CHAPTER 4

THE NATURAL VALUES OF NORTHERN AUSTRALIA

For many Australians, the overwhelming impression of Northern Australia is of nature in abundance: endless tracts of savanna, flocks of Magpie Geese sweeping down to a billabong, vast wetlands swollen from heavy rains. On a planet where nature is often the pieces left behind after intensive human modification, the North is a place where nature stands out.

In the previous chapter we discussed the ecological processes and connections that maintain these natural values of the region. Here we give an overview of these values and their significance, globally and nationally. We do not attempt to describe the full suite of values that occur in all the regions across the North.

We focus in this chapter on describing some specific assessments of the national and international significance of the natural values of Northern Australia. These frames of reference are important because it is easy to take the local and familiar for granted; what is locally commonplace may be nationally or internationally of great significance.

LOCAL VALUES

There are discrete localities in Northern Australia that are exceptional by any measure. Their value is clear and generally well-understood and acknowledged. Two of the more obvious such examples are described in some detail in the boxes *'The Arnhem Land Plateau'* on page 46 and *'Life along land's edge – the wading birds of Roebuck Bay, Broome'* on page 47. Other obvious cases of outstanding values for biodiversity conservation include the North Kimberley and its islands (particularly so for endemic plants and animals, and for mammal species that have declined across most of the rest of their range: Wheeler *et al.* 1992; Graham and McKenzie 2004) and Cape York Peninsula (Abrahams *et al.* 1995; Mackey *et al.* 2001).

Change the scale and focus marginally and there is a vast network of sites across Northern Australia that have national significance for biodiversity, because they maintain populations of threatened species, large assemblages of waterfowl or other wildlife aggregations, important nesting sites for seabirds or marine turtles, unusual species richness, or support

1 Nesbit River, McIlwraith Range, Cape York Peninsula. *Photo by Kerry Trapnell*

THE ARNHEM LAND PLATEAU

Loosely, we can characterise Northern Australia as comprising three main environmental elements: the vast expanse of low-land plains, typically supporting eucalypt woodlands; a more discrete network of highly productive wetlands; and the stone country, a series of rugged rocky outcrops and ranges that give the land its grandeur and sense of immemorial time. Each has a contrasting biota; each its own problems.

The rugged uplands are most extensive and variable in the Kimberley, but there are other significant ranges scattered across the breadth of Northern Australia.

For cultural and natural values, the Arnhem Land plateau is one of the most important of these ranges. This predominantly sandstone massif occupies about 32,000 km^2, of which about one quarter is included within Kakadu National Park. Although it contains spectacular cliffs, escarpments and gorges, the total altitudinal range is relatively limited: the highest point is only about 400 m.

The caves and sandstone walls of this plateau contain some of the most spectacular and abundant rock art in the world, and this stone country is densely populated with sites of major cultural significance to Indigenous people.

The Arnhem Land plateau is extremely rich in endemic (restricted) plants and animals. About 200 plant species occur nowhere else in the world (Woinarski *et al*. 2006a). Endemic animals include three birds (the White-throated Grass-wren, Chestnut-quilled Rock-pigeon and Banded Fruit-dove), 12 reptiles (including one of Australia's largest snakes, the Oenpelli Python); five mammals (including the rare Black Wallaroo); together with three fish, one frog and numerous invertebrates. These latter include a spectacular radiation of crustaceans, including an endemic family of shrimps (Kakaducarididae) and exceptional species diversity in the *Eophreatoicus*, an endemic genus of isopods. Many of these species are extraordinarily localised, to single streams or springs (Finlayson *et al*. 2006).

The high levels of endemism and species richness arise from a combination of factors. For some species-groups (such as the trigger-plants *Stylidium* and resurrection grasses *Micraira*) with limited dispersal ability, the deep gorges, spectacular waterfalls and/or sheer cliffs isolate local populations, ultimately giving rise to divergence and speciation. The topographic variability of the stone country also promotes richness, through offering such a variety of microclimates and microhabitats. In contrast to the surrounding lowlands, the plateau has stood largely

Arnhem Land escarpment. *Photo by Glenn Walker*

stable in the landscape for more than 100 million years, and has provided refuge from (or has moderated the impacts of) climate change, inundation and fire. Many species have persisted here since ancient times, and are now relictual markers of an earlier age: such species include the plants *Drummondita, Hildergardia* and *Podocarpus*). The most notable of these relicts is the large evergreen tree *Allosyncarpia ternate*, a primitive relative of eucalypts, that now dominates the patchy network of rainforests scattered across the gorges and cliffs of the Arnhem Land plateau.

The ruggedness of the plateau has provided protection to these plants and animals since ancient times. Over the last 50 years, that protection is breaking down. The plateau lands are now largely depopulated, and the loss of traditional fire management has resulted in what is now an anarchic regime characterised by frequent extensive fires. In the absence of managers, feral animals (especially Water Buffalo) have spread to all but the most inaccessible parts of the stone country. The distinctive and finely tuned ecological communities of the stone country are unravelling. What was for so long inviolable and sheltered is now exposed: the stone country now has more threatened species than anywhere else in the North.

John Woinarski and Brendan Mackey

stable or increasing populations that are in decline across most of the rest of their range.

To a large extent, there has been a detailed accounting of such sites over most areas of Northern Australia over the last few decades, notably so for the Kimberley (Burbidge *et al.* 1991), Northern Territory (Anon. 2007) and Queensland (Stanton 1976; Abrahams *et al.* 1995; Mackey *et al.* 2001). We do not aim to repeat such analyses here.

Instead, our approach recognises that such sites are indivisibly connected to the landscape as a whole. The maintenance of their significant site-specific values is dependent upon the continuing connectivity of landscape-wide ecological processes. For example, the status of conservation assets on the Arnhem Land plateau is affected by fires coming from the surrounding lowlands. The numbers of wading birds visiting Broome will decline if wetlands and coastal areas elsewhere become degraded.

Further, as described in the opening paragraphs of this chapter, we aim here to see this land in a broader national and international context: what is the conservation significance of Northern Australia as a whole? Thus, we choose not to divide and compartmentalise this landscape into artificial segments and weigh up the measure of each of these individually – the region's value is far more than the sum of its constituent parts.

NATIONAL AND INTERNATIONAL VALUES

The state of the world's tropical savannas

Tropical savanna occurs in tropical monsoonal climates throughout the world, and once covered about 12% of terrestrial Earth (16.1 million km^2). The most extensive areas occur, or occurred, in Northern Australia, Africa, India and South America. Smaller areas are found in Madagascar, Indochina, Indonesia, the Philippines and southern New Guinea (Figure 4.1). The different savannas vary greatly in their composition of animal and plant species present but, due to the similar climates of alternate Wet and Dry seasons, have similar vegetation structure – sweeping grasslands with varying levels of tree cover, sometimes with a generally open shrub layer.

LIFE ALONG LAND'S EDGE – THE WADING BIRDS OF ROEBUCK BAY, BROOME

Every year millions of shorebirds – sandpipers and knots, godwits and curlews, whimbrels and tattlers – come to Australia from the Northern Hemisphere. Their life is spent chasing an eternal summer.

Eastern Curlew flock.
Photo by Dean Ingwersen

In our winter they breed in the tundra, taiga and shores of Asia and North America. During our spring they head south, seeking the southern summer on the shores of Australia. After summering here, they moult into breeding plumage, store fat and head North again in our autumn, off to their breeding grounds, up to 10,000 km away. This great bi-annual river of birds is called the East Asian-Australasian Flyway.

Throughout the world, shorebirds rely heavily on very specific habitats. Most species prefer marine mudflats in their non-breeding seasons. These are rich in shellfish, crabs and marine worms. Northern Australia has many areas of such habitat with important wader habitat in areas such as Darwin Harbour, and the southern coast of the Gulf of Carpentaria.

However all mudflats are not equal. A shallow sloping coast, soft muddy sediments and big tides are necessary to produce huge mudflats that make prime habitat for hundreds of thousands of shorebirds. There are only a dozen or so areas in the world with such huge intertidal mudflats rich in shorebirds.

The Kimberley has two of these global shorebird hotspots – Roebuck Bay, and just to the south, the 80 Mile Beach. These are by far the richest shorebird habitats in Australasia. And only one other such shorebird-rich area occurs in the tropics – in the Guyanas in South America.

Every year nearly a million shorebirds of more than 25 species migrate to Roebuck Bay and 80 Mile Beach. They join a few species of resident Australian shorebirds that never leave the continent.

Northern Australia also has the third most important shorebird area in Australia – the mudflats and mangroves of the southern coast of the Gulf of Carpentaria.

Concentrations of shorebirds can be easily seen by visitors on Roebuck Bay at the Broome Bird Observatory near Broome town, and also on the Esplanade in the middle of Cairns on the other side of Northern Australia.

Barry Traill

COMPARING THE STATE OF THE WORLD'S TROPICAL SAVANNAS

To assess the condition of tropical savanna woodlands globally, we combined data on three factors associated with effects on the vegetation cover of a landscape:

- The proportion of land cleared for cropping (Figure 4.1a) – this represents an extreme end of the gradient of native vegetation condition, indicating the complete or near complete removal of natural vegetation from a landscape;
- The density of livestock, such as cattle, sheep and goats (Figure 4.1b) – the effect of this factor depends on the carrying capacity of the environment but, in the absence of comprehensive data on carrying capacities, we assumed that the higher the density of livestock, the more likely a landscape was to be exposed to unsustainable grazing regimes; and
- The density of the human population (Figure 4.1c) – potentially degrading activities (such as over-cutting of fuel wood for heating and cooking) are associated with large numbers of people, particularly among subsistence farmers and pastoralists.

Further details of the data sources and methods used in this analysis are given in Appendix 1.

Combining the data from the above factors gave a vegetation disturbance index (Figure 4.2). The values of this index range from 0.0–1.0. Low values indicate poor condition due to extensive cropping, high densities of livestock, and large human population numbers; high index values represent the opposite.

In interpreting this analysis, we recognise that cropping, livestock density and human populations are not the only factors affecting savanna health. For example, tropical Australia contains large numbers of feral herbivores, including water buffalo, pigs and cattle. These animals can degrade the vegetation cover in particular parts of the landscape, such as around water holes, during the Dry season (see Chapter 5 for further discussion). Although Australian savanna woodland has a relatively low density of livestock, the total density is not the sole determinant of environmental impact. Where livestock are concentrated in the landscape they can lead to soil erosion; for example by destroying natural levee banks, which leads to rapid draining of areas, drying of soil and loss of vegetation (Pringle and Tinley 2003). Also, as explained above, effects of livestock density depend on carrying capacity of the landscape.

This index also assumes that the greater the human population in an area, then the more degraded the vegetation condition. However, in many parts of Northern Australia there are probably fewer people living on country than at any time in the last 50,000 years (the earliest recorded data for human occupation of the continent). Some of the less obvious ecological problems emerging in Northern Australia are related to Aboriginal depopulation over the last century and some of the solutions to the problems are to be found in re-establishing active management of the land.

1 Eucalypt savanna, Port Stewart, Cape York Peninsula. *Photo by Kerry Trapnell*

A recent global analysis *(The United Nations Millennium Ecosystem Assessment: Millennium Analysis)* examined the natural integrity of the world's biomes (large areas of similar climate and vegetation).[1] Although that study did not specifically consider savanna or savanna woodland, it assessed the state of 'Tropical Dry Forest' and 'tropical and subtropical grasslands, savanna and shrub lands' ('Tropical Grasslands'). The Millennium Analysis showed that Tropical Dry Forests have been significantly affected by cultivation, with almost half of the biome's native habitats replaced by cultivated lands. Tropical Dry Forests and Tropical Grasslands have both had around 60% of their natural distribution cleared by humans, with about 15% of this occurring since 1950. The Millennium Analysis also noted that in addition to the total amount of habitat loss, the spatial configuration of loss can strongly affect biodiversity, with habitat fragmentation typically accompanying land use change, leaving a complex landscape mosaic of native and human-dominated habitat types. The Millennium Analysis highlighted that habitat fragmentation typically endangers species by isolating populations in small patches of remaining habitat, rendering them more susceptible to genetic and demographic risks as well as natural disasters.

Building on the Millennium Analysis and other studies, we analysed the state of the world's tropical savannas, as context for the savannas of Northern Australia. We used computer-based geographical information from a variety of international sources, including NASA satellite sensors (see box *'Comparing the state of the world's tropical savannas'* on page 48 for details of this study). The global datasets we used covered tropical savanna woodland, defined here as 'savannas with trees'. The analysis therefore did not cover treeless tropical savanna grasslands, shrublands, and denser tropical forest.

The results are presented in Figure 4.1, which provides a combined index of the extent to which these savannas vary from relatively natural to highly modified by human activity.

Globally, tropical savanna woodland originally covered 11.99 million km². Almost 70% of these savanna woodlands have now been removed, leaving only 3.69 million km². Of the remaining savanna woodlands, only about 22% has a high vegetation condition index (shown in blue in Figure 4.2 and Figure 4.3), and

FIGURE 4.1a **WORLD SAVANNA CONDITION, CROPS**

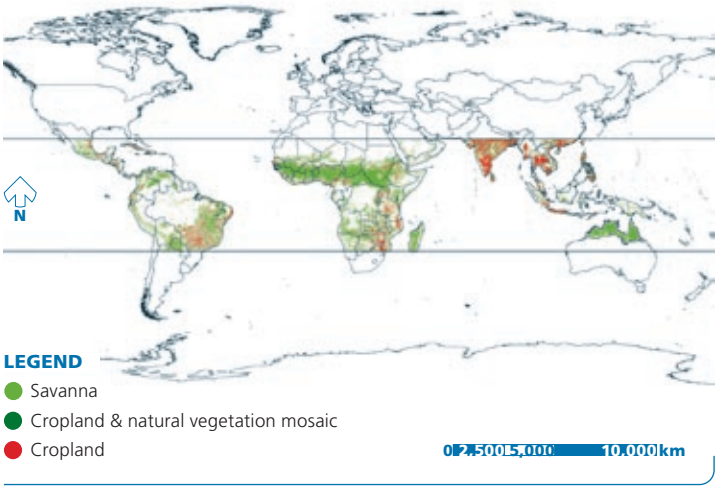


FIGURE 4.1b **WORLD SAVANNA CONDITION, LIVESTOCK**

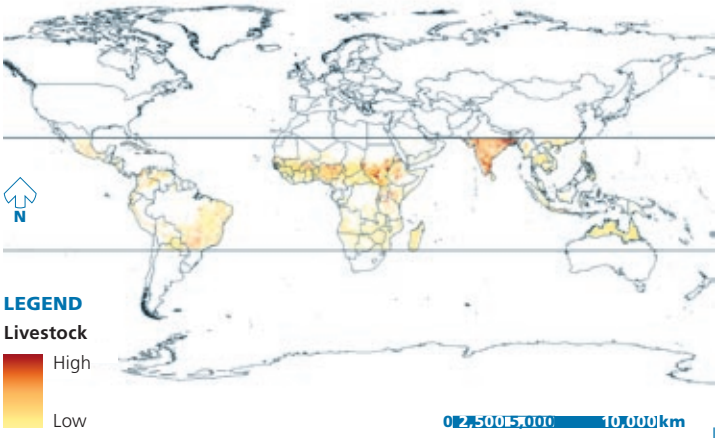
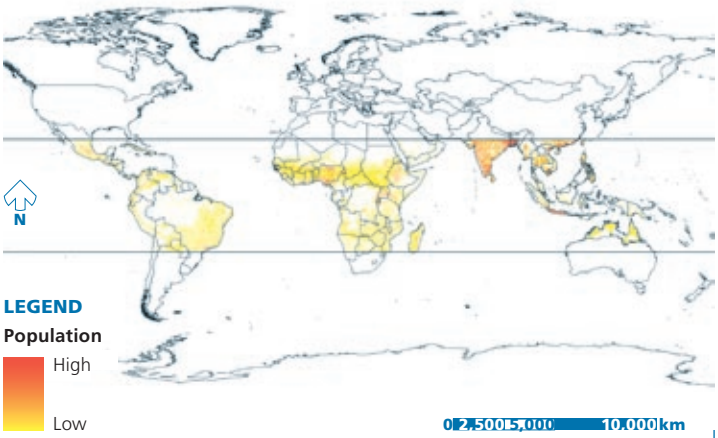
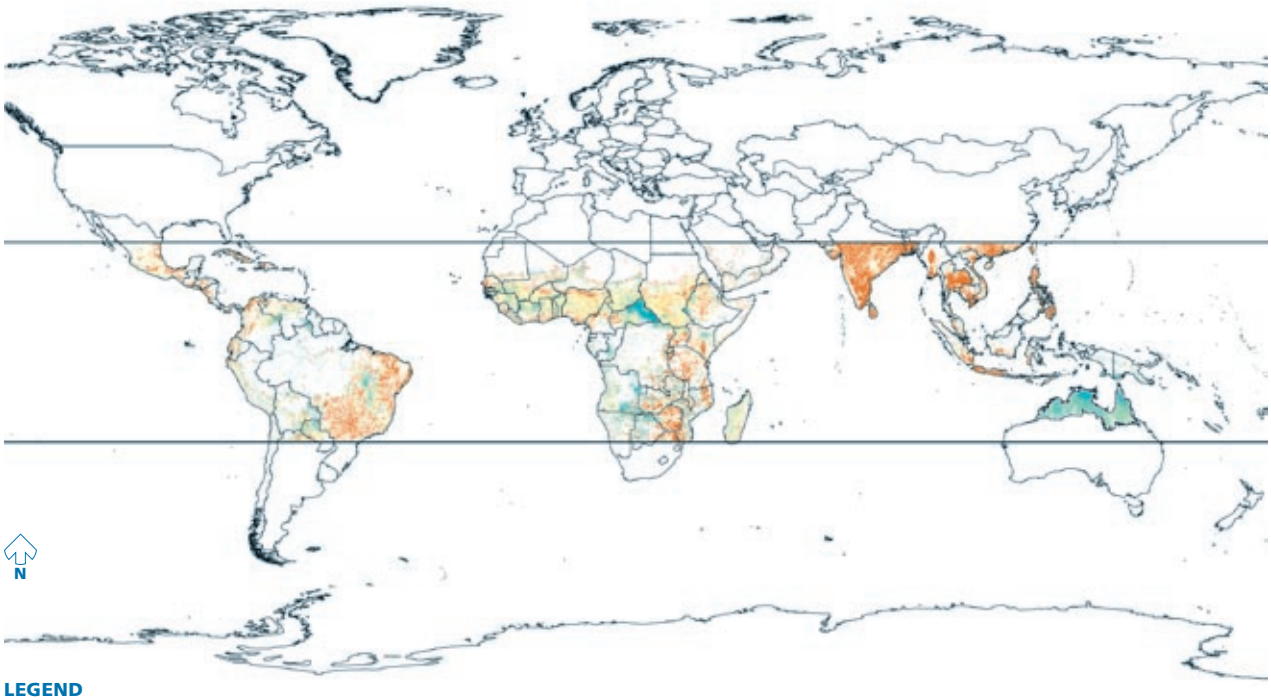


FIGURE 4.1c **WORLD SAVANNA CONDITION, POPULATION**



1 www.maweb.org/documents/document.354.aspx.pdf

FIGURE 4.2 **OVERALL WORLD SAVANNA CONDITION**



1 Jabiru on Gulf Country wetlands. *Photo by Wayne Lawler*

2 Savanna grassland, Cape York Peninsula. *Photo by Kerry Trapnell*

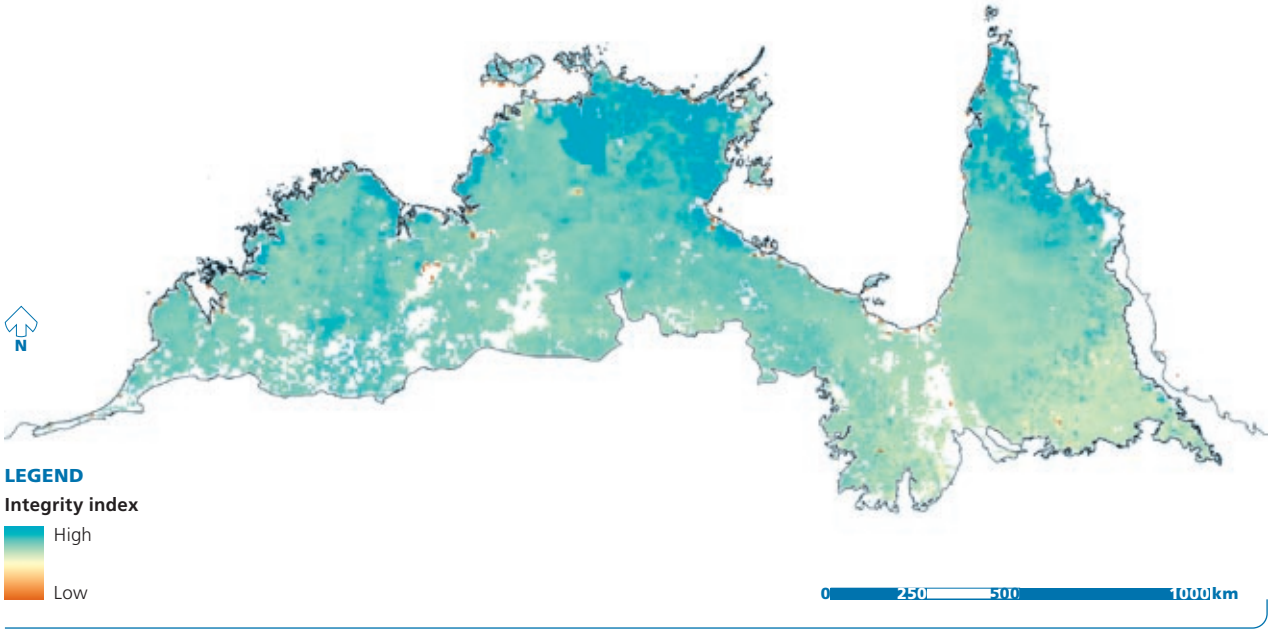
much of this, especially in Africa, comprises fragmented patches rather than extensive areas.

By far the largest expanses of tropical savanna woodland remaining in good condition are in Northern Australia. Australia has more than 25% of the remaining savannas; no other country has more than 9%. Australia is also the only economically developed and politically stable nation containing extensive areas of tropical savanna. This combination of attributes makes Australian tropical savannas of very high conservation value at a global level.

This level of international importance of Australia's tropical savannas is in contrast to that of Australia's celebrated tropical rainforests, for which Australia contributes only about 1% of the world's tally.[2]

2 As of 1999, the extant area of tropical forest globally was estimated to be around 1,407,649 x 1.03 km², while in Australia, it was estimated at 14,088 x 1.03 km² (see EarthTrends online database of the World Resources Institute; www.wri.org)

FIGURE 4.3 **AUSTRALIAN SAVANNA CONDITION**



COMPARING THE STATE OF AUSTRALIA'S WOODLANDS

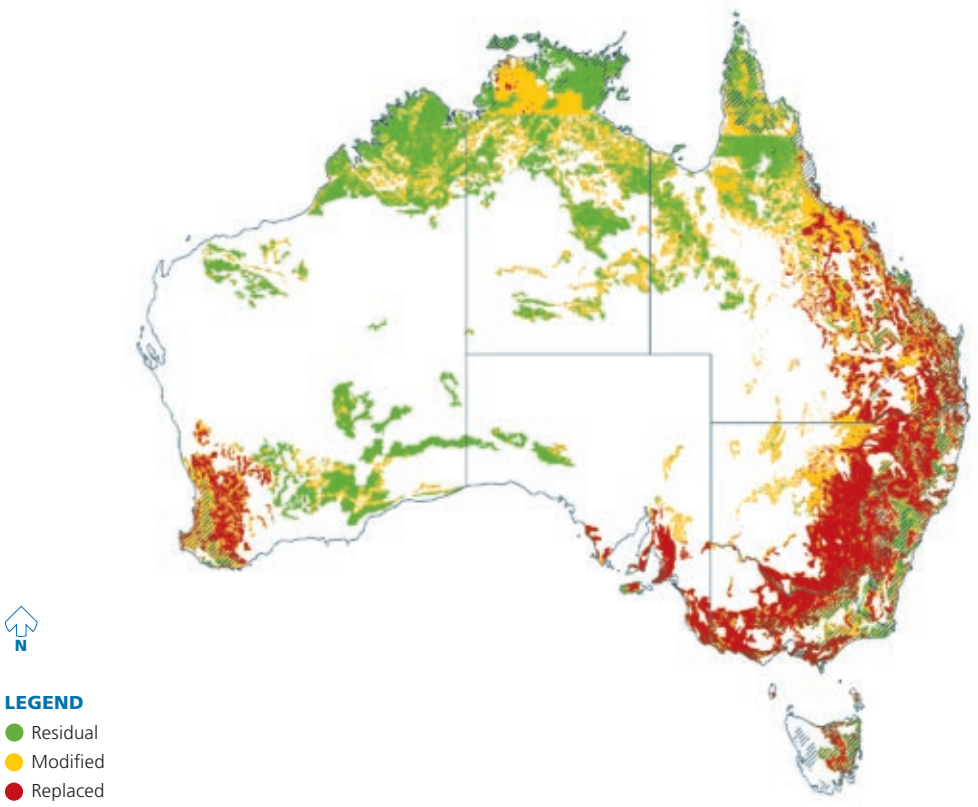
Vegetation structure (i.e. the height, density and layering of the plants) varies along a gradient from dense forest to grassland. The structure of tropical savanna woodland, as defined for our global analysis, mainly correlates with vegetation types mapped in Australia as 'woodland' (Figure 4.4). Given this, we compared the pre-1788 and current continental distribution and condition of Australia's woodlands, including the tropical savanna of Northern Australia, and the subtropical and temperate woodlands of Queensland, New South Wales, Victoria, South Australia and Western Australia.

Data on the extent of woodland and forest cleared for cropping is from 'Integrated Vegetation Cover V1' (BRS 2003). The 'replaced' class indicates woodland and forest cleared for a land use other than cropping. 'Modified' represent an intermediate level of change, which in the pastoral zone largely reflects the intensity of commercial grazing.

Details of the data and methods used in this analysis are given in the Appendix.

FIGURE 4.4 **DISTRIBUTION & CONDITION OF EUCALYPT WOODLAND**

To improve map interpretation, the relatively small areas of forest are shown as areas over-shadowed with dark grey. All other coloured areas are, or were, eucalypt woodland. White areas are other vegetation types. 'Residual' refers to woodland and forest that is the least disturbed from contemporary post-European settlement land use activity.



THE STATE OF AUSTRALIA'S WOODLANDS

We undertook a comparable analysis at a national scale of the significance of the dominant vegetation of the North—the savanna. 'Woodland' and 'forest' rather than 'savanna' is the broad term usually used in identifying and mapping all open-treed vegetation throughout Australia. Here we compare the condition of eucalypt woodlands throughout Australia. The procedures and data sets used are presented in the box *'Comparing the state of Australia's woodlands'* on page 52.

Figure 4.4 shows the distribution of Australian eucalypt woodland and forests before European settlement and now. Note that unmapped parts of Northern Australia (white space) in Figure 4.4 comprise other vegetation types, including savanna grassland and heathland.

More than 80% of the temperate and subtropical woodlands have been cleared for intensive land uses, or heavily modified by intensive grazing or other disturbances. In striking contrast, woodlands and forests remain extensive and in relatively unmodified condition in Northern Australia.

THE STATE OF AUSTRALIA'S WATERWAYS

Hydro-ecological processes are critical to the healthy functioning of country in the North (Chapter 3). Here we briefly examine the state of wetlands and waterways in Northern Australia relative to that of the continent as a whole, based on recent national and regional level analyses.

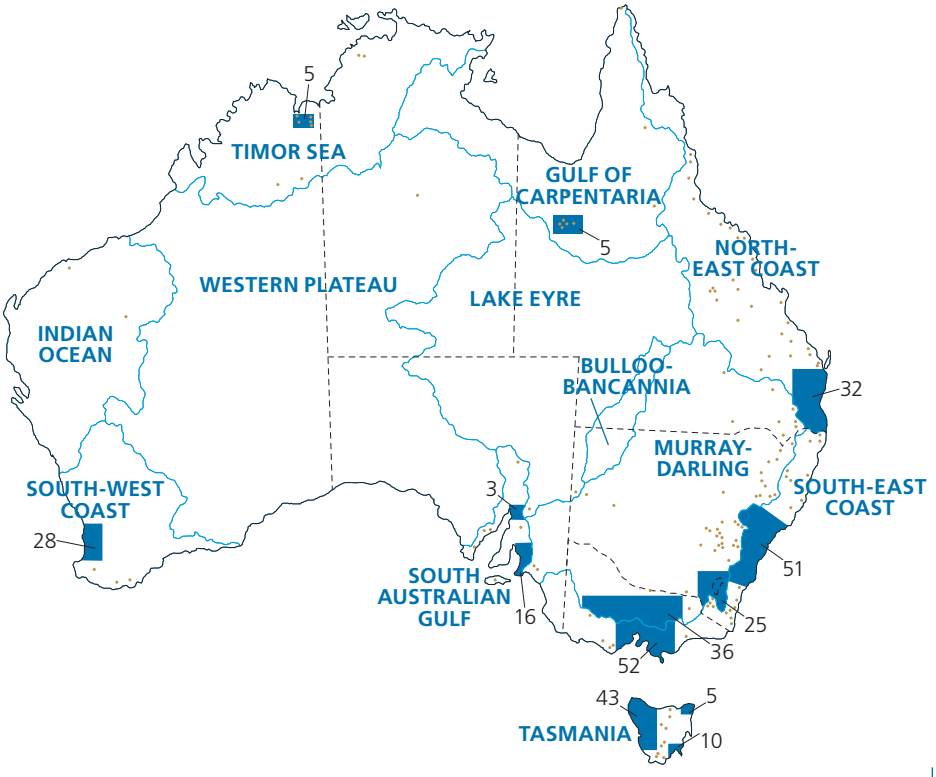
1 Land clearing has removed more than 85% of Eucalypt woodlands in Southern Australia. *Photo by Barry Traill*

2 A Diporiphora dragon, one of many species dependant on savanna. *Photo by Ian Morris*

1 Ord River irrigation channel.
Photo by Barry Traill

FIGURE 4.5 **LOCATIONS OF LARGE DAMS IN AUSTRALIA**

Large dams – with a crest height greater than ten metres – marked with dots or numbers for shaded areas indicate numbers of dams, blue lines identify river basins.



Source: Kingsford (2000).

Impacts of dams

One of the most significant changes humans can impose on the hydro-ecology of a landscape is the construction of large dams on major rivers. Australia has at least 446 large dams (crest height >10 m), which divert water from floodplain wetlands (Figure 4.5).

Dams can change aquatic vegetation, reduce vegetation health and reduce populations of waterbirds, native fish and invertebrates (Kingsford 2000). They can also cause some floodplain wetlands to become permanent storages, so that the naturally occurring plants and animals are replaced with species not tolerant of variable flooding regimes. Table 4.1 shows the number of large dams in water basins, and the percentage of divertible flow taken from each. Northern Australia has relatively few dams compared with other climatically humid water basins in Australia. Consequently, more of its floodplains and associated wetlands are intact.

An example of the potential impacts of large dams can be observed in the one of Australia's biggest dams, which is in the North: the Ord River Irrigation Area (ORIA). ORIA is a 150,000 hectare 'flow-through' irrigation scheme on the Ivanhoe and Packsaddle Plains near Kununurra. Irrigation waters diverted from Lake Kununurra are delivered by a gravity-feed system of channels. Agricultural effluent returns to the lower Ord River (via a drainage network). Maintenance of the 'hydraulic head' of water pressure, which is necessary for irrigation, restricts downstream water-flow patterns. Environmental impacts in the ORIA include high sediment loads due to sheet and gully erosion in the Ord River catchment, which reduce the water storage capacity of Lake Argyle; and inappropriate land and water management practices, which have effects on health and resource management. Water impoundment has reduced the distribution and abundance of barramundi to about one-quarter of their former range in the river (Doup and Pettit 2002).

Condition of rivers and catchments

The condition of Australia's rivers and catchments, including those of Northern Australia, has been comprehensively assessed in a recent study (Stein *et al*. 2002). This study calculated a 'River Disturbance Index', a measure of the impact of structures and human activities on river condition, in addition to the impacts caused by large dams. As with the vegetation condition index, a high value represents a high level of disturbance.

TABLE 4.1 **NUMBERS OF LARGE DAMS & PERCENTAGE OF DIVERTIBLE FLOW**

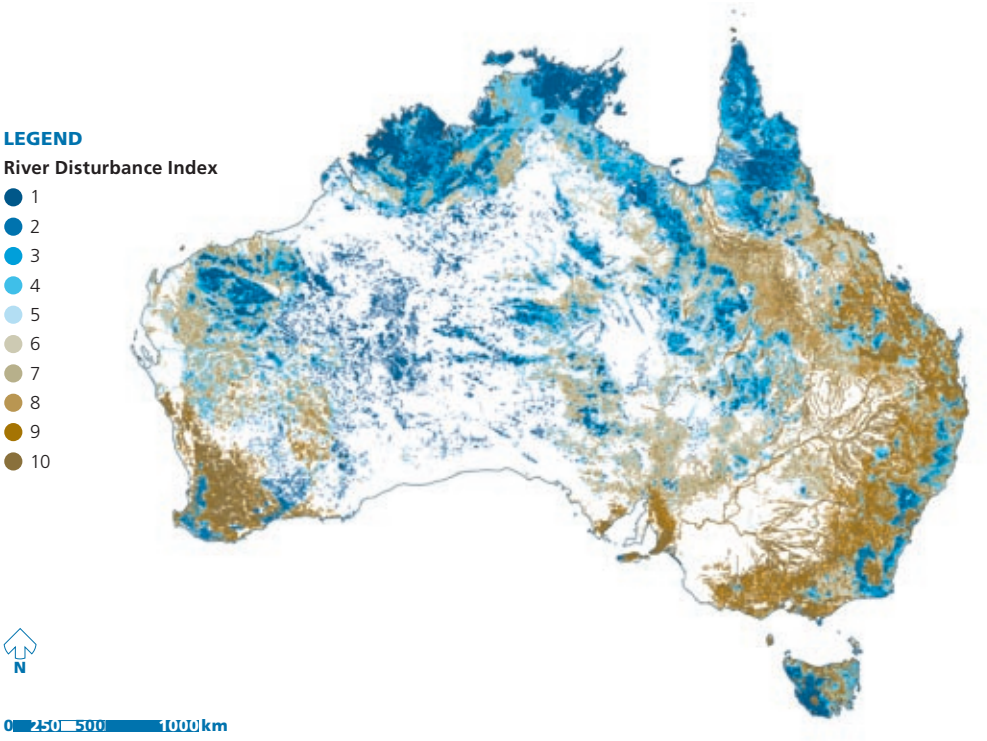
River basin	Number of dams (crest height >10 m)	Percentage of divertible flow (taken for human use)
North-east coast	63	16
South-east coast	128	28
Tasmania	70	9
Murray-Darling	107	81
South Australian Gulf	25	44
South-west coast	31	13
Indian Ocean	2	9
Timor Sea	9	9
Gulf of Carpentaria	8	1
Lake Eyre	2	13
Bulloo-Bancannia	0	0
Western Plateau	1	0
Total	446	21

Source: Kingsford (2000)

Figure 4.6a shows the River Disturbance Index for Australia. This map may be misleading, because many of the rivers are in arid Australia and do not support regular water flows. The exception is the Lake Eyre Basin, where water that originates in the summer monsoon rains of Northern Australia causes seasonal flooding in the channel country, occasionally reaching Lake Eyre. For this report, we compared the rivers of Northern Australia with other climatically humid zones, where a surplus of water is generated to support stream flow and groundwater recharge. Figure 4.6b shows these rivers in the humid zones and their disturbance index values.

FIGURE 4.6a **RIVER DISTURBANCE INDEX FOR AUSTRALIA**

Class 1 indicates rivers and catchments with a relatively high level of natural integrity. Class 10 indicates rivers and their catchments that have been highly altered and disturbed by human activity, including water impoundment and diversion, and degradation of the catchment's vegetation cover.



Source: Updated version of continental analysis by Janet Stein and colleagues (Stein *et al.* 2002).

From a continental perspective, it is clear that Northern Australia retains the largest expanses of intact rivers and catchments in the continent. Across Northern Australia, the land cover of most water catchments remains in relatively good condition and there has been little alteration to the flow regime from impoundments, flow diversions or discharges and levee banks. Natural river processes associated with hydrological, geomorphological and biological activity remain largely intact across most of Northern Australia, with profound implications for the conservation of biodiversity and associated natural values.

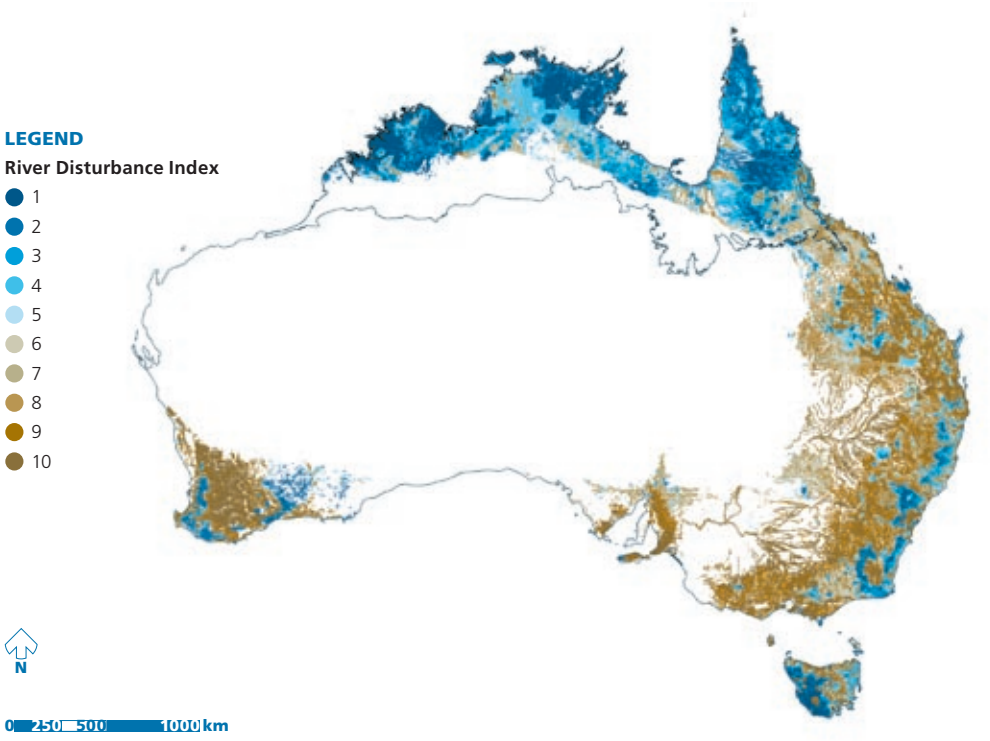
For Southern Australia, the general picture is of major degradation to river systems, with most rivers in poor condition. There remain some rivers with a high level of natural integrity, but these are largely restricted to some forested landscapes in mainland southern Australia and south-west Tasmania.

Any detailed assessment of the characteristics of the rivers of Northern Australia is hampered by the lack of suitable data. The Australian government undertook a data audit of Australia's northern rivers, including associated wetlands, estuaries and floodplains within a catchment and land use context (NGIS 2004). One main conclusion was that information about water resources is limited and incomplete for large parts of remote Northern Australia. For example, data are insufficient to understand disturbance and point-source pollution in the region, existing riparian (river bank) vegetation data are at too coarse a scale, and spatial data about inland fish is lacking. The lack of fine-resolution data means that certain environmental impacts on river condition (including the impact of feral animals) could not be factored into the River Disturbance Index.

The general picture of good condition of rivers in Northern Australia relative to those elsewhere on the continent is also supported by studies that

FIGURE 4.6b **RIVER DISTURBANCE INDEX WITHIN THE HUMID CLIMATIC ZONE**

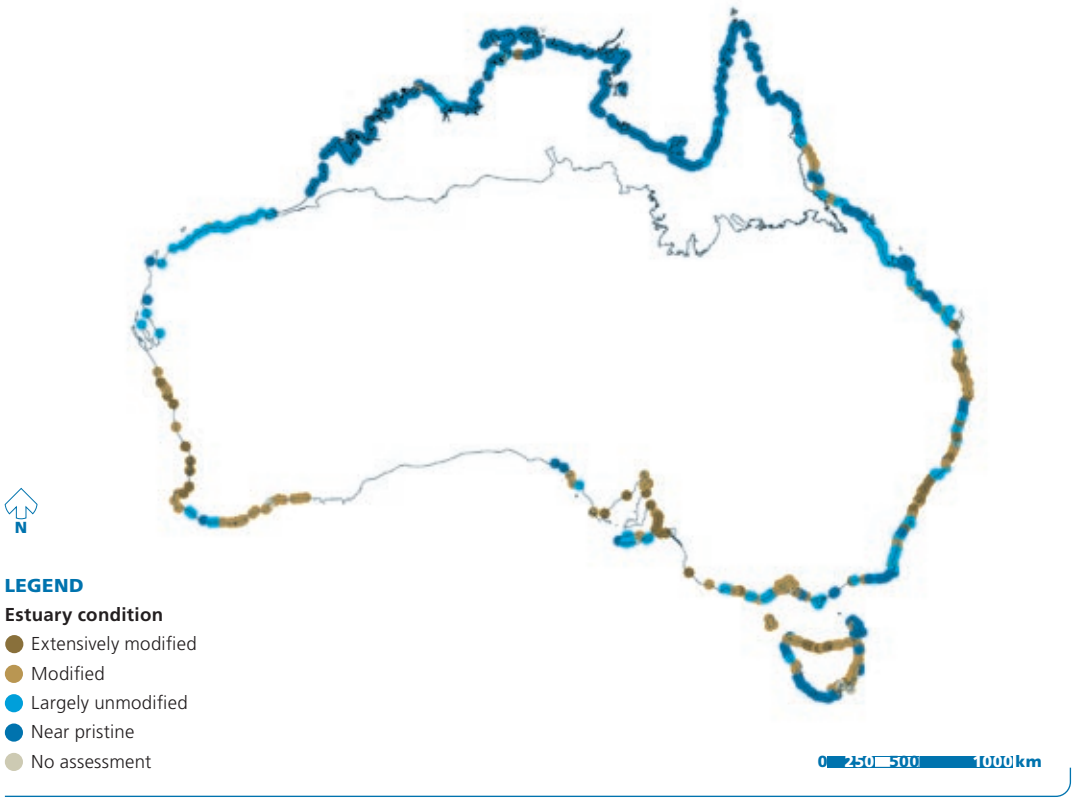
Index classes as for Figure 4.6a. Shown only are river disturbance conditions for humid areas where a surplus of water is generated to support stream flows and groundwater recharge. The boundary of Northern Australia is also shown.



Source: Updated version of continental analysis by Janet Stein and colleagues (Stein *et al.* 2002).

1 Nypa Palm Forests, Cape York Peninsula. *Photo by Kerry Trapnell*

FIGURE 4.7 **CONDITION OF ESTUARIES IN AUSTRALIA**



Source: Land & Water Australia Audit 2004.

have systematically examined the integrity of aquatic biodiversity. Such studies (e.g. Dostine 2002) demonstrate that aquatic plant and animal communities in most Northern Australian rivers remain in largely natural condition, a feature atypical of rivers nationally or internationally.

Health of estuaries

Estuaries are coastal ecosystems where rivers meet the sea. They vary greatly in shape and form depending on the influence of river flow, tidal flow and waves. Estuaries are key habitat for a number of marine and freshwater species. The major estuaries on the coast of Northern Australia provide significant habitat for one of the densest populations of saltwater crocodiles in the world, and feeding and/or breeding areas for seabirds, waterfowl and shorebirds, dugongs and marine turtles.

Land and Water Australia recently completed an analysis of the condition of Australia's estuaries. The analysis was based on a range of biological and physical data sets and expert opinion.[3] The results from this study are presented in Figure 4.7, which shows that most estuaries in Northern Australia are in a 'near pristine' condition, contrasting strongly with southern Australia. This is largely because estuaries in Northern Australia have a high proportion of natural vegetation cover in their catchments; minimal changes to hydrology in the catchment; no changes to tidal regime; minimal disturbance from catchment land use; minimal changes to floodplain and estuary ecology; low impact human use of the estuary; and minimal impacts from pests or weeds.

The Land and Water Australia analysis also considered the economic and social benefits that are derived regionally from these natural values, which include cultural values, pearl aquaculture, commercial (prawn and finfish) and recreational fishing, safaris, eco-tourism and traditional harvesting.

Landscapes and seascapes in good environmental condition provide invaluable environmental services to a broad range of users. One such example is in the extent to which recreational and commercial fisheries depend upon the

3 Details of the datasets and methodology used in the estuary condition assessments are at www.lwa.gov.au/downloads/publications_pdf/PR040674_p55-58.pdf)

maintenance of productive and healthy marine environments, with this condition itself dependent upon that of the landscapes that fringe estuaries and make up the catchment as a whole (see box *'Comparing the state of Australia's woodlands'* on page 52).

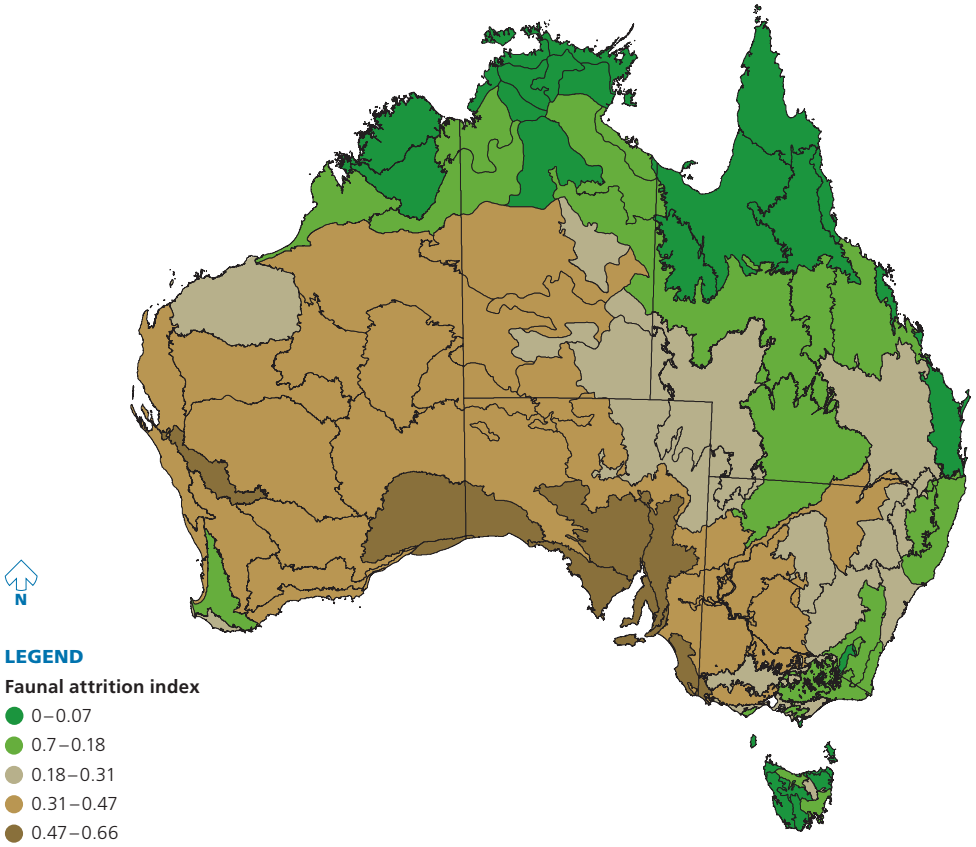
THE NORTH AND AUSTRALIA'S BIODIVERSITY

A range of national analyses has examined the state of Australia's biodiversity (e.g. Land and Water Australia 2002; Australian government 2001, 2006), however the data are limited by the lack of any comprehensive, long-term and systematic monitoring programs. The component of Australia's biodiversity that has fared worst since European settlement has been the highly distinctive native mammal fauna. Of about 310 species present at the time of European settlement, 22 native mammal species are now extinct and a further ten species have had their formerly extensive continental ranges eliminated and they now occur only on a small number of offshore islands. Australian species comprise about one-third of the world's mammal species that have been lost in modern times.

The pattern of loss of Australian mammal species is notably geographically uneven (Figure 4.8). Losses – mostly of wallabies, bandicoots and larger rodents – have been most pronounced in arid and semi-arid areas, and in the more intensively developed areas of eastern, southern and south-western Australia. By far the most intact native mammal faunas are in Northern Australia and Tasmania. It is only in these areas that one can see mammal communities much as they were 200 years ago.

FIGURE 4.8 **DECLINE OF AUSTRALIA'S MAMMALS**

The numbers refer to the proportion of mammal species in each bioregion that have disappeared from more than half of that region.



Source: National Land and Water Resources Audit, Assessment of Terrestrial Biodiversity 2002 Database.

In part, these losses have been due to the spread of introduced mammals, and in particular the fox. With the recent (lamentable) introduction of foxes to Tasmania, it is only Northern Australia that has proven unsuitable for, or uninvaded by, the fox. The story is broadly similar for that other great pest, the rabbit.

There is no comparable continental analysis for other animal or plant groups, but the trends are probably broadly analogous, if less catastrophic than for mammals. A series of recent analyses have demonstrated broad-scale decline of birds in most temperate woodlands (e.g. Ford *et al.* 2001), whereas woodland bird communities remain reasonably intact in Northern Australia (Garnett and Crowley 2000; Sattler and Creighton 2002).

Another marker of the natural integrity of environments is the proportion of introduced (naturalised) plants in a region. While Northern Australia has some significant problems with introduced plants, in general the plant communities are far more intact than is typical in other parts of Australia (Table 4.2).

CONCLUSION

Australia is the only economically developed and politically stable nation containing extensive areas of tropical savanna with a high level of natural integrity. From a national perspective, Northern Australia's vegetation is also significant, as it retains savanna woodlands, rivers and estuaries with a high level of natural integrity, unlike the more environmentally degraded south. In turn these relatively intact vegetation types support plant and animal communities that are generally more intact than those elsewhere in Australia.

1 Gulf Country aerial. *Photo by Wayne Lawler*

TABLE 4.2 **WEEDS IN AUSTRALIA**

Region	Number of native plant species	Number of naturalised non-native plant species	Percent of non-native (%)
Australia[a,b]	20,500	2700	12
Northern Australia			
Kimberley, species[c]	1977	108	5.2
Kimberley, including varieties[d]	2647	254	8.8
Kakadu (Alligator Rivers Region)[e]	1773	99	5.3
Top End (NT)[f]	3186	233	7.3
Set of 57 islands off north-eastern Arnhem Land[g]	665	19	2.8
Cape York Peninsula[h]	3538	274	7.2
Gulf Plains (Qld)[h]	1961	140	6.7
Comparative areas elsewhere in Australia			
Western NSW[i]	~1514	~403	21[b]
New South Wales[j]	6539	1292	16.5
Victoria[k]	3709	1191	24.3
South-western Australia[d]	8419	1051	11
Tasmania[l]	1773	729	41

Sources: a Groves *et al.* 2003; b Cork *et al.* 2006; c Wheeler *et al.* 1992; d WA FloraBase http://florabase.calm.wa.gov.au; e Brennan 1996; f NT Herbarium, I Cowie (*pers. comm.*); g Woinarski *et al.* 2000a; h QEPA Wildnet; i Grice 2000; j PlantNet – Plant Information Network System of the Botanic Gardens Trust Version 2.0 http://plantnet.rbgsyd.nsw.gov.au; k *A Census of the Vascular Plants of Victoria,* published by the National Herbarium of Victoria, Royal Botanic Gardens, Private Bag 2000, Birdwood Avenue, South Yarra Vic 3141, Australia, www.rbg.vic.gov.au/static/viclist/viclist_ed7.pdf; l M Duretto (*pers. comm.*).

Therefore, Northern Australia stands out as a unique global asset, with nearly a third of the total area of remaining intact tropical savanna, and the largest and the most intact expanses left on Earth. Throughout the world's tropical savanna, the expansion and intensification of human populations, crops and domestic stock are all taking their toll on the natural integrity of these landscapes. The prospects for what remains are often bleak. The African countries with the largest amounts of intact tropical savanna are among the 50 poorest nations on Earth. They include Angola, the Central African Republic, Chad, Sudan and Zaire, all of which have long histories of colonial exploitation, civil war and violence. Achieving conservation goals for only a few years in such countries is fraught with uncertainty, as their people struggle to improve their economic, social, environmental and political situation, and secure their basic human rights and needs. Put simply, the quality of the natural landscapes of Northern Australia are now very rare on Earth.

In following chapters we discuss the threats to the values of the North and what is needed to mange and protect them in the long term.