A SUSTAINABLE FUTURE FOR NORTHERN AUSTRALIA

PROTECTING THE NATURAL LEGACY

In part through the good management of the North by many of its landowners, in part because historical attempts at intensive development have been limited and fitful, and in part because of some resilience in the landscape itself, we have been gifted a great natural legacy – the largest intact savanna remaining on Earth, an extraordinarily vast, natural landscape with a rich biodiversity of international significance. The challenge is to ensure that this legacy is appreciated, respected and retained.

This legacy provides an unusual opportunity to live in and use an extensive landscape, sensibly and sustainably. We can be guided by the benefits of good knowledge of the ecological limitations of this land and by the lessons from elsewhere of the consequences of unsustainable development. There are few comparable opportunities in the world.

We take as our starting point that Australians do not want to repeat the environmental mistakes of the South, but rather want to maintain the North's natural legacy, while also enabling appropriate economic development to meet communities' needs and aspirations. This chapter considers how such a future may be achieved.

CONSERVATION PLANNING

Historically, the environmental values of Northern Australia have been discounted, and the environmental impacts of economic activities in Northern Australia generally overlooked. The rationale occasionally put forward has been that with so much land, water and bush there is simply no need to be concerned about any local impacts. More recently, it has become mandatory to assess the local environmental impact of large site-specific projects such as mining. However, the process frequently ignores cumulative environmental impacts outside the immediate local district. Similarly, the widespread and pervasive impacts from activities such as pastoralism are rarely assessed, and the cumulative effects of many small changes to the environment in a region are not considered. Instead, it is assumed that there is abundant land to cater for natural values somewhere else.

These are symptoms of a reactive approach to land use and conservation planning; an approach

1 *(Previous page)* Egrets, Northern Australia. *Photo by Wayne Lawler*

2 Steven Murphy, carrying out burning for habitat management, Mornington Station, Kimberley. *Photo by Alex Dudley*

3 Short-eared Wallaby *Petrogale brachyotis*. *Photo by Glenn Walker*

characterised by ongoing episodes of narrowly focused considerations, usually in response to specific acute development pressures. Here, we argue that this is not strategic, and will result in the incremental erosion of conservation values. Instead, we propose that a sustainable future for Northern Australia can be achieved only through broad-scale and long-term planning, in which primacy is given to the national and international significance of the natural landscapes of Northern Australia.

The conventional target-based approach to conservation planning

Elsewhere in Australia, and overseas, conservation planning has largely focused on a land allocation process, where a portion of the available land parcels is set aside as National Park, largely surrounded by lands not managed for conservation.

This conventional approach typically focuses on achieving, as efficiently as possible, a target level of protection through reserves, National Parks or other protected areas. This target is based on the reservation of representative samples of each class of ecosystem that can be mapped (in practice, usually defined in terms of major vegetation types); critical habitat for, or populations of, particular target species (typically threatened plants and animals); and other specified special features. Conservation targets are usually expressed as a nominated percentage level; for example, many planning exercises seek to protect within conservation reserves 10–30% of the historic extent of every vegetation type. The regional conservation objective is that this set of conservation lands comprises a comprehensive reserve network. This approach has been advocated in parts of Northern Australia (e.g. Burbidge *et al*. 1991; Price *et al*. 2000).

Assumptions underlying this approach are that:

- Target levels are scientifically robust, and reservation to that target level will provide long-term security for the represented biodiversity;
- The environmental layer used in target-setting provides a good surrogate for the distribution of most elements of biodiversity;
- A relatively small network of protected areas can ensure the long-term conservation of biodiversity at all levels (genetic, species, ecosystem), and will be reasonably insulated from the impacts of the surrounding, majority land uses;
- Natural values can be traded-off against competing land uses by identifying alternative locations (e.g. habitat loss at one location can be compensated by protecting habitat at another location); and
- There are enough land parcels available to set aside within conservation reserves the full suite of environments.

Why the conventional approach will fail in the North

Unfortunately, these assumptions are often invalid, and the approach has major problems, most evident in largely natural intact landscapes. Land use allocation exercises may rapidly descend into arguments over site-specific issues – the demonstrable value of a particular site considered in isolation. In such debate, the currency of conservation values is often difficult to match against that of an explicit or perceived economic value. The end-result and typical aim of this approach is usually a landscape dissected by contrasting land uses, with isolated conservation areas scattered throughout a landscape largely transformed by modern land use activities. Generally, these conservation areas are too few in size and number, and are in areas of low value to other land users (often because these are infertile, too steep, or otherwise of low productivity).

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Further, the approach was designed to wring some conservation outcome within regions that typically had been largely fragmented and disturbed, where dedication to conservation reserves of some of the remaining patches of native vegetation was the least worst of the limited conservation options possible. For the intact landscapes of Northern Australia, the conventional approach of focusing conservation effort towards establishment of National Parks representing 10–30% of the extent of every vegetation type implies that the dominant 70–90% of the landscape may lose its conservation attributes.

Elsewhere in Australia (and in some locations in Northern Australia) the failure of conservation planning to take into account the ecological processes and connections that make the landscape work and keep it healthy has caused major environmental problems. The environmentally harmful effects of unsustainable land management in the Murray-Darling basin and the south-west of Western Australia are well documented. Failure to protect hydro-ecological processes has caused salinity and degraded rivers; as a result, there are major salinity issues on farmland, and many nomadic and migratory species have greatly declined due to the removal and degradation of key habitats.

In most cases, the degradation of ecological processes is due to the accumulated impact of incremental changes that alter the country (e.g. another paddock sown to exotic pasture grasses, a few more megalitres diverted for irrigation, another patch of tree clearing), repeated tens or hundreds of times over a region.

Although an extensive network of protected areas is a necessary component of the long-term maintenance of the natural values of Northern Australia, it will not be sufficient for their protection. In particular, a conventional

approach that focuses on just achieving target levels of protection will not provide a sustainable future for Northern Australia, because:

1. It fails to incorporate the landscape-wide ecological processes that sustain natural values. For example, however large the protected area network may be, many critical natural values will depend for part of the time on lands and resources outside conservation reserves. Ultimately, species and other natural values within isolated conservation lands will decline and degrade as the ecological connections that they depend upon break down.

2. This approach does not recognise nor maintain the greatest conservation asset of Northern Australia – its extensive landscape connectedness and intactness.

3. There is little unallocated land available. In contrast to conservation planning in most temperate regions of Australia, where new conservation reserves can be created from 'vacant' crown land or lands long established as forest reserves, there are existing proprietal interests in almost all lands in Northern Australia.

An alternative approach – managing across the landscape

A new approach to conservation, land management and land use has been developed in sparsely-populated and largely natural extensive landscapes in North America (Soulé and Terborgh 1999), and subsequently re-tuned for Australian conditions (Soulé *et al.* 2002; Mackey *et al.* 2007). This approach is based on the maintenance of ecological processes and emphasises the maintenance, or in some cases restoration, of large-scale connectivity of natural ecosystems. It advocates the development of collaborative partnerships for land management across landholders and promotes the establishment of significant conservation reserves as the core areas of an interconnected conservation network. And, the approach supports the development of a conservation economy, including livelihoods associated with land management.

Within Australia, a major government review recently advocated such large-scale collaborative conservation planning as a necessary response to attempt to reverse ongoing biodiversity decline (Natural Resources Policies and Programs Committee Biodiversity Decline Working Group 2005). It is far more feasible to attempt to implement such an approach in Northern Australia than almost anywhere else in the nation.

The likely impact of global climate change further emphasises the need for conservation to be based on large-scale connectivity, because smaller and more isolated conservation reserves can be expected to come under increasing pressure.

Here, we draw upon these initiatives and propose that the sustainable future of Northern Australia must be based on inverting the conventional planning approach of leaving to conservation the residues or samples left over after other land uses have taken their priority picks (Nix 2004). Instead, we propose that maintenance of the natural landscapes, with their full suite of natural values and processes, should explicitly underpin the sustainable future of Northern Australia.

From this premise, we derive a series of guiding principles for Northern Australia:

1. *The natural environments must be valued recognising their national and international significance;*

2. *The ecological integrity of the processes that support life must be maintained;*

3. *The population viability of all native species must be protected;*

4. *Thresholds defined by the limits to ecological integrity, including cumulative impacts, must be used to assess and guide development options; and*

5. *The contributions of all property-holders and managers are needed to maintain the North's natural values.*

It follows from these principles that connectivity of natural vegetation and waterways must be maintained at property and regional scales. Biodiversity and links of interconnecting ecological processes occur on all lands and waters, and all properties, in Northern Australia. All property-holders and managers have the opportunity to enhance or degrade the natural values on their properties, and thus on the properties and landscapes around them. Society should expect a reasonable level of sustainable management by property-holders, and beyond that provide incentives for proactive environmental management.

1 Fishing of all types depend on healthy rivers and catchments in Northern Australia. *Photo by Larelle McMillan*

2 Rangers Vince and Simeon Lalara carrying out turtle track counts in 2006 on Angwardinumanja Island. *Photo by Simon Hartley*

LIVING IN THE LAND

The sustainability and conservation planning approach described here is not about locking up land, keeping people out, stopping economic development, nor keeping Aboriginal landholders in stasis. For a range of compelling social and economic reasons, the North requires development, and the conservation management of Northern Australia will require substantial funding. However, if the natural values of the North are to be retained, then that development must fit the nature of the country.

To ensure the long-term protection of the North's natural values, priority should be to develop and improve the economy in ways that are compatible with the North's environment. In particular, further support is needed for developing the 'conservation economy', that is, income-generating economic activities that provide employment opportunities and benefit the environment, such as management of parks and control of invasive plants and animals. These kinds of natural resource management activities provide benefits for all Australians – ensuring a natural base for northern tourism and for commercial, recreational and Indigenous fisheries. Indeed, such activities are already a significant part of some regional economies in the North. In some communities, the conservation economy may also provide direct social benefit through alleviating underemployment, through maintaining cultural traditions and strength, and through improving health. Such social benefits will serve to improve outcomes from, and reduce economic costs associated with, the current delivery of health and welfare services. The benefits of such conservation management investments on Indigenous lands is increasingly being realised, and funded, by national and state governments (e.g. $48 million has been allocated in the 2007 national budget over four years for the *Working on Country* program), and the Indigenous Protected Areas program is recognised as

1 Recreational fisherman, Yellow Waters, Kakadu National Park, Top End. *Photo by Larelle McMillan*

a particularly cost-effective, successful and productive government investment – indeed, one of the few success stories for Indigenous engagement (Gilligan 2006).

Other landholders may also derive an income stream and economic gain from conservation management and the indirect economic benefits that flow from environmental sustainability. Some lands that are currently managed for pastoralism may derive more income from nature tourism or from a biodiversity conservation focus. It is now a reasonable community expectation that all landholders contribute to preventative management of weeds and pests, which in many cases may otherwise pose substantial economic costs to many industries (e.g. the annual cost of weeds to Australia's livestock industries has been estimated at $315–345 million: Sinden *et al*. 2004). Where such management is beyond a reasonably expected duty of care, funding should be available to landholders for such work through an expanding range of environmental stewardship options (e.g. Australian government 2007).

Payments to landholders and management agencies for looking after the environments of Northern Australia may be seen by some as a parasitical burden on the economy of the nation. However, as well as the environmental benefits, such payments should be considered in relation to the social benefits they bring to deprived and impoverished communities that characterise much of the North. Additional considerations are the maintenance of a natural asset of tangible value for international tourism and the landscape health on which most resource-dependent industries depend. It can also be justified as an offset for the environmental degradation that has been a consequence of the intensive economic development of temperate Australia.

Increasingly, well-managed and extensive areas of natural vegetation may be expected to provide economic and other social benefits through the

TROPICAL SAVANNAS, FIRE & GREENHOUSE GASES

The tropical savannas of Northern Australia are subject to frequent, extensive fire. These fires produce substantial emissions of greenhouse gases (GHGs), such as carbon dioxide, carbon monoxide, methane and various oxides of nitrogen. Nationally, this savanna burning contributes about 3% of Australia's national GHG emissions. Regionally, these emissions may be very significant – for example, they represent about 50% of the Northern Territory's countable emissions.

Pivotal to understanding how different fires have different effects in the landscape is the 'fire regime' concept. This concept recognises that fires are recurrent, and that the season, intensity and frequency of fire will vary from place to place. Fire regimes are shaped by variations in climate and topography. They are also influenced by the growth rates and flammability of plants. And of course they can be modified by humans.

Emissions of greenhouse gases will vary with fire regime. In Northern Australia, fires in the late Dry season may be extensive and intense, resulting in widespread consumption of dead and living biomass, including litter, logs, grass, shrubs and trees. Intense fires can kill woody plants, particularly trees which store much carbon. All other things being equal, such late Dry season fires result in relatively high greenhouse gas emissions. In comparison, fires in the early Dry season are relatively low in intensity, consume less fuel, and are generally smaller. Consequently emissions of greenhouse gases are lower from these fires than late Dry season fires.

Plants take up carbon dioxide from the atmosphere by photosynthesis, and store it in living tissues (e.g. tree trunks and roots) or in the soil. Carbon dioxide is returned to the atmosphere by respiration (in the plants themselves, and the soil), by animals, both vertebrates and invertebrates (notably by termites), and by fire. The balance between uptake and loss is sometimes referred to as the carbon 'sequestration' potential – if more carbon is taken up than lost over time, carbon is said to be sequestered.

Under the current Australian Greenhouse Office accounting procedures for the national inventory of greenhouse gases, savanna fires are assumed to be carbon neutral. That is, it is assumed that carbon lost by Dry season fires is balanced by carbon uptake the following Wet season. This is not necessarily the case and current research is quantifing the sequestration capacity of savannas, and its sensitivity to variation in fire regime.

Our current estimates (e.g. Chen *et al.* 2003; Williams *et al.* 2004, 2005; Cook *et al.* 2005) suggest that for the *Eucalyptus miniata-tetrodonta* savannas, which are very extensive in the higher rainfall areas of Northern Australia, more carbon is sequestered than lost back to the atmosphere, with this amount increasing when fires are less frequent, intense or extensive. That is, these savannas are carbon sinks. Importantly, the sequestration capacity can be increased if fire frequency is decreased. However, if the savannas are subjected to repeated late Dry season fires, they become a net source of carbon.

Knowing that GHG emissions and the sequestration potential of savannas are sensitive to fire regime, and that fire regimes can be manipulated by people, means that the people of Northern Australia have the opportunity to reduce GHG emissions by managing fire better. This can be done, in particular, by using prescribed fire early in the Dry season to decrease the extent and intensity of fire later in the Dry season, which in turn decreases fire frequency.

Managing fire for abatement of greenhouse gases by decreasing fire extent and frequency brings with it several collateral benefits. These include biodiversity benefits, because a number of plant and animal groups in the savannas are likely to benefit from reduced fire extent and frequency.

There are also commercial benefits. The GHG abatement that could be achieved in places such as Arnhem Land, the Gulf and the Kimberley amounts to millions of tonnes of greenhouse gases per year. This compares very favourably to other national GHG abatement projects which are already operating commercially. For example, in 2004, five million tonnes worth of carbon credits were available to use the under the New South Wales Greenhouse Gas Abatement Scheme (NSW NGAS). GHG abatement in the savanna region through improved fire management is also cheaper per unit CO_2 than many carbon capture and storage schemes in the energy sector (~$10 per tonne vs ~$50). Hence, savanna abatement enterprises may become highly sought after by national and international investors.

These abatement scenarios present real economic opportunities for Aboriginal people, who own extensive areas of the savannas, have the capacity to deliver on-ground fire management, and who are indeed currently engaged in abatement activities. This is an obvious win-win outcome.

There are threats to achieving this abatement potential however. One in particular is the undoubted capacity of exotic pasture grasses such as Gamba Grass to establish, spread and thicken in the savannas. These highly productive grasses lead to hotter, more destructive fires than those fuelled by native grasses. This leads to greater emissions of GHGs and, through higher mortality of trees, a reduction in the capacity of savannas to sequester carbon. This is clearly a lose-lose scenario, and provides an additional reason for controlling the spread of exotic grasses.

Dick Williams, CSIRO Sustainable Ecosystems, Darwin and CRC for Tropical Savanna Management

1 Setting fire to vegetation while walking through central Arnhemland: an example of natural resource management that has clear benefits to both human and landscape health. *Photo by Fay Johnston*

carbon economy. Markets for carbon trading in Australia are currently under development. In Europe, carbon trades typically from $5–30 per tonne per year (Bayon *et al*. 2007). The savanna woodlands of Northern Australia currently operate as a carbon sink, with about one tonne gain of carbon sequestered per hectare per year (Williams *et al*. 2004). With appropriate land management, these carbon stocks can potentially provide a substantial source of income, given the vast extent of intact savanna woodlands in Northern Australia, especially if a monetary value is placed on protecting extant carbon stocks. This carbon resource can be substantially affected by vegetation clearance, fire regimes, and livestock. The box on the previous page describes one case where fire management to reduce greenhouse gas emissions in savanna woodlands provides a substantial and recognised economic benefit, as offset for a large petrochemical emission source. This case may prove to be a forerunner of a more general situation, whereby the influence of a carbon market shifts the relative economic value of different land uses in favour of enhanced conservation management rather than pastoralism or intensive use based on substantial modification of natural landscapes (Ockwell and Lovett 2005). A further consideration will be the substantial greenhouse gas costs associated with methane from cattle production (about 1.7 tonnes of CO_2 equivalent per head per year, www.ago.gov.au).

STORIES FROM THE LAND

This section provides stories from people making a living from the country in sustainable ways.

The Healthy Country Healthy People project

The future of Australia's landscapes and biodiversity cannot be considered without specific consideration of Indigenous lands and people. Internationally significant landscapes, most within inalienable Aboriginal communal titles, amount to an area the size of NSW in the Northern Territory alone. While Northern Australia has unparalleled opportunities to avoid treading the same path of environmental ruination as southern Australia, without active management, wildfires, weeds and feral animals will degrade these lands.

Indeed, a core problem in managing Northern Australia is the recent depopulation of Indigenous people from their lands that has almost uniformly resulted in unemployment, poverty, ill health and social disruption. Will there be a continuing decline in biodiversity and Indigenous wellbeing in the North mirroring the 19th and 20th Century trends of southern Australia? Or can Indigenous participation in land management activities result in nationally significant benefits to both Northern Australian landscapes and Indigenous health?

The Healthy Country Healthy People project sought Indigenous views about these issues in Northern Australia. In addition it conducted empirical ecological research comparing indices of landscape health under contrasting land management regimes (Indigenous, non-Indigenous and mixed), and epidemiological research evaluating how the health and wellbeing of individuals is affected by engaging in natural and cultural resource management in either traditional or contemporary ways.

The project has provided evidence supporting Indigenous assertions that the wellbeing of people and country are fundamentally connected. Being on country not only provides ongoing and essential management of lands, it provides opportunities for increased physical activity, improved diet, mental wellbeing and fosters cultural and spiritual identity (Franklin *et al.* 2007, Johnston *et al*. 2007). Moreover, higher levels of engagement with natural and cultural resource management were found to be significantly associated with lower risks

of diabetes and heart disease, conditions that collectively account for 40% of excess Indigenous mortality (Garnett and Sithole 2007). Similarly a recent review of the Indigenous Protected Areas Program, which supports Indigenous land management for achieving national conservation goals, found that the majority of participating communities reported a range of positive changes including reduced substance abuse, increased school attendance and other indicators of social wellbeing (Gilligan 2006).

Dr Fay Johnston
GP and Medical Health Physician,
Menzies Research Institute

Kaanju Ngaachi Wenlock and Pascoe Rivers, Cape York Peninsula

Homelands and economic development aspirations

I am a Traditional Owner for Kaanju Ngaachi, which encompasses some 840,000 hectares of country centred on the Wenlock and Pascoe Rivers in Central Cape York Peninsula, Northern Australia. We have re-established a permanent community on our Ngaachi at Chuulangun, and have worked hard to ensure the reoccupation of our homelands is sustainable and consistent with Kaanju land management principles. Our ancient governance and cosmology underlie all aspects of Kaanju relationships with homelands and also determine contemporary management of country. Cultural, environmental, economic and social factors cannot be separated as they are all integrated into sustainable land management.

This philosophy is reflected in the comprehensive Management Plan we have developed for our Ngaachi. The Plan sets out the management regime for Kaanju Ngaachi, describing current and future plans for homelands and economic development, including the establishment of an Indigenous Protected Area. An important aspect of our vision is the development of homelands-based economic enterprises that enhance sustainable land management and provide support for our growing homelands community into the future. We are also working with non-Indigenous landowners in the region to enhance sustainable land management and industry to improve livelihoods on country. The establishment of campgrounds and tourism-based activities, the investigation of micro-enterprise based on the sustainable use of Indigenous plant medicines, and a native plant nursery are a few of the many enterprises we are developing on Ngaachi.

Our vision is to conserve, protect and enhance the values of our Ngaachi by way of sustainable land management based on Indigenous governance and cosmology and, at the same time, to benefit economically from our Ngaachi. Integral to the achievement of our vision is recognition and investment from the government and non-government sectors of proper Indigenous governance, land management and the re-establishment of Indigenous people on their particular Homelands.

David Claudie
Kaanju Traditional Owner
Chairman, Chuulangun Aboriginal Corporation,
Cape York Peninsula
www.kaanjungaachi.com.au

2 Fencing of a significant Kaanju cultural site. *Photo by Chuulangun Aboriginal Corporation*

3 Traditional Owners collecting seeds for revegetation project. *Photo by Chuulangun Aboriginal Corporation*

4 David Claudie on the upper Wenlock River. *Photo by Chuulangun Aboriginal Corporation*

Bininj dja Balanda – working together

Early burning ngarri-wurlhke ka-wurlhme kondah this Arnhem Land. Ngarri-wurlhke bu yekke, bangkerreng ka-yakmen.

Kunwern ngarrih-nani bu TV every city runguhruyi bedberre. Eli arri-wurlhke man-wurrk minj ngarri-djalbawon man-djewk dja man-djewk wardi ka-wurlhme.

Djarre ka-birlire wardi ka-bolkrung, dja Bininj kabirri-rung.

Kamak nganekke ngarri-djare yiman ka-yime ngayi nga-djare.Yawurrinj ba kabirri-durrkmirri kabarri-wokihme kamakNgarrbenbukkan yawurrinj ba bu kabirri-bengkan like ngad maitbi ngarri-danjbik ngarri-dowen.

Wanjh yawurrinj kabirri-bolknahnan kun-red. Karri-djarrkdurrkmirri Balanda dorrengh, ba Balanda kun-wok bedberre dja ngad ngarri-bulerri kun-wok ngarri-wokdi.

Dja Balanda ngandi-bidyikarrme nawu ka-bengkan kun-wale dja kun-wok ngadberre, birri-wern Balanda minj kabirri-bengkan KunwinjkuBu ngayi nga-djare wanjh kunred Bininj ngarri-marnbun, dja Balanda, Balanda law or Bininj law, ngarduk law.

Here in Arnhem Land, we are burning the country early in the year before the hot season. Fires are lit early here.

A lot of times we have seen on the TV, homes in the southern cities have been destroyed by fire. That's why it's important to burn early (after the Wet season) and not to let fuel build up year after year and that is what we do. If this is not done, the fires will travel all over the country for long distances and people will be injured.

This (fire management project) is a good thing and is something we have all wanted. I have really wanted to see this. Proper jobs! Our young people are finding work as rangers. This is a good thing!

We elders need to teach these young people, because when we have died then it's up to young people to look after the country.

And we need to work together with non-Aboriginal people but using both languages. And working with people who are bi-cultural because many non-Aboriginal people do not know our language.

I want it that way. I wanted a place where both Aboriginal and non-Aboriginal people are together – a combination of Aboriginal and non-Aboriginal laws/culture.

(Lofty) Bardayal Nadjamerrek AO

Extract from Catalyst program interview, May 2006, Kabulwarnamyo. Transcription of, and translation from, Kundedjnjenghmi dialect of the Bininj Kunwok language, Dr Murray Garde.

Bringing back the managers

Today a line of longitude and a massive disparity in land management funding separates the stone country of Kakadu National Park from the rest of the Arnhem Land Plateau. The deeply dissected sandstone plateau, with spectacular gorges, jungles, ancient *Allosyncarpia* patches, heathlands and upland forests represents the biodiversity crown jewels of the Northern Territory and is a globally recognised centre of plant diversity.

Despite supporting this extraordinary biological richness, the Arnhem Plateau's soils, climate and ruggedness did not draw the pastoral settlement which saw one group of land managers and land management objectives replaced by others across much of the northern savanna. Instead, the Aboriginal people of the plateau were steadily drawn off their lands from the late nineteenth century until, by the mid-1960s, only a few families persisted on country. Tobacco, medical treatments, flour, sugar and a variety of trade goods drew people. Some found work on pastoral properties, some were encouraged to settle in government settlements and although knowledge of country, both physical and spiritual, persists amongst the plateau diaspora, physical connection and customary land management fell away quickly for many clans.

But now a small group of elders who were born on the plateau, and who represent a precious link with an ancient tradition, are trying to bring back effective Aboriginal management to a largely empty land. A partnership of Indigenous knowledge and science, Aboriginal landowners, government and private enterprise, is underpinning a movement towards a vision of 'healthy country and healthy people'.

Fire has been a focus for the partnership as scientists and Indigenous experts acknowledge the change to destructive and unsustainable fire regimes which accompanied depopulation. From 1997 to 2006 the NHT invested about $1 million in rebuilding Indigenous capacity to deliver more benign and beneficial fire on the Arnhem Plateau. The Aboriginal organisations of Jawoyn Association, Bawinanga Corporation, Demed Association and the Northern Land Council provided about the same investment and the Northern Territory government's Bushfires NT added critically important science, mapping and remote-sensing.

As the partners developed strategies to reduce catastrophic late Dry season wildfire and replace it with more early Dry season burning, reducing fuel by patch burning and creating long burned firebreaks, the focus shifted to the larger, longer term need – funding labour, operations and capital needs. Through the NT government, the West Arnhem Land Fire Abatement (WALFA) partners have now successfully negotiated agreements providing more than $1 million per year for the next 17 years to fund Indigenous on-ground management. This will be accompanied by the scientific monitoring and accounting to document achievement of a targeted abatement of 100,000 metric tonnes CO_2 equivalent annual emissions from wildfires on the plateau, measured against a ten-year average. The funding is not *from* government but *through* government, as part of emissions offset arrangements with the operators of Darwin's large liquefied natural gas plant, Darwin Liquefied Natural Gas (DNLG). The amount of funding linked to the planned life of the gas plant represents a landmark arrangement between private enterprise and Aboriginal people caring for country on Aboriginal land.

The Indigenous partners have established a permanent land management base at Kabulwarnamyo on the high plateau to undertake fire and other conservation work. Leaders like Bardayal are bringing back new generations of the landowner diaspora to learn about their country and how to look after it. Endangered Indigenous knowledge is being conserved for sustainable use by this new generation of land managers, who draw on both Indigenous and scientific knowledge systems. Jobs are being created where none have been possible before. Ground work is being laid for other Indigenous landowners

1 Bardayal Nadjamerrek briefs Manwurrk ranger, Len Naborlhborl on where to drop incendiary capsules from a helicopter during the 2007 early Dry season WALFA program. *Photo by Peter Cooke*

2 Bardayal Nadjamerrek and Peter Cooke discuss management issues on the West Arnhem Land fire abatement program. *Photo courtesy of Peter Cooke*

1 Butch Maher over Fitzroy Bluff, Kimberley. *Photo by Ecopix*

2 The Hon. Greg Hunt MP and Tony Wurramarrba (Chairman of ALC) at the launch of the Anindilyakwa Indigenous Protected Area. *Photo by Linda Hughes*

to develop more jobs through tourism, when they feel they are in control of land and cultural management issues. By the end of 2007, landowners plan to declare an area of about 9000 km² of the plateau as an Indigenous protected area, providing management to IUCN specified standards. With extraordinarily high natural and cultural values, and Indigenous management again on the rise, the stage is set for consideration of seeking World Heritage Continuing Cultural Landscape recognition, as landowner confidence and capacity grows.

Peter Cooke

Managing fire in the Kimberley

My name is William Maher. My family came to Yeeda station in 1964 and since then I have worked in the pastoral industry in the Kimberley and the Pilbara regions, especially in the higher rainfall area of the north Kimberley. I have seen big changes in fire management through this period.

The biggest change I think has come with a change in economy. By this I mean that people used to travel over the country a lot more than they do now. The season was started by a team going out to clear around yards and do repair work to them, gather firewood for the branding fire, and pull trees off roads if you had no grader. All the time you would be burning as you went. These fires would be quite small and fairly cool. The easterly winds were not going at this time.

Then would come the mustering team covering the country quite extensively. You would burn as you went, and the fires were bigger and hotter as the easterly wind was going well. The ground still had a lot of moisture in it and encouraged good regrowth. These fires would be stopped by the patches of early burns in some cases and in others by creeks that would still have water in them and by sparse areas of grass that had been burnt the year before.

The next thing in the fire department was thunderstorms. These would come in the early Wet season and could be extensive if you had a series of dry storms. Others would cover much smaller areas if the storms had good rain in them.

The difference these days is that we now spend a lot less time burning the country early in the year. The moving around is done by aircraft when managers wish to look over the land. Time now is spent doing other things that are more productive to the way things are set up. Wages are so high and labour is so hard to find that some things are now excluded from the day-to-day running of the station.

So in this cyber age we see a lot of fire on our computer screens whereas 30 years ago we only saw what came over the horizon. The satellite technology can be a great tool or it can also be very frightening to the uneducated. I think that the fire permit system has created more fire than it has prevented. People are so worried about prosecution that they will not do preventative burns where otherwise they might have. I think these changes with fire are causing all sorts of problems with wildlife.

I have been involved with fire management in one way or another for a lot of my life. I am a licensed chopper pilot, and some of my time now is spent with contract aerial incendiary work. I believe that smaller fires spread throughout the year, creating varied fire histories, are preferable to one large burn, and I hope I help achieve this with the chopper service.

There are very few people left in the area who have knowledge and a history of fire usage, few who can educate youngsters and newcomers.

Butch Maher

Indigenous Protected Area program – Groote Eylandt

The Indigenous Protected Area or IPA program is an initiative of the federal government (www.environment.gov.au/indigenous/ipa/index.html). It fosters the long-term cooperative management of premium Aboriginal-owned land for the preservation of cultural and ecological values. The IPA program is nested within the broader National Reserve System, which aims to establish comprehensive, adequate and representative samples of Australian bioregions. A prerequisite for an IPA is a plan identifying agreed objectives, actions, guidelines and standards for land management. In general, these are closely aligned with other state, territory or federally managed conservation areas, meaning IPAs are managed to the same standards as a National Park.

Benefits of an IPA are broad. Fundamental is the commitment to the long-term protection, sustainability and integrity of environmental and cultural values. It recognises conservation as a legitimate and worthwhile land use and, importantly, provides financial benefit. Development of an IPA and subsequent management actions encourage and facilitate extensive Indigenous participation and engagement with government and other NRM agencies. This promotes a recognition, understanding and appreciation for Indigenous land management practices. IPAs provide a mechanism whereby traditional ecological and cultural knowledge can be synthesised with contemporary scientific approaches to maximise outcomes. Further, exposure to western land management practices and science provides opportunity for Indigenous skills development and vice versa.

Complementary to this are notable social benefits. Aboriginal people often live within a community struggling with elements of social dysfunction. Poor health, low standards of education, unemployment, substance abuse, higher rates of crime and incarceration are sadly far too common. Among this background, an IPA program offers real jobs, money, opportunity and hope. Aboriginal people are closely affiliated with country, and often have a cultural obligation as guardians of their land. Working as a ranger, or being involved in an IPA provides one opportunity to facilitate this requirement. Feelings of pride, satisfaction, wellbeing and happiness can be all associated with environmental work. For individuals, IPAs offer opportunities for training, chances to exchange ideas and experiences with other rangers, and ultimately self improvement. In time, a functioning IPA ranger group engages with schools, educating children about the value of conservation.

Simon Hartley

A case study: the Anindilyakwa (Groote Eylandt) IPA

The Anindilyakwa archipelago includes approximately 40 islands, and is located in the Gulf of Carpentaria about 630 km east of Darwin. All land is owned by Anindilyakwa speaking (the local language) clans. The main island, Groote Eylandt, is Australia's third largest island and covers an area of about 2687 km^2. In the 2001 census the population was estimated to be 2419, of which approximately 1500 were Indigenous.

The Anindilyakwa archipelago is in an enviable position in the context of Australia's, and indeed the world's, natural environment. The area is relatively biodiverse with more than 40 mammals, 70 reptiles, 15 amphibians and more than 200 bird species. Included in this group are some threatened species such as the Northern Quoll, Brush-tailed Rabbit-rat, Northern Hopping-mouse and several species of marine turtle. Whilst there is an impressive list of endemic and threatened wildlife, probably of more significance is the absence of feral animals from the island. This is probably the largest area in Australia without exotic grazing mammals, and there are no pigs, buffalo, foxes, horses, cattle, goats and cane toads.

Complementing the archipelago's wildlife is a plant community which hasn't been farmed, grazed, forested or cleared in a major capacity and, whilst there is a small amount of mining, impacts are localised and there is a rehabilitation program. Surrounding the island is a marine

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environment with stunning scenery, fabulous reef systems and rich Indigenous, commercial and recreational fisheries. Accompanying all of this is an Indigenous population that speaks traditional language, harvests bush tucker and medicines, and still practises long-established customs and rituals. Having all these qualities in a single place is rare in the context of contemporary Australia and truly makes Groote a unique and highly valuable location in terms of environmental values, and well-qualified as an IPA.

The Groote archipelago was designated an IPA in mid-2006, following implementation of a plan of management by the Anindilyakwa Land Council (ALC) from 2005. Six Indigenous rangers, a coordinator and a project officer are employed to execute the plan of management. Their duties are broad, and in the last 12 months have included intensive training, construction of a board and chain road, surveys for threatened species and biodiversity, trapping of pest animals, monitoring of turtle populations, visitor management, patrols for illegal fishing vessels, crocodile removals, talks to school children, and the collection, processing and recording of ghost nets and marine debris. This work is underpinned by IPA and ALC funding, but could not be sustained without external funding, which requires constant applications, presentations and reporting.

The rangers initially took to the program with vigour and enthusiasm. The first 12 months were productive in terms of on-ground activity and skill development. For individuals there were some pleasing outcomes. Qualifications such as a driver's licence, coxswain's ticket, chainsaw tickets and first-aid courses were lifetime firsts. For some, a commitment to a work ethic and sense of achievement was evident. They had pride in their performance, developed self-esteem and demonstrated through more than 20 talks to the community about their work. As one of the rangers said, 'This work provides me with a reason for being'.

Support offered by the employer, project officer and coordinator assists with an understanding of mainstream Australian lifestyle skills such as banking. The collection and recording of data demonstrated the value of literacy and numeracy and fostered a desire for knowledge. The attendance of rangers' kids at school increased and anti-social behaviour decreased.

Some benefits, especially the social ones, could have been delivered by any worthwhile work program; however, the reality is that looking after country is culturally important to Aboriginal people, and therefore makes the IPA program more likely to deliver. The Anindilyakwa IPA is relatively new but, with continued support and hard work, the program has the ability to deliver significant environmental, cultural and social benefits.

Simon Hartley

Mornington Wildlife Sanctuary, central Kimberley

Mornington Wildlife Sanctuary sits squarely in the middle of the Kimberley, and is blessed with a spectacular landscape. The heavily rippled sandstone layers of the King Leopold Ranges arc through the southern part of the property. North of this, massive mesas and smaller volcanic hills stand majestically over the sweeping savannas. Monsoonal rains are collected in a network of rivers and creeks that coalesce in the heart of Mornington to form the Fitzroy River, which then squeezes through kilometres of magnificent sandstone gorges to reach the expansive Lower Fitzroy floodplain country.

Besides a dramatic landscape, Mornington has outstanding natural values, including healthy populations of several threatened animals, like Northern Quolls and the dazzling Gouldian Finch, as well as ecosystems that are not protected in National Parks. Before the Australian Wildlife Conservancy (AWC) bought it in 2001, Mornington was managed as a pastoral lease.

AWC is an independent, non-profit organisation dedicated to the conservation of Australia's threatened wildlife and ecosystems. It owns 15 properties nationally, covering more than 1,100,000 ha. Five of these (covering 670,000 ha) are in Northern Australia. AWC invests an enormous effort (sometimes with the help of partner organisations) into on-ground management, conservation-related research, and educational visitor programs, all of which are funded by tax-deductible donations, augmented with grants for specific projects.

Mornington is the largest AWC sanctuary, at over 350,000 ha. Eight to ten permanent staff live onsite to implement the fire management, destocking, feral animal and weed control, as well as carrying out a suite of biological

monitoring and research programs designed to improve the land management. The Traditional Owners of the area, who live on Mornington at Tirralintji, are actively involved in these land management programs.

During the Dry season, a small visitor facility – a combination of a luxury tented camp and a campground – is run by an additional ten seasonal staff. As well as giving the 3500 annual visitors an opportunity to experience the landscape and wildlife of Mornington, the Wilderness Camp provides a program of guided and self-guided walks, evening slideshows, and a small interpretation centre that showcases the AWC mission and the conservation issues facing Northern Australia.

Mornington provides a nexus for ecologists, land managers, Traditional Owners, travellers and philanthropic supporters to express their care for the environment, and is an example of a sustainable land use alternative in Northern Australia.

Sarah Legge
Ecologist, Australian Wildlife Conservancy

1 Kim Hands *(second from left)* guiding Mel Berris *(left)*, Emma Flaxman and Annette Cook on Mornington Station. *Photo by Alex Dudley*

2 Brush-tailed Possum captured in monitoring program, Top End. *Photo by Brooke Rankmore*

1 Brahman Bull.
Photo by Barry Traill

Lessons from history – Valuable for the future

After nearly 100 years and four generations of one family on one property, valuable lessons have been learnt regarding successful management techniques for profitable production and environmental sustainability. Our property, Trafalgar covers 33,000 hectares and is situated in the semi-arid tropics near Charters Towers in North Queensland. We specialise in beef production, but are passionate about natural resource management, as we believe it underpins not only successful beef enterprises, but also a healthy environment generally.

When my grandfather bought the property in 1913, it was relatively undeveloped with few waters and very little fencing. The cattle herd was all British breeds and had little tolerance of drought conditions or parasites such as the cattle tick. As a result, mortality rates were high, so overgrazing rarely occurred and pasture integrity was maintained. During the 1960s, the tropical breed, Brahman, was introduced along with new technologies like supplementary feeding and some exotic pasture species. Brahmans have a much higher tolerance for drought and parasite resistance so the mortality rates experienced with British breeds were greatly reduced.

During the beef price slump of the 1970s high cattle numbers were maintained largely due to a run of good wet years in conjunction with the feeding technologies now widespread in the industry. It was in the mid-1980s that producers, scientists and other interested groups realised the ramifications of the then current management practices. Pasture degradation, in the form of loss of perennial species, decreasing basal area, exotic weed intrusion and erosion due to bare areas, was highly evident. Because of the low pasture yields, preparing for drought was not an option, so it also became a high-risk enterprise. On Trafalgar, we reduced our stocking rate by 60%. Then by spelling at least 20% of the property every Wet season, we were able to restore native pasture species to greater than 80% within a few years.

These lessons have now led us to our current management regime, where spelling 20% of the property annually, strategic use of small areas of exotic pasture, conservative stocking rates and intensive herd management have increased our productivity (i.e. higher calving rates, earlier and heavier turn-off weights, better meat quality) and therefore profit. Monitoring sites on the property also confirmed the improvement in pasture quality, soil health and water quality. We also have an annual control program for exotic weeds. Current research in natural resource management also confirms these strategies lead to improved biodiversity and ecosystem health.

Because of the high amount of biomass available in the pastures, there is very little risk attached to the enterprise in the event of a failed Wet season. In other words, there are always options whether it be drought mitigation, the use of fire for weed control or pasture regeneration or taking advantage of low cattle prices to buy in stock to fatten.

As farming land in Australia becomes more expensive, more pressure is going to be applied to existing land, particularly marginal grazing areas. Planning at a national, regional and property level is imperative, if we are to combine best practice and research to achieve sustainable outcomes for the Australian landscape and its inhabitants.

Roger Landsberg
Trafalgar Station Charters Towers

ECONOMIC ACTIVITIES

There are diverse existing interests in the future of Northern Australia. In Table 6.1 we list a range of land use activities and classify them in terms of their effect on natural values and ecological processes as either *conservation*, *compatible*, *potentially compatible* or *incompatible*. This classification draws upon documented experiences with environmental problems from unsustainable land use activities both in the North and in southern Australia. While this assessment is qualitative, it identifies the different potentials for sustainability, and for serious and irreversible environmental harm. As shown in this table, compatible activities may be completely or largely separate from country (e.g. information technology), or may use country but with minimal impact (e.g. nature-based tourism).

Accordingly, we believe that certain proposed developments, such as broad-scale clearing,

TABLE 6.1 **CLASSIFICATION OF COMPATIBLE & INCOMPATIBLE LAND USES**

Classification of economic activity	Description	Examples
Conservation	Activities that directly and actively help to maintain ecological processes and natural values.	• Some government services (border control and quarantine) • Conservation management of country • National Parks, Indigenous Protected Areas, off-reserve management • Feral animal control and harvesting
Compatible	Activities that rarely if ever degrade, but may simply be neutral to the environment.	• Most government services (defence, health, education, provision of infrastructure) • Visual and creative arts, including the Indigenous arts and crafts sector • Nature and culture-based tourism • Information technology services • Biotechnology (e.g. bioprospecting); for example, identifying new medicines using traditional knowledge
Potentially compatible	Activities that can be compatible with maintaining natural values and processes if done with care and in particular ways.	• Pastoralism dependent on native pasture and operating within carrying capacities • Mining operations that have minimal water requirements and small ecological footprints • Low input aquaculture; for example, with natural feeding stock (e.g. shellfish, sponges) • Harvesting of native plants and animals from the wild • Fishing (commercial, recreational and Indigenous) • New residential and tourist developments • Mass tourism • Military training • Trophy hunting of feral or native animals
Incompatible	Activities that are inherently degrading to natural values and processes, for which significant damage can only be reduced, and generally not to a satisfactory level.	• Permanent and large-scale clearing of native vegetation for agriculture • Mining operations with a large ecological footprint (such as strip mining without adequate rehabilitation or protection of hydrological systems) • Large-scale water off-takes, impoundments and irrigation • Extensive plantation development • Extensive aquaculture developments with high input (e.g. fish fed other fish) • Genetically-modified crops • Pastoralism using invasive introduced grasses

1 King George Falls cascades 80 metres off the Kimberley Plateau into the saltwater reaches of the King George River on the North Kimberley Coast. *Photo by C Hugh Brown*

2 Cattle mustering, Mornington Station, Kimberley. *Photo by Alex Dudley*

which are *incompatible* should be rejected. This recommendation will be resisted by some, including those with vested interests. However, the exclusion of incompatible land use activities will remove many of the large-scale damaging threats to natural values and ecological processes, thereby providing the basis for ecologically sustainable development.

We have attempted to capture the possible range of environmental compatibility within different land uses in Figure 6.1. For many activities, the manner in which they are carried out will determine their category. Conservation management in almost all areas of Northern Australia now needs people on the ground, delivering management services, in terms of weed, pest and fire management. For land use activities potentially compatible with the sustaining environmental values, the challenge is to progressively shift into the positive side of the ledger. For society as a whole, the question is how best to support industries to do that.

Pastoralism

Pastoralism – largely for beef production – is by far the dominant land use in Northern Australia, covering more than one million square kilometres. The industry can potentially have major impacts beyond boundary fences of properties, through the escape of exotic pasture grasses to lands of other tenure, and through catchment-wide impacts on water flow and quality. Given this, the sustainability of Northern Australia's ecological assets is contingent upon how the pastoral industry is managed.

Pastoralism has a history from the beginning of European settlement of Northern Australia. Unlike industries with more conspicuous, localised impacts, there is far less public appreciation of the environmental costs associated with pastoralism and assessment or explicit regulation of that impact. Nonetheless, all northern jurisdictions are now engaging in policy and legislative processes to review conditions of pastoral leasehold lands. In some cases, these reviews may provide for greater environmental accountability of pastoral landholding. But, against this momentum of higher community expectations for environmental stewardship of pastoral lands, there is an increasing drive for intensification of land use. In part, this drive is a response to rising operational costs that force landholders to try to derive more income from their leases. This may mean more cattle at densities which are much closer to (or above) carrying capacity. Increased stocking rates are achieved through developing infrastructure (such as for smaller paddock sizes), increased use of invasive foreign grasses (that often need tree clearance to establish effectively), and greater use of water.

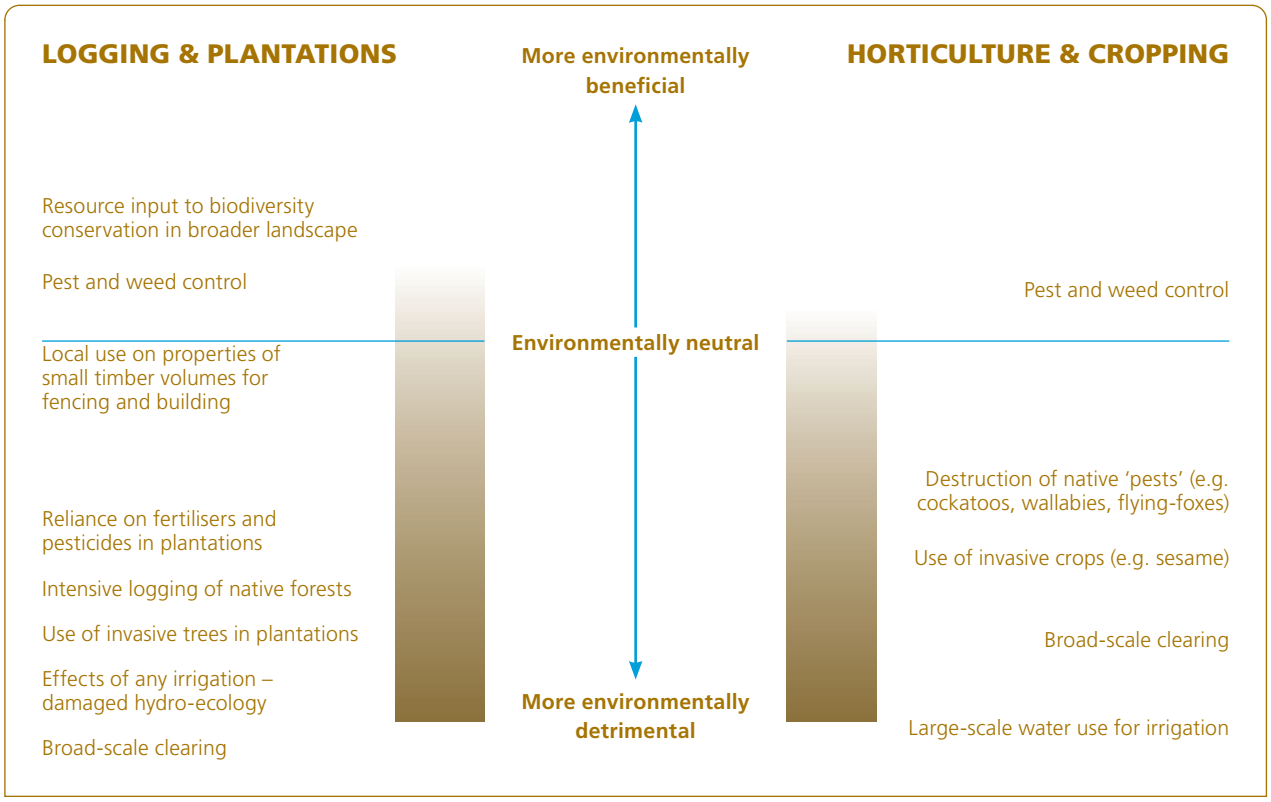
Increasing the intensity of land use is not generally compatible with protecting biodiversity and maintaining the ecological processes that underpin healthy country. With respect to the pastoral industry in Northern Australia, implementing our guiding principles requires that:

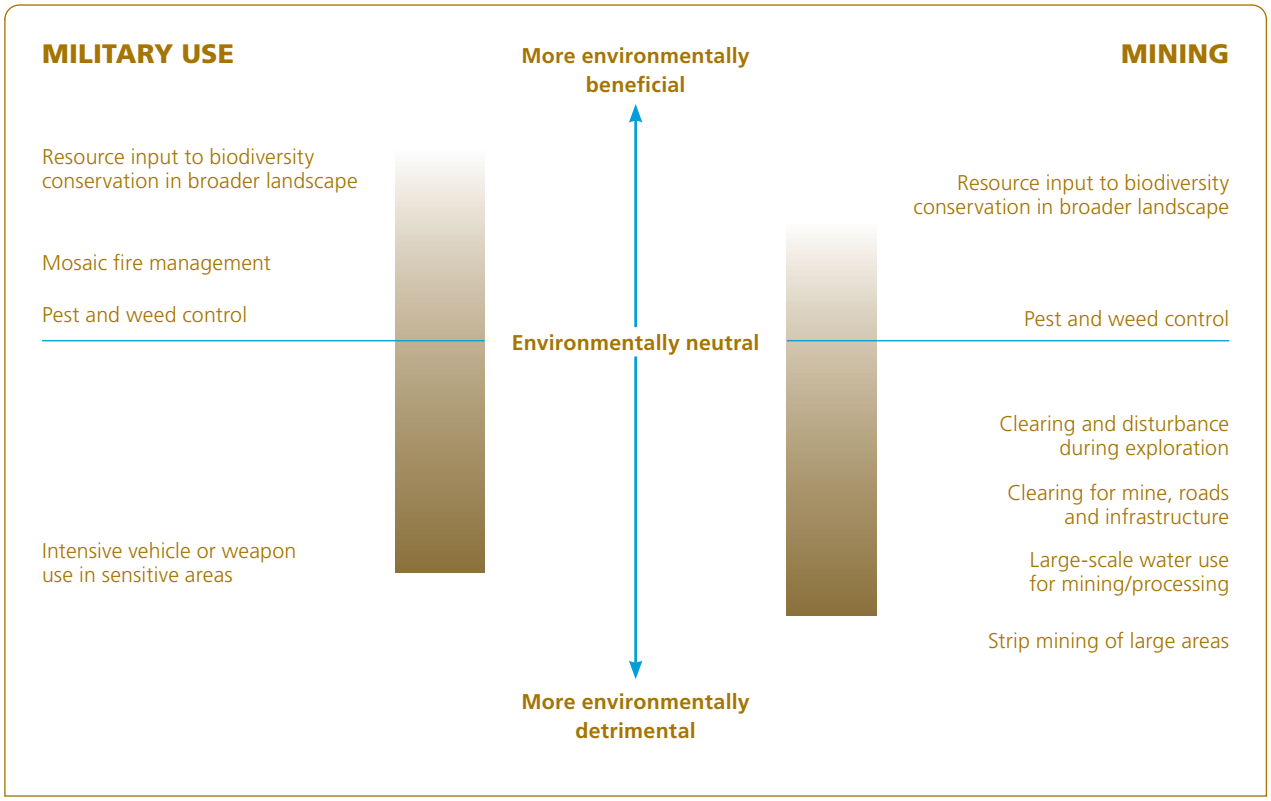
- There is an adequate representation of all environments within lands managed primarily as conservation reserves. Currently, some more productive grassland types are almost exclusively held by the pastoral industry;
- Any substantial intensification on pastoral lands be assessed through an environmental impact process, with due attention given to the value of natural environments and the risks posed by land use change;
- The carrying capacity of pastoral lands be explicitly defined, with inclusion of the full gamut of biodiversity attributes, and never exceeded;
- An adequate level of duty of environmental care should be expected of pastoral landholders;
- Incentive programs should be available to encourage landholders to extend their environmental standard beyond the duty of care benchmark;
- Non-pastoral use (explicitly including management for conservation benefit) should be encouraged, at least in part to increase the long-term security of Northern Australian economies through enterprise diversification;
- Clear disincentives should be applied to landholders who fail to exhibit reasonable duty of environmental care; and
- 'Best Management Practices' (BMP) should be developed for the industry. BMPs can be used to establish explicit and attainable environmental goals and timetables that are regularly updated to reflect changing conditions and new knowledge.

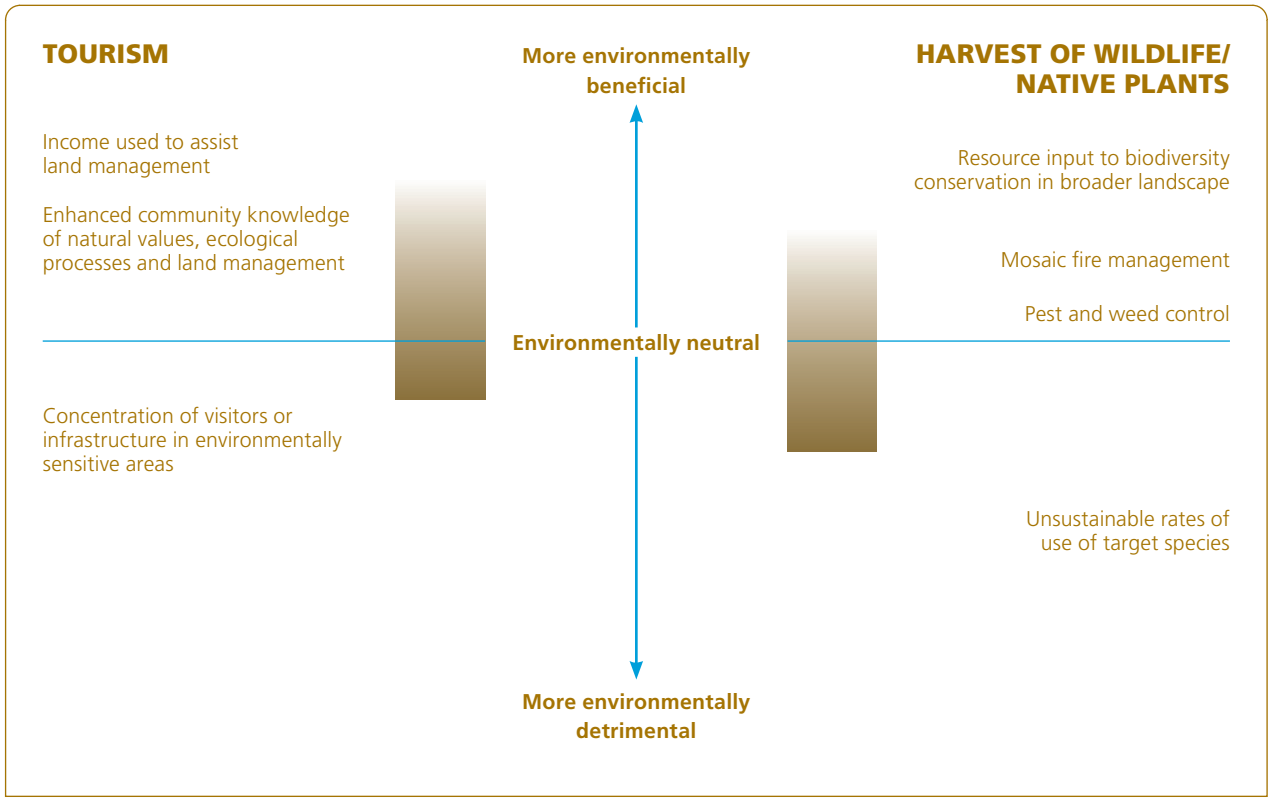
Indigenous lands

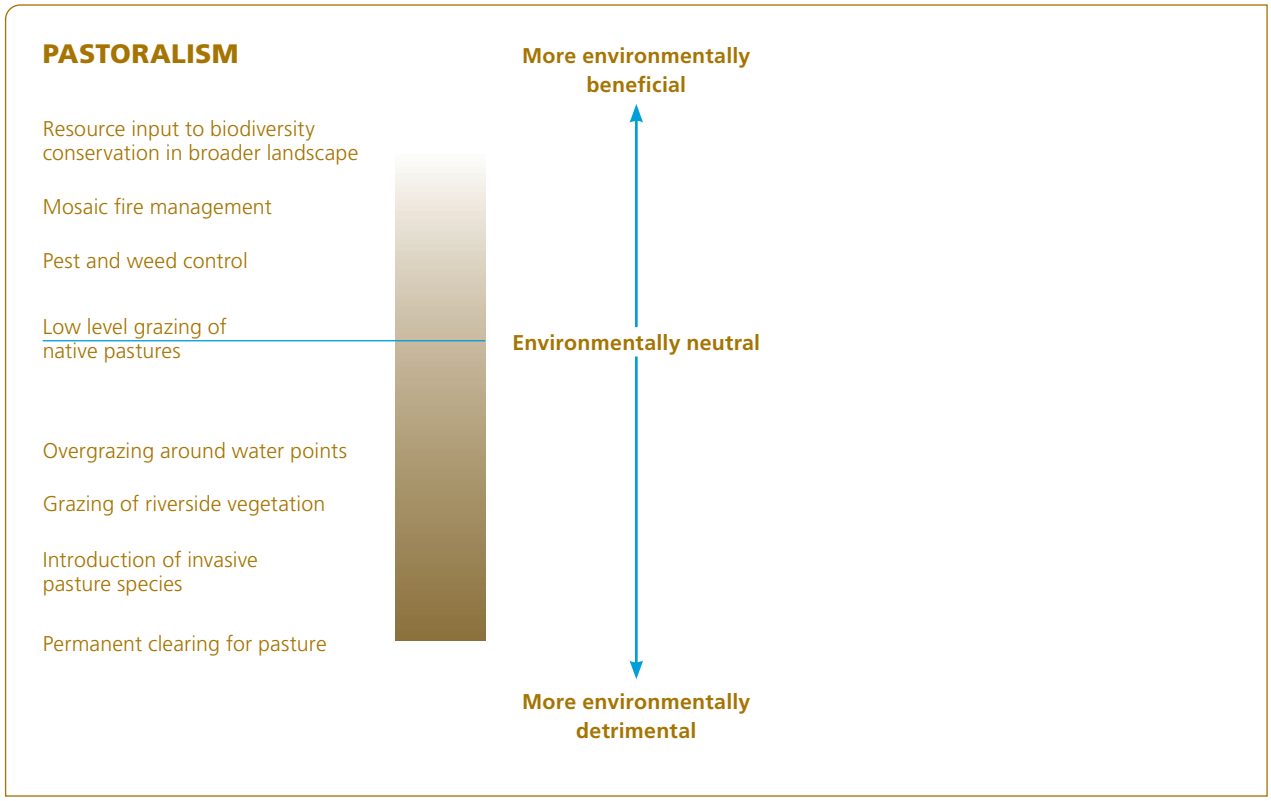
Aboriginal and Islander lands comprise nearly 20% of Northern Australia, and this will increase in the future as further pastoral lands are purchased by Indigenous agencies, and an increasing proportion of conservation lands are returned to Aboriginal ownership or joint management. Aboriginal lands make a major contribution to the natural value of Northern Australia. A complex set of factors affect the management of these lands. The most dominant of these factors is the socio-economic disadvantage characteristic of most Aboriginal communities. The local economies are usually limited, with few employment opportunities, inadequate resources available for management, and health and education standards are poor. There are strong cultural drivers for Aboriginal people to live on remote country and maintain traditional management and culture. Conversely, there are economic and social drivers for people to join the mainstream, live in more centralised communities and open their lands to more intensive economic activities (such as for plantations, mining and pastoral enterprises). Relative to the North's non-Indigenous population, Indigenous birth-rates are high and emigration rates low. There is an inexorable demographic trend that Aboriginal people

FIGURE 6.1 **ENVIRONMENTAL CAPABILITY OF DIFFERENT LAND USES**






TOURISM
Income used to assist land management
Enhanced community knowledge of natural values, ecological processes and land management
Concentration of visitors or infrastructure in environmentally sensitive areas
More environmentally beneficial
Environmentally neutral
More environmentally detrimental
HARVEST OF WILDLIFE/ NATIVE PLANTS
Resource input to biodiversity conservation in broader landscape
Mosaic fire management
Pest and weed control
Unsustainable rates of use of target species


PASTORALISM
Resource input to biodiversity conservation in broader landscape
Mosaic fire management
Pest and weed control
Low level grazing of native pastures
Overgrazing around water points
Grazing of riverside vegetation
Introduction of invasive pasture species
Permanent clearing for pasture
More environmentally beneficial
Environmentally neutral
More environmentally detrimental

will comprise an increasing proportion of the North's population, and will be the demographic group with the most long-term residents.

A sustainable future for Northern Australia is tied to Indigenous people and lands. To best nurture that future, substantial resources must be invested in providing jobs and education for Aboriginal people to manage, live in and sustainably use their lands. Such use may include conservation partnerships (such as joint-management of National Parks and the development of Indigenous Protected Areas), carbon trading, sustainable economic use of resources for the art/craft industry, for bush foods, for safari hunting and other modes of tourism, and harvest of native foods for local consumption. But, inevitably, there will also be demands and opportunities for intensive development. This may be an appropriate and reasonable source of socio-economic benefit so long as (a) it does not compromise the environmental fabric that underlies the sustainable future of Northern Australia; (b) development constraints are not framed by Third World standards (e.g. approval conditions must not be weakened to allow for the local and short-term financial benefit of a development that has poor environmental credentials); and (c) socio-economic returns are not distorted to the current low economic standards of communities (e.g. rents paid to Aboriginal landowners for land use should not be less than those paid for similar provision by landowners elsewhere in Australia).


1

Conservation lands

National Parks and other conservation lands comprise about 6% of Northern Australia, appreciably less than basic international and national benchmarks (Sattler and Glanznig 2006). The overall standards of management, resourcing and monitoring of performance and biodiversity retention are variable. With respect to protected areas in Northern Australia, implementing our guiding principles requires:

- A substantial expansion of the core reserve system to at least meet national objectives;
- Landscape-wide planning to maintain ecological connections between core reserves and facilitate collaborative management of threats across land tenures, including enhancement of the formal government reserve system, and non-government reserves such as Indigenous Protected Areas and privately owned conservation reserves, conservation covenants and other off-reserve initiatives;
- Substantially enhanced resourcing for the parks network; and
- Explicit management planning to ensure that reserves deliver clearly articulated biodiversity conservation outcomes.

Military lands

Lands managed for military operations and training constitute nearly 1% of Northern Australia. Such lands may provide considerable conservation outcomes (Woinarski and Ash 2002; Woinarski *et al*. 2002), because they often have substantial resources available for land management, no livestock and management is explicitly tied to Commonwealth environmental standards under the *Environment Protection and Biodiversity Conservation Act*. However, they may also be susceptible to local intensive and damaging use (such as areas in which live firing is concentrated), and there may be little scope for public accountability. Conservation benefits of these lands will be maximised when the management planning adequately addresses biodiversity issues, when management of weeds, pests and fire is approached within a broader regional context, and when the sustainable limits of intensive use are not exceeded.

Mining

Mining is the most important non-government economic sector in Northern Australia. Its characteristics, scope and impact vary considerably, depending upon the mine

type, duration, extent and location. The most substantial impacts occur with strip-mining (currently for bauxite at Weipa and Gove, and for manganese on Groote Eylandt), which requires extensive vegetation clearance and the risk of substantial impacts to hydrology, soils and local biodiversity. Some individual smaller mines produce a risk of long-term pollution through leaching of toxic materials. In certain regions, while the impacts of individual mines may be limited, a procession of mines may lead to substantial cumulative impacts. While recognising that Northern Australia will continue to have a substantial mining industry, implementing our guiding principles will require acceptance that:

- There are habitats, places and regions in Northern Australia where the environmental values and ecological integrity are so profound that no mining should be countenanced;
- For any mine, there must be an explicit condition of no off-site impact;
- For any mine, there must be an explicitly-defined objective to return at the end of the mine-life to pre-mining natural environmental state, with adequate and assured resourcing to provide for such return and adequate independent auditing to evaluate such return; and
- A proportion of the mining economic benefit be allotted to regional provision of environmental offsets, to ensure that there is no net loss of environmental values due to the mining venture.

Horticulture and plantations

Horticultural production, including plantation forestry, is a steadily escalating land use in Northern Australia, stimulated recently by an increased awareness of the environmental fragility of horticultural production zones in southern Australia. The history of horticulture in Northern Australia is chequered, with some notable instances of failure and environmental degradation (Bauer 1977). Many failures were due to lack of appreciation of the environmental characteristics and constraints in Northern Australia; particularly related to the limitations and challenges of climate (including cyclones and floods), water availability, and very limited areas of fertile soils. Notwithstanding the recurrent spruiking, and more insistent recent interest, the ecological reality is that the horticultural potential of Northern Australia is limited. For those regions where intensive horticulture may have prospects, such development may come at considerable environmental cost. Hence, to implement our guiding principles in Northern Australia, horticultural development should:

- Not proceed in habitats, places and regions in Northern Australia where the environmental values and ecological integrity are profound;
- Be evaluated within a regional context that first ensures adequate lands and water are set aside for the maintenance of environmental values and functions;
- Have no off-site impacts; and
- Include provision of regional environmental offsets, to ensure that there is no net loss of environmental values due to the horticultural development.

1 Bauxite mine, Weipa, Cape York Peninsula. *Photo by Kerry Trapnell*

2 Mango farm near Darwin, Top End. *Photo by Barry Traill*

WHERE TO FROM HERE?

We have not attempted here to provide a detailed plan for appropriate development and conservation management across Northern Australia. Such a task is beyond the scope of our study. This is the responsibility of all people across the North, and of all Australians interested in its future. Furthermore, a variety of legal, programmatic, fiscal and policy mechanisms must still be developed to provide the framework on which to base a sustainable future for the North; including voluntary covenants, co-management arrangements, markets for new ecosystem services, and private investment in new green industries.

INCREMENTAL INDUSTRIAL ACTIVITY ON THE KIMBERLEY COAST

The current industrialisation of the Kimberley coast offers a text book example of how incremental decision making can occur without assessment of the combined impacts.

The Kimberley coast (and its immediate inland areas) is one of the most isolated parts of Northern Australia. It is well-known for its spectacular scenery and its natural values remain highly intact. Off the coast is the Browse Basin, with large and so far untapped natural gas fields. A number of companies are in the highly advanced stages of planning new industrial development along the Kimberley based on the resources of gas, and minerals on the adjacent lands of the Kimberley.

These proposals include: offshore gas production and building of two new large liquefied natural gas plants at coastal sites, two bauxite mines, two ports, an alumina smelter, a zinc mine and smelter, and an iron ore mine on an island.

Many or all of these proposals offer the potential of significant wealth for Australia as a whole. However, each single proposal is likely to have significant local environmental impacts, and local social impacts. In combination, the plans mean that the Kimberley coast potentially faces considerable industrial development along its length. Many community groups have called for a regional planning process to assess the whole basket of development.

Despite the likelihood of the accumulating impacts on the environment, at the time of writing there has been no attempt to carry out a region-wide analysis or consultation on the cumulative, region-wide impacts of these proposals. As has been the pattern with this approach elsewhere the combined incremental changes that may occur could have a severe impact on the nature of the Kimberley. Piecemeal assessments are unlikely to produce ideal conservation and development outcomes.

Barry Traill

Our focus here has been to provide information on the natural values and ecological processes of the North so that they can be understood, appreciated, and serve to frame guiding principles for delivering a sustainable future. However, we can usefully make some further comments on the requirements for sustainable development pathways. As noted, current conservation and development planning across the North usually follows an approach of incrementally assessing development and conservation.

We have suggested that this approach is a pathway to incremental degradation, and to a development portfolio that is environmentally unsustainable. An example demonstrating the problems of this approach is detailed in the side box on Kimberley Gas developments.

Much more sophisticated regional planning processes are required if we are to build development pathways that work for people and country.

And how do we deal with specific industries? In the text and figures above we explain how some economic activities are incompatible with the long-term protection of the natural values of the North. We have also explained how many can be more or less compatible depending on the way in which they are conducted.

Where currently present, those existing incompatible activities should not be extended. Rather, alternative approaches to economic development should be pursued when possible.

For activities where compatibility with the long-term maintenance of land and water is possible, pursuing pathways to improve sustainability is already in place in many industries, such as in pastoralism. Pursuing environmental Best Management Practices at an industry level provides an approach that has potential to deliver major improvements to performance.

The challenge now and in the coming decades is to maintain the natural values of the North, protect the ecological processes that sustain these values, and repair any environmental damage that has already occurred. A large part of meeting this challenge will involve promoting a shift in the kinds of land use activities that occur in Northern Australia, and how these are carried out. The contributions of Indigenous and pastoral communities will be crucial, as they are the majority of owners and active custodians. If we fail in this challenge, then it is inevitable that the North's natural values will erode over time, leading to the kinds of environmental problems now dominating the South – water security, species extinctions, land degradation and loss of agricultural productivity.

SUMMARY

In summary, our analysis of the nature of Northern Australia has been in three parts.

First, we document that Northern Australia has natural values of great significance. In particular, it has the largest and most intact tropical savanna left on Earth, and the majority of Australia's remaining natural rivers and associated wetlands. It also has nationally important areas of rainforest, mangroves, tropical heathlands and other habitats. It has many species found nowhere else in the world. This natural landscape provides valuable ecological assets on which major northern industries such as tourism, fisheries and pastoralism are based.

Second, we outline and illustrate the importance of ecological processes and connections that link and support nature, environmental health and ecological functioning in Northern Australia. Unlike southern Australia, in the North these processes remain largely intact. Hydro-ecology (water), disturbance (fire), and long-distance movements of wildlife are the key ecological processes at work. Maintaining these processes is a foundation of maintaining healthy ecosystems and the people they support across the North.

Third, we propose a model for shifting development in the North onto a pathway that maintains, supports and protects the natural values and supporting ecological processes of the North:

- A regional planning process that identifies the capacity of regions to absorb human-induced changes to the landscape;
- The establishment of core areas to be managed primarily for conservation;
- Constraints on activities that are directly or indirectly destructive to the natural values and ecological processes of the North;
- The promotion of economic activities that are, or can be made to be, compatible with those values and processes;
- The promotion and coordination of management compatible with conservation across all land tenures;
- Fostering collaborative approaches to conservation and management amongst landholders; and
- The facilitation of a 'conservation economy'; enterprises that yield a net positive gain for the natural environment.

1 The Kimberley Quest II brings travellers to the King George Falls, Kimberley Coast. *Photo by C Hugh Brown*

The diagram on the following pages illustrates this model by showing alternative approaches to land use in Northern Australia.

CONCLUSION

Over the course of our history, Australians have grappled with working sustainably on our continent. In many regions we have demonstrably failed. Our generation, and future generations, are now recognising the consequences of unsustainability, and the price of attempting to restore over-used environments. In other regions, such as the North, collectively we now know enough and are wealthy enough, to not follow the same pathways. We can consciously make decisions to look after country, and support the people of Northern Australia in the process.

The natural environment of Northern Australia has undergone extraordinary changes since humans first arrived. Many of these changes have been the result of Indigenous land use activities, framed within traditional cultural obligations to manage country. But every plant and animal species alive today in the North evolved millions of years ago and has persisted through the rise and fall of sea levels, and periodic global warming and cooling. And, as we are only now beginning to appreciate, they have survived for the last 50,000 years in an intimate relationship with their Indigenous custodians. What will be our legacy?


HEALTHY COUNTRY IN THE NORTH
Sandstone plateaus and escarpments
Water from springs maintain river flows in Dry season
Healthy springs keep waterholes full during the Dry
Indigenous rangers on outstation manage country
Fruit-bats move over savanna, seeking nectar and pollinating trees
Rainforest in escarpment gullies
Rainforest patches survive in unburnt areas, including by rivers
On pastoral property, country is managed for sustainable beef production
River vegetation fenced off from cattle
Fruit-eating birds move between rainforest patches spreading seeds
Patchy fires prevent big late Dry season fires, protect rainforests and create habitat mosaic in savanna
Permanent water hole
Seed-eating birds rely on patchy fires to find food all year
Waterbirds move between wetlands seeking areas of right depth for feeding and breeding
Healthy mangroves
Deep billabongs
Paperbark trees growing around healthy wetlands
Natural flows maintain productive fisheries


DEGRADED COUNTRY IN THE NORTH
Strip mine
Fruit-eating birds fail to reach patches of rainforest isolated by clearing, so seeds not spread
Big late Dry season fires damage country and affect many animals
Dam severely damages river health and reduces fish populations
Seasonal nectar supplies for wildlife reduced by clearing
Rainforest dries out as water table lowers
Water pumped from river, water table lowers and rainforest dries out
Cleared pastures
Irrigated paddocks
River vegetation and banks damaged by cattle
Water supplied from bore
Loss of wetlands reduces breeding opportunities for water birds
Overgrazing on fragile soils leads to erosion, causing sand to fill in waterholes
Pigs and buffalo damage wetlands and rainforests
Billabong gets flooded less
Weeds like Mimosa and Rubbervine choke wetlands and bushland
Sea level rises from global warming – and salt water kills coastal paperbark swamp
Changed fire practices reduce food for seed-eating birds
Reduced river flows lead to lower fish populations