



TIWI ISLANDS REGIONAL NATURAL RESOURCE MANAGEMENT STRATEGY



TIWI LAND COUNCIL 2003



This Strategy was ratified at a full sitting of the Tiwi Land Council at Milikapiti on the 29th of September 2003.

Dedicated to the late Keith (Jacko) Miller and Kelvin Brown; two extraordinary young men who put so much into Tiwi Land Management. Hopefully it can provide a vehicle for others like them.

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However, the aspirations embedded in this document are a reflection of the unified Tiwi desire to secure authority over all aspects of our lives.

Valuable assistance and advice during preparation was also received from John Hicks (Tiwi Land Council Executive Secretary). The accompanying Map Atlas was prepared by Brian Lynch (Spoonbill Geographics).

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FOREWORD

Looking back in Tiwi history and looking forward into the Tiwi future there is one thing that does not change. It is our land.

How we use the land does change – why we use the land does not change.

Always we use it to support the lives of our people. Once it was only the fruits of the ground and the trees and the animals that live throughout the land and along the beaches. We still use the land in this way, but not as much as we did in the past.

Now we need to use the land in other ways to support our people. For jobs and income to benefit our new generation of Tiwi.

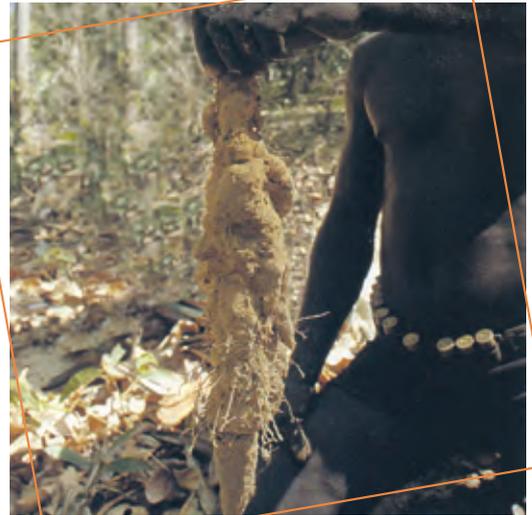
It is not enough to hope that the land will look after itself. Using the land for jobs and our own economy requires us to manage the land properly. We must bring together our knowledge of the past with the new scientific information about the land. Why the soils behave like they do; how the water reserves work; the way the animals and plants work together to keep the land healthy; the impact of fire and erosion and foreign weeds and pests.

Just as Tiwi traditional owners understood and cared for our land when we used it for the traditions in the past, the new generations of Tiwi land managers need to understand and care for it now and into the future.

Our ceremonies of reliance on the land now include reliance on new information. This Strategy is part of the new information story. It is the story of our communities and new industry that uses our land; it is the story of why our land is so precious; of the information we must have to keep it healthy; and the new ways we must develop to care for it.

The land information story is both an old story and a new story. Most of all it is an important story affecting all our lives.

Frederick Mungatopi
Chairman
30 September 2003



EXECUTIVE SUMMARY

The Tiwi Islands logically form a discrete region for natural resource planning and management, from both social and biophysical perspectives.

There has been an unbroken history of occupation and ownership of the Tiwi Islands by Tiwi people, and the current population in the region is over 90% Tiwi. Historically, family or clan groups met continually for ceremony and to determine unified joint responses to external threats. The Tiwi were noted for their unification, which is reflected in the translation of 'Tiwi' as 'we, the only people'. There is no question that the permanent residents consider the Tiwi Islands a distinct region, and they have strived over a number of years for a system of governance that provides true regional authority over all aspects of their lives.

Separated from the mainland by a sea barrier, the two main Islands of Melville (5,788 km²) and Bathurst (1,693 km²) are large enough to develop a distinct regional weather pattern within the tropical monsoonal zone. In terms of total rainfall, the region has the highest in the Northern Territory.

The underlying geology is also unique to the region, with the large extent van Diemen sandstone providing high water storage capacity, numerous freshwater springs and very high quality water.

Although the Tiwi Islands support a distinctive biota, many of the species and environments also occur on the mainland. 'Tiwi-Coburg' is a nationally recognised bioregion that comprises the Tiwi Islands, Croker Island and Coburg Peninsula. The Tiwi Islands do, however, contain a number of species that are endemic, and are regarded as having great importance for biodiversity conservation.

The importance of place values to residents of the region cannot be overstressed: *the ownership, allocation and expression of land and natural resources provides the definition of who a person is, and where they fit within society.*

Additionally, the region provides traditional values through the use and associations of plants and animals, and economic values through rich food resources, particularly within the marine and coastal environment.

The region is also recognised as having economic potential in terms of enterprise development. This is supported by Tiwi leaders who have identified an urgent need for the creation of an independent Tiwi economy not reliant on destructive welfare influences. To date two enterprises being pursued to achieve such independence are plantation forestry and sea cage aquaculture. Identification of other sustainable industries is one of the underlying thrusts of this Strategy. The other is the long term protection of natural resource and cultural values.

Sixteen key issues have been identified for the protection of natural resource and cultural values. These fall broadly under headings of Planning and Regional Management, Managing the Risks, and Capacity Building.

Issues associated with planning and regional management have been identified as:

- Information: availability, management and ownership.
- Areas of high value to Tiwi people, and areas of shared value.
- Biodiversity.
- Freshwater resources.
- Coastal management.
- Economic resources.

Issues associated with managing risk include:

- Communities and outstations.
- Construction and infrastructure.
- Economic development.
- Weeds.
- Feral animals.
- Land clearing.
- Soil erosion.
- Fire.

Capacity building issues involve:

- Creating and building local capacity to manage natural resource issues.

Each of the sixteen issues are discussed separately in the Strategy, and addressed through the identification of a range of desired outcomes and



objectives. Linkages are also provided between the objectives in the Strategy and the nine key areas identified for natural resource management in the Tiwi Land Council Environmental Policy.

One hundred and five recommended actions have been identified to achieve the outcomes and objectives of the Strategy. Each has been allocated a responsible body for implementation along with potential partner organisations, an estimated funding requirement and a key performance indicator. For the purposes of implementation they have been placed under the categories of:

- Institutional processes;
- Processes that develop local capacity;
- Research;
- Regional planning processes;
- Processes that protect and restore regional natural resource values, and
- Processes that protect and restore local natural resource values.

The proposed timeframe for implementation has been staged depending on the urgency of the existing or potential threat to natural resource values, and the contribution to strategic outcomes:

Current – action is already being carried out, and should continue;

Immediate priority – action within the next 12 to 18 months;

High priority – action within the next 3 years;

Moderate priority – action within the next 5 years.

Ongoing monitoring, amendment and review is crucial to Strategy implementation, and will be achieved through assessment against the key performance indicators. Three formal review processes have also been proposed that complement the implementation timeframe:

- Review activity 1 carried out 12 to 18 months after Strategy implementation –focus on performance to date and re-evaluating time-lines and resourcing.
- Review activity 2 carried out after three years – assessment of whether the actions are meeting the objectives and outcomes, and updating the recommended actions where required.

- Review activity 3 carried out after five years – a review and update of the Strategy to ensure that the objectives remain valid.

Due to the identification of a number of agencies and organisations with a role in natural resource management in the region, monitoring and review will be a consultative process, and recommendations for change will be considered from all stakeholders.

Overall Strategy implementation will be guided by the principles of:

- Coordinated and cooperative planning;
- Recognition of majority stakeholders;
- Achievement of economic, social and environmental outcomes;
- Full utilisation of existing structures and procedures;
- Oversight at the regional level; and
- Responsive monitoring and review.



Keith (Jacko) Miller





INTRODUCTION



INTRODUCTION

The Tiwi Land Council is pleased to present the Tiwi Islands Regional Natural Resource Management Strategy. While the Strategy has been developed over three years of consultation between Tiwi organisations, members of Tiwi communities, industry and government, the underlying tenets of regional management have always been integral to Tiwi decision making.

There has been an unbroken history of occupation and ownership of the Tiwi Islands by Tiwi people for thousands of years. Traditionally, the natural resources of the region were used for food, shelter, medicine, weapons, tools and spiritual purposes. From the late 1800's the natural resources were seen as a source of wealth by outside developers, culminating in the 1960's and 1970's with Melville Island being selected as the focus for a major plantation forestry industry for the Northern Territory.

In later years Tiwi leaders identified the urgency of developing an independent economy as a viable means of improving social outcomes through business and employment opportunities, especially for youth. The greatest assets of the Tiwi Islands are their natural resources and the people, and natural resource utilisation has been identified as a key area for economic development. It is also an area with high potential for providing long-term employment and training opportunities that are attractive to Tiwi residents.

The Tiwi Islands have also been recognised for their high contemporary conservation values, and the challenge is to consider the interests of non-residents while acknowledging that it is those who rely on the region for their daily living that will be most affected by natural resource management actions both now and into the future.

In response to the different interests within the region, this Strategy has been prepared on the principle of sustainable development. Together with the Tiwi Geographic Information System, it compiles and presents baseline information, identifies and defines regional values, and identifies and prioritises issues that need to be addressed. It also recommends activities that need to be carried out in order to protect and manage environmental values.

Ultimately, however, the underlying purpose of the Strategy is to support the lives of the permanent residents of the Tiwi Islands.

The document itself grew from recognition by the Tiwi Land Council that a strategic approach to natural resource management was a prerequisite for progressing sustainable industries with minimal adverse environmental impact. In 2001 Land Council Managers developed an Environmental Policy that identified a vision for natural resource management within the region, and nine key areas for natural resource management.

This Strategy is the next step to implementing the Environmental Policy. It aims to bring together all natural resource management projects already completed or underway, and to provide a template for long term planning and decision making. It will also embed the responsibility for informed natural resource management in Tiwi leaders.

This is the first regional natural resource management strategy for the Tiwi Islands. Contemporary regional natural resource planning and management is an evolutionary process, and monitoring, amendment and review are an integral part of strategic implementation. Since the Strategy recommends direction for government, industry, communities and other land users, the review process will be consultative, and recommendations for change will be considered from all stakeholders.

It is also the intention of the Land Council to circulate the Strategy widely among communities, government and industry. In this way it can be consulted when resource use proposals are being developed to ensure that they conform to the desired outcomes of the major stakeholders.

The authority for strategic natural resource planning and management is vested in the Tiwi Land Council under the *Aboriginal Land Rights (Northern Territory) Act 1976*, primarily to faithfully and responsibly represent the interests of their people in respect to the management of, and their various interests in, land. This has increasingly expanded to include carrying out specific actions that address natural resource management issues, a trend that is expected to continue into the future.



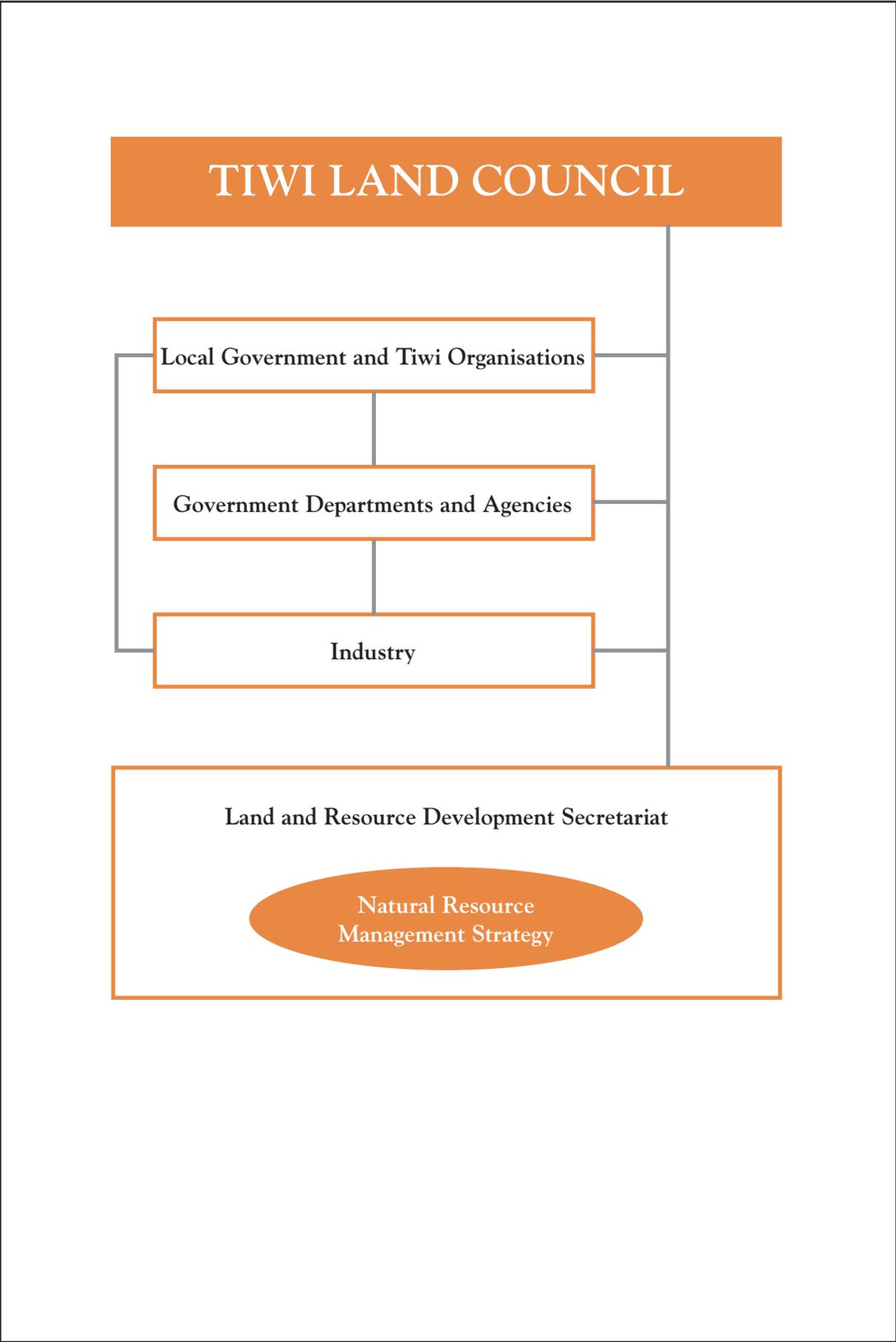


Figure 1: Relationships between organisations that affect natural resource management on the Tiwi Islands.





REGIONAL PROFILE



Definition of the Region

The Tiwi Islands are located between latitudes 11° and 12° South and longitudes 130° and 131°40' East. They are approximately 60km north of Darwin, and 20km north of the Australian mainland at the closest point across Clarence Strait.

Bathurst and Melville are the main islands in the group, with several much smaller islands close to the coastline. Melville Island is the second largest island off the Australian mainland at 5,788km², and Bathurst the fifth largest at 1,693km² (Woinarski *et al.* 2003). The two islands are separated by Apsley Strait, which is approximately 70km long, and ranges from approximately 600m to 6km in width.

History

At the end of the last ice age, between 18,000 and 20,000 years ago, the Tiwi Islands were connected to the mainland through what is now Coburg Peninsula. Rapid sea level rises between about 8,000 to 12,000 years ago separated the islands from the mainland and each other. It is likely that the original inhabitants of the Tiwi Islands were living in the area when it was still part of the mainland (Forrest 1998).

The first known written recording of a sighting of the Tiwi Islands was by Dutch navigator Pieter Pieterszoon in 1636. In 1644 another Dutch navigator, Abel Tasman sailed through Dundas Strait between the Tiwi Islands and Coburg Peninsula. Neither of these two established that the two islands were separate land areas.

Early contact with the Tiwi was characterised by violence and hostility. The first recorded contact was in 1705 when three Dutch ships led by Maarten van Delft spent several months exploring the Tiwi and Coburg coastline. They landed on the north coast of Melville Island on what is now known as Karslake Peninsula, and were met by spears in an attempt to drive them from the land. In contrast to other areas along the north coast, evidence suggests that the Tiwi were also consistently hostile to Macassans.

It was the British navigator Phillip Parker King who, in 1818, finally established that there were two separate land areas, and named them Bathurst Island and Melville Island respectively. King's

exploration led to the British becoming interested in establishing a settlement on the north coast of Australia, and in 1824 Fort Dundas was established on Melville Island near what is today Pirlangimpi. Continuing hostility between the British and the Tiwi along with other problems associated with the location led to the fort becoming abandoned in 1829.

One legacy left behind by the British was a number of buffalo that had been shipped from Timor. In 1895 the entrepreneur EO Robinson organised a shooting party for Melville Island, and by 1915 over 18,000 buffalo hides had been taken (Hooper 2000). As an off season activity, and as buffalo numbers became depleted, interest turned to cutting and milling the native cypress *Callitris intratropica*, and three sawmills were established on Melville Island between 1895 and 1916.

In 1910 the Roman Catholic Church was granted 10,000 acres on the south eastern tip of Bathurst Island, and in 1911 Father Francis Gsell established a mission site at Nguuu. The mission and ensuing government policies resulted in the establishment of communities as residential centres, which endures to today.

“Whatever the total impact of contact in the historical period may be assessed as having been, the striking fact is that the Tiwi are today arguably Australia's most intact Aboriginal group. Certainly they retain their fiercely possessive attitude toward their land and their culture, and they have a resolute determination to maintain controls over those essentials of Tiwi integrity”. (Forrest 1998)



Governance

The estimated Tiwi population of 1,062 in 1928 was based on nine 'bands' or 'hordes' made up of smaller family or clan groups (Campbell 2002). These groups met continually for ceremony and to determine unified joint responses to external threats. In 1882, Foelsche noted the common language and cultural traditions of a collectively unified Tiwi (Hicks 2000). Minutes of the Provisional Tiwi Land Council on 1 June 1977 state:

"Everyone on the two Islands are related and are in constant contact... There has always existed an authority exercised by what are in fact the traditional owners, recognised and respected by all the people."

The Tiwi Islands were declared Aboriginal reserves in 1941, and the Tiwi Land Council was created in 1978 following the passage of the *Aboriginal Land Rights Act (1976)*, when tenure of the Islands was passed to the Tiwi Aboriginal Land Trust. Evidence suggests that the creation of the Land Council had less to do with land ownership than with the Tiwi desire to secure authority over all aspects of their lives (Hicks 2000).

Also in 1978 the Northern Territory Government initiated a new form of local government for small and remote communities. Milikapiti and Pirlangimpi communities became Community Government Councils in 1983 and 1984, with Nguu following in 1987. The aim was to create communities that could govern themselves by managing their own local affairs and municipal services (Campbell 2002). Wurankuwu on Bathurst Island remains an Aboriginal Corporation under Commonwealth legislation.

This structure resulted in a well-established group of clan leaders and representatives within the Tiwi Land Council with landowning authority over the management, protection and development of Tiwi interests, and municipal bodies with authority over community services. Although there was overlap in membership between the two systems and a respectful relationship, they largely operated in separate spheres.

In 1998 the NT Government announced its local government reform agenda, designed to amalgamate existing Community Government Councils in order to deliver a more efficient system of local government. The Tiwi put forward their proposal for regional government, and in 2001 the Tiwi Islands Local Government was formed.

The aim of Tiwi regional governance was to bring together traditional land owning leadership and community leadership in a single forum. It was hoped that such a forum would progress the goals of exploring development opportunities as a means of gaining self-determination and control.

The formation of Tiwi Islands Local Government did not entirely achieve the Tiwi aim of regional governance. Political acknowledgment and support for true regional authority is required if the Tiwi are to achieve more than mere local control over local government services.



Population

The current population of the Tiwi Islands is concentrated in the three main communities of Nguiu (Bathurst Island), Pirlangimpi (Melville Island) and Milikapiti (Melville Island). Wurankuwu is a smaller community on Bathurst Island (officially recognised as an outstation), and there are four other official outstations, all located on Melville Island.

The 2001 Census counted 2,228 people on the Tiwi Islands, which is approximately 1% of the total Northern Territory population. Tiwi made up 4% of the indigenous population of the NT, and 92.4% of the Islands' total population.

Age group	Tiwi Islands					Total NT	
	1986	1991	1995	2001		2001	
				total	%	total	%
0-4	229	176	202	263	11.8	16,386	8.1
5-19	618	599	574	637	28.6	46,995	23.2
20-34	545	555	559	637	28.6	52,451	25.9
35-49	237	328	401	444	19.9	46,892	23.1
50-64	140	143	208	191	8.6	29,389	14.5
65+	36	54	65	56	2.5	10,616	5.2
Total	1,805	1,855	2,009	2,228	100	202,729	100

Table 1: Population by Age Group (Australian Bureau of Statistics 2001)



Community Profiles

Nguiu

Nguiu is the largest community on the Tiwi Islands, and is located on the south eastern coast of Bathurst Island. It is acknowledged as the 'capital' of the Islands, and houses the main administrative and finance divisions of Tiwi Islands Local Government. According to NT Government figures, the population of Nguiu was 1,410 at 30 June 2002.

Originally the site of the Catholic Mission in 1911, by the mid 1950's Nguiu boasted a chapel, radio hut, presbytery, convent, hospital and many other buildings. There were extensive fruit and vegetable gardens, a sawmill and dairy cattle. Tiwi attached to the Mission lived on the foreshore in semi-permanent structures, while another group of Tiwi lived further inland and visited the Mission on a daily basis (Forrest 1998).



Today Nguiu is a modern community managed by the Nguiu Community Management Board under the Tiwi Islands Local Government umbrella. The Management Board is made up of 16 members who are elected through Skin Group meetings.

Facilities at Nguiu today include a Centrelink Agency, EFTPOS facilities, Commonwealth Bank Agency and a Post Office, all located in the Management Board office complex. Other facilities include a store, health clinic, pharmacy, recreation club, restaurant, police station, garage and workshop, childcare centre, respite centre, swimming pool, sport and recreation hall, two football ovals, golf course, market garden, and commercial accommodation. Nguiu also has a museum, and is the Islands base for Tiwi Tours.

Tiwi Designs produces artwork for sale both on and off the Islands, as does Ngaruwanajirri, a centre designed to provide employment for the disabled.

The Community Development and Employment Programme was introduced to Nguiu in 1994, and provides employees and equipment for a range of community service activities.

Pirlangimpi

Pirlangimpi community is located at Garden Point, on the north west coast of Melville Island on the Apsley Strait. It was established from the stationing of a police officer at Garden Point in 1939, whose role was to act as 'Sub-Protector of Aborigines' and to control Japanese contact with the Tiwi. A number of 'incorrigibles' were taken from Darwin to Garden Point in the same year. In 1940 a Catholic Mission was established as an institution for part Aboriginal children, and the incorrigibles moved on to a new settlement at Snake Bay. By 1943 the Garden Point Mission had a wharf, market gardens and dormitories (Forrest 1998).

In 1967 the settlement was taken over by the Commonwealth Government's Welfare Branch, and in 1984 became Pirlangimpi under the NT Government's new form of local government.

At June 2002 the population of Pirlangimpi was 365, and the Pirlangimpi Community Management Board currently manages the community. Existing facilities include a Centrelink Agency, EFTPOS facilities, Commonwealth Bank Agency and a Post Office. Other facilities include a store, bakery, health clinic, laundromat, recreation club, police station, garage and workshop, swimming pool, sport and recreation hall, football oval,



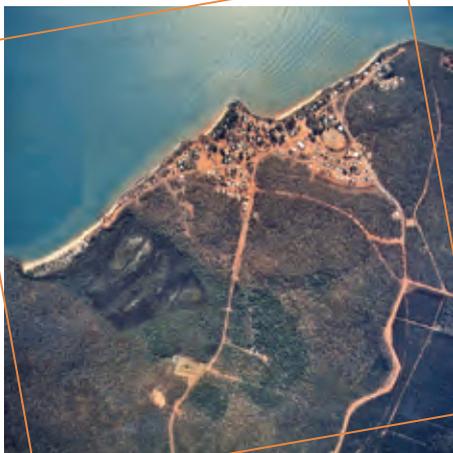
and golf course. Pirlangimpi regularly hosts golf tournaments that are well attended by locals and visitors to the Islands, and has a tourist fishing resort that offers guided tours and accommodation. Munupi Arts produces artwork for sale both on and off the Islands.

The Pirlangimpi Progress Association was formed in 1971 and is credited with starting a number of business enterprises including the supermarket, fuel depot, social club, bakery and take away food outlet. It still operates many of these businesses today.

The Community Development and Employment Programme was introduced to Pirlangimpi in 1988, and provides employees and equipment for a range of community service activities.

Milikapiti

Milikapiti is located on the north coast of Melville Island at Snake Bay. It was established as a Welfare Branch settlement in 1940 to take the 'incurrigibles' from Garden Point, and to prevent association between part Aboriginal children and traditional Aboriginals.



During WWII the settlement served as a military depot with construction of an airstrip and jetty, and all three services were represented in the area. Local men were enlisted as Coastwatchers, and 'rendered outstanding war service' (Forrest 1998). The Tiwi have continued their relationship with the Defence Services to this day.

As with Nguiu and Pirlangimpi, Milikapiti moved through Welfare control to become managed under a Community Government Council in 1983, and is now managed by the Milikapiti Community Management Board under Tiwi Islands Local Government. At June 2002, the community had a population of 491.

Facilities at Milikapiti include a Centrelink Agency, Traditional Credit Union and postal facility located in the Management Board Office. Within the community is a large modern store, health clinic, recreation club, garage and workshop, sport and recreation hall, football oval, and a tourist fishing resort. Jilamara Arts and Crafts produces artwork for sale both on and off the Islands, and also houses a museum.

Milikapiti also operates a Community Development and Employment Programme that provides for a range of community service activities.

Wurankuwu

Wurankuwu outstation was established in 1994 as a resource centre and a population centre for people with links to the central west of Bathurst Island. It is located on the western side of Bathurst Island approximately 60km from Nguiu, with an estimated population of 50 at 2002.

Buffalo Trading, a Tiwi enterprise, owns and operates a store and social club, and the community also has a small school, health clinic (not permanently manned), football oval, and postal facilities. A project officer manages the community and is responsible for essential services, housing and administration. An elected member represents Wurankuwu on Tiwi Islands Local Government.

The other official outstations on the Islands are small and have no services apart from bores and generators. They are Paru (7 houses), Taracumbi (2 houses), Yimpinari (1 house) and Takamprimili (1 house). All are located on Melville Island.



Education, Training & Employment

Nguiu has two Catholic schools, offering education from pre-school to junior secondary. Wurankuwu also has a Catholic primary school, while Pirlangimpi and Milikapiti have NT Government schools offering primary education only. A significant number of students attend educational institutions in Darwin.

Type of institution	Male	Female	Total
Pre school	13	21	34
Infants/Primary	187	156	343
Government	90	67	157
Catholic	97	89	186
Secondary	54	49	103
Government	10	10	20
Catholic	38	35	73
Other non-Govt	6	4	10
TAFE/Tertiary	10	16	26
Total	264	242	506

Table 2: Enrolment in Educational Institutions (Australian Bureau of Statistics 2001)

The Tiwi Islands Training and Employment Board was established in 1999 and coordinates all vocational education and training activities on the Tiwi Islands. It is a Registered Training Organisation, and manages one of only two NT funded Group Training Organisations operating a new apprenticeship scheme.

At April 2003 the Board had agreements with seven Registered Training Organisations who provide training on the Islands, and 142 apprentices employed through the Group Apprenticeship Scheme.

Apprentices are only employed in areas where there are sustainable employment opportunities, and are currently working in the fields of baking, carpentry, civil operations, local government, retail, education, fishing, forestry, essential services, motor mechanics, child care, aged care, environmental health and indigenous health.

In addition to apprenticeships, the Board provides other accredited training that enhances skills and creates pathways to apprentices or direct employment. These include child care, health

work, welding, small engine mechanics, chainsaw operations, small boat handling, first aid, art and craft, literacy enhancement, computer operations and small business operations.

In 2003 the Board constructed the first of a proposed cluster of training centres on the two Islands, which will substantially increase their capacity to provide on site training.



Employment sector	Males	Females	Total
Employed with CDEP	219	145	364
Other employment	131	122	253
Unemployed	68	31	99
Not in labour force	358	443	801

Table 3: Employment by Sector (Australian Bureau of Statistics 2001)

Industry	Males	Females	Total
Agriculture, forestry & fishing	20	0	20
Manufacturing	6	0	6
Construction	24	0	24
Retail trade	18	29	47
Accommodation, cafes & restaurants	8	7	15
Transport & storage	13	0	13
Finance & insurance	0	3	3
Property & Business Services	3	4	7
Government administration & defence	151	75	226
Education	24	51	75
Health & community services	24	63	87
<i>Health services</i>	20	38	58
<i>Community services</i>	4	17	21
<i>Undefined</i>	0	8	8
Cultural & recreational services	14	9	23
Personal & other services	19	9	28

Table 4: Employment by Industry (Australian Bureau of Statistics 2001)



Health

As with other predominantly Aboriginal areas, the Tiwi Islands suffer poor health status. In the 1990's the Tiwi Islands had arguably the worst overall health statistics for any population group in Australia (Tiwi Health Board 2001). Issues included renal disease, diabetes, heart disease, ear disease and mental health. Drug and alcohol abuse, suicide and domestic violence were also major health and social concerns.

In 1995 the Tiwi Land Council proposed the formation of the Tiwi Health Board with the aim of empowering Tiwi people to improve health by taking over service delivery. In December the same year, the Commonwealth Government offered additional funds to the Tiwi to run one of four indigenous health care trials. The aim of the trials was to achieve a more coordinated approach to the delivery of health care services, and improve the quality of care. The Tiwi trial was operated through the Tiwi Health Board, which included an additional aim of transferring the responsibility for health services from the Territory Health Service to local administration.

The Commonwealth Government carried out a review of the trials in 2001, which showed that considerable progress had been made towards all aspects of reform, including:

- Enhanced service access.
- Improved service appropriateness.
- Improved individual empowerment.

(Commonwealth Department of Health and Aged Care 2001).

This is supported through Tiwi Health Board statistics within in the same time frame, including:

- 80% reduction in loss of kidney function amongst renal patients.
- 4 years sustained reduction in death and renal failure.
- 11.5% reduction in hospital admissions.
- Reduction in suicides.
- Mental health, youth and chronic disease programmes fully operational.
- Operation of the first indigenous owned pharmacy.

(Tiwi Health Board 2001)

Since its inception, Tiwi Health Board activities broadened from the treatment and prevention of disease to encompass the social well being of the community as a whole. This is shown through the broad variety of facilities and services that have been offered, including:

- A renal dialysis unit at Nguiu.
- Health centres in all four communities.
- A soon to be commenced \$2.5m modern health centre at Nguiu.
- Aged Care services and facilities in all communities, including a new respite centre at Nguiu.
- Chronic disease programme.
- 'Tiwi for Life' – a Tiwi initiative with a focus on prevention through education and training.
- Youth services and life promotion.
- 'Ngaruwuniwani Heath Team' – focus on mental health, social and emotional well being, and offering services in all communities.
- Ongoing education and training for service deliverers.
- Implementation of national quality assurance standards.

Recent funding issues have placed the operation of Tiwi Health Board programmes in jeopardy and despite their successes, continued function is not assured.



Housing

The majority of housing on the Tiwi Islands is sourced through the Indigenous Housing Authority of the NT, a partnership between the Commonwealth and NT Governments that allocates funds to areas based on needs analyses. As with many other areas across the NT, there is a distinct shortage of suitable housing, with severe overcrowding often identified as a priority issue. Some existing dwellings are poor standard, and waiting lists are common.

Nguiu, Pirlangimpi and Milikapiti each have housing associations that manage the construction and maintenance of housing stocks using both local employees and outside contractors.



Household type	Indigenous		Other	
	Number of Households	Persons in households	Number of Households	Persons in households
One family	315	1390	32	98
Multi family	78	631	0	0
Lone person	23	24	30	38
Total	416	2,045	62	136
Mean household size	4.8		2.7	

Table 5: Household Structure (Australian Bureau of Statistics 2001)

Dwelling Structure	Tenure Type		
	Owned or being purchased	Rented	Other (includes rent free)
Separate house	0	451	15
Flat or unit	0	0	4
Improvised home, tent, sleepers out	0	0	3

Table 6: Housing Type by Tenure (Australian Bureau of Statistics 2001)

Essential Services

Electricity is generated by on-site diesel power stations in all four communities. Payment operates through a card system, where consumers pre-purchase cards for insertion into individual meters.

The Power and Water Corporation and the Northern Territory University carried out extensive experiments on tidal power in the Apsley Strait from 1993. While the results were promising, the cost of the required supporting infrastructure limits further development at this time.

The domestic water supplies for Nguiu, Wurankuwu and Milikapiti are sourced from production bores, while Pirlangimpi sources water from a permanent spring that is pumped into a 1 million litre holding tank. A bore field has been identified for Pirlangimpi should an upgrade be required in the future.

All communities have water borne sewerage systems pumped into sewerage ponds.

The Power and Water Corporation controls essential services on the Islands through contract arrangements, either with individual Community Management Boards or outside contractors.

Transport

There are approximately 250km of roads on Bathurst Island, not including numerous cultural, hunting and recreational tracks. Formed roads provide good access west of Nguiu to Cape Fourcroy, Cape Helvetius and Port Hurd, and north to Wurankuwu community. Further north, flat bladed tracks provide access to Interview Point and Caution Point with only some sections gravelled. There is minimal all weather access to other parts of the Island. Sealed roads are confined to 14km within Nguiu community.

Melville Island has approximately 280km of road, again excluding numerous seasonal tracks. A combination of gravel and formed roads provide reasonably good access between Milikapiti, Pirlangimpi, Paru and Pickertaramoor, all of which are in the western half of the Island. Access to the eastern side of the Island is limited to flat graded tracks which, although accessible during most wet seasons, are of very poor standard. Sealed roads are limited to Pirlangimpi and Milikapiti internal roads.

The Islands are well serviced by air, and the three major communities have community owned and licensed aerodromes with sealed airstrips. Landing areas are also located at Port Hurd (Bathurst Island), Pickertaramoor, Rolla Plains and Maxwell Creek (Melville Island).

There is a regular public transport service (RPT) to the Islands, with Nguiu serviced three times a day and Pirlangimpi and Milikapiti twice daily. Air charter flights are common outside the RPT's, and are the only available air service to Wurankuwu community.

The Tiwi Islands rely heavily on shipping services for the majority of freight transport, and each community has a government owned barge landing with associated hard stand area. Pirlangimpi, Milikapiti and Wurankuwu landings are concrete ramps, while the Nguiu ramp is gravel. A Tiwi owned ramp was also constructed at Paru in 1996, and an additional landing south of Pirlangimpi is due for completion in 2004. This will be used to load logs for export under the existing forestry project on the Islands, as well as other commercial shipping.

Tiwi Barge Services Pty Ltd is a joint venture with the Tiwi Land Council, and provides a regular barge service to each community. It also provides a regular service to the Port Hurd Marine Harvest Aquaculture Facility, and operates regular charters as required. During 2003 Tiwi Barge more than doubled its capacity with the purchase of *Tiwi Islander*, taking total capacity from 140 tonnes to 290 tonnes for general, chilled and frozen cargo.

Current projects aimed at improving sea transport include a high speed passenger ferry between Nguiu and Darwin, and an inter-island ferry that currently operates between Nguiu and Paru with the capacity to carry vehicles and small machinery as well as passengers.



Communications

Satellite dish receivers provide a television service to the Islands, broadcasting ABC, Imparja and 7 Central. ABC Radio National is also transmitted to the area. Local news and information is provided through BRACS (Broadcasting for Remote Area Communities Service) in Nguiu, Pirlangimpi and Milikapiti, and through 'Tiwi Times', a monthly newspaper prepared by the Tiwi Islands Training and Employment Board.

The Tiwi Islands are connected through Telstra to the national telecommunications system, and a CDMA tower erected at Nguiu in 2003 provides a mobile telephone service to that area. Similar upgrades may be available for the remainder of the Tiwi Islands, but at 2003 there is no other mobile telephone coverage.

During 2003 the Tiwi Islands became one of a number of initiatives under the Commonwealth's 'Networking the Nation' program to improve online capabilities to community councils. The project provided a web publishing template, training in IT business systems, establishment and support of a local area network and funding for on and off site IT support.



Economic Development

In 1999 the Tiwi Land Council assessed the Tiwi economy at \$25 million/year. This was made up of \$11.5m commercial fishing generated by non-Tiwi interests, \$9.5m 'welfare economy' generated by Tiwi, and \$4m enterprise and non-welfare payments accruing to the Islands' organisations and business sector (Tiwi Land Council 1999).

Previously, in 1986, Tiwi leaders had identified the urgency of developing an independent economy as a route to improved social outcomes, and elimination of the destructive influence of welfare dependence. This led to the establishment of the Tiwi Islands Community Trust as a commercial replica of the Land Council.

The Trust's initial economic development was by means of joint venture partnerships in forestry, tourism, cultured pearls and coastal barging. The risks associated with joint venture and marginal profits resulted in all joint venture partnerships being ended apart from Tiwi Barge Pty Ltd. The two tourism joint ventures, Tiwi Tours and Barra Base Lodge, were purchased outright by the Trust, while Tiwi Pearls was sold at considerable profit. The Melville Forest Products joint venture was terminated in 1997 due to incompatible aspirations between the joint venture partners.

Lessons learned from joint venture operations led to a set of requirements for future economic development on the Islands:

- Tiwi employment.
- Tiwi participation as landowners receiving rents.
- Tiwi participation through investment once the operation had been proved commercially viable.
- A small share of product revenue without damaging commercial viability and investor aims.

In 1996, a Tiwi economic development strategy was commissioned and developed by Street Ryan and Associates Pty Ltd. While the Strategy provides a comprehensive assessment of mostly small enterprise and internal opportunity, it has been the belief of Tiwi leaders that one large core enterprise on the Islands will provide the springboard for sustained, long term economic development. This is currently being realised through forestry and aquaculture.

Forestry

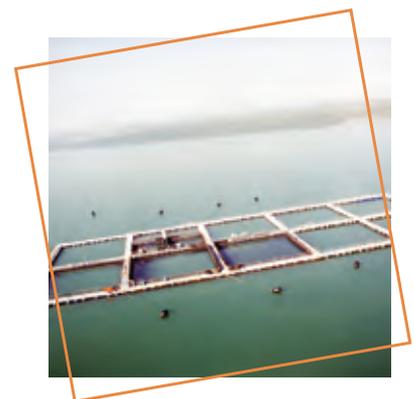
In 1995 the Tiwi Land Council commenced discussions with Sylvatech Australia Pty Ltd with a view to establishing large scale plantation forestry on the Islands. In 1998 the Tiwi had executed options over land in favour of Sylvatech, of which almost 6,000ha had been taken up by July 2003. Majority plantings are fast growing *Acacia mangium* destined for the woodchip market. Associated with plantation establishment is the harvest and export of historic *Pinus caribaea* plantings and native timber. Tiwi involvement in this project includes:

- Compliance with Tiwi Training and Employment Strategy.
- Land rental with leases over 30 years.
- Investment in *Acacia* plantings.
- Production share of FOB product price Melville Island.
- Approval and compliance under the *Environment Protection and Biodiversity Conservation Act*.

Aquaculture

In 1999 Marine Harvest, the largest aquaculture company in the world, commenced a \$6m trial and constructed barramundi sea cages at Port Hurd off the west coast of Bathurst Island. By mid 2003, they were harvesting and marketing 20 tonnes of farmed barramundi each week. Tiwi involvement in this project has been negotiated and includes:

- Tiwi employment.
- Rental of the Barra Base Lodge as the land base of the project.
- Opportunity to purchase cages.
- Crop share when commercially viable.
- Environmental approvals and compliance.



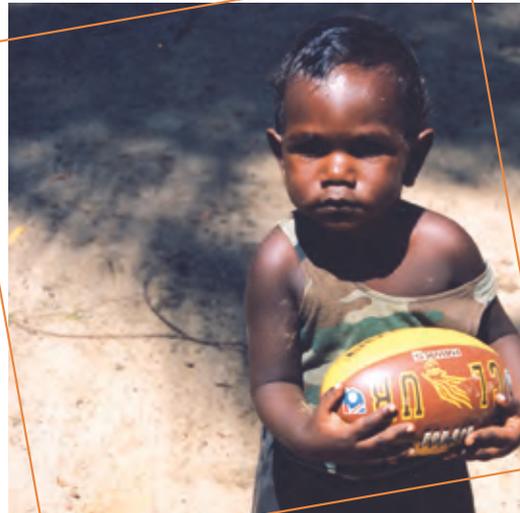
Football

No profile of the Tiwi Region would be complete without a mention of Australian Rules football. It is believed that Catholic missionaries introduced Australian Rules football to the Tiwi Islands in the 1930's. In 1952, Ted Egan and Father Collins formed the St Mary's Football Club in Darwin. Most of the team was made up of Tiwi people living in Darwin, and Brother Pye operated as talent scout for the Club on Bathurst Island.

The Nguilla Football League was formed on the Tiwi Islands in 1968, and comprised five teams. After 1990 the name changed to the Tiwi Islands Football League, and has had up to eight teams in the competition. Currently there are seven teams.

Football has been taken into Tiwi culture with the Tiwi Islands Football League grand final the biggest day of the year. Permits are waived for the day, and spectators come from all around Australia and overseas. In 2003, more than 1,500 visitors and football identities arrived in Nguiu for the final.

Many Tiwi footballers have been signed on to play with Darwin and southern clubs over the years, and the tradition continues.





PHYSICAL PROFILE

Physical Profile





Climate

“**Kumunupunari** is the dry season, when there is little or no rainfall. The first part of the dry season is called **wurringawuni**, when the first dry winds blow in from the south-east and flatten the tall grass and dry up a lot of surface water. The period some time later when the dry grass is burnt is called **kimirrakinari**. The wind later in the dry season that causes your skin to become dry and flaky is called **pumutingari**.

The colder weather in the middle of the dry season is referred to as **yirriwini** and **mirniputi**. This cold weather only lasts for a week or two and is signalled by the flowering of **wurritjinga** (*Eucalyptus confertiflora*).

Tiyari is the season of hot weather with high humidity and little rain. **Wurrijingarri** is the period when many trees flower; it is also the time of **milikornari** when the ground is very

hot and the soles of your feet become hot when you walk. Later in tiyari there are often cloudy skies, **rakungumpara**, and even black clouds, **turniyuwa**, and thunder, **pumwanyinga**, but very little rain.

The thunder and lightning is telling you that the wet season is not far away. **Tiyari** is a season of hardship with water levels low and not many bush foods available.

Jamutakari is the wet season, when rain, **pakitiringa**, falls consistently every day and the swamps, creeks and rivers are full. **Wunijaka**, the north-west wind blows and brings rain. There is much lightning [**pumurali**] and thunder with the rain.”

(Puruntatameri *et al.* 2000)



Figure 2: Tiwi Seasons

The climate of the Tiwi Islands is tropical monsoonal, characterised by a hot and humid 'summer' (wet season) and a hot and dry 'winter' (dry season). These two distinct periods of annual drought and highly predictable annual rainfall are typical throughout the Top End.

The timing of the transition between the two seasons is variable, with the dry season commencing any time between late March and late May. The length of the seasons, however, is relatively constant. Winds are predominantly north-westerly in the wet season, and south-easterly in the dry season.

Average temperatures range from 25 to 36°C in October and 19 to 29°C in July. During the colder dry season months of June and July, inland temperatures can reach as low as 12°C overnight (Plumb 1977 & Puruntatameri *et al.* 2001). The variation in daylight length is small at around 1.5 hours.

In terms of total rainfall, the Tiwi Islands have the highest rainfall in the Northern Territory, with around 90% falling between November and April. Mean annual averages range from 1200mm to 1400mm in eastern Melville Island, and up to 2000mm in northern Bathurst Island and north-western Melville Island (Hollingsworth 2003). The variability of rainfall between months is high, with monsoonal storms typically occurring in January and February. The months either side are characterised by high intensity convectional storms and storms associated with the monsoon trough.

'Hector' is a local storm cell that forms over the Islands in the late afternoons prior to and during the wet season. It is responsible for bringing significant early rainfall to the Islands, resulting in a slightly longer wet season than that of the mainland. Hector has also been the subject of international study under the maritime continental thunderstorms experiment.

Cyclones are regular events on the Tiwi Islands, and have at times caused great damage and loss of life. Below is a random selection of the many cyclones that have affected the Islands:

April 1827

Category 3 Destroyed fences, gardens, wharf and buildings at Fort Dundas settlement, Melville Island.

February 1915

Category 4 250mm of rain in 8 hours at Bathurst Island. Trees uprooted and building damage at Bathurst and Melville Islands.

March 1919

Category 4 Nguui destroyed. Storm surge washed away the wreckage and one baby drowned.

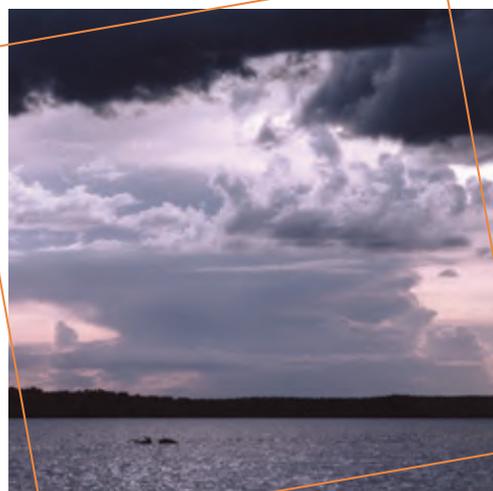
November 1948

Category 3 Severe damage on Bathurst and Melville Islands. Most of the huts at Nguui demolished. Lugger *La Grange* wrecked with 10 lives lost.

December 1998

Category 5 Cyclone Thelma. Maximum wind gusts to 320 km/hr north of Bathurst Island. Major disruptions to communications and power supplies. Many large trees blown down and minor building damage at Pirlangimpi. Extensive tree damage around north Bathurst Island and north-west Melville Island. Waves to 6m and swells to 8m reported at Cape Fourcroy.

(Northern Territory Government 2000).



Geology Landform and Soils

“Long ago there were no people on the earth and darkness covered the land. There were no rivers or billabongs, there was no water in the streams, no hills or valleys. There were no animals living in the sea, no fish, turtles or crocodiles.

One day Murtankala dug her way from a cave underground and arrived on earth. When she knelt to rest, her children cried because they were hungry. Murtankala had no milk so she looked around for food for her children, and for soft ground where she could lay them, but she could find nothing. There was no grass, no water nor any bushland where they could look for food.

So then she began to crawl at that place where she had arrived on the earth. When she crawled along she made a large hole behind her and the seawater began to rush in behind her back. She was facing towards where the sun now rises and her face was turned to that eastern side. She crawled along and after a long time returned to where she first started. And so she created these two Islands.”

(Kerinauia 1989)

Detailed information on the geology of the Tiwi Islands is provided by Hughes, who compiled the 1:250,000 scale Geological Series *Bathurst Island and Melville Island, Northern Territory*.

Bathurst and Melville Islands consist of a thin, gently north westerly dipping sheet of Mesozoic and Cainozoic sediments deposited on a stable sheet known as the Bathurst Terrace. The main units are shown in Figure 3.

The Wangarlu Member is comprised mostly of mudstone and siltstone, and underlies the Islands from approximately sea level to a depth of about 500m. It is seen in drill cuttings as sticky to firm grey clay, and can be seen exposed at low tide on the south eastern coast of Bathurst Island (Haig *et al.* 2003). It was accumulated during a time when open marine conditions occurred across the platform (Hughes 1976).

Sand, silt and mud were deposited as the sea withdrew, creating the overlying Moonkinu

Member. This is described as fine to very fine sandstone interbedded with grey carbonaceous mudstone and siltstone (Hughes 1976). A highly weathered hard, dark brown section of this unit can be seen along the beach at Milikapiti (Haig *et al.* 2003).

A period of chemical weathering followed, which resulted in an extensive cover of laterite. In the subsequent Tertiary period, earth movements resulted in slight tilting to the north west. Much of the area remained above sea level, and subsequent erosion and deposition resulted in the laying down of the Van Diemen sandstone. This consists of friable, white to yellow, medium to coarse grained quartzose sandstone with lenses of siltstone (Hughes 1976). This formation covers most of Melville and Bathurst Islands, and varies in thickness from 20m in gently undulating terrain, to over 60m on the higher ridges (Haig *et al.* 2003).

AGE	Era	Period	Formation
	Cainozoic	Quaternary	Alluvial sediments
		Tertiary	Van Diemen Sandstone
	Mesozoic	Cretaceous	Moonkinu Member
Wangarlu Member			

Figure 3: Geological Units (Hughes 1976)

Thin alluvial sediments of silt, sand and gravel were laid down during the Quaternary period, and are widespread over the Islands. Red sandy soils developed on the Van Diemen Sandstone, and grey to yellow sandy soils developed on the Moonkinu Member (Hughes 1976).

The Tiwi Islands are of low relief and topographically simple. Lateritic rises and dissected plateaux drain mostly northwards across inland sand plains and out into coastal plains.

The areas of higher relief to the south (up to 120m on Bathurst Island, and 160m on Melville Island) are remnants of the Van Diemen Sandstone laid down in the Tertiary period. Inland sand plains formed northwards as a result of the erosion and deposition of the Tertiary surface, while poorly drained open plains around Maxwell Creek on Melville Island and central Bathurst Island are a result of exposure of the earlier Moonkinu Member (Hughes 1976).

The coastal plains are made up of mangrove-lined tidal flats extending inland along river channels, and deposits of beach and littoral sand that have accumulated on the western and northern coasts. Sand dunes occupy a 20km coastal strip on southern Bathurst Island, where they rise to more than 20m above sea level, and extend inland up to 1.5km (Hughes 1976).

Bauxite is present in northern Melville Island, but has been assessed as uneconomical. Similarly, occurrences of phosphate along the south coast of Bathurst Island are not considered to be of commercial value. Several areas of significant concentrations of mineral sands have been identified on the north coast of Melville Island and west coast of Bathurst Island (Hughes 1976).

Detailed soil descriptions are provided in Hollingsworth (2003), who described eighteen soil types from surveys of 385 sites. The main soil types reflect the parent material, with red and yellow sandy soils occurring on the residual plateaux surrounded by well drained sandy profiles. Recent alluvium deposited along creeks forms localised clay terraces, while the low lying coastal plains are primarily saline clays. The coastal dune systems are primarily siliceous sands with some calcareous sands in places (Forsci 1998).

The surface soils of the Islands are typically highly leached and nutritionally poor, common with most soils in the Top End of the Northern Territory (Hollingsworth 2003). More detailed analyses of soil fertility are provided in Forsci (1998).



Hollingsworth (2003) mapped and described thirty discrete land units at 1:100,000 scale, and provided capability assessments for a range of key land use objectives:

Land Unit	Land-form	Area (ha)	Opportunities/limitations
Laq086	Plateau, summit surface	9,463	Opportunities for forestry, agriculture, horticulture, building and construction, roads, septic tanks.
Gaq086	Plateau, summit surface	25,428	Opportunities for forestry, agriculture, building and construction, roads, septic tanks.
Uec088	Rises, fan	72,690	Opportunities for building and construction, roads.
Gec090	Rises, footslopes	3,366	Opportunities for building and construction, roads.
Gfc085	Plain, slopes	15,155	Opportunities for roads. Erosion risk limitations.
Lfo095	Plain	5,270	Opportunities for gravel extraction; severe drainage limitations.
Lfo109	Plain	4,680	Opportunities for gravel extraction; drainage limitations.
Gfo109	Plain	29,780	Opportunities for construction, road material, gravel extraction; drainage limitation.
Lrm099	Estuary, tidal flat	115,140	Drainage and flooding limitations.
Usj098	Chernier plain, beach ridge	1,190	Opportunities for building and construction, roads, sand extraction. Moderate drainage and flooding limitations.
Ueo107	Low hills, hill slopes and crests	19,490	Opportunities for gravel extraction; slope, drainage and surface rock limitations.
Uef085	Plain, slopes	44	Opportunities for roads; erosion risk limitation.
Lfl098	Rises, slopes	4,660	Drainage limitations.
Laq105	Plateau, summit surface	110,910	Opportunities for building and construction, roads.
Gaq085	Plateau, undulating rises, hill crests & plateau edges	9,376	Opportunities for roads; erosion risk limitation.
Uaf100 Lef100 Laf100 Rdf100	Plateau, hill slopes and plateau edges	2,050	Opportunities for gravel extraction; surface rock and erosion risk limitations.
Gec088	Sandplain, fan	13,080	Opportunities for building and construction, roads.
Lgl101	Plain	342	Drainage limitations.
Gec091	Sandplain, slope and flat	59,827	Opportunities for building and roads; drainage limitations.

Lfc093	Plateau, plain	102,810	Opportunities for building and construction, septic tanks.
Udf085	Plain, slopes	103,510	Opportunities for roads; erosion risk limitation.
Lfc087	Plateau, summit surface	2,810	Opportunities for forestry, agriculture, horticulture, building and construction, septic tanks.
Gec084	Plain, footslopes	532	Surface rock and drainage limitations.
Gfo095	Plain	9,413	Opportunities for gravel; drainage and flooding limitations.
Lrm110	Estuary, supra-tidal flat	5,590	Severe drainage and flooding limitations.
Lff112	Plain	7,700	Opportunity for gravel extraction; soil depth and surface rock limitations.
Lsj113	Sand plain, swamps	3,560	Opportunity for sand extraction; drainage and flooding limitations.
Lfc114 Lef114	Plain, swamps and drainage depressions	2,840	Drainage and flooding limitations
Lfc116	Estuary, supra-tidal flat	392	Drainage limitations.
Gel117	Rises, stream channels	Approx 200	High conservation value and not suitable for development.

Table 7: Land Units (Hollingsworth 2003)



Hydrology

“The old woman continued her journey overland and once again the moulded earth filled with the flow of water.”

(Kerinaiua 1989)

The water resources of the Tiwi Islands were mapped, described and evaluated by Haig *et al.* in 2003, and are summarised below. Assessments were carried out on groundwater and surface water, the interactions between the two, and water resource management issues.

Groundwater

Haig *et al.* identified two regional aquifer systems on the Tiwi Islands: a shallow, unconfined aquifer; and a deep, confined aquifer.

The shallow aquifer occurs within the Van Diemen Sandstone and overlying laterite and alluvium. It covers the majority of both Islands, and is the most readily used for bore water supplies on the Islands.

Production potential is dependent on the thickness of the aquifer. In areas where the sandstone is greater than 60m thick, yields of up to 10 litres/second are likely. Areas of less than 20m thickness are likely to only produce

up to 0.5 litres/second, while the likelihood of shallow water supplies is low where there is no underlying Van Diemen Sandstone, or less than 10m thickness.

The shallow aquifer is made up of sandstone with layers of silt and clay. As these materials do not readily react with water, the stored water largely retains the properties of the annual rainfall recharge. Subsequently, the quality of water from the aquifer has been assessed as very high. pH is typically low (between 4 and 6), however is within acceptable limits for drinking water. Hardness and salinity are also low, with the exception of areas near the coast where salt water may intrude into the groundwater.

Recharge occurs each wet season through direct infiltration of localised rainfall. A series of rainfall events is required before there is sufficient recharge to affect the aquifer water table, although once a certain level of saturation is reached the response time reduces. During the dry season, water drains from the shallow portion of the aquifer, with shallow bores fluctuating up to 5 metres between seasons. In contrast, the deeper bores show seasonal fluctuations of between only 1 and 3 metres. This shows the ‘buffering’ effect of the greater thickness of the sandstone, and the greater length of time required for the recharge water to penetrate into the deeper portion.

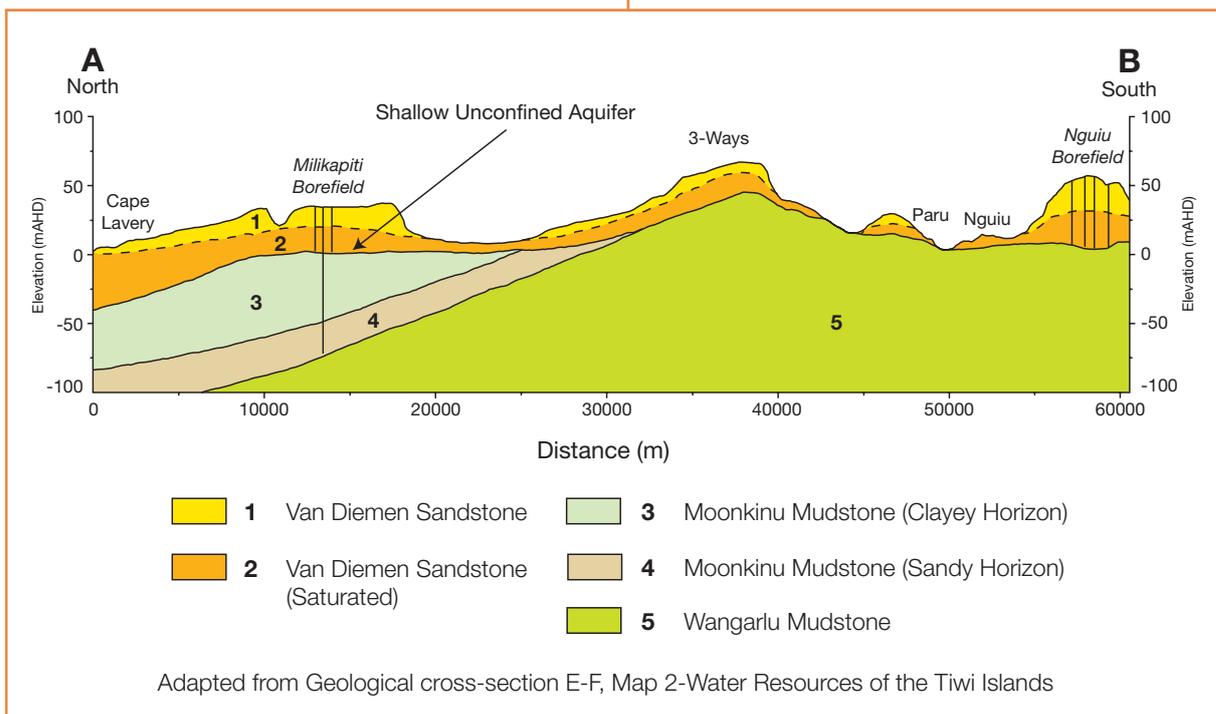


Figure 4: Geological Cross Section of the Shallow Unconfined Aquifer (Haig *et al.* 2003)

The deep, confined regional aquifer occurs within the Moonkinu Member, and is separated from the shallow aquifer by a relatively impermeable layer of claystone and siltstone. It is approximately 30 to 60 metres thick, and dips gently to the north west. The top of this aquifer is located at about sea level in central Bathurst and Melville Islands, and at about 110m depth in the north of Melville Island.

The aquifer has been identified in three locations on the Tiwi Islands, with bore yields ranging from 0.5 litres/second to 4 litres/second. As with the shallow aquifer, water quality has been assessed as very high, with the presence of carbonate in the aquifer material resulting in higher pH values.

Recharge to the deep aquifer occurred more than 7,000 years ago when the sea level was approximately 130 metres lower than present. Rainfall in the centre of the Island recharged the aquifer where it is close to the land surface, and then slowly flowed down gradient to the north west. Over a long period of time the deeper portion was fully recharged. Recharge no longer occurs, as the water levels in the aquifer are now at sea level.

Surface Water

The areas of higher relief in the south of the Tiwi Islands drain mostly northwards through creek and river systems. Major catchment areas for the Islands are:

Main drainage feature	Catchment area km ²
Bathurst Island	
Dudwell Creek	333
Gullala Creek	165
Fuingatingerrany & Kulaka-Iniarimu Creeks	250
Tunganapu Creek	209
Munanampi & Maand Creeks	241
Euro Creek	195
Tipabina Creek	89
Southern Bathurst	161
Melville Island	
Kilu-Impini Creek	536
Mirikau-yunga & Maxwell Creeks	386
Tjipripu River	726
Andranangoo Creek	554
Jessie (Aliu) River	492
Johnston River	890
Dongau Creek	552
Takamprimili Creek	610
Southern Melville	980

Table 8: Major Catchments

Flows in rivers and creeks are highest during the wet season. Soils become saturated and rainfall converts to runoff, which becomes the dominant flow component. At the end of the wet season and into the dry season when rainfall reduces, the dominant flow is sourced from springs or drainage of the shallow aquifer along the course of the waterway. This is known as base flow.

Base flow occurs through drainage of the Van Diemen Sandstone. Where the sandstone is thicker, the volume and duration of flow is greater. This results in some of the smaller rivers and creeks in the northern half of Melville Island flowing all year round, while many areas



on the southern side where the sandstone is very thin (<20m) tend to be dry by the end of the dry season. Similarly, spring fed creeks at higher elevations tend to dry up earlier than those at lower elevations, reflecting the drainage behaviour of the aquifer.

The surface water quality from 29 sites on both Bathurst and Melville Islands has been assessed as high, with chemistry similar to that of groundwater from the shallow aquifer. A study of Takamprimili Creek in south west Melville Island in 1994-1996 found that the creek was in good health, with a macro-invertebrate population comparable to that of other Top End creeks. This was despite the area being subject to major forestry operations in the past (Haig *et al.* 2003; Suggit and Edwards 1997).

Localised increases in turbidity and nutrients have been reported in some areas of the Islands, and attributed to feral buffalo activity on Melville Island and feral pig activity on Bathurst Island. Another potential impact on turbidity and sediment load has been identified as the introduction of suspended solids from road works and clearing operations.

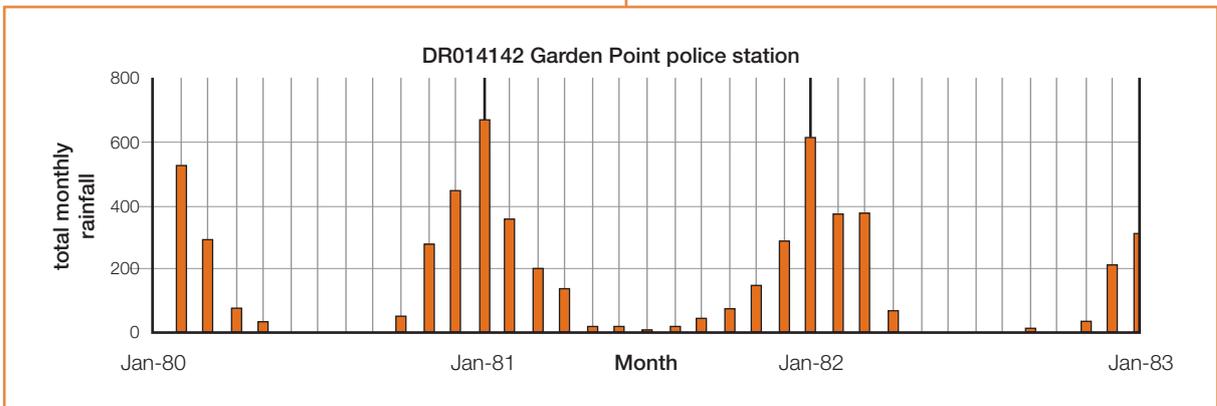


Figure 5: Rainfall data from Garden Point Police Station (Haig *et al.* 2003)

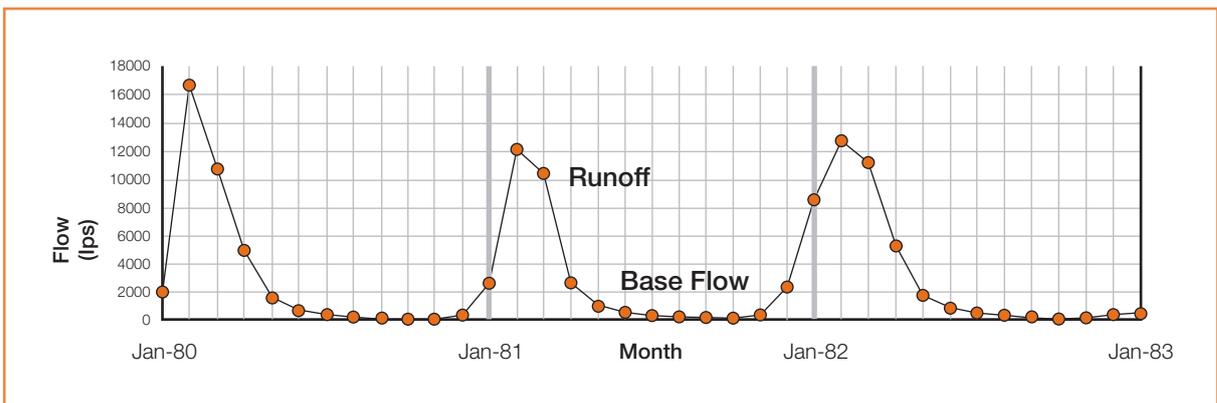


Figure 6: Flow Volumes in Blue Water Creek (Haig *et al.* 2003)

Flora and Fauna

Before she left, Murtankala covered the islands she had created with plants and filled the land and sea with living creatures. Finally the land was prepared for her children and for the generation of Tiwi who followed.

(Kerinaiua 1989)

Up until 2000, European knowledge of the biodiversity of the Tiwi Islands was sparse and fragmented, and impending plantation forestry development led the Tiwi Land Council to initiate a number of biodiversity studies from 2000 onwards. Carried out by the Parks and Wildlife Service of the NT, the most recent study will provide a three-part report on environments and plants, fauna, and management. Specialist consultants were also engaged to consider implications for individual species.

Although the Tiwi Islands support a distinctive biota, many of the species and environments also occur on the mainland, particularly Coburg Peninsula. 'Tiwi-Coburg' is a nationally recognised bioregion that comprises the Tiwi Islands, Croker Island and Coburg Peninsula.

Vegetation

Traditional Tiwi knowledge recognises ten different vegetation classifications:

Class/name	Description
Rapatinga	Sand dune areas with little or no vegetation.
Kurlimipiti	Sand dune covered with grass.
Mirriparinga, Pamparinga	Mangrove areas.
Yawurlama	Monsoon vine forest, jungle.
Yiringarni	Billabong, swamp, waterhole.
Turringiya	Open plains, grassy areas.
Turrungini	Open area with no plants.
Warta	Eucalypt forest and woodland.
Tingata	Beach areas
Murinyini	Shrubby vegetation to about 2-3m high.

Table 9: Tiwi Vegetation Types (Puruntameri *et al.* 2001)

Woinarski *et al.* recorded 1082 native plant species, and identified twelve native vegetation types on the Islands from interpretation of LANDSAT imagery and intensive field sampling. Their classification illustrates the dominance of eucalypt forests and woodlands, which comprise 5,725km² or 76% of the total area. It also highlights the low level of disturbance, with at least 98% of the Islands' native vegetation relatively intact (Woinarski *et al.* 2003).



Class	Description	Area (km2)		
		Bathurst	Melville	Total
wet rainforest	Floristically diverse tall closed forests around springs and some sheltered watercourses.	4.4	21.7	26.1
dry rainforest	Coastal thickets and dry slopes of broken plateau edge	29.7	102.8	132.5
mangroves	Tall dense forests to low open woodlands in tidally inundated coastal areas, with a range of dominant species including <i>Sonneratia alba</i> , <i>Rhizophora stylosa</i> , <i>Bruguiera parviflora</i> , <i>Xylocarpus mekongensis</i> and <i>Ceriops tagal</i> .	275.6	515.8	791.4
sand & salt flats	Typically saline coastal areas intermixed with mangals, and supporting no vegetation, coastal dune fields, or grasslands dominated by <i>Sporobolus virginicus</i> .	14.8	115.5	130.3
sedgeland & grasslands	Mostly seasonally inundated areas, typically dominated by <i>Eleocharis dulcis</i> and <i>Scirpus litoralis</i> .	13.2	159.7	172.9
<i>Melaleuca</i> open forests	Forests dominated by a range of <i>Melaleuca</i> spp. (typically including <i>M. leucadendra</i> and <i>M. viridiflora</i>) in riparian areas and swamplands.	13.7	47.1	60.8
<i>Melaleuca</i> low woodlands	Low woodlands or shrublands typically on poorly drained sites, dominated by <i>M. nervosa</i> and/or <i>M. viridiflora</i> .	3.8	12.5	16.3
treeless plains	Low open woodlands typically dominated by <i>Acacia</i> spp., <i>Grevillea pteridifolia</i> and <i>Banksia dentata</i> .	22.1	160.7	182.8
eucalypt forest (dense)	Tall forest dominated by <i>Eucalyptus miniata</i> , <i>E. tetradonta</i> and/or <i>E. nesophila</i> (often with ironwood <i>Erythrophleum chlorostachys</i> subdominant), typically with dense tall understory (variably including <i>Acacia</i> spp., <i>Gronophyllum</i> , <i>Livistona</i>); also including smaller areas of <i>Lophostemon lactifluus</i> and <i>Eucalyptus ptychocarpa</i> in drainage lines.	610.0	1384.5	1994.5
eucalypt forest (mid-open)	Tall forest dominated by <i>Eucalyptus miniata</i> , <i>E. tetradonta</i> and/or <i>E. nesophila</i> , typically with grassy understory.	477.7	2130.9	2608.6
eucalypt forest (open)	Forest typically dominated by <i>Eucalyptus bleeseri</i> with open grassy understory.	152.6	873.5	1026.1
eucalypt woodland	Woodland dominated by <i>Eucalyptus oligantha</i> or <i>E. latifolia</i> or <i>E. alba</i> with grass understory	0	94.8	94.8
Plantations		2.2	78.9	81.1
built-up area		19.5	6.2	25.7

Table 10: Western Scientific Vegetation Types (Woinarski et al. 2003)



Information on the weed status of the Tiwi Islands is documented in Fensham and Cowie (1997). This was compiled using data from five vegetation surveys of the Tiwi Islands from 1986 to 1992. 95 exotic species were identified, including declared noxious weeds, introduced pasture plants, forestry species and garden ornamentals. Ten naturalised species were identified, and twelve declared weeds. Most occurrences are currently restricted to communities and disturbed areas, with the vast majority of native vegetation in the Islands weed free. The proportion of naturalised species in undisturbed areas is also relatively low compared to other areas in the NT and Australia as a whole (Woinarski *et al.* 2003).

Species name	Common Name
Naturalised species	
<i>Alysicarpus vaginalis</i>	Buffalo clover
<i>Cyperus rotundus</i>	Nutgrass
<i>Dactyloctenium aegyptium</i>	Button grass
<i>Echinochloa colona</i>	Barnyard grass
<i>Hyptis suaveolens</i>	Hyptis
<i>Lantana camara</i>	Common Lantana
<i>Malachra fasciata</i>	Malachra
<i>Passiflora foetida</i>	Wild passionfruit
<i>Stylosanthes humilis</i>	Stylo
<i>Triumfetta rhomboidea</i>	Jute
Declared species	
<i>Cenchrus echinatus</i>	Mossman River grass
<i>Cryptostegia madagascariensis</i>	Ornamental rubber vine
<i>Hyptis suaveolens</i>	Hyptis
<i>Lantana camara</i>	Common Lantana
<i>Mimosa pigra</i>	Mimosa, giant sensitive plant
<i>Pennisetum polystachion</i>	Mission grass
<i>Senna obtusifolia</i>	Sicklepod
<i>Senna occidentalis</i>	Coffee senna
<i>Sida acuta</i>	Spinyhead sida
<i>Sida cordifolia</i>	Flannel weed
<i>Sida rhombifolia</i>	Paddy's lucerne
<i>Stachytarpheta cayennensis</i>	Snake weed



Table 11: Naturalised and Declared Weeds (Fensham and Cowie, 1997)

Fauna

While recording traditional Tiwi knowledge during 1994-1996, Puruntatameri *et al.* recorded 171 animal taxa. The majority were bird species, representing one third of the total listing. The next most recorded groups were reptiles, fish, insects, mammals, shellfish and molluscs, and crustaceans.

Grouping	No of species recorded	Total species recorded
Birds		
bush fowl, ducks, geese, turkey	7	
carnivores, insectivores	10	
cockatoos, lorikeets and parrots	5	
granivores, frugivores	6	
owls and nightjars	5	
raptors	7	
waterbirds	16	56
Fish	24	24
Mammals		
bandicoots, gliders, possums	3	
bats	3	
wallaby	1	
feral mammals	3	
marine mammals	3	
rats	3	
others	2	19
Reptiles		
crocodiles	1	
lizards, skinks, goannas	9	
snakes	12	
turtles	5	27
Shellfish/molluscs	9	9
Crustaceans	5	5
Insects	23	23
Other	8	8

Table 12: Tiwi Fauna Groups (Puruntatameri *et al.* 2001)

Woinarski *et al.* collated historical information on the fauna of the Islands, and described detailed results from studies undertaken in 2000-2001. Limited information is available for fish, freshwater systems, marine systems and invertebrates, with most emphasis placed on terrestrial vertebrate fauna. Woinarski *et al.* did, however, systematically inventory ants, and identified 151 species during 2000-2001, also noting that the tally was likely to be very incomplete.

Results from historical collations and recent studies are broadly summarised on the following page:



Grouping	No of species recorded	Total species recorded	Comments
Birds	216	216	4 may need confirmation
Fish	49	49	includes many estuarine species
Mammals			
dasyurids	4		
bandicoots	1		
macropods	1		
possums	2		
bats	16		1 may need confirmation
rodents	10		2 may need confirmation
dingoes	1		
dugongs	1	36	
exotic	6	6	Exotic
Reptiles			
crocodiles	1		
marine turtles	5		
freshwater turtles	2		
geckoes	5		1 is exotic
legless lizards	3		
dragons	6		2 may need confirmation
goannas	6		1 may need confirmation
skinks	21		1 may need confirmation
blind snakes	3		1 is exotic
pythons	4		
file snakes	2		1 may need confirmation
colubrid snakes	6		
elapid snakes	11		
sea snakes	6	81	
Frogs	17	17	
Ants	151	151	6 are exotic

Table 13: Western Scientific Fauna Groups (Woinarski *et al.* 2003)

Six exotic mammal species were identified during the study; black rat, water buffalo, cattle, pig, horse and cat. Water buffalo and horses occur exclusively on Melville Island, with the exception of one resident stallion at Nguiu known locally as Charlie. A survey by Saalfield in 1997 estimated 4107 ± 2009 buffalo concentrated mostly in the eastern half of Melville Island, and 1397 ± 1234 horses predominantly in the southern half. The survey methodology suggests that these estimates are likely to be significantly low (Saalfield 2003).

Until recently, feral pigs were thought to occur exclusively on Bathurst Island. Sporadic but unconfirmed reports of pigs on Melville Island led the Tiwi Land Council to initiate a localised survey in 2003, which confirmed their presence. Although numbers are not known, it is believed that their occurrence is restricted to one area in the north west of the Island. Pigs have been present on Bathurst Island since Mission settlement, and while their numbers are also not known, they have caused significant local impact in many areas of the Island.

Cats have largely been restricted to the communities on both Islands, however reports of bush sightings are increasing.

Of the six introduced ant species recorded, five are considered to be relatively innocuous. The sixth, *Pheidole megacephala*, or big-headed ant, is known as one of the world's most invasive ant species and a threat to biodiversity values. At this stage, the ant is known only from communities, and did not appear in recent Tiwi fauna surveys (Andersen *et al.* 2003).





VALUES AND VISION





Place and Landscape Values

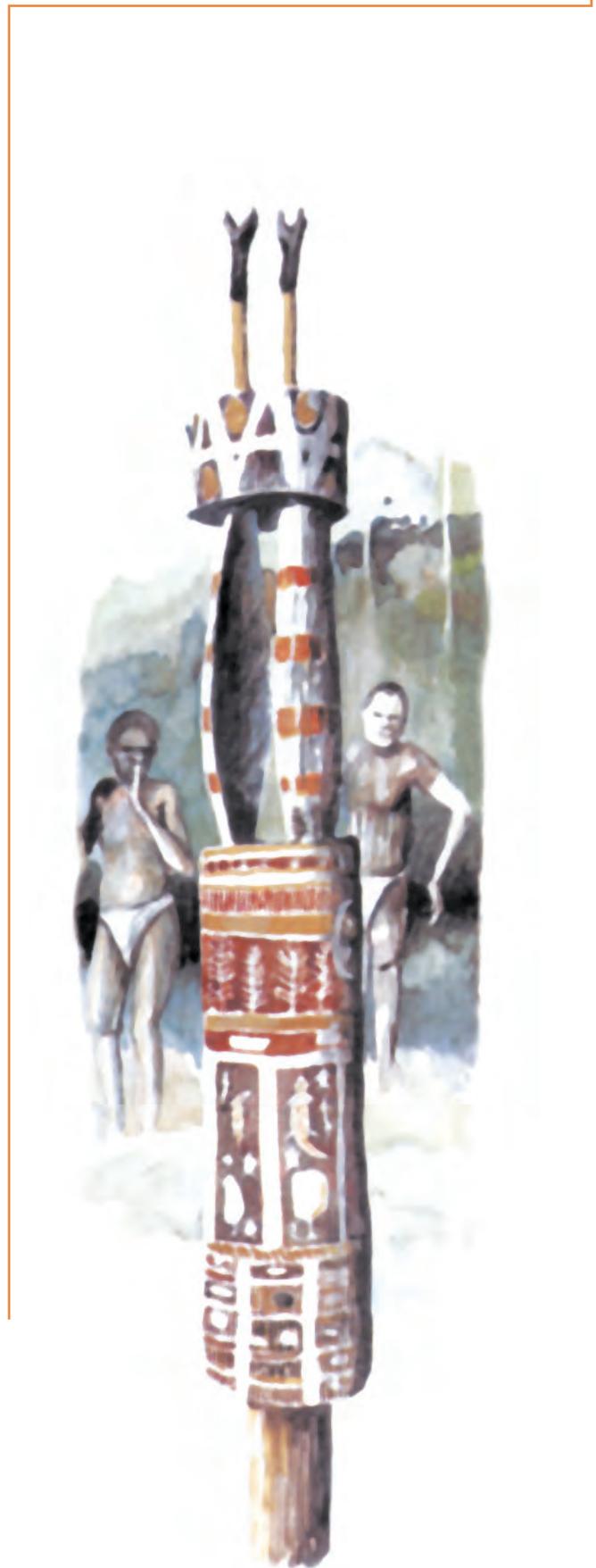
The importance of place values of the Tiwi Islands cannot be overstressed: *the ownership, allocation and expression of land and natural resources provides the definition of who a person is, and where they fit within society.*

There has been an unbroken history of occupation and ownership of the Tiwi Islands by Tiwi people. Place values are important because of their role in determining how Tiwi people have and still define themselves today.

Some areas of land and specific sites have high spiritual value determined through Tiwi history and culture. Currently there are three sacred sites registered with the Aboriginal Areas Protection Authority, and another 56 recorded sites of significance including two sites on the Northern Territory mainland. In addition, there are sites of shared history that have significance to both Tiwi and non-Tiwi. These include Fort Dundas (listed on the National Estate), and several saw mills and World War II installations.

Land plays an important role in kinship and relationship networks, with each person belonging to a landowning group, and having particular connections to spatially defined areas. Similarly, there are aspects of managing and allocating land and natural resources that are inseparable from kinship and relationship ties. While landowning rights are inherited from the father, the responsibility for the care of particular sites comes through the mother's line.

The Tiwi landscape provides inspiration that is expressed through ceremonies, art, dance, stories and song. These are fundamental elements of Tiwi society that reaffirm individual and group roles and positions.



Traditional Use Values

There are many Tiwi plants and animals that are valuable for ceremonial purposes and for the traditional knowledge that is attached to them. One of the most important is Kurlama (*Dioscoria bulbifera*); a yam that is considered 'cheeky' (poisonous) if eaten without proper preparation. It provides the focus for the Kurlama ceremony, a three-day annual event that involves ritual cooking of the yam, singing and dancing. The purpose of the ceremony is to heal hurts and express sorrow over events of the previous year, to bestow Tiwi names on children, and to ensure good health and plentiful bush food for the coming year. Kurlama ceremonies are still practiced by suitably qualified people today.



Other ceremonial and knowledge values of Tiwi plants and animals are documented in Puruntatameri *et al.* (2001), and summarised below:

Value	No. of plant species	No. of animal species	Total no. of species
Calendar association	6	1	7
Medicine	37	6	43
Material culture			
Artefacts/carving	3		
Baskets	4		
Fibre crafts	18		
Firewood	7		
Glues/adhesives	4		
Poisonous/harmful	3		
Shade/shelter	5		
Toys	4		
Feathers/down		4	
Leather/fur		2	
Sinew/bone		1	
Others	11		66
Weapons/implements			
Canoes	11		
Clap-sticks	2		
Didgeridu	6		
Digging sticks	3		
Fighting/throwing sticks	6		
Fire sticks/carriers	13		
Smoking pipes	2		
Spears	14		
Other	7		64

Table 14: Tiwi Plant Uses (Puruntatameri *et al.* 2001)

Economic Values

Puruntatameri *et al.* recorded the names and uses of 216 plants and 171 animals on the Tiwi Islands. Of these, 133 (45.4%) of the plants were identified as a food resource, and 56 (81%) of the animals. Included are a number of introduced species that are highly valued as a food resource. These include cashew (*Anacardium occidentale*), mango (*Mangifera indica*), English yam (*Dioscorea alata*), water buffalo (*Bubalus bubalis*) and pig (*Sus scrofa*).

The marine environment is recognised as being particularly valuable for food, as relatively little effort is required to harvest a good quantity. Shellfish, mussels, oysters, periwinkles, mangrove worms and mud crabs occur in mangrove communities in abundance, while possums and other edible mammals can sometimes be found feeding on the flowers of mangrove trees. Fish, dugong and turtle are regularly harvested from the sea, and certain beaches are good sources of turtle and bird eggs.

The natural resource values of the Tiwi Islands have long been recognised for their economic potential in terms of enterprise development. Vegetables and fruit were successfully grown adjacent to communities during the Mission days, and Nguuu and Milikapiti still operate ‘farms’ which provide horticultural produce. In the mid 1990’s, Milikapiti was successfully exporting sweet potato for sale on the mainland. The Islands were also assessed for improved pasture potential, with research and trials carried out from 1973 to 1975 (Archer 1979).

In 1921/22, C E J Allen, Superintendent of Agriculture in the NT, and Gerald Hill of the Townsville Institute suggested that a forestry reserve be established on the Islands. In 1960 the Commonwealth Government established plantations and trials, and Melville Island was chosen as the focus for future forestry development. The Island offered a number of advantages over the mainland, including better rainfall distribution, more favourable soil types, groundwater reserves and lower incidences of termite attack.

Plantation forestry and the subsequent harvest of native timber is now one of the major contributors to the region’s economy. Sea cage

aquaculture is also proving to be viable, with 20 tonnes of farmed barramundi currently being exported every week.

In addition to forestry and aquaculture, potential exists for a range of economic opportunities based on the region’s natural resources, including (but not limited to):

- Climatic conditions and soil types that are favourable for various cropping and grazing activities;
- Sand, topsoil and gravel suitable for construction and mineral extraction;
- Native fruit and wildlife for commercial harvest (for example Kakadu Plum and crocodile eggs);
- Pharmaceutical and cosmetic (for example essential oil) properties of native vegetation;
- Native vegetation and soils (timber, clay, ochres) for art and craft production;
- Quality and quantity of surface and groundwater for domestic supply, irrigation and tourism activities;
- Well stocked marine fishery for commercial and tourism activities;
- Large tracts of undisturbed areas for nature based tourism enterprises.

Hollingsworth (2003) carried out a land capability study on selected land uses of the Tiwi Islands from historical records and field survey. The classification of land capability was based on soil properties, landform, slope, elevation, distance from streamlines and distance from the coast. This information will provide a scientific basis for assessing potential future economic ventures based on the region’s natural resources.





Conservation Values

Vegetation types

Woinarski *et al.* identifies some major vegetation types on the Tiwi Islands that are significant for conservation at the Northern Territory scale:

Wet and dry rainforest

Many of the largest patches in the NT, many of the most floristically rich, and many with high numbers of endemic and threatened species. They are also more numerous on the Tiwi Islands compared with similar sized areas on the NT mainland, and distinctly different in plant species composition.

Treeless plains

Recognised as endemic to the Tiwi Islands.

Eucalypt forest

Best developed eucalypt formations in the Northern Territory, and floristically distinct with the exception of Coburg Peninsula.

In addition to the above, riparian zones and wetlands were considered to be of value for conservation planning due to their importance for regional biodiversity (Woinarski *et al.* 2000).

Native plant species

Of the 1082 native plant species recorded by Woinarski *et al.*, twenty are listed in the Northern Territory as endangered or vulnerable, with a further 43 listed as Data Deficient. Eleven species are endemic to the Tiwi Islands, and nineteen occur in the Northern Territory only on the Tiwi Islands, but also occur beyond the Northern Territory. Although all habitats are represented, most of the threatened plants occur in rainforests.

Scientific name	Habitat	Status
<i>Eliocarpus meigi</i>	Rainforest	Critically endangered (NT); NT distribution limited to the Tiwi Islands
<i>Burmannia</i> D61177 Bathurst Island	Rainforest	Endangered (NT); Endangered (National); Endemic to the Tiwi Islands
<i>Cephalomanes obscurum</i>	Rainforest	Endangered (NT)
<i>Garcinia warrenii</i>	Rainforest	Endangered (NT); NT distribution limited to the Tiwi Islands.
<i>Tarennoidea wallichii</i>	Rainforest	Endangered (NT); NT distribution limited to the Tiwi Islands.
<i>Typhonium jonesii</i>	Eucalypt open forest	Endangered (NT); Endemic to the Tiwi Islands
<i>Typhonium mirabile</i>	Eucalypt open forest	Endangered (NT); Endemic to the Tiwi Islands
<i>Utricularia subulata</i>	Melaleuca woodland	Endangered (NT)
<i>Xylopia</i> D30127 Melville Island	Rainforest	Endangered (NT); Endemic to the Tiwi Islands
<i>Calochilus caeruleus</i>	Paperbark swamp	Vulnerable (NT)
<i>Cycas armstrongii</i>	Eucalypt open forest	Vulnerable (NT)
<i>Dendromyza reinwardtiana</i>	Rainforest	Vulnerable (NT); NT distribution limited to the Tiwi Islands
<i>Endiandra limnophila</i>	Rainforest	Vulnerable (NT)
<i>Freycinetia excelsa</i>	Rainforest	Vulnerable (NT)
<i>Freycinetia percostata</i>	Rainforest	Vulnerable (NT)
<i>Hoya australis oramicola</i>	Rainforest	Vulnerable (NT); Endemic to the Tiwi Islands
<i>Luisia teretifolia</i>	Rainforest	Vulnerable (NT)
<i>Mapania macrocephala</i>	Rainforest	Vulnerable (NT)
<i>Mitrella</i> D24710 Melville Is.	Rainforest	Vulnerable (NT); Endemic to the Tiwi Islands
<i>Thrixspermum congestum</i>	Rainforest	Vulnerable (NT); NT distribution limited to the Tiwi Islands
<i>Desmodium tiwiense</i>	Eucalypt open forest	Endemic to the Tiwi Islands
<i>Goodenia</i> D1547 Melville Island	Eucalypt woodland	Endemic to the Tiwi Islands
<i>Lindernia cowiei</i>	Wetlands	Endemic to the Tiwi Islands
<i>Parsonsia</i> D30178 Melville Island	Rainforest	Endemic to the Tiwi Islands
<i>Spermacoce</i> D43976 <i>retitesta</i>	Eucalypt open forest	Endemic to the Tiwi Islands
<i>Acmenosperma claviflorum</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Actinostachys wagneri</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Calochilus caeruleus</i>	Paperbark swamp	NT distribution limited to the Tiwi Islands
<i>Clerodendrum longiflorum glabrum</i>	Rainforest margins	NT distribution limited to the Tiwi Islands
<i>Crinum venosum</i>	Paperbark swamps	NT distribution limited to the Tiwi Islands
<i>Dendrobium trilamellatum</i>	Paperbark swamps	NT distribution limited to the Tiwi Islands
<i>Hedyotis auricularia melanescia</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Hypolytrum nemorum</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Hypserpa decumbens</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Hypserpa polyandra</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Litsea breviumbellata</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Scleria carphiformis</i>	Treeless plains	NT distribution limited to the Tiwi Islands
<i>Strychnos minor</i>	Rainforest	NT distribution limited to the Tiwi Islands
<i>Triumfetta repens</i>	Coastal dunes	NT distribution limited to the Tiwi Islands

Table 15: Listed Flora (Woinarski *et al.* 2003)

Fauna

Woinarski *et al.* considered that “The Tiwi Islands have outstanding values for fauna conservation”. Of the 542 native species recorded, eighteen are listed as endangered or vulnerable at either the Northern Territory or national level, eight subspecies of birds and two subspecies of mammals are regarded as endemic, as are 10% of the recorded ant species. In addition, 51 species are listed under international conventions for the protection of migratory species. Most of the threatened species occur in eucalypt open forest, although all main habitat types support at least one threatened taxon (Woinarski *et al.* 2003).

Taxonomic group	Species	Status
Snails	<i>Amphidromus cognatus</i>	Vulnerable (NT)
	<i>Trochomorpha melvillensis</i>	Vulnerable (NT)
Butterflies	Dodd’s Azure butterfly <i>Ogyris iphis doddi</i>	Endangered (NT)
	Northern grassdart butterfly <i>Taractrocera ilia ilia</i>	Vulnerable (NT)
Reptiles	Green turtle <i>Chelonia mydas</i>	Vulnerable (national); BONN
	Hawksbill turtle <i>Eretmochelys imbricata</i>	Vulnerable (national); BONN
	Olive Ridley <i>Lepidochelys olivacea</i>	Endangered (national); BONN
	Flatback turtle <i>Natador depressus</i>	Vulnerable (national); BONN
	Loggerhead turtle <i>Caretta caretta</i>	Endangered (NT & national); BONN
	Saltwater crocodile <i>Crocodylus porosus</i>	BONN
Birds	Red goshawk <i>Erythrotriorchis radiatus</i>	Vulnerable (NT & national)
	Partridge pigeon (eastern subspecies) <i>Geophaps smithii smithii</i>	Near threatened (NT); Vulnerable (national)
	Masked owl (Melville Island subspecies) <i>Tyto novaehollandiae melvillensis</i>	Endangered (NT); Vulnerable (national)
	Hooded robin (Tiwi Islands subspecies) <i>Melanodryas cucullata melvillensis</i>	Endangered (NT)
	Brown booby <i>Sula leucogaster</i>	CAMBA; JAMBA
	Lesser frigatebird <i>Fregata ariel</i>	CAMBA; JAMBA
	Eastern reef egret <i>Egretta sacra</i>	CAMBA
	Great egret <i>Ardea alba</i>	CAMBA; JAMBA
	Glossy ibis <i>Plegadis falcinellus</i>	CAMBA
	White bellied sea eagle <i>Haliaeetus leucogaster</i>	CAMBA
	Pin tailed snipe <i>Gallinago stenura</i>	CAMBA; JAMBA
	Swinhoe’s snipe <i>Gallinago megala</i>	CAMBA; JAMBA; BONN
	Black tailed godwit <i>Limosa limosa</i>	CAMBA; JAMBA; BONN
	Bar tailed godwit <i>Limosa lapponica</i>	CAMBA; JAMBA; BONN
	Little curlew <i>Numenius minutus</i>	CAMBA; JAMBA; BONN
	Whimbrel <i>Numenius phaeopus</i>	CAMBA; JAMBA; BONN
	Eastern curlew <i>Numenius madagascariensis</i>	CAMBA; JAMBA; BONN
	Marsh sandpiper <i>Tringa stagnatilis</i>	CAMBA; JAMBA; BONN
	Common greenshank <i>Tringa nebularia</i>	CAMBA; JAMBA; BONN
	Terek sandpiper <i>Xenus cinereus</i>	CAMBA; JAMBA; BONN
	Common sandpiper <i>Actitis hypoleucos</i>	CAMBA; JAMBA; BONN
	Grey tailed tattler <i>Heteroscelus brevipes</i>	CAMBA; JAMBA; BONN

Birds (cont.)	Ruddy turnstone <i>Arenaria interpres</i>	CAMBA; JAMBA; BONN
	Asian dowitcher <i>Limnodromus semipalmatus</i>	CAMBA; JAMBA; BONN
	Red knot <i>Calidris canutus</i>	CAMBA; JAMBA; BONN
	Great knot <i>Calidris tenuirostris</i>	CAMBA; JAMBA; BONN
	Red necked stint <i>Calidris ruficollis</i>	CAMBA; JAMBA; BONN
	Sharp tailed sandpiper <i>Calidris acuminata</i>	CAMBA; JAMBA; BONN
	Curlew sandpiper <i>Calidris ferruginea</i>	CAMBA; JAMBA; BONN
	Sanderling <i>Calidris alba</i>	CAMBA; JAMBA; BONN
	Broad billed sandpiper <i>Limacola falcinellus</i>	CAMBA; JAMBA; BONN
	Grey plover <i>Pluvialis squatarola</i>	CAMBA; JAMBA; BONN
	Pacific golden plover <i>Pluvialis fulva</i>	CAMBA; JAMBA; BONN
	Lesser sand plover <i>Charadrius mongolus</i>	CAMBA; JAMBA; BONN
	Greater sand plover <i>Charadrius leschenaultii</i>	CAMBA; JAMBA; BONN
	Caspian tern <i>Sterna caspia</i>	CAMBA; JAMBA
	Lesser crested tern <i>Sterna bengalensis</i>	CAMBA
	Little tern <i>Sterna albifrons</i>	CAMBA; JAMBA
	Common tern <i>Sterna hirundo</i>	CAMBA; JAMBA
	White winged black tern <i>Chidonias leucopterus</i>	CAMBA; JAMBA
	Oriental cuckoo <i>Cuculus saturatus</i>	CAMBA; JAMBA
	White throated needletail <i>Hirundapus caudacutus</i>	CAMBA; JAMBA
	Fork tailed swift <i>Apus pacificus</i>	CAMBA; JAMBA
	Rainbow bee eater <i>Merops ornatus</i>	JAMBA
	Leaden flycatcher <i>Myiagra rubecula</i>	BONN
	Restless flycatcher <i>Myiagra inquieta</i>	BONN
Rufous fantail <i>Rhipidura rufifrons</i>	BONN	
Oriental reed warbler <i>Acrocephalus orientalis</i>	CAMBA	
Mammals	Butler's dunnart <i>Sminthopsis butleri</i>	Vulnerable (NT & national)
	Northern brush tailed phascogale <i>Phascogale (tapoatafa) pirata</i>	Vulnerable (NT)
	Bare rumped sheath tail bat <i>Saccolaimus saccolaimus nudicluniatus</i>	Critically endangered (Bat action plan)
	Little north western freetail bat <i>Mormopterus loriae cobourgiana</i>	Near threatened (NT)
	Brush tailed rabbit rat <i>Conilurus penicillatus</i>	Vulnerable (NT)
	False water rat <i>Xeromys myoides</i>	Vulnerable (national)
	Dugong <i>Dugong dugon</i>	BONN

CAMBA = China-Australia Migratory Bird Agreement (CAMBA, 1986)

JAMBA = Japan-Australia Migratory Bird Agreement (JAMBA, 1974)

BONN = Convention of the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)

Table 16: Listed Fauna (Woinarski *et al.* 2003)



Statement of Vision

The Tiwi vision is a statement of the values placed on the natural resources of the Tiwi Islands by the majority stakeholders; Tiwi people. It recognises their importance in terms of economic development, while also acknowledging their cultural, spiritual and recreational values. Others also value the Islands' natural resources, predominantly for contemporary conservation aims. The challenge is to accommodate and protect the variety of values placed on the Tiwi Islands, while acknowledging that it is those who rely on the Islands for their daily living that will be most affected by natural resource management actions both now and into the future.

“Our vision is of an independent and resilient Tiwi society built on the orderly and well managed utilisation of our natural resources.

Inherent in this is the maintenance and protection of our unique cultural and natural resource values for the enjoyment and benefit of future generations of Tiwi.”

Tiwi Land Council
Management
Committee 2001.



NATURAL RESOURCE MANAGEMENT ISSUES & RECOMMENDATIONS FOR MANAGEMENT







PLANNING & REGIONAL MANAGEMENT



Information: availability, management and ownership

Principle:

Optimal strategic resource management outcomes are achieved through consensus decision-making, comprehensive knowledge of the resource base, and appropriate tools to manage and manipulate data.

Historically, the documented knowledge of the natural resources of the Tiwi Islands has been fragmented, and focussed on specific areas (such as potential forestry sites), or subjects (such as rainforests or bamboo). Information that is available for the whole region has been based on broader studies, and has not contained enough detail for regional planning (for example the 1:1,000,000 scale Northern Territory Vegetation Map).

In recent years, the potential for large-scale plantation forestry in the region has required more detailed studies, in particular for biodiversity. Scientific interest in the region remains constant, with the NT Government studying water resources and studies also being undertaken on a wide variety of subjects from cultural heritage to tidal flows. The Tiwi Land Council, in exploring opportunities for sustainable economic development, has also initiated studies on land capability and traditional knowledge.

While recent studies have greatly improved the knowledge base of the region, there are still areas where information is scant. In contrast, there are some specific subject areas that have been researched and studied in some depth. The source data for many of these studies are scattered amongst external agencies and institutions, and are not easily accessible.

Paucity and fragmentation of baseline data on the Tiwi Islands has led to legislative bodies invoking the 'precautionary principle' whereby commercial development cannot occur in the absence of sufficient data. While this principle is sound for sustainable management, it needs to be matched by research effort so that informed natural resource management decisions can be made.

One of the issues facing Tiwi leadership is ownership of natural resources. Under current Federal and Territory legislation, cultural and

natural heritage values are determined largely by non-Tiwi, and ownership of the elements that make up those values are vested with the relevant Ministers, both territorial and federal. This has led to dis-empowerment of Tiwi leaders to negotiate economic projects with potential investors, lack of certainty, and an undermining of the rights of landowners to responsibly manage their own resources.

In order to develop and maintain sound regional natural resource management decision processes, there must be acknowledgment and inclusion of the major stakeholders as resource owners, comprehensive knowledge of the resource base, a central repository for natural resource information, and the capacity to manage and manipulate data.



Outcome:

Effective strategic natural resource planning and management decisions.

Objectives:

1. Collect, collate and manage natural resource information.
2. Include all stakeholders in decision making processes.

Recommended Actions:

- 1.1 Finalise current studies on biodiversity, water resources and land capability.
- 1.2 Commence a programme for identifying and filling priority gaps in resource knowledge. Invite and manage research effort in areas of shared interest.
- 1.3 Finalise development of the Tiwi Geographic Information System (GIS).
- 1.4 Purchase appropriate computer hardware and software dedicated to natural resource management, and develop a central library for natural resource information.

- 1.5 Source and obtain data sets held within other organisations.
- 1.6 Develop protocols for updating the Tiwi GIS, including data format protocols for information sourced from external agencies.
- 1.7 Ensure that agreements for research and study include the provision of data in an appropriate format.
- 1.8 Regularly review and update this Strategy and the Tiwi GIS to include improvements in the knowledge base.
- 2.1 Provide advice to government on issues relating to natural resource management on the Tiwi Islands.
- 2.2 Encourage and promote the formation of co-management bodies to negotiate instances of competition in natural resource allocation, and to ensure that differences in views are adequately addressed in the decision making process.



Areas of high value to Tiwi people, and areas of shared value

Principle:

The natural and cultural resources of the region provide definition for who people are, and where they fit within society. Areas and elements that have high place values for Tiwi people should be protected and appropriately managed.

Davis (1983) stated 'The continued violation of traditional Tiwi rules of access to ritually restricted areas by non-Aboriginal persons has led to a demeaning of the status of some sites and accompanying psychological stresses for Tiwi custodians. The continued presence of non-Tiwi persons in such areas...has forced Tiwi custodians in some areas to diminish the size of the area in order to maintain its identity and lessen the desecration.'

A number of sacred and significant sites have been recorded and entered into the Tiwi Geographic Information System. Knowledge about some sites and resources is restricted to suitably qualified and experienced people, and cannot therefore be presented in documents and maps available for general scrutiny. The information, however, must be taken into account when considering access and land disturbance.

In addition to these sites, there are other areas that are highly valued for the resources they contain and their historical usage. These include areas such as Goose Creek where there are significant populations of Magpie Geese, Seagull Island, which is significant for bird eggs, and certain beaches and mangrove communities important for food gathering.

Areas of shared history can be important to both Tiwi and non-Tiwi, as they represent a Tiwi identity in relation to the outside world. One such site of shared value is Fort Dundas, the British settlement established near Punata in 1824 and abandoned in 1829. Other sites are documented in Bathgate and Lewis (1999), and include Mission infrastructure and remains, sawmills and WWII installations. Apart from Fort Dundas, there has been minimal assessment of the value of the remaining sites to Tiwi people. Some, in fact, may be reminders of earlier, unhappier times in Tiwi history, and their preservation may be detrimental to some sectors of the community.

Outcome:

Natural resource management that is appropriate for the majority stakeholders - Tiwi people.

Objective:

3: Preserve and protect areas and resources of high value to Tiwi people.

Recommended Actions:

- 3.1 Through consultation, confirm areas of cultural significance and update the Tiwi GIS where appropriate.
- 3.2 Identify areas of cultural significance that require management/rehabilitation plans; develop and implement where required.
- 3.3 Develop and implement Codes of Practice for consultation with landowners through the appropriate authority prior to land and sea access and disturbance.
- 3.4 Prepare and distribute maps of land ownership and authority.
- 3.5 Provide regular orientation workshops for non-Tiwi staff and residents.



Biodiversity

Principles:

The Tiwi Islands are valued for their endemic, rare and threatened species and environments. These areas and the ecological processes essential for their continued existence should be maintained.

Including Tiwi people and industry representatives in the allocation of biodiversity values is fundamental for the protection of areas of high value.

The region's biodiversity values have been determined through contemporary scientific survey and subsequent analysis. Value has been assigned based on the intact nature of the region, and the relative rarity of species and environments in both regional and broader contexts. In general, the biodiversity of the Tiwi Islands is considered to be in good condition. Detailed survey results, analysis of data and assessments of value are covered in Woinarski *et al.* 2000 & 2003.

There are areas where the Tiwi determination of value does not correspond with the contemporary view, and these differences need to be addressed in the decision-making process for natural resource allocation and subsequent management.

The north coast of Melville Island has some of the highest numbers of Olive Ridley turtle nesting in Australia, and is also one of the key areas for dugongs in the Northern Territory (Chatto 2001). Seagull Island is also the largest reported crested tern rookery in Australia (Watanabe 1999). Turtle, dugong and tern eggs are sought after food for Tiwi residents, and Tiwi leaders have expressed concern from time to time about the sustainability of local harvests. An assessment in 2001 by the Parks and Wildlife Commission of the Northern Territory found that the current harvest of tern eggs is sustainable, and that the larger threat to Olive Ridley turtle nesting was predation by wild dogs. There is no current information on the status of the dugong population in the region.

Given the importance of the north coast of Melville Island to both Tiwi and non-Tiwi values, protection of the area's marine biodiversity should be a high priority.

Marine Harvest is currently undertaking sea cage aquaculture in Port Hurd off the western coast of Bathurst Island. Preliminary biodiversity surveys have been carried out, and an Environmental Management Plan is currently in draft form. Anticipated impacts, risk assessments and recommended actions have been determined for a wide range of issues for both the estuarine and land based aspects of the facility. A monitoring programme has also been recommended, and includes monitoring the mangrove area, extent and composition; benthic infauna; epiphytic algal growth and plankton counts.

Biodiversity management and monitoring protocols have also been developed as a component of the current plantation forestry project, which is to date the largest scale land development on the Islands. Monitoring requirements under the *Environment Protection and Biodiversity Conservation Act* focus on the threatened bird species red goshawk (*Erythrotriorchis radiatus*), masked owl (*Tyto novaehollandiae melwillensis*) and partridge pigeon (*Geophaps smithii smithii*). Additional management protocols have been determined for the threatened mammal butler's dunnart (*Sminthopsis butleri*), and other elements that may impact on biodiversity.



The Tiwi Land Council's Plantation Forestry Strategic Plan includes a commitment for monitoring additional species such as hooded robin (*Melanodryas cucullata melvillensis*), brush-tailed rabbit-rat (*Conilurus penicillatus*), black-footed tree-rat (*Mesembriomys gouldii*), *Typhonium jonesii*, *Typhonium mirabile* and *Desmodium tiwiense*.

Also in the Forestry Strategic Plan are management and monitoring commitments for wet rainforests, and elements that may impact on biodiversity values (surface and groundwater quantity and quality, weeds, quarantine, soil erosion and fire). These commitments were based on preliminary biodiversity information available at 2000, and incorporated the known biodiversity values for the region as a whole. More detailed studies carried out during 2001 and 2002 are currently being analysed by the Parks and Wildlife Service of the Northern Territory, who will provide further recommendations.

It is important that the current and ongoing development of biodiversity management and monitoring recommendations is an inclusive process involving all key stakeholders - landowners, industry and government.

Outcome:

Natural resource management that supports the health and functioning of areas of significant nature conservation value.

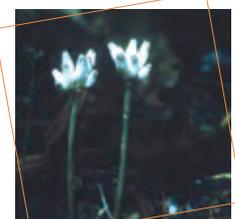
Objective:

4. Develop and implement processes that preserve and protect areas and resources of high scientific and contemporary conservation value.

Recommended Actions:

- 4.1 Promote early and full inclusion of Tiwi stakeholders in the determination of biodiversity values. Include stakeholder views in recommendations for management.
- 4.2 Develop and implement consultative mechanisms for the preparation of species recovery plans for threatened species in the region.
- 4.3 Progress sea-closures and other protective measures for the north coast of Melville Island as a high priority (see also Coastal Management).

- 4.4 Initiate and manage ongoing research on turtle and dugong population and habitat status, including recommendations for management.
- 4.5 Progress biodiversity management and monitoring protocols for aquaculture and forestry through an inclusive negotiation process involving landowners, industry and government. Revise and update prior commitments where relevant.
- 4.6 Implement existing commitments for biodiversity management and monitoring under the *Environment Protection and Biodiversity Conservation Act*.
- 4.7 Record on the Tiwi GIS as protected from significant changes in land use:
 - Seagull Island.
 - The mouths and landward waters of Shark Bay, Snake Bay, Goose Creek, Lethbridge Bay, Brenton Bay and adjacent areas significant for turtle breeding, seagrass and seaweed.
 - Known locations of listed threatened species, and associated buffers.
 - Environments listed as threatened.
 - Rainforest areas.
 - Riparian zones.
 - Wetlands.
 - Other significant habitats for animals listed under international treaties.
- 4.8 Flag on the Tiwi GIS as requiring further investigation when considering changes in land use:
 - The northern coastline of Melville Island.
 - Treeless plains.
 - Data deficient species, with the priority on endemic species.
- 4.9 Continue discussions for areas set aside as reserves, with a focus on the provision of adequate resources for their ongoing management.



Freshwater resources

Principle:

The Tiwi Islands are valued for their freshwater resources. Allocation of freshwater quantity and quality should include current and future uses in the areas of domestic supply; recreation, food gathering and tourism; plantation forestry and other economic enterprises; environmental flows and intermittent, short term development use.

Major current uses of the freshwater resources on the Tiwi Islands include domestic supply (including irrigation of small market gardens at Nguui and Milikapiti), recreation, food gathering and tourism, plantation forestry and the natural environment. Intermittent, short-term demands may also occur during periods of infrastructure development such as road and airstrip construction and upgrades. An assessment by Haig *et al.* in 2003 determined that current usage levels pose no undue concerns to the health and sustainability of the freshwater resources.

Domestic supply

Nguui, Milikapiti and Wurankuwu each have developed bore fields that supply domestic water. Yimpinari, Taracumbi and Takamprimili outstations are serviced by bores, as are Wulyuwunga, a popular local camping site and Maxwell Creek, the plantation forestry base. A combination of rainwater tanks and a sand spear provides the Port Hurd supply, which is the land base for the sea cage aquaculture development.

Pirlangimpi community and Pickertaramoor camp are each serviced by surface water, while other popular camping sites have water carted to holding tanks during 'bush holidays'. Paru outstation also relies on carted water. It is intended that a proposed outstation at Putjamirra accesses the Wulyuwunga bore for domestic supply.

According to Haig *et al.*, the bore fields at Nguui, Milikapiti and Wurankuwu have been constructed according to standard methods, which ensure that the possibility of contamination is eliminated or reduced to an insignificant amount. Bores have also been located outside minimum recommended distances from contaminant sources such as rubbish tips, fuel storage and market gardens. While current supplies are adequate, future increases in population may necessitate

upgrading and increased availability. Similarly, bores at Yimpinari, Taracumbi, Takamprimili, Wulyuwunga, Maxwell Creek and Port Hurd are constructed and located to provide an adequate supply with minimal risk of contamination.

The Pirlangimpi domestic water supply from Blue Water Creek is also adequate for current usage, but although treated prior to consumption, is sometimes at risk of contamination from overland flow. A potential borefield has been identified to the east of the community for future development if required.

Haig *et al.* 2003 made estimates of the levels of domestic water use in the three main communities of Nguui, Milikapiti and Pirlangimpi. Milikapiti and Pirlangimpi estimates are in excess of 1,000 litres/person/day, with Nguui over 500 litres/person/day. This may indicate that water is not used as efficiently in Milikapiti and Pirlangimpi, however corroborative evidence is unavailable.

Paru outstation does not currently have a suitable or sustainable domestic water supply. In the past, a pumping station supplied water from a creek approximately 4km away, however this was decommissioned due to the creek becoming brackish during the dry season. A pipeline constructed across the Apsley Strait from Nguui was also unsuccessful due to the strong currents and shifting sea bed, and bores drilled in the vicinity of Paru in 2000 proved unsuitable due to low yields (0.2 litres/second). There are two existing bores 13km away at Three Ways, and advice from the Northern Territory Government is that either could be used as a production bore for Paru outstation.

Recreation, food gathering and tourism

Although Tiwi prefer saltwater fish to freshwater fish as a food resource, wetlands provide habitat for a number of important food species, including water chestnuts (also important magpie goose food), waterlilies, mud mussels, magpie geese, whistling ducks, burdekin ducks, water monitors and freshwater turtles. Pelicans are also a common subject for wood carvings, and paperbark trees were historically used for a variety of



purposes. Moantu Lake on Bathurst Island is an important spiritual site, and people often spend time camping during 'bush holidays' in wetland areas. Coastal swamps adjacent to communities are also important areas for recreation.

Freshwater springs in the region provide high quality waterfalls and swimming areas for both local residents and tourists. Tumwarripi and Taracumbi waterfalls, and Maralumpi and Kilu-Impini waterholes have all been popular destinations for tourists, and the Johnston and Jessie Rivers are also used by fishing tour operators.

Uncontrolled and sustained access has caused degradation of waterway banks in several areas, due to vehicle and foot traffic, semi-permanent camp sites, and informal boat launching. Remedial works to date have been carried out in the worst affected areas of Taracumbi, Tumwarripi and Maralumpi.

Plantation forestry

The potential contaminants of surface and groundwater from plantation forestry establishment and operation include sediments (surface water only), nutrients from fertiliser applications, agricultural chemicals such as herbicides and pesticides, and other chemicals such as fuel and oil.

It is expected that there will be some initial elevation of sediment and nutrient levels in surface runoff, however previous experience from areas under intensive horticulture, and advice from the NT Government suggests that these are likely to return to background levels once plantations mature.

Three tiers of mitigation measures have been developed for the forestry project, including at source, within plantation areas and off-site. Measures include protocols for storing, handling, transporting and applying chemicals; protocols for waste disposal; effective erosion and sediment control; and the provision of protective buffers around receiving waters. A monitoring programme has also been developed that measures and assesses elements relevant to forestry operations.

Information on groundwater levels is available from a number of bores scattered throughout the region. This information is sufficient to track both short and long term trends in groundwater levels and associate them with monthly rainfall.

Monitoring bores have also been established in and near forestry areas. This will allow gross changes occurring at or near plantation sites and not elsewhere to be determined, and possible impacts assessed on advice from the NT Government.

Natural environment

Wet and dry rainforests on the Islands have been identified as significant at the Northern Territory scale, and wetlands and riparian areas as important for conservation values. All of these ecosystems are dependent on ground and surface water for their health and maintenance. Haig *et al.* assessed that current levels of water use has not caused any noticeable impact on areas of environmental significance, however the issue should be addressed when increasing existing or establishing new bore fields.

Intermittent use

Large scale developments can be heavy users of the freshwater resource. Projects during 2003 included upgrading the Pirlangimpi airstrip, a major upgrade of a section of road between Pirlangimpi and Maxwell Creek, and development of port facilities for forest log export. These projects have been assessed as having no significant impact on the long term water resource, and future large scale projects will similarly need to be assessed on a case by case basis.



Outcome:

Sustainable use and allocation of the freshwater resources on the Tiwi Islands.

Objective:

5. Develop and implement processes that balance freshwater flow volumes and flow quality between the maintenance of biological systems, quality of life for residents and consumptive needs.

Recommended Actions:

- 5.1 Develop and implement a groundwater monitoring programme for Nguiu and Milikapiti bore fields.
- 5.2 Designate and exclude from development the potential bore field that has been identified for Pirlangimpi.
- 5.3 Implement contamination protection measures for Blue Water Creek.
- 5.4 Develop and implement an education and awareness programme on domestic water use.
- 5.5 Provide a sustainable water supply for Paru outstation.
- 5.6 Investigate the feasibility of 'Waterwatch' type programmes to monitor surface water quality at local swimming holes.
- 5.7 Develop Codes of Practice for tour operators and recreational users wishing to regularly access waterways and wetlands, and include in licence provisions.
- 5.8 Implement freshwater management and monitoring commitments for the plantation forestry project.
- 5.9 Initiate and manage research on environmental flow, spring flow, and deep aquifer production capability and recharge.
- 5.10 Recommission the NT Government surface water gauging stations at Blue Water Creek, Taracumbi Creek and Takamprimili Creek.
- 5.11 Include assessments of freshwater resource requirements for large scale development projects where relevant.



Coastal management

Principle:

The coastal zone provides significant resources for residents, visitors and industry. Competing interests need to be appropriately managed if these resources are to be maintained.

The Tiwi Islands coastline has historically been a major focus of activity and contact, from Macassan traders to European explorers, Japanese pearlsh, traders, and Missionaries. Most of the significant sites identified in Tiwi history are located on the coast, as are residential, hunting and ceremonial campsites.

This continues today, with the importance of mangrove and estuarine areas for food, and the preference for saltwater over freshwater fish. The three main communities of Nguiu, Pirlangimpi and Milikapiti are all coastal communities, and Wurankuwu has direct coastal access through a number of nearby watercourses. Similarly, the majority of other outstations and permanent campsites are either on the coast or within easy distance.

The importance of the coastal zone, its access and resources, is evidenced through decades of Land Council business addressing and discussing coastal issues, and investigations into sea closures as early as 1980. Tiwi leaders have long had to deal with competing interests between landowners, recreational and commercial fishing, industry fishing and farming interests, tourism, government, researchers and public lobby groups.

In 1995 the Tiwi Coastal Waters Consultative Committee was formed to progress dialogue between Tiwi interests and the NT Government. The Committee meets regularly, and now includes permanent representation from the Amateur Fishing Association of the NT (AFANT) and Marine Harvest, who operate the aquaculture facility off Bathurst Island.

The Committee has dealt with many issues over the years, including net debris, marine legal enforcement, jurisdictional interests, illegal immigrants and their vessels, river closure lines, recreational permits and agreements, and commercial aquaculture planning. The Tiwi Land Council also provides representation on forums such as the NT Marine and Coastal Management

Policy Sub-committee, the Aquatic Resource User Group Forum, and the Seas Working Group, made up of representatives from each of the coastal Land Councils in the NT.

High fish stocks and close proximity to the mainland has made the region a favourite destination for recreational fishing, and the Islands have featured in a number of popular fishing magazines. Visitation to the area is increasing, especially as keen fishermen access larger vessels with greater ranges. The north coast of Melville Island especially has become a more viable option for those looking for a rewarding trip, and Port Hurd and the west coast of Bathurst Island have become regular destinations.

Trips are usually over two or three days, and are also becoming more popular with Fishing Tour Operators (FTO's), who often operate mother ships with tendered dinghies. AFANT expects these trends to increase. Under current legislation, FTO's are classed as recreational fishers, and as such are permitted to access and fish any waterway. As long as individuals do not enter the land without a permit, they can remain and fish any area for any length of time.

In an effort to manage uncontrolled access to the Islands associated with recreational fishing, an agreement was made between the Tiwi Land Council and the NT Government in 1998. The agreement, administered by AFANT, identified six sites on the islands that were available for camping after obtaining a permit. According to AFANT estimates, permits are issued for an average five to six boats on selected dry season weekends, with up to 15 boat parties obtaining permits for club organised events. Anecdotal evidence suggests that non-compliance is an issue, with reports of people camping without permits (Harrison, 2003).

Bathurst and Melville Islands have a combined coastline of nearly 800km, and the vast majority is inaccessible by road. The population of the Islands is concentrated on the southeast coast of Bathurst Island and the northwest coast of Melville Island, and so sea access to other areas of the coast by local residents is also restricted to larger vessels and long voyages. The remoteness of the Tiwi coastline and its importance to local people creates significant issues to do with uncontrolled access to both the land and

coastal resources. Of major concern to Tiwi leaders is the trend towards increased effort by recreational fishers and FTO's, and the impact this may have on coastal resources, including the inadvertent transport of pest species. The impact of commercial fishing on the region is also poorly understood, and confidentiality of data makes it difficult for Tiwi stakeholders to access information on the use of the resource.

Port Hurd is an important area for industry and Tiwi economic interests, as it contains the Marine Harvest barramundi sea cage facility. It may also become a base for a commercial Tiwi fishing tour operation in the future. Recreational fishers and FTO's regularly visit this area, with one instance of visitors fishing into a sea cage late at night despite the area being aquaculture lease. Port Hurd was also the landing for an illegal foreign fishing boat, the crew of which mistook the area for the Australian mainland. A closure line currently exists across Port Hurd, however it is inland from the Marine Harvest facility.

In response to ongoing coastal issues, the Tiwi Land Council approached the NT Government in 2000 with a proposal for a Tiwi Marine Ranger programme, with the first Ranger commencing duties in 2001. The main function of the Ranger position is to provide a visible presence within the broader fishing community, and to monitor and record fishing activity. Other duties include the provision of a liaison and advisory service to tour operators and local residents. The programme has been so successful that it formed the model for other Marine Ranger Programmes elsewhere in the Top End.

The Marine Ranger is based at Pirlangimpi on Melville Island, from where he carries out patrols of north and west Bathurst Island, the Apsley Strait and the southern coast of Melville Island. He also patrols selected areas of northern Melville Island by vehicle. Given the size of the area, the patrols are often widely spaced, with some areas not patrolled at all. This severely reduces the effectiveness of the programme. Currently the Marine Ranger works alone, and seeks volunteer assistance for longer voyages. A two-person team would provide a safer service, and allow for ongoing training.

Subsequent approaches to the NT Government and recurrent funding from the Tiwi Land

Council has won support for an additional Marine Ranger which will allow an expansion of the areas patrolled, and more regular patrolling of key areas. The additional Ranger will be based at Milikapiti, effectively doubling the exposure and providing a far more efficient service.

Outcome:

Sustainable and equitable management of the Tiwi Islands coastlines.

Objective:

6. Assess and manage current impacts on the coastal zone, and develop and implement processes to manage future impacts.

Recommended Actions:

- 6.1 Record important marine and coastal hunting areas as protected from significant disturbance on the Tiwi GIS.
- 6.2 Continue representation on government and other marine and coastal bodies.
- 6.3 Through the Tiwi Coastal Waters Consultative Committee and Aquatic Resource User Group Forum, lobby for FTO's to be recognised as commercial operators.
- 6.4 Develop and implement a programme to carry out permit checks for recreational camping twice yearly. Locations and times to be determined on advice from AFANT.
- 6.5 Through AFANT, initiate log book projects for recreational fishers.
- 6.6 Through the Tiwi Coastal Waters Consultative Committee, initiate and manage research on the impacts of both the commercial and recreational fishing industry in the region.
- 6.7 Relocate the Port Hurd closure line to the mouth of Port Hurd.
- 6.8 Erect 'No Trespassing' signs around the Marine Harvest aquaculture lease.
- 6.9 Expand the Tiwi Marine Ranger Programme to two vessels and four ranger staff.
- 6.10 Provide ongoing training opportunities for Marine Rangers.



Economic resources

Principle:

Land, extractive minerals, selected plants, animal stock and water are natural economic resources that should be available for sustainable production, and protected from alienating uses.

In 1996 Tiwi leaders identified the urgency of developing an independent economy as a route to improving social outcomes, and elimination of the destructive influence of welfare dependence. The greatest assets of the Tiwi Islands are their natural resources and the people, and natural resource utilisation has been identified as a key area for economic development.

It is also an area with high potential for providing long-term employment and training opportunities that are attractive to Tiwi residents. The challenge facing Tiwi organisations is to ensure that economic development supports and/or enhances the cultural and natural resource values of the region. Economic development and the associated allocation and management of natural resources has become a major focus of Tiwi Land Council activity.

An economic development strategy for the region prepared in 1996 provided a comprehensive assessment of mostly small enterprise and internal opportunity. It has been the belief of Tiwi leaders, however, that one large core enterprise on the Islands will provide the springboard for sustained, long term economic development. Small 'cottage industry' type enterprises in the past have proven to be high risk and, although valuable, have not provided the means for economic self-sufficiency.

Several areas of significant concentrations of mineral sands have been identified on the north coast of Melville Island and the west coast of Bathurst Island, and although Tiwi leaders have previously chosen not to pursue mining in the region, it remains a potential economic resource. The two key economic ventures that have been identified from natural resource utilisation that also have the potential to underpin a broader economic base for the region are aquaculture and plantation forestry.

Puig carried out a suitability assessment for aquaculture in 2000, and identified three prime sea cage sites in the region in addition to Port Hurd. He also provided detailed assessments for land based prawn aquaculture, and identified a number of sites with potential. The Port Hurd sea cage aquaculture facility is currently the only aquaculture project in the region.

Forestry was identified as a potential industry for the region as early as 1921, and advantages over the mainland included better rainfall distribution, more favourable soil types, groundwater reserves and lower incidences of termite attack. Hollingsworth carried out land resource capability assessments for forestry in 2003, and identified significant areas with high capability.

The current forestry project involves 30,000ha of plantation development, which is less than 4% of the Islands land mass, and around 5% of the selected vegetation type. The major natural resource issue arising out of the project has been the paucity of biodiversity information for the region, and the potential impact on biodiversity values. This has prompted intensive study over the past three years, and the most current recommendations are due for release in 2004. Lack of data has created some uncertainty for potential investors and landowners, and delays in project milestones.

While aquaculture and forestry are the two key economic ventures that have been identified as core industries for the region, Tiwi Land Council initiated a land capability study to identify other potential opportunities for development. The table below shows land capability classes for a selection of economic land uses.



Land Use	Class	Class Description	Area (ha)
Agriculture - general	1	Irrigable and forestry - no constraints	6,400
	2	Irrigable and forestry - sandy soils	21,500
	3	Irrigable and forestry with erosion control	197,000
Agriculture - bananas	1	Highly suitable	4,300
	2	Moderately suitable	19,200
Agriculture - peanuts	1	Highly suitable	4,300
	2	Moderately suitable	75,200
Aquaculture ponds	2	Moderate soil limitation	62,900
Roads and tracks	1	Slight site limitation	421,400
	2	Moderate site limitation	12,800
Roadfill	1	Good	17,200
Construction sand	1	Probable	4,800
Gravel	1	Probable	6,400

Table 17: Land Capability Classes (Hollingsworth 2003)

The Tiwi Islands have been formally involved in the tourism industry for many years, and in 1995 established the Tiwi Tourism Authority. Landowners recognised the potential value of high-end eco-tourism opportunities, and in 2000 agreed to the development of an exclusive, low impact resort on the north coast of Melville Island focusing on eco-tours and recreational fishing.

Recent global events postponed this project indefinitely, however landowners are now exploring alternative options for eco-friendly tourism. Tiwi Tours operates one and three day tours to Bathurst Island, and there are currently two Fishing Tour Operators resident on the Islands that offer catch and release guided fishing trips, and feral pig and buffalo trophy hunting. The Tiwi Art Network also co-ordinates specialised art tours of each community.

Major attractions for visitors to the Islands are the cultural experience, local art and craft, the 'unspoiled' environment, good fishing and the opportunity to hunt large game. The unpredictable nature of the tourist industry precludes it from becoming a core industry with which to underpin regional economic independence, however it will remain an important sector of the Tiwi economy.

From time to time opportunities arise for small scale commercialisation of natural resources. Projects have included crocodile and crocodile egg harvesting, mud crab farming, small scale market gardens, buffalo management, pharmaceutical compounds in native plants, essential oil production, native bush fruits and bottled water. Limited investigations have been undertaken within the commercial (wild catch) fishing industry, however it is an area where opportunities may be available for Tiwi enterprise in the future.



Outcome:

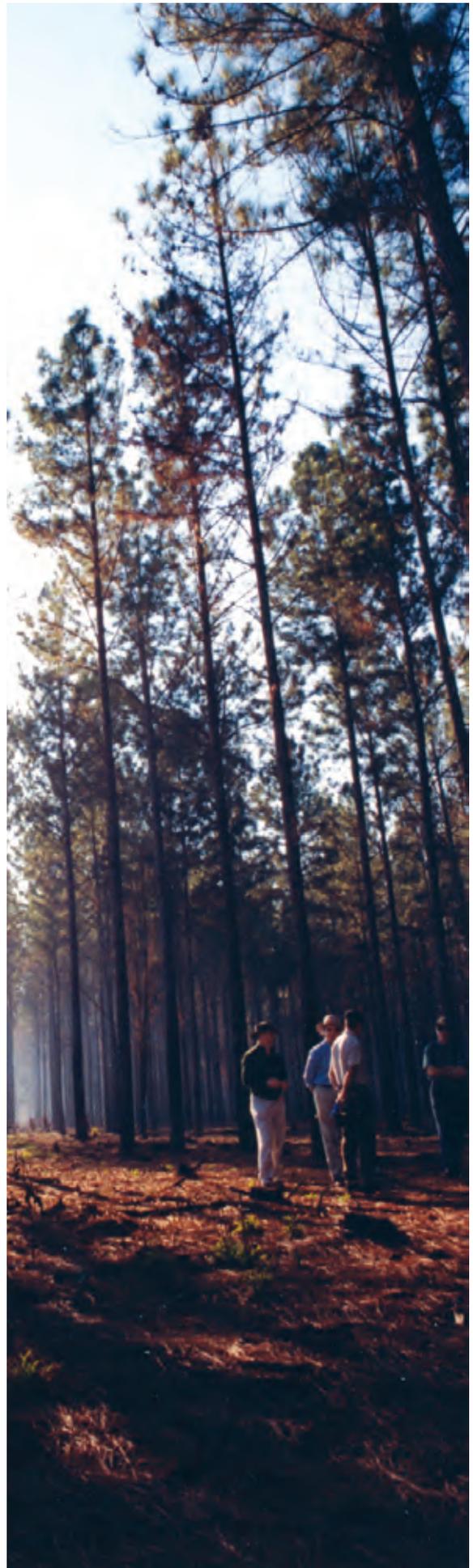
An independent and resilient Tiwi economy based on the orderly and well managed utilisation of natural resources.

Objective:

7. Develop and implement processes that provide for a range of sustainable economic resource development options that are consistent with other natural resource management objectives.

Recommended Actions:

- 7.1 Progress the development and expansion of land and sea based aquaculture in line with existing suitability studies.
- 7.2 Progress the development and expansion of forestry enterprise in line with existing land capability studies and biodiversity planning.
- 7.3 Finalise biodiversity studies in order to provide certainty to landowners and investors, and to avoid a 'shifting of the goal posts' approach.
- 7.4 Investigate the development and implementation of 'development zones' and 'conservation zones' within a regional context.
- 7.5 Update suitability and capability ratings as relevant information becomes available, and use as a basis for regional planning.
- 7.6 Continue to seek opportunities for high-end eco-tourism ventures.
- 7.7 Identify and protect areas of value to eco-tourism, including local swimming holes, tracts of wilderness and raw materials for art and craft (for example, ochre deposits, wood suitable for carving).
- 7.8 Support and encourage considered approaches for commercial wildlife utilisation opportunities.
- 7.9 Identify and assess wild catch fishery resources, and Tiwi access to commercial opportunities.







MANAGING THE RISKS



Due to the region's low population, low level of development and remoteness from the mainland, the pressure on natural resources and the presence of threatening processes are not high compared to mainland Australia. Economic utilisation of the natural resources and relatively high population growth trends, however, tend to raise concerns with the effect of development on the continued value and productivity of the region.

Pressures on the resource include community expansion and outstation development, construction and infrastructure, and natural resource based economic development. Threatening processes in the region that can cause land and water degradation include weeds, feral animals, limited quarantine procedures, land clearing, soil erosion and fire. In addition, factors that limit the capacity of landowners to manage the natural resource base can be threatening processes in themselves. These include public awareness and education, availability of resources, and lack of co-ordination between groups.

Communities and outstations

Principle:

Communities and outstations are the main population centres in the region. Pressures placed on natural resource values from population expansion and community development need to be adequately planned for and appropriately managed.

As with other predominantly Aboriginal areas, the Tiwi Islands have a relatively young population. The 2001 Census counted 1,537 people under age 35, and 900 people under age 20. This represents 69% and 40% respectively of the total Tiwi population. In comparison, figures for the total Northern Territory are 57% under age 35, and 31% under age 20.

Tiwi people now largely reside in communities, and current and anticipated trends in population growth will lead to increased demand for appropriate land for urban expansion. The three main communities of Nguiu, Pirlangimpi and Milikapiti all have constraints to expansion, with serviced lots in increasingly short supply. Constraints to expansion include cultural areas, flood risk, excessive slope, water catchment areas, noise and height restrictions due to power stations and airstrips, and height restrictions for the provision of water and sewerage. Pirlangimpi and Milikapiti in particular will soon be faced with the need to identify and develop new subdivisions that are outside currently serviced areas. While the lead responsibility for community land use planning is with the NT Government, adequate and appropriate consultation with landowners must be carried out if effective long-term plans are to result.

All three main communities are located on the coast, and coastal cliff regression has emerged as a significant issue in both Nguiu and Milikapiti. While much of the regression is a natural process, it is accelerated in some areas by concentrated urban stormwater runoff. No buildings are under immediate threat at this time, however fence lines and gardens have been lost at Milikapiti, and some cliff areas of Nguiu are showing significant structural failure and slumping.

Similarly, the coastline adjacent to Paru outstation is regressing at rates of up to 1m in a wet season. Monitoring transects were installed in risk areas during 2001 and 2002, however it will take several years to determine long term trends. Anecdotal evidence suggests that a section of cliff at Milikapiti retreated 3m during cyclone Thelma in 1998, and the effect of another such event is unknown.

The region is characterised by high volume and intensity rainfall, and for many years urban stormwater drainage has been a vexing issue for all communities and most outstations. Subdivision development has historically begun in the lowest areas closest to the coast, and drainage structures in these areas have been unable to carry increased flow generated from later, higher sub-divisions. Failures of stormwater drainage structures are frequent during most wet seasons, and it is common for stormwater to enter houses during normal wet season rainfall events.

Stormwater eventually drains into the sea through both formal and informal means, and it is common to see red plumes as inadequate

drains incise and erode. The natural freshwater swamp adjacent to the Pirlangimpi coast has so much sediment deposited that it now overtops and creates erosion gullies through the coastal dune system into the sea. Milikapiti also has a number of gullies along the coastal cliff where uncontrolled runoff has channelled over the edge.

Outstations have historically been designed to sheet flow stormwater, however this method consistently fails as traffic and normal living create areas that will concentrate and channel sheet flow. Similarly, increased runoff from roofs, roads and hard stand areas will not disperse through sheet flow.

While drainage standards are improving in the three main communities, repairs and upgrades are ad hoc, and funding opportunities often compete with the provision of housing. Similarly, developments of new sub-divisions are rarely scoped to provide adequate drainage to final outlets. Outstation planning rarely takes stormwater drainage into account, and often does not address issues associated with future expansion.

Community waste disposal emerges as an issue from time to time, and Milikapiti, Pirlangimpi and Wurankuwu all operate the trench method of waste disposal, where rubbish is deposited into an excavated trench and compacted and buried as required. Nguuu has recently opened an area fill site, where rubbish is deposited, regularly compacted and covered with fill.

Minor issues with fencing, formalising rubbish and extending the trenches are generally addressed as required, and the facilities are located sufficient distances from each community and community water supply. Inspections by NT Government environmental representatives have not raised any issues with leachate or other pollutants. Some issues arise from uncontrolled dumping of rubbish, and individual communities are exploring methods to deal with this. Although not a priority issue at this stage, the provision of dedicated machinery for tip management would be useful in extending the life of these facilities and improving operations.

Previous rubbish disposal at Nguuu involved tipping rubbish into a natural gully head that outlets into an estuarine marine system, creating a number of issues including rat infestation, weed

proliferation and leachate entering the natural system. Stabilisation and rehabilitation of this area should be considered a matter of priority.

Sewerage ponds operate effectively in the three main communities and Wurankuwu, while outstations are serviced by septic systems. Munupi Lodge outside Pirlangimpi is also serviced by a septic system, which is insufficient to service the needs of the facility. During times of high demand, diluted effluent runs out over the coastal cliff into an area of mangroves. Options for upgrading the system have been identified, however lack of funding to date has precluded a solution.

Outcomes:

Sustainable community and outstation growth and management.

Objectives:

8. Develop and implement improved planning processes for community and outstation development.
9. Address priority natural resource management issues in communities and outstations.

Recommended Actions:

- 8.1 Through a process of early and thorough consultation, develop 5 to 10 year land use structure plans for Nguuu, Milikapiti and Pirlangimpi communities.
- 8.2 Continue coastal monitoring in high risk areas, and develop estimates of erosion rates.
- 8.3 Implement a policy of assessing all developments within 100m of the coastline before allowing development activities.
- 8.4 Undertake a consultative review of stormwater drainage design standards for communities and outstations.
- 9.1 Identify priority areas, and actively explore options for prioritised stormwater drainage upgrades in all communities.
- 9.2 Rehabilitate the old waste disposal site at Nguuu, and discourage informal use.
- 9.3 Upgrade sewerage disposal facilities at Munupi Lodge, Pirlangimpi.



Construction and infrastructure

Principle:

Construction activity and infrastructure development within the region has led to some land degradation processes. These processes should be minimised through improved planning and strategic rehabilitation.

Construction and infrastructure issues in addition to community issues arise from the extraction of sand, topsoil and gravel, and the construction and management of infrastructure such as roads, airstrips, barge landings and other facilities.

Sand and topsoil are mostly required for community development activities, and while construction sand is often barged in for larger projects, local reserves are required for community jobs and cultural activities. Sand and topsoil reserves close to community centres are becoming increasingly scarce, and new areas need to be identified. The ongoing operation and rehabilitation of extractive areas is also an issue that needs to be addressed. Previous practices of sourcing sand from coastal dune areas has all but ceased, however until alternative sources are identified there will be increasing pressure on this resource.

By far the major ongoing use of gravel in the region is for the construction and maintenance of roads. Smaller uses are maintenance of airstrips and construction of hard stand areas.

Most of the main roads on the Islands generally follow lateritic ridgelines, and gravel can often be sourced along the road alignment. Gravel reserves at the top of the catchment are often shallow, and large areas sometimes need to be accessed to gain sufficient material. There will be a steady increase in demand for this resource as construction and maintenance programmes in the region progress.

Economic considerations limit the haulage distance for gravel, and there are numerous pits and scrapes located along main road alignments. Gravel pit rehabilitation has not been a common practice in the region, and issues associated with a number of these pits include weed proliferation and soil erosion. Guidelines for the operation and rehabilitation of borrow pits were recently prepared by the Tiwi Land Council, and have been distributed to local and external contractors.

All connecting roads in the region are unsealed with varying levels of construction standard, including formed and sheeted sections, sections formed from natural material, flat bladed tracks and wheel tracks. Main connecting roads between the communities are regularly maintained, however other tracks often receive only irregular and cursory maintenance. Insufficient funds in the past has led to maintenance practices on all roads that have progressively lowered the surface, leading to issues associated with ponded water, soil erosion and sediment deposition.

Flat bladed tracks, wheel tracks and creek crossings have led to severe gully erosion in some areas, as have poorly designed drainage structures on some of the main roads. Major upgrades and better construction techniques have recently been carried out on sections of main road outside Pirlangimpi and Milikapiti, and this should be progressively extended to other main roads in the region. The Tiwi Land Council carried out an assessment of natural resource issues associated with other roads and tracks in the region in 2001, and these should be addressed on a priority basis.

Airstrips outside of the main communities include Maxwell Creek, Rolla Plains, Pickertaramoor and Port Hurd. Port Hurd airstrip was originally constructed to service the Barra Base tourist lodge, and now services the Marine Harvest aquaculture facility. Location of the airstrip has led to severe gully erosion, and while Marine Harvest are not responsible for the degradation, they contribute to ongoing maintenance and rehabilitation work. A joint programme between the Tiwi Land Council and Marine Harvest has successfully reduced the rate of erosion, and should result in the long term stabilisation of the area.

Non-government barge landings include Paru and a proposed forestry loading facility at Barlow Point. The Barlow Point facility has been assessed under current environmental legislation, and detailed erosion and sediment control works are being finalised. Paru barge landing is a concrete structure that has been subject to soil erosion due to prevailing currents, and the integrity of the facility is under question. Costly repair work will need to be assessed against the value of the facility, however the erosional process has stabilised and is not causing significant environmental damage.

Due to its northerly location, the region has been important for defence purposes, and has had a long association with defence force activity. A large radar facility proposed for Point Fawcett is currently in the final planning stage, and detailed assessments have been carried out for potential land degradation processes and impacts on the coastal zone. Results from studies indicate that no threatening processes will result from the facility.

External contractors and service agencies such as Telstra and PowerWater often undertake civil works projects in the region. In most instances, vehicles, machinery and equipment are barged to the Islands from the mainland, creating a risk of transporting feral ants, weeds and other pest species. The imminent arrival of cane toads in Darwin is a major issue the Land Council is attempting to address through the production and distribution of quarantine brochures, and construction of quarantine facilities on the mainland (see also Quarantine).

Movement by contractors and others around the Islands also creates issues with weed and feral animal transport within the region. Education, awareness and legislative opportunities should be further explored to minimise the impacts of movement both between the region and the mainland, and within the region itself.

Outcome:

No adverse impacts on natural resource values from construction activities and infrastructure development.

Objectives:

10. Develop and implement improved planning processes for construction activities and infrastructure development.
11. Identify and record land degradation processes resulting from construction and infrastructure activity, and develop prioritised plans for rehabilitation.

Recommended Actions:

- 10.1 Identify suitable sites for the extraction of sand, topsoil and gravel, and enter onto the Tiwi GIS.
- 10.2 Actively encourage the implementation of guidelines for borrow pit operation and rehabilitation through community education and inclusion in external contract conditions.

- 10.3 Develop and disseminate best practice guidelines for the construction and maintenance of unsealed roads. Include in external contract conditions.
- 10.4 Develop and disseminate Codes of Practice for external contractors and service agencies, focusing on issues associated with moving vehicles and equipment within the region.
- 10.5 Include rehabilitation and revegetation in work scopes for all new developments at the initial planning stage.
- 11.1 Develop and implement a rehabilitation plan for spent extractive areas prioritised on the level of active degradation.
- 11.2 Prepare and cost a plan for the progressive upgrading and/or rehabilitation of roads and tracks that are actively contributing to land degradation.
- 11.3 Continue erosion control works at Port Hurd airstrip.



Economic development

Principle:

Economic resource development is a priority activity within the region. The sound planning and management of economic projects is required for the protection of economic values, minimisation of off site effects, and maintenance of natural resource values.

Natural resource allocation issues arising out of current and potential economic development have been discussed in previous sections, with the main issue identified as competing uses between biodiversity conservation and economic utilisation. Natural resource management issues arise from the planning and ongoing management of economic projects.

The existing Port Hurd sea cage aquaculture facility has a small footprint, and natural resource management issues have been satisfactorily addressed through the Environmental Management Plan currently in draft form. Potential expansion of the facility in situ and to other areas within the region will undergo further environmental assessment, and management and monitoring protocols revised and updated as required. Risk assessments for the current project have been carried out and protocols developed for the following:

- Visual impact;
- Water movement in the estuary;
- Entrapment of marine life in nets;
- Mooring equipment failure;
- Public access for recreational purposes;
- Decommissioning;
- Collision with seagoing vessels;
- Fuel spills;
- Noise;
- Escaped fish;
- Fish faeces;
- Excess feed;
- Chemical treatment of fish;
- Removal of food from the food chain;
- Erosion on the land base;
- Waste generation;
- Raw water usage;

- Native flora and fauna on the land base;
- Fire on the land base;
- Storage and handling of hazardous materials;
- Impact on mangrove area, extent and composition;
- Impact on benthic infauna and habitat;
- Impact on epiphytic algal growth on mangrove roots;
- Impact on plankton counts;
- Impact on water quality.

The current plantation forestry project is a proposed 30,000ha of hardwood plantations grown on short rotation for woodchip production. Associated with this is the harvest and sale of native timber, and mature plantations of *Pinus caribaea* and *Callitris* spp. established by the Commonwealth Government during the 1960's. The project has been assessed and approved under NT and Commonwealth environmental legislation, and management and monitoring protocols have been developed for:

- Biodiversity;
- Management of the main plantation species *Acacia mangium*;
- Weeds;
- Feral animals;
- Quarantine;
- Surface and groundwater quality and quantity;
- Erosion and sediment control;
- Fire;
- Heritage;
- Waste;
- Greenhouse gases;
- Contingencies arising out of inadequate growth, plantation damage or project failure.

It is anticipated that forestry product will be loaded onto ships and taken direct to export destinations. This creates a risk of introduction of marine pests, and the proponents are currently working with the aquatic pest management section of the NT Government to develop management and monitoring protocols.

Both the current aquaculture and forestry projects have land bases. The aquaculture base is located at Barra Base, a facility originally constructed as

a tourist resort. Existing infrastructure includes living quarters, a central communal, cooking and ablution area, workshop, storage area, open work area and a waste disposal area. Investigations carried out during the development of the Environmental Management Plan did not identify any significant natural resource management issues. There is no current intention to expand the site, but should this be required further impact studies will be undertaken.

The forestry base is located at Maxwell Creek, a facility originally constructed by the government during their period of plantation development. The site is also utilised intermittently by external contractors undertaking civil works projects in the area. Built infrastructure includes transportable accommodation and ablution facilities, a central cooking and mess area, workshops, storage areas and a waste disposal area. The facility is located in a previously cleared area among original pine plantations, and the extent of original clearing will accommodate future expansion. NT Government assessments have not identified major natural resource management issues associated with further development of the site.

The Maxwell Creek base was left largely unmanaged after the government withdrew, and several houses constructed for employees are now uninhabitable and uneconomic to repair. Weeds introduced during past forestry activity have proliferated, although they are still confined to the immediate area. It is anticipated that permanent occupation of the area and further development of the site will facilitate ongoing weed management activities.

Pickertaramoor is also an abandoned forestry base, and natural resource management issues include the proliferation of weeds, road and track erosion and abandoned buildings. Rehabilitation of this site should be tied in to a general weed management plan, and options for future uses of the area explored.

The Tiwi Islands are currently at a critical stage of economic development. The aquaculture and forestry industries are being proven as viable, and now have the capacity to provide significant employment and investment income. Gaps in physical infrastructure such as roads, ports, airstrips and accommodation are constraining the

realisation of economic independence through core industries.

A collaborative approach between the Commonwealth Government, Northern Territory Government, Tiwi and private investors where each stakeholder is clear on their role and responsibility, and where the common goal is to maximise opportunities for economic development would go some way to identifying and addressing infrastructure constraints. Infrastructure programs based on per capita funding formulas, or designed to support already established industries will not meet the region's needs given the current stage of development.

Outcome:

Sustainable natural resource utilisation resulting in regional economic growth and development.

Objective:

- 12 Implement and regularly review planning and management procedures for natural resource based economic development projects.

Recommended Actions:

- 12.1 Regularly update, review and implement the Port Hurd Aquaculture Environmental Management Plan.
- 12.2 Regularly update, review and implement the Tiwi Islands Plantation Forestry Strategic Plan.
- 12.3 Prepare and implement management and monitoring protocols for marine pest risk management associated with timber export.
- 12.4 Actively encourage the ongoing management of land degradation issues associated with Maxwell Creek and Pickertaramoor bases.
- 12.5 Implement a collaborative approach to infrastructure development, with a focus on providing sustainable resource development, and optimum opportunities for investment in the region.



Weeds

Principle:

The spread of weeds is the greatest current threatening process in the region to both economic and natural resource values. In order to produce effective outcomes, weed management must be carried out within a strategic context.

Large areas of the Tiwi Islands are remote, unpopulated, difficult to access and under-resourced in terms of land management. Limited human and financial resources combined with low intensity land use has led to a serious threat of weeds proliferating and becoming out of control on a large scale.

Weeds have been a feature of the Tiwi landscape for many years. As with other Aboriginal owned areas, the Tiwi Islands were selected by government for pasture and plantation forestry research trials, particularly during the 1960's and 1970's. In more recent times, the increase of traffic from the mainland has resulted in an increased risk of the introduction of weeds and weed seed from mainland areas.

Until recently, weed occurrence on the Tiwi Islands was largely confined to communities, outstations and agricultural trial areas. Outbreaks are now, however, occurring in areas progressively further away from historical disturbance. This is not only posing a threat to the natural resources of the region, but is a very real danger to emerging enterprise developments.

The identification of gamba grass *Andropogon gayanus*, mission grass *Pennisetum polystachion* and guinea grass *Panicum maximum* syn. *Urochloa maxima* outbreaks poses concerns for the alteration of fire regimes still practiced on the Islands, and threats to the *Acacia mangium* plantations currently being assessed. An outbreak of the declared noxious weed *Mimosa pigra* was recently discovered on the south coast of Melville Island, and government plantings of *A. mangium* have produced wildlings that may have the potential to become weedy. Although other weeds occur in the region, the above have been identified as priority threats.

Weed control activities have, and continue to be carried out on the Islands. However, with human and financial resources directed to community areas, it is difficult to address the issue on a regional scale. Under the current scenario, the best possible outcomes are local weed reduction

and eradication. These outcomes will be temporary as communities are re-infested from surrounding areas.

The Tiwi Land Council previously developed a five-year weed control and monitoring plan, which encompassed comprehensive surveys to determine the full extent of infestation; training in weed identification; mapping and control techniques; systematic weed control activities; ongoing monitoring and recording of results; and development of a Regional Weed Management Plan under current legislation. The anticipated core outcome was the development of a culture of weed awareness and control in all Tiwi communities, and also within industry organisations that carry out projects in the region. Lack of funding support has prevented implementation of the plan to date.

Unlike many other areas in the Top End, there is a real possibility of eradicating many of the invasive weed species from the Tiwi Islands. The sea barrier from the mainland combined with improved quarantine infrastructure and procedures means that it is also possible to maintain a relatively weed free status. The development of a Weed Management Plan for the Tiwi Islands under the *Weeds Management Act 2001* should provide legislative support for weed management activities on both the Islands and mainland.

Outcome:

Protection of the region's economic and natural resource values from the impacts of weeds.

Objective:

- 13 Develop and implement long term weed management strategies.

Recommended Actions:

- 13.1 Develop and enforce policies and by-laws specific for regional weed issues, including complimentary education and awareness programmes.
- 13.2 Develop and implement a Weed Management Plan for the Tiwi Islands under the *Weeds Management Act 2001*.
- 13.3 Support and encourage local weed management activities within a regional context.

Feral animals

Principle:

Feral animals are an economic and food resource for the region. Large, uncontrolled numbers, however, have the potential to cause significant natural resource degradation.

Introduced fauna species in the region have been identified as mammals (black rat, water buffalo, cattle, pig, horse, cat), reptiles (gecko, flowerpot blind snake) and six species of ants (Woinarski *et al.* 2003). Of these, pigs, cats and big-headed ants are considered as significant threats to natural resource values. Water buffalo and pigs are considered high value food to Tiwi people, and are also valued for their contribution to tourism through trophy hunting, and their confirmed disease free status. Concentrations of buffalo occur in remote areas of south and east Melville Island, and anecdotal evidence suggests that there may be some detrimental impacts to wetland communities. There are no reports of buffalo on Bathurst Island.

Feral pigs have historically been confined to Bathurst Island, where there is considerable evidence of widespread degradation associated with their presence. The first confirmed sighting and capture of a feral pig on Melville Island occurred during 2003, and evidence suggests that they are confined to a discrete coastal wetland on the north-west coast. The Tiwi Land Council is currently investigating options for eradication in this area, and commenced a control programme in partnership with the Parks and Wildlife Service in October 2003.

Tiwi residents are aware of the damage pigs cause to natural systems, and are concerned about their potential impact if they proliferate through the wetlands on Melville Island. It is a Tiwi Land Council policy that any pigs kept as pets on Melville Island must be de-sexed, and intact pigs cannot be released on the Island.

Concern about feral cats is raised as an issue from time to time, and although there is no information on total numbers in the region, sightings are often reported during hunting and recreational activities. Eradication of feral cats has been reported by Environment Australia (1999) as a continuing requirement with significant costs involved, and, due to the difficulties involved, should

be concentrated in areas critical to threatened species conservation. The Tiwi Land Council has instigated a policy that no cats can be transported to the Islands unless they have been de-sexed, and permission must be sought before any cats are taken into the region.

The African big-headed ant, *Pheidole megacephala* has been recorded at Nguuiu on Bathurst Island, and Pirlangimpi, Milikapiti and Takamprimili on Melville Island. According to Andersen *et al.* (2003), it is one of the world's worst invasive ant species, and has had a major ecological impact in at least one rainforest patch near Darwin. Surveys on the Islands during 2000 and 2001 indicated that it had not spread out from the main communities.

The yellow crazy ant, *Anoplolepis gracilipes* is also known for its high impact on rainforests and, although it has not been recorded from the Tiwi Islands, is considered at high risk of being introduced.

The Tiwi Land Council in partnership with CSIRO has commenced an exotic ant survey and eradication programme on the Islands, and current advice is that the likelihood of eradication is high. The new washdown bay facility at Tiwi Barge Services on the mainland has also been designed for ant exclusion, which will significantly lower the risk of re-infestation.



Outcome:

Protection of the region's economic and natural resource values from the impacts of feral animals.

Objective:

- 14 Develop and implement prioritised feral animal management strategies.

Recommended Actions:

- 14.1 Develop and implement a feral pig eradication programme for Rangini (Melville Island).
- 14.2 Assess and record the extent of degradation from feral pigs and buffalo.
- 14.3 Investigate options for pig and cat control in priority areas under Commonwealth Government species recovery plans and threat abatement plans.
- 14.4 Investigate and encourage economic opportunities for the utilisation of buffalo and pigs.
- 14.5 Carry out a prioritised feral ant eradication programme.
- 14.6 Develop and enforce policies and by-laws specific for regional feral animal issues, including complimentary education and awareness programmes.



Quarantine

Principle:

The region is relatively free of many of the invasive species that are present on the mainland. Strict quarantine measures will ensure that new introductions are minimised, and that control of existing species is effective.

Threats to the region's natural resources from introduced species originate mostly from overseas and intra-territory: there is limited direct interstate travel to and from the Islands. The Australian Quarantine and Inspection Service (AQIS) undertakes regular surveys of the region as part of their ongoing programme under the Northern Australia Quarantine Strategy. Pests and diseases not currently present in Australia that may gain entry through the Tiwi Islands have also been identified and recorded as part of the Tiwi Plants and Animals book, which is widely distributed throughout the region. Quarantine procedures for the proposed entry of overseas ships for forestry export are also under development, and legislation is in place to prevent unwanted entries.

The major threat from introduced species is the introduction and re-introduction of exotic species that are currently present on the Northern Territory mainland. While some of these species already occur within the region, their abundance is relatively low, and further introductions are likely to increase the rate of spread. It will also limit the effectiveness of current and proposed control activities. Vectors for the entry of unwanted mainland species have been identified and include barges and barge freight, airline freight and personal luggage, and recreational campers travelling by private vessels.

The recent identification of *Mimosa pigra* along a remote stretch of coastline on Melville Island, and the imminent arrival of cane toads in Darwin has elevated quarantine to an urgent priority.

The Tiwi Land Council has implemented a number of quarantine initiatives including the construction of quarantine facilities at Tiwi Barge premises, the main exit point for freight travelling from the mainland. Proposed infrastructure includes a quarantine washdown bay, and the Land Council is actively pursuing additional funding for the construction of a quarantine

holding area specifically designed to exclude cane toads. Public awareness activities include articles and interviews for local and national news media, and the production and wide distribution of quarantine brochures and bookmarks. The Tiwi Land Council was awarded the 2003 AQIS Regional Quarantine Award for its work in quarantine activities and awareness.

A Cane Toad Action Plan has also been prepared and implemented, and activities include awareness, training, monitoring and reporting. These activities will need to be ongoing to maintain quarantine as a high priority for both residents and visitors, and legislative methods of intra-territory control should be further explored.

Outcome:

Protection of the region's economic and natural resource values from the impacts of inadvertent or unauthorised introductions of exotic species.

Objective:

15. Develop and implement processes that prevent the introduction of new exotic pest species, and the re-introduction of exotic pest species already present within the region.

Recommended Actions:

- 15.1 Support and encourage the expansion of existing AQIS programmes within the region, including training local people in monitoring activities.
- 15.2 Seek and obtain funding support for expanded quarantine infrastructure at Tiwi Barge Service premises on the mainland.
- 15.3 Regularly review and update the Cane Toad Action Plan.
- 15.4 Include quarantine requirements in all tenders let within the region that involve transport of machinery and freight.
- 15.5 Maintain quarantine public awareness and education activities both within the region and on the mainland.
- 15.6 Actively explore opportunities for intra-territory quarantine legislative controls as an urgent priority.
- 15.7 Develop and implement a Quarantine Management Plan for the region.



Land clearing

Principle:

Current land clearing proposals and land clearing operations have been identified as low threatening processes to natural resource values. Land clearing issues associated with plantation forestry development, road construction, extractive activities and infrastructure development have been addressed elsewhere within the Strategy.

In contrast to other areas in Australia, land clearing has not been a major threat to the natural resources of the region. Woinarski *et al.* (2003) estimated that historic and recent clearing for timber plantations and other disturbed areas constituted only about 2% of the region, and listed clearing as a low threatening process.

Significant clearing proposals for the region are limited to the expansion of plantation forestry. The current 30,000ha project takes up less than 4% of the land mass, and clearing related threats such as loss of biodiversity, weed invasion, decreased water quality and quantity and soil erosion are addressed both in the Plantation Forestry Strategic Plan and elsewhere in this Strategy. Potential fragmentation of retained native forest from plantation operations has been addressed by consolidation of the plantation estate into the western half of Melville Island, and the retention of buffer zones and wildlife corridors.

Other clearing activity in the region is restricted to road upgrades, extraction of sand, topsoil and gravel, construction of a radar defence facility at Point Fawcett and (anticipated) expansion of community and outstation areas. Development of generic clearing guidelines, while not a priority, would further limit degradation processes associated with land clearing, and the implementation of existing guidelines for borrow pit operations should be strongly encouraged.

Outcome:

Protection of the region's economic and natural resource values from on and off-site effects of clearing operations.

Objective:

16. Encourage best practice clearing operations within the region.

Recommended Actions:

16.1 Develop generic clearing guidelines; distribute locally and to external contractors.



Soil erosion

Principle:

Accelerated soil erosion can occur through land disturbance and uncontrolled runoff. Sound land use planning and appropriate timing of operations will minimise erosion hazard.

High intensity rainfall, massive sandy soils and long slopes make much of the region inherently prone to sheet, rill and gully erosion, and Hollingsworth (2003) considered most of the Tiwi Islands at risk from erosion. Most areas of coastline and river banks are also naturally susceptible to erosive processes.

Soil erosion issues within the region arise out of the location of infrastructure in erosion prone areas, and disturbance activities that can accelerate natural erosion processes. Protection of red earths in the region is particularly important due to their potential economic value.

As discussed elsewhere, Paru outstation and the three main communities of Nguiu, Pirlangimpi and Milikapiti are located on the coast, and coastal erosion issues have emerged through natural cliff regression and accelerated erosion from concentrated stormwater runoff. Similarly, disturbance associated with the Port Hurd airstrip has led to severe localised gully erosion.

Most of the main roads within the region are generally located along lateritic ridge lines, which reduces the risk of soil erosion from road location. Past construction and maintenance techniques, however, have created issues with erosion of road and track surfaces, and surface and side drainage. Flat grading of both main roads and access tracks has resulted in lowering of the surface, and the creation of soil windrows along alignments.

In many areas this has led to concentration of flow, rill erosion, ponding and sedimentation of watercourses. Repeated grading out of surface depressions has progressively worsened the problem in some areas, and side drainage has been rendered ineffective. Many tracks constructed without side drainage have become eroding watercourses during the wet season, and those located in wetter areas have created localised wetland degradation.

As with other areas in the Northern Territory, off-shoot drains along main roads have historically been constructed as V drains. Drain construction and alignment has led to concentrated flow in many areas, causing gully erosion and subsequent sedimentation. Improved construction and drainage techniques recently implemented on road upgrades on Melville Island should be actively encouraged, and maintenance programmes should be developed that maintain the integrity of the works.

The main land disturbance activity proposed for the region is development of plantation forestry. Initial issues with soil erosion have now been addressed through planning and operational activities that include smaller catchment areas, improved planting alignments, erosion control structures along internal roads and firebreaks and regular monitoring. Erosion and sediment control plans are also prepared and implemented for each discrete planting area.

Uncontrolled and sustained access has caused erosion of river banks in several areas, due to vehicle and foot traffic, semi-permanent camp sites, and informal boat launching. Codes of Practice developed for recreational users and tour operators should address these issues, and could be supplemented by education and awareness activities.

The level of impact from feral animal activity on erosion and soil structure within the region has not been quantitatively assessed, although there is evidence of gully erosion in areas frequented by buffalo in southern Melville Island, and areas of soil compaction in pig infested areas on Bathurst Island.



Outcome:

Protection of the region's economic and natural resource values from the hazard and incidence of soil erosion.

Objective:

17. Develop and implement processes and procedures that minimise erosion hazard.

Recommended Actions:

- 17.1 Extend land capability mapping to identify areas of inherent erosion risk, and use as a basis for land use planning.
- 17.2 Identify key land use activities that contribute to soil erosion, and develop and disseminate sector specific guidelines/ awareness material for erosion minimisation.
- 17.3 Carry out an erosion survey of the region, and enter results onto the Tiwi GIS.
- 17.4 Prepare and cost a plan for erosion control works prioritised on the level and extent of active soil erosion.



Fire

Principle:

Burning is an important land management tool, however community and economic assets need to be protected from uncontrolled fires.

Woinarski *et al.* (2000) analysed seven years of fire data for the region from 1993 to 1999. They concluded that large areas of Melville Island and central Bathurst Island were burnt almost every year, with less accessible areas burnt less often. Burning was concentrated along roads and in more frequently visited areas, and there was no aerial burning. A preferred fire regime for retention of biodiversity values was suggested as *'fine-scale burning in the early to mid dry season, with probably around one-third of every clan estate burnt each year, but with the locations burnt varying substantially from year to year.'*

Burning is an important land management tool for Tiwi residents for both historical and contemporary reasons, and existing regimes have not raised significant natural resource management issues. Recent developments, however, have elevated the importance of fire management within the region.

The majority of the Tiwi population now overwhelmingly resides in communities and permanent outstations with significant built infrastructure, and the protection of life and property from fire is an important consideration. The population centres in the region are also areas that have the most concentrated infestations of exotic tussock grasses such as mission grass, gamba grass and guinea grass. These grasses dry off late in the dry season, and carry high fuel loads. Late season fires in these areas tend to burn very hot, and can pose a severe hazard to life and property.

To date the spread of exotic tussock grasses has been limited to main population centres. Outbreaks of mission grass in particular are now occurring in areas progressively further away from historical disturbance, especially along road alignments. These grasses out compete the native vegetation, and their proliferation will result in increasingly hot late season fires throughout the region, thereby contributing to soil erosion

and native vegetation and habitat decline. Implementation of a weed management strategy is fundamental to reducing the risk of destructive late season fires.

Acacia mangium is fire sensitive when young, and protection of plantation areas from fire is crucial to the success of the plantation forestry project. Fire management principles have been developed in consultation with Bushfires Council NT, whose advice is that hazard reduction burning is currently the only effective method of providing adequate insurance against destructive late season fires. Hazard reduction burning is currently carried out early in the dry season within plantation lease areas, and where fuel loads are likely to create a significant risk. If required, fuel management will be refined on results from the biodiversity monitoring programme, and areas identified as requiring fire protection for biodiversity conservation have been identified as fire exclusion zones.

Outcome:

The protection of life, natural resources and assets through minimising the risk and intensity of wildfire.

Objective:

18. Develop and implement processes and procedures that minimise the risk of wildfire within communities and plantation lease areas.

Recommended Actions:

- 18.1 Support and maintain existing community and forestry fire management training.
- 18.2 Carry out an annual awareness and education campaign for the protection of plantation forestry lease areas from wildfire.





CAPACITY BUILDING





Capacity to manage natural resources

Principle:

The development and maintenance of local capacity is fundamental to achieving strategic long term natural resource management outcomes.

Natural resource management has become a major focus for landowners on the Tiwi Islands. Global trends for improved environmental management, the urgent need for economic opportunities, and maintenance of cultural and lifestyle values are all issues that need to be balanced and actively managed. Efficient and effective management of the region's natural resources will only be achieved if the major stakeholders play a lead role, and the development and maintenance of local capacity is fundamental to natural resource management outcomes. Methods to increase the capacity of landowners to undertake these management responsibilities include public awareness, education and training; adequate human and financial resources; and effective co-ordination between groups.

A number of opportunities have been identified for improving information, including identified research priorities, development of a Tiwi GIS, maintaining a central library for natural resource information, and accessing information held within other organisations. Public awareness activities involve dissemination of appropriately targeted information and access to information sources. A local area network has recently been established that provides an IT link to all communities within the region, and it is anticipated that natural resource information will be accessible to the broader community through this medium.

The Tiwi Land Council currently writes an environmental management column for the monthly news sheet *Tiwi Times*, and each month targets priority natural resource management issues. Issues covered to date include cane toads, quarantine, feral pigs, feral cats, feral ants and current environment projects. Brochures on environmental management and quarantine have been produced and widely distributed, and the Tiwi Land Council Environment Officer regularly visits communities to discuss natural resource management issues with community members.

Schools are a major focus in communities for creating greater awareness and education about natural resource management issues, and may also provide a resource for community based environmental management and monitoring. School activities have been ad hoc in the past, and the potential to include natural resource management activities as part of school programmes should be further explored. *Waterwatch*, for example, is a programme that could be used within schools to monitor vegetation and river health.

The Tiwi Land Council has recently produced a CD-Rom that addresses natural resource management issues through Tiwi and English narrations, and attention catching fly through images and graphics. Timed release of the CD and other innovative natural resource management material could form the basis for structured resource management activities within schools.

Local council staff and Community Development Employment Programme (CDEP) participants are responsible for the management and maintenance of community areas and infrastructure such as roads, road reserves and open space areas. Given the importance of these areas as vectors for resource management threats, staff training in identification and management techniques should be encouraged.

Training could include weed identification and control, revegetation techniques for disturbed sites, equipment hygiene to minimise transport of weeds and diseases, road maintenance and erosion control techniques, materials extraction and handling techniques, and the operation and rehabilitation of extractive sites. Training should also include the use of GPS technology so that information can be included in regional strategic planning and management. Where practical, joint training opportunities should be explored between organisations, and this could be facilitated through field days and on-island training opportunities. Field days could also be used to educate the broader community about natural resource management issues.

The sharp end of natural resource management is made up of on-ground activities, and natural resource management outcomes cannot be achieved without these activities being carried out. Similarly, natural resource management

projects that do not involve major stakeholders are unlikely achieve long term results. Nor will activities that are ad hoc, and not part of a larger strategic programme. Short term grant funding for specific projects, while useful, does not build capacity within the region, and often addresses symptoms rather than causes.

Successful strategic natural resource management requires a living plan, core staff, operational capacity and maximum involvement of stakeholders. It also requires ongoing mentoring and training. The Tiwi Land Council currently employs an Environment and Heritage Officer, whose role is to address natural resource management issues under the direction of the Land Council. The operation of this position alone does not give any depth to natural resource management within the region, and limits sustainable outcomes.

An additional, local trainee Environment Officer supported by small, resourced on ground teams will provide a rounded and sustainable natural resource management capability. Funding for the programme could be sought from a mix of sources including economic activity on the islands, CDEP, private sponsorship, representative aboriginal corporations, and local, territory and federal governments. Long term success of the programme will rely on secure, recurrent funding and ongoing support from relevant organisations.

There are a number of organisations represented within the region that are either intimately involved in, or interface with, natural resource management. They include the Tiwi Land Council, Tiwi Islands Local Government, Community Management Boards, Tiwi Health Board, Tiwi Islands Training and Employment Board and private industry. To varying degrees, each of these organisations are involved in, or affected by natural resource management decisions. Lack of coordination between these groups can lead to duplication of effort, inefficient use of resources, failed projects and a community that is not engaged.

For efficient and effective ongoing natural resource management outcomes, it is vital that consultative and cooperative mechanisms are in place to guide natural resource management decisions and activities within the region. The creation of a broadly represented natural resource

management committee will ensure that all stakeholders are informed and involved with the natural resource management of the region.

The Commonwealth and Territory Governments also have roles and responsibilities to do with natural resource management. Cooperation between a Tiwi natural resource management committee and all tiers of government, with a common goal to maximise local capacity, will go a long way to achieving sustained regional outcomes.

Outcome:

Community ownership of natural resource management within the region.

Objective:

19. Develop and implement processes and procedures that build community capacity in natural resource management.

Recommended Actions:

- 19.1 Investigate and implement methods of including natural resource information into existing community information technology communication links.
- 19.2 Encourage, support and facilitate school based natural resource management activities and projects.
- 19.3 Develop and implement staff training in natural resource management information and techniques, including field days.
- 19.4 Facilitate Tiwi involvement in mainstream natural resource management training and educational programmes.
- 19.5 Develop and resource a natural resource management team consisting of Environment Officer, Trainee Environment Officer and small on ground teams.
- 19.6 Form a regional natural resource management committee from representatives of relevant Tiwi organisations, and develop formalised communication links between organisations.
- 19.7 Develop and maintain communication links between the Tiwi regional natural resource management committee and government.
- 19.8 Continue to access short term grant funding for on-ground projects within a regional context.





SUMMARY OF OBJECTIVES & RECOMMENDED ACTIONS

Summary of Objectives & Recommended Actions





Vision:

Our vision is of an independent and resilient Tiwi society built on the orderly and well managed utilisation of our natural resources. Inherent in this is the maintenance and protection of our unique cultural and natural resource values for the enjoyment and benefit of future generations of Tiwi.

PLANNING AND REGIONAL MANAGEMENT

Objectives	Recommended Actions
1. Collect, collate and manage natural resource information.	<ul style="list-style-type: none"> 1.1 Finalise current studies on biodiversity, water resources and land capability. 1.2 Commence a programme for identifying and filling priority gaps in resource knowledge. Invite and manage research effort in areas of shared interest. 1.3 Finalise development of the Tiwi Geographic Information System (GIS). 1.4 Purchase appropriate computer hardware and software dedicated to natural resource management, and develop a central library for natural resource information. 1.5 Source and obtain data sets held within other organisations. 1.6 Develop protocols for updating the Tiwi GIS, including data format protocols for information sourced from external agencies. 1.7 Ensure agreements for research and study include the provision of data in an appropriate format. 1.8 Regularly review and update this Strategy and the Tiwi GIS to include improvements in the knowledge base.
2. Include all stakeholders in decision-making processes.	<ul style="list-style-type: none"> 2.1 Provide advice to government on issues relating to natural resource management on the Tiwi Islands. 2.2 Encourage and promote the formation of co-management bodies to negotiate instances of competition in natural resource allocation, and to ensure that differences in views are adequately addressed in the decision-making process.
3. Preserve and protect areas and resources of high value to Tiwi people.	<ul style="list-style-type: none"> 3.1 Through consultation, confirm areas of cultural significance and update the Tiwi GIS where appropriate. 3.2 Identify areas of cultural significance that require management/rehabilitation plans; develop and implement where required. 3.3 Develop Codes of Practice for consultation with landowners through the appropriate authority prior to land and sea access and disturbance. 3.4 Prepare and distribute maps of land ownership and authority. 3.5 Provide regular orientation workshops for non-Tiwi staff and residents.



<p>4. Develop and implement processes that preserve and protect areas and resources of high scientific and contemporary conservation value.</p>	<p>4.1 Promote early and full inclusion of Tiwi stakeholders in the determination of biodiversity values. Include stakeholder views in recommendations for management.</p> <p>4.2 Develop and implement consultative mechanisms for the preparation of species recovery plans for threatened species within the region.</p> <p>4.3 Progress sea-closures and other protective measures for the north coast of Melville Island as a high priority (see also Coastal Management).</p> <p>4.4 Initiate and manage ongoing research on turtle and dugong population and habitat status, including recommendations for management.</p> <p>4.5 Progress biodiversity management and monitoring protocols for aquaculture and forestry through an inclusive negotiation process involving landowners, industry and government. Revise and update prior commitments where relevant.</p> <p>4.6 Implement existing commitments for biodiversity management under the <i>Environment Protection and Biodiversity Conservation Act</i>.</p> <p>4.7 Record on the Tiwi GIS as protected from significant changes in land use:</p> <ul style="list-style-type: none">• Seagull Island.• The mouths and landward waters of Shark Bay, Snake Bay, Goose Creek, Lethbridge Bay, Brenton Bay and adjacent areas significant for turtle breeding, sea grass and seaweed.• Known locations of listed threatened species, and associated buffers.• Environments listed as threatened.• Rainforest areas.• Riparian zones.• Wetlands.• Other significant habitats for animals listed under international treaties. <p>4.8 Flag on the Tiwi GIS as requiring further investigation when considering changes in land use:</p> <ul style="list-style-type: none">• The northern coastline of Melville Island.• Treeless plains.• Data deficient species, with the priority on endemic species. <p>4.9 Continue discussions for areas set aside as reserves, with a focus on the provision of adequate resources for their ongoing management.</p>
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<p>5. Develop and implement processes that balance freshwater flow volumes and flow quality between the maintenance of biological systems, quality of life for residents and consumptive needs.</p>	<ul style="list-style-type: none"> 5.1 Develop and implement a groundwater monitoring programme for Nguiu and Milikapiti bore fields. 5.2 Designate and exclude from development the potential bore field that has been identified for Pirlangimpi. 5.3 Implement contamination protection measures for Blue Water Creek. 5.4 Develop and implement an education and awareness programme on domestic water use. 5.5 Provide a sustainable water supply for Paru outstation. 5.6 Investigate the feasibility of 'Waterwatch' type programmes to monitor surface water quality at local swimming holes. 5.7 Develop Codes of Practice for tour operators and recreational users wishing to regularly access waterways and wetlands, and include in licence provisions. 5.8 Implement freshwater management and monitoring commitments for the plantation forestry project. 5.9 Initiate and manage research on environmental flow, spring flow, and deep aquifer production capability and recharge. 5.10 Recommission the NT Government surface water gauging stations at Blue Water Creek, Taracumbi Creek and Takamprimili Creek. 5.11 Include assessments of freshwater resource requirements for large scale development projects where relevant.
<p>6. Assess and manage current impacts on the coastal zone, and develop and implement processes to manage future impacts.</p>	<ul style="list-style-type: none"> 6.1 Record important marine and coastal hunting areas as protected from significant disturbance on the Tiwi GIS. 6.2 Continue representation on government and other marine and coastal bodies. 6.3 Through the Tiwi Coastal Waters Consultative Committee and Aquatic Resource User Group Forum, lobby for FTO's to be recognised as commercial operators. 6.4 Develop and implement a programme to carry out permit checks for recreational camping twice yearly. Locations and times to be determined on advice from AFANT. 6.5 Through AFANT, initiate log book projects for recreational fishers. 6.6 Through the Tiwi Coastal Waters Consultative Committee, initiate and manage research on the impacts of both the commercial and recreational fishing industry in the region. 6.7 Relocate the Port Hurd closure line to the mouth of Port Hurd. 6.8 Erect 'No Trespassing' signs around the Marine Harvest aquaculture lease. 6.9 Expand the Tiwi Marine Ranger Programme to two vessels and four ranger staff. 6.10 Provide ongoing training opportunities for Marine Rangers.



<p>7. Develop and implement processes that provide for a range of sustainable economic resource development options that are consistent with other natural resource management objectives.</p>	<p>7.1 Progress the development and expansion of land and sea based aquaculture in line with existing suitability studies.</p> <p>7.2 Progress the development and expansion of forestry enterprise in line with existing land capability studies and biodiversity planning.</p> <p>7.3 Finalise biodiversity studies in order to provide certainty to landowners and investors, and to avoid a 'shifting of the goal posts' approach.</p> <p>7.4 Investigate the development and implementation of 'development zones' and 'conservation zones' within a regional context.</p> <p>7.5 Update suitability and capability ratings as relevant information becomes available, and use as a basis for regional planning.</p> <p>7.6 Continue to seek opportunities for high-end eco-tourism ventures.</p> <p>7.7 Identify and protect areas of value to eco-tourism, including local swimming holes, tracts of wilderness and raw materials for art and craft (for example ochre deposits, wood suitable for carving).</p> <p>7.8 Support and encourage considered approaches for commercial wildlife utilisation opportunities.</p> <p>7.9 Identify and assess wild catch fishery resources, and Tiwi access to commercial opportunities.</p>
<p>MANAGING THE RISKS</p>	
<p>8. Develop and implement improved planning processes for community and outstation development.</p>	<p>8.1 Through a process of early and thorough consultation, develop 5 to 10 year land use structure plans for Nguu, Milikapiti and Pirlangimpi communities.</p> <p>8.2 Continue coastal monitoring in high risk areas, and develop estimates of erosion rates.</p> <p>8.3 Implement a policy of assessing all developments within 100m of the coastline before allowing development activities.</p> <p>8.4 Undertake a consultative review of stormwater drainage design standards for communities and outstations.</p>
<p>9. Address priority natural resource management issues in communities and outstations.</p>	<p>9.1 Identify priority areas, and actively explore options for prioritised stormwater drainage upgrades in all communities.</p> <p>9.2 Rehabilitate the old waste disposal site at Nguu, and discourage informal use.</p> <p>9.3 Upgrade sewerage disposal facilities at Munupi Lodge, Pirlangimpi.</p>
<p>10. Develop and implement improved planning processes for construction activities and infrastructure development.</p>	<p>10.1 Identify suitable sites for the extraction of sand, topsoil and gravel, and enter onto the Tiwi GIS.</p> <p>10.2 Actively encourage the implementation of guidelines for borrow pit operation and rehabilitation through community education and inclusion in external contract conditions.</p> <p>10.3 Develop and disseminate best practice guidelines for the construction and maintenance of unsealed roads. Include in external contract conditions.</p> <p>10.4 Develop and disseminate Codes of Practice for external contractors and service agencies, focusing on issues associated with moving vehicles and equipment within the region.</p> <p>10.5 Include rehabilitation and revegetation in work scopes for all new developments at the initial planning stage.</p>

<p>11. Identify and record land degradation processes resulting from construction and infrastructure activity, and develop prioritised plans for rehabilitation.</p>	<p>11.1 Develop and implement a rehabilitation plan for spent extractive areas prioritised on the level of active degradation.</p> <p>11.2 Prepare and cost a plan for the progressive upgrading and/or rehabilitation of roads and tracks that are actively contributing to land degradation.</p> <p>11.3 Continue erosion control works at Port Hurd airstrip.</p>
<p>12. Implement and regularly review planning and management procedures for natural resource based economic development projects.</p>	<p>12.1 Regularly update, review and implement the Port Hurd Aquaculture Environmental Management Plan.</p> <p>12.2 Regularly update, review and implement the Tiwi Islands Plantation Forestry Strategic Plan.</p> <p>12.3 Prepare and implement management and monitoring protocols for marine pest risk management associated with timber export.</p> <p>12.4 Actively encourage the ongoing management of land degradation issues associated with Maxwell Creek and Pickertaramoor bases.</p> <p>12.5 Implement a collaborative approach to infrastructure development, with a focus on providing sustainable resource development, and optimum opportunities for investment within the region.</p>
<p>13. Develop and implement long term weed management strategies.</p>	<p>13.1 Develop and enforce policies and by-laws specific for regional weed issues, including complementary education and awareness programmes.</p> <p>13.2 Develop and implement a Weed Management Plan for the Tiwi Islands under the Weeds Management Act 2001.</p> <p>13.3 Support and encourage local weed management activities within a regional context.</p>
<p>14. Develop and implement prioritised feral animal management strategies.</p>	<p>14.1 Develop and implement a feral pig eradication programme for Rangini (Melville Island).</p> <p>14.2 Assess and record the extent of degradation from feral pigs and buffalo.</p> <p>14.3 Investigate options for pig and cat control in priority areas under Commonwealth Government species recovery plans and threat abatement plans.</p> <p>14.4 Investigate and encourage economic opportunities for the utilisation of buffalo and pigs.</p> <p>14.5 Carry out a prioritised feral ant eradication programme.</p> <p>14.6 Develop and enforce policies and by-laws specific for regional feral animal issues, including complementary education and awareness programmes.</p>



<p>15. Develop and implement processes that prevent the introduction of new exotic pest species, and the re-introduction of exotic pest species already present within the region.</p>	<p>15.1 Support and encourage the expansion of existing AQIS programmes within the region, including training local people in monitoring activities.</p> <p>15.2 Seek and obtain funding support for expanded quarantine infrastructure at Tiwi Barge Service premises on the mainland.</p> <p>15.3 Regularly review and update the Cane Toad Action Plan.</p> <p>15.4 Include quarantine requirements in all tenders let within the region that involve transport of machinery and freight.</p> <p>15.5 Maintain quarantine public awareness and education activities both within the region and on the mainland.</p> <p>15.6 Actively explore opportunities for intra- territory quarantine legislative controls as an urgent priority.</p> <p>15.7 Develop and implement a Quarantine Management Plan for the region.</p>
<p>16. Encourage best practice clearing operations within the region.</p>	<p>16.1 Develop generic clearing guidelines; distribute locally and to external contractors.</p>
<p>17. Develop and implement processes and procedures that minimise erosion hazard.</p>	<p>17.1 Extend land capability mapping to identify areas of inherent erosion risk, and use as a basis for land use planning</p> <p>17.2 Identify key land use activities that contribute to soil erosion, and develop and disseminate sector specific guidelines/ awareness material for erosion minimisation.</p> <p>17.3 Carry out an erosion survey of the region, and enter results onto the Tiwi GIS.</p> <p>17.4 Prepare and cost a plan for erosion control works based on the level and extent of active soil erosion.</p>
<p>18. Develop and implement processes and procedures that minimise the risk of wildfire within communities and plantation lease areas.</p>	<p>18.1 Support and maintain existing community and forestry fire management training.</p> <p>18.2 Carry out an annual awareness and education campaign for the protection of plantation forestry lease areas from wildfire.</p>
<p>CAPACITY BUILDING</p>	
<p>19. Develop and implement processes and procedures that build community capacity in natural resource management.</p>	<p>19.1 Investigate and implement methods of including natural resource information into existing community information technology communication links.</p> <p>19.2 Encourage, support and facilitate school based natural resource management activities and projects.</p> <p>19.3 Develop and implement staff training in natural resource management information and techniques, including field days.</p> <p>19.4 Facilitate Tiwi involvement in mainstream natural resource management training and educational programmes.</p> <p>19.5 Develop and resource a natural resource management team consisting of Environment Officer, Trainee Environment Officer and small on ground teams.</p> <p>19.6 Form a regional natural resource management committee from representatives of relevant Tiwi organisations, and develop formalised communication links between organisations.</p> <p>19.7 Develop and maintain communication links between the Tiwi regional natural resource management committee and government.</p> <p>19.8 Continue to access short term grant funding for on-ground projects within a regional context.</p>



POLICY FRAMEWORK





In 2001 the Tiwi Land Council developed an Environmental Policy that identified nine key areas for natural resource management. The objectives identified in this Strategy support the Tiwi Environmental Policy in the following ways:

Tiwi Environmental Policy – Key Areas	Natural Resource Management Strategy – Objectives
Develop and implement a Regional Natural Resource Management Strategy for the Tiwi Islands that will provide a framework for the integration of development, environment protection and conservation.	
Record and catalogue baseline data on topography, soils, flora, fauna and water resources.	1. Collect, collate and manage natural resource information.
Identify and quantify potential resource development options that are consistent with the maintenance and protection of cultural and natural resource values.	7. Develop and implement processes that provide for a range of sustainable economic resource development options that are consistent with other natural resource management objectives.
Preserve and protect areas of significance to our people, and areas of high contemporary scientific conservation significance.	3. Preserve and protect areas and resources of high value to Tiwi people. 4. Develop and implement processes that preserve and protect areas and resources of high scientific nature conservation value. 18. Develop and implement processes and procedures that minimises the risk of wildfire within communities and plantation lease areas.
Identify and manage processes that threaten our natural resource values.	6. Assess and manage current impacts on the coastal zone, and develop and implement processes to manage future impacts. 8. Develop and implement improved planning processes for community and outstation development. 10. Develop and implement improved planning processes for construction activities and infrastructure development. 13. Develop and implement long term weed management strategies. 14. Develop and implement prioritised feral animal management strategies. 15. Develop and implement processes that prevent the introduction of new exotic pest species, and the re-introduction of exotic pest species already present within the region. 16. Encourage best practice clearing operations within the region. 17. Develop and implement processes and procedures that minimise erosion hazard.



<p>Develop and implement Action Plans for weeds, feral animals, quarantine, water quality, soil erosion, revegetation and infrastructure management.</p>	<ul style="list-style-type: none"> 5. Develop and implement processes that balance freshwater flow volumes and flow quality between the maintenance of biological systems, quality of life for residents and consumptive needs. 9. Address priority natural resource management issues in communities and outstations. 13. Develop and implement long term weed management strategies. 14. Develop and implement prioritised feral animal management strategies. 15. Prevent the introduction of new exotic pest species, and the re-introduction of exotic pest species already present within the region. 17. Develop and implement processes and procedures that minimise erosion hazard.
<p>Monitor the health of the environment and take remedial action where necessary.</p>	<ul style="list-style-type: none"> 11. Identify and record land degradation processes resulting from construction and infrastructure activities, and develop priority plans for rehabilitation. 12. Implement and regularly review planning and management procedures for natural resource based economic development projects. 13. Develop and implement long term weed management strategies. 14. Develop and implement prioritised feral animal management strategies. 15. Prevent the introduction of new exotic pest species, and the re-introduction of exotic pest species already present within the region.
<p>Promote community involvement in natural resource management, and develop interesting and appropriate tools for the transfer of information and decision making.</p>	<ul style="list-style-type: none"> 2. Include all stakeholders in the decision making process 19. Develop and implement processes and procedures that build community capacity in natural resource management.
<p>Encourage and support educational and employment opportunities for Tiwi people in natural resource management.</p>	<ul style="list-style-type: none"> 19. Develop and implement processes and procedures that build community capacity in natural resource management.





IMPLEMENTATION & REVIEW

Implementation & Review





Implementation

Implementation of the Strategy will be guided by the principles of:

- Coordinated and cooperative planning.
- Recognition of majority stakeholders.
- Achievement of economic, social and environmental outcomes.
- Full utilisation of existing structures and processes.
- Oversight at the regional level.
- Responsive monitoring and review.

Strategy implementation is largely the responsibility of Tiwi organisations, however it relies heavily on support from all stakeholders, including government and industry. The Action Plan that follows identifies key organisations and agencies with lead responsibility for implementing specific actions, as well as potential partner organisations.

In order to link management organisations and stakeholder groups to the outcomes identified in the Strategy, mechanisms for effective collaboration need to be developed and maintained. It is proposed that this be achieved initially through the identification of a natural resource management committee of made up of Tiwi organisations, and the subsequent development of formal communication links between partner organisations and agencies. It is possible that such a committee already exists and will naturally take on the role of implementation.

Specific roles for government in Strategy implementation include institutional actions such as policy development and review; communication, consultation and engagement strategies; urban and infrastructure planning and development, and funding support under the new natural resource management regional framework and other mechanisms. These will be more readily achieved through developing a close working relationship with the Tiwi natural resource management committee.

Industry roles include developing and presenting project proposals, and undertaking resource usage in ways that conform to the outcomes of the Strategy. They also include appropriate and accepted methods of operation within the region, and ongoing consultation and dissemination of information.

Local government and communities within the region will implement the Strategy by increasing involvement and capability in natural resource management, increasing community awareness and understanding of natural resource use implications, and undertaking specific actions guided by the natural resource management committee.

The Tiwi Land Council, under the authority of the *Aboriginal Land Rights (Northern Territory) Act*, will guide implementation to ensure that the interests of their people are being faithfully and responsibly represented. They will also undertake more specific roles such as engaging the Tiwi community, reviewing resource use proposals for conformity with desired outcomes, maintaining a strategic focus, and carrying out specific on-ground actions.



Review

The Tiwi Land Council will also manage accountability by monitoring the implementation of the Strategy and assessing progress towards outcomes. Ongoing monitoring, amendment and review is crucial to Strategy implementation, and will be achieved through assessment against the key performance indicators. Three formal review processes have been proposed, and included in the Action Plan:

1. Twelve to eighteen months after Strategy implementation, an assessment of achievements to date and outcomes achieved. Management response may include a re-evaluation of time-lines and resourcing.
2. Three years after Strategy implementation, an analysis of progress towards Objectives. Management response may result in changes to the Recommended Actions.
3. Five years after Strategy implementation, an assessment of whether the Objectives are still valid. Management response will result in a review and update of the Strategy.

Formal review of the Strategy will be a consultative process, and recommendations for change will be considered from all stakeholders, including government, communities, industry and other land users.

In order to achieve a responsive management process, informal review activities and Strategy updates may also be undertaken at other times. These could be triggered by a number of internal and external influences such as changes in government policies, technological changes, key milestones achieved ahead of time, changing priorities of stakeholders and identification of new opportunities for sustainable natural resource utilisation.





Action Plan

ACTION PLAN





The Table following lists the Recommended Actions in priority order. The timeframe for implementation has been assigned as:

Current – already being carried out, and should continue.

Immediate Priority – action within the next 12 to 18 months.

High Priority – action within the next three years.

Moderate Priority – action within the next five years.

Each Recommended Action has also been assigned a responsible agency, an indicative cost for currently unfunded items, and a key performance indicator against which progress will be measured.

The following acronyms have been used:

AFANT	Amateur Fishermen’s Association of the NT	IHANT	Indigenous Housing Association of the NT
AQJS	Australian Quarantine Inspection Service	NAHS	National Aboriginal Health Strategy
ARUGF	Aquatic Resource User Group Forum	OEH	Office of Environment and Heritage
CDEP	Community Development Employment Programme	PMFEU	Police Marine Fisheries Enforcement Unit
CSIRO	Commonwealth Scientific and Industrial Research Organisation	PPA	Pirlangimpi Progress Association
DCDSA	NT Department of Community Development, Sport and Cultural Affairs	PWS	Parks and Wildlife Service of the Northern Territory
DBIRD	NT Department of Business Industry and Resource Development	SLAP	Serviced Land Availability Plan
DIPE	NT Department of Infrastructure Planning and Environment	TASMAC	Tiwi and Sylvatech Management Advisory Committee
DEH	Commonwealth Department of Environment and Heritage	TCWCC	Tiwi Coastal Waters Consultative Committee
FTO	Fishing Tour Operator	THB	Tiwi Health Board
GIS	Geographic Information System	TILG	Tiwi Islands Local Government
		TITEB	Tiwi Islands Training and Employment Board
		TLC	Tiwi Land Council



Current – already being carried out, and should continue.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated funding requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Institutional processes					
6.3 Lobby for FTO's to be recognized as commercial operators.	TLC	TCWCC, ARUGF	Core business		Commercial status recognised.
15.4 Include quarantine requirements in tenders let.	TLC	TILG, DIPE	Core business		Quarantine requirements included in tenders.
Processes that develop local capacity					
19.8 Continue to access short term funding for on-ground projects.	TLC	Natural resource management funding bodies.	Core business		Project funding received.
15.5 Maintain quarantine public awareness.	TLC	TILG		5,000	Public awareness material produced; media interviews; activities undertaken.
13.3 Support and encourage local weed management.	TLC, TILG	DIPE, PWS		1,500	Weed control undertaken; public awareness activities.
18.1 Support and maintain community and forestry fire management training.	TILG, Sylvatech	DIPE, TITEB	Core business		Training carried out.
19.2 Facilitate school based natural resource management activities and projects.	TLC	All Tiwi schools, Education Dept		2,000	School visits, material provided, projects undertaken.
1.5 Source and obtain data held within other organisations.	TLC		Core business		Natural resource management data obtained.
6.2 Continue representation on marine and coastal bodies.	TLC		Core business		Representation on marine and coastal bodies.
2.1 Provide advice to government on Tiwi natural resource management issues	TLC		Core business		Representation on natural resource management bodies; meetings with government

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated funding requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Research					
4.4 Turtle and dugong population and habitat status and recommendations for management.	TLC	Research and educational bodies		7,500	Research projects developed and implemented.
Regional planning processes					
4.3 Progress sea-closures and other protective measures for the north coast of Melville Island.	TLC	TCWCC, ARUGF, DEH, PWS		2,500	Protective measures identified and implemented.
8.2 Continue coastal monitoring in high-risk areas, and develop estimates of erosion rates.	TLC		Core business		Estimates of erosion rates determined.
8.3 Implement a policy of assessing all developments within 100m of the coastline.	TLC	TILG	Core business		Policy developed and implemented.
7.6 Seek opportunities for high-end eco-tourism ventures.	TLC		Core business		Opportunities identified and assessed.
7.8 Support and encourage considered approaches for commercial wildlife utilisation opportunities.	TLC		Core business		Approaches received and considered.
4.9 Discussions for areas set aside as reserves, and management requirements	TLC	DEH, PWS	Core business		Discussions held and options assessed.
5.11 Include assessments of freshwater resource requirements for large scale development projects.	TLC	TILG, DIPE, developers	Core business		Projects assessed.
1.7 Agreements for research and study to include provision of data in an appropriate format	TLC	Research bodies	Core business		Data provided.



Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated funding requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
1.8 Regularly review and update this Strategy and Tiwi GIS.	TLC	All interested stakeholders.		2,000	Strategy and GIS regularly reviewed and updated.
Processes that protect and restore regional natural resource values					
15.3 Review and update the Cane Toad Action Plan.	TLC		Core business		Plan updated.
4.6 Implement existing commitments for biodiversity management under EPBC.	TASMAC	DEH, PWS	84,000	74,000	Biodiversity management and monitoring programme implemented.
4.5 Progress biodiversity management and monitoring protocols for aquaculture and forestry through inclusive negotiation.	TASMAC, Marine Harvest	PWS, DEH	Core business		Prior commitments reviewed and accepted by all stakeholders.
Processes that protect and restore local natural resource values					
14.1 Develop and implement a pig eradication programme for Rangini (Melville Island).	TLC	PWS, DEH	19,000 (funding committed)	8,600	Eradication programme developed and implemented.
5.8 Implement freshwater management and monitoring commitments for the plantation forestry project.	TASMAC	DIPE		26,500	Freshwater management and monitoring programme implemented.
11.3 Continue erosion control works at Port Hurd airstrip.	TLC	Marine Harvest, DIPE		2,500	Works implemented annually.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated funding requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Additional personnel requirement: Project management; 0.5 staff Forestry environmental management; 1 full time staff	TLC			30,000	
	TASMAC			55,000	
Total estimated funding required for continuation of current activities			84,000	217,100	



Immediate Priority – action within the next 12 to 18 months.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Institutional processes					
15.6 Actively explore opportunities for intra-territory quarantine legislative controls.	TLC	DBIRD	Core business		Legislative controls identified.
13.1 Develop and enforce policies and by-laws for regional weed issues, including education and awareness programmes.	TLC	TILG, DIPE, TASMALC	5,000	1,500	Policies and by-laws developed, education and awareness programmes developed.
3.3 Develop Codes of Practice for appropriate consultation prior to land and sea access and disturbance.	TLC	All agencies and industry with business in the region.	2,500		Codes of Practice produced and disseminated.
4.1 Early and full inclusion of Tiwi stakeholders in determination of biodiversity values.	TLC	DEH, PWS	1,000	500	Formal protocols for consultation and consideration accepted by stakeholders and implemented.
4.2 Consultative mechanisms for preparation of species recovery plans.	TLC	DEH, PWS	1,000	500	Consultative mechanisms developed and accepted by stakeholders.
Processes that develop local capacity					
19.5 Develop and resource a natural resource management team.	TLC	TILG (CDEP), TITEB, DEH, PWS	85,000	295,000	Natural resource management team in place.
6.9 Expand the Tiwi Marine Ranger Programme to two vessels and four ranger staff.	TLC	TILG (CDEP), TITEB, DBIRD	90,000	170,000	Expanded Marine Ranger programme in place.
6.10 Provide ongoing training opportunities for Marine Ranger staff.	TITEB	TLC, DBIRD	5,000		Training opportunities identified and accessed.
19.4 Facilitate Tiwi involvement in mainstream natural resource management training and education programmes.	TITEB	TLC, TILG	Core business		Mainstream courses identified and accessed

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
1.3 Finalise development of the Tiwi GIS.	TLC		7,000		Tiwi GIS completed.
18.2 Carry out an annual awareness and education programme for the protection of plantation forestry lease areas from wildfire.	TASMAC		1,000	2,000	Annual programme developed and implemented.
Research					
6.6 Initiate and manage research on the impacts of commercial and recreational fishing.	TCW/CC	Research and educational bodies.	10,000		Research projects developed and implemented.
1.1 Finalise current studies on biodiversity, water resources and land capability.	PWS, DIPE, Consultants	TLC			Current studies finalised.
7.3 Finalise biodiversity studies in order to provide certainty to landowners and investors.	PWS	TASMAC	5,000		
1.2 Identify and fill current gaps in resource knowledge.	TLC	Consultants	2,500	To be determined	Gaps identified, programmes developed in relevant areas.
6.5 Initiate log book projects for recreational fishers.	AFANT	TLC	5,000	5,000	Log book project implemented.
Regional planning processes					
19.6 Form a Tiwi natural resource management committee, and develop communication links between Tiwi organisations.	TLC	TILG, TITEB, THB		12,000	Committee established and operational, meeting every two months.
10.1 Identify sites for extraction of sand, gravel and topsoil.	TLC	TILG	1,500		Sites identified, recorded on Tiwi GIS and disseminated to Community Management Boards.



Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
3.4 Prepare and distribute maps of land ownership and authority.	TLC		5,000		Maps prepared and distributed.
7.4 Investigate the development and implementation of 'development zones' and 'conservation zones'.	TLC	DEH, PWS	Core business		Discussions held and options assessed.
10.5 Include rehabilitation and revegetation in work scopes for all new developments.	TLC, TILG	All agencies carrying out development in the region.	Core business		Processes developed and implemented.
4.7 Record on the Tiwi GIS as protected from significant changes in land use: <ul style="list-style-type: none"> • Seagull Island. • The mouths and landward waters of Shark Bay, Snake Bay, Goose Creek, Lethbridge Bay, Brenton Bay and adjacent areas significant for turtle breeding, sea grass and seaweed. • Known locations of listed threatened species, and associated buffers. • Environments listed as threatened. • Rainforest areas. • Riparian zones. • Wetlands. • Other significant habitats for animals listed under international treaties. 	TLC		Core business		Locations recorded and classified.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
<p>4.8 Flag on the Tiwi GIS as requiring further investigation when considering changes in land use:</p> <ul style="list-style-type: none"> The northern coast of Melville Island. Treeless plains. Data deficient species, with the priority on endemic species. 	TLC		Core business		Locations recorded and classified.
10.4 Develop and disseminate Codes of Practice for external contractors and service providers.	TLC		5,000		Codes of Practice produced and disseminated.
5.7 Develop and disseminate Codes of Practice for tour operators and recreational users using waterways and wetlands, and include in licence provisions.	TLC		2,500		Codes of Practice produced and disseminated. Clauses included in licence provisions.
Processes that protect and restore regional natural resource values					
15.2 Seek and obtain funding support for expanded quarantine infrastructure at Tiwi Barge.	TLC	Tiwi Barge Services		Core business	Funding obtained.
14.5 Carry out a prioritised feral ant eradication programme.	TLC	CSIRO	10,000 (funding committed)	2,500	Eradication programme complete, monitoring programme developed.



Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
6.4 Carry out permit checks for recreational camping twice yearly.	PMFEU	AFANT, TLC		6,000	Checks implemented.
Processes that protect and restore local natural resource values					
5.2 Designate and exclude from development the potential Pirlangimpi bore field.	TLC	TILG, PowerWater, IHANT	Core business		Area designated as future bore field and entered on SLAP.
12.3 Prepare and implement marine pest management protocols for timber export.	TASMAC	DBIRD, Forest industry partners	2,500	1,500	Protocols developed and implemented.
5.3 Implement contamination protection measures for Blue Water Creek.	PowerWater	TILG, NAHS	7,500		Protection measures implemented.
9.2 Rehabilitate the old waste disposal site at Ngutu, and discourage informal use.	TILG	NAHS, OEH	10,000		Site rehabilitated and closed.
5.5 Provide a sustainable water supply for Paru outstation.	TILG	NAHS	245,000		Water supply installed.
6.8 Erect 'No Trespassing' signs around Marine Harvest aquaculture lease.	Marine Harvest		2,500		Signs installed.
6.7 Relocate Port Hurd closure line to the mouth of Port Hurd.	TLC	ARUGF, DBIRD	Core business		Closure line installed.
9.3 Upgrade sewerage disposal facilities at Munupi Lodge, Pirlangimpi.	PPA		80,000		Sewerage upgraded.
Additional personnel requirement					
GIS & Project management; 0.5 staff	TLC			30,000	
Total estimated funding required for Immediate Priority Actions					
			576,500	531,500	

Review Activity 1 – Assessment of Key Performance Indicators

Assess status of completion and outcomes achieved	TLC	All stakeholders	5,000	Management response which may result in a re-evaluation of time-lines and resourcing.
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High Priority – action within the next three years.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Institutional processes					
2.2 Formation of co-management bodies to negotiate competition in natural resource allocation, and to ensure differences in views are addressed in the decision-making process.	TLC	DEH, PWS, DIPE	5,000	2,000	Co-management bodies established and operational.
12.5 Collaborative approach to infrastructure development with a focus on providing sustainable resource development and optimum opportunities for investment within the region.	TLC	TILG, Relevant NT and Commonwealth Govt representatives, relevant industry representatives (Commonwealth body?)	2,000	1,000	Formal protocol for collaboration developed; collaborative bodies established and operational.
8.4 Consultative review of stormwater drainage design, and revise standards for communities and outstations.	IHANT	TILG, TLC, DIPE, NAHS	10,000		Revised standards accepted by all stakeholders.
Processes that develop local capacity					
19.1 Investigate and implement methods of including natural resource information into existing community information technology links.	TLC	TILG		Core business	Methods identified and implemented.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
19.3 Staff training in natural resource management information and techniques, including field days.	TLC	All Tiwi organisations.	5,000	5,000	Training courses and field days carried out.
1.4 Purchase appropriate computer hardware and software dedicated to natural resource management, and develop a central library.	TLC		30,000	2,500	Equipment purchased and central library established.
15.1 Expansion of existing AQIS programmes and training.	AQIS	TLC		5,000	Expanded AQIS programme.
5.4 Education and awareness programme on domestic water use.	TLC	DIPE, TILG	7,500		Education and awareness programme developed and implemented.
Research					
17.1 Expand land capability mapping to identify areas of erosion risk, and use as a basis for land use planning.	TLC	Consultant	3,500		Erosion risk mapping included as a layer on Tiwi GIS.
7.9 Identify and assess wild catch fishery resources, and Tiwi access to commercial opportunities.	TCWCC		Core business		Opportunities identified.
5.10 Recommission surface water gauging stations at Blue Water Creek, Taracumbi Creek and Takamprimili Creek.	TLC	DIPE	27,000	9,000	Automatic gauging stations operational.
Regional planning processes					
15.7 Develop and implement a Quarantine Management Plan for the region.	TLC	DBIRD	5,000	To be determined	Plan developed and implemented.



Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
6.1 Record important marine and coastal hunting areas as protected on the Tiwi GIS.	TLC		Core business		Locations recorded and classified.
3.1 Confirm areas of cultural significance and update Tiwi GIS where appropriate.	TLC		Core business		Areas recorded and classified.
7.7 Identify and protect areas of high value to eco-tourism.	TLC		Core business		Areas recorded on Tiwi GIS, and excluded from inappropriate development.
7.1 Development and expansion of land and sea based aquaculture in line with suitability studies.	TLC	Relevant industry	Core business		Opportunities for expansion identified, and approaches made to potential investors.
7.2 Development and expansion of forestry enterprise in line with land capability studies and biodiversity planning.	TLC	Relevant industry	Core business		Opportunities for expansion identified, and approaches made to potential investors.
8.1 Develop 5 to 10 year land use structure plans for Nguu, Milikapiti and Pirlangimpi.	IHANT	TILG, TLC, DCDSCA	25,000		Land use structure plans developed.
1.6 Develop protocols for updating Tiwi GIS, including data format protocols.	TLC		1,000		Protocols developed and disseminated.
7.5 Update suitability and capability ratings as information becomes available, and use as a basis for regional planning.	TLC			1,000	Ratings updated and recorded on Tiwi GIS.
17.3 Carry out an erosion survey and enter results onto Tiwi GIS.	TLC		5,000		Survey completed and data recorded on Tiwi GIS.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
3.5 Regular orientation workshops for non-Tiwi staff and residents.	TLC			2,000	Workshops undertaken.
10.2 Implementation of guidelines for borrow pit operation and rehabilitation.	TLC	TILG, DIPE, External contractors	Core business		Improved borrow pit operation and rehabilitation undertaken.
10.3 Develop and disseminate best practice guidelines for the construction and maintenance of unsealed roads.	TLC		2,500		Guidelines developed and disseminated.
12.1 Update, review and implement the Port Hurd Aquaculture Environmental Management Plan.	Marine Harvest	TLC		1,500 (review only)	Plan updated, reviewed and implemented.
12.2 Update, review and implement the Tiwi Islands Plantation Forestry Strategic Plan.	TLC	Sylvatech		1,500 (review only)	Plan updated, reviewed and implemented.
Processes that protect and restore regional natural resource values					
9.1 Identify priority areas, and explore options for prioritised stormwater drainage upgrades in all communities.	TILG	IHANT, NAHS	2,500		Priority areas identified, report produced and approaches made to relevant organisations for works.
11.2 Prepare and cost a plan for progressive upgrading/rehabilitating of roads and tracks.	TLC	TILG	2,000		Plan prepared.
11.1 Develop and implement a rehabilitation plan for spent extractive areas.	TLC	TILG	1,500 (dev. only)		Plan developed and implemented.
14.4 Investigate and encourage economic opportunities for buffalo and pig utilisation.	TLC		Core business		Discussions held with potential operators.



Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Processes that protect and restore local natural resource values					
12.4 Actively encourage ongoing management of land degradation issues associated with Maxwell Creek and Pickertaramoor	TLC	Sylvatech	Core business		Restoration activities carried out.
5.1 Develop and implement a groundwater monitoring programme for Nguuu and Milikapiti bore fields.	PowerWater	TILG, DIPE	1,000	1,000	Monitoring programme implemented.
Total estimated funding required for High Priority Actions			135,500	31,500	

Review Activity 2 – Assessment of whether the Actions are meeting the Objectives

Analyse progress towards Objectives	TLC	All stakeholders	5,000	Management response which may result in changes to the Recommended Actions.
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Moderate Priority – action within the next five years.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Institutional processes					
19.7 Develop and maintain communication links between the Tiwi regional natural resource management committee and government.	Tiwi regional natural resource management committee.	DEH, PWS, DIPE, DBIRD, OEH		6,000	Regular meetings between Tiwi committee representative and government representatives.
14.6 Develop and enforce policies and by-laws for regional feral animal issues, including education and awareness programmes.	TLC	TILG, PWS	5,000	1,500	Policies and by-laws developed, education and awareness programmes developed.
Processes that develop local capacity					
5.6 Investigate the feasibility of ‘Waterwatch’ type programmes to monitor surface water.	TLC	Tiwi schools	1,000		Programmes assessed, and recommendations made for adoption.



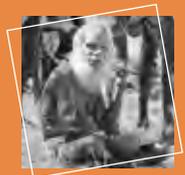
Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Research					
14.2 Assess and record the extent of degradation from feral pigs and buffalo.	TLC	PWS	10,000		Survey completed and data recorded on Tiwi GIS; management recommendations prepared.
5.9 Initiate and manage research on environmental flow, spring flow and deep aquifer production capability and recharge.	TLC	DIPE, research and educational organisations.	To be determined		Research programmes developed and implemented.
Regional planning processes					
13.2 Develop and implement a Weed Management Plan under the <i>Weeds Management Act 2001</i> .	TLC	Darwin Region Weeds Advisory Committee	2,500 (dev. only)	To be determined	Weed Management Plan developed and implemented.
17.2 Identify key land use activities that contribute to soil erosion, and develop and disseminate sector specific guidelines/ awareness material.	TLC		3,500		Guidelines and awareness material developed and disseminated.
16.1 Develop and disseminate generic clearing guidelines.	TLC		2,500		Guidelines developed and disseminated.

Recommended Action (summarised)	Responsible Organisation	Partner Bodies & Potential Partner Bodies	Estimated Funding Requirement (\$)		Key Performance Indicators
			Start-up	Recurrent	
Processes that protect and restore regional natural resource values					
14.3 Investigate options for pig and cat control under Commonwealth Government species recovery plans.	TLC	DEH, PWS	Core business		Opportunities identified and follow up commenced.
3.2 Identify areas of cultural significance that require management/rehabilitation plans; develop and implement plans where required.	TLC		1,500 (Areas identified only)	To be determined	Plan developed, including a programme for implementation.
17.4 Prepare and cost a plan for erosion control works based on the level and extent of active soil erosion.	TLC		1,500		Plan developed, including a programme for implementation.
Total estimated funding required for Moderate Priority Actions			27,500	7,500	
Review Activity 3 – Strategy Review					
Determine whether Objectives are still valid	TLC	All stakeholders	5,000		Management response which will result in a review and update of the Strategy.





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14	Tiwi with spears	Northern Territory News
15	Tiwi Land Council delegates	Tiwi Land Council
16	Tiwi artists Natalie Tungutalum & Marie-Evelyn Pautjimi	Tiwi Plants and Animals Book
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18	Milikapiti	NT Government
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19	Bobcat training at Milikapiti	Kate Hadden
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22	Historic Tiwi housing Nguiu	Nginingawila Literature Production Centre
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24	Satellite navigation Melville Island	Kate Hadden
25	Sea cages Port Hurd	Tiwi Land Council
26	Tiwi Islands football	Tiwi Land Council
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37	Kawarri/Muwani (<i>Veranus gouldii</i>)	Tiwi Plants and Animals Book
39	Rainforest Melville Island	Tiwi Plants and Animals Book
40	Club Mangrove (<i>Aegialitis annulata</i>)	Tiwi Plants and Animals Book
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41	Purruti (<i>Pandion haliaetus</i>)	Tiwi Plants and Animals Book
42	Rijingini/Rijinga (<i>Petaurus breviceps</i>)	Tiwi Plants and Animals Book
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59	Fort Dundas	Clayton Fredericksen
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61	<i>Burmammia</i> D61177 Bathurst Island	NT Parks and Wildlife Service
63	River Melville Island	Tiwi Land Council
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