

Appendix 4 – Land

4.1 Description and Values

The relationship between the physical characteristics of land and land use is cyclical. Physical characteristics dictate how land will be used, while land use affects the condition of those physical characteristics.

4.1.1 Soils

The ancient nature of major geologies and severe weathering conditions means that most of the Territory's substrates, or the parent material from which soil derives, is deeply weathered and often relatively infertile. Table 8 summarises the major soil types across the NT and the potential land uses they can support.

Table 8 Characteristics and locations of major NT soils.

| Soil type | Characteristics | Location |
|-----------|--|---|
| Kandosols | Well-drained earthy soils, and have significant soil water holding capacity at depth. | Occur on level to gently undulating landscapes. |
| Tenosols | Weakly developed sandy soils. Pose a very high erosion risk. Mainly used for the grazing of native pastures, as they have poor water retention, almost universal low fertility. | Includes a diverse range of soils, particularly widespread in the Top End. |
| Rudosols | Associated with significant slopes and have a high risk of erosion. They have few commercial uses because of their inherent properties. Often used for native pasture grazing. Some Rudosol areas have spectacular scenery such as the Katherine Gorge the Arnhem Escarpment and the MacDonnell Ranges. | Located in large areas of the Arid Centre, and patched thorough out the NT. |
| Hydrosols | Hydrosols are saturated for at least 2-3 months in most years and they are commonly referred to as seasonally inundated or waterlogged soils. They have restricted productive capacity. Inappropriately disturbing Hydrosols can degrade riparian landscapes, wetlands and accelerate erosion (Hill 2004). They include significant areas of potentially acid sulfate soils found amongst the extensive mangrove and floodplain systems. | The coastal floodplains and drainage systems. |
| Vertosols | Clay soils that exhibit strong cracking tendencies when dry. Common on Alluvial plains. These soils support rich grazing lands. | Extensive in the Victoria River District, Barkly Tableland and generally in arid and semi-arid regions. |
| Dermosols | Structured soils, commonly developed on volcanics. Supports a wide range of land uses including cattle and cropping. | Occur in the parts of Victoria River District and in some areas of the Roper and Southern Gulf. |

Adapted from Isbell (1998).

Erosion, a typical feature of the NT landscape, is largely the result of natural processes. The rate of wind and water erosion on unprotected areas in the Top End is usually greater than in temperate regions because tropical storms are much more intense. In the lower rainfall regions such as the Savanna Rangelands and the Arid Centre, wind causes considerable damage, especially during the driest periods (DLPE 2000). High intensity storms do occur in the Savanna Rangelands and the Arid Centre and these can cause significant erosion damage. This damage is largely due to the low vegetative cover, particularly after an extended period of drought.

Because of the erodable nature of soils and the intense rainfall in the NT, slopes with greater than a 1.5% gradient are susceptible to being completely stripped of soil even in their natural state. These natural processes, however, can be further accelerated through land use activities.

Soils have been mapped at a broad scale in the NT (Map 24) with productive regions such as the Victoria River District and Daly region currently being mapped at a finer scale.

With only a small percentage of the NT developed, soils are generally intact and in good condition. Soil condition is usually determined using surrogates such as vegetation cover and satellite techniques to measure soil degradation. In the regions where development is intense or becoming intensified soil health could be declining, but this is yet to be determined.

To ameliorate the effect of development on soil agricultural practices have been modified to suit the various soil types and the various climatic conditions across the Northern Territory, for example, by using zero/conservation tillage. The adoption of tools and programs such as Biograzed have enabled recognition of the impacts of livestock on soil, especially with regard to compaction and erosion near water points, and ways to lessen these impacts. Carbon content and acidification data has also been collected for some specific areas. This data can provide a useful indication of soil condition.

4.1.2 Vegetation

Soil properties, fertility and the presence of micro-organisms along with moisture dictate the form of native vegetation that grows in particular regions and the land's potential for cultivation and stocking. In the Territory 112 broad vegetation types have been described and mapped at 1:1,000,000 scale (Wilson et al. 1990). The major vegetation types that sustain some of the NT's important land uses include riparian corridors, floodplains and wetlands, grassy woodlands and open grasslands (see Map 1).

Regions throughout the NT have been modified through clearing for development, changes in fire regimes or the introduction of declared weeds and ecologically invasive plants and feral animal species. The overall extent of native vegetation clearing is relatively low. There has been substantial clearing for agricultural and horticultural development in some regions, such as the Top End, particularly (and not surprisingly) in and around urban areas (Appendix 3: Table 4 *Summary of total extent of clearing for selected Territory regions to 2000*). These developments generally occur in urban areas and where there is sufficient rainfall and productive land.

The breakdown of vegetation types that have been affected by clearing follows:

- 82 of the 112 (=73%) vegetation types have had negligible ($\leq 0.001\%$ of their extent) clearing;
- 18 vegetation types (16%) have had $< 1\%$ of their extent cleared;
- 9 vegetation types (8%) have had 1-5% of their extent cleared; and
- the remaining three vegetation types have had more than 5% of their extent cleared.

The three most cleared vegetation types are:

- *Livistona humilis* tall open shrubland, of which 13.9% of the original extent is already cleared (mostly in the Litchfield-Finiss-Dundee area)
- Acacia open shrubland with Sorghum understorey, of which 10.0% of the original extent is already cleared (mostly on Melville Island); and
- *Eucalyptus tetradonta* - *E. miniata* - *Corymbia bleeseri* woodland with Sorghum understorey, of which 5.8% of the original extent is already cleared (mostly in the Darwin Rural Area).

There is no current coherent baseline of condition assessment for most of the 112 vegetation types and no established protocol for measuring condition. Nonetheless there are existing evaluation elements, the most substantial of which are the monitoring programs on pastoral lands that regularly report on land condition that could help develop ways of assessing condition.

The condition assessment of pastoral land is monitored through a two-tiered system. Tier 1 monitoring is based on benchmark photographs and visual assessments at the paddock scale while Tier 2 is based on remote sensing data and is therefore somewhat more objective. (Karfs et al. 2001). This monitoring system is still in the establishment stage. Comprehensive comparative monitoring data will not be available for all pastoral districts for many years (Pastoral Land Board 2003). The current ability of this monitoring system to provide an informed assessment on any trends in pastoral condition is therefore, limited. Table 9 provides an indication of the extent to which pastoral condition is known.

Table 9 Extent of condition and monitoring on pastoral land

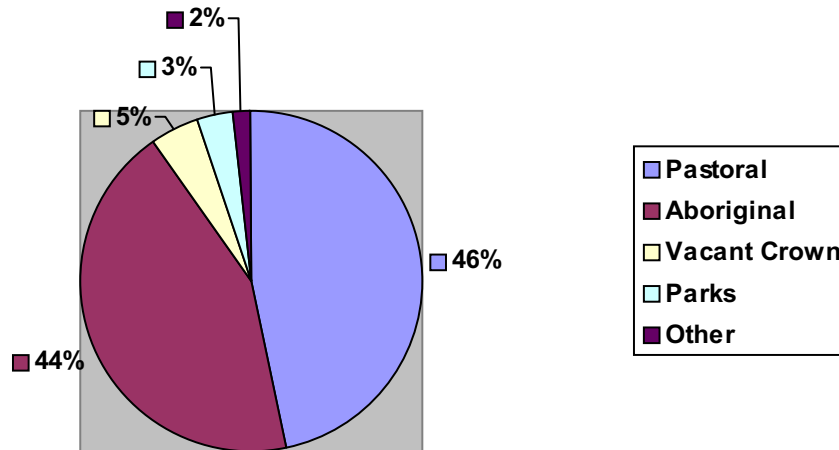
| Pastoral District | Tier 1 | Tier 2 |
|--------------------------|---|--|
| Darwin | Predominantly good | No Tier 2 monitoring occurring |
| Katherine | Good condition | No Tier 2 monitoring occurring |
| Roper | Good condition | No Tier 2 monitoring occurring |
| Victoria River District | Good condition and ground cover is high. However increase of rubber bush in the area may result in a decline in land condition. | Overall good condition. |
| Sturt Plateau | Good condition | No Tier 2 monitoring occurring |
| Gulf | Good condition with high levels of ground cover. | No Tier 2 monitoring occurring |
| Barkly | Land condition considered to be good. | No Tier 2 monitoring occurring |
| Tennant Creek | Good condition | No Tier 2 monitoring occurring |
| Plenty | Good condition | No Tier 2 monitoring occurring |
| Northern Alice Springs | Over half the sites were recorded as being in good condition, compared to previous assessments where only 14% of the same sites were in good condition. | No Tier 2 monitoring occurring |
| Southern Alice Springs | Improved number of sites with good condition compared to previous assessments where the majority of sites were only fair. | Stable conditions for most of the district, whilst non-productive landscapes showed increases in vegetative cover. |

(Adapted from the Pastoral Land Board 2002/03 Annual Report & Karfs & Saunders 2004)

4.1.3 Land Use Overview

The majority of the Northern Territory (90%) comprises Aboriginal freehold land (44%) and pastoral leases (46%) (see 2 Karfs et al 2001). Other important tenures include vacant Crown land, parks and mining leases.

Figure 2 Proportion of Land in Different Tenure Types



In the Top End the land is primarily used for urban development, horticulture and agriculture. Urban development is concentrated in the Darwin Region, with horticulture and agriculture mainly occurring in the Darwin rural area (Litchfield Shire). There are also small pockets of pastoralism in Litchfield and Coomalie shires. Aboriginal Land Trusts own a large proportion of the land in the Top End. This land is used for a variety of purposes including subsistence living, pastoralism, customary hunting and harvesting, tourism, parks and urban development.

In the Savanna Rangelands urban development is mainly concentrated in the Katherine region with the surrounding areas largely supporting intensive horticulture and agriculture. Most of the Savanna Rangelands are made up of Aboriginal lands and pastoral leases and include places like the Barkly Tablelands and Victoria River District, which are some of the most productive pastoral lands in the NT.

The Arid Centre has a high proportion of the NT's Crown Land and Alice Spring is the NT's second largest urban centre. The remaining land is predominantly pastoral lease and Aboriginal land. There is also a significant horticultural development in the Ti Tree region.

The condition of Northern Territory lands is generally good because development has, to date, been limited. Urban, agricultural, horticultural and mining developments have resulted in some localised degradation and fragmentation of ecosystems but improving land practices and property planning have the potential to minimise impacts from both current and future developments.

4.1.4 Customary Economies

Thirty per cent of Australia's Aboriginal population live in small remote communities in the Northern Territory (Altman 2004). Many of these communities do not have mainstream economies, have no long term sustainable employment and are generally supported through government funding (Armstrong et al. 2004). However customary economies exist and are slowly becoming recognised as a valid and important part of Aboriginal communities. The customary economy includes any productive activities, based on cultural activities such as hunting, gathering and fishing that create economic benefit. The value of the customary economy is generally unquantified or unrecognised as a factor in the Territory economy (Altman 2001).

Recognising and encouraging customary economies is important as it:

- provides opportunities for Aboriginal people to remain on country, which in turn sustains capacity for land and sea management, particularly in remote regions;
- generates economic benefits for individuals and communities;
- opens up opportunities for commercial enterprise; and
- has on ground benefits and mainstream economic implications through improved NRM (Altman 2001, Altman & Whitehead 2003).

Harvesting native plants, native animals and feral animals are important elements of customary economies. They contribute substantially to Indigenous livelihoods by forming an important part of people's diet and reinforcing attachment to land (NLC 2004), whilst encouraging the transfer of Indigenous Ecological Knowledge.

One of the more successful and well known customary economic activities is the harvesting of native plants for arts and crafts. The industry engages thousands of indigenous people in the Northern Territory through employment and contributes to regional economies (Altman & Whitehead 2003). This industry continues to grow and there are few issues with its sustainability based on current levels of resource use. The harvest of materials for the industry requires a wide range of skills and regular activity on country.

Emerging markets which could potentially increase the profile and benefits of the customary economy include:

- bush foods;
- nursery trade;
- traditional medicine;
- wildlife harvesting;
- farming of native animals such as crocodiles and magpie geese; and
- carbon abatement programs through traditional fire management (Armstrong et al. 2004).

There is a strong desire by many Indigenous people to live on country and maintain it in a cultural and sustainable way. Their continuing presence on country can result in improved fire, declared weed, ecologically invasive plant and feral animal management and the early detection of disease (Armstrong et al. 2004). Preliminary research indicates that Indigenous land management costs much less than the management of parks, but the conservation outcomes are similar (Armstrong et al. 2004). This is an important consideration as some Indigenous land includes nationally significant bioregions.

Indigenous people play an important role in NRM in many remote regions which may otherwise go unmanaged. Mainstream institutions should encourage and support the development of customary economies as an avenue to improve Indigenous people's socio-economic circumstances and maintain cultural connections and obligations to country (Armstrong et al. 2004).

4.1.5 Pastoralism

Pastoralism is a significant and extensive form of land use in the NT. The pastoral estate of the Northern Territory covers around 619,000 km² comprising nearly 46% of the area of the Territory (see Map 25). Pastoral holdings vary from small stations of 198 km² to the Territory's largest station, which runs cattle over 12,212 km² (Pastoral Land Board 2003). The trend in pastoral production, measured by turn off percentage has now risen from only 10% in 1975 to over 30%. This reflects major improvements in husbandry, efficiency of production and is an indication of the sustainability of pastoral land in the NT (Pastoral Land Board 2003 and MacDonald pers. comm. 2005).

There have been vast changes in community perceptions of the pastoral industry and the attitudes of pastoralists since the industry first began in the late 19th Century. The first pastoralists in the NT were seen as pioneers opening up and developing the country. The industry experienced many problems during this phase as 'southern' practices were employed and there was a lack of understanding of the

processes occurring in the landscape. In today's society, the environmental sustainability of the pastoral industry is under scrutiny. Pastoralists have adapted to the changing social attitudes and pressures. By employing new concepts such as Biograzing, Environmental Management Systems, Best Management Practice and Landcare, they are endeavouring to meet society's expectations to be environmentally sustainable.

Pastoralism is a major contributor to natural resource management in the NT. Pastoralists are managing threatening processes such as weeds, fire and feral animals in remote regions and working towards the sustainable management of large tracts of land. Pastoralists are important holders of local knowledge of the landscape and its processes. This knowledge is used to practice adaptive management to combat the uncertainty of climate, new threatening processes and uncertainty of markets. Pastoral environmental knowledge has rich experiential, historical and social dimensions (Gill 2003). This knowledge is born of the relationships pastoralists have with the land. These relationships are forged in history, labour, through family reproduction and through events such as drought (Gill 2003).

It is important to note that as well as being important towards the management of natural resources the industry is also economically important in providing incomes in rural and remote areas, keeping people in the rural community.

4.2 Issues and Threats

4.2.1 Fire, Weeds, Feral Animals and Clearing of Vegetation

Fire, weeds and feral animals are major threats to the viability of the land asset. To avoid unnecessary duplication these threats have been described in Appendix 3 – Terrestrial Biodiversity.

4.2.2 Unsustainable Land Use Practices

Primary industries such as pastoralism, agriculture and horticulture rely directly on a productive natural resource base and unsustainable land use practices potentially threaten both the industries and the NT's natural resources. These practices may often not be intentional; rather they may arise because land managers have insufficient knowledge, ability and resources.

Generally, unsustainable land use practices often involve an overworking of the land beyond its carrying capacity. The four key pressures, which together can cause cumulative impacts on all natural resource assets, are:

- overgrazing;
- inappropriate clearing;
- extensive use of fertilisers and pesticides; and
- inappropriate placement and maintenance of infrastructure (in particular roads and fence lines).

Overgrazing can cause significant changes to the structure and composition of native vegetation (Woinarski et al. 2000). Generally, overgrazing causes deep-rooted trees to be replaced by shallow-rooted species, which leads to unwanted changes in water tables, increases in introduced weed species and in some cases, the development of monocultures (Storrs and Finlayson 1997).

A significant proportion of native plants and animals in NT ecosystems are 'grazing-sensitive' and they may decline or disappear from areas because of the direct or indirect effects of heavy or even moderate grazing pressure. A typical response to heavy grazing is a decrease in the frequency and cover of palatable perennial species and an increase in unpalatable perennials or annual species. Prolonged overgrazing may result in the removal of most perennial grass species and a dominance of annuals, making the area susceptible to drought and erosion (Parks and Wildlife Service 2004). Overgrazing by domestic and feral animals can also make vegetation cover patchy and compact the soil, which in turn inhibits the regeneration of some plants. This often occurs around stock watering points where grass

cover is minimal late in the Dry season, when the bare ground leaves the soil vulnerable to intense rainfall and loss of topsoil is likely. Where cattle and feral animals are overgrazing along drainage lines, there may be pronounced changes in erosion and runoff patterns and sediment loads in waterways (VRDCA 2004, Telfer 1998).

There is potential for overgrazing in the large number of pastoral properties throughout the NT, as there are still questions as to what are the most sustainable grazing rates for the various native pastures in the NT (Tropical Savannas CRC 2004a). Extensive research into sustainable land management practices is showing that sustainable grazing is primarily dependent on the management of pasture use, especially in relation to the level of use and timing (Tropical Savannas CRC 2004b). The DBIRD Pastoral Production Program operates throughout the NT and is responsible for researching both animal and rangeland aspects of production. A large part of their research is investigating the sustainable levels of utilisation of the extensive native pastures of the NT, with the end result being reliable guidelines on recommended utilisation rates. This important research must continue to ensure the long term sustainable use of pastoral land.

In general, the industry is managed within acceptable limits of land condition, but it is clear that maintaining relatively high densities of a large exotic animals will affect some native plants and habitats and, as a result, native animals. Pastoralism occupies nearly half of the Northern Territory and because this is such a large area, any impacts to biodiversity from typical pastoral use will be extensive.

The clearing of vegetation is another important threat to the sustainability of the land and this is dealt with in Appendix 3 – Terrestrial Biodiversity 3.2.1 *Vegetation clearance*.

Other issues that need to be considered in intensive agricultural and horticultural areas are soil fertility and structure. Soils that have been cropped commonly show a decline in organic matter (Hamblin 2001). Agriculturalists typically apply nutrients (fertilisers) to the soils to combat this problem, herbicides and pesticides are also frequently applied to crops, but excessive application can lead to many of these nutrients and chemicals making their way into waterways through irrigation and rainfall runoff. Alternatively, they can leach out of the soil and into underground aquifers, potentially contaminating groundwater supplies (Waugh & Padovan 2004). The accumulation of nutrients in waterways can result in serious implications for water quality. Continuous monitoring of the health of aquifers and waterways in regions of intense agricultural and horticultural development is required

Soil acidification is an issue which is accelerated by cropping activities. The application of ammonium based fertilisers as well as the removal of naturally alkaline crops such as fruits and vegetables, means the loss of alkalinity in the soil is inevitable in the long term if it is not addressed. The loss of alkalinity from crop removal is not widely recognised by producers, and to combat the problem the alkalinity must be replaced if long term cropping is to be sustainable (Moody 2000). Little work has been carried out on soil acidification in the NT and the long term effects are unknown, but it would appear that there is a risk, based on trials in North Queensland.

Unlike other rangeland areas in Australia the Northern Territory's soils are not affected by dryland salinity. Dryland salinity is caused by rising groundwater tables following the clearing of deep-rooted trees and shrubs. The combination of largely intact native woody vegetation over much of the Territory and the predominance of non-saline groundwaters in areas of the Top End subject to highest development pressure means that dryland salinity is unlikely to become a significant threat. Recent hazard mapping for dryland salinity does, however, identify the Sturt Plateau (centred on Daly Waters) and pockets of land west of Katherine, south-west of Tennant Creek, in the Victoria River District and in Arnhem Land as being at 'moderate' hazard (Map 26). Planning of any new enterprises or developments that require clearing of vegetation in these areas has to be based on precautionary principles to avoid the risk of dryland salinity.

Irrigated cropping has the potential to affect soil composition. Large scale or inappropriate irrigation can make the water table rise and bring salts to the surface. Irrigation salinity happens gradually,

generally taking at least 5-10 years for effects to emerge. Irrigation salinity is a low priority threat in the Northern Territory. Irrigation salinity occurs in Alice Springs township due to the basin's geology, historical climatic events and the use of water imported from outside the catchment area on gardens (Tickell 1994). Irrigation salinity in the area is being managed through awareness programs, management and monitoring (DIPE 2002).

There is potential for irrigation salinity in the Keep River region (Humphreys et al. 1995) and a minor risk in the Ti Tree region (Water Studies Pty Ltd 2001). In these regions monitoring regimes, staged development and the development and implementation of best management practice is essential to avoid the occurrence of irrigation salinity. Hydrogeological studies to determine the potential for irrigation salinity are recommended for any large-scale irrigation developments. The potential for irrigation salinity elsewhere in the NT is generally low.

Inappropriately placed and maintained infrastructure can also cause problems on the land. Roads and fence lines built in unsuitable areas are among the most significant causes of erosion in remote regions, because they can cause high levels of sediment runoff and leave large areas exposed to wind and water erosion (Roper River Landcare Group Inc 2004, Telfer 1998, Pastoral Land Board 2003). Although erosion and subsequent loss of soil condition is a primary result of poor land use practices, these problems are exacerbated in the NT by climatic conditions such as extended dry periods and very heavy downpours.

Sustainable land use practices are critical to the productivity of pastoralism, horticulture and agriculture in the NT. Key pressures can all be controlled through appropriate land use planning and management within the limits of the land to sustain a variety of uses.

4.2.3 Greenhouse Emissions

Chapter 3 – Biodiversity provides an overview of the potential to significantly reduce NT greenhouse gas emissions using fire management. Chapter 4 provides an overview of pastoralism and agricultural related greenhouse gas emissions including the potential for offsetting emissions through carbon sequestration.

4.2.4 Climate Change

The impacts of climate change are discussed in Chapter 4 – Land; Chapter 5 – Inland Waters, Chapter 6- Coastal & Marine, Appendix 3 – Terrestrial Biodiversity and Appendix 6 – Coastal and Marine.

4.2.5 Other Impacts

For information on the potential impacts of mining, hunting, harvesting, tourism and recreation see Appendix 5 – Inland Waters.

4.2.6 Emerging Issues

Genetically Modified Organisms (GMOs) are an emerging issue in natural resource management. There are polarised views on the effects of GMOs. They can be seen as opportunities to design organisms to overcome problems in agriculture (yield limitations, pestilence and climatic limitations) or they could create ecological problems. Genetically modified cotton (Bt cotton) is the only broad acre GMO in production in Australia and is currently grown in the Northern Territory only as a controlled research crop. The use of GMOs is an issue which will need to be considered in the near future.

4.3 Current Management Responses

4.3.1 Legislation

The *Pastoral Land Act 1992* governs the use of Pastoral land in the Northern Territory. Monitoring and reporting on the condition of pastoral land is a key function of the Pastoral Land Board. The Board is also responsible for instigating remedial action to restore pastoral land condition.

Development within the NT is regulated under the *Planning Act 2003* and relevant district land use plans. This legislation is the primary assessment tool used, although other Acts such as the *Environmental Assessment Act 1982* are also invoked for developments with significant environmental implications.

These acts are supported by guidelines, such as the reclamation guidelines for coastal regions and the land clearing guidelines. New clearing controls have been implemented to ensure any clearing in excess of one hectare is only undertaken after careful consideration of the implications, including measures to specifically ensure biodiversity conservation.

Proponents of significant developments may be required to demonstrate that their proposals consider and minimise potential for environmental impacts under the *Environmental Assessment Act 1982*. As part of this process an Environmental Management Plan may be stipulated where there are ongoing environmental threats. This act is currently administered by DIPE. Ongoing management of mines is, however, specifically controlled by *The Mining Management Act 2001*, which is administered by DBIRD.

Land-based pollution is very limited in the NT and generally restricted to developed areas. DIPE's Waste and Pollution Management Sections regulate land-based pollution by:

- developing and implementing policies and legislation for managing wastes which are hazardous to the environment;
- developing waste management plans and strategies;
- licensing and approving landfills, waste handlers, wastewater discharge and LNG/methanol manufacturing; and
- operating a 24-hour community pollution hotline, by which environmental pollution incidents can be monitored and regulated.

4.3.2 Industry Support

DBIRD and DIPE support pastoralists through the provision of advice including information on stocking rates for different soil and vegetation types. Cooperative groups in each region, such as the Sturt Plateau Best Practice Group, have been important and effective in receiving and distributing pastoral knowledge, industry research, best practice and other important land management information.

Over the past ten years Landcare principles have been widely adopted by pastoralists, resulting in improved biodiversity management and reduced degradation. Most pastoralists aim to continually improve their practices toward greater environmental sustainability. The extent to which this goal is being met varies considerably across the Territory.

The agricultural industry is supported through industry organisations (Northern Territory Agricultural Association and the Northern Territory Horticultural Association) and subsidiary groups such as the Mango Growers Association. DBIRD supports these industries, encourages use of best practice techniques through an extension officer program and collaborative research programs, and provides advice as required.

4.3.3 Fire, Weeds and Feral Animals

Action on fire, weeds and feral animals has been detailed in Appendix 3 – Terrestrial Biodiversity.

4.3.4 Managing Indigenous Land

Indigenous people own approximately 44% of land in the NT and about 85% of the coastline. Most of this land and sea country is Inalienable Aboriginal Freehold Land created under the *Aboriginal Land Rights (Northern Territory) Act 1976*. Four Land Councils (Anindilyakwa, Central, Northern and Tiwi), also created under this Act, help manage aspects of this Aboriginal land under the direction of their respective Traditional Owners. The Central and Northern Land Councils are also responsible for coordinating Native Title claims for the Territory.

The Land Councils each use different mechanisms to manage natural resources on Aboriginal Land. Each council is, however, focussed on building sufficient capacity of land owners groups and associated resource agencies to manage their land sustainably. Examples of this strategy include:

- Tiwi Land Council has a Natural Resource Management Plan (2004);
- Central Land Council recently developed a Regional NRM Overview (2004);
- Northern Land Council has recently developed Environmental Management Status reports (2004); and
- Anindilyakwa Land Council is currently developing a Natural Resource Management Plan.

Each of these documents is based on the desire of Indigenous owners to build capacity at all stages and in all levels of natural resource management, from concept development to plan development to on ground action.

Using and managing natural resources is a key feature of homeland, or outstation, life. There is great potential for local industry based on natural resources including crocodile harvesting, bush tucker gathering, fishing, development of art and craft products, nature tourism and export of Indigenous ecological knowledge.

Customary harvesting is an important part of Indigenous livelihoods and is regulated by the Commonwealth *Native Title Act 1993* Section 211 which allows Indigenous people to carry out activities such as harvesting of native flora and fauna without permits.

4.3.5 Resource Monitoring

Scarce resources limit the ability of the NT Government or the Regional Body (LCNT) to assess and monitor the condition of the natural resources in the NT and particularly to provide fine-scale data. Unlike other States and Territories, the NT has relatively few extensive trend data sets from which informed natural resource decisions can be made. This is understandable, considering that the NT is a large expanse with a relatively small population and is at an early stage of development. There is, however, a growing amount of baseline inventory and survey data which could be built into more comprehensive monitoring programs.

The NT has invested significantly in remote sensing for broad scale monitoring of landscape processes. This also involves a limited amount of field work to calibrate data to changes on the ground (referred to as ‘ground-truthing’). It is not used to monitor species composition.

References

Altman, J.C. (2001) Sustainable development options on Aboriginal land: The hybrid economy in the twenty-first century. Technical Report Discussion Paper No.226/2001. Centre for Aboriginal Economic Policy Research, Australian National University website: <http://eprints.anu.edu.au/archive/00001069> Accessed 18 November 2004.

Altman, J.C. Whitehead, P.J. (2003) Caring for Country and Sustainable Indigenous Development: Opportunities, constraints and innovation. Conference Proceedings: National Landcare Conference. 28 April -1 May 2003, Darwin. Web Site: <http://www.landcareconference.nt.gov.au> Accessed 17 November.

Altman, J.C. (2004) Economic Development and Indigenous Australia: Contestations over Property, Institutions and Ideology? Centre for Aboriginal Economic Policy Research. The Australian National University, Canberra. Website: <http://www.anu.edu.au/caepr> Accessed: 17 November 2004.

Armstrong, R., Yu, P., Lingiari Foundation, Morrison, J., (2004) A Structure for the Strategic Development of the North Australian Indigenous Land and Sea Management Alliance. Discussion Paper. NAILSMA Forum – Menngen Aboriginal Land Trust (Innesvale Station) Northern Territory. Website: <http://savanna.ntu.edu.au/centre/nailsma.html> Accessed 15 November 2004.

Department of Infrastructure, Planning and Environment (2002) Alice Springs Town Basin Fact Sheet. DIPE Website: <http://www.ipe.nt.gov.au/whatwedo/water-resources/facts/pdf/AliceSpringsTownBasin.pdf>

Department of Land, Planning and Environment (2000) Resource Management Guidelines for the Northern Territory – Soil Erosion and Sediment Control Draft. DLPE Unpublished. Management Strategy 1996-2005. Northern Territory Government, Darwin.

EcOz (2003). Wangamaty (Lower Daly River) Management Plan. Report by EcOz Environmental Services (Project No: Ldlg0301).

Gill, N. (2003) Environmental (Re) Education and local environmental knowledge: statutory ground-based monitoring and pastoral culture in Central Australia. In *Rangelands Journal* 25(1), 85-104.

Hamblin, A., 2001. Land, Australia State of the Environment Report 2001 (Theme Report), CSIRO Publishing on behalf of the Department of the Environment and Heritage, Canberra.

Hill, J. (2004) Land Resources of Darwin River Dam and Manton Dam Catchments – Draft. Technical Report No.08/2004D. Land Assessment Unit Department of Infrastructure Planning and Environment, June 2004.

Humphreys, G., Tickell, S., Yin Foo, D., Jolly, P. (1995) Sub Surface Hydrology of the Keep River Plains. Technical Report. Report 25/95D. Water Resources Division, Power and Water Authority. Darwin.

INRM Consultation Database (2004) Integrated Natural Resource Management Consultation Database Landcare Council of the Northern Territory (Unpublished).

Isbell R.F., (1998) *The Australian Soil Classification*. CSIRO Publishing, Melbourne.

Karfs, R., and Saunders, N., (2004) *Rangeland Assessment of the Barkly Pastoral District 2004*. Land Monitoring Branch, Resource Management Division, Conservation Natural Resources, Department of Infrastructure, Planning and Environment.

Karfs, R., Bastin, G., Chewings, V., Bartolo, J., Grant, R., Lynch, D., Wauchope, S., Watson, I., & Wood, B. (2001) Resource inventory, condition assessment and monitoring activities on Pastoral Leases in the Northern Territory conducted by the Department of Lands Planning and Environment. Report prepared for the Rangeland Theme of the National Land and Water Resources Audit. July 2001, Version 1.0.

Moody, P.W (2000) Soil Acidity In: Eldershaw, V.J, Hey, K.M., McElnea, A.E, Smith, C.D, Tewes, G.I. (eds.) *Understanding Soils, Soil Data & Land Management Issues. Refresher Training Course – Course Papers*. Toowoomba, 1-2 November 2000. Australian Society of Soil Science Inc.

Northern Land Council (2004) Environmental Management Status Reports for Aboriginal Lands in the Northern Land Council Region. A supporting document for the Council Caring for Country Strategy 2003 – 2006 Healthy Country Healthy Families, Northern Land Council.

Northern Territory Government (2002), Mangrove Management in the Northern Territory. Department of Infrastructure, Planning and Environment, Darwin NT.

Parks and Wildlife Service, (2004) Conservation Issues – Pastoral Land Use. Northern Territory Government Website:

http://www.nt.gov.au/ipe/pwcnt/index.cfm?attributes.fuseaction=open_page&page_id=1057 Accessed 16 November 2004.

Pastoral Land Board (2003) Pastoral Land Board Annual Report 2002/2003.

Roper River Landcare Group Inc. (2004) Roper River Catchment Natural Resource Management Plan. Roper River Landcare Group.

Storrs, M.J. and Finlayson, M. (1997). Overview of the conservation status of wetlands of the Northern Territory. Supervising Scientist Report 116, Supervising Scientist, Barton ACT. 90pp.

Telfer, D.J. (1998) Land Conservation in Gulf River Catchments. Department of Lands, Planning and Environment. Katherine.

Tickell, S. (1994) Dryland Salinity Hazard Map of the Northern Territory. Power and Water Authority. Northern Territory of Australia. Report 54/94D.

Tropical Savannas CRC (2004a) VRD Management Issues. (Online) Tropical Savannas Website:

http://savanna.ntu.edu.au/information/vs/ongoing_research.html

Accessed 16 November 2004.

Tropical Savannas CRC (2004b) Grazing Management Tools. (Online) Tropical Savannas Website:

http://savanna.ntu.edu.au/research/projects/grazing_management.html Accessed 17 November 2004.

Victoria River District Conservation Association (2004). The Victoria River District Natural Resource Plan 2004 Victoria River District Association

Water Studies Pty Ltd. (2001) Development of a Groundwater Model for the Ti Tree Farms Area. Report for the Department of Lands, Planning and Environment, Report No: WSDJ00205. Water Studies Pty Ltd.

Wagh, P.S., Padovan, A.V. (2004) Review of Pesticide Monitoring, Use and Risk to Water Resources in the Darwin Region. Report No. 02/2004D January 2004. Natural Resource Management Division, Conservation and Natural Resources Group, Department of Infrastructure, Planning and Environment.

Wilson, DC.B.A. Brocklehurst, P.S., Clark, M.J., and Dickinson, K.J.M. (1990). Vegetation survey of the Northern Territory, Australia. Technical report no. 49. (Conservation Commission of the Northern Territory: Darwin.)

Woinarski J.C.Z., Fisher, A., Fensham, R., (2000) Conservation of the grassy landscapes of northern Australia. Conference Proceedings: Northern Grassy Landscapes Conference. Katherine.