



SAVANNA LINKS

Cooperative Research Centre for the Sustainable Development of Tropical Savannas

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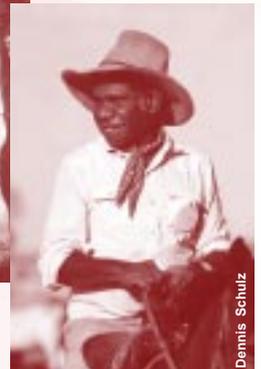
Northern future: managing diversity



Kate O'Donnell



Greg Calvert



Dennis Schultz

Perceptions of northern Australia are often shaped by the landscape itself—the dramatic scenery and the often harsh climate. Less attention is paid to the social and economic conditions. Recent surveys, however, show that the north has levels of remoteness and socio-economic disadvantage that are much higher than in agricultural areas in the south. Also, regions within northern Australia are developing at a different pace and in different ways. Turn to Page 4 for a synopsis of some of these issues.

View from Sunday Creek

"For me life in northern Australia is about three things — for cattle, for country and for kids"

Tom Stockwell is a pastoralist from Sunday Creek station in the NT, he's also chairman of the North Australia Beef Research Council. On Page 6 he outlines his view of the north's pastoral industry; the knowledge it needs, the challenges it faces.



CO₂ rising: what's in store for the savannas?

Rising levels of CO₂ may well change fundamental aspects of Australia's savannas: trees could out-compete grasses, the grasses, while growing better, may be less nutritious for the

animals that feed on them. A new study outside Townsville will measure some of these changes so land managers can plan for the future. See Page 10.



New Tropical Savannas CRC to go ahead

THE Tropical Savannas CRC has been renewed for another seven years, with a new CRC beginning in mid-2001. On January 18, Minister for Science Senator Nick Minchin announced funding of \$18.2 million for the new Tropical Savannas Management CRC (TSM-CRC) as part of the annual application round for new CRCs.

The new CRC, as its title suggests, has a greater focus on management and will use the tools and science developed during the seven-year life of the original CRC.

“In the first round of the CRC we developed some scientific understanding and platforms of technology that we could use for monitoring and modelling the landscape,” said director John Childs.

“What we want to do now is apply that knowledge and tools in a range of areas, including properties, Aboriginal-owned land and across regions. Our focus is shifting to an application of the science and technology in how we interact with the landscapes that we use.”

New partners in the TSM-CRC include the Alliance of Aboriginal Land Councils across northern Australia and the pastoral industry through the North Australia Beef Research Council and Meat and Livestock Australia. The University of Queensland is another new partner.

“We’re fortunate to have funding for a seven-year period,” said John. “When addressing issues of sustainability, you have to look at it for a fairly long period of time, and seven years of funding makes a tremendous difference to strategic planning for the future.”

The TSM-CRC will also use the theme structure developed in the first CRC to integrate its research. The themes however, have changed to reflect the new direction in applying research.

Theme 1: Landscape Ecology and Health aims to understand the ecological principles behind landscape health and the processes which maintain it and where necessary restore it.

Theme 2: Industry and Community Natural Resource Management aims to develop, with industry and communities, policy and management principles and practices for natural resource management, environmental protection and biodiversity conservation.

Theme 3: Regional Planning and Management aims to develop, apply and test regionally focused planning, administration and management models that identify a ‘triple bottom line’ for communities: ecological sustainability, economic viability and social desirability.

Theme 4: Human Capability Development aims to understand specific education requirements and learning processes relevant to people living in remote and isolated parts of northern Australia and to provide them with the necessary information and learning materials so they can increase their skills and knowledge in environmentally responsible management.

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National salinity action plan under way across north

BOTH the Northern Territory and Queensland have now signed the inter-governmental agreement to fight salinity through a national action plan. The agreement involves the Commonwealth and all states and territories and stipulates that funding will be shared among community-based groups in 20 key catchments and regions across Australia. The Council of Australian Governments

endorsed the National Action Plan for Salinity and Water Quality in November 2000. All state and territory governments participated in developing the plan.

In Queensland, the federal and state governments will provide around \$81 million each over the next seven years to fight salinity in the state. Priority catchments are the Burdekin-Fitzroy; Lockyer-Burnett-

Mary; Condamine-Balonne-Maranoa and Border Rivers.

The NT will receive \$6 million over the next seven years, reflecting the fewer problems it has because of smaller amounts of land clearing.

In Western Australia, regional catchment groups are established across the south-west of the state. They will target about 26 sub-catchments within five catchments.

Tropical Savannas CRC: Linking the North

The Tropical Savannas CRC is a joint venture of the major organisations involved in land management of the savannas of north Australia. It comprises two universities, two divisions of CSIRO, four NT, three Queensland, two WA government agencies and one federal agency. The Centre promotes sustainable use and conservation of Australia’s tropical savannas by acting as a bridge

between agencies engaged in land-management research and industries representing land users: e.g. pastoralists, Aboriginal groups, the tourist industry and conservation managers; and by looking for ways to ensure more research ends up being used on the land. Director: Mr John Childs
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Carbon credit trading on the way

QUEENSLAND landowners may soon be able to use trees and other vegetation on their land to profit from the anticipated worldwide carbon credit trading scheme, although the status of the Kyoto agreement was uncertain at the time of writing.

The State Government is preparing the Forestry Act Amendment Bill 2001 to allow commercial dealings in carbon credits. Trading will involve carbon credits and emissions permits, with credits comprising a set tonnage of carbon to be removed from the atmosphere by a given area of trees and other vegetation.

Permits will be allocated to greenhouse gas emitters. However, carbon credits are likely to be generated only in forests planted since 1990 on land that had been cleared for agricultural use.



Pictured left is Federal Environment Minister Robert Hill with Dhimurru Land Management Aboriginal Corporation Rangers and staff including Chairman Bawurr Munyarryun (seated left) and Senior Ranger Nanikiya Mununguritj (standing beside the Minister) at a ceremony on March 16 to mark the declaration of Dhimurru Indigenous Protected Area in the NT. At right is a map of the Dhimurru Indigenous Protected Area



Protected area declared in Arnhem Land

AROUND 100,000 hectares of ecologically and culturally significant land in north-east Arnhem Land was declared an Indigenous Protected Area (IPA) in March.

The Dhimurru IPA is the first such agreement in the Northern Territory, and the thirteenth to be declared in Australia. This brings the total of Indigenous owned lands managed as IPAs to 3.1 million hectares.

The Natural Heritage Trust has granted \$110,000 of funding to Dhimurru Land Management Aboriginal Corporation to assist with establishing and managing the IPA. The IPA program is a Commonwealth initiative funded through the Natural Heritage Trust.

Under the program, indigenous landowners commit to manage their lands as part of Australia's National Reserve System. In return, landowners receive funding and technical support to manage their lands.

The Dhimurru IPA contains a vast diversity of plant, animal and sealife, some species of which are thought to

occur only in the IPA. Ecological systems include sand dunes, grasslands, monsoon rainforest, mangroves, saline swamps, open forest, woodlands, pandanus swamp, and riparian forest. The IPA also includes coastal zones which cover territory of several threatened turtle species and the nesting and feeding habitats for numerous sea birds.

The major management issues are visitor pressures on recreation areas, rehabilitation from past uncontrolled vehicle access, and wildlife protection and research including monitoring the impact of marine debris on threatened turtle populations.

The Dhimurru Indigenous Protected Area takes its name from the Dhimurru Land Management Aboriginal Corporation, formed in 1992 to represent the interests of the 14 clan groups which have links to the Dhimurru lands.

For more information about the Indigenous Protected Area Program go to:
Web: www.environment.gov.au/bg/indigenous-policy/fact-sheets
Web: www.octa4.net.au/dhimurru/default.html

Savannas' website a hit with US educators

THE Tropical Savannas CRC's website has been chosen as a preferred site by not one, but two online education providers in the United States. Lightspan's StudyWeb provides curriculum-based, educational software and Internet products and services for use in schools and at home in the US.

It picked the TS-CRC's Savanna Explorer section for inclusion in its Biomes sub-section which covers other environments such as deserts, prairies and tundras.

US National Science Teachers Association (NSTA) also picked the TS-CRC's website for inclusion in their SciLinks site. SciLinks is essentially an outcome of a partnership between US textbook publishers and the NSTA. Textbooks published within this arrangement contain

sciLinks numbers throughout their margins that direct readers to a suite of websites tied to the specific point in the book.

If you're interested, go to the site, (see URL below) and log on as 'Guest'. A page will come up where you can insert the codes—here are some from various textbooks: HE084 (temperate forests); HE140 (ocean pollution); HW116 (alternative fuels); HW182 (nuclear reactions: fission).

- THE New Zealand site 'Tussock Grassland Management Information System' has also linked to the TS-CRC website. This site provides information on the ecology and management of tussock grasslands in New Zealand.

Lightspan StudyWeb: www.studyweb.com
SciLinks: (Log on as Guest) www.scilinks.org
NZ Tussocks MS: www.tussocks.net.nz/

AS some of you will have noticed the TS-CRC has revamped its home page with a new look that allows easier access to our ever-expanding fund of information on the savannas.

This new structure allows you to go straight to features such as Savanna Explorer and Savanna Search, the online version of this newsletter, Centre news and new publications.

We've also streamlined many of our graphics to make download times faster.

For those who still find graphics of all kinds a barrier to speedy surfing, we have a major upgrade under way that will introduce a text-only version of our site before the end of the year.

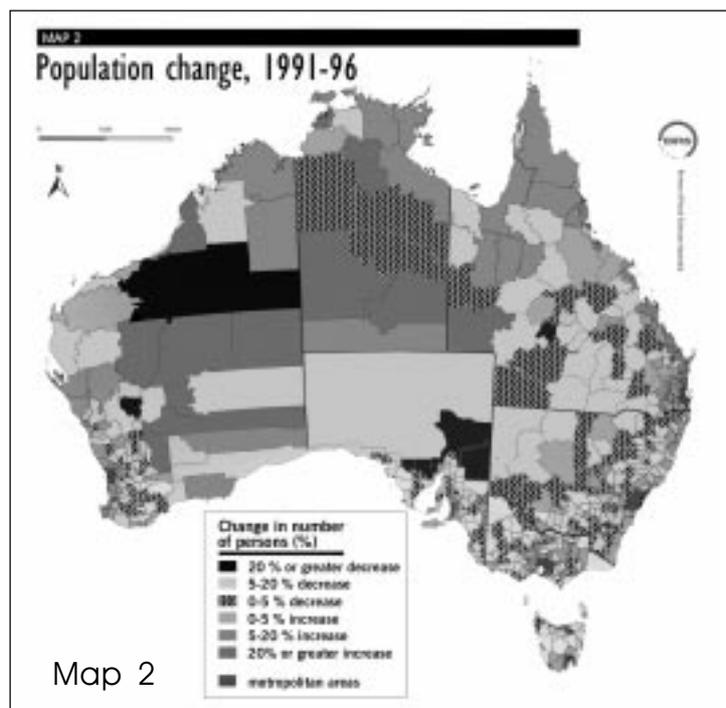
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Map 2: Between 1991 and 1996, Australia's population increased by 5.8 per cent, from 16,770,774 to 17,739,124. While non-metropolitan and metropolitan average growth was similar, there was substantial variation across non-metropolitan Australia in terms of population growth and decline. Growth was concentrated along the east and south-west coasts and the outer urban areas of major cities.

Map 79 shows the distribution of relative socio-economic disadvantage (SEIFA) across Australia. SEIFA is a composite of several census variables. Areas with the greatest relative disadvantage have higher proportions of low income families, unemployed people, low educational qualifications, public housing and people in low-skilled occupations.

The value for Australia as a whole is standardised at 1000. Values exceeding this figure have high levels of socio-economic wellbeing than the Australian standard, and vice versa for those below it.

Map 80: The ARIA index (Accessibility/Remoteness Index of Australia) represents a generic measure of remoteness across all non-metropolitan parts of Australia. It was developed using a GIS to calculate an index of remoteness at each distance of more than 11,000 populated places around Australia. The scores are divided into five categories, ranging from extreme remote to high accessibility. Virtually all of the rangelands are in the most remote category.



Northern future: managing diversity

Recent surveys show that northern Australia has levels of remoteness and socio-economic disadvantage that are much higher than in agricultural areas in the south. *Mark Stafford-Smith* considers some of the issues.

The various land users of northern Australia have to cope with powerful biophysical features: a monsoonal climate, a fire-prone landscape and the generally low fertility of the soils. However, they are also living and working within a distinct social context; one that affects land use and is affected by it. There is an immense amount of work ahead of us to create a better understanding of how biophysical characteristics interact with the social, cultural and economic factors.

Land uses

The main land uses in the region are grazing, defence, conservation, tourism, intensive agriculture and horticulture, 'lifestyle' habitation and Aboriginal homelands, and mining. A common characteristic of most Aboriginal lands is that they support a multitude of land uses, often overlapping and interacting. This is increasingly becoming a feature of other lands also—and the resolution of the resulting diversity of land use objectives is a matter of considerable importance for research.

Major social and economic trends

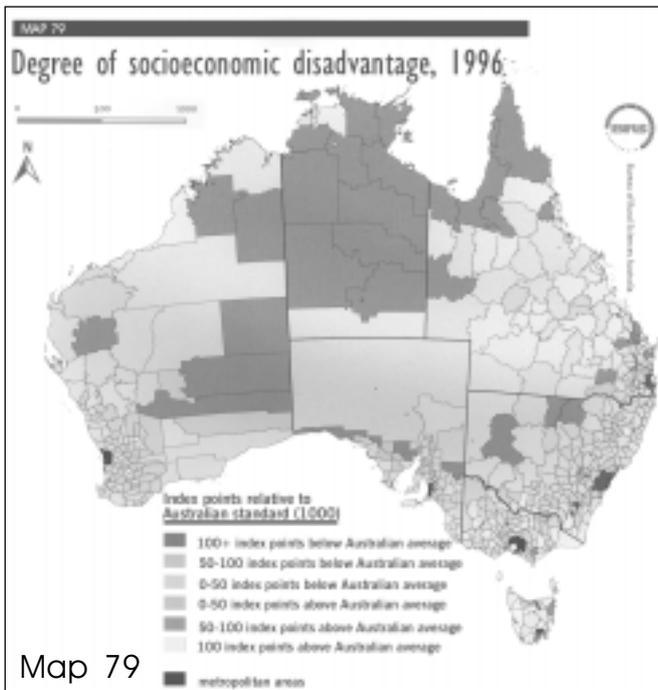
The Bureau of Rural Sciences' Social Atlas (*Country Matters: Social Atlas of Rural and Regional Australia* BRS 1999) contains much useful baseline data that points to emerging socio-economic patterns in the north.

Three generalisations can be made about northern Australia compared to the nation as a whole. Firstly, according to some indicators, northern Australia has much more in common with rural areas in general than with urban areas. Yet according to others, northern Australia as a whole differs markedly from the remainder of rural

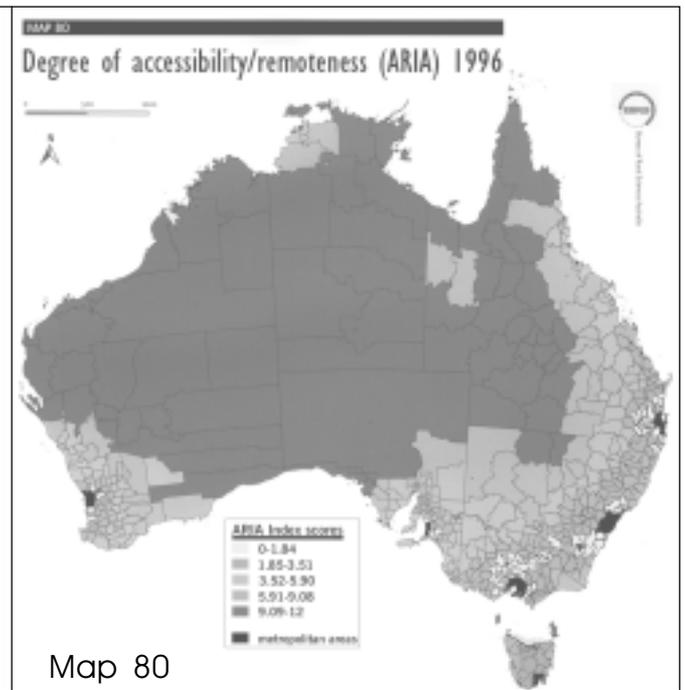
Australia. Finally, one of the most notable features about many of the statistics is the degree of variability *within* northern Australia. If one was to look across the agricultural belts in southern Australia, the variation in levels of remoteness or socio-economic disadvantage is much less than it is across the north, and many other factors follow this pattern. While it is important everywhere in outback Australia to understand regional differences, this is especially so in the 'undeveloped' north. There is a noticeable divide between eastern Queensland and the rest of northern Australia in a whole range of statistics, no doubt reflecting the much greater population density of eastern Queensland, and the flow-on effects of this in economic terms. To a lesser extent a gap also exists between the Darwin/Queensland coastal areas and the inland. These two trends suggest the possibility of ongoing unequal development across the north in ways that could produce even greater inequities in the future.

Approach used by the Atlas

The atlas uses information from the 1996 census on population and housing. It focuses on Australia's non-metropolitan population, which at the time of the census was 6,588,438. The maps' data is presented in two basic ways: in absolute values, for example in the number of persons per square kilometre, and in percentage values as compared to the non-metropolitan average. The maps use Statistical Local Areas, which comprise a single local government area or any unincorporated area. The atlas gives two maps for most features: a 'snapshot' illustrating the most recent situation (1996), and maps that show what has changed since 1991.



Map 79



Map 80

The BRS Social Atlas is printed in colour. The maps in this newsletter have been adjusted for black and white printing. Please visit the BRS website to view the maps online at: www.brs.gov.au/social_sciences/atlas.html

Population change

Map 2 shows population change (1996) and illustrates that although rural populations, and those across the north, are generally low, the change in these between 1991 and 1996 varies hugely between regions.

For example, parts of the Top End—East and West Arnhem Land—showed a 5–20 per cent increase over the five year period, while the Elsey SLA (which includes Katherine) showed a 20 per cent or greater increase. However, South Alligator, to the west, showed a 5 to 20 per cent decrease. Although the map shows many northern areas are growing, the numbers are low.

Indigenous population

The indigenous component of the population in northern Australia is high compared to the national average. Indigenous people represent 2 per cent of the total Australian population, nearly 4 per cent of people in rural Australia generally, but more than 20 per cent for most of northern Australia, except eastern Queensland where numbers drops to the rural average.

The rate of increase in this population is high in almost all northern regions, even those in eastern Queensland with currently low proportions. According to census results, the indigenous population in regional and remote Australia increased by 27.3 per cent between 1991 and 1996, compared with a 48.0 per cent increase in metropolitan areas. However, about half this increase was due to people identifying as Aboriginal in 1996 but not in 1991.

Families, youth and schooling

Between 1991 and 1996 the number of people under 15 years of age increased by 2.2 percent nationally. However, this figure varied significantly between regions, with little relationship to either the base population or its indigenous component.

In some areas this young component declined, especially in Queensland, while in the Northern Territory

growth of this age group was on average particularly strong. Overall, the strongest growth of this age group occurred along the east coast and in the south-west, and especially in the outer urban areas.

The proportion of single-parent families with dependents across most of northern Australia is very high (12.2 per cent) when compared to the national average (10.1 per cent) in most regions, but then notably lower in eastern Queensland which is generally less than 8.1 per cent.

This partially relates to a higher incidence of single-parent families among indigenous people, but also reflects the high degree of isolation in these areas leading to higher than average rates of family break-ups. However, the next map in the series shows that these proportions are on the increase in almost all regions, including eastern Queensland.

Northern Australia generally has a low proportion of 16-year olds attending school; this may reflect in part the fact that many move elsewhere for high school education. This is paralleled in low levels of tertiary education among inhabitants in most areas of the north, though this may result from tertiary educated people staying in cities because of better wages and job opportunities.

Male to female ratio

Inland Australia generally has a very high male to female ratio compared with the Australian average, and the north is no exception. The overall Australian average is 98 males to 100 females, rural Australia is 101:100, but almost all northern regions exceed this, often reaching 125:100 and even 150:100.

Government benefits

The proportion of families receiving government benefits is high in many regions in the north and notably low in others. This partially correlates with indigenous population concentrations, but there are other contributing factors. As the atlas notes, government financial

Continued on page 7

The view from Sunday Creek

Savanna Links talks to pastoralist Tom Stockwell on the northern beef industry's rewards and challenges.

What is important to you about being a northern pastoralist?

For me life in northern Australia is about three things: for cattle, for country and for kids. The three are closely linked. Country is probably the central driver because the environment of northern Australia is so strong, so unique and so overpowering that it drives our abilities and our attitudes to work and play.

What was the industry like when you came here?

When I first came to the Territory there were few fences, large pastoral leases and lots of uncontrolled domestic and feral stock. There were also huge areas of under-utilised country (such as the Sturt Plateau) where no use was made of the resource because of the conventional wisdom that there was "no water".

Our history was with few exceptions one of numbers of cattle as first priority and the amount and quality of grass that they ran on as a distant second. There was virtually no range management research carried out in the Katherine region prior to the late 1980s.

So what are the challenges confronting the northern pastoral industry?

Pastoralism is the major user and manager of the tropical savannas and will continue to be so. The challenge for the northern pastoral industry is to ensure that our resources are potentially the same in 2000 years as they are after 100 plus years of pastoral use. I have seen the effects of 2000 years of over-use in other parts of the world and it is not a pretty sight. Grazing and social practices used at about the time when the great holy books were being written have not stood the test of time—and yet there are still plenty of followers. There are plenty who would argue that 200 years has been enough in southern Australia. It is my opinion—compared to the effort put into improved pasture and forage systems—rangelands or extensive native pasture has been the prodigal child of the northern beef industry. We are finally starting to recognise the importance and strength of our rangelands systems for the northern beef industry.

What shape is the northern pastoral industry in?

When you see some of the former grassy landscapes of the old world, it is clear that we are more technologically advanced and have a much greater understanding of the forces driving production and sustainability in our northern savannas. We are relatively knowledge rich and technologically well supplied. However, it is also clear that we are in the luxurious position of relative youth and low population densities. We are also in the very strong position of being able to learn from others mistakes.

So what is different about being a pastoralist today?

We are now in a much stronger and more knowledgeable position on the management of our native pasture thanks to having more time for management, the development of



Tom and Bev Stockwell, who run Sunday Creek Station in the Sturt Plateau region of the Northern Territory

more profitable markets and some relevant research and development work. Our local producer group, the Sturt Plateau Best Practice Group Inc. provides an example. When the group first got together in 1994–95 we had, for example, about 16 different opinions on the use of fire. We got involved with some NHT (Natural Heritage Trust) and MLA (Meat & Livestock Australia) funded research and demonstrations over the next five years. When we reviewed our Best Practice Manual in 1999, we found we had general agreement on the role and management of fire. Some people had changed their management practices 180 degrees.

What sort of knowledge is available to help you meet these management challenges?

We now have available in the Katherine region grass production models specific to soil type which enable you to estimate quantity and quality of grass from seasonal rainfall. We have learned that country in poorer condition will not respond to rainfall as efficiently as country in good condition. We have photo point monitoring systems. We are judged on how well we look after the resource—not on how much development we do.

Do pastoralists in northern Australia have any sort of competitive advantage over other beef producers?

Native pasture is the great sustainable competitive advantage of the northern beef industry; greater than any genetic infusion of Brahman or Charolais genes, greater than any exchange rate, supplementation or HGP treatment, greater than any grazing gimmickry you might subscribe to. It is where the value-adding occurs; we can turn a renewable resource into protein from a low-cost base.

So things are pretty good. What more needs to be done?

This question has been addressed within the North Australia Beef Research Council (NABRC) and various regional councils across the north. They decided the needs for the northern industry are a mix of improved productivity, understanding our resource base and ensuring we have markets and are able to meet their specifications.

You are absolutely dependent on sustaining the natural ecosystems. Is the industry doing enough to protect them?

That the vast majority of the savannas are in good condition suggests that the industry is doing and has done enough. I'm not convinced that this will be good enough for the future however.

In terms of obtaining a balance between production, resources and people (the cattle, the country and the kids) I believe that as an industry we have invested significantly in improving our knowledge of resource management over recent times. The industry's continuing commitment to this CRC is one example of this. There are also numerous programs devoted to improving resource management at a range of levels such as the learning our district group has done on improving our fire, pasture and water-point management. The increasing use of pasture monitoring and modelling of seasonal pasture growth to improve our ability to use resources sustainably. Many producers are now involved in groups that actively aim to learn more about managing their enterprises and properties.

For the future I think we need to be able to prove, in a transparent way, to the markets and consumers that we are producing healthy products from a healthy environment. In this way the good management of natural resources will be valuable in the market place and the industry will be rewarded.

What can an industry based on native pastures do to stay profitable?

In an age of increasing energy costs, the energy available in our native pastures becomes even more valuable. The greater the cost of energy in the future, the more important it will become to use ruminant animals to convert energy in grass to protein and energy for human consumption.

I believe our pasture resources and our low-input philosophy are the greatest opportunities and strengths of our industry. As the price of energy rises, our ability to use natural and renewable systems in a sustainable way will be a terrific natural advantage. If for no other reason I think we should continue to try to better understand what drives sustainable production in rangelands. I believe it to be a relatively simple system and we could get ourselves into trouble trying to make it complicated.

While the technology is and will increasingly become available to model and forecast seasonal variations and the effects of different management strategies, I think the greatest benefits will come in understanding how to match the production system with the resource to meet the markets with some sort of flexibility.

There is also a significant opportunity to attract consumers and community support by producing food from a natural system which is energy efficient and manages the natural resources sustainably.

From p. 5

Northern future: managing diversity

land management

transfers are important to the local economies of many areas.

Health and socio-economic advantage

Northern Australia has uniformly desperate health statistics compared to the rest of the continent, including rural areas in the south. The infant mortality rate is considered a good indicator of general socio-economic well-being. While Australia has low infant mortality rates (6.8 per 1000 live births for non-metropolitan areas and 5.8 for metropolitan areas) these rates vary considerably in non-metropolitan regions, with rates increasing with remoteness.

Northern Australia has low levels of 'socio-economic advantage' (Map 79) compared to the rest Australia which may reflect in part the substantial indigenous population, and a high remoteness index (Map 80).

Management, policy and research

Northern Australia, like much of the rest of rural Australia, depends on money from government, financed in part from the more populated regions in the south. Conversely, much of the resources taken out of northern Australia disappear completely into the

cities and overseas. John Holmes described this as the phenomenon as 'geographical transfer of resources'.

It includes tourism companies retaining the majority of profits in capital city headquarters, and mining companies developing fly in-fly out communities that take most of their spending money (and mineral profits) back to the coast.

The pastoral industry on the other hand tends to reinvest a greater proportion of its profits within the region. In many areas Aboriginal investments, originally derived from mining royalties and other sources, are now the most substantial contributor to local economies after public finance.

A critical message is that there is an immense diversity among the regions of northern Australia, in terms of socio-economics and culture as well as biophysical characteristics.

Holmes (1997) has analysed current trends in remoter Australian regions, to suggest a diversity of futures, from core pastoral regions, through 'frontier regions in flux', to those clearly dominated by indigenous homelands, or an urban focus linked to mining or tourism.

There is an urgent need to recognise the difference between regions and to project possible scenarios of where the futures of these different regions may lead given different levels and types of public investments.

In northern Australia as elsewhere, the failure to properly account for these differences could lead to policy paralysis and eventual inequity as regions develop at different rates.

This is not to suggest that all should be the same—they never will be—but a sense of the northern community will only be maintained if the development paths, and the investments that pave them, are created through transparent processes shared by all regions.

This article is based on a paper given by Mark Stafford Smith, CSIRO Centre for Arid Zone Research, at the *Northern Grassy Landscapes Conference*, in Katherine, August 2000.

Country Matters, A Social Atlas of Rural and regional Australia is published by the Bureau of Rural Sciences, Australia. Cost is \$40.

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Web: www.brs.gov.au/social_sciences/atlas.html

The Ord: A river in transition

By Kathryn Thorburn

The Ord River Irrigation Scheme, now in its 38th year of operation, changed the lower Ord from a seasonally dry river that carried huge floods in wet years to one with fairly constant water levels and a continuous flow. While negative impacts have occurred above the dam wall and in the Cambridge Gulf, a TS-CRC project has found the changed flow conditions have had significant benefits for the lower Ord's riverside ecology. Management implications of these ongoing changes are, however, unclear.



New riparian vegetation on the banks of the lower Ord River

Riparian systems—riverside animals and plants—are critical components of Australia's tropical savanna landscapes. They contain a substantial proportion of the savannas' biodiversity and are a focus for all sorts of activities that include pastoral, tourist and agricultural industries. The TS-CRC project, led by Dr Tony Start, from WA's Conservation and Land Management (CALM), with help from Dr Karl-Heinz Wyrwoll of the University of WA, his research students and technical officer, Tricia Handasyde, used the Ord's riparian systems as a model to better understand savanna riparian systems generally. However, the team's research will also be used to help manage the Ord itself, and in planning for Stage 2 of the Ord Irrigation scheme (see story on Ord Irrigation Scheme, opposite page.)

The Ord River irrigation scheme began in 1963 when a diversion dam was built on the Ord River at Kununurra to provide water for irrigation. The scheme came into full operation in 1973, when the second dam was completed at Lake Argyle, and the artificial lake was filled. The lake, about 62.5 km long and 45 km wide, stores wet-season flows which are released at regular intervals into the diversion dam, keeping the latter at a constant level. While some of the water is diverted to farms, much of it is released into the lower Ord. The scheme also provides hydro-electricity.

Riverside vegetation thriving

The total area of riverside vegetation downstream of the dams is now substantially larger than it was. Many of the now common and widespread vegetation species and communities were previously restricted to small 'refuge' patches. These new and dynamic vegetation zones now provide habitat for many species of birds, including

growing numbers of the buff-sided robin, recently removed from the endangered species list. The changing nature of the river itself means that the number of other fauna species, including crocodiles, turtles and barramundi has increased.

River flow transformed

Before the dam's construction the river's environment was dominated by its 'dry-tropics' character, and its flow was strongly seasonal. Huge floods occurred every two to three years, while in the dry season surface water was restricted to pools. During floods, water up to 50 feet deep would roar down the channel, shifting massive quantities of sediment and stripping vegetation from the riverbed. In contrast, during the dry, there would often be no flow at all. Not surprisingly, the dynamics of the river's flow determined where vegetation was established.

Since the dam's construction, the river has been transformed into one with a much more even temperament; it is now akin to a wet-tropics river. Water levels are now fairly constant and there are no longer periods where the river does not flow.

This effect is almost the inverse that seen in most other dams, where the wall cuts off the supply of water to areas below, devastating the habitats of plants and animals that had relied on the river's continuous flow. In the case of the lower Ord, the regular flow has created a favourable environment for aquatic and riparian vegetation to colonise, in turn allowing more sediment to be deposited in the riverbed. New vegetation is now established more or less continuously along the riverbanks and on newly formed islands. This process has not yet reached equilibrium as vegetated bars are continuing to encroach into the channel.

As a result of the regulated flow, the relationship between vegetation and the river's processes is completely reversed. Riverside vegetation now exerts a very strong influence over where and how the river deposits sediments.

Gums, coolabahs decline

Many of the vegetation communities have expanded with the changes to the river, but some (see boxed story on the 2000 flood) have been degenerating. In particular, vegetation that exists high on the riverbank, including river gums *Eucalyptus camaldulensis* and coolabahs *E. microtheca*, require regular flooding to regenerate and are now diminishing.

The lack of flooding in these zones has also lead to

Ord Irrigation Scheme

Lake Argyle is the largest artificial lake in Australia, its huge reservoir collecting the wet season rains and storing them for use during the dry. Water is released continuously through hydro-turbines into the diversion dam, keeping the latter at a constant level. While some of the water is diverted to farms, much of it is released into the lower Ord. Lake Argyle is about 62.5 km long and 45 km wide, its total area covering 745 km² and containing 96 islands. It holds 10,760 million cubic metres—triple that when in flood, and its total storage capacity is 18 times that of Sydney Harbour.

Ord Stage 2, a joint project between the NT and WA governments, proposes to develop around another 43,000 ha of irrigated land, which will mean constructing new supply channels from the diversion dam (from which all water for irrigation is taken) as well as roads and other infrastructure. According to the Kimberley Development Commission the scheme will generate many new jobs and potentially add up to \$500 million to the current annual income of \$56 million from agricultural production on the irrigated lands.

significant invasion by a wide range of weeds including passion vine and buffel grass. In the dry season, these weeds act to carry fire into the vegetation growing high up on the banks.

Changing channel dynamics

The process of change occurring on the lower Ord is by no means complete, and it is difficult to predict where it will end. At present however, a growing number of barramundi fishers and tour operators, who rely on a navigable river, are complaining that the river is becoming too shallow for safe passage in many parts. The mouth of the river is also getting shallower—the massive tides of the Cambridge Gulf continually dump muddy silt at the mouth which was previously washed out regularly by the big pre-dam floods.

Flood pulses for management

Generating flood pulses is seen by some as a management option to achieve a variety of objectives including:

- maintaining navigability of the river for fishing and other uses; flushing cumbungi (*Typha domingensis*) and ribbon weed, aquatic weeds which have built up because of stable water levels;
- recreating conditions so riparian vegetation such as river gums can regenerate high on banks. However, weed invasion and fire regimes may now prevent seedlings establishing even if sufficient floods could be provided;
- controlling exotic weeds on riverbanks. While there is some evidence that regular flooding may remove some weed species, it may act to spread others.

It is now impossible to turn back the clock and provide

floods as large and as frequent as those of old. Yet smaller floods may wash away the benefits of the current regime without achieving the management goals.

“We will have to be very careful,” says Tony Start, “not to end up with a lose-lose situation for everyone.”

Future of the lower Ord

Last year Tony Start and Karl-Heinz Wyrwoll produced a series of scenarios for the Western Australian Water and Rivers Commission that examined the impact on riparian vegetation and sedimentation of various flows, either increasing or decreasing the total volume of water moving down the river—all of these would have very different impacts on vegetation and channel dynamics.

The commission is currently determining ecological water requirements of the lower Ord so that it can construct a water allocation plan. This would identify water volume to be released down the river and how this could be engineered given the water needs for the Ord Stage 2 irrigation scheme.

The project’s research findings will also form a component of the Ord Bonaparte Project (a major initiative of Land & Water Australia, the Fisheries Research & Development Corporation and CSIRO for integrated research in the region). As well, the Ord Land and Water project (a community-driven, NHT-funded project) is drawing up an issues document for managing the Ord.

The curious issue for Tony Start is that a natural resource of ecological and economic value has now been created—but does the fact that this habitat was created artificially make it less worthy of protection? After all, as Tony points out, the area’s original values were also changed by human factors: stock, weeds and fire. The question now appears to be: what are the values to be conserved when considering the management of a totally altered environment?

These new values will need to be considered in the debate about the future parameters of the Ord 2 Scheme, as well as the future management of the lower Ord itself.

Ex-Cyclone Steve: 2000 flood

Floods still occur yearly on the lower Ord but their size has decreased markedly. However, in 2000 there was a major flood that tested the resilience of the new vegetation. While floods of pre-dam times would have lasted days, if not weeks, floodwater in 2000 inundated vegetation in the lower Ord for many months. Water escaped slowly by the spillway, where it was about 6.5 metres deep at the flood’s height. Most vegetation showed a remarkable resilience and all species present before the flood are now evident again. Some communities, especially aquatics and herbs were destroyed, but are now re-colonising the river from seed left on the banks by the receding water. Boabs and some figs did not do so well, with many dying even where their crowns were above water. Other trees, though badly battered, survived as long as some of the canopy was in the air. Ironically, 2001 is seeing an equally big wet but it remains to be seen before the effects can be ascertained.

Tony Start, Conservation & Land Management WA
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Email: tonys@calm.wa.gov.au
Go to TS-CRC Website: <http://savanna.ntu.edu.au>
(Research Section)
Websites: Kimberley Development Commission
www.kimberley.wa.gov.au/
Springboard to the Kimberley
www.discoverwest.com.au/kunnun.html

Rising CO₂: what's in store for the savannas?

By Kate O'Donnell

A study outside Townsville is examining the potential effects on savanna vegetation of rising CO₂ levels.

The study, a collaboration between CSIRO Sustainable Ecosystems, James Cook University and Queensland Nickel Industries (QNI), is the first of its kind not only in the savannas, but also Australia. Called a Free Air Carbon Dioxide Enrichment study (FACE) it will pipe different levels of CO₂ over six 15 m round plots, each containing native grasses and trees, over the next five years. While there are a number of FACE studies in operation overseas, only a couple involve natural or semi-natural systems.

"Most are looking at crops, plantation forests and improved pastures," explained CSIRO's Andrew Ash, one of the leaders of the study. "From existing work we can probably plot the growth of individual species. But we can't predict the response of what will happen between species in a real ecosystem. That is the real unknown, and one of great importance, that this study allows us to do."

The project's co-leader, JCU eco-physiologist Joe Holtum, will study potential impacts on plant physiology: from changes in competition between trees and grasses and between the grasses themselves, to changes in soil composition and plant defence mechanisms. In the long term, he hopes to set up collaborative studies to examine what might happen to the insects that depend on the flowers and seeds of the plants.

Another issue the study will shed some light on is one of carbon storage by looking at carbon flow through the ecosystem. Australia's savannas are important stores of carbon, and it is estimated they currently contain 33 per cent of Australia's terrestrial carbon overall, a proportion which may increase as CO₂ levels rise.

The study is situated next to QNI's nickel plant at Yabulu, 20 km north of Townsville. QNI has given substantial support to the project, providing land, infrastructure, electricity and CO₂—itself no small contribution considering the project will use 1 to 1.5 tonnes of CO₂ per day over the life of the experiment, a prohibitive cost for the researchers to meet themselves.

The study area is dominated by tussock perennial grasses with the main species being Kangaroo grass (*Themeda triandra*), Golden beard grass (*Chrysopogon fallax*) and Wanderrrie grass (*Eriachne obtusa*). The plots do not have mature trees or shrubs in them so two native species from the immediate area, *Acacia holosericea* (soap bush) and *Eucalyptus crebra* (narrow leaf ironbark) were planted to study tree-grass interactions.

Work performed on the effects of elevated CO₂ on savanna grasses—again by CSIRO and JCU—suggests that the grasses grow better because they use water more efficiently under higher amounts of CO₂. If this is correct, there may be more water available in the soil, and shrubs and trees could do better.



CSIRO's Andrew Ash and Mike Whiting at one of the study's plots. The pipe ringing the plots sends CO₂ over the vegetation. Two plots simulate current CO₂ levels (370 parts per million), two will have 450 ppm—levels we'll be living with in about 30 years—and the last two 550 ppm, CO₂, the level predicted for 2050.

One of the potential results, says Andrew, might be an increased woody layer across the savannas. Another is that with greater water-use efficiency, savanna systems might become less prone to the effects of drought, and produce a more stable supply of forage from year to year. The FACE study will help answer these questions.

"We're also looking at the effect of grass quality and quantity from the pastoral perspective," said Andrew. The experiment simulates grazing effects and high nutrient growing conditions as well as a more natural low-nutrient regime. "We know that under high CO₂ grass grows more, but it could be at the expense of forage quality. You might be able to grow more, but animals might not do as well."

The grazing simulation will also help give a better picture of just how grazing affects carbon storage. Apart from the woody layer, most carbon is actually stored under perennial grasses. So, if these grasses are overgrazed, a lot of carbon will be lost from the system.

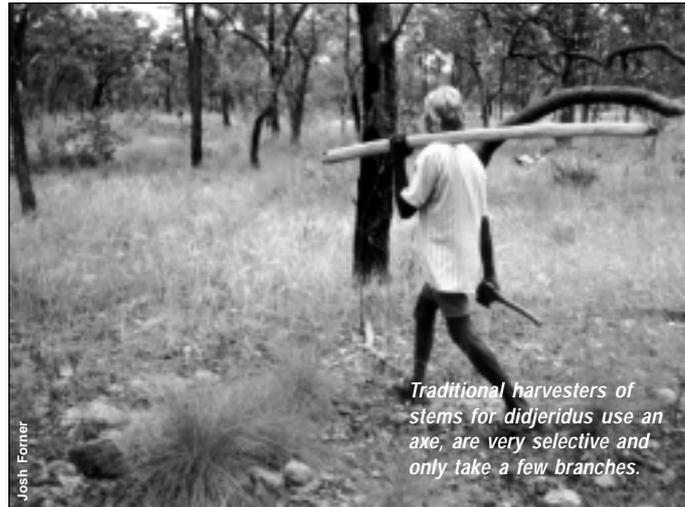
Joe will be examining the physiology of how the trees and grasses compete against each other under different conditions. "We want to see what the new equilibrium is, to see how they function physiologically," he explained. "That will eventually relate to the rates of growth, and the productivity of the whole savanna." Another variable is competition between grasses. For example, if annual grasses start performing better, they may start out-competing perennial grasses.

The project leaders are both keen to develop collaborative research with other institutions and scientists. One such collaborative study that might begin soon is on plant defence mechanisms. Plants growing under high CO₂ tend to allocate carbon and nitrogen—the building blocks of their protein—differently. As the plant generally does better, it doesn't need to put as much nitrogen into protein. Instead, the extra nitrogen may go towards producing more defensive compounds against the creatures that eat it, which may result in quite different food ranges for the animals and insects that live off the plants. Stephanie Brown, a JCU/TS-CRC Honours student, has already begun measurements of seedlings and will be spending the year measuring plant responses to elevated CO₂.

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Tel: (07) 4753 8540 Fax: (07) 4753 8600 Email: andrew.ash@tag.csiro.au
Joe Holtum, James Cook University
Tel: (07) 4781 4391 Fax: (07) 4725 1570 Email: joseph.holtum@jcu.edu.au

Recent research into the harvest of native timbers for the didgeridu market suggest that it may be reaching unsustainable levels in some areas of the NT's Top End. A former TS-CRC Honours student Josh Forner is building on his Honours work in a PhD examining the impacts of current harvest levels on these tree populations.

By Kathryn Thorburn



Traditional harvesters of stems for didgeridus use an axe, are very selective and only take a few branches.

Josh Forner

Illegal harvests blight traditional didgeridu trade

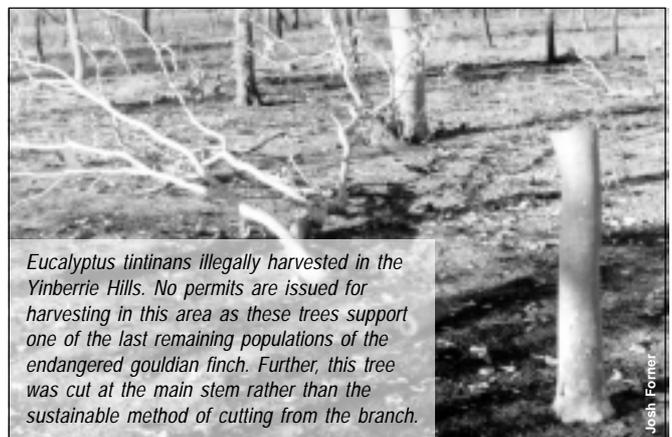
On Aboriginal Jawoyn lands near Katherine in the Northern Territory, Josh found substantial harvesting of stems for didgeridus, despite the fact that commercial harvesting in this area is illegal. These stems are mostly taken by commercial cutters with little or no affiliation with Aboriginal groups of central and eastern Arnhem Land who regard themselves as the originators of the instrument. The total production of instruments by non-Aboriginal people may run into the tens, and perhaps hundreds, of thousands every year.

The techniques and volume of modern harvests differ hugely from traditional harvesting. These involved small groups of Aboriginal men using axes to collect the stems of several species of Eucalypt (*E. miniata*, *E. tetradonta* and *E. phoenicea*) and a native bamboo (*Bambusa arnhemica*). The Eucalypts tend to have branches naturally hollowed by termites, while the bamboo is naturally hollow, an attribute considered essential for an authentic didj sound. Traditionally, tree limbs were selected carefully to ensure that the impact was minimal. The harvest volume was limited to what men could carry.

Now harvests take the form of groups of people, often non-indigenous, collecting the stems of various species with chainsaws and transporting dozens of stems in four wheel drives and even helicopters. In addition to the total volume of material being removed, Josh also is concerned about the sheer intensity of the commercial cutters' stem harvest. "I have come across tracts of land where the trees have hardly any limbs left," he said. "Some are felled one foot from the ground. The impact on the tree population is plain enough to see, but there are also many birds and animals relying on these hollow limbs for shelter and nesting. It is much harder to measure these effects in terms of the broader ecology."

Josh plans to leave aside the obvious issues of intellectual property rights that commercial harvesting raises. Instead, he is assessing the actual and potential impacts of current harvest regimes on population dynamics of Eucalyptus woodlands. He is also looking at methods for estimating the distribution and density of tree species suitable for didgeridu harvest.

Staff from the PWCNT in Katherine are working with Aboriginal people and didgeridu harvesters to create a tagging scheme for the industry. Under this scheme the Commission would issue legitimate harvesters with tags for insertion into stems at harvest time. Each stem could then be followed through from harvest to point of sale. It is hoped that the system will increase the value of tagged stems, by giving them greater legitimacy in the market place. A similar system is in place in Western Australia, where many stems are harvested around Kalgoorlie, and another is being developed in Queensland.



Eucalyptus tintinnans illegally harvested in the Yinberrie Hills. No permits are issued for harvesting in this area as these trees support one of the last remaining populations of the endangered Gouldian finch. Further, this tree was cut at the main stem rather than the sustainable method of cutting from the branch.

Josh Forner

Where possible, Josh hopes to involve local Aboriginal people in establishing experimental harvest plots which will be monitored using a combination of field ecology and remote sensing technologies. His research is being supported by the Key Centre for Tropical Wildlife Management, the Parks and Wildlife Commission of the Northern Territory, the Jawoyn Association and the NTU Remote Sensing and GIS Group.

In the longer term, data from Josh's work may be integrated with other information to produce a framework to manage didgeridu harvests. This could form a blueprint for harvests occurring in other parts of northern Australia.

Contact: Josh Forner, Key Centre for Tropical Wildlife Management
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The Ants of Northern Australia

UP to 20 million ants, representing 100 different species, can be found in each hectare of bush in northern Australia. However, up to three-quarters or more of the species are undescribed, and workable keys are unavailable for most described species.

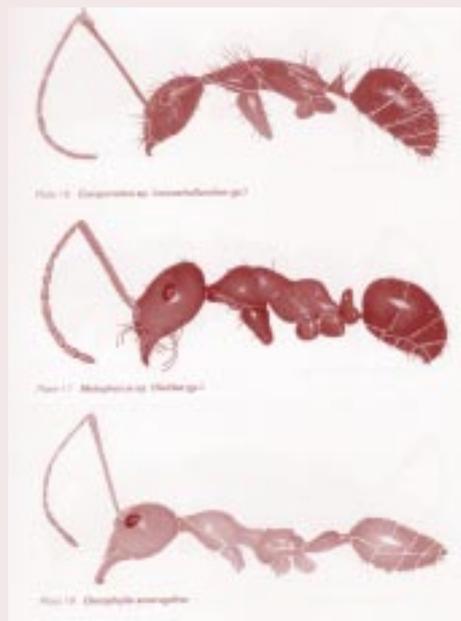
A new book—by CSIRO ecologist Dr Alan Andersen—now addresses this problem and is the first to describe the ants of northern Australia at the species level. It will help in the identification of the 1500 or so ant species occurring in the region. *The Ants of Northern Australia: a Guide to the Monsoonal Fauna* aims to enable professional researchers (including graduate students, academics and applied scientists) and knowledgeable amateurs to identify the ants occurring in monsoonal Australia.

“Ants are being used as indicators in areas such as mine-site rehabilitation, off-site mining impacts, grazing management and fire management,” says Alan. “The book will provide valuable support for land managers wishing to use ants as bio-indicators, as well as for environmental researchers.”

Cost: \$34.95 plus \$9.00 postage and handling.

To order a copy contact CSIRO publishing on Tel: 1800 645 051.

To read more about Alan Andersen's research on invertebrates in the savannas go to: <http://savanna.ntu.edu.au/research/projects/vechange.html>



The book's illustrations are by Peter Jacklyn, the TS-CRC's Communication Coordinator

Twenty-year strategic plan for Gulf region

A COMPREHENSIVE development plan for the Gulf of Carpentaria is set to provide the strategic framework for the region over the next 20 years. The Gulf Regional Development Plan (GRDP) has been endorsed by the Queensland Cabinet and the Gulf Regional Planning Advisory Committee and was prepared by key stakeholders and all levels of Government, as well as communities in the Gulf. The plan addresses key issues confronting the region including: native title protocols; economic development; management of the environment and natural resources; community services and development and the provision of infrastructure. The Gulf region covers a vast area of north-west Queensland along the southern waters of the Gulf of Carpentaria and east to the Northern Territory border. Copies can be obtained from the Cairns office of the Department of Local Government and Planning or from Local Council offices in the region.

Go to Gulf Regional Development Plan:

www.mediablue.com.au/archive/clients/dlgp/grdp.htm

Savanna Explorer: <http://savanna.ntu.edu.au/information/savannaexplorer.html>; choose Gulf Country.

Satellite imagery manages bushfires

DATA and images from the National Oceanic and Atmospheric Administration and from the Landsat satellite are proving vital tools for the Northern Territory Bushfires Council in responding to wildfires and monitoring potential hotspots. NT Minister for Parks and Wildlife, Mike Reed, said remote sensing data and images were used extensively in the latest bushfire season to monitor wildfires and to provide post-fire analysis. Satellite imagery played an important role in determining the Bushfire Council's response to a fire near a pastoral property in Central Australia last year, with the Fire Control Officer monitoring the blaze via images taken from space. While the fire activity was substantial the NT Bushfires Council was

able to use the imagery to determine if fire scars from the year before would act as a secure firebreak protecting the pastoral property. This information led to a decision not to dispatch resources as the fire would burn out into previously fire-damaged country with reduced combustible material. Satellite images will now provide the foundation for identifying options for strategically joining fire scars to limit the spread of wildfires in the future. It is also envisaged they will assist with identifying high fuel load areas to be targeted for fuel reduction programs.

Web: www.nt.gov.au/bfc

Rebates for renewable energy on Qld properties

FAMILIES on properties in Western and Northern Queensland are now eligible for an energy rebate valued at up to \$175,000 through the joint Commonwealth/Queensland Government Renewable Remote Power Generation Program. The scheme provides rebates of up to 65 per cent for families to install renewable energy technologies at sites not serviced by the main electricity grid, reducing their reliance on diesel power generation. The scheme provides individual rebates for family-owned properties in 14 western and northern Queensland shires: Barcoo, Boulia, Bulloo, Burke, Carpentaria, Cloncurry, Cook, Croydon, Diamantina, Mareeba, McKinlay, Mount Isa, Quilpie and Winton.

Contact: Energy Advisory Service on 1300 369 388, quoting the Working Property Rebate Scheme.

E-Commerce in Rural Australia: The real story

E-COMMERCE in rural Australia remains in the early stages of development. A new Rural Industries Research and Development Corporation (RIRDC) report, *E-commerce in Rural Areas: Case Studies*, shows that some rural businesses are successfully using the internet for a broad range of activities. This includes email communication, online banking and bill-paying, customs clearance, market

Reading

Weed Management Systems

Australian Weed Management Systems, edited by B.M. Sindel, claims to be the first Australian textbook on integrated weed management for students, researchers and managers of agriculture and natural ecosystems.

It is produced by the CRC for Weed Management Systems where a variety of experts have contributed selected chapters in their areas of expertise.

The textbook was developed in association with the new CRC-initiated undergraduate course in IWM which is being taught at the University of Adelaide, University of New England and Charles Sturt University. Price \$32.90 plus \$10 postage in Australia. Web: www.weedinfo.com.au Tel/Fax: (03) 5286 1533 Email: richardson@weedinfo.com.au

Greenhouse trading

Greenhouse Gas Emissions Trading: Allocation of Permits, a report from the Australian Greenhouse Office, outlines possible methods of allocating permits to emit greenhouse gases under an emission trading regime. Questions explored include: How will entities acquire the tradeable permits they require to acquit for their emissions of

greenhouse gases? Will permits be sold by the Government or will they be allocated by some administrative process? If permits are distributed by administrative means, to whom will they be allocated? Web: www.greenhouse.gov.au.

Landcare report

The Bureau of Rural Sciences has released a report that concludes that while Landcare has been an important factor in improving land-management practices, making farming systems more sustainable will be a slow process that will require more than voluntary measures.

Influencing Improved Natural Resource Management on Farms, by researchers Neil Barr and John Cary, concluded that the impact of Landcare had probably peaked and that it was "unrealistic to expect any greater degree of penetration of the farming community than has been achieved".

The report found that factors such as financial capacity, skills, financial returns and motivation influenced the adoption of sustainable practices more than notions of altruism, and that individual farmers tended to underestimate the extent of soil degradation on their own farms.

It warned that the barriers preventing farmers

from changing their practices were "overwhelmingly structural", and that most broadacre farms did not produce sufficient economic surplus to encourage investment in natural resource management and the environment.

You can download the report from the Bureau of Rural Sciences at www.affa.gov.au/corporate_docs/publications/pdf/rural_science/nat_resource_mgt.pdf Tel: (02) 6272 4282 Fax: (02) 6272 4747 Email: info.pubs@brs.gov.au

Plants of Australia

Plants of Importance to Australia—A Checklist, compiled by R.C.H. Shepherd, R.G. Richardson and F.J. Richardson, provides an accurate botanical name, authority, family and a preferred common name for each plant that is or may be of importance to Australia.

The species chosen include weeds of both agriculture and the environment; crop species of all sorts and ornamental species that have, or may, become environmental weeds. More than 12,000 common names are listed.

Cost is \$33, plus \$10 postage in Australia. Order from Web: www.weedinfo.com.au or contact the Victorian publishers:

Tel/Fax: (03) 5286 1533.

research, product promotion, document delivery, on-line sales, industry promotion and support, business-to-business trading and supply chain management. For many, email is now an integral part of business operations, quickly supplanting traditional forms of communications and generating substantial cost-savings. This was particularly marked in businesses operating in international markets.

Summary: www.rirdc.gov.au/reports/HCC/00-185sum.html
The full report can also be downloaded free from this page. Copies of this report can be also ordered from RIRDC Tel: (02) 6272 4819 for \$15, plus postage.

Cutting edge website on climate change

THE UK's Meteorology Office's website contains impressive moving graphics on climate change and carbon modelling. Also included is an update on recent research from UK's Hadley Centre, including patterns and trends in climate change, modelling the carbon cycle, and the variable effects of using forests as carbon sinks. According to TS-CRC researcher Lindsay Hutley, the Hadley Centre is at the cutting edge of modelling climate change. "Their recent work is what is driving new predictions of a much greater warming (up to 6 deg) than thought a year ago," he said. (See Cox, P.M., Betts, R.A., Jones, C.D., Spall, S.A., Totterdell, I.J., 'Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model', *Nature*, 408(6809): pp. 184-187, 2000.)

Go to: www.metoffice.gov.uk/research/hadleycentre/pubs/brochures/B2000/index.html

Call to Rural Poets

The Queensland DPI Women in Rural Industries Unit is seeking poems about rural women for its next edition of *A Vision for Change: Women Working for the Future of Rural Queensland 2001*.

Email your poems with your relevant contact details to Naree Wood. Fax: (07) 3239 3685; Email: woodn@dpi.qld.gov.au

Mimosa pigra found in Queensland

MIMOSA pigra has been found outside Northern Territory for the first time. About 500 plants were found at Peter Faust Dam near Proserpine—about 250 km south of Townsville—in Queensland in February. A six-person crew from the Queensland Department of Natural Resources and Mines led efforts in eradicating the weed over a two-week period. *Mimosa pigra* is a Weed of National Significance and has infested more than 80,000 hectares of wetlands in the NT. The outbreak at Peter Faust Dam is the only confirmed infestation of *mimosa pigra* outside the NT. All seed pods were collected from the plants at the site and about 1.5 tonnes of plant material were collected and incinerated. An extensive survey of the immediate catchment area took place and further surveys will be conducted in September to ensure no further seeding plants remain. Seeds are known to stay viable in the soil for a minimum of 30 years and possibly as long as 50 years. From a distance, *Mimosa pigra* looks similar to prickly acacia or common mimosa.

Go to DNR website: www.dnr.qld.gov.au

May

Mareeba: National Action Plan for Salinity & Water Quality Public Information Meeting May 2, 9am-2.30pm

Venue: Dept. Primary Industries Mitchell Room, Mareeba
Contact: Christine Murphy, Dept of Natural Resources and Mines.
Tel: (07) 4048 4850
Web: www.dnr.qld.gov.au

National Science Week 4–13 May 2001, Nation-wide

Theme: Celebrating international biodiversity observation year

Web: www.scienceweek.info.au

4th International Conference on Environmental Chemistry and Geochemistry in the Tropics 7–11 May 2001, Townsville

Venue: Jupiters Townsville Hotel and Casino

Theme: Geochemical cycles of the elements on land and sea in the tropics: Implications for global and regional change.

Purpose: The key objective of the conference series is to critically analyse successes and failures associated with environmental chemical and geochemical research in the tropics. Also, the conference presents an excellent opportunity to share research results and applications in practice, to debate research theories and strategies, to network, and to stimulate needs-driven research and the development of technology .

Contact: Dr A. D. Noble
CSIRO Land and Water
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QLD 4814 Australia
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Email: andrew.noble@tvl.clw.csiro.au
Web: www.tvl.clw.csiro.au/geotrop2001/

CRC Association Conference 15–17 May 2001, Perth

Venue: Novotel Langley Hotel, Perth

Theme: CRC Research & Development—Return on Investment”.

Main objectives are the promotion of the CRC Program through CRC achievements; involvement of key stake holders/decision makers; helping to advance cooperation in R&D across Australia; self-help for CRCs

Tel: (08) 9333 6272 **Fax:** (08) 9333 6146
Email: leme@per.dem.csiro.au
Web: www.crc.asn.au

12th Australasian Vertebrate Pest Conference 21–25 May 2001, Melbourne, Victoria

Venue: Melbourne Exhibition and Convention Centre

Contact: Convention Associates Pty. Ltd.
Postal: 13 Jeffrey St, Mt Waverley, Victoria 3149
Tel: (03) 9887 8003 **Fax:** (03) 9887 8773
Email: convention@optushome.com.au

Fire and Land-Management Issues 28–31 May, 2001 Jabiru, Northern Territory

Venue: Gagudju Crocodile Hotel, Jabiru, NT, Kakadu National Park.

The conference will be of interest to land managers, pastoralists, resource management researchers and students, adult educators, community organisations, policy makers and others interested in the present practices using fire as a land management tool.

The conference will focus on land-management issues; indigenous initiatives; urban/rural; fire and biodiversity. The program includes field based presentations, flood plain burning experience, information sharing discussions and poster sessions. Guest speakers will include Arnhem Land indigenous land managers, fire ecologists and practising rangeland managers.

Contact: Helen Spiers
Tel: (08) 8979 2257 **Email:** hspiern@ntu.edu.au
Web: <http://members.optusnet.com.au/~vivmohanram/index.html>

June

Groundwater Quality 2001 18–21 June 2001, Sheffield, UK

This research-based international conference addresses the newest understanding of natural and enhanced restoration regarding pollutants in groundwater and soils.

Contact: The Secretariat
Email: gq2001@sheffield.ac.uk **Web:** www.shf.ac.uk

July

Geospatial Information and Agriculture Conference 17–19 July 2001, Sydney

Venue: Australian Technology Park, Eveleigh, Sydney.

This conference aims to provide leading-edge reports on the improvement of agricultural and associated land management decisions that result from using information delivered by geospatial technologies.

Geospatial information is produced by a range of geospatial technologies to assist in, for example:

- precision agriculture;
- remote sensing and geographic information systems (GIS);
- finding the best location for new enterprises;
- predicting potential threats from new pests and diseases.

The link in this set of technologies is that they produce information that could be presented as maps. Mapping facilitates management decisions where the level or location of activities may be varied across a paddock, a property or a region.

Who should attend:

- Leading farmers;
- Agricultural consultants;
- Agribusiness;
- Landcare;

- Government agencies;
- Researchers;
- Land managers;
- Catchment managers;
- Natural resource managers;
- Local government;
- Information technology providers.

A comprehensive trade exhibition will be held in conjunction with the conference. The exhibition will cover a wide range of products and services in the field of Geospatial Information.

Contact: Conference Secretariat

Postal: GIA 2001 Conference Secretariat
GPO Box 128

Sydney NSW 2001

Tel: (07) 55528677 **Fax:** (07) 55528895

Email: K.Sullivan@mailbox.gu.edu.au

Web: www.giaconference.com

August

Asian Wetland Symposium

27–30 August 2001, Penang, Malaysia

Venue: City Bayview Hotel, Georgetown, Penang, Malaysia

Theme: Bringing Partnerships into Good Wetland Practice

The symposium will provide a much-needed platform to achieve the following objectives:

- To review and discuss the trends and emerging issues in the wise use of wetlands, their resources and biodiversity in the Asia-Pacific region;
- To formulate guidelines and recommendations of good practices in wetland management and conservation in the region;
- To explore opportunities for developing strategic cooperation between universities and research organisations and developing collaboration and regional capacity in wetland conservation.

Web: <http://aws2001.domainvalet.com>

3rd Australian Stream Management Conference: 'The value of healthy streams'

27–29 August 2001, Brisbane

Themes include: (i) ecosystem services; (ii) hydrological connectivity; (iii) biophysical integration; and (iv) tools and techniques. Conference will be held in conjunction with this year's Brisbane River Symposium.

Contact: John Amprimo, Conference convenor

Tel: (07) 322 47668

Email: stream.conference@dnr.qld.gov.au

September

The National conference of Interpretation Australia

3–7 September 2001, Alice Springs

Venue: Red Centre Resort, Alice Springs

Theme: Getting to the Heart of it: Connecting people to heritage.

The conference will focus on cultural and natural heritage,

technology, arts and the media, and community projects. The Interpretation Australia Association (IAA) is a national non-profit organisation with professional and non-professional membership. It has affiliations with Heritage Interpretation International, which represents interpreters internationally.

The program will interest people who advocate, practice, or are learning about interpretation including people involved with the tourist industry, parks, cultural sites, homelands, historic sites, museums, botanic gardens, art galleries, visitor centres, information centres, community education services, educational institutions as well as contractors who work on interpretation projects.

The conference will be relevant to tour managers and guides, rangers, education and community education officers, and people involved with community projects such as World Wildlife Fund, Greening Australia, Land Care, Water Watch, Bush Care, and Coast Watch.

Contact: Robin MacGillivray, Conference Convenor.

Tel: (08) 8999 4408 **Web:** www.vicnet.net.au/~interpoz

Postal: Eileen Boocock

Action Enterprises PO Box 1381

Alice Springs NT 0870

Tel/Fax: (08) 8952 4061

Email: eileenb@ozemail.com

3rd International Conference on Land Degradation and the Meeting of the IUSS Sub-commission C: Land Degradation: New Trends towards Global Sustainability

17–21 September 2001, Brazil

Venue: Hotel Glória, Rio de Janeiro

Recognizing and assessing land degradation was important in establishing the IUSS Working Group on Land Degradation that resulted in International Conferences on Land Degradation. The focus of this conference is:

- monitoring land quality and global climate changes;
- land-use ethics;
- social implications of land degradation;
- land reclamation technologies; and
- public policies to achieve sustainable land use.

The Meeting of the IUSS Subcommission C–Soil and Water Conservation will be held as part of the conference.

Contact: Embrapa Solos - ICLD3

Postal: c/o Beáta Madari

Conference Secretary

Rua Jardim Botânico, 1024

22460-000 - Rio de Janeiro, RJ, Brazil

Tel/Fax: +55 21 294 8039

Tel: +55 21 274 4999

Fax: +55 21 274 5291

Email: icld3@cnps.embrapa.br

Web: www.cnps.embrapa.br/icld3/

AIATSIS Indigenous Studies Conference

18–20 September 2001, Canberra

Venue: Manning Clark Centre, Australian National University, Canberra

Theme: The Power of Knowledge and the Resonance of

Tradition in Indigenous Studies'. There will be formal papers, workshops, discussion groups, debates, performances, and poster presentations. Presentations are called for. Papers should address the conference theme, and issues relating to the symposia:

- A: Land, Resources and Knowledge;
 - B: Knowledge and Tradition in the Colonial Context;
 - C: The Resonance of Tradition;
- Contact:** Dr Graeme Ward, Research Fellow
Postal: AIATSIS, GPO Box 553
 Canberra ACT 2601
Fax: (02) 6249 7714 **Email:** gkw@aiatsis.gov.au

14th Australia-New Zealand Climate Forum

18–21 September, Darwin

Venue: Darwin Entertainment Centre

The main focus will be tropical climate: monitoring and prediction, the research and impacts of climate on habitat, rainforests, building and construction, trade and weather related natural hazards. The forum will discuss management, education and partnerships.

Contact: Hakeem Shaik
Tel: (08) 8920 3814
Email: h.shaik@bom.gov.au
Website: www.bom.gov.au/weather/nt/inside/anzcf_2001/index.shtml

October

Australasian Pacific Extension Network Conference

3–5 October, Toowoomba

Venue: University of Southern Queensland, Toowoomba

Theme: Contemporary extension as a powerful vehicle for regional change.

Contact: Convener, John James
Tel: (07) 5460 1495
Email: jamesj@dpi.qld.gov.au
Web: www.apen.org.au/apen2001

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Seminars

Tropical Ecosystems Research Centre
Venue: CSIRO Conference Room
McMillans Road, Darwin
Time: 3.45 pm, Fridays (monthly)

Contact: Barbara McKaige
Tel: (08) 8944 8411 **Fax:** (08) 8944 8444
Email: barbie.mckaige@terc.csiro.au
Web: www.dar.dwe.csiro.au/seminars.asp

Friday, April 27, 2001

More than can be said: A study of pastoralists' learning.

Allan Arnott, Rebecca Benson & Dick Fell, TS–CRC, Darwin.

Friday, May 18, 2001

Can't see the wood for the trees: The northern forest mapping project.

Chris Meakin and Dave Howe, NT Department of Lands, Planning and Environment, Darwin, NT

Friday, June 8, 2001

Come on baby light my fire: Habitat use by partridge pigeons in the tropical savannas.

Fiona Fraser, Key Centre for Tropical Wildlife Management, NTU, Darwin.

Friday, October 12, 2001

On the hop in the top: Foraging habits of agile wallabies.

Simon Stirrat, Parks & Wildlife Commission NT

CSIRO Seminars, Townsville

Venue: Conference Room, Davies Lab.

Time: 11am, Fridays

Contact: John Gross
Email: John.Gross@tag.csiro.au

Queensland Herbarium seminars, Brisbane. Held on a monthly basis

Toowong, Brisbane, Qld 4066.

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