LC		
Laridae	*Onychoprion anaethetus*[13]	Bridled Tern	M	LC		Wild-Net & published records.
Laridae	*Onychoprion fuscata*	Sooty Tern		LC		
Laridae	*Sternula albifrons*[14]	Little Tern	M	E	high	Published record.
Laridae	*Gelochelidon nilotica*	Gull-billed Tern		LC		Wild-Net, published & unpublished records.
Laridae	*Hydroprogne caspia*	Caspian Tern	M	LC		Wild-Net, published & unpublished records.
Laridae	*Chlidonias hybrida*	Whiskered Tern		LC		
Laridae	*Chlidonias leucopterus*	White-winged Black Tern	M	LC		Published record.
Laridae	*Sterna dougallii*	Roseate Tern	M	LC		Published record.
Laridae	*Sterna striata*	White-fronted Tern		LC		
Laridae	*Sterna sumatrana*	Black-naped Tern	M	LC		Wild-Net & published records.
Laridae	*Sterna hirundo*	Common Tern	M	LC		
Laridae	*Thalasseus bengalensis*[15]	Lesser Crested Tern	M	LC		Wild-Net & published records.
Laridae	*Thalasseus bergii*	Crested Tern		LC		Wild-Net, published & unpublished records.
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull		LC		Wild-Net, published & unpublished records.
Cacatuidae	*Probosciger aterrimus*	Palm Cockatoo		NT		
Cacatuidae	*Eolophus roseicapilla*	Galah		LC		
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo		LC		Wild-Net, published & unpublished records.
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet		LC		Wild-Net, published & unpublished records.
Psittacidae	*Cyclopsitta* species	fig-parrot species				
Psittacidae	*Eclectus roratus polychloros*	Eclectus Parrot		LC		
Psittacidae	*Geoffroyus geoffroyi*	Red-cheeked Parrot		LC		
Cuculidae	*Centropus phasianinus*	Pheasant Coucal		LC		Wild-Net & published records.
Cuculidae	*Eudynamys orientalis*	Eastern Koel		LC		
Cuculidae	*Urodynamys taitensis*	Long-tailed Cuckoo				
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo		LC		Published record.
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-Cuckoo		LC		Wild-Net & published records.

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Cuculidae	*Chalcites osculans*	Black-eared Cuckoo		LC		
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo		LC		Published record.
Cuculidae	*Chalcites minutillus*	Little Bronze-Cuckoo		LC		Published record.
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo		LC		
Cuculidae	*Cacomantis castaneiventris*	Chestnut-breasted Cuckoo		LC		
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo		LC		
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo		LC		Wild-Net, published & unpublished records.
Cuculidae	*Cuculus optatus*[16]	Oriental Cuckoo	M	LC		Published record.
Strigidae	*Ninox connivens*	Barking Owl		LC		Published & unpublished records.
Strigidae	*Ninox novaeseelandiae*	Southern Boobook		LC		
Tytonidae	*Tyto longimembris*	Eastern Grass Owl		LC		
Alcedinidae	*Ceyx azureus*	Azure Kingfisher		LC		Published record.
Alcedinidae	*Ceyx pusilla*	Little Kingfisher		LC		
Halcyonidae	*Tanysiptera sylvia*	Buff-breasted Paradise-Kingfisher		LC		
Halcyonidae	*Tanysiptera galatea*	Common Paradise-Kingfisher		LC		
Halcyonidae	*Tanysiptera hydrocharis*	Little Paradise-Kingfisher				
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra		LC		
Halcyonidae	*Syma torotoro*	Yellow-billed Kingfisher		LC		
Halcyonidae	*Todiramphus macleayii*	Forest Kingfisher		LC		Wild-Net, published & unpublished records.
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher		LC		Published & unpublished records.
Halcyonidae	*Todiramphus chloris*	Collared Kingfisher		LC		
Meropidae	*Merops ornatus*	Rainbow Bee-eater	M	LC		Wild-Net, published & unpublished records.
Coraciidae	*Eurystomus orientalis*	Dollarbird		LC		Published & unpublished records.
Pittidae	*Pitta erythrogaster*	Red-bellied Pitta		LC		
Pittidae	*Pitta versicolor*	Noisy Pitta		LC		Published record.
Ptilonorhynchidae	*Ptilonorhynchus nuchalis*	Great Bowerbird		LC		
Acanthizidae	*Sericornis beccarii*	Tropical Scrubwren		LC		
Acanthizidae	*Gerygone levigaster*	Mangrove Gerygone		LC		
Acanthizidae	*Gerygone magnirostris*	Large-billed Gerygone		LC		Wild-Net & published records.
Acanthizidae	*Gerygone palpebrosa*	Fairy Gerygone		LC		
Meliphagidae	*Meliphaga notata*	Yellow-spotted Honeyeater		LC		Wild-Net, published & unpublished records.

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Meliphagidae	*Meliphaga gracilis*	Graceful Honeyeater		LC		
Meliphagidae	*Lichenostomus versicolor*	Varied Honeyeater		LC		
Meliphagidae	*Manorina melanocephala*	Noisy Miner		LC		
Meliphagidae	*Ramsayornis modestus*	Brown-backed Honeyeater		LC		Published & unpublished records.
Meliphagidae	*Conopophila albogularis*	Rufous-banded Honeyeater		LC		
Meliphagidae	*Myzomela obscura*	Dusky Honeyeater		LC		Wild-Net, published & unpublished records.
Meliphagidae	*Myzomela erythrocephala*	Red-headed Honeyeater		LC		Published record.
Meliphagidae	*Cissomela pectoralis*	Banded Honeyeater		LC		
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater		LC		Wild-Net, published & unpublished records.
Meliphagidae	*Philemon buceroides*	Helmeted Friarbird		LC		Wild-Net, published & unpublished records.
Meliphagidae	*Philemon argenticeps*	Silver-crowned Friarbird		LC		
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird		LC		
Meliphagidae	*Philemon citreogularis*	Little Friarbird		LC		
Meliphagidae	*Xanthotis flaviventer*	Tawny-breasted Honeyeater		LC		
Pomatostomidae	*Pomatostomus temporalis*	Grey-crowned Babbler		LC		
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		LC		Wild-Net, published & unpublished records.
Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike		LC		
Campephagidae	*Coracina lineata*	Barred Cuckoo-shrike		LC		
Campephagidae	*Coracina tenuirostris melvillensis*	(Melville) Cicadabird	M	LC		Published record.
Campephagidae	*Lalage tricolor*	White-winged Triller		LC		
Campephagidae	*Lalage leucomela*	Varied Triller		LC		Wild-Net, published & unpublished records.
Pachycephalidae	*Pachycephala melanura*	Mangrove Golden Whistler		LC		
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		LC		
Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush		LC		Wild-Net & published records.
Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird		LC		
Oriolidae	*Oriolus flavocinctus*	Yellow Oriole		LC		
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		LC		Published record.
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow		LC		Wild-Net, published & unpublished records.
Artamidae	*Artamus cinereus*	Black-faced Woodswallow		LC		
Artamidae	*Artamus minor*	Little Woodswallow		LC		
Artamidae	*Cracticus quoyi*	Black Butcherbird		LC		

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo		LC		Wild-Net, published & unpublished records.
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	M	LC		Wild-Net & published records.
Rhipiduridae	*Rhipidura phasiana*	Mangrove Grey Fantail		LC		
Rhipiduridae	*Rhipidura rufiventris*	Northern Fantail		LC		
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail		LC		
Corvidae	*Corvus orru*	Torresian Crow		LC		
Monarchidae	*Myiagra ruficollis*	Broad-billed Flycatcher		LC		
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher		LC		Wild-Net & published records.
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher	M	LC		Predicted by the EPBC Protected Matters Search Tool
Monarchidae	*Myiagra alecto*	Shining Flycatcher		LC		Published record.
Monarchidae	*Myiagra inquieta*	Restless Flycatcher		LC		
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	M	LC		
Monarchidae	*Monarcha frater*	Black-winged Monarch	M	LC		Published record.
Monarchidae	*Symposiarchus trivirgatus*[17]	Spectacled Monarch	M	LC		Wild-Net & published records.
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		LC		
Monarchidae	*Arses telescopthalmus*	Frilled Monarch		LC		
Paradisaeidae	*Phonygammus keraudrenii*	Trumpet Manucode		LC		
Paradisaeidae	*Ptiloris magnificus*	Magnificent Riflebird		LC		
Petroicidae	*Microeca flavigaster*	Lemon-bellied Flycatcher		LC		
Petroicidae	*Peneoenanthe pulverulenta*	Mangrove Robin		LC		
Petroicidae	*Drymodes superciliaris*	Northern Scrub-robin		LC		
Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola		LC		Wild-Net, published & unpublished records.
Acrocephalidae	*Acrocephalus australis*[18]	Australian Reed-Warbler	M	LC		Published record.
Megaluridae	*Megalurus timoriensis*	Tawny Grassbird		LC		Published record.
Megaluridae	*Megalurus gramineus*	Little Grassbird		LC		
Timaliidae	*Zosterops citrinella*	Pale White-eye		LC		
Timaliidae	*Zosterops lateralis*	Silvereye		LC		
Hirundinidae	*Hirundo rustica*	Barn Swallow	M	LC		Predicted by the EPBC Protected Matters Search Tool
Hirundinidae	*Hirundo neoxena*	Welcome Swallow		LC		Published & unpublished records.
Hirundinidae	*Petrochelidon ariel*	Fairy Martin		LC		
Hirundinidae	*Petrochelidon nigricans*	Tree Martin		LC		Published record.
Hirundinidae	*Cecropis daurica*[19]	Red-rumped Swallow	M	LC		

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
Turdidae	*Zoothera* sp.	thrush species		LC		
Sturnidae	*Aplornis cantoroides*	Singing Starling		LC		
Sturnidae	*Aplornis metallica*	Metallic Starling		LC		Published record.
Sturnidae	*Sturnus tristis*	Common Myna		I		
Nectariniidae	*Dicaeum geelvinkianum*	Red-capped Flowerpecker		LC		
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird		LC		Wild-Net & published records.
Nectariniidae	*Nectarinia jugularis*	Olive-backed Sunbird		LC		Wild-Net, published & unpublished records.
Estrildidae	*Poephila personata*	Masked Finch		LC		
Estrildidae	*Lonchura punctulata*	Nutmeg Mannikin		I		
Estrildidae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin		LC		Wild-Net & published records.
Passeridae	*Passer domesticus*	House Sparrow		I		
Motacillidae	*Motacilla* sp.	Yellow Wagtail species	M	LC		
MAMMALS						
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		LC		
Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot		LC		
Peramelidae	*Isoodon obesulus*	Southern Brown Bandicoot		LC		
Macropodidae	*Macropus agilis*	Agile Wallaby		LC		
Pteropodidae	*Dobsonia magna*	Bare-backed Fruit-bat		NT		
Pteropodidae	*Macroglossus minimus*	Northern Blossom-bat		LC		
Pteropodidae	*Syconycteris australis*	Common Blossom-bat		LC		
Pteropodidae	*Nyctimene cephalotes*	Torresian Tube-nosed Bat		NT		
Pteropodidae	*Nyctimene robinsoni*	Eastern Tube-nosed Bat		LC		
Pteropodidae	*Pteropus alecto*	Black Flying-fox		LC		
Pteropodidae	*Pteropus conspicillatus*	Spectacled Flying-fox	V	LC	high	Predicted by the EPBC Protected Matters Search Tool
Pteropodidae	*Pteropus macrotis*	Large-eared Flying-fox		LC		
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox		LC		Unpublished record.
Rhinolophidae	*Rhinolophus philippinensis* (large form)	Greater Large-eared Horseshoe Bat	E	E	high	
Hipposideridae	*Hipposideros ater aruensis*	(eastern) Dusky Leaf-nosed Bat		LC		
Hipposideridae	*Hipposideros cervinus*	Fawn Leaf-nosed Bat		V	high	

Family	Scientific Name[3]	Common Name	Status[4]			Badu Island
			EPBC Act	NC Act	BoT	
Hipposideridae	*Hipposideros diadema*	Diadem Leaf-nosed Bat		LC		
Emballonuridae	*Saccolaimus saccolaimus nudicluniatus*	Bare-rumped Sheathtail-bat	CE	E	high	
Emballonuridae	*Taphozous australis*	Coastal Sheathtail Bat		V	high	
Molossidae	*Chaerephon jobensis*	Northern Freetail-bat		LC		
Molossidae	*Mormopterus beccarii*	Beccari's Freetail-bat		LC		
Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary Wattled Bat		LC		
Vespertilionidae	*Miniopterus australis*	Little Bent-wing Bat		LC		
Vespertilionidae	*Miniopterus schreibersii*	Eastern Bent-wing Bat		LC		
Vespertilionidae	*Myotis macropus*	Large-footed Myotis		LC		Unpublished record.
Vespertilionidae	*Nyctophilus bifax*	Eastern Long-eared Bat		LC		Unpublished record.
Vespertilionidae	*Pipistrellus* sp.	Pipistrelle species		LC		
Muridae	*Conilurus penicillatus*	Brush-tailed Tree-rat	V	LC		Predicted by the EPBC Protected Matters Search Tool
Muridae	*Hydromys chrysogaster*	Water-rat		LC		Unpublished record. Uncertain identification.
Muridae	*Melomys burtoni*	Grassland Melomys		LC		
Muridae	*Melomys capensis*	Cape York Melomys		LC		Australian Museum record.
Muridae	*Melomys rubicola*	Bramble Cay Melomys	E	E	high	
Muridae	*Mus musculus*	House Mouse		I		
Muridae	*Pseudomys delicatulus*	Delicate Mouse		LC		
Muridae	*Rattus exulans*	Pacific Rat		I		
Muridae	*Rattus norvegicus*	Brown Rat		I		
Muridae	*Rattus rattus*	Black Rat		I		
Muridae	*Xeromys myoides*	Water Mouse	V	V	high	Predicted by the EPBC Protected Matters Search Tool
Canidae	*Canis lupus*	Dingo, Domestic Dog		I		Unpublished record.
Felidae	*Felis catus*	Cat		I		Unpublished record.
Equidae	*Equus caballus*	Horse, Brumby		I		Unpublished record.
Suidae	*Sus scrofa*	Pig		I		Unpublished record.
Bovidae	*Capra hircus*	Goat		I		Tony O'Keeffe *pers. comm*.
Cervidae	*Cervus timorensis*	Rusa Deer		I		

1. Known from Museum records, published literature (*eg* Tyler 1972; Storr 1973; Draffan *et al*. 1983; Whittier & Moeller 1993; Clarke 2004a, b; 2005, 2006; Wilson 2005; Ingram 2008), Wild-Net database and/or reports and other grey literature (*eg* Smith & Smith 2006; Borsboom 2007; Conics 2008a, b, c; 2009a, b; Schaffer 2010). These sources are not necessarily mutually exclusive and many records are un-confirmed. Some appear unreliable. Wild-Net database searches were conducted for Boigu, Saibai, Dauan, Bramble Cay, Erub, Mer, Mabuiag, Iama, Mua, Badu, Possession, Thursday, Wednesday, Friday, Horn, Hammond and Prince of Wales Islands.
2. Predicted by the EPBC Protected Matters Search Tool maintained by the Department of Sustainability, Environment, Water, Population and Communities, Canberra (DSEWPC) http://www.environment.gov.au/erin/ert/epbc/index.html. Only noted if not recorded from another source.
3. Nomenclature follows the Australian Faunal Directory maintained by DSEWPC. http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/index.html
4. Status: CE = Critically Endangered, E = Endangered, V = Vulnerable, NT = Near-Threatened, M = Migratory, LC = Least Concern (Common), I = Introduced (Exotic) under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) and/or *Nature Conservation Act* 1992 (NC Act). BoT = species listed as critical or high priority under the Back on Track species prioritisation framework. Department of Environment and Resource Management, Brisbane. http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/back_on_track_species_prioritisation_framework/index.html.
5. Also listed under the EPBC Act (ROKAMBA) as *Chaetura caudacuta*.
6. Listed under the EPBC Act (CAMBA, JAMBA) as Great Egret *Ardea alba*. Australian birds elevated to full species level as *A. modesta* (Kushlan & Hancock 2005; Christidis & Boles 2008).
7. Listed under CAMBA as *Ardeola ibis*, listed under JAMBA as *Bubulcus ibis*.
8. Listed under the Bonn Convention as Osprey *Pandion haliaetus*. Australian birds have been elevated to species level as *P. cristatus* (Wink *et al*. 2004; Christidis & Boles 2008).
9. Also listed under CAMBA and ROKAMBA as *Tringa hypoleucos*.
10. Also listed under the Bonn Convention and JAMBA as *Heteroscelus brevipes*.
11. Also listed under the Bonn Convention and JAMBA as *Heteroscelus incanus*.
12. Also listed under ROKAMBA as *Crocethia alba*.
13. Listed under the EPBC Act (CAMBA, JAMBA) as *Sterna anaethetus*.
14. Listed under the EPBC Act (Bonn Convention, CAMBA, JAMBA, ROKAMBA) as *Sterna albifrons*.
15. Listed under the EPBC Act (CAMBA) as *Sterna bengalensis*.
16. Listed under the EPBC Act (CAMBA, JAMBA, ROKAMBA) as *Cuculus saturatus*. Australian birds elevated to full species level as *A. optatus* (Christidis & Boles 2008).
17. Listed under the EPBC Act (Bonn Convention) as *Monarcha trivirgatus*.
18. Listed under the EPBC Act (Bonn Convention) as Clamorous Reed-warbler *Acrocephalus stentoreus*. Australian birds elevated to full species level as *A. australis* (Higgins *et al*. 2006b).
19. Listed under the EPBC Act (ROKAMBA) as *Hirundo daurica*.

Appendix F. Profiles of Significant Terrestrial Fauna Species Potentially occurring on Badu Island and Surrounding Islets

Fawn leaf-nosed bat *(Hipposideros cervinus)*

NC Act: Vulnerable

Fawn leaf-nosed bat is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

Fawn leaf-nosed bats occur in rainforest, gallery forest and open eucalypt forest. The species roosts in caves and mines in colonies mostly of 20 to 100 individuals and occasionally of up 900 individuals. Individuals are occasionally found roosting in buildings. Foraging occurs below the canopy and the species also forages around buildings and in open areas. Fawn leaf-nosed bats eat a variety of insects and move along well established pathways, often creeks and gullies (Churchill 2008; Pavey & Burwell 2008).

Fawn leaf-nosed bats are widespread in Malaysia, Indonesia, the Philippines, New Guinea and the western Pacific. In Australia it is restricted to Cape York Peninsula, north of Coen (Churchill 2008; Pavey & Burwell 2008). In the Torres Strait the fawn leaf-nosed bat is known from Thursday Island (Wild-Net database record) and there is a Queensland Museum record (reported in Conics 2008b) and four Wild-Net records (DERM 2010f) for Mua Island. The species is not known from Badu Island but may occur in forests and woodlands, particularly along creeks with intact riparian vegetation.

Fawn leaf-nosed bats are threatened by roost destruction. It is believed that roost disturbance, habitat alteration and predation by cats also threaten this species (DERM 2011b). These threats would be relevant on Badu Island should the species be present.

Coastal sheathtail bat (*Taphozous australis*)

NC Act: Vulnerable

The coastal sheathtail bat is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The coastal sheathtail bat is seldom found more than a few kilometres from the ocean, where it roosts in sea caves, rock fissures, boulder piles and, occasionally, in buildings (Churchill 2008; Richards 2008). Colonies are usually of two to 25 individuals, though up to 100 have been recorded. The species is often found on islands and will forage on nearby mainland (Churchill 2008). Foraging occurs in a wide range of habitats, including open eucalypt forest, coastal heathlands, grasslands, sand dune scrub, monsoon forests and mangroves (Duncan *et al*. 1999; Churchill 2008). Little is known of its breeding biology but most births probably occur from September to November (Churchill 2008; Richards 2008).

The coastal Sheathtail Bat occurs from Shoalwater Bay on the central Queensland coast north to Torres Strait and extralimitally in New Guinea (Duncan *et al*. 1999; Churchill 2008). In the Torres Strait there are 15 Australian Museum specimens from Possession Island (OZCAM 2011), two Wild-Net records (DERM 2010f) and Queensland Museum specimen (reported in Conics 2008b) from Mua Island, and observations and Anabat recordings from Pulu (Watson 2009, Hitchcock *et al.* 2009). The proximity of Badu and Mua Islands means that individuals would move between the islands even if there were no suitable roost sites on Badu Island. It is expected, however, that roosts will be located if searches are conducted.

Major threats to the species probably include loss of foraging habitat from coastal development and roost disturbance, particularly in the southern part of their range (Duncan *et al*. 1999). On Badu Island the coastal Sheathtail Bat would be threatened by disturbance to any roosts and maternity sites and by loss of foraging habitat including mangroves, forest, woodland and shrubland.

Bare-backed fruit-bat (*Dobsonia magna*)

NC Act: Near-Threatened (listed as *D. moluccensis*)

The bare-backed fruit-bat is found in rainforest, gallery forest and woodlands and occurs in New Guinea and associated islands and south to Cooktown on Cape York Peninsula (Churchill 2008; Hall 2008). Churchill (2008) states that the species is found in the Torres Strait, without further detail. Duncan *et al*. (1999) reports the species for Mua Island and Ingram (2008) and Conics (2008b) both report Wild-Net records for the island. Given the proximity of Mua Island to Badu Island then the species is expected to occur, even if only as a foraging visitor.

The bare-backed fruit-bat is the only species of mega-bat in Australia known to regularly roost in caves (Hall 2008). The species also roosts in boulder piles, disused mines, abandoned buildings, dark rainforest thickets and large tree hollows. Colonies are usually 100 individuals or less. The species feeds on fruits and blossom. A single young is born between September and November (Churchill 2008; Hall 2008).

The species is eaten by humans in New Guinea but this is not reported for Australia (Hall 2008). Duncan *et al*. (1999) state that no large scale decline has been observed in Australia, although shooting has caused small losses of numbers and the species has been regularly killed on barbed wire. There has been some loss of habitat through clearing and the species may be threatened by changes to vegetation through historical changes to fire regime. On Badu Island the species is most likely to be threatened by disturbance at roost sites, should they exist.

Torresian tube-nosed bat (*Nyctimene cephalotes*)

NC Act: Near-Threatened

In Australia the Torresian tube-nosed bat is known only from three specimens from Mua Island. Another tube-nosed bat of uncertain identification, possibly *N. cephalotes*, has been collected from central eastern Cape York (Duncan *et al*. 1999). Churchill (2008) considers these records from Torres

Strait and Cape York dubious and questions both the taxonomy and identification of species within the genus. The Torresian tube-nosed bat is widespread in New Guinea and specimens are known from the coast immediately adjacent to Torres Strait (Duncan *et al*. 1999).The specimens from Mua were caught on the edge of rainforest and open grassy woodland, and the species is found in lowland rainforest in Papua New Guinea (Bonaccorso 1999). It may also inhabit mangroves as there are records from south coastal New Guinea (Duncan *et al*. 1999). There is no record of any species of tube-nosed bat for Mabuiag Island but the species could possibly occur in closed and open forest on the island. No threat is known at present, but removal of rainforest or mangrove habitat would pose a serious threat if the Australian distribution of this species were limited to Torres Strait and Cape York Peninsula (Duncan *et al*. 1999).

Water mouse *(Xeromys myoides)*

EPBC Act: Vulnerable. **NC Act:** Vulnerable

Water mouse is also considered of 'High' priority under the Back on Track species prioritisation framework (DERM 2011a).

The water mouse (also known as the False Water-rat) is nocturnal and lives in mangroves, saltmarsh, sedges, lakes, near foredunes and coastal freshwater swamps. It is a capable swimmer but prefers to follow the receding tide to forage for crustaceans, molluscs and flatworms. During the day, or when foraging areas are inundated the water mouse shelters in a nest, termitarium-like mounds up to 60 cm high, in tunnels in natural and human-made banks, and in mud structure associated with hollow tree trunks. The nests, regardless of type or structure, primarily serve as diurnal refuges and reproductive sites. Nests often occupy naturally elevated ground and utilise the bases of fallen trees or logs for support of the nest structure (Van Dyck 1996; Gynther & Janetzki 2008).

The water mouse is patchily distributed in the Northern Territory, and from the Gold Coast to Proserpine in Queensland (Menkhorst & Knight 2004). The species has been recorded from New Guinea (Hitchcock 1998). It is not likely to occur on Mabuiag Island but its occurrence should be considered a possibility until a reasonable level of targeted survey work is conducted.

The species is threatened by swamp and mangrove reclamation, feral predators, changes to water tables, offshore pollution, the spread of weeds and the impacts of grazing (Woinarski 2007; Gynther & Janetzki 2008). On Mabuiag the species would be dependent on mangroves and would be threatened if mangrove habitat was destroyed.

Slender chained gecko (*Lepidodactylus pumilus*)

NC Act: Near-Threatened

The slender chained gecko is found in southern New Guinea, the Torres Strait and the tip of Cape York (Covacevich *et al*. 1982; Ehmann 1992). In the Torres Strait there is a Wild-Net database record from Mer Island (DERM 2010d), and a Queensland Museum specimen (reported in Conics 2008b) and a record by Ingram (2008) from Mua Island. There are also Australian Museum specimens from

Saibai, Masig, Murray, Hammond and Prince of Wales Islands (OZCAM 2011) and it is likely the species occurs more widely through the region than is yet documented.

The species is arboreal and occurs in open and closed forests and coastal habitats (Ehmann 1992; Wilson & Swan 20010) and in human dwellings (Wilson 2005). It is likely to occur on Mabuiag Island in habitats other than grasslands and on coastal dunes.

Threats to the species are unknown. Ehmann (1992) states the species is common and secure. However, the species is not known from any national park or other reserve affording protection (Covacevich *et al*. 1982). The slender chained gecko may be threatened by loss of habitat due to clearing and/or rising sea levels and storm surges as a result of climate change and by competition with Asian House Gecko (*Hemidactylus frenatus)*, in both natural habitats and on buildings (Case 1994; Buden 2007; Hoskin 2010). Asian house gecko is present on Mabuiag Island but is unlikely to pose a threat to any possible population of slender chained gecko unless the introduced species spreads into natural habitats.

Littoral Whiptail-Skink (*Emoia atrocostata*)

NC Act: Near-Threatened

The littoral whiptail-skink is found on rocky shores and in foreshore vegetation, including mangrove forests. It shelters in rock recesses and crevices, in tree root crevices and in logs. It readily swims in tidal pools and can remain submerged for short periods (Heatwole 1975; Ehmann 1992). Cogger (2000) states that the species also occurs in lowland forests, coastal scrubs and grasslands near beaches but Hediger (1933-34 in Heatwole 1975) states that it is never found more than 100 m from the sea.

The littoral whiptail-skink is widespread from Japan, through south-east Asia and into the south-west Pacific. It is found on the tip of Cape York Peninsula and islands of the Torres Strait (Ehmann 1992; Wilson 2005). Cogger (2000) considers its distribution poorly known and despite references to its occurrence on Torres Strait Islands there is no available record for any island except Boigu Island (Wilson 2005; Schaffer 2010). Ingram (2008) refers to a Wild-Net record from Mua but the species was not returned by a search of the database in 2010 (DERM 2010f) and the validity of the record is uncertain. It is a common mangrove species in some areas and is especially abundant on rocky foreshores (Cogger 2000). *Emoia* species are efficient rafters and colonise islands on floating debris (Wilson 2005) and it is likely to occur on Torres Strait Islands other than Boigu. If not already present on Mabuiag Island there is an on-going likelihood of colonisation.

Threats are unknown, however small reptiles, including littoral whiptail-skink, are eaten by cats (*Felis catus)* on Christmas Island. However, the species made up a very small percentage of known prey (Tidemann *et al.* 1994), possibly due to cats spending little time foraging in foreshore habitats. The littoral whiptail-skink would be threatened by any loss of mangroves due to clearing or storm damage.

Jardine River Turtle (*Emydura subglobosa)*

NC Act: Near-Threatened

The Jardine River turtle is found in watercourses and lagoons across northern Australia, from Cape York Peninsula to the north-eastern Kimberleys of Western Australia. The species is also widespread in New Guinea (Ehmann 1992; Wilson & Swan 2010) where it is mostly found in forest sinkholes and swamps (Georges *et al*. 2008). The species is omnivorous, eating molluscs, snails, fruit and other vegetable matter (Wilson & Swan 2010). In New Guinea it nests from September to February (Ehmann 1992), burying its eggs in the forest floor, often at the base of trees (Georges *et al*. 2008).

Freshwater turtles are threatened by habitat destruction by feral pigs (Doupé *et al*. 2008), predation by feral predators (Ehmann 1992), illegal collection and modification and pollution of habitat (Cogger *et al*. 1993). In New Guinea the Jardine River turtle is also hunted for food (Georges *et al*. 2008). Should the species be present on Badu Island it would be threatened by pigs and possibly hunting.

Sooty oystercatcher (*Haematopus fuliginosus*)

NC Act: Near-Threatened

The sooty oystercatcher is restricted to marine coastal habitats, with a preference for rocky headlands and ledges, coral reefs, and sandy beaches near intertidal mudflats and rocky areas, usually within 50 m of the shore line (Blakers *et al*. 1984; Marchant & Higgins 1993). They forage around exposed rocks at low tide for molluscs, crustaceans, other invertebrates and small fish. The species is resident, maintaining territories all year round (Marchant & Higgins 1993).

Sooty oystercatchers are endemic to Australia, not extending north to New Guinea despite records from the Torres Strait. The species breeds in all Australian states and is most common in south-eastern Australia (Pringle 1987; Marchant & Higgins 1993). Draffan *et al*. (1983) reports the species from Poruma (Coconut), Channel Rock, Twin and Saddle Islands and considered it a non-breeding visitor to Torres Strait. There is also an unconfirmed record from Iama (Conics 2008a). The sooty oystercatcher can be inconspicuous on rocky shores and if present only sporadically may be under-recorded in the area due to a lack of consistent survey effort. Breeding occurs mainly October to January and may begin as early as June in the tropics (Pringle 1987; Marchant & Higgins 1993). They often roost and breed on offshore islands, nesting in shallow depressions on a range of substrates including sand, gravel, coral rubble and rocks in quiet, isolated spots above the high-tide mark (Marchant & Higgins 1993). On light coloured beaches sooty oystercatchers place eggs in low visibility nest sites next to and under vegetation (Lauro & Nol 1995).

The species is threatened by human disturbance and damage to feeding, nesting and roosting areas and from predation by feral animals such as dogs (*Canis lupus)* and cats (*Felis catus)* (NSW NPWS 2002). These threats would be relevant to the species if it occurs on Badu Island.

Appendix G. Information on Migratory Fauna Species Potentially occurring on Badu Island and Surrounding Islets

Waders

Life history: Waders listed as Migratory under the EPBC Act that have been recorded in the Torres Strait include plovers, sandpipers and oriental pratincole. Sandpipers are known by a number of common names including snipe, godwit, curlew, tattler, knot and stint. The majority of the waders recorded occur in coastal areas, particularly in the intertidal zone, on mudflats, sandflats, beaches, saltmarsh, coastal lagoons and mangroves. Some also forage and/or roost on rocky shores. Many of these species are also found on freshwater and artificial waterbodies such as rivers, streams, swamps, dams and sewage ponds. Two species are unlikely to be found in the intertidal zone, oriental pratincole and wood sandpiper. Oriental pratincole is largely restricted to grasslands and other open areas and wood sandpiper occurs on freshwater waterbodies (Pringle 1987). None of these wader species breed in Australia but individuals of some species, especially large sandpipers such as eastern curlew and bar-tailed godwit, may be present year-round.

Flat tidal shores with extensive muddy intertidal areas support the most species and individuals, though some waders feed in mangroves forests at low tide (Lane 1987). The coastal species have a life cycle driven largely by the tidal cycle, roosting in mixed species flocks above the high water mark at high tide and moving to feeding areas as the tide recedes. Most of these species are gregarious, wary and fly strongly and swiftly (Pringle 1987; Geering *et al*. 2007). Smaller species, such as red-necked stint and curlew sandpiper, feed for longer each tide cycle than do larger species and may continue to feed in non-tidal areas during high tide (Lane 1987).

Other than double-banded plover, which breeds in New Zealand, all the migratory waders breed in the northern hemisphere during the Australian winter. Migration to Australia after breeding starts in mid-July and finishes by December. Birds begin returning to breeding grounds as early as mid-February, though most birds leave in mid-March (Lane 1987).

Threats: Although none of the species breed in Australia they are susceptible to loss of foraging and roosting habitat and to disturbance when foraging or roosting by human activities and feral and domestic animals. Such disturbance may limit their ability to undertake long migration flights through depletion of their energy reserves. Pollution may also affect the intertidal invertebrate species on which so many migratory waders depend (Lane 1987). There appears to be little freshwater habitat on Mabuiag Island and threats to waders appear limited to disturbance on mudflats, beaches and around mangroves. This will be most relevant prior to return passage in autumn.

Terns

Life history*:* Terns, with gulls, belong to the family Laridae. The terns include the noddies, a group of largely tropical pelagic species. Four migratory tern and one noddy species have been recorded from Mabuiag Island, though other species are also expected to occur.

Many tern species are cosmopolitan, with very large distributions. Most species are coastal, found in a variety of habitats, including open beaches, lagoons, estuaries, river mouths, lakes, bays, harbours and inlets. Some species do also occur on inland freshwater habitats and others are largely restricted to pelagic waters. Fish is the major food item but crustaceans and insects are also taken by some and those species that feed in freshwater may also eat reptiles, frogs and small mammals. Most terns are gregarious when feeding and are colonial nesters, with most of the species that breed in Australia simply laying their eggs in shallow depressions, though noddies will nest in trees (Pringle 1987; Higgins & Davies 1996).

Threats: Ground-nesting makes many species susceptible to loss of eggs and chicks through native and feral predators and adverse weather conditions. Colonies can be threatened by human disturbance and birds are affected by degradation of feeding areas, pesticide residues in fish, and oil-fouling, both of birds and beaches. Birds occasionally are tangled in fishing nets (Blakers et al. 1984; Higgins & Davies 1996; Garnett & Crowley 2000). There is likely to be little, if any, breeding by terns on Mabuiag Island. Threats appear to be minimal.

Herons and Egrets

Life history: The family Ardeidae includes herons, egrets and bitterns and all species are characterised by long necks and legs and long sharp bills. Although there is variation, most species forage in shallow water and eat fish, crustaceans, frogs, insects and other small animals (McKilligan 2005). Three species listed as Migratory occur in the Torres Strait; eastern great egret, cattle egret and eastern reef egret.

Eastern great egrets are generally associated with shallow water, both freshwater and saline, but also occur in dry habitats. The species occurs on coastal and inland habitats, including rivers, estuaries, tidal mudflats, swamps, man-made dams and ponds, sewage farms and wet pasture. Eastern Great Egrets eat mainly fish but also small vertebrates such as frogs and aquatic insects (Pringle 1985; Marchant & Higgins 1990; McKilligan 2005). The cattle egret inhabits grasslands, wetlands and wooded lands, often foraging away from water in grassland, pasture and crops. The species is strongly associated with grazing animals in Australia, but also forages at garbage tips, follows machinery, and feeds independently. Cattle egrets feed on invertebrates, especially grasshoppers, and small vertebrates such as frogs, reptiles and mammals (Pringle 1985; Marchant & Higgins 1990). Eastern reef egret is found on coastlines, foraging on rocky and muddy shores. The species eats mostly fish, but also crustaceans, molluscs, bird chicks and turtle hatchlings (McKilligan 2005).

Eastern great egret is common and widespread in Australia even in some arid areas. The cattle egret occurs in all Australian states and mainland territories. Eastern reef egret occurs along most of the Australian coastline. All three species extend through the Torres Strait into south-east Asia. The cattle egret has a limited distribution in the Torres Strait but has been undergoing a global expansion of range (Pringle 1985; Marchant &Higgins 1990; McKilligan 2005). It may become more widespread and common in the Torres Strait if there are changes to land use which favour the species.

Threats: The eastern great egret is threatened by destruction and modification of freshwater habitats by drainage and groundwater extraction, clearing, livestock, burning, increased salinity and weed invasions (Marchant & Higgins 1990). The most important issue is the allocation of water from regulated rivers in sufficient quantity and with appropriate timing to maintain suitable wetland conditions (Maddock 2000). The cattle egret is also threatened by loss of breeding habitat through drainage of wetlands and river regulation and water harvesting that prevent or limit flooding of temporary wetlands. Nestlings may be susceptible to predation by cats (DSEWPC 2011b). Eastern Reef Egrets can be disturbed by human activity near nest sites and are threatened by reclamation of tidal areas and deepening of channels. However, the species often tolerates human presence and roosts, and sometimes breeds, on artificial structures (Marchant & Higgins 1990).

Neither eastern great nor cattle egret is likely to breed on Mabuiag Island and threats appear minimal. Eastern reef egret may breed and would be susceptible to disturbance at its nest. The level of threat is likely to be minor.

Swifts

Life history: In Australia the white-throated needletail and fork-tailed swift are almost completely aerial species, possibly even sleeping on the wing. These species are sometimes found roosting in trees and may on rare occasions rest in trees and on the ground during the day. They are found over a wide variety of habitat, including forest, open areas, modified land and the ocean. Foraging for aerial invertebrates occurs at heights from less than one metre up to more than 1000 metres (Higgins 1999).

Both species breed in Asia and arrive in Australia in September/October and leave by April. Some birds may over-winter. White-throated needletail is widespread in eastern and south-eastern Australia and fork-tailed swift is widespread throughout Australia (Higgins 1999). The total population of white-throated needletail is unknown but it is described as abundant in some regions of Australia (Chantler 1999). A comparison of Birds Australia atlas data between 1977–81 and 1998–2002 indicates that the species has undergone a decline in both its area of occupancy and extent of occurrence in Australia (Blakers et al. 1984; Barrett et al. 2003). Worldwide the fork-tailed swift is thought to have a stable population with no evidence for any declines or substantial threats (BirdLife International 2011).

Threats: Both species are occasionally killed by collision with man-made structures, and fork-tailed swifts are occasionally killed by cats (Higgins 1999), but there is no apparent major threat to either species overall, either in Australia or elsewhere (DSEWPC 2011a, f). A potential threat is a reduction in prey due to loss of habitat (Low 1995; DSEWPC 2011a). Neither species would be subject to any significant level of threat on Mabuiag Island.

Raptors

Life history: The family Accipitridae includes a very large number of species with an enormous variety of body sizes, prey species and habitat use. The two Migratory raptors, eastern osprey and white-bellied sea-eagle, are, however, very similar in much of their life history. Both species occur

along the entire Australian coastline and extend far inland, typically along major rivers or on large lakes and reservoirs. Eastern osprey feeds on fish but the white-bellied sea-eagle also eats mammals, birds, reptiles and carrion. Both species will nest on cliffs and in large trees but Eastern Osprey also nest on artificial structures such as power poles and towers (Debus 1998; NSW NPWS 2002). Established breeding pairs are mostly sedentary although there is evidence that territorial adults move long distances. Inland territorial birds are probably more dispersive than those on the coast and may move as waters disappear (Debus 1998).

Threats: The eastern osprey population in Australia has decreased since European settlement but has been recovering in recent years (Olsen 1998). They are threatened by loss of existing and suitable replacement breeding trees, disturbance at the nest site, reduction in quality and quantity of fish stocks, collision with or electrocution by power lines, and the use of pesticides (NSW NPWS 2002). The white-bellied sea-eagle is threatened by clearing of forests and the consequent loss of optimal breeding sites (Marchant & Higgins 1993) and disturbance at nest sites (Debus 1998). There is no record of eastern osprey for Mabuiag Island but it is expected to occur. Neither species is likely to be threatened by current land use practices on Mabuiag Island.

Glossy Ibis (*Plegadis falcinellus*)

The glossy ibis is usually seen as single individuals or small groups. It feeds on aquatic invertebrates and occurs in terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; Marchant & Higgins 1990). The species is widespread, occurring in Europe, Africa, Asia and North America. It occurs in much of Australia but is more widespread in the wetter northern and eastern areas. Glossy Ibis breeds in dense colonies, often with other species of ibis and waterbirds (Marchant & Higgins 1990).

Threats: The species is generally uncommon and erratic in occurrence (Pringle 1985) and is threatened by destruction or modification of wetlands, invasion of wetlands by weeds and predation of breeding birds (Marchant & Higgins 1990). Occurrence on Mabuiag Island is unlikely and threats would be minimal should it occur.

Oriental Cuckoo (*Cuculus optatus*)

The oriental cuckoo breeds in northern Asia with birds spending the non-breeding season in south-east Asia, New Guinea, the Solomons and Australia. The species mostly occurs on the northern and eastern coasts of Australia, between September and April. Most birds do not arrive in Australia until December. Oriental cuckoos occur in rainforest, vine thicket and open forest and woodland. The species is sometimes found in mangroves and is often recorded in gardens and plantations. It feeds on invertebrates, particularly caterpillars (Blakers et al. 1984; Higgins 1999).

Threats: The species is sometimes killed by cats and by collisions with windows and lighthouses (Higgins 1999). Oriental cuckoo is likely to be a sporadic, possibly annual, visitor to Mabuiag Island, in almost any habitat other than grasslands, but threats would be minimal.

Rainbow Bee-eater (*Merops ornatus*)

The rainbow bee-eater occurs in almost any habitat. The species eats insects, preferring bees and wasps, which are mostly caught in the air, and will also take food from the ground or vegetation and occasionally water. It is widespread in Australia, New Guinea, Indonesia and Micronesia. In northern Australia populations are present in coastal or sub-coastal areas where they breed in the riparian areas and move into more open habitat after the breeding season. Breeding may take place individually or in colonies, nesting in burrows in soft sand or soil (Higgins 1999; Boland 2004a).

Threats: The species appears little threatened, although cane toads *Rhinella marina* have been found to prey on the eggs and nestlings (Boland 2004b). Rainbow bee-eater could occur in, or over, all habitats on Mabuiag Island. Cane toads are not reported for the island and threats to rainbow bee-eater would be minimal.

Passerines

Ten species of migratory passerine are known from the Torres Strait. These species may be split into two broad groups, species that occur mostly in wooded habitats and those that occur mostly in open habitats. Members of these pairings may not be particularly closely related.

Wooded habitat species

Life history: Six of the 'Migratory' passerine species that occur in Torres Strait occur mostly in wooded habitats. All of these birds, (Melville) cicadabird (subspecies melvillensis), rufous Fantail, satin flycatcher, black-faced, black-winged and spectacled monarchs, occur in rainforest, melaleuca woodlands, mangroves and occasionally open forests, except for satin flycatcher, which typically avoids closed forest. All the species are insectivorous, though the cicadabird may also eat some fruit and seeds. All breed in Australia and, except for black-winged monarch; all are at least partly resident in Australia. Some individuals of black-winged monarch may also be present year-round (Higgins et al. 2006a).

Threats: Threats include the loss and fragmentation of habitat, especially along the migratory routes, and predation of eggs and young by the black rat (*rattus rattus*) (Higgins et al. 2006a). All six species do or could occur on Mabuiag Island and would use a majority of the habitats present. Breeding by any species would be limited, if any breeding occurs, and black rat has not been reported. Threats would appear to be limited to habitat loss should land use practices change.

Open habitat species

Life history: Four of the 'Migratory' passerine species that occur in Torres Strait occur mostly in open habitats. Reed-warblers in Australia were previously thought to be a subspecies of the Migratory clamorous reed-warbler (*Acrocephalus stentoreus)*. They are now considered a full species, Australian reed-warbler (*A. australis*), and all movements are thought to occur within Australia. Australian reed-warblers typically occur in reeds and other dense vegetation in and adjacent to a

variety of wetland types. They feed on insects and spiders. The species is not known to breed in the Torres Strait (Higgins *et al.* 2006b).

Barn and red-rumped swallows are both widespread species, particularly in the northern hemisphere, and neither breeds in Australia. Barn swallow is an annual visitor to northern Australia in small numbers but red-rumped swallow may not be present every year. Both species feed in open areas, particularly over wetlands, cane fields and sporting fields and often perch on overheard wires.

Yellow wagtail is listed under the EPBC Act as (*Motacilla flava* s. lat.). The birds that occur in Australia are now treated as full species, eastern yellow wagtail (*M. tschutschensis*) and green-headed yellow wagtail (*M. taivana)* (Christidis & Boles 2008). They were previously regarded as subspecies of *M. flava*, which is no longer considered to occur in Australia. The occurrence of yellow wagtails in the Torres Strait appears unconfirmed but yellow wagtails have been reported for Boigu, Thursday and Horn Islands (Baxter 2010) and are likely to occur as irregular visitors on many of the Torres Strait Islands.

Yellow wagtails occur in open areas with low vegetation, especially in cultivation and on lawns, sporting fields and air fields. They are often recorded near water. Yellow wagtails are probably regular wet season non-breeding visitors to north Queensland. Diet consists mainly of invertebrates, taken mostly from the ground and occasionally from the air (Higgins *et al.* 2006b).

Threats: The major threat to Australian reed-warbler is loss of habitat due to coastal development in natural habitat areas (Higgins *et al*. 2006b). Barn and red-rumped swallows appear to be increasing in numbers in Australia, though this may be due to an increase in observers. Neither species appears subject to any particular threat in Australia. Threats to yellow wagtail in Australia are unknown. None of these species is known from Badu Island and should they occur threats would be minimal. Other than Australian reed-warbler, increased clearing of wooded areas would actually benefit the species.