BIODIVERSITY CONSERVATION ON THE TIWI ISLANDS, NORTHERN TERRITORY:

Part 3. Management and planning for biodiversity conservation

Natural Heritage Trust
Helping Communities Helping Australia
An Australian Government Initiative

TIWI LAND COUNCIL

Northern Territory Government
Department of Infrastructure, Planning and Environment

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Cover photo: Part of the focus of this report involves maintaining biodiversity values represented in the Tiwi Island native forests dominated by *Eucalyptus miniata*, *Eucalyptus tetrodonta* and *Corymbia nesophila* (left) within a development context that includes replacement of parts of these forests by commercial plantations of *Acacia mangium* (right).

SUMMARY

This part of the report recapitulates the major conservation values of the Tiwi Islands, introduced previously in Parts 1 and 2. These values are considered to be unusually significant.

A series of goals for the identified conservation assets are proposed, arising from a range of national and Northern Territory legislation and strategies, and ecological principles. We provide examples of how such goals can be incorporated into specific land-use allocation planning, but we do not provide here any alternative solutions to comprehensive land use allocation, partly because this is a process that still requires input from more detailed land unit mapping (currently being finalised outside this project scope), and partly because such planning will require far more consideration by the major stakeholders. Nonetheless, the examples presented demonstrate an appropriate capability for balancing productive use with biodiversity conservation.

A biodiversity monitoring program is detailed, that extends substantially beyond that currently required under federal approval for forest plantation development.

The Tiwi Islands' biodiversity values clearly surpass the standard typically considered appropriate for the establishment of national parks in other jurisdictions. The management and monitoring activities proposed here as needed to maintain those biodiversity values are substantial and will require considerable additional resources above those currently available. One mechanism for attempting to leverage those management resources is through the establishment of some form of protected area, supported by a Tiwi NRM ranger program. There are a range of options available for establishment of protected areas, and the long-term costs and benefits of these options should be considered by the Tiwi Land Council.

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1. INTRODUCTION

1.1. Purpose of this report

The previous two parts of this report have described the environments and biota of the Tiwi Islands, highlighting in particular their context relative to the rest of the Northern Territory and their significant attributes. The Tiwi Islands are clearly of great importance for biodiversity conservation. As described in the previous two parts of this report, they contain:

- 20 plant taxa that are listed as Endangered or Vulnerable under Northern Territory legislation (including one species listed as Endangered under the federal *Environment Protection and Biodiversity Conservation Act 1999*) and a further 44 species listed as Data Deficient;
- 17 animal species listed as Endangered or Vulnerable under either Northern Territory or Commonwealth legislation; with a further 29 species listed as Data Deficient in the Northern Territory;
- 11 endemic (i.e. restricted to the Tiwi Islands) plant taxa, with a further 19 plant species known in the Northern Territory only from the Tiwi Islands (with most of these occurring also in Indonesia and/or Cape York Peninsula);
- many endemic animal species - these include 8 bird subspecies, two mammal subspecies, about 10% of the 151 known ant species, and an unknown number of other invertebrates, but known to include some butterfly, dragonfly and snail species;
- 51 migratory animal species listed for special protection under bilateral and other international treaties;
- many plant and animal species with important cultural and subsistence value to Tiwi landowners;
- more than 1200 rainforest patches, constituing a higher density of rainforests in the landscape than anywhere else in the Northern Territory, and comprising rainforest types of unique floristic composition;
- extensive areas of the best developed (i.e. tallest and with greatest basal area) eucalypt forests in the Northern Territory;
- vertebrate spcies composition that is distinctly different to that of the Northern Territory mainland; and
- a broad mix of environments including woodlands dominated by *Eucalyptus oligantha* (the most extensive area of this formation in the Northern Territory), wetlands, coastal dune formations, "treeless plains" (a low woodland, almost restricted to the Tiwi Islands), mangal (mangroves), grasslands and *Melaleuca* forests.

This is a rich legacy, that has been largely maintained and nurtured by many thousands of years of traditional Aboriginal land management.

In part, that traditional land management is now changing, and Tiwi people seek to develop a range of mechanisms for enhancing the productive use of at least some of their lands. This use includes the ongoing development of a major forest plantation industry.

It is the purpose of this report to describe options for the protection of the significant environmental values of the Tiwi Islands within a framework that acknowledges changing land-use patterns, most notably the reality of increased development and gradually diminishing traditional management.

This report is part of a broader context of land management initiatives specifically focused on, or relevant to, the Tiwi Islands. That package includes:

- the development of recovery plans for all listed threatened Tiwi Island plants (Anon 2003);
- the development of recovery plans for a set of Top End bird and mammal species (in preparation by NT DIPE, and expected to be completed by December 2003);
- the development of an overarching natural resource management strategy for the Tiwi Islands (Tiwi Land Council, in preparation, and expected to be completed by December 2003);
- detailed land unit mapping for the entire Tiwi Islands, with commentary on the constraints for development (by Ian Hollingworth, EWL Sciences, expected to be completed by December 2003);
- the preparation of forestry development plans (Tiwi Land Council 2000); and
- a set of environmental conditions imposed upon the development of plantation forestry (Appendix D).

In addition, there is a broader context of policy and legislation bearing upon biodiversity conservation and forestry development. This is outlined in section 1.2 of this report.

Given this context, the focus of this report is:

(1) setting of long-term conservation goals;
(2) description of the distribution of conservation values;
(3) safeguarding priority conservation assets within a development setting;
(4) management of threatening processes;
(5) monitoring of biodiversity assets;
(6) development of options for protection and management of lands supporting major conservation values; and
(7) identification of areas of uncertainty.

Parts of this report are drawn or adapted from a previous report (Woinarski *et al.* 2000). Notable areas of difference from that report include: addition of substantial data sets from a major biological survey effort on Bathurst Island (2000-02); additional intensive survey work on some threatened species, notably the red goshawk (Baker-Gabb 2001); and updates in the conservation status of all NT threatened species. More notably, the context of this report and its predecessor are notably different. The earlier report was framed within a context of Governments' assessment of the environmental impacts of the major forestry proposal. Approval for that proposal has since been given. The previous report attempted to provide a set of options for zoning areas for vegetation retention and conservation, leaving a residue for development. This report does not attempt to be so prescriptive, although it does illustrate some of the mechanisms of such indicative allocation exercises.

1.2. Policy and legislative framework

A range of international, national and Territory initiatives, strategies and legislation relates to, and gives direction to, planning for biodiversity conservation.

These include the:

- *Environment Protection and Biodiversity Conservation Act 1999*;
- *Territory Parks and Wildlife Conservation Act 2000*;
- *National objectives and targets for biodiversity conservation 2001-2005* (Environment Australia 2001);
- Japan-Australia Migratory Bird Agreement (JAMBA, 1974);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979);
- China- Australia Migratory Bird Agreement (CAMBA, 1986);
- National Strategy for Ecologically Sustainable Development (1992);
- Australian National Strategy for the Conservation of Australian Species and Communities Threatened with Extinction (Endangered Species Advisory Committee 1992);
- National Forests Policy Statement 1992;
- Nationally Agreed Criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia (JANIS 1996);
- National Strategy for the Conservation of Australia's Biological Diversity 1996;
- Northern Territory Parks Masterplan 1997;
- National Greenhouse Strategy 1998;
- National Principles and Guidelines for Rangeland Management (Australian & New Zealand Environment and Conservation Council [ANZECC], and Agriculture & Resource Management Council of Australia & New Zealand [ARMCANZ] 1999);
- Australian guidelines for establishing the National Reserve System (ANZECC 1999);
- Natural Heritage Trust – Agreed special circumstances affecting land and resource administration in the Northern Territory (1999);
- National Framework for the management and monitoring of Australia's native vegetation (ANZECC 1999); and the
- Strategy for Conservation of the Biological Diversity of Wetlands in the Northern Territory of Australia (2000)

Of most relevance for conservation planning on the Tiwi Islands, these strategies and initiatives include commitments to

- **the establishment, at regional, State and National levels, of a comprehensive, adequate and representative conservation reserve system**. For forest environments, this system should include at least 15% of the area of all forest types (recognised at the 1:100,000 or 1:250,000 scale), and far higher proportions of forest types recognised as vulnerable or endangered. For other ecosystems generally, reservation should be sufficient to "provide ecological viability and integrity" (NRS guidelines).
- **particular attention to, and obligation for, the conservation needs of threatened species and environments**;
- **particular attention to, and obligation for, the conservation needs of migratory species (and especially birds)**;
- **consideration of the landscape setting of the reserve system**, most notably in the provision of corridors between reserves;

- **bioregional planning, which seeks *inter alia* to co-ordinate and encourage cooperation in conservation management across all tenures**;
- **maintenance of the native forest cover** ("the Governments will adopt the policy that further clearing of public native forests for non-forest use or plantation establishment will be avoided or limited, consistent with ecologically sustainable management, to those instances in which regional conservation and catchment management objectives are not compromised", – NFPS);
- **implementation and encouragement of conservation mechanisms and actions off-reserve**, including the incorporation of biodiversity conservation objectives into property management planning, recognition that landholders have a "duty of care" obligation for the sustainable management of native vegetation on lands for which they are responsible, and that incentives should be provided for public conservation services additional to this fundamental duty of care.
- **continual review of the impact of agricultural and pastoral management activities on biological diversity** and seeking changes where appropriate (Biodiversity Strategy);
- **control of the introduction and spread of introduced species** with emphasis given to "(a) assessing the types and levels of impacts and the likely extent of harm to native biological diversity; (b) increasing risk assessment studies of potential impacts on biological diversity of species introduced for commercial, scientific and other purposes" (Biodiversity Strategy), and prevention of the development of new weed and pest problems.
- **reduction in the adverse impacts of altered fire regimes on biological diversity**; and
- **maintenance and enhancement of the ecological integrity and physical stability of ground and surface water systems**, including associated riparian zones and wetlands; protection and rehabilitation of lowland wetlands and saltmarshes.

Extracts from three of the most relevant national forest strategies and initiatives are attached in Appendix A.

Much of this body of commitments was given legislative power in the recent federal *Environment Protection and Biodiversity Conservation Act 1999*, which *inter alia* defines the Commonwealth's role in the assessment of actions likely to have environmental impact. That Act commits a Commonwealth assessment and approval process for matters of identified national significance, defined to include World Heritage properties, Ramsar wetlands, nationally threatened species and ecological communities, migratory species, Commonwealth marine areas and nuclear actions. Appendix B includes a summary of operational guidelines for the assessment of the significance of any impact upon these matters.

At a Territory level, the most relevant conservation planning legislation is included within the *Territory Parks and Wildlife Conservation Act 2000*. This Act defines an obligation to classify the conservation status of all NT species, and defines the power to declare any area as *essential habitat*, necessary for the maintenance of one or more species. The relevant sections of this Act are included in Appendix C.

2. DEFINITION OF CONSERVATION GOALS

Any land-use planning exercise needs specific targets and objectives in order to be effective and to advance beyond well-meaning truisms. However, there is no straightforward procedure for setting such targets, because the setting of targets is partly a reflection of what society finds acceptable, and partly because there remains some uncertainty about the ecological underpinning of conservation targets.

There is some context for the development of conservation objectives and targets for the Tiwi Islands.

2.1. Savanna health and NRM regional planning approach

Through a series of workshops involving a broad range of stakeholder groups across northern Australia, the Tropical Savannas Cooperative Research Centre sought to develop performance benchmarks for defining healthy savannas and their attributes, and identifying indicators of landscape health (Whitehead *et al.* 2000). A "healthy" landscape was defined there as one that:

- maintains basic functions (including but not confined to nutrient cycling, water capture, provision of food and shelter for fauna) at all spatial scales;
- maintains viable populations of all native species of plants and animals at appropriate spatial and temporal scales; and
- reliably meets the long-term needs (spiritual, aesthetic and material) of those with an interest in savannas.

These features were used as a base for developing a framework for regional natural resource management plans across northern Australia (McDonald *et al.* 2002). The biodiversity objectives in that framework comprised:

- *progress towards a comprehensive adequate and representative reserve system*;
- *landscape structure and complexity is maintained*;
- *ecosystem diversity and integrity are maintained*; and
- *species diversity is maintained.*

2.2. National strategies, initiatives and agreements

Section 1.2 of this report lists some of the many Commonwealth and Territory-level policies and legislation relevant to the establishment of biodiversity conservation targets.

Some target criteria for conservation planning on the Tiwi Islands can be drawn from this body of strategies, agreements and legislation. Our interpretation is that these should include the set listed below:

- A minimum of 15% of every forest type (recognised at at least 1:250,000 scale) should be maintained.
- Preferably this retained forest should be incorporated in some formal conservation reserve system.

- There should be no ecologically significant reduction in the population (or viability) of any plant or animal taxon listed as threatened at either national or Northern Territory level, nor of the condition of the main habitats of these.
- There should be no ecologically significant reduction in the population (or viability) of any listed migratory animal taxon, nor of the condition of the main habitats of these.
- There should be no ecologically significant reduction in the value or viability of aquatic systems, especially those of riparian areas and wetlands.
- Development which leads to the regional loss of any species or community is by definition not ecologically sustainable and hence should not be approved.

These are very conservative criteria, and reflect the focus of most national strategies on forested areas of southern and eastern Australia, where priority is forced by the generally highly fragmented and substantially reduced forest estate, and where the bulk of native forests is held in public lands. The national forest goals and guidelines do not apply so well for the Tiwi Islands (and many other parts of the northern half of the Northern Territory), where all forests are in private lands, and where retention of 15% of forest cover would represent a major loss of biodiversity from that held within the current extent of 90 to 100% of the original forest extent.

2.3. Precedents in other Northern Territory regional planning.

Recent regional conservation plans for the Northern Territory - e.g. the Daly Basin (Price *et al.* 2000) and Mary River catchment (Armstrong *et al.* 2002) have argued that some environments merit special protection because they are highly restricted yet possess unusually rich biodiversity with high fidelity to that environment, and/or because they harbour important resources that are a lynchpin for the ecological functioning across the landscape more broadly. These environments are rainforests, wetlands and rivers/riparian areas.

There are a number of distinctive features of rainforests generally which afford them particular conservation priority (Russell-Smith and Bowman 1992; Russell-Smith *et al.* 1992; Price *et al.* 1995, 1999), including:

- patches typically vary substantially in their species composition, such that each patch has an idiosyncratic assemblage of plants;
- many rainforest plant species occur in only a very few patches;
- some species are typically represented in any given patch by very few individuals;
- patches are typically very small and together comprise only a very small proportion of the landscape;
- very many species which occur in rainforests do not also occur in the surrounding more extensive open forests and savanna;
- rainforests are readily degraded by weeds, feral animals and some fire regimes; and
- some rainforest animals require access to several or many rainforest patches at any one time or serially, and, complementarily, some rainforest plants exchange genetic material or otherwise "move" between rainforest patches in a manner that is dependent upon the persistence of animal dispersers.

For the Daly Basin, Price *et al.* (2000) set the following targets:

- all rainforest patches should be maintained, along with a buffer of natural vegetation of 500m around the perimeter of each patch;
- all wetlands should be maintained, along with a buffer of 200m of natural vegetation around each patch;

- all rivers and their riparian habitats should be maintained, along with a buffer of 200m of native vegetation from each high bank of rivers, 100m to either side of creeks and 50m to either side of drainage lines.

Partly consistent with these recommendations the DIPE Land Clearing Guidelines associated with the *Interim Development Control Order No. 12* under the *Planning Act* stipulates that native vegetation buffers should be maintained around drainage lines (20 metres), intermittent streams (25-50 metres), creeks (100 metres), rivers (250 metres) and wetlands (200 metres).

2.4. Conditions attached to environmental approval of plantation forestry.

Conditions of the approval of plantation forestry on the Tiwi Islands as an action under the *Environment Protection and Biodiversity Conservation Act 1999* included:

"APG and TLC also must not clear vegetation within the following buffer zones:

- rivers - 150m from each high bank;
- creeks - 100m from each bank;
- other drainage lines - 50m both sides;
- wetlands - 150m around wetland perimeter;
- wet rainforest patches - 600m; and
- other rainforest patches - 200m.
- 300m radius around nest sites of the red goshawk. If nests are located outside the buffers for rivers, wetlands and creeks, they must be linked by a corridor of 300m width to the nearest riparian buffer;
- 100m radius around nest and roost sites for the masked owl;
- 500m radius around known locations of carpentarian dunnart[1]."

2.5. Biodiversity conservation targets for the Tiwi Islands

The approaches and commitments described in the above sections provide some baseline from which to develop biodiversity conservation targets for the Tiwi Islands.

For environments, there is a clear obligation, and acceptance of the need, to protect and maintain the "significant" environments of wetlands, rivers and riparian systems, and rainforests, and reasonable guidelines in place for maintaining native vegetation in buffers around these environments.

Beyond these relatively restricted discrete environments, targets for conservation of environments are less well based on any underlying policy or legislation. National strategies urge the establishment of a protected area system that is comprehensive adequate and representative. By conventional usage this can be translated as incorporating around 10% of all vegetation types (identified at a scale of 1:100,000 or 1:250,000) within a protected area system. For forest ecosystems, a reservation target of 15% of the historic extent was indicated by JANIS (1996). Across the Australian rangelands as a whole, a target of 30% retention (i.e. not necessarily reservation) of native vegetation has been suggested as a guiding principle (e.g. McIntyre *et al.* 2000, 2002). However, this level is probably inadequate to maintain biodiversity over a scale of decades: for example McAlpine *et al.* (2002) suggest that reduction of vegetation extent to 30% of its former occurrence will lead to loss of 25-35% of a regional vertebrate fauna. The value of 30% retention is

[1] Note that the conditions use the wrong name carpentarian dunnart to refer to butler's dunnart *Sminthopsis butleri*.

also the threshold used in Queensland to denote a regional ecosystem as "of concern", and hence to trigger clearing control mechanisms. For biodiversity retention, McAlpine *et al.* (2002) recommended a target value of maintenance of 50% of the extent of every ecosystem within a region. This appears to be the most relevant justified precursor for setting retention thresholds for environments (other than those above designated as "significant") on the Tiwi Islands.

For species, there is a clear obligation, and acceptance of the need, to protect and maintain species listed as critically endangered, endangered or vulnerable under federal legislation (the *Environment Protection and Biodiversity Conservation Act 1999*), that is the plant *Burmannia* D61177 Bathurst Island, green turtle, hawksbill turtle, olive ridley, flatback turtle, loggerhead turtle, red goshawk, partridge pigeon, masked owl, butler's dunnart and false water-rat. The administrative guidelines for the *Environment Protection and Biodiversity Conservation Act 1999* (see Appendix B) define a significant impact upon listed endangered (and critically endangered) species as *any* long-term decrease in the population, or extent of occupancy, or any modification destruction, or decrease in the availability or quality of habitat to the extent that the species is likely to decline. For listed vulnerable species, a significant impact is defined as a reduction in the area of occupancy and/or long-term decrease in the size of an *important population*, and/or any modification destruction, or decrease in the availability or quality of habitat to the extent that the species is likely to decline. For the *Act*, "important populations" are defined as including: key source populations either for breeding or dispersal; populations that are necessary for maintaining genetic diversity; and/or populations that are near the limit of the species range. All Tiwi populations of vulnerable taxa would unambiguously meet the definition of "ímportant population" through the third of these criteria, and most would also meet the two alternative criteria.

There is also a clear obligation for the protection and maintenance of species categorised as threatened under Northern Territory legislation, which includes 20 plant and 11 animal species occurring on the Tiwi Islands. Guidelines for the interpretation of management targets for such species are less prescriptive than for those listed under the *EPBCA*. In the absence of any clear precedence, it seems appropriate that this set of species is treated in the same way as for nationally threatened species. Such action seems especially apt, given that it is likely that there will be greater conformity of national and NT-based listings of threatened species in the future.

The *EPBCA* also includes consideration of migratory species listed under bilateral and other international treaties, of which 51 species are known to occur in the Tiwi Islands. The overwhelming majority of these are shorebirds (waders) and waterfowl. The populations of waterbirds should be maintained partly through the target above of protecting all wetlands. The Tiwi Islands provides important habitat for some of these listed migratory shorebirds, and an appropriate conservation target for these species is the protection and maintenance of all beaches and mudflat areas that are identified as significant for these species. There is a small set of bushland birds listed under these treaties (comprising oriental cuckoo, rainbow bee-eater, leaden flycatcher, restless flycatcher and rufous fantail). Appropriate targets for these species are probebly met within the guidelines given above for protection of environments.

Beyond these listed species, conservation planning on the Tiwi Islands should include a specific target to maintain viable populations of *all* plant and animal species native to the Tiwi Islands. For those taxa endemic to the Tiwi Islands, this target should may need more explicit attention and higher levels of population security. In this instance, it is suggested that an appropriate goal for Tiwi endemic taxa is to ensure no increased risk of extinction of Tiwi populations as demonstrated by population viability analysis: until such time as such analyses are completed, it is suggested here that a minimum of 90% of the range or population size of every endemic taxon is maintained.

These targets are summarised in Table 2.1 below.

Table 2.1. Targets proposed for biodiversity conservation on the Tiwi Islands. In the usage below, "protected area" is taken to refer to an area in which conservation management is an explicit priority, and "retention" refers to native vegetation that is not (to be) cleared.

Attribute	*Target within protected areas*	*Target for retention*	*Interpretation*
Environments			
rainforests	>10% of extent	100% of extent	Plus 200-600m buffers of native vegetation surrounding patches
rivers and riparian systems	>10% of extent	100% of extent	Plus buffers depending upon river order
wetlands	>10% of extent	100% of extent	Plus 150m buffers of native vegetation
forest environments	>15% of extent	>50% of extent	For every forest type mapped at 1:100,000 or 1:250,000 scale
all other environments	>10% of extent	>50% of extent	For every type mapped at 1:100,000 or 1:250,000 scale
Species			
EPBCA-listed threatened plant and animal taxa		100% of population size and range maintained; habitat quality maintained	consistent with Admininstrative Guidelines of EPBCA
NT-listed threatened plant and animal taxa		100% of population size and range maintained; habitat quality maintained	by analogy with above
EPBCA-listed migratory species on international treaties		maintenance and protection of all significant coastal sites	assumed that species other than shorebirds are protected under the targets for other attributes above
all other taxa endemic to the Tiwi Islands		no increased risk of extinction for Tiwi populations	until PVAs completed, >90% of population size and range maintained
all other species		maintenance of long-term population viability	

3. DISTRIBUTION OF CONSERVATION VALUES

The previous parts of this report defined biodiversity values which any conservation plan for the Tiwi Islands should aim to maintain or enhance. In this section, we consider the broad distribution of these values, by location and habitat. Such consideration aims to highlight areas where conservation effort may be most effectively and efificently targeted.

3.1. Geographic location of sites of high conservation value.

In parts 1 and 2 of this report, we map the distributions of threatened plant and animal species, rainforests, and sites of significance for migratory shorebirds, breeding colonies of seabirds and concentrations of nesting sites of marine turtles. These maps are reproduced in Fig. 3.1 on the following page.

Although reflecting some sampling bias, the highest concentration of threatened plant and animal species is in the northwest of Melville Island and north of Bathurst Island, although most areas of the islands support at least one threatened species. Rainforest patches occur across much of Bathurst and Melville Islands, but particularly along the northern coastlines and in the north-west of Melville Island. There is some consistency in this patterning given that many threatened species (particularly plants) occur mainly in rainforests (see section 3.2 below), and that there is a substantial rainfall gradient across the islands, with the highest rainfall in the Northern Territory (and hence generally most suitable climatic environment for rainforests) occurring in the northwest of Melville Island and north of Bathurst Island.

The most significant aggregation of nesting seabirds lies on Seagull Island, off the north-west tip of Melville Island, but smaller colonies are scattered around the coastline. Migratory shorebirds and nesting sites of marine turtles occur around the coastline of both islands, but the former are concentrated particularly on the southeastern mudflat coastline of Melville Island and the latter around the more extensive sandy beaches of the northern coastline of Melville Island and southwestern tip of Bathurst Island.

These conservation values are clearly not all funnelled into a small portion of the Tiwi Islands to which particular conservation significance should be attached. Rather, there is some substantial complementarity in the distribution of attributes, with almost any and every part of the Islands supporting some significant features. This argues for integrating across the whole Islands area in the development of conservation management initiatives.

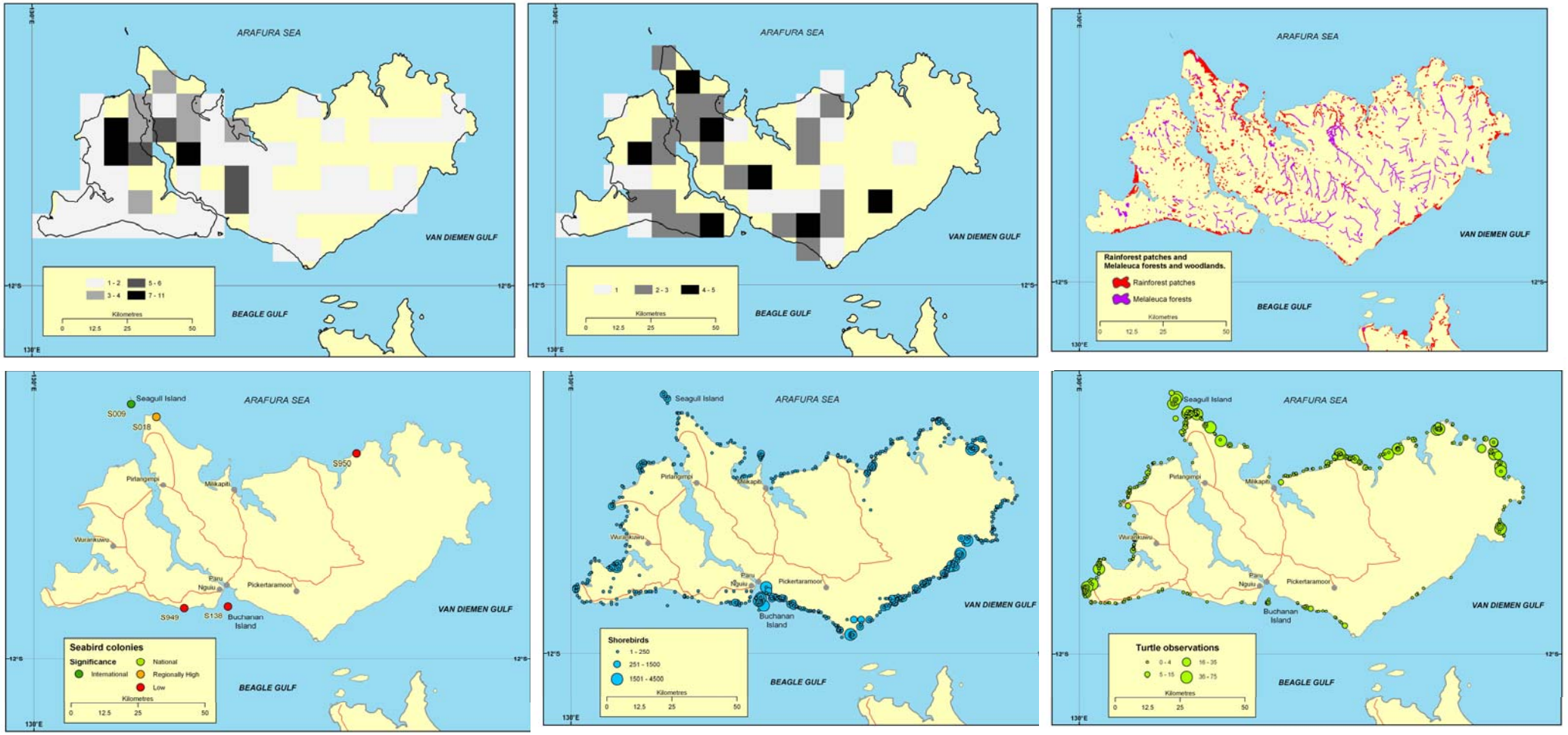

Figure 3.1. Location of significant contribution attributes on the Tiwi Islands.
Top row (from left) number of threatened plant species; number of threatened animal species; rainforest patches (red).
bottom row (from left): seabird colonies; aggregations of migratory shorebirds; marine turtles.

3.2. Habitat distribution of threatened species

In parts 1 and 2 of this report, we examined the habitat preferences of every threatened plant and animal species. The broad habitats primarily used by these species were tallied, and are illustrated in Fig. 3.2 below.

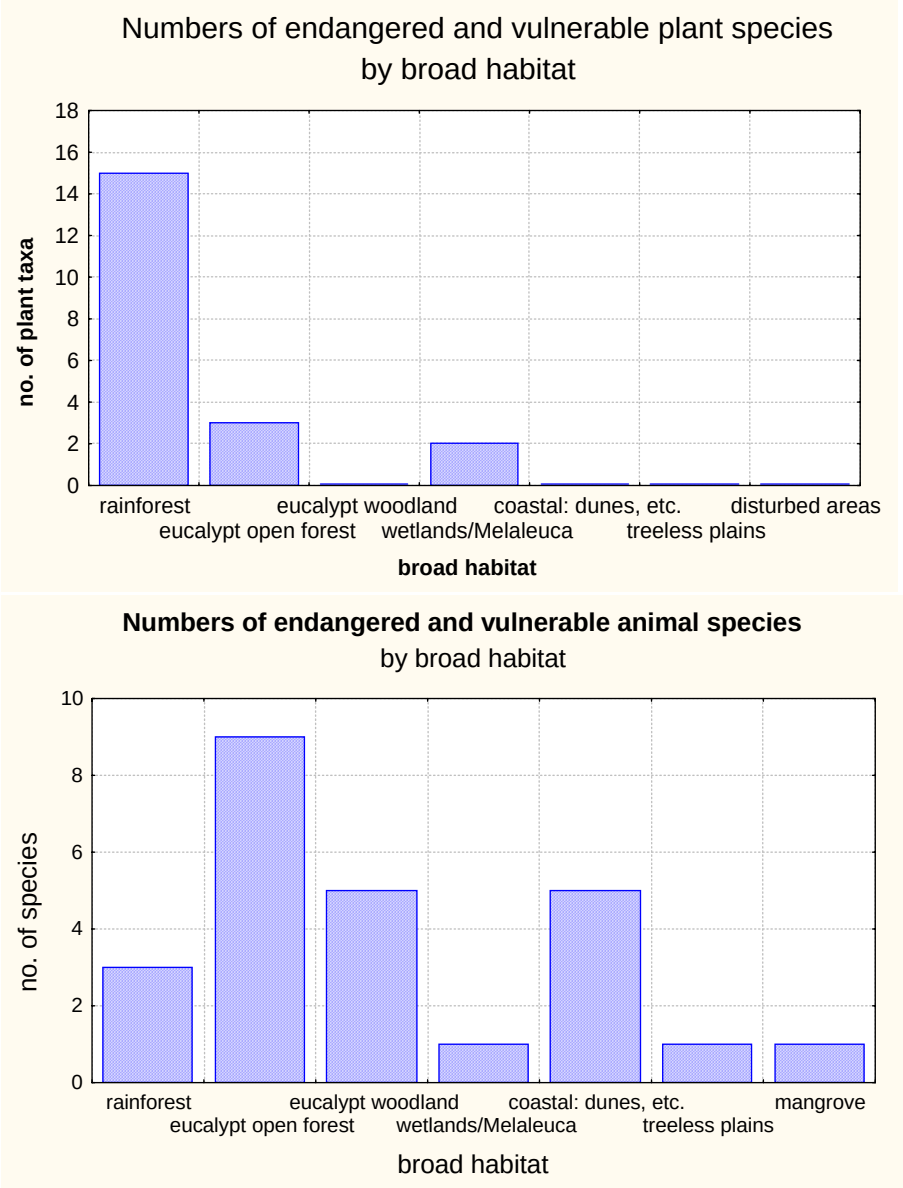

Figure 3.2. Habitat distribution of threatened Tiwi plant (top) and animal (bottom) taxa.

All Tiwi broad environments provide the primary habitat for at least one threatened species. However, most threatened plant species occur primarily in rainforests. In contrast, threatened animal species occur predominantly in eucalypt open forests.

3.3. *Data bases for individual threatened species, and predictive modeling*

The geographic and habitat paterning of threatened species described above provides some shorthand assessment of where conservation actions may be prioritised, but ultimately every threatened species has its own idiosyncratic distribution and ecology, such that planning must consider threatened species at an individual species level. To this end, we have compiled comprehensive (in that they contain all known records) data bases of the distribution of every threatened species (and all other plant and terrestrial vertebrates) known from the Tiwi Islands. The number of records in these data bases varies among threatened species from fewer than five (e.g. for false water-rat) to several hundred (for species such as brush-tailed rabit-rat). This data base can provide a major input to decisions about determination of land uses.

For some species, point-based distributional data can be reliably extrapolated to predicted distributional patterns across the whole of the islands, using modeling. In some cases, these modeled distributions provide more reasonable inputs into planning than do the sites of known occurrence (which are at least partly distorted by any sampling biases). Examples of such modeling are presented below (from Woinarski *et al.* 2000), for three threatened species: brush-tailed rabbit-rat, black-footed tree-rat and masked owl.

Maps of habitat suitability (or, the likelihood of occurrence) for these three species are presented in Figure 3.1.

predictive distributional models

for *masked owl*

$e^y / (1 + e^y) = -10.62 + 0.1077$ (band5) $- 0.000353$ (band5)^2.
[deviance explained =11%; p<0.01]

for *black-footed tree-rat*

$e^y / (1 + e^y) = -6.513 + 0.0656$ (band1) $- 0.000202$ (band1)$^2 + 0.000259$ (dist. to rainforest).
[deviance explained = 9.5%; p<0.001]

for *brush-tailed rabbit-rat*

$e^y / (1 + e^y) = -12.26 + 0.0135$ (band1) + [8.34 (if vegetation is eucalypt forest (open)) or 8.57 (if vegetation is eucalypt forest (dense or mid-open)) or 1.11 (if vegetation is *Melaleuca* open forests or low woodlands, or sedgelands and grasslands) or 8.10 (if vegetation is rainforests) or 0.23 (if vegetation is mangals) or -0.16 (if vegetation is treeless plains) or 8.95 (if vegetation is eucalypt woodlands) or 0.0135 (if vegetation is plantations)]
[deviance explained = 14%; p<0.01];

where **y** is the probability of occurrence (varying from 0 if certain to be absent to 1 if doubtless likely to be present) of the nominated species within a pixel, **band5** is values for Landsat bands 4 to 7, **band1** is the first principal component of Landsat bands 1,2,3 (i.e visual bands) and **dist. to rainforest** is the linear distance to the nearest mapped patch of rainforest.

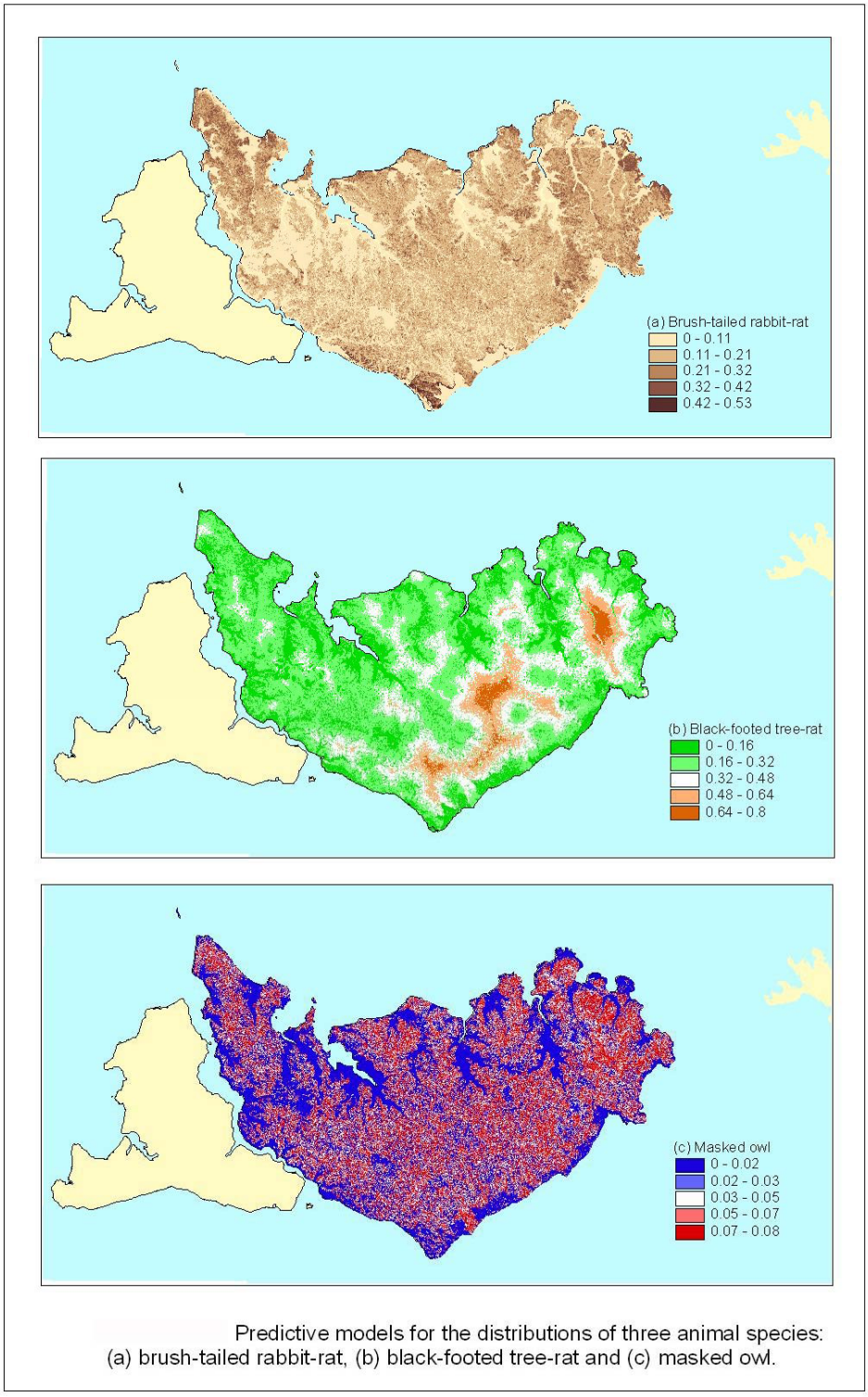

Figure 3.3. Examples of predictive distributional modeling for three threatened animal species. Melville Island distributions only (from Woinarski *et al*. 2000).

4. SAFEGUARDING CONSERVATION VALUES WITHIN A DEVELOPMENT SETTING

4.1. Rationale

Maintenance of the Tiwi Islands' rich legacy of bioiversity conservation values is not incompatible with development. However, such compatability can be achieved if and only if:

- there is carefully considered allocation of lands to be developed;
- the target values identified for biodiversity conservation are met;
- lands are managed appropriately, and threatening processes operating beyond development areas (e.g. weeds, pests, and unfavourable fire regimes) are controlled; and
- an adequate biodiversity monitoring program is implemented.

This section provides an illustration of the processes that can address the first two of these points. Section 5 addresses the issue of threatening processes, and Section 6 the issue of monitoring.

4.2. Planning for conservation and development

This section reproduces some geographic analyses presented in Woinarski *et al.* (2000) as an example of the deliberative assessment of designation of lands for conservation and development. This report is not the place for more prescriptive or precise determinations of appropriate boundaries for retained lands and lands open for development. Apart from issues of confidentiality and proper process, such analyses will require detailed consideration of environmental mapping, currently being completed by Hollingworth (2003). Rather, here we show the mechanism by which such allocation decisions can be best informed.

In contrast to the highly modified landscapes of southern Australia, the Tiwi environments and conservation values are generally intact and can be represented in retained areas in very many possible combinations. This flexibility allows for potential conservation networks to be varied in response to different arrays of other variables (such as potential for development, or to accommodate differences between clan groups in willingness to manage areas for conservation). Such balancing is an iterative process that has not yet been properly instigated among stakeholders for the Tiwi Islands. Hence our purpose here is largely to outline the process and types of rules that we consider should be used in establishing a network of areas retained for conservation purposes, and to provide some indication of the area required to meet the stated conservation targets.

There are many alternative ways of representing some attributes (e.g. wide-ranging species such as yellow-tinted honeyeater, or a "reservation" target of 15% of an extensive vegetation type). In contrast, there may be no options for highly localised attributes (such as species known from only one or two sites). In general, the process of conservation planning is most efficient if it builds from the most localised attributes to the most generalised. The planning process is also most efficient if it can deal with many co-occurring attributes at once. We also recognise that the conservation attributes described in the previous section are not all of comparable value - for example, we consider that it is relatively unimportant to provide areas specifically for the CAMBA and JAMBA listed oriental cuckoo, because that species is relatively widespread across the Tiwi Islands and

elsewhere in northern Australia - whereas the plant *Burmannia* DNA61177 'Bathurst Island' is known in the world from only small populations in two rainforest patches on Bathurst Island.

Much of the immediate imperative for conservation planning on the Tiwi Islands is because of the current and projected transformation of some large areas of eucalypt open forests to plantations of exotic tree species. This suggests a substantial loss of biodiversity, which can be in some ways balanced by providing greater conservation security for biodiversity in the retained vegetation. This argument rests on the assumption that at least some elements of biodiversity will be disadvantaged in the transformation from native forest to plantation. Woinarski *et al.* (2000) provided evidence that such is the case.

4.3. Prioritised steps for conservation planning

In the section below we outline a framework for identifying areas which together meet at least some of the conservation targets described in Section 3. This framework builds in a series of steps, with each subsequent step incorporating the outcomes of the preceding ones.

From Figure 3.2, it is readily apparent that many of the most threatened, endemic or otherwise localised plant species found on the Tiwi Islands are confined to rainforest patches, and are dependent upon the retention of rainforest environments. The Tiwi Islands rainforest network is highly significant at a Territory scale: it constitutes a relatively large proportion (5.8 to 14.8%, depending upon the scale of mapping) of the total rainforest area in the Territory, some of the largest individual patches, many species which occur nowehere else in the Territory, and two rainforest types which are endemic or virtually so.

Together, these features have justified a response now used in conservation planning in the Top End (e.g. Price *et al.* 2000) that all rainforest patches should be retained. This makes an appropriate start point for our conservation design.

STEP 1: Retain all rainforest patches.

Across Melville Island, this sums to 124 km^2 (or 2.14% of the Island area).
Across both Tiwi Islands, this sums to 158 km^2 (or 2.11%) of the Islands area.

But rainforests will not be maintained unless their perimeters are buffered from external threats, and their hydrological character is retained. Best practice guidelines for protection of rainforests were derived by Price *et al.* (2000), and applied for conservation planning in the Daly Basin bioregion. These stipulated that native vegetation should be retained in a 500m buffer around every rainforest patch. This is an appropriate benchmark for rainforests.

However, we recognise that the network of rainforest patches on the Tiwi Islands is composed of many more patches (a total of 302 on Bathurst Island and 959 on Melville Island) distributed across more of the landscape than for anywhere else in the Top End of the Northern Territory, such that the absolute application of the buffer guidelines would result in a substantial "cost" of land area. Accordingly, we here consider weakening this criterion, to apply only to those endemic rainforest groups 3 and 5 (as described by Russell-Smith 1991) - which are the most dependent upon maintenance of hydrological integrity - and reduce the buffer to 250m for all other rainforest groups on the Tiwi Islands.

STEP 2: Retain native vegetation in a buffer around all rainforest patches
(500m for Groups 3 & 5; 250m for other rainforest groups)

For Melville Island, this sums to 816 km^2 (or 14.1% of the Island area) (including the area of the rainforests themselves).

Across both Tiwi Islands, this sums to 1015km^2 (or 13.55% of the Islands area) (including the area of the rainforests themselves).

[Note that a buffer of 500m around all rainforest patches would increase this area to 1528km^2 (or 20.40%) of the Islands area (including the area of the rainforests themselves).]

Wetlands and river systems are the next group of localised features which self-evidently merit protection. Selection to incorporate these features, and example buffer areas of native vegetation around them, is described in Step 3 below.

STEP 3: Retain native vegatation in a buffer around all wetlands and river systems
(200m from each high bank of rivers; 100m from each bank of creeks; 50m to either side of other drainage lines; 200m around the wetland perimeter)

For Melville Island, this sums to an additional 694 km^2, hence a cumulative retained area of 1510 km^2 (26.1% of the Island area).

Across the Tiwi Islands, this sums to an additional 875 km^2, hence a cumulative retained area of 1890km^2 (25.23% of the Islands area).

The network of retained areas following Steps 1-3 is illustrated in Fig. 4.1.

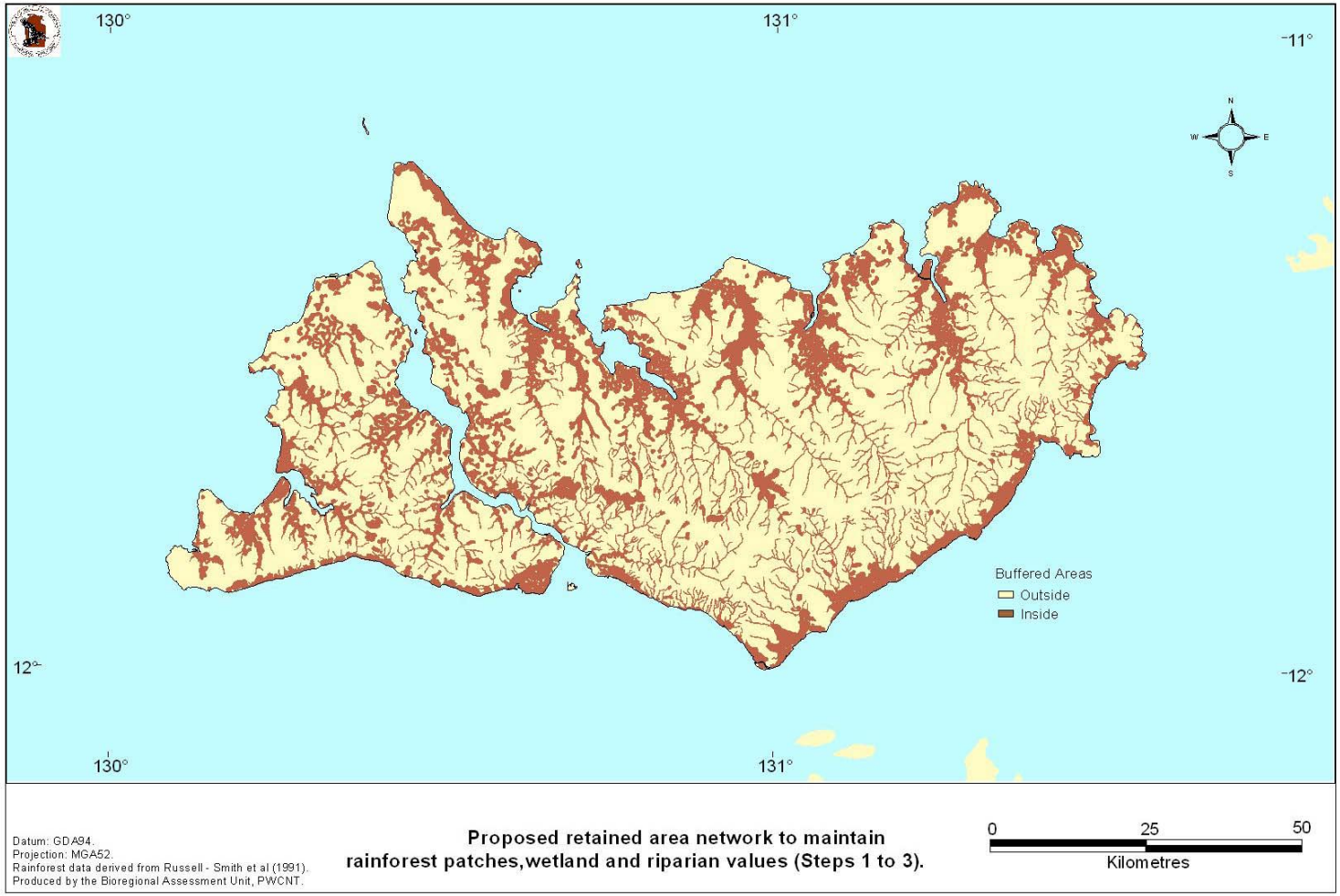

Figure 4.1. Occurrence of retained areas (brown) for protection of rainforests, wetlands and riparian areas (from Woinarski *et al*. 2000).

To build up a retained area network that adequately represented targets for all conservation attributes, Woinarski *et al.* (2002) then used a series of steps that included the known occurrences of threatened species (and various buffers around these sites), and representation of environments other than rainforests, riparian areas and wetlands.

In contrast to the highly localised sites of occurrence of rainforests, riparian areas and wetlands, and the target for protecting 100% of these, there is far more flexibility possible in selecting for retention the various targets (e.g. 50%, 90%) for representation of other vegetation types and threatened species.

It is a relatively straightforward GIS exercise to overlay the various coverages of vegetation types, predicted distributional maps for threatened species, and other relevant layers to derive spatial options for meeting conservation targets and for the identification of areas appropriate for development, and then for stakeholders to consider the most appropriate of these options. Such analyses, interpretation and consideration is now integral to ongoing planning for development of forest-based industries on the Tiwi Islands.

5. MANAGEMENT OF THREATENING PROCESSES

Regardless of the extent to which the Tiwi Islands are cleared for development, the conservation assets of retained areas will be gradually diminished unless they are appropriately managed. Obviously, over tens of thousands of years, traditional management by Tiwi people has ensured the maintenance of the values that we see today. But to some extent, traditional management practices have now changed. Large areas are now seldom visited, and hence no longer subjected to carefully modulated fire regimes. As bush tucker comprises an increasingly smaller proportion of people's diets, so the country will be increasingly less managed in ways that were formerly used to promote rich but sustainable harvests of yams and other foodstuffs. Inevitably this will produce some changes in vegetation patterning and hence the distribution and abundance of animal species, with some species benefitting from the less intricate and intimate environmental management and other species being disadvantaged. Superimposed on this relaxation of management, the ecology of the Islands has also been affected by the spread of a range of exotic plants and animals. Some of these introduced species exert a powerful influence on the environment. For example, mission grass *Pennisetum polystachion* grows so lushly that it can create a major increase in fuel loads and hence trigger increasingly more intense fires and thus major changes in plant communities (Kean and Price 2003). In rainforest patches, feral pigs may disturb the underlying natural water sources and consume such a high proportion of the fruits, seeds and seedlings of rainforest plants that recruitment is stopped, leading ultimately to the senescence and simplification of rainforest assemblages, and the loss of yams and other traditional Tiwi food resources. Even the most vigorously imposed traditional Tiwi management may be ineffective against such recently-arrived environmental modifiers.

Detailed consideration of management isssues, especially in relation to the development of forestry, weeds and feral animals, is addressed elsewhere (Tiwi Land Council 2000 and Natural Resource Management Strategy in preparation). However, here we provide some brief comment on issues related to biodiversity conservation.

Note that in this section and the next we offer some recommendations, indicated within boxes within the text below.

5.1. Fire

There has been substantial research examining the impacts of different fire regimes upon biodiversity in the Top End of the Northern Territory (e.g. Bowman *et al.* 1988; Fensham 1990*b*; Andersen *et al.* 1998, 2003; Dyer *et al.* 2001; Williams *et al.* in press; Woinarski *et al.* in press). This research reveals a complex variation in responses between different species, environments and the many parameters of fire regimes (e.g. timing, extent and frequency of fires).

Figure 5.1 summarises the recent (1993-99) fire history of the Tiwi Islands. Large areas of western Melville Island and central Bathurst Island are burnt almost every year. In contrast, the far less accessible eastern half of Melville Island is burnt appreciably less frequently. Burning is concentrated along roads and in more frequently visited areas. In contrast to much of the Territory mainland, there is no aerial burning.

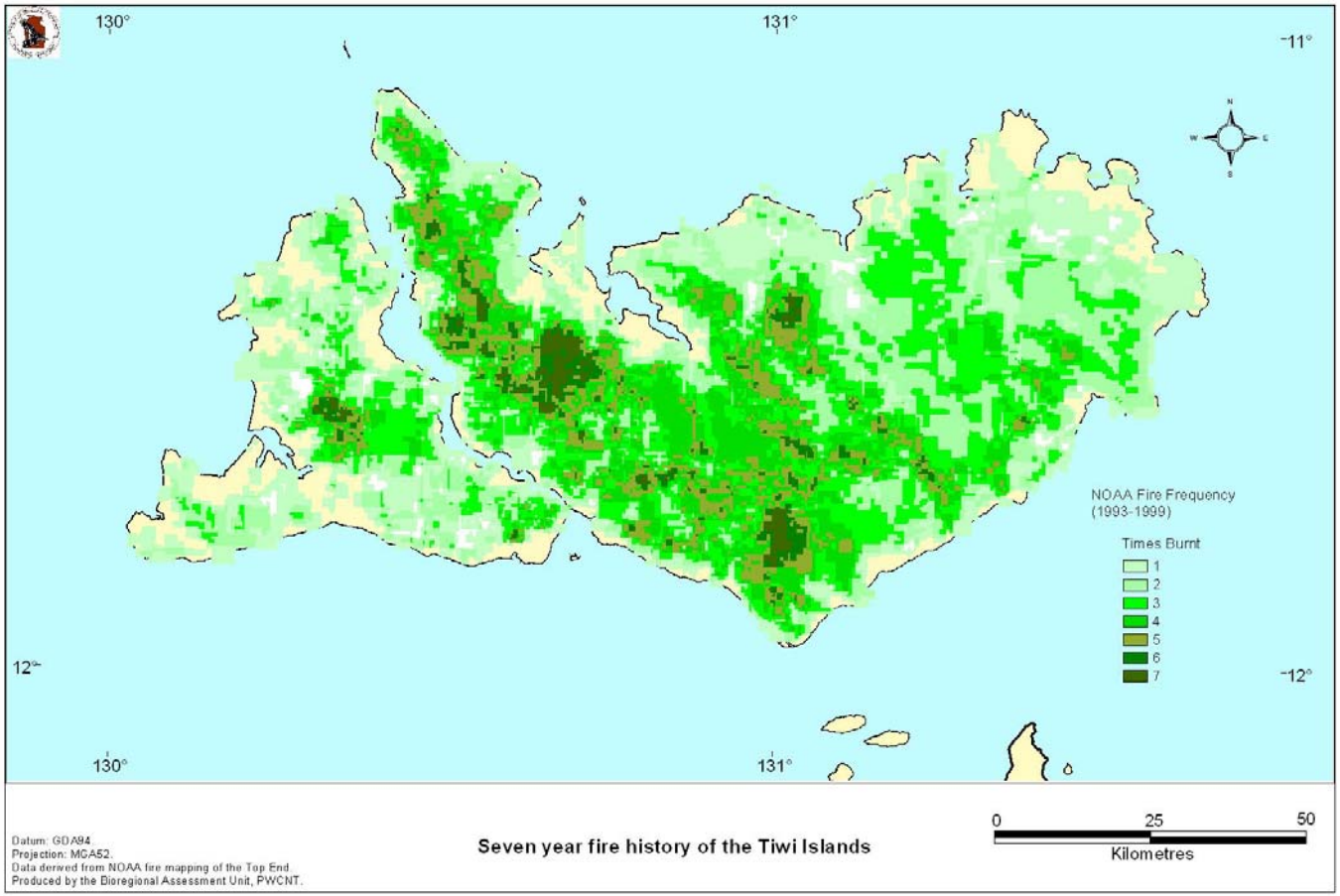

Figure 5.1. **Recent fire history for the Tiwi Islands** (from Woinarski *et al*. 2000).

Lands burnt every year may be expected to suffer gradual erosion of some of their conservation values - simplifying the structure of eucalypt forests, diminishing the number of hollow logs and hollow-bearing trees, shrinking back rainforest boundaries, and increasing the prevalence of fire-tolerant and fire-promoting grasses. Lands burnt less frequently tend to eventually produce more structurally complex forests, expansion of rainforests, and be less prone to invasion by exotic plants (Woinarski *et al.* in press). But these generalities need to be tempered by recognition that some early burning may break the country up, reducing the likelihood of more destructive and extensive late dry season fires, that the extent of fires may be at least as important as the frequency, and that the survival of many animals may require local access to a range of fire histories rather than all areas within their range being subjected to the same fire history.

Forest clearance and development of plantation forestry will affect fire regimes. Because of their lack of connection, remnant patches of retained forest will be likely to have more extreme fire regimes than formerly, typically being completely burnt more frequently or else quarantined from fire. Fire exclusion will obviously be the aim for plantation areas, and will involve the establishment of cleared peripheral fire breaks, probably surrounded by a buffer of native forest which is subjected to annual fuel suppression fires. This regime will gradually degrade those buffered forests. There may also be a danger that rigorous enforcement of fire exclusion around plantation areas will discourage Tiwi people from burning more generally across their lands.

We offer three suggestions about fire:

*5.1.1. **Preferred regime**. A fire regime which maximises the probability of retention of most biodiversity elements would comprise fine-scale burning in the early to mid dry season, with probably around 20-33% of every clan estate burnt each year, but with the locations burnt varying substantially from year to year.*

*5.1.2. **Forestry area**. Fire management in any area devoted to forestry should be carefully and clearly distinguished from fire management for the rest of the Islands. If native forests surrounding the plantation area are managed primarily to minimise fire risks to plantation (e.g. by annual fuel suppression fires), they should be clearly recognised as sacrifice or impact areas rather than assumed to be wildlife corridors or conservation zones.*

*5.1.3. **Fire mapping**. The accompanying fire map (Fig. 5.1) is based on relatively coarse resolution NOAA imagery. Far more detailed and precise mapping is available through LANDSAT TM imagery (which gathers information at a pixel size of 30m x 30m). In order to better understand and manage contemporary fire regimes on Melville Island, and to document and monitor changes due to forestry development, more frequent reporting of fire occurrence, using LANDSAT TM, should be instituted.*

5.2. Weeds

Because of their isolation and relative lack of modification, the Tiwi Islands have a relatively low incidence of weeds, and notably have been affected far less than many nearby mainland areas by some particularly virulent and noxious environmental weeds. Indeed, Fensham and Cowie (1998) noted that "the vast majority of the native vegetation on the Tiwi Islands is free of exotic plants", a highly significant and relatively unusual conservation attribute.

Nonetheless, a series of surveys over the last decade (mostly in association with the North Australian Quarantine Strategy) has resulted in the documentation of 127 species of exotic plants on the Tiwi Islands (Part 1 of this Report). While many of these are garden ornamentals, food crops or plantation timber species, some are clearly less benign. Fensham and Cowie (1998) outlined the current and potential environmental problems associated with these weeds, and provided a series of recommendations, which are paraphrased below:

- the relatively small populations of mission grass at Milikapiti, Pirlingimpi and Yapilika should be removed, and subsequent introduction prohibited (most of these populations have since been removed);
- the small populations of the declared noxious weeds, para grass *Brachiaria mutica* and prickly mimosa *Mimosa pigra* (one individual only) at Nguiu, should be removed and subsequent introduction prohibited;
- for three other declared species, coffeebush *Leuceana leucocephala,* lantana *Lantana camara* and sicklepod *Senna obtusifolia* - the relatively small populations should be targetted for eradication;
- watching briefs, and opportunistic control, should be maintained for other declared species mossman river grass *Cenchrus echinatus*, hyptis *Hyptis suaveolens*, coffee senna *Senna occidentalis*, spiny head sida *Sida acuta*, flannel weed *S. cordifolia*, paddy's lucerne *S. rhombifolia* and snakeweed *Stachytarpheta cayennensis*.

Subsequent to that report, the serious environmental weed gamba grass *Andropogon gayanus* has been recorded from two locations on the Tiwi Islands, and the elimination of these small populations is clearly a major priority (Flanagan 2000).

Management of weeds on the Tiwi Islands requires:

> 5.2.1. *the development and maintenance of adequate quarantining procedures* (checking and cleaning materials shipped or flown to the Islands);
>
> 5.2.2. *training Tiwi people in the identification of (and costs associated with) weeds*;
>
> 5.2.3. *the establishment of a strategic weed plan, reporting process (aimed particularly at early warnings for new weed outbrekas) and control strategy*; and
>
> 5.2.4. *the provision of adequate resources and information for safe and long-term weed control*.

5.3. Feral animals

Isolation has protected the Tiwi Islands from invasion by some of the feral animals which have affected much of the rest of Australia. Nonetheless, there are some significant problems associated with feral animals on Bathurst and Melville Islands.

Introduced with the establishment of the ill-fated Fort Dundas in 1829, **water buffalo** *Bubalus bubalis* are now common and widespread on Melville Island. They supported a meat and skin industry from about 1890 to 1920, but are now not controlled in any systematic manner. Their numbers have built up to exceptionally high densities (>10 individuals/km²: Bayliss 1985) in the southeast of Melville Island. Feral buffalo have a range of impacts upon conservation values, including trampling and degradation of wetlands; killing rainforest and paperbark trees through rubbing; and spread of weeds (especially *Hyptis*).

Feral **horses** *Equus caballus* also occur on Melville Island, particularly in the western half, but the total population is much smaller than for buffalo. The range of impacts is generally similar to, but less substantial than, that of buffalo.

Feral **pigs** *Sus scrofa* are common on Bathurst Island but were until recently absent from Melville Island. Environmental damage caused by pigs is widespread and prominent in wet rainforests, riparian areas and wetlands. Pig rooting disturbs the ground across extensive areas of rainforests and wetlands, affecting the quality and flow of water, and depleting the recruitment of rainforest plants (and especially yams). Pigs are also predators of ground-nesting birds and other small terrestrial vertebrates and a wide range of terrestrial invertebrates. Some pigs are remarkably effective at locating nests of marine turtles, digging these up and consuming entire clutches.

Feral **cattle** *Bos taurus* occur on both Bathurst and Melville Island, although in far smaller numbers than for buffalo.

Feral **cats** *Felis cattus* are widespread but not especially common on Bathurst and Melville Island. They are voracious predators which may be reducing the abundance of some native Tiwi mammals, birds and reptiles.

Feral **dogs** *Canis familiaris* appear to have increased recenty in abundance in some areas of Bathurst and Melville Island. Some of these dogs are major predators of the eggs of marine turtles.

Some exotic invertebrates are present on the Tiwi Islands. That of most concern for biodiversity conservation is the big-headed ant *Pheidole megacephala*, which has recently been detected on Bathurst Island (Part 2 of this Report). This species aggressively colonises a range of habitats (particularly rainforests), excluding many native invertebrate species, decreasing the abundance of some vertebrates, and reducing the health of forest stands (e.g. Hoffmann *et al.* 1999).

There are also populations of the exotic Asian house gecko *Hemidactylus frenatus* (Bathurst and Melville Islands) and flowerpot blind snake *Ramphotyphlops braminus* (reported from Melville Island). Neither of these is likely to have a major impact on conservation values.

Isolation may protect the Tiwi Islands from invasion by the **cane toad** *Bufo marinus*, which is rapidly colonising the mainland Top End. However, this species has spread to many islands off the Queensland coast and to islands in the Sir Edward Pellew group, mainly through inadvertent shipment on fishing boats and barges. In order to prevent the accidental shipment of toads, inspection and washdown procedures will be needed for boats travelling to the Tiwi Islands.

As with the management of weeds, the management of exotic animal pests on the Tiwi Islands will require considerable discussion about the costs and benefits of pests; the establishment of a

reporting process and control strategy; and the provision of adequate resources and information for long-term control.

The most immediate steps for this process are:

8.3.1. Elimination of the recent outbreak of feral pigs on Melville Island, and enhanced systems for alert, warnings and response for any possible new outbreaks

8.3.2. Control of pigs on Bathurst Island, including reduction in numbers and, where appropriate, exclusion fencing for susceptible rainforest patches;

8.3.3. Reduction in numbers of buffalo on Melville Island, and particularly in the eastern half (where the population is at highest density);

8.3.4. Establishment of quarantine procedures to prevent cane toads travelling to or between the Islands, and establishment of rapid response strategy for any breaches of such quarantine.

8.3.5. Eradication of big-headed ants from known areas of occurrence, and survey to detect any other populations

6. MONITORING OF CONSERVATION VALUES

6.1. Introduction

A range of factors unrelated to forestry or any other development projects is already causing changes to biodiversity on the Tiwi Islands, as for northern Australia as a whole (Franklin 1999; Woinarski 1999, 2000). These factors include the spread of feral pest animals, the invasion and spread of weeds, changes in the previously long-established pattern of burning, changes in the intensity and practices of hunting, changing climate and possibly changes in the incidence, prevalence and types of diseases and parasites. Typically, these factors have complex impacts, each benefitting and disadvantaging different sets of species, and sometimes acting synergistically or in a compensating manner. Recent evidence suggests that these changes are leading to a gradual winnowing of some of the most distinctive fauna of northern Australia (notably including the granivorous rodents, finches, quails and some pigeons) and relatively subtle but pervasive and insidious changes in vegetation. Typically, these changes have been least, and most delayed, on islands. But there is some evidence (e.g. for hooded robin and for *Burmannia* DNA61177 "Bathurst Island") for recent and current decline for some species on the Tiwi Islands. Unfortunately, the lack of previous biodiversity sampling on the Tiwi Islands limits our capability to assess this "background" level of change (although many Tiwi people may have an accurate assessment of which species are becoming either more or less common).

Monitoring provides some reassurance against unanticipated impacts, provides an assessment of trends in the status of individual species (and hence whether species should be listed or delisted as threatened), and provides feedback on management actions and their prioritisation. Biodiversity monitoring is now generally recognised as a pivotal component of the management of conservation and other lands in northern Australia (e.g. Whitehead *et al.* 2001; Woinarski *et al.* 2002, submitted; Watson and Woinarski 2003).

6.2. Monitoring biodiversity impacts of plantation development - background

Many of the landscape-wide factors mentioned in the opening paragraph above provide diffuse but pervasive impacts upon biodiversity. Establishment of a substantial forestry industry is likely to create more acute at least localised changes in biodiversity. In terms of assessing the impact of that industry and maintaining best quality environmental management standards, it is desirable to segregate the impacts due to forestry from the more pervasive "background" changes due to other factors.

In approving the development of *Acacia mangium* plantation forestry on Melville Island, the Minister for the Environment stipulated a monitoring program for federally-listed threatened species, revised in December 2002 to:

7. Within one year of commencing operations APG and TLC must prepare and submit for the Minister's approval a plan to monitor the impacts of the action on listed threatened species. The plan must include measures to:

> **(i) establish five 20ha biodiversity monitoring sites (control sites) and five 20ha biodiversity monitoring sites (impact sites) on Melville Island to undertake intensive sampling of the red goshawk, the masked owl and the partridge pigeon. At least four of which must be established within one year of commencing operations.**
> **(ii) locate and monitor at least six red goshawk nests in and around the control sites, and at least six red goshawk nests in and around the proposed forestry plantations within seven**

years of commencing operations. Control and impact biodiversity monitoring sites should contain a red goshawk site where possible.
(iii) monitor plantation areas for foraging by masked owl and partridge pigeons.

The plan must be approved by the Minister and must be implemented.

Some contribution to this monitoring was carried out by PWCNT in May-June 2002. This comprised assessments in four sub-catchments in forested areas around existing and proposed plantation sites of western Melville Island. At each of the four subcatchments, eight quadrats (each of 1 ha for bird survey) were sampled, making a total of 32 sample points. Masked owls were recorded in none of these sampling points, and partridge pigeons in eight of them. These preliminary data suggest that the monitoring approach stipulated in the conditions to development approval will not be successful, at least for masked owls.

Monitoring is a complex issue, and becomes a futile exercise in window dressing if the monitoring scheme is not practicable, properly designed, and nestled within a context of specific triggers for response and management amelioration. In rare cases where the total population size of a target species is small and where those individuals are relatively easy to locate, monitoring can be a straightforward and direct exercise in counting the total population size and absolute increases or decreases in these over time. Recent studies of the red goshawk on Melville Island (Baker-Gabb 2001) suggest that this species may fit that bill. However, more generally, monitoring involves sampling only a small proportion of the total population, and using indices of abundance to measure trends and assess the significance of such trends. In such cases, a statistical power analysis should be used for the design of a monitoring protocol. In a recent evaluation of results from repeat surveys of vertebrates at Litchfield National Park, Woinarski *et al.* (submitted) calculated the sampling effort required to (i) be 90% certain of detecting a 20% change in abundance, while putting up with a 10% chance of claiming a change had taken place when it fact it hadn't (a "Type 1" error); and (ii) be 80% certain of detecting a 50% change in abundance, while putting up with a 20% chance of accepting a Type 1 error. For most of the 92 species in this analysis the sampling effort required to meet these monitoring preconditions was extremely large: typically several thousand sampling quadrats for the first set of conditions and several hundred for the second. Based on such estimates it is extremely unlikely that two clusters of five monitoring points will provide sufficient information for a reliable broad-brushed monitoring program.

Rather, two complementary approaches would be more effective. The first approach would be to continue to re-sample (at 5-year intervals) the "baseline" sampling provided by our 351 quadrats sampled for fauna during 2000 and 2001 (Part 2 of this report). On the basis of the Litchfield NP analyses (Woinarski *et al.* submitted), this intensity of sampling should be sufficient to provide be 80% sure of detecting a 50% change in abundance for around half of the vertebrate species present on the Tiwi Islands, with the interpretability and precision in detecting trends increasing in third and subsequent re-samplings. Complementary to that approach should be a set of very specifically tailored monitoring programs for individual species of most concern. Such a tailored monitoring program has already been developed for the red goshawk (Baker-Gabb 2001). We will outline suggestions for specific monitoring programs for other individual threatened species below.

However, before considering the detail of such program, we must be clear about the purpose and priorities for monitoring. There are two inter-related threads to the establishment of a biodiversity monitoring program on the Tiwi Islands. The first is to gauge broad-scale changes across the biota as a whole over all of the Islands, in response to factors such as changed fire regimes, feral animals, weeds and long-term climate change. *Inter alia*, the measure of such landscape-scale changes provides a necessary background to interpret any changes in biota related to forestry development. For example, changes in the abundance of a threatened species across the Islands as a whole may throw into relief trends observed for that species in the environs of a new plantation: a measured decrease around the plantation may be interpreted as not due to forestry activities if similar trends were observed more broadly across the Islands as whole.

So, the second necessary thread of an integrated monitoring program is to attempt to assess the direct impacts of forestry development upon biodiversity. For a monitoring program to be useful, it should be able to reliably detect a change of some specified magnitude or threshold (e.g. a decrease in abundance of 10% within the study area), it should be able to provide a rapid response (e.g. trends measured at least annually), it should be able to be related directly to management actions (such that unexpectedly detrimental management actions can be identified and ameliorated), and it should be able to segregate localised impacts due to development from Islands-wide changes due to other factors.

How should impacts upon biodiversity of forestry development be counted? For most of the threatened species occurring in Tiwi eucalypt forests, it is highly likely that populations will not persist in areas converted from complex native forest to short-rotation plantations of exotic timber spcies (although some threatened species, such as partridge pigeons, may well use the plantations at least occasionally). Should these losses be measured? Or should monitoring of forestry development be restricted to impacts in retained forests around the plantation edges or in fragments of native forests surrounded by plantation? In order to get a complete assessment of the population change due to plantation development, it would be necessary to monitor both the use of plantations by specified sets of biota and the fate of that biodiversity in native forest around the plantation area and forest patches isolated by plantation.

6.3. Monitoring biodiversity impacts of plantation development - specific programs

What set of biodiversity should be most specifically monitored for development impact? The monitoring conditions noted above, associated with the Commonwealth approval for forestry development, relate only to federally-listed threatened species. Those components of the Tiwi environments which are most likely to be affected by forestry development, and/or those for which it is least desirable to suffer even minor impacts comprise:

- *aquatic biota*, potentially disadvantaged by changes to water quality (e.g., increased sedimentation), flows (e.g. due to increased use by plantations of groundwater) and pollution (by fertilizers or pesticides).
- *riparian vegetation*, for the same reasons as above;
- *wet rainforests*, largely because of plantation use of groundwater;
- *wide-ranging vertebrates for which the eucalypt forests form a major habitat component* (notably including red goshawk, masked owl, hooded robin, partridge pigeon, butler's dunnart, brush-tailed rabbit-rat and black-footed tree-rat), which are unlikely to persist in areas transformed from eucalypt forest to plantations, may not persist in retained areas fragmented or diminished by plantations, and possibly may have their total Tiwi populations reduced so much that their longer-term Islands-wide persistence is jeopardised;
- *a small set of threatened and/or endemic plants in the understorey of eucalypt forests* (notably *Typhonium jonesii, T. mirabile* and *Desmodium tiwiense*).

These elements should form the focus of the biodiversity component of monitoring associated with plantation development. Such monitoring should also include ongoing assessment of any spread of weeds and other exotic plants, and of the effectiveness (and collateral damage) of weed control measures.

With the exception of the first of these sets (aquatic biota, which falls beyond the domain of this report), more detailed guidelines for the establishment of such monitoring are set out below. In all cases, it will be necessary to review these approaches following initial establishment in order to ensure that the program is of sufficient power to meet the program's aims.

riparian vegetation

The health, extent and composition of riparian vegetation should be monitored at a set of around 10-20 subcatchments influenced by plantation development and a comparable set of catchments retained in natural condition. In each subcatchment, a set of permanent transects perpendicular to the watercourse should be established, with the transects extending beyond the current outer edge of riparian vegetation. Along each transect, all individual trees should be mapped, identified, tagged, measured (dbh) and their health assessed. Understorey vegetation (including tree seedlings and saplings) should be assessed in a series of subquadrats permanently positioned along each transect. All transects should be measured at least annually, with particular note paid to the occurrence of fire and any change in the location of the edge of riparian vegetation. Thresholds should be set for adjusting the sampling effort to necessary power, and for categorising impact as significant. Until such figures have been informed by real data, a reasonable starting condition for the monitoring is that impacts are deemed significant if either:

(i) riparian vegetation boundaries in impact area decrease by 5% more than boundaries in control area:
(ii) inter-annual change in floristic composition at impact sub-catchments is 5% or more greater than in control sub-catchments;
(iii) tree death or other measures of health is 5% more in impact sub-catchments than in control sub-catchments;
(iv) recruitment of riparian species is 5% less in impact sub-catchments than in control sub-catchments; and
(v) increase in occurrence of exotic plant species is 5% greater in impact sub-catchments than in control sub-catchments.

wet rainforests

Monitoring of wet rainforests should be analogous to that of riparian areas, with a set of rainforest patches selected in impact sub-catchments matched to a set in control sub-catchments, with the vegetation of each patch assessed through permanent transects extending across the patch edge. Sampling variables should be as for riparian vegetation, with comparable thresholds for assessment of required sample size and triggering of remedial management intervention.

threatened vertebrates associated with eucalypt forests

A specific and adequate monitoring program for the **red goshawk** is described elsewhere (Baker-Gabb 2001). This comprises survey and monitoring of six nests in the east of Melville Island ("control" sites) and six nests in the west around the proposed plantation development area ("impact" sites).

Monitoring trials for the **masked owl** were undertaken by NT DIPE staff in May-June 2002. This searching comprised nocturnal car traverses along much of the track network of western Melville Island. At approximately kilometre intervals, masked owl calls (previously recorded from Melville Island) were broadcast for 10 mins, and any response was recorded. A total of 202 sites were sampled, and precise GPS locations recorded. Owl response was reported at 15 sites: in most cases, this involved close approach by 1 or 2 individuals, typically with persistent and very evident calling. This trial demonstrates that monitoring for this species should be feasible, although several hundred sample sites will be necessary to detect sufficient individuals to provide enough power to detect change. These sample sites should be permanently sited to represent "control" uncleared forests; retained forest patches isolated by plantation development; and plantations. Given a probably large

territory size for this species, some care should be taken in the choice of sample sites to consider the mix of vegetation types around and represented by any sampling point; and the influence of forest development may extend to relatively large retained areas in the region around forest development. For this reason, a set of monitoring sites should also be established either on Bathurst Island or in the east of Melville Island (away from the proposed focus of forestry development), or both.

Complementary to this monitoring program, more intensive ecological study of masked owls on the Tiwi Islands should be undertaken, in order to establish the factors limiting population size, home range size, population, use of forest remnants and plantation areas, and requirements for roost and nesting sites.

A preliminary threshold for use in defining sampling effort from power analysis of initial sampling, and for triggering remedial action, should be set at 5% greater decrease in abundance index in disturbed areas than in control areas.

A monitoring program for the **hooded robin** is impossible to describe at this stage, because this species has not been reported on the Tiwi Islands since 1992 (Fensham and Woinarski 1992), despite the relatively substantial amount of biodiversity survey undertaken since then. This lack of records suggests that its status on the Islands is parlous. The priority for the conservation of this endemic subspecies is a comprehensive search, followed by intensive study to determine population size, habitat requirements, and threatening processes. The development of a monitoring program should be one of the outcomes of such a study.

Based on results from the trial program established in May-June 2002, monitoring of **partridge pigeon** should be achievable using the approach recommended in the conditions of approval for forestry development. Partridge pigeons are relatively conspicuous, and common and widespread on the Tiwi Islands. Site selection will be an important component of any monitoring program: monitoring should aim to include sampling sites in extensive native forest, forest fragments isolated by clearing, and plantations.

As with the hooded robin, a monitoring program for **butler's dunnart** is difficult to specify because of the extreme paucity of records. The species is clearly not amenable to detection using the standard wildlife survey procedures that we have employed. However, dunnarts generally may be encountered more frequently when pitfall trapping effort is increased. A trial sampling (and thence monitoring) program should be instituted targeting this species, based on greatly expanded use of pitfall trapping. The approach recommended is to establish sets of long (>200m) permanent trapping lines of pitfall traps (a range of buckets and PVC tubing, placed every 10m), connected by driftline fencing. Pitfall traps should be left open for at least 10 days (and checked at least daily), with trapping episodes at least 3 times per year. Traplines should be placed to sample extensive retained native forest; forest fragments surrounded by plantation development; and plantations; with at least 10 lines (replicates) in each of these categories. Assessment of power, sampling effort required and thresholds of change required to trigger remedial action should be considered following analysis of trial data.

The **brush-tailed rabbit-rat** and **black-footed tree-rat** should be monitored jointly, using trapping grids at which mark-recapture is used to provide estimates of population density. Sampling sites of 16 ha (in which 400 traps were set out in a regular grid, over a 5 night period) have been used recently to successfully estimate population size of brush-tailed rabbit-rats on Cobourg Peninsula (PWCNT 2000). The location of sites for these trapping grids should mirror that stated above for butler's dunnart - i.e. at least 10 sites in each of extensive retained forest, forest fragments now isolated by plantation development, and plantation. Assessment of power, sampling effort required and thresholds of change required to trigger remedial action should be considered following analysis of trial data.

endemic plants in the understorey of eucalypt forests

Three Tiwi-endemic plants, *Typhonium jonesii, T. mirabile* and *Desmodium tiwiense*, are restricted to the understorey of native eucalypt forests. While monitoring is important to establish trends in abundance of these species, this is probably not the main priority. Rather, the available information on these species is so meagre that it is impossible to circumscribe distributions with any precision, estimate abundance and total population size, describe habitat requirements, or consider possible relationships with a range of threatening processes. Such intensive study should be a precursor to the design of a monitoring program.

6.4. Monitoring of biodiversity, other than related to forestry

There are many important biodiversity conservation attributes on the Tiwi Islands that are likely to be unaffected by forestry, but may be being deleteriously affected by other processes. Monitoring programs suitable for some of these attributes are described briefly below. Note that monitoring should not be considered to be the only management action for these species: at least as important is to undertake management that reduces the impact of threatening processes.

marine turtles: Consistent with collaborative monitoring programs established in most other important marine turtle breeding areas in northern Australia, a program should be established for the Tiwi Islands that provides regular feedback to Tiwi landowners and relevant national and Territory agencies on trends in the population size of nesting marine turtles, breeding success, and the abundance and impacts of feral animals that affect this success (notably pigs and dogs). Such monitoring can be undertaken through a combination of regular aerial surveys and on-ground counts and assessment of breeding success.

seabird colonies: One of Australia's largest seabird breeding colonies occurs on the Tiwi Islands, and several other regionally important sites are also present. There is some indication that the main colony at Seagull Island is witnessing an increase in population of silver gull and a concomitant decrease in population of crested tern. The colony is subject to harvesting by Tiwi people. The long-term maintenance of this resource and conservation attribute should be safeguarded through at least annual monitoring of numbers of terns and silver gulls and of resource use by Tiwi people.

shorebirds (migratory waders): Parts of the Tiwi Island coastal zone have national (and probably international) significance for large numbers of shorebirds. Trends in the population of these birds should be monitored at 2-5 year intervals.

feral animals: Biodiversity and other values on the Tiwi Islands are affected, to varying levels, by the occurrence of feral pigs, horses, cattle, buffalo and dogs. Recently, the exotic big-headed ant has spread to the township of Nguiu on Bathurst Island; and pigs have established a feral population on the previously-pig free Melville Island. It is likely that additional exotic animals, such as the cane toad, will spread to the Tiwi Islands in the future, unless quarantining is vigilant. The Tiwi Natural Resource Management Plan (in prep.) discusses management of feral animals in more detail. Monitoring programs for all species should be established in order to detect new outbreaks (that can most readily and economically be controlled), to assess population size and distribution, to assess environmental (and other) impacts, to guide control management programs, and to measure the efficacy of such management actions. Aerial survey can be used for monitoring the distribution and abundance of cattle, buffalo and horses.

weeds: As with feral animals, weed management should be focused on eradication where practical, complemented by a systematic monitoring program. Priorities for weed management and monitoring are more fully described in the Tiwi Natural Resource Management Strategy currently being finalised.

fire: The distribution of fires on the Tiwi Islands should be monitored at least two-three times during the dry season, in order to describe long-term trends in fire regimes, and to highlight areas where fire regimes may be detrimental to biodiversity (and other) values. Fire histories can be compiled reasonably readily by interpretation of satellite imagery, as is done routinely by the Bushfires Council of the Northern Territory.

threatened species occurring in rainforests, mangroves and other habitats: A range of threatened species has not been included in any of the above categories. This includes a set of rainforest plant species, including the highly restricted endangered rainforest herb *Burmannia* D61177 "Bathurst Island". Some specific monitoring programs may be necessary to ensure the persistence of these species, and the benefits of any imposed management actions for them (e.g. pig exclosures). Monitoring programs for these plant species are described in Anon (2003).

The status of the vulnerable false water-rat on the Tiwi Islands should also be further investigated. As described in Part 2 of this Report, this species is known in the Northern Territory from 10 records at 6 sites, of which the two Tiwi records were nearly 30 years ago. It is unrealistic to suggest a monitoring program based on such little data: rather, first a more intensive search and study is required in order to establish population size, distribution, habitat requirements and threatening processes for the Tiwi populations of this species.

6.5. Costs of monitoring

It is futile and doubtfully responsible to propose the above set of monitoring programs if it is not accompanied by some consideration of costs. Some estimates are given in Table 6.1. below, however it should be recognised that these are reasonable guesses rather than tightly argued budgets.

Table 6.1. Estimated costs of monitoring and research programs described above. (Note that all costs have been adjusted to annual estimates; and costs may vary substantially depending upon who does the work and whether or not it is assumed vehicles are available on the Tiwi Islands.)

monitoring action	*notes*	*personnel*	*operational expenses (per year)*
1. Biodiversity monitoring activities related to forestry development			
1.1. Riparian vegetation	carried out annually (est. for 4 weeks)	2 people x 4 weeks	$4000
1.2. Rainforest vegetation	carried out annually (est. for 4 weeks)	2 people x 4 weeks	$4000
1.3. Red goshawk	carried out annually (est. for 6 weeks)	2 people x 6 weeks	$10000
1.4. Masked owl	carried out annually (est. for 3 weeks)	2 people x 6 weeks	$5000
1.5. Partridge pigeon	carried out annually (est. for 6 weeks)	2 people x 6 weeks	$8000
1.6. Butler's dunnart	carried out annually (est. for 8	2 people x 8 weeks	$10000

monitoring action	*notes*	*personnel*	*operational expenses (per year)*
	weeks)		
1.7. Brush-tailed rabbit-rat and Black-footed tree-rat	carried out annually (est. for 6 weeks)	2 people x 6 weeks	$5000
1.8. Broad-scale re-sampling of all wildlife survey quadrats	carried out at 5 year intervals (est. for 15 weeks)	4 people x 3 weeks (averaged per year)	$10000
2. Biodiversity research related to forestry development			
2.1. Hooded robin	research study for 6 months	1 person for 6 months	one-off expense of $12000
2.2. three threatened plants of eucalypt forest understorey	research study for 6 months	1 person for 6 months	one-off expense of $12000
3. Biodiversity monitoring activities unrelated to forestry development			
3.1. Marine turtles	carried out annually (est. for 6 weeks)	2 people x 6 weeks	$15000
3.2. Seabird colonies	carried out annually (est. for 4 weeks)	1 person x 4 weeks	$4000
3.3. Shorebirds	1 weeks aerial survey every 2 years	2 people x 1 week	$5000
3.4. Feral animals	1 week aerial survey every 2 years; 4 weeks annually x 2 people for on-ground work	2 people x 4.5 weeks	$10000
3.5. Weeds	carried out annually (est. for 6 weeks)	2 people x 6 weeks	$6000
3.6. Fire history	4 weeks satellite interpretation per year	1 person x 4 weeks	$5000
3.7. Threatened rainforest plants	carried out annually (est. for 4 weeks)	2 people x 4 weeks	$6000
4. Biodiversity research unrelated to forestry development			
4.1. False water-rat	research study for 6 months	1 person for 6 months	one-off expense of $12000

The Department of Infrastructure Planning and Environment, Tiwi Land Council, and Sylvatech have varying responsibilities for involvement in, supervision of or assessment of these monitoring programs. The resources currently allocated to monitoring are undoubtedly less than the sum of the components listed above. This suggests that there will be a need to source additional funding to undertake the program described above. This may be achieved most readily through the establishment and development of Tiwi ranger and resource management schemes and/or an integrated Natural Resource Management strategy (currently in preparation).

7. OPTIONS FOR CONSERVATION LAND-USES

The minimum requirement for the notional retained area network that we describe and map in the previous section is that these areas are not cleared or otherwise modified. But there are many options for their status beyond this simple exclusion from clearing.

These options should be evaluated, as a whole and for any given nominated location, in terms of:

- the amount of management input required to ensure the retention of the values for which the areas have been nominated;
- the significance of the values themselves;
- the size of the nominated tract of land;
- the landscape setting;
- the relationship between management status and likelihood of management support; and, ultimately and most importantly,
- the wishes of the Tiwi landowners.

Essentially, the five main options available for describing and managing retained areas, and for linking them to some regulatory status, are: National Park, Indigenous Protected Area, Section 73 Agreement of the *Territory Parks and Wildlife Conservation Act*, declaration as "essential habitat" and *status quo* (i.e. no new formal conservation designation). There is substantial overlap between the first three of these options, each of which can cover a broad spectrum of arrangements. The options can also obviously be mixed to match different levels of protection and management input to different locations with contrasting conservation and other values.

The Parks and Wildlife Commission of the Northern Territory has a range of cooperative arrangements with Aboriginal landowners for the joint management of National Parks and other conservation reserves, most notably including Nitmiluk National Park and Gurig National Park (PWCNT 1998), and Parks Australia has analogous but different cooperative arrangements with Aboriginal landowners for Kakadu and Uluru National Parks. The details of these agreements, and their successes and failures, are described in PWCNT (1998) and Woenne-Green *et al.* n.d.). The general principle is that there is a partnership for management of Aboriginal lands, and that conservation of biodiversity is an agreed aim. Within this broad ambit, there is considerable flexibility. For example, in both Gurig and Nitmiluk National Parks, executive power is vested in a Board of Management which has majority Aboriginal representation, and which is not subject to the direction of the Minister or Director of PWCNT. For Tiwi landowners, this option involves some ceding of management flexibilty and outright responsibility, as it requires the formal inclusion of a government conservation agency in management considerations, and the recognition of biodiversity conservation as an explicit land management objective. The National Park option also brings greater likelihood of training, jobs, availability of expertise, attraction for tourism, and management resources.

In the Northern Territory context, joint management of conservation reserves is now going through a major overhaul, with a far more explicit commitment to Aboriginal aspirations, employment and guidance in Park management. This overhaul has been given major legislative underpinning through the recent enactment of the **Parks and Reserves (Framework for the Future) Act 2003**. Briefing notes for this Act are attached at Appendix E.

Environment Australia has recently developed a program for Indigenous Protected Areas, which can include similar arrangements to the joint management described above, but can also grade to

unilateral management by Aboriginal landowners, but with support for resourcing in exchange for the establishment of some conservation objectives and actions on those lands.

A similarly broad ambit is allowed for under Section 73 of the *Territory Parks and Wildlife Conservation Act*, which allows for Northern Territory government assistance for the protection and conservation of wildlife on Aboriginal lands, through bilateral agreements ranging from limited assistance to lease back. In general, this is a more flexible and less bureaucratic arrangement than cooperative management of National Parks, but it is less likely to attract management resources.

The *Territory Parks and Wildlife Conservation Act 2000* provides for the declaration of essential habitat for biodiversity conservation, which can be imposed upon an area of land judged to be necessary for the protection of a particular nominated species, or assemblage of species (see Appendix C below). This would generally be a last recourse, invoked only when other options for cooperative management for conservation were exhausted.

Finally, no formal conservation management program or conservation status may be attached to the retained lands. This would preserve absolute Tiwi authority over their lands, but it would be likely to reduce the probability of accessing management and employment resources, it may limit the possibility of improved land management (such as to control weeds or new pests), and the lack of establishment of formal conservation areas or conservation management programs may contribute to a negative assessment by government regulatory authorities of major land use proposals on the Tiwi Islands.

These options may readily be mixed. For example, there may be no special need for cooperative mechanisms simply to manage riverside buffers, whereas extensive retained areas with highly significant conservation values but substantial management problems may best be dealt with in some form of cooperative management, which can provide resources and employment for Tiwi people.

Zoning of any protected area provides further flexibility in levels of use and protection. For example, it would be possible to include all of the Tiwi Islands within a National Park or IPA, and to use management zoning to delineate areas of intensive (production) use on the one hand and areas where biodiversity conservation is a priority use on the other hand.

8. UNCERTAINTY AND SHORTCOMINGS

In our prevous report (Woinarski *et al.* 2000), we noted that land use and conservation planning on the Tiwi Islands was constrained by some information limitations. The most serious information shortcomings (and hence interpretative uncertainty) identified there related to:

- a small group of ground layer plants which occur in eucalypt open forests and which are evident only in the wet season and early dry season (specifically including *Typhonium mirabile* and *T. jonesi*);
- a group of animal species which have low populations but which are or may be especially associated with eucalypt open forests (red goshawk, butler's dunnart, hooded robin);
- verification of our preliminary vegetation map; and
- relative lack of information for Bathurst Island.

Work since that report has contributed substantial information to some of those identified areas of relative ignorance. In particular, over the last two to three years we have undertaken detailed systematic biodiversity surveys on Bathurst Island; there has been a series of major studies on the red goshawk (Baker-Gabb 2001), and a far more detailed environmental map is now being produced (Hollingworth 2003).

However some of the deficiencies in information base remain, compromising reliability in conservation assessment, management and planning. These are described in the sections below.

There are three processes for ameliorating or remedying these deficiencies: additional specifically targetted studies; intensive pre-clearing searches or studies in areas proposed for development; and use of the precautionary principle in conservation planning.

8.1. Additional targetted studies

<u>seasonal bias in sampling</u>

Our main field work (and that of most previous environmental studies on the Tiwi Islands) occurred in the mid to late dry season. The relative lack of wet season sampling:

- prevented us from obtaining (substantial) information on wet season migratory birds (such as the CAMBA and JAMBA listed oriental cuckoo). In our opinion this is not a major problem, as these species typically have a reasonably broad habitat range and the Tiwi Islands do not hold a significant proportion of total populations for any migratory land bird taxon.
- prevented us from examining any seasonal change in habitat use for vertebrate animals. For example, it is possible that some species recorded here (based on dry season surveys) as habitat generalists may become more specialised in their habitat use in the wet season, and hence more vulnerable to land use changes than is apparent from our data. Again, in our opinion this is not likely, based on our experience with seasonal variation in habitat use by vertebrates on the Top End mainland.
- prevented us from adequately delineating the status and distribution of some plant species which are evident for only part of the year. We recognise that this is a substantial problem, that can be properly resolved only with supplementary sampling during the wet season.

8.1.1. Undertake supplementary wet season sampling to provide a more comprehensive assessment of the abundance and distribution of some annual plants occurring in the eucalypt open forest, particularly Typhonium jonesii *and* T. mirabile.

vertebrate species whose status remains poorly known

Our intensive field sampling attempted to address two aims, that of deriving as much information as possible about all species across as much of Melville Island as we could access, and that of attempting to obtain as much information as possible about some pre-selected species. We would claim to be reasonably successful in both aims, but with the significant exceptions for three of the pre-selected species - false water-rat, butlers dunnart and hooded robin. The information that we collected and collated for these three species is insufficient to allow confidence in conservation planning for these species. The difficulty with collecting data for these species (and paradoxically the reason why it is of concern that we should have inadequate information) is that all probably have only very low population totals. There is need for additional studies on each of these species, in order to better clarify status (total population size, distribution, threats and habitat preferences). Such studies may usefully incorporate the traditional knowledge of these species possessed by Tiwi people, to a greater extent than was possible in our study.

8.1.2. Undertake supplementary studies of the distribution and abundance of false water-rat, hooded robin and butler's dunnart.

8.2. "Pre-clearing" surveys

The data that we have assembled relates to about 1300 sites for plants and 500 sites for animals, a total sampled area of around 0.04% of the Tiwi Islands. While we can extrapolate from this small base for some species through distributional modelling, we can obviously never be certain about what biota is in any given unsampled area. This uncertainty is generally especially problematical for rarely recorded species. One obvious response is to ensure that additional "pre-clearing" surveys are undertaken across a set of possible sites proposed for development, and that any from this set which are found to have significant conservation attributes are then accorded lowest priority for development. This response will be workable when there is some flexibility for developers to choose from among a set of sites which together occupy a larger area than that needed for development.

8.2.1. Before any clearing, reconnaisance surveys should be undertaken to examine for the presence of threatened species considered here. Sites containing such species should be accorded the lowest priority for clearing.

8.3. Precautionary conservation planning

In northern Australia, there is very little information concerning the short-term (let alone long-term) environmental consequences of extensive clearing of native vegetation and the development of plantation forestry. It is responsibly prudent to stage development well within safe bounds, and to link staged expansion of development to an ongoing assessment derived from a carefully designed environmental monitoring programs.

Given the uncertainty described above for the status of some conservation attributes on the Tiwi Islands, it is also important that conservation planning minimises risks. Weakening of the biodiversity goals and targets from those proposed here will increase such risks.

8.3.1. Developments should be staged, with carefully designed monitoring programs accompanying development, and results from these programs used to refine the assessment of impacts of any further extensions.

8.3.2. The conservation goals and targets that we recommend should not be weakened, without explicit recognition that such action will increase the risks of loss of biodiversity.

9. CONCLUSIONS

Accepting then that the biodiversity conservation values of the Tiwi Islands are important, a series of inter-related questions follow:

- are those values secure?
- if not, do they need more deliberate conservation management attention?
- where should this attention be directed?
- what mechanisms should be used for the management and protection of these values?
- how can these mechanisms be supported?

We have attempted to answer these questions over the course of this report.

Unfortunately, the Tiwi conservation values cannot be assumed to be secure. This is despite the isolation of the Islands from many of the factors threatening biodiversity on the mainland, and the maintenance over most of the Islands' area of land management which at least partly continues that long practised by the Tiwi people. Insecurity is an inevitable fear for species occurring only in small populations at a few sites. But the insecurity is greatly magnified with ongoing and apparently inexorable increase in the impacts of feral animals and weeds, and gradual transformation of traditional burning practices. To this gradual change is added the uncertainty surrounding more acute and pronounced impacts of the proposed extension of plantation forestry, the catalyst for the present study. Without some formal attention to the identification and management of biodiversity conservation values, the proposed plantation developments would be likely to diminish at least some of those values, in some cases possibly irrevocably.

Hence, we argue that the conservation values do need management attention, in the form of landscape wide control of the impacts of weeds, feral animals and fire, but also more sharply in terms of defining areas that should be set aside and excluded from clearing or other form of development.

The establishment of some form of protected area mechanism, supported by and providing resources for, a Tiwi ranger program, is a pivotal component of any long-term strategy to maintain the extraordinary natural values of the Tiwi Islands.

This report is one step in the protection of Tiwi environments, plants and animals. With the information now collected, we can continue to plan with, consult and collaboratively develop options for continuing along that pathway.

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11. REFERENCES

Andersen, A.N., Braithwaite, R.W., Cook, G.D., Corbett, L.K., Williams, R.J., Douglas, M.M., Gill, A.M., Setterfield, S.A., and Muller, W.J. (1998). Fire research for conservation management in tropical savannas: introducing the Kapalga fire experiment. *Australian Journal of Ecology* **23**, 95-110.

Andersen, A.N., Cook, G.D., and Wiliams, R.J. (eds) (2003). *Fire in tropical savannas: the Kapalga experiment.* (Springer-Verlag, New York.)

Anon. (2003). *Recovery plan for threatened plants of the Tiwi Islands in the Northern Territory of Australia.* Report to Department of Environment and Heritage. (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Armstrong, M., Woinarski, J., Hempel, C., Connors, G., and Beggs, K. (2002). *A plan for the conservation of biodiversity in the Mary River catchment, Northern Territory.* (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Baker-Gabb, D. (2001). Red Goshawks and other threatened birds on Melville Island (mitigation measures and monitoring). Report to Australian Plantation Group Ltd. (Elanus Pty Ltd: Melbourne.)

Bayliss, P. (1985). *Report on the 1985 Aerial Survey of Feral Animals in the Top End of the Northern Territory.* Unpublished report to the Conservation Commission of the Northern Territory.

Bowman, D.M.J.S., Wilson, B.A., and Hooper, R.J. (1988). Response of *Eucalyptus* forest and woodland to four fire regimes at Munmarlary, Northern Territory, Australia. *Journal of Ecology* **76**, 215-232.

Dyer, R., Jacklyn, P., Partridge, I., Russell-Smith, J. and Williams, D. (2001). *Savanna burning: understanding and using fire in northern Australia.* Tropical Savannas Cooperative Research Centre: Darwin.

Environment Australia (2001) *National objectives and targets for biodiversity conservation 2001-2005* (Environment Australia; Canberra.)

Fensham, R.J. (1990). Interactive effects of fire frequency and site factors in tropical *Eucalyptus* forest near Darwin, northern Australia. *Australian Journal of Ecology* **15**, 255-266.

Fensham, R.J. (1993). The impact of pig rooting on populations of *Burmannia* sp., a rare rainforest herb on Bathurst Island. *Proceedings of the Royal Society of Queensland* **103**, 5-12.

Fensham, R.J., and Cowie, I.D. (1998). Alien plant invasions on the Tiwi Islands: extent, implications and priorities for control. *Biological Conservation* **83**, 55-68.

Fensham, R.J., and Woinarski, J.C.Z. (1992). *Yawulama: the ecology and conservation of monsoon forest on the Tiwi Islands, Northern Territory.* Report to DASET. (Conservation Commission of the Northern Territory: Darwin.)

First Management Corporation Ltd. (1999). *Prospectus. Tiwi islands – Acacia Project no. 1. A short rotation forestry project.* (First Management Corporation Ltd.: Sydney.)

Flanagan, G. (2000). *Tiwi weed management principles.* (Department of Primary Industries and Fisheries: Darwin.)

Franklin, D.C. (1999). Evidence of disarray amongst granivorous bird assemblages in the savannas of northern Australia, a region of sparse human settlement. *Biological Conservation* **90**, 53-68.

Garnett, S.T, and Crowley, G.M. (2000). *The Action Planfor Australian Birds 2000.* (Environment Australia: Canberra.)

Hoffmann, B.D., Andersen, A.N., and Hill, G.J.E. (1999). Impact of an introduced ant on native rain forest invertebrates: *Pheidole megacephala* in monsoonal Australia. *Oecologia* **120**, 595-604.

Hollingworth, I. (2003). *Land capability study of the Tiwi Islands*. Report to NT Department of Infrastructure Planning and Environment. (EWL Sciences Pty Ltd, Darwin.)

Kean, L., and Price, O. (2003). The extent of mission grasses and gamba grass in the Darwin region of Australia's Northern Territory. *Pacific Conservation Biology* **8**, 281-290.

Kinhill Pty Ltd (2000). *Ord River Irrigation Area Stage 2. Proposed development of the M2 area. Draft Environmental Impact Statement*. (Kinhill: Perth.)

Magnusson, W.E., Webb, G.J.W., and Taylor, J.A. (1976). Two new locality records, a new habitat and a nest description for *Xeromys myoides* Thomas (Rodentia: Muridae). *Australian Wildlife Research* **3**, 153-158.

McAlpine, C.A., Fensham, R.J., and Temple-Smith, D.E. (2002). Biodiversity conservation and vegetation clearing in Queensland: principles and thresholds. *Raneland Journal* **24**, 36-55.

McDonald, G.T., McAlpine, C., Taylor, B., and Vagg, A. (2002). *Criteria and methods for evaluating regional natural resource management plans in tropical savanna regions*. (Tropical Savannas Cooperative Research Centre: Darwin.)

McIntyre, S., McIvor, J.G., and Macleod, N.D. (2000). Principles for sustainable grazing in eucalypt woodlands: landscape-scale indicators and the search for thresholds. In *Management for sustainable ecosystems* (eds. P. hale, A. Petrie, D. Moloney and P. Sattler) pp. 92-100. (Centre for Conservation Biology, University of Queensland: Brisbane.)

McIntyre, S., McIvor, J.G., and Heard, K.M. (eds) (2002). *Managing and conserving grassy woodlands*. (CSIRO: Melbourne.)

Parks and Wildlife Commission of the Northern Territory (1998). *Northern Territory Parks Masterplan*. (PWCNT: Darwin.)

Parks and Wildlife Commission of the Northern Territory (2000). *Studies of the brush-tailed rabbit-rat Conilurus penicillatus in Gurig National Park*. (PWCNT: Darwin.)

Price, O., Woinarski, J.C.Z., Liddle, D.L., and Russell-Smith, J. (1995). Patterns of species composition and reserve design for a fragmented estate: monsoon rainforests in the Northern Territory, Australia. *Biological Conservation* **74**, 9-19.

Price, O.F., Woinarski, J.C.Z., and Robinson, D. (1999). Very large area requirements for frugivorous birds in monsoon rainforests of the Northern Territory, Australia. *Biological Conservation* **91**, 169-180.

Price, O., Milne, D., Connors, G., Harwood, B., and Woinarski, J. (2000). *A conservation plan for the Daly Basin bioregion*. (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Russell-Smith, J. (1991). Classification, species richness and environmental relations of monsoon rain forest in northern Australia. *Journal of Vegetation Science* **2**, 259-278.

Russell-Smith, J., and Bowman, D.M.J.S. (1992). Conservation of monsoon rainforest isolates in the Northern Territory, Australia. *Biological Conservation* **59**, 51-63.

Russell-Smith, J., McKenzie, N.L. & Woinarski, J.C.Z. (1992). Conserving vulnerable habitat in northern and northwestern Australia: the rainforest archipelago. In: *Conservation and development issues in northern Australia* (eds. I. Moffatt & A.Webb). pp. 63-68. North Australia Research Unit, Darwin.

Tiwi Land Council (2000). *Plantation forestry strategic plan*. (Tiwi Land Council: Darwin.)

Watson, M., and Woinarski, J. (2003). *Vertebrate monitoring and resampling in Kakadu National Park, 2002*. Report to Parks Australia North. (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Whitehead, P., Woinarski, J., Jacklyn, P., Fell, D., and Williams, D. (2000). Defining and measuring the health of savanna landscapes: a north Australian perspective. (Tropical Savannas Cooperative Research Centre: Darwin.)

Whitehead, P., Woinarski, J., Fisher, A., Fensham, R., and Beggs, K. (2001). *Developing an analytical framework for monitoring biodiversity in Australia's rangelands.* Project 3 - Theme 4 (Rangelands monitoring). Report to National Land and Water Resources Audit. . (Tropical Savannas CRC: Darwin.)

Williams, R.J., Woinarski, J.C.Z., and Andersen, A.N. (in press). Fire experiments in northern Australia: lessons for ecology, management and biodiversity conservation. *International Journal of Wildland Fire*

Woenne-Green, S., Johnston, R., Sulan, R., and Wallis, A. (n.d.). *Competing interests: Aboriginal participation in National Parks and conservation reserves in Australia.*

Woinarski, J.C.Z., Woolley, P.A., and Van Dyck, S. (1996). The distribution of the dunnart *Sminthopsis butleri*. *Australian Mammalogy* **19**, 27-29.

Woinarski, J.C.Z., Brennan, K., Dee, A., Njudumul, J., Guthayguthay, P., and Horner, P. (2000*a*). Further records of the False Water-rat *Xeromys myoides* from coastal Northern Territory. *Australian Mammalogy* **21**, 245-247.

Woinarski, J., Brennan, K., Hempel, C., Firth, R., and Watt, F. (2000). *Biodiversity conservation on the Tiwi Islands: plants, vegetation types and terrestrial vertebrates on Melville Island.* Report to the Tiwi Land Council. (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Woinarski, J., Watson, M., and Gambold, N. (2002). *Vertebrate monitoring and resampling in Kakadu National Park.* Report to Parks Australia North. (Parks and Wildlife Commission of the Northern Territory: Darwin.)

Woinarski, J.C.Z., Risler, J., and Kean, L. (in press). The response of vegetation and vertebrate fauna to 23 years of fire exclusion in a tropical *Eucalyptus* open forest, Northern Territory, Australia. *Austral Ecology.*

Woinarski, J.C.Z., Armstrong, M., Price, O., McCartney, J., Griffiths, T., and Fisher, A. (submitted). The terrestrial vertebrate fauna of Litchfield National Park, Northern Territory: monitoring over a 6-year period, power analysis and response to fire history. *Wildlife Research*

Appendix A:

Extracts from relevant national strategies and initiatives concerning forest conservation and use.

National Forests Policy Statement 1992

The NFPS was endorsed by the Commonwealth and all State/Territory governments and provided a series of goals, objectives and policies for Australian forest environments.

The NFPS noted that the goals "*should be pursued within a regionally based planning framework that integrates environmental and commercial objectives*".

The goals of the NFPS included:

- ***Conservation***. "*The goals are to maintain an extensive and permanent native forest estate in Australia and to manage that estate in an ecologically sustainable manner so as to conserve the full suite of values that forests can provide for current and future generations. These values include biological diversity, and heritage, Aboriginal and other cultural values*".
- ***Integrated and coordinated decision making and management***. "*The goals are to reduce fragmentation and duplication in the land use decision-making process …*"
- ***Water supply and catchment management***. "*The goals are to ensure the availability of reliable, high-quality water supplies from forested land and to protect catchment values.*"

The NFPS noted that

"*the protection of the full range of forest ecosystems and other environmental values is fundamental to ecologically sustainable forest management. It entails the maintenance of the ecological processes that sustain forest ecosystems, the conservation of the biological diversity associated with forests (particularly endangered and vulnerable species and communities), and the protection of water quality and associated aquatic habitat …*"

and that the Governments will

"*manage for the conservation of all species of Australia's indigenous forest fauna and flora throughout those species' ranges, and they will maintain the native forest cover where a reduction in this cover would compromise regional conservation objectives, consistent with ecologically sustainable management.*"

These objectives are to be pursued in three ways.

> "*First, parts of the public native forest estate will continue to be set aside in dedicated nature reserve systems to protect native forest communities, based on the principles of comprehensiveness, adequacy and representativeness*. The reserve system will safeguard endangered and vulnerable species and communities. Other areas of forest will also be protected to safeguard special areas and to provide links where possible between reserves or other protected areas … In developing the nature conservation reserve system and forest management approaches in other public native forests, each Government will, where possible, ensure that effective corridor systems link reserves, refuges and areas with a relatively large range of altitudinal and other geographic variation so as to take into account the possible impacts of climate change.*"
>
> "*Second, there will be complementary management outside reserves, in public native forests that are available for wood production and other commercial uses and in forests on unallocated or leased Crown land.*"
>
> "*Third, the management of private forests in sympathy with nature conservation goals will be promoted.*"

* These terms were defined as:

Comprehensiveness: "includes the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels".

Adequacy: "the maintenance of ecological viability and integrity of populations, species and communities"

Representativeness: "those sample areas of the forest that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities".

On climate change, the NFPS recognised the need "*to manage forests so as to maintain or increase their 'carbon sink' capacity and to minimise the emission of greenhouse gases from forest activities*".

On clearance of forested areas in public land, the NFPS noted:

> "*The Governments agree that it is desirable to maintain and protect the extent and ecological integrity of native forest on public land. Accordingly, the Governments will adopt the policy that further clearing of public native forests for non-forest use or plantation establishment will be avoided or limited, consistent with ecologically sustainable management, to those instances in which regional conservation and catchment management objectives are not compromised*",

and for private lands

> "*… native forests on private lands contain some ecosystems and species that are not well represented in nature conservation reserves. They also help to maintain environmental and aesthetic values and basic ecological processes, and under conditions of climate change they may provide refuges or corridors for the movement of native species.*
>
> *Accordingly, the objectives in relation to private native forests are to encourage the maintenance of existing private native forest cover and to facilitate the ecologically sustainable management of such forests for nature conservation, catchment protection, wood production of other economic pursuits.*
>
> *… While encouraging the retention of native forests, the Governments acknowledge that private forest owners may wish to clear native forest for a range of economic uses. They agree that land clearing can be permitted provided it complies with State and regional conservation management objectives, relevant planning schemes and legislation.*"

***The Nationally Agreed Criteria for the establishment of a comprehensive, adequate and representative reserve system for forests in Australia*, a report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee** (JANIS 1996).

This agreement provided detailed criteria for the implementation of the NFPS, specifically concerning the development of a national forest reserve system. It recognised that

"*the objectives of biodiversity conservation for forests are:*

- *to maintain ecological processes and the dynamics of forest ecosystems in their landscape context;*
- *to maintain viable examples of forest ecosystems throughout their natural ranges;*
- *to maintain viable populations of native forest species throughout their natural ranges; and*
- *to maintain the genetic diversity of native forest species.*

These objectives will be most efficiently and effectively achieved through the development of integrated regional conservation strategies, which provide for the establishment and effective management of conservation reserves and complementary management of adjoining forest areas."

JANIS (1996) provided considerable operational development for the delivery of the NFPS conservation goals, including specific criteria for the development of a forest comprehensive, adequate and representative reserve system:

The main set relates to <u>biodiversity criteria</u>.

> "(1) *As a general criterion, 15% of the pre-1750 distribution of each forest ecosystem should be protected in the CAR reserve system with flexibility considerations applied according the regional circumstances*
>
> *(2) Where forest ecosystems are recognised as vulnerable, then at least 60% of their remaining extent should be reserved. A vulnerable forest ecosystem is one which is:*
>
> *i) approaching a reduction in areal extent of 70% within a bioregional context and which remains subject to threatening processes; or*
> *ii) not depleted but subject to continuing and significant threatening processes which may reduce its extent.*
>
> *Vulnerable ecosystems include those where threatening processes have caused significant changes in species composition, loss or significant decline in species that play a major role within the ecosystem, or significant alteration in ecosystem processes.*
>
> *(3) All remaining occurrences of rare and endangered forest ecosystems should be reserved or protected by other means as far as is practicable … A rare ecosystem is one where its geographic distribution involves a total range of generally less than 10,000 ha, a total area of generally less than 1000 ha or patch sizes of generally less than 100 ha, where such patches do not aggregate to significant areas. This criterion is to be applied within a bioregional context having cognisance of distribution in adjoining bioregions … An endangered ecosystem is one where its distribution has contracted to less than 10% of its former range or the total area has contracted to less than 10% of its former area, or where 90% of its area is in small patches which are subject to threatening processes and unlikely to persist.*

(4) Reserved areas should be replicated across the geographic range of the forest ecosystem to decrease the likelihood that chance events such as wildfires or disease will cause the forest ecosystem to decline.

(5) The reserve system should seek to maximise the area of high quality habitat for all known elements of biodiversity wherever practicable, but with particular reference to:

- *the special needs of rare, vulnerable or endangered species;*
- *special groups of organisms, for example species with complex habitat requirements, or migratory or mobile species;*
- *areas of high species diversity, natural refugia for flora and fauna, and centres of endemism; and*
- *those species whose distributions and habitat requirements are not well correlated with any particular forest ecosystem.*

(6) Reserves should be large enough to sustain the viability, quality and integrity of populations.

(7) To ensure representativeness, the reserve system should, as far as possible, sample the full range of biological variation within each forest ecosystem, by sampling the range of environmental variation typical of its geographic range and sampling its range of successional stages.

(8) In fragmented landscapes, remnants that contribute to sampling the full range of biodiversity are vital parts of a forest reserve system. The areas should be identified and protected as part of the development of integrated regional conservation strategies.

There is also a set of old-growth forest criteria and wilderness criteria. However JANIS noted that their criteria "*apply to all forested regions except those in the Northern Territory where the vast areas involved mean a different set of criteria will need to be developed*". Similarly, JANIS noted that the criteria developed for wilderness "*apply to all forested regions except those in northern Australia where the vast areas involved mean a different set of criteria will need to be developed*".

JANIS also developed a set of criteria for the design and management of individual reserves:

- *reserves should be set in a landscape context with strong ecological integrity, such as catchments;*
- *large reserved areas are preferable to small reserved areas, though a range of reserve sizes may be appropriate to adequately sample conservation values;*
- *boundary-area ratios should be minimised and linear reserves should be avoided where possible except for riverine systems and corridors identified as having significant value for nature conservation;*
- *reserves should be developed across the major environmental gradients if feasible, but only if these gradients incorporate key conservation attributes which should be incorporated in the CAR system;*
- *each reserve should contribute to satisfying as many reserve criteria as possible;*
- *reserve design should aim to minimise the impact of threatening processes, particularly from adjoining areas;*
- *reserves should be linked through a variety of mechanisms, wherever practicable, across the landscape.*

JANIS also provided interpretation of the application of these criteria. On the conservation reserve network, JANIS noted that:

"*All reasonable effort should be made to provide for biodiversity and old-growth forest conservation and wilderness in the dedicated reserve system on public land … In situations where it is not possible or practicable to include conservation values into dedicated reserves, it is appropriate for areas to be reserved under other secure tenure or management arrangements. In practice such areas should be set aside specifically for conservation purposes and meet the following principles:*

- *they are established in approved management plans and managed accordingly;*
- *there is an opportunity for public comment on changes to reserve boundaries;*

- *they are able to be accurately identified on maps;*
- *they are of an area and design sufficient to maintain the values they seek to protect.*

Where the nature of a forest value that is needed to contribute to the CAR reserve system makes inclusion in either dedicated or informal reserves impractical (for example, very rare values, values with fragmented distributions, or values naturally occurring in linear form such as riparian vegetation), then protection may be prescribed in Codes of Practice or Management Plans and where appropriate, identified on maps."

On the contribution of private lands, JANIS noted that:

"*The NFPS establishes that the CAR reserve system should in the first instance be selected from public land. However, in many regions it will need to include private land …. A number of strategies are appropriate for protecting biodiversity on private land, ranging from purchase of priority areas to the development of incentives for the establishment of mechanisms to ensure protection, such as covenants on leasehold and freehold lands*".

JANIS also provided interpretation of the biodiversity criteria developed:

"*The biodiversity criteria … relate primarily to biodiversity at the forest ecosystem and species level*" and,

"*the focus … should be on those species that depend on reservation for protection … It is not necessary to ensure that every element of biodiversity that occurs within a forest ecosystem is reserved within that ecosystem. Many species may be well represented in one forest ecosystem in a region and infrequent in another, and it is not necessary to distort reserve boundaries to ensure that they are reserved in each ecosystem occurrence.*"

"*The priority for reservation at the forest ecosystem is related to how much remains relative to its initial distribution and its vulnerability to threatening processes … 15% of pre-European distribution is seen as a desirable objective, however some flexibility is both acceptable and desirable. For instance, where socio-economic impacts are not acceptable, or where biodiversity conservation objectives can be demonstrably achieved, such as for forest ecosystems which are extensive, a lower level of reservation (e.g., 10%) may prove adequate*".

"*The criteria should generally be applied within a biogeographic regional framework based upon IBRA regions, but it is important to consider the distribution of a species or forest ecosystem in adjacent regions when applying the criteria*".

"*Mapping of forest ecosystems at 1:100 000, or 1:250 000 is considered to be an appropriate scale for planning a reserve system*".

"(These criteria should) *be considered as guidelines rather than mandatory targets. Though all forest species and ecosystems should be represented in the reserve system, the effort to achieve this for the last few percent of communities and habitats may reach a point of diminishing return, and in these situations nature conservation objectives may be more efficiently and effectively achieved through other strategies … In the final selection of reserves, biodiversity, old-growth forest and wilderness values will be considered iteratively to most effectively capture the range of values within the proposed CAR reserve system. Provided that all criteria are considered when making the final reserve design, biodiversity should take precedence.*"

On socio-economic considerations. "*It should be recognised that the extent of potential social and economic impacts may limit the ability to meet reserve criteria. Determination of the CAR reserve system will therefore require a comprehensive planning approach which integrates conservation requirements with social and economic considerations. The analytical processes which integrate the application of the reserve criteria with social and economic considerations should be transparent. The principle of least cost should be used and, where different configurations of reserves can be identified as meeting the criteria, the option which imposes the least cost on the community should be adopted*".

Appendix B:

Extracts from Administrative Guidelines of the *Environment Protection and Biodiversity Conservation Act 1999*.

Determining whether an action is likely to have a significant impact on a matter of national environmental significance

The guidelines set out below include criteria which are intended to assist in determining whether the impact of an action on any matter of national environmental significance is likely to be significant.

Criteria are set out for each matter of national environmental significance.

The guidelines are intended to provide general guidance on the types of actions that will require approval and the types of actions that will not require approval. They are not intended to be exhaustive or definitive. The particular facts and circumstances of a proposed action will need to be taken into account in determining whether that action will have a significant impact on a matter of national environmental significance.

In order to decide whether an action is likely to have a significant impact, it is necessary to take into account the nature and magnitude of potential impacts.

In determining the nature and magnitude of an action's impact, it is important to consider matters such as:

- all on-site and off-site impacts,
- all direct and indirect impacts,
- the frequency and duration of the action,
- the total impact which can be attributed to that action over the entire geographic area affected, and over time,
- the sensitivity of the receiving environment, and
- the degree of confidence with which the impacts of the action are known and understood.

The Act provides that the Minister must, in deciding whether an action is likely to have a significant impact on a matter of national environmental significance, take account of the precautionary principle. Accordingly, the fact that there is a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on a matter of national environmental significance.

The Act provides that in deciding whether the action is a controlled action, the Minister must not consider any beneficial impacts that the action has, will have or is likely to have. Therefore, activities which will have only beneficial impacts will not be captured by the Act.

Exceptions

An action does not require approval from the Environment Minister under the Act if:

- the action is approved under, and taken in accordance with, a State management plan that is accredited by the Commonwealth for the purposes of a bilateral agreement (see section 46 of the Act), or
- the action is approved under, and taken in accordance with, a Commonwealth management plan that is accredited by the Environment Minister for the purposes of a Ministerial declaration (see section 33 of the Act), or

- the action is a forestry operation taken in a Regional Forest Agreement region (see Part 4, Division 2 of the Act), or

- the action is taken in the Great Barrier Reef Marine Park and is authorised by certain instruments issued under the Great Barrier Marine Park Act 1975 (see section 43 of the Act), or

- the action has been authorised by a Government decision on which the Minister's advice has been sought (see section 160 of the Act).

In addition, an approval is not required for an action if:

- the action was authorised by the Commonwealth, a State or a Territory prior to the EPBC Act commencing (16 July 2000), and

- at the time the EPBC Act commences, no further authorisation is required to allow the action to be lawfully taken.

Finally, the EPBC Act provides that approval is not required for an action that is a lawful continuation of a use of land, sea or seabed that was occurring immediately before the commencement of the Act. (This exception does not apply to an enlargement, intensification or expansion of an existing use.)

Listed Threatened Species and Ecological Communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,

- critically endangered,

- endangered, or

- vulnerable.

An action will also require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- critically endangered, or

- endangered.

An action does not require approval if it is covered by one of the exceptions identified above.

Some of the criteria below refer to the concept of 'habitat critical to the survival of a species or ecological community'. This habitat includes the critical habitat for many species and community identified in recovery plans for those species/communities and the critical habitat on the Register maintained by the Minister for the Environment under the Act. However, there may not be recovery plans in place for all listed species and communities, as plans take some time to prepare. Similarly, the Register may not be comprehensive. The absence of a recovery plan or the fact that an area may not be listed on the Register of Critical Habitat does not mean that there is no habitat critical to the survival of the species or community.

Habitat critical to the survival of a species or ecological community may include areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal,
- for succession,
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species / community.

Habitat critical to the survival of a species or ecological community will depend largely on the particular requirements of the species/community in question. For example, areas only incidentally used by a vulnerable species, and which the species is unlikely to be dependent upon for its survival or recovery, are not areas of habitat critical to the survival of a species or ecological community.

Some of the criteria below refer to actions likely to lead to a "long-term decrease" in the size of a population or a "long-term adverse affect" on a community. Depending on the level of endangerment and the nature of the action, not all actions which create an immediate decrease in the population of a nationally listed threatened species or impact on a community will have long-term consequences. For example, an action which causes injury or death to only one or a very small number of a species will not, except in the case of the most endangered of species, generally lead to a long-term or irreversible decrease in the population that normal processes, rates of mortality and recruitment could not buffer.

Critically endangered and endangered species

Criteria

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or
- interfere with the recovery of the species.

(*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.)

Vulnerable species

Criteria

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an *important population* of a species, or
- reduce the area of occupancy of an *important population*, or
- fragment an existing *important population* into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an *important population*, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

(* Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.)

An *important population* is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Listed Migratory Species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. (However, an action does not require approval if it is covered by one of the exceptions identified above.)

Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

Criteria

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of *important habitat* of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of *important habitat* of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an *ecologically significant proportion* of the population of the species.

(* Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.)

An area of *important habitat* is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species, or

2. habitat utilised by a migratory species which is at the limit of the species range, or

3. habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an *ecologically significant proportion* of the population varies with the species (each circumstance will need to be evaluated).

Appendix C:

Extracts from sections of the *Territory Parks and Wildlife Conservation Act* 2000.

"37. Declaration of area of essential habitat

"(1) Subject to section 38, if there is an area of land that, on its own or together with another area of land or other areas of land, is a habitat that is essential for the survival in that area or those areas of wildlife generally or a species of wildlife, the Administrator may, by notice in the *Gazette*, declare the area to be an area of essential habitat.

"(2) The Administrator must not make a declaration under subsection (1) unless -

(a) he or she is satisfied that the Director has consulted with the owner and, if not the same person, the occupier of the land and any other person who, in the opinion of the Director, has an interest that is likely to be adversely affected by the declaration; and

(b) the Minister recommends the making of the declaration under section 38(3)(a).

"(3) Despite subsection (1), if, in the opinion of the Minister, there is an area of land in which there is a species of wildlife that is likely to become extinct if not immediately protected, the Minister may, by notice in the *Gazette*, declare the area to be an area of essential habitat.

"(4) The area of land referred to in subsection (1) or (3) may be -

(a) land that has been alienated from the Crown, including Aboriginal land but not including other freehold land; or

(b) land that is reserved or dedicated under a law in force in the Territory.

"(5) In a declaration under this section, the Administrator or Minister, as the case may be, must -

(a) describe the area of land declared to be an area of essential habitat;

(b) specify the wildlife to which the declaration relates;

(c) give the reasons for making the declaration;

(d) give details of the proposed management of the area the subject of the declaration, including specification of the objectives of making the declaration and any management programs, co-operative management programs and by-laws made under section 71 that apply to the land; and

(e) state that the land the subject of the declaration is to be used and enjoyed in a manner that is consistent with the objectives of the declaration.

"(6) In a declaration under this section, the Administrator or the Minister, as the case may be, may specify -

(a) an article, thing, animal or plant that may not be taken into or out of the area of essential habitat the subject of the declaration; or

(b) the activities that may not be carried out in the area of essential habitat the subject of the declaration,

unless authorised in writing by the Director.

"(7) The land the subject of a declaration under this section is to be used and enjoyed in a manner that is consistent with the declaration.

"38. Submissions regarding declaration of area of essential habitat

"(1) Before the Administrator makes a declaration under section 37(1) and on the making by the Minister of a declaration under section 37(3), the Minister must invite written submissions in respect of the declaration from -

(a) the owner and, if not the same person, the occupier of the land that is or is proposed to be the subject of the declaration and any other person who, in the opinion of the Director, has an interest that is likely to be adversely affected by the declaration by serving a written notice on each of those persons; and

(b) any other interested person by giving public notice.

"(2) Notice under subsection (1) is to -

(a) include a description of the terms of the declaration; and

(b) specify the date not more than 28 days after the date of the notice by which submissions are to be received by the Minister.

"(3) The Minister must consider each submission made to the Minister under this section and any other matter that comes to his or her attention in relation to the declaration and may -

(a) if the declaration is proposed to be made under section 37(1) - make the recommendation he or she thinks appropriate to the Administrator in relation to the making of the declaration or refuse to recommend the making of the declaration; or
(b) if the Minister made the declaration under section 37(3) - vary (including by the imposition of conditions) or revoke the declaration as he or she thinks appropriate.

"39. Notification of declaration of area of essential habitat
"The Director must, not later than 7 days after the date a declaration of an area of essential habitat is made under section 37 or the date the Minister varies or revokes a declaration under section 38(3)(b) -

(a) serve written notice of the making or variation of the declaration and its terms or the revocation of the declaration on the persons on whom written notice was served under section 38(1)(a); and
(b) give public notice of the making or variation of the declaration and its terms or the revocation of the declaration.

"41. Notification of area of essential habitat on title
"Where a declaration of an area of essential habitat has the effect of imposing a restriction on the use and enjoyment of land, the declaration is a restriction for the purposes of section 191B of the *Real Property Act*.

"42. Conservation officer may carry out certain work
"(1) A conservation officer may carry out the work in an area of essential habitat that the Director considers necessary to attain the objectives of the declaration of the area of essential habitat.
"(2) The conservation officer may, after giving the person in lawful occupation of land in the area of essential habitat reasonable notice of his or her intention to do so, enter the land with the assistance, plant, machinery and equipment as the Director considers appropriate to carry out the work.
"(3) The Commission is liable to pay reasonable compensation for any damage or loss suffered in consequence of work being done under this section.

These proposed amendments were explained further in the Minister's second reading speech. Relevant extracts are cited below:

"*Declaration of essential habitats is critical to the long term conservation of the Territory's biodiversity. Many species and some entire assemblages of wildlife such as patches of rainforest depend on the continued existence of one or a few often relatively small habitats. These include areas used for roosting and feeding by migrant waders during their travels between Northern Asia and Australia, areas used for breeding by sea birds, some water birds and bats, as well as patches of habitat that represent the last one or few habitats containing endangered species such as the palm, Ptychosperma bleeseri.*

There is no way in which it is possible for all such habitats be included in the system of national parks. Indeed, the special conservation needs of these habitats was discussed in the recently approved NT Parks master plan. Nor is it possible for the officers of the Parks and Wildlife Commission to attend to the needs of all such habitats requiring some form of management. In the Territory, we remain fortunate in that many of these habitats are sufficiently remote and intact not to need management intervention at this stage. Essential habitats provide a significant opportunity for community groups to become involved in conservation management and for government to devolve the responsibility in a responsible way. It is already happening with groups such as those that have been involved in the management of Ptychosperma bleeseri over the years. These amendments will formalise these responsibilities through co-operative management agreements with public accountability and quality control provided through management programs and their associated monitoring.

There are two ways in which essential habitats may be declared. The first is by the Administrator on the recommendation of the minister. This is the way in which most such habitats will be declared. The Parks and Wildlife Commission will consult with landholders and other parties whose interests may be affected by a declaration

of an essential habitat. The habitat must be one that is essential to the survival in that area or those areas of wildlife in general or a particular species of wildlife. Upon receiving a proposal from the director, the minister must seek submissions from the land owners or occupier, any other person who may have an interest in the land or any other interested party. The minister must consider these submissions and any other matter that comes to his/her attention and may make a recommendation to the Administrator.

The declaration must describe the land, the species of wildlife of concern, the reasons for the declaration, details of proposed management and state the land is to be used and enjoyed in a manner consistent with the objectives of the declaration. Alternatively, the minister may make such a declaration in circumstances where the minister believes that extinction will occur if the land is not protected. The declaration is made by a notice in the Gazette and the minister must immediately call for submissions as occurs with declarations undertaken by the Administrator.

Areas of essential habitat impose a restriction on the use and enjoyment of land for the purpose of section 191(b) of the Real Property Act. Landholders may receive just compensation for such restriction and this may be determined by an appropriate court."

Appendix D.

Conditions specified under Commonwealth approval for the action of establishing up to 26,000 ha of hardwood plantation.

(a) Initial conditions (August 2001)

1. APG and TLC may clear up to 1000 hectares of native forest in the first six months during which this approval has effect. To avoid doubt, paragraphs 4,5 and 7 do not apply to up to 1000 hectares of native forest cleared in the first six months during which this approval has effect. However, paragraph 9 does apply.

2. APG and TLC must not clear more than 26,000 hectares in total, and may not clear more than 10,000 hectares in any 24 month period.

3. APG and TLC must not clear the treeless plains or riparian areas near springs or watercourses (including intermittent watercourses) or rainforest. APG and TLC also must not clear vegetation within the following buffer zones:

- rivers - 150m from each high bank;
- creeks - 100m from each bank;
- other drainage lines - 50m both sides;
- wetlands - 150m around wetland perimeter;
- wet rainforest patches - 600m; and
- other rainforest patches - 200m.
- 300m radius around nest sites of the red goshawk. If nests are located outside the buffers for rivers, wetlands and creeks, they must be linked by a corridor of 300m width to the nearest riparian buffer;
- 100m radius around nest and roost sites for the masked owl;
- 500m radius around known locations of carpentarian dunnart[1].

4. Before clearing any native forest, except as provided for in paragraph 1 above, the APG and TLC must prepare and submit for the Minister's approval, a plan outlining strategies to deal with the following matters:

- spread and control of weeds;
- fertilizer application;
- water quality and groundwater levels;
- spread of *Acacia mangium* beyond the plantations;
- erosion control;
- sediment deposition;
- fire management;
- outbreaks of pests and diseases; and
- quarantine procedures.

The action must be taken in accordance with the plan approved by the Minister.

5. Before clearing each area of native forest, except as provided for in paragraph 1, the APG and TLC must prepare and submit for the Minister's approval, a plan for managing the impacts of forestry in that area on the red goshawk, masked owl, partridge pigeon and carpentarian dunnart. Each plan may cover no more than 5,000 hectares, and must contain provisions to conserve adequate habitat for those species, including but not necessarily limited to the buffer areas required by paragraph 3. Each plan must contain a 1:25,000 scale map showing boundaries for each

[1] Note that the conditions use the wrong name carpentarian dunnart to refer to butler's dunnart *Sminthopsis butleri*.

plantation area, natural vegetated buffers, natural vegetation blocks, and relevant habitat sites. The action must be taken in accordance with the plan approved by the Minister.

6. Before preparing each of the management plans referred to in paragraph 5, the APG and TLC must undertake the following ecological studies on the red goshawk, masked owl, partridge pigeon and their habitats:

- surveys of the birds' nests for the initial 1000 ha and subsequent tranches before clearing and development take place;
- surveys of the birds' nests must also be undertaken during the wet season before clearing of the tranches;
- relevant studies of the birds, to delineate population size, distribution, plantation impacts and habitat preference to develop population viability models;
- relevant studies of the abundance and distribution of plants which provide habitat for the threatened species.

The APG and TLC must provide the results of these studies to the Minister at the same time as, or before, the plans referred to in paragraph 5.

7. Before clearing any native forest, except as provided for in paragraph 1 above, APG and TLC must prepare and submit for the Minister's approval, a plan to monitor the impacts of their action on listed threatened species. The plan must include measures to:

- establish five 20ha biodiversity monitoring sites at the east of Melville Island (control sites) and five 20ha biodiversity monitoring sites at the west (impact sites) of Melville Island during the first and second years of the project, to undertake intensive sampling of the red goshawk, the masked owl and the partridge pigeon;
- locate and monitor at least six red goshawk nests in the east of Melville Island, and at least six red goshawk nests in the west of Melville Island in and around the proposed forestry plantations;
- locate and monitor nest sites for the red goshawk, masked owl or partridge pigeon in and around the proposed forestry plantations;
- monitor plantation areas for foraging by masked owls and partridge pigeons.

The plan approved by the Minister must be implemented.

9. The APG and TLC must designate an Environmental Officer responsible for the environmental management for the Melville Island forestry project. The environmental officer will oversee compliance with Approval conditions under the EPBCA Act, including:

- implementation of the monitoring program and overseeing biodiversity studies and surveys;
- incorporating information relevant to the listed threatened species from future studies on the Tiwi Islands into the relevant plans; and
- updating the plan required under paragraph 4 and the plans required under paragraph 5 on a triennial basis.

10. An independent auditor must audit compliance with these conditions on a triennial basis. The auditor must be accredited by the Quality Society of Australasia, or such other similar body as the Minister may notify in writing. The audit criteria must be agreed by the Minister. The resulting report must be forwarded to the Minister within six months after the triennial anniversary of commencement of the action. The report must address:

- the effectiveness of mitigation measures and the monitoring program;

- compliance with the plan required under paragraph 4;
- compliance with the plans required under paragraph 5; and
- recommendations to deal with non-conformance, more effective mitigation measures and an improved monitoring regime.

11. Within 12 months of the action commencing, ATG and TLC must prepare and submit for the Minister's approval a plan setting out what steps will be taken to safeguard the ongoing viability of the red goshawk, masked owl, partridge pigeon and carpentarian dunnart if forestry operations cease. The plan must include an estimate of the cost of implementing the plan. With 6 months of the plan being approved by the Minister, APG and TLC must secure either an unconditional bank guarantee or an insurance policy to cover the estimated cost of implementing the plan. In the event that forestry operations cease, the plan must be implemented.

(b) Variations to conditions of approval (determined December 2002)

Delete paragraphs 5,6,7,10 and 11 of Annexure 1 to the Approval, and substitute the following:

5. APG and TLC must prepare and submit to the Minister, a plan prior to clearing of each tranche of existing vegetation, until 26,000 hectares have been cleared. Each tranche plan (no greater than 5,000 hectares) must provide information on surveys undertaken for the red goshawk, masked owl, partridge pigeon and carpentarian dunnart within the tranche (including nest sites), and map/s showing boundaries, natural vegetated buffers, natural vegetation blocks and relevant habitat sites required by paragraph 3. The action must be taken in accordance with the plan submitted to the Minister.

6. APG and TLC must undertake the following ecological studies on the red goshawk, masked owl, partridge pigeon and their habitats:

- relevant studies of the bird, to delineate population size, distribution, plantation impacts and habitat preference to develop population viability models;
- relevant studies of the abundance and distribution of plants which provide habitat for the threatened species.

The APG and TLC must provide the results of these studies in a threatened species management plan for the Minister's approval, at the same time as, or before, the first triennial audit referred to in paragraph 11. The plan must be implemented.

7. Within one year of commencing operations APG and TLC must prepare and submit for the Minister's approval a plan to monitor the impacts of the action on listed threatened species. The plan must include measures to:

(i) establish five 20ha biodiversity monitoring sites (control sites) and five 20ha biodiversity monitoring sites (impact sites) on Melville Island to undertake intensive sampling of the red goshawk, the masked owl and the partridge pigeon. At least four of which must be established within one year of commencing operations.
(ii) locate and monitor at least six red goshawk nests in and around the control sites, and at least six red goshawk nests in and around the proposed forestry plantations within seven years of commencing operations. Control and impact biodiversity monitoring sites should contain a red goshawk site where possible.
(iii) monitor plantation areas for foraging by masked owl and partridge pigeons.

The plan must be approved by the Minister and must be implemented.

8. If the results of the second triennial audit determine the APG and TLC were unable to find the appropriate numbers of red goshawk nest sites required under paragraph 7(ii) after adequate surveying, then paragraph 7(ii) does not apply.

10. APG and TLC must maintain legally enforceable agreements delineating the respective responsibilities of APG and TLC to rehabilitate the environment, to ensure the continuing viability of habitat for listed threatened species in the event that forestry operations cease.

11. An independent auditor must audit compliance with these conditions on a triennial basis. The auditor must be accredited by the Quality Society of Australasia, or such other similar body as the Minister may notify in writing. The audit criteria must be agreed by the Minister. The resulting report must be forwarded to the Minister within six months after the triennial anniversary of commencement of the action. The report must address:

- effectiveness of mitigation measures and the monitoring program;
- compliance with the plan required under paragraph 4;
- compliance with the plans required under paragraph 5;
- adequacy of the surveying for threatened species required under paragraphs 5 and 7;
- adequacy of agreements referred to in paragraph 10 to protect listed threatened species; and
- recommendations to deal with non-conformance, more effective mitigation measures and an improved monitoring regime.

Appendix E.

Briefing notes for the proposed NT *Parks and Reserves (Framework for the Future) Act 2003*

Parks and Reserves (Framework for the Future) Act 2003

Introduction

The Parks and Reserves (Framework for the Future) Act 2003 provides a framework for the establishment, maintenance and management of a comprehensive system of parks and reserves in the Northern Territory.

This framework draws together the Aboriginal obligation to care for country and maintain cultural traditions with a range of government objectives, including protection of biological diversity, enhancing recreational, educational and tourist opportunities, optimising employment and training and creating a sound and sustainable economic base for regional development.

The Territory's parks and reserves will be substantially enriched by recognition of traditional Aboriginal ownership arrangements. That recognition will significantly enhance parks attraction to visitors. It will give Aboriginal landowners and traditional custodians throughout the Northern Territory opportunities to actively participate in the overall management of the parks, and an opportunity to guide how their culture is presented to visitors. Joint land management arrangements between Aboriginal people and the Northern Territory Parks and Wildlife Service will become the norm, together with employment of Aboriginal people in a range of roles within the park system.

This Act results from initiatives announced on 25 October 2002 to resolve uncertainty created by land claims over parks and reserves, in particular uncertainty that arose from the High Court's judgement in the Ward case.

At that time the Government decided to act responsibly and decisively in seeking to resolve the uncertainty whilst also avoiding costly and long term litigation that would have left us in the courts for countless years. It would have delayed economic development opportunities and maintained uncertainty over our Parks system.

The objectives and content of the Act.

In developing this Act the Government has exercised its primary responsibility to balance wider community interests in land use, conservation, recreation and tourist development and Aboriginal interests in protecting and maintaining cultural traditions. It has sought to achieve this by establishing a framework for the future management of the unique natural and cultural resources encompassed within our parks system.

Specifically the Act recognises, for the first time, that one of the objectives of the Territory parks system is to maintain and promote Aboriginal traditional values alongside protection and promotion of the values of the natural environment. The Bill sets down a timeframe for Aboriginal traditional owners to agree to the framework offer set out under the legislation. The Bill ensures this occurs in a transparent manner and subject to certain pre conditions being satisfied allows the Chief Minister to do certain things.

If these conditions are not complied with, within a defined timeframe, then the sunset clause set out in the legislation will apply, and the framework offer will lapse.

It is an ambitious and visionary framework that is balanced by requirements that will protect the interests of all Territorians and key stakeholders.

Specific provisions

Part 1 of the Act outlines its primary purpose, that is, to provide a framework for the establishment, maintenance and management of a comprehensive system of parks and reserves in the Northern Territory.

It defines this comprehensive system as one that:

a) is developed in partnership between the Territory and the traditional owners of the parks and reserves;
b) benefits those traditional owners by recognising, valuing and incorporating Indigenous culture, knowledge and decision making processes;
c) protects biological diversity;
d) serves the educational and recreational needs of Territorians and visitors to the Northern Territory; and
e) enjoys widespread community support.

Consistent with other legislation, the Act contains a number of definitions and confirms that the Act will bind the crown consistent with the powers of the NT Legislative Assembly and should also be read as being consistent with other relevant Commonwealth legislation. It also confirms that the Chief Minister will be responsible for the administration of the Act.

Part 2, Sections 8 to16, outlines the framework offer.

Section 8 authorises the Chief Minister to do the following:

- request the Commonwealth Minister responsible for the *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA) to schedule the parks and reserves set out in Schedule 1 of the Bill;
- grant NT freehold title over Parks and Reserves set out in Schedule 2 of the Bill;
- execute, on behalf of the Territory leases to the Territory of each of the Parks and Reserves at Schedules 1 and 2;
- execute, on behalf of the Territory a joint management agreement for each of the Parks and Reserves specified in Schedules 1, 2 and 3; and
- execute, on behalf of the Territory, one or more Indigenous land use agreements.

Section 9 provides an explanation of the nature of the Parks title and the conditions that apply to the future use of the land held under this title. These include conditions under which grants may be made, establishment of Park Land Trusts to hold title, restrictions on sale or mortgaging of the land and provisions for surrender and compulsory acquisition. It also sets out the relationship between the title and relevant provisions of the Crown Lands Act.

Section 10 of the Act makes it clear that the Chief Minister is only authorised to do the things specified in Section 8 provided certain conditions are met with on or before a specified date. These conditions include:

- the withdrawal of claims under ALRA for those parks specified in schedules 2 and 3;
- Indigenous Land Use Agreements (ILUA's) executed in respect of the parks in Schedules 1, 2 and 3 that deal with compensation for the impact on native title rights and interests by the use of those parks. In addition they will facilitate future development in those parks and reserves;
- agreed terms of the leases consistent with the principles set out in schedule 4 These include lease terms of 99 years, good faith negotiations for renewal, preference for Aboriginal participation in commercial activities in the lease, use and enjoyment by traditional owners, and provision of living areas subject to the joint management agreement.
- agreed the joint management agreements consistent with principles in Schedule 4.

- Agreement by the traditional owners to lease existing ALRA land, as set out in Schedule 5, to the Territory for use as Park and Reserves on terms consistent with the principles in Schedule 5.

Section 12 of the Act creates a reservation from occupation under Section 178 of the Mining Act which will protect mining interests, whilst also suspending further applications over the land in question until the offer either lapses, or is executed by the Chief Minister exercising the relevant authorisations provided for under Section 10.This clause is necessary to comply with the core principle that ensures existing mining interests are protected.

Section 13 provides the Chief Minister with a discretion to omit parks and reserves and Aboriginal land from the schedules on the basis that the relevant Land council advises her in writing that the traditional owners of those areas will not comply with the conditions set out in Section 10(1), and the Chief Minister is satisfied that the omission will not defeat the purpose of the Act. This power can only be exercised once and must occur on or before 31 July 2004.

Section 14 provides for the Chief Minister to amend the schedule, by notice in the Gazette to either excise or include the Aboriginal community living areas on the Parks identified in Schedules 1, 2 or 3.

Section 15 provides for the Planning Scheme under the Planning Act to include provisions that constrain the use of the land granted as Parks's freehold for parks and parks related purposes. The land can only be used for other purposes with the consent of the Planning Minister.

Section 16 sets out a sunset provision for the framework offer which takes effect on 30 June 2004, but allows the Chief Minister to prescribe a later date only if she is satisfied there is substantial acceptance of the offer, and that full compliance will occur within a set timeframe, but no later than 31 December 2004.

The establishment of a world class Parks's system is vital to the future protection of the biological diversity of the Territory and its economic development. It will also ensure that Territorians continue to enjoy the benefits of access to some of the most pristine, culturally enriched and unique areas on the Australian continent.