



SAVANNA LINKS

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Brooke Rankmore radio-tracks a quoll in its new island home



Grim news for Territory's quolls

One of Australia's best-loved marsupials, the northern quoll, is under threat. Meri Oakwood reports on new surveys that show their populations are falling as cane toads invade Kakadu. See pages 6, 12.

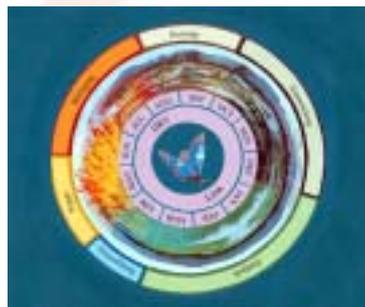
Quolls move offshore

A rescue program relocating quolls to islands off Arnhem Land are showing promising results as the marsupials take to their new home. See pages 7,12.

Breakthrough fire websites

Satellites have been providing people with images of bushfires from space for years, but data was usually updated infrequently and used by government agencies or large companies. Now, advances in web and satellite technology mean fires can be monitored soon after they are detected—by anybody with a reasonable internet connection.

Read about the new Northern Australian Fire Information website, page 2.



Step into the seasonal rhythms of Kakadu

A new children's book by Diane Lucas takes us on a journey into the six seasons in Kakadu, pictured left, speaking in English and the Gundjeihmi language. See page 13.

Also read about riverbank regeneration, natural resource management and regional planning, new light on cattle nutrition, the International Rangelands Conference, and more.



CRC
AUSTRALIA

Established and supported under the Australian Government's Cooperative Research Centres Program

Breakthrough websites track fires by satellite

NEW websites are now providing people across Australia with information on bushfires that was previously only dreamed of. Advances in web and satellite technology mean anybody with a reasonable Internet connection can monitor fires from space soon after they are detected.

One of the first websites to offer satellite-based views of fire to the public was developed by Western Australia's Department of Land Assessment in the late 90s. It showed simple maps of 'hotspots'—the location of suspected fires—as seen by each satellite pass. Hotspots were calculated from images provided by American weather satellites (National Oceanic and Atmospheric Administration, or NOAA). Although designed to measure things like cloud and sea temperatures, instruments on NOAA satellites could locate fires to within about four square kilometres.

In the last few years, however, NASA has launched two satellites, Aqua and Terra, specifically designed to monitor the earth's surface. One of the detectors they carry is the Moderate Resolution Imaging Spectroradiometer (MODIS) which can be used to locate burning fires to within about a square kilometre. The new NASA satellites, together with the NOAA satellites, can now provide a few readings a day, making it possible to monitor fires in close to real time (cloud cover permitting). Recent advances in web technology now allow hotspots to be placed on interactive web-based maps, where users can zoom in, display detailed map features, and query hotspots for their time of detection.

Last year CSIRO, the Defence Imagery and Geospatial Organisation and Geoscience Australia developed the Sentinel website that used MODIS data to display hotspots on an interactive map. The site is aimed largely at emergency services which need to respond to fires quickly. The site shows hotspots detected at various times over the most recent three days. WA's Department of Land Information (DLI) also has a site that shows hotspots and fire histories from both MODIS and NOAA on an interactive map.

A fire site for north Australia

The latest interactive fire mapping website is the North Australian Fire Information or NAFI site, developed by



Page from the NAFI site showing hotspots and fire scars near Maningrida, Northern Territory. The text navigation bar on the left means maps can be created quickly.

Tropical Savannas CRC and Ecobyte Systems in collaboration with the Bush Fires Council NT, Kimberley Regional Fire Management Project and the Cape York Peninsula Development Association. It is designed to meet the needs of northern rural and remote fire managers and uses hotspot data supplied by Sentinel and WA DLI.

Remote fire managers not only want to know where fires are burning now, but what areas have already been burnt as recently burned areas can be used as fire breaks. The NAFI site allows users to see hotspots from all months of the year as well as recent hotspots.

The site also shows fire scars which are hand-mapped from satellite images and put onto the site every few weeks. Users can also navigate to different map locations by clicking on text links rather than zooming in on images. Customised 'quicklooks' can also be created that deliver a compact image of fires in an area with one mouse click.

Developers are also providing back-up fire information such as emails and faxes of hotspot locations.

North Australian Fire Information: <www.firenorth.org.au>

WA Department of Land Information: <www.rss.dola.wa.gov.au/apps/firewatch.html>

Sentinel: <www.sentinel.csiro.au/mapping/viewer.htm>

MODIS: <modis.dli.wa.gov.au/>

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 northern Australia.

It comprises three universities, government agencies from the NT, Qld and WA and the Commonwealth, CSIRO, and representatives from Aboriginal groups and the pastoral industry.

The Centre promotes sustainable use and conservation of Australia's tropical savannas by acting as a bridge between agencies engaged in land and resource-management research, and research

users and decision makers. These include pastoralists, conservation managers, Aboriginal land managers, and the tourism and mining industries.

The Centre communicates the outcomes of its research and other knowledge about the savannas to ensure this knowledge can be used effectively by people living and working in Australia's savannas.

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NTU to CDU

THE Northern Territory University is to amalgamate with Centralian College to form a new institution, the Charles Darwin University (CDU) from January 2004. CDU is the head office of the Tropical Savannas CRC, and our website address will now take the initials 'cdu' instead of 'ntu'. However, our site will always be accessible under our former URL address.

For information on Charles Darwin University: <www.cdu.edu.au/newuni.html>

Reports explore regional dynamics and NRM plans

NEW reports on regional dynamics and regional resource planning in the tropical savannas are now available on the Tropical Savannas CRC website.

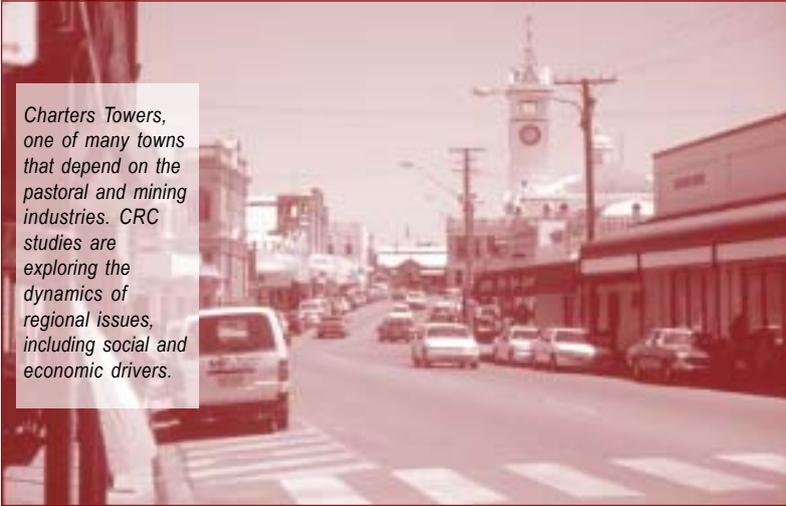
Regional dynamics

Increasingly planners are realizing that they need to take account of the dynamic nature of regions—the way different sectors interact within regions. For example, a new railway will have flow-on effects on road transport, tourism, mining and many other sectors. New developments will also affect areas like the environment and human health that may be hard to measure in financial terms. Tools that would allow planners to better take account of the dynamic nature of regions would be very useful. Consequently the Tropical Savannas CRC supported a Regional Dynamics Scoping Study in 2002–03, led by Dr Mark Stafford-Smith of CSIRO Sustainable Ecosystems. A full report and a stand-alone summary Report are available from the CRC website. The summary report is also available in limited numbers as a hard copy.

Regional planning

As more regional resource planning devolves to community groups through NHT 2, two CRC projects have looked at ways of assisting tropical savanna regional groups and planners with NRM planning. The projects worked in collaboration with Queensland's Regional Natural Resource Management (NRM) Taskforces' Regional Arrangements Planning Team and involved Bruce Taylor and Allan Dale from Department of Natural Resources and Mines and Geoff McDonald at CSIRO Sustainable Ecosystems.

The first project centred around evaluating regional



Charters Towers, one of many towns that depend on the pastoral and mining industries. CRC studies are exploring the dynamics of regional issues, including social and economic drivers.

Photo: Kate O'Donnell

plans in the tropical savannas asking the key question of how technically sound the existing set of voluntary and government plans are in the region. The booklet *Evaluating regional plans in tropical savanna regions* provides a framework for reviewing and improving the technical content of regional plans based on landscape and social sustainability issues in northern Australia.

The second project looked at improving the integration of regional planning in savanna regions.

“By working with Natural Resources and Mines and community planners in both the Burdekin and Fitzroy Regional Bodies, we've been able to put together some practical advice for regions and the policy-makers in Brisbane,” said project manager Bruce Taylor.

This advice is in the form of two short guidelines: one on integrating water resource planning with regional NRM plans and arrangements; and one on integrating vegetation management plans into the broader NRM plans and arrangements for regions.

These booklets and reports can be downloaded free from our website. Go to: savanna.ntu.edu.au/publications/books_reports/

—See page 11 for the new biodiversity monitoring report

Outback atlas looks to map regional viability

ONE of the main principles emerging from work on defining healthy savannas is that people are part of the system and that social and economic issues play a key role in natural resource management.

A new joint project between the Tropical Savannas CRC and the Desert Knowledge CRC aims to develop an ‘atlas’ of savanna regions and their challenges—as a framework for understanding these issues and how they interrelate.

A recent study on regional dynamics and the issues outback communities face (see above story) emphasised the strong differences between outback issues compared

with those faced in more densely settled areas.

There is also considerable diversity within different parts of the outback, which can be overlooked by general representations of remote areas. The atlas aims to help define and represent issues and indicators that characterise viable and socially desirable regions. Unlike a conventional atlas, the idea is to produce a dynamic product that will help integrate and disseminate CRC research and target future activities.

A preliminary study is exploring and testing the concept and

what the project can contribute to the knowledge base on issues of regional viability in outback Australia.

This study has reviewed existing literature on regional viability, and held discussions with case study communities in Greenvale (Qld) and Ti-Tree (NT).

The project team is currently developing a full proposal. If you would like to contribute ideas, or see synergies with other CRC projects, contact the project team. Tom Measham Tel: (07) 4753 8593 Email: <Tom.Measham@csiro.au> Yiheyis Maru Tel: (08) 8950 7129 Email: <Yiheyis.maru@csiro.au>

Cattle nutrition: getting the scoop from cow poop

Near Infrared Reflectance Spectroscopy (NIRS) technology to analyse cattle dung is giving producers a better idea of diet and pasture quality for grazing animals across tropical Australia.

Deborah Cavanagh writes.

Faecal NIRS research started in Australia in 1994 when CSIRO researcher David Coates began developing the technology for application in the northern Australian beef cattle industry. The technology was pioneered by scientists at Texas A&M University in the United States, but the results could not be applied to Australia initially because of different pastures and conditions. Subsequently, David and his colleagues have conducted hundreds of feeding trials throughout northern Australia to develop a picture of livestock diet across tropical Australian pastures.

Initially aimed at predicting the dietary crude protein and digestibility levels in grazing cattle, the project is now providing comprehensive information about animal diets, making NIRS a useful tool for sustainable grazing, as producers can better understand and manage their livestock. The research team itself has also expanded to include scientists from the Queensland Department of Primary Industries, Northern Territory Department of Business, Industry and Resource Development, the University of Queensland and CSIRO Sustainable Ecosystems.

According to David, more than 600 beef producers have submitted samples of cattle dung for analysis during the past few years. “Many producers have submitted the samples routinely, to get an idea of the seasonal changes on their properties,” he explained.

Results of analyses provide producers with information that gives them a better understanding of the nutritional limitations of the forage on their properties, and helps with decisions relating to the nutritional management of their cattle.

“In addition, the collective and accumulated results from many thousands of samples provide us with new and beneficial insights into grazing behaviour and the nutritional complexities of the northern pastures,” he said.

Selective grazers

Estimating diet quality of grazing animals has always been a problem for researchers because cattle are selective grazers. This often means that the quality of the pasture may bear little relationship to the quality of the diet selected by the cattle.



David Coates and the NIRS instrument, which is proving a useful tool in better understanding cattle nutrition

Photo: Deborah Cavanagh

While looking at cattle diets from large stations in northern Australia, the team found that cattle in large paddocks do not feed uniformly and some animals fare much better than others.

“Diet tends to be quite uniform in the smaller paddocks and we expected more variation between animals in the larger paddocks. But the results really surprised us because the variation was far greater than we anticipated,” said David.

“In the last lot of samples we found that the amount of non-grass in the diet of cattle in the same large paddock varied between 11 to 78 per cent.”

Further research into this aspect of grazing behaviour will be conducted by Leeanne Goody, a PhD student from the University of Queensland, who is studying grazing systems at Pigeon Hole Station in the Northern Territory.

The little grey box

The NIRS instrument itself is a nondescript grey box about the size of a small television. A beam of infrared light is directed at a small sample of dried dung to measure reflectance over the range of wavelengths from 400 to 2500 nanometers (human eyesight stops at around 700 nanometers). Each sample is scanned 32 times with 10,500 reflectance readings taken per scan. These are averaged out and transmitted to a computer and displayed as a graph of reflectance plotted against wavelength, all in the space of about one and a half minutes.

David explained that a single NIRS analysis can provide a number of predictions including dietary protein level, digestibility, the proportion of non-grass in the diet, faecal nitrogen concentration and an estimate of cattle growth rates.

“The technology is designed to be another decision support tool in producers’ armouries, to complement their own knowledge and experience, and to assist them in managing their enterprises for productivity, profit and sustainability,” he said.

Samples can be collected and analysed as a ‘once-off’, for a specific purpose, or at regular intervals, to provide producers with a profile of the seasonal and yearly nutritional changes. These profiles can add to a producer’s

Cont. page 5

Web tool helps involve community in NRM

NATURAL resource management group, the Burdekin Dry Tropics Board, has developed a new-look website that allows people to monitor and provide feedback on developing the region's major natural resource management (NRM) plan.

The regional NRM plan is required to guide the investment of the National Action Plan for Salinity and Water Quality, Natural Heritage Trust and other funding initiatives to community driven on-ground actions in the Burdekin Dry Tropics region.

These actions need to deliver maximum impact in NRM priority areas in the region, as defined by the people who live and work there. This 'bottom-up' approach aims to ensure that funds are spent in the areas of highest priority.

InfoBase—the new website—outlines the process for plan development, the timelines for upcoming events and the outputs to date.

InfoBase project manager, Arwen Rickert, pointed out that site is designed not to replace other methods of communication, but to be another tool in the community involvement toolbox.

"We recognise that people are busy and can't always attend community forums," she explained. "InfoBase enables them to track progress on the plan and have their say in their own home and in their own time."

Over the next few months, community members and other stakeholders in the region will be invited to participate in workshops to determine the plan's targets and actions. These workshops will be held in collaboration with existing sub-regional community groups and will build upon plans developed as part of NHT 1. Workshop outputs will be placed on InfoBase and people who were unable to attend can comment via email.

InfoBase also contains information on the Burdekin Dry Tropics Board, community-based natural resource management activities and projects in the region, a library of relevant documents and a positions vacant section.

Go to: <www.burdekindrytropics.org.au>

More information: Arwen Rickert, InfoBase Project Manager or Holly Hanlon, InfoBase Project Officer, Burdekin Dry Tropics Board, Townsville Tel (07) 47 243 544

Email: <Holly@burdekindrytropics.org.au>



InfoBase: new-look website for the Burdekin Dry Tropics Board. The site will allow the region's community to comment and participate in the region's NRM planning

Forum for Territory NRM network

A NEWLY formed natural resource management network in the Northern Territory, the Savannah NRM Network, has organised a one-day forum about the region's NRM research. The 'Linking NRM Research and the community' forum will focus on:

- Sharing information on current NRM research in the region
- Identified NRM research priorities for the region
- New partnerships between NRM researchers and NRM community groups / landholders
- Uptake of techniques to implement research

The network comprises the Victoria River District Conservation Association, the Katherine Landcare Group, the Roper River Landcare Group and Greening Australia – Katherine region.

Date: November 20 **Venue:** Katherine Training Centre, 19 Second St, Katherine (the old High School)

Contact: Royce Sample Tel: (08) 8971 0368 or Julia Chalmers Tel: (08) 8971 1775

Getting the scoop from cow poop

Cont. from page 4

understanding of the potential, the limitations and the complexities of pasture nutrition, particularly with regard to pasture species or mixtures, soil type, weather conditions, grazing systems and the like.

For example, following the 2002 drought, Mitchell grass did not respond well to rains in February 2003. Nevertheless, cattle in much of the Mitchell grass country performed very well.

Faecal NIRS analysis showed that stock were selecting a high-quality diet of green herbage. According to David, the drab appearance of many of the pastures may have led producers to give out conventional urea-based supplements quite early in the year. However, analysis showed that such supplements would not have conferred any benefit while sufficient green herbage remained to boost dietary protein levels.

"The technique is extremely

practical because collecting, processing and analysing the samples is uncomplicated, and the technique is quick and inexpensive compared to traditional chemical analysis," he said.

"The technique is also excellent because the grazing animals do all the work of sampling the pasture."

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Quolls decline with advance of toads

Surveys of quoll populations reveal grim news as cane toads invade Kakadu, writes Meri Oakwood

As their range has expanded into the Northern Territory, there has been considerable debate over what impact cane toads will have on the native fauna (See: 'The cane toad dialogues: disaster or disruption', *Savanna Links*, 16, p. 1). Some experts, such as Professor Mike Tyler from the University of Adelaide, forecast an ecological disaster affecting a range of predatory species. Other scientists, such as Dr Bill Freeland, former head of the NT Parks and Wildlife Commission, believe that although species may suffer massive declines initially, they will bounce back within a few seasons. Unfortunately, in the areas of Queensland that experienced toad invasion years ago, no methodical scientific monitoring was conducted. We only have a couple of field studies in the Gulf country^{1,2} and anecdotal stories from Queensland on which to base predictions.

Cane toads reached Kakadu in 2001, and were first recorded in the south-east at the junction of Gimbat Creek and a creek from Mt Evelyn in April of that year. Since then they have spread northwards and westwards across the Park with sightings now occurring in Jabiru.

There have been several projects instigated in the Park to monitor the effect of cane toads on the native fauna. Professor Gordon Grigg (University of Qld), Dr Andrew Taylor (UNSW) and Hamish McCallum (UQ) installed audio monitors at six sites to determine whether the composition of the native frog community changes. Dr Dan Holland has radio-tracked the two largest species of woodland goannas, *Varanus panoptes* and *V. gouldii*. Michelle Watson (Charles Darwin University) has been conducting broad-scale fauna surveys before and after toad invasion. I have been monitoring two populations of northern quolls, *Dasyurus hallucatus*, considered to be a high-risk species of carnivorous mammal.

Profile of the northern quoll

Northern quolls are opportunistic predators, consuming anything that moves that is within a size range that they can manage. They eat several species of native frogs³ and cane toads are easy prey. Unfortunately, all the quoll has to do is mouth the toad to cause it to exude poison from its parotoid glands (the swellings on each shoulder behind the eardrum). The poison is then ingested by the quoll. An individual of a closely related species of quoll



Photo: Ian Morris

Northern quoll *Dasyurus hallucatus*

Quolls are rabbit-sized marsupial carnivores, found only in Australia and New Guinea. There are four Australian species, and two species restricted to New Guinea. All Australian species have declined considerably, and three (the eastern quoll *D. viverrinus*, the western quoll *D. geoffroyi* and the spotted-tailed quoll *D. maculatus*) are listed as nationally threatened.

The northern quoll is the smallest of quolls, with a maximum weight of 1.2 kg. It shelters during the day in rock crevices, tree hollows, logs or termite mounds and forages at night, both in trees and on the ground, for invertebrates, vertebrates and fruit. Northern quolls have an annual highly synchronised mating season; shortly after mating, all the males in the population die off. Home range sizes vary from 35 ha (in females) to over 1 km² for males in savanna woodland.

— John Woinarski & Meri Oakwood

was observed moulting a toad and dying ten minutes later⁴. Some social native species, such as crows, have been reported to be able to consume toads safely by turning them over and only devouring the stomach region. Unfortunately, northern quolls are solitary hunters⁵, so there is little chance that they will learn safe toad-consuming behaviour by observation of other individuals.

The quoll/cane toad project has two study sites: one in southern Kakadu (Mary River District) and one in northern Kakadu (East Alligator District)⁶. Trapping, radio-tracking and post-mortem examinations are being used to monitor the quolls and road surveys are conducted to monitor the progress of the toads. The cane toads reached the Mary River District in December 2001 and were first recorded at the study site in February 2002.

Immediately some of the radio-tracked quolls were found dead of apparent toad-poisoning. However, the wet

Continued page 12

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References

1. Freeland, WJ, & Kerin, SH 1988, 'Within-habitat relationships between invading *Bufo marinus* and Australian species of frog during the tropical dry season', *Australian Wildlife Research* 15, 293–305.
2. Catling, PC, Hertog, A, Burt, RJ, Wombey, JC, & Forrester, R 'The short-term effect of cane toads (*Bufo marinus*) on native fauna in the Gulf

Country of the Northern Territory', *Wildlife Research* 26, 161–185.

3. Oakwood, M 1997, The ecology of the northern quoll, *Dasyurus hallucatus*, PhD thesis, Australian National University.

4. Prof. M Archer, Director of the Australian Museum, pers. comm.

5. Oakwood, M, 'Spatial and social organisation of a carnivorous marsupial, *Dasyurus hallucatus* (Marsupialia: Dasyuridae)', *Journal of Zoology, London* 257, 237–248.

6. Oakwood, M 2003, 'The effect of cane toads on a marsupial carnivore, the northern quoll, *Dasyurus hallucatus*', Report to Parks Australia North.

Island refuge gives quolls chance at survival

A plan to rescue this unique marsupial from the march of the cane toad is off to a promising start.

The project team reports.

Cane Toads are likely to colonise all of the monsoonal northern mainland of the Northern Territory within the next two or three years and as Meri Oakwood's study indicates (see opposite page), we may now lose the Territory's entire mainland quoll population. Consequently, a 'rescue' program was initiated to establish quoll populations in a safe refuge on offshore islands remote enough to be beyond the reach of toads.

This exercise was marked by a high degree of collaboration among Parks Australia North (the agency managing Kakadu National Park), the NT's Department of Infrastructure Planning and Environment, the Northern Land Council and the Threatened Species Network. In the Northern Territory, almost all islands are inalienable Aboriginal freehold lands, and wildlife management programs in these areas must have the consent and involvement of Aboriginal landowners. In this case, the Aboriginal owners of the islands supported the program, and were prepared to accept the new responsibility of looking after the translocated animals.

Through Aboriginal custom, the translocation had to be negotiated between Aboriginal landowners from which the quolls were sourced, and Aboriginal landowners on the islands. Mainland landowners 'lent' their quolls for safe-keeping to the owners of the islands, in the expectation that, if properly looked after, the quolls (or more likely, their descendants) will be returned once the menace has passed.

Island journey

Two uninhabited islands were selected for the program: Pobassoo and Astell, in the English Company Islands group, off north-eastern Arnhem Land. On the basis of previous surveys, these islands were known to contain suitable habitat, were large enough to support a reasonable quoll population, were remote, and had no other conservation values that may have been affected by the introduction of quolls.

In February and March of this year, 65 quolls were captured from mainland areas not yet penetrated by cane toads. Each quoll was first taken to the Territory Wildlife Park to be microchipped and genetically profiled. With a



Above: Luke Djamanggi Bukuladjpi, David Campbell and Bruce Lirrwa Ganambar examine a quoll

Keen for freedom and to investigate its new home, a northern quoll leaps out of the bag, released by Martin Armstrong, right. As quolls are nocturnal they were released at sunset to reduce stress.



Photos: Ian Morris

field team of zoologists and Aboriginal landowners, the quolls were then transported, by plane and boat, to the islands. On each of the two islands, at least 10 quolls were fitted with radio-transmitters, in order to monitor their fate over the first few weeks following their release.

The quolls thrived, proving hardier travellers than many of the humans. On release, most moved immediately to large boulder piles and rocky cliffs that provided ideal shelter. Over the next few weeks, some settled within a small area while others moved up to 2–3 km. During this time we re-trapped many of the released individuals and their condition and weight gains were mostly excellent.

Continued page 12

Authors: Brooke Rankmore, John Woinarski, Rob Taylor, Ian Morris, Lirrwa, Martin Armstrong, Mark Ziembicki, Terry Mahney, Terry Yumbulul, David Lawson, Meri Oakwood, Kendall Fox.

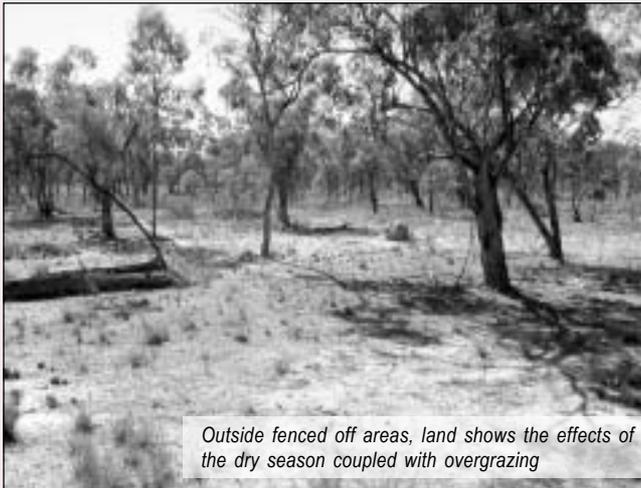
Acknowledgements

This work was dependent upon the help of many people and groups, including Parks Australia, Arafura Pearls, the Territory Wildlife Park and the Threatened Species Network

In 1935, the Australian Bureau of Sugar Experimental Stations imported about 100 cane toads from Hawaii to the Meringa Experimental Station near Cairns, releasing more than 3000 in the sugar cane plantations of north Queensland. The toads were meant to eat French's cane beetle and the greyback cane beetle, the larvae of which eat the roots of sugar cane and kill or stunt the plants¹.

While it had little effect on the cane beetles, the toad has spread rapidly since, causing extensive but still poorly defined impacts upon Australian wildlife. By 1982, they had spread from north Queensland to the Northern Territory border and, by 2001, they had reached Kakadu National Park.

1. Australian Museum Online <www.amonline.net.au/factsheets/canetoad.htm>



Outside fenced off areas, land shows the effects of the dry season coupled with overgrazing



Good pastures inside the fenced-off riparian zone

Photos: Toni Somes

A decision to fence off fragile riparian areas has proved a catalyst for major management changes for north Queensland cattle producers Shane and Tracey Meteyard. *Toni Somes* writes.

Riverbank regeneration aids grazing

The Meteyards own and operate three grazing properties the base one being Milray Station, Pentland, about 300 km from Townsville on the Cape River. The changes on their property were part of a \$1.1million Natural Heritage Trust project, which saw 1235 km of fencing erected along vital watercourses in north Queensland. The project involved fencing off selected creeks and rivers on 60 cattle properties in the Dalrymple Shire, surrounding Charters Towers, and about 200 km west of the eastern coast (see box on frontage country). Most properties were located on strategic watercourses or river catchments, all of which flow into the Great Barrier Reef.

The couple said the NHT riparian fencing projects initiated significant management changes on their properties prompting them to undertake \$150,000 worth of water developments. This extensive water development program—replacing river and creek watering points with polypipe-fed troughs—along with the additional fencing has allowed the landholders to introduce a more closely controlled grazing program.

While the cost of their in-kind water infrastructure significantly overshadowed the NHT-funded fencelines, Shane Meteyard credits the project with prompting the changes on his home front. “Fencing the riparian zones forced us to reconsider and redevelop our watering points and in short, it means we completely changed how we managed the property,” Shane said.

The Meteyards initially took advantage of NHT funding for riparian fencing in 1999 and, in the four years since, have completed 58 km of fencing themselves along watercourses on Milray and their other two properties Uralla and Mytonvale. Their focus was on fencing the Cape River, Betts and Warrigal Creek riparian zones to reduce the grazing pressure on the favoured, sweeter creek and riverbank pastures. Using a controlled grazing system and wet-season spelling, the Meteyards aim to fence off

riparian zones during the wet and introduce stock in closely monitored numbers when these sensitive areas have significant pasture coverage. In this way, they aim to reduce erosion and sediment run-off and allow regeneration of pastures in areas which have been overgrazed for decades.

“Our motivation has been to improve our riparian zones, decrease stocking pressure on sensitive areas and work towards a more controlled approach to grazing,” said Shane. “Already we have seen some regeneration of pastures in these riparian zones, through less grazing pressure, but it is still very early days for us.

“This is realistically our first year, so what pasture improvement we did see was limited, because we had such a light season and then army grubs decimated 75 per cent of the standing feed.

“Longer term, though, the additional fencing means more paddocks, we now have more watering points and it will allow us to really use controlled grazing.

Implementing water infrastructure

Before riparian areas could be fenced off, alternative watering points to those established almost a century ago along the river and creeks, had to be developed.

The initial plan to erect laneways through riparian areas to existing watering points was altered, and 40 km of polypipe was laid to take water from the bore at the main homestead to nine tanks and 16 new troughs. Solar pumps were installed and an effective and comprehensive watering program developed to complement fenced-off riparian areas. The increase in the number of watering points and their strategic location meant the Meteyards were better able to utilise their country.

While they believe the riparian areas will now prove a valuable feed resource for selected stock at specific times within the season, there is another advantage to allowing grass levels along the watercourses to build up.

“When we have a substantial amount of dry feed in the waterways we can put a hot fire through and hopefully make an impact on woody weeds, specifically in our case rubber vine.”

Controversy: locking up the sweeter country

Shane is not daunted by comments from within the rural sector criticising the riparian fencing project as “locking up your best country” or labelling it a government ploy to control watercourses and water access.

“I believe it is in my best interest to adopt the best management practices to manage my most sensitive country: the more fragile, sweeter river and creek areas.

“It improves the way in which we graze, and if governments see that we are managing our riparian areas in a sustainable way, they will be much less likely to insist that cattle are excluded from grazing along watercourses.

In the long term, the Meteyards’ plan is to continue to develop their 44,800 ha land area with a focus on controlled grazing—they currently use a four-paddock rotational system—and strategic management of sensitive areas.

“Admittedly we’ve got some work to do regenerating areas, which have been overgrazed by previous generations, but we also have the benefits of polypipe and an understanding of the impact of some earlier management practices.

“The hardest part of being a young landholder is not knowing definitely how doing things differently will impact; or whether new methods will even work. But knowing all the same, that some things need to be done differently to how they were done in the past.”

Toni Somes, Dalrymple/NHT Riparian Fencing Project support officer
Tel: 0427 878 387 Fax: (07) 4787 8387 Email: <some@austrnet.com.au>

Frontage country benefits from fencing

RIPARIAN fencing project coordinator, Bob Shepherd, said the project grew from concerns a group of Charters Towers landholders had with woody weed management along watercourses and the management of better, more sensitive frontage country.

“They were keen to investigate alternatives to herbicide for controlling woody weeds and trial fire, but were hindered because cattle tended to graze the frontage heavily leaving limited fuel for burning,” he explained. He said landholders’ reluctance to continue controlling weed infestations chemically was two-fold: costs inhibited large-scale treatments and there were concerns about using herbicides in close proximity to watercourses.

The project was administered by the Dalrymple Shire Council, coordinated by the Department of Primary Industries in Charters Towers and the Dalrymple Landcare Committee, and run in conjunction with the Australian Centre for Tropical Freshwater Research at James Cook University (ACTFR).

Roger Landsberg, northern landholder and chairman of the project’s management committee, said the project’s primary positive outcome was improvement in managing sensitive watercourses and creek flats.

“Graziers can now use controlled grazing practices to better utilise their frontage country, which ultimately means better managed country and improved productivity,” he said. “This also means less nutrient and soil run-off into watercourses, and downstream less run-off to the Great Barrier Reef.”

Contact: Bob Shepherd, DPI, Tel: (07) 4787 2155
Email: <bob.shepherd@dpi.qld.gov.au>

Choose the time and place to exclude cattle

ACTFR researcher Damien Burrows said data collected as part of the project had provided the framework for one of the most detailed water quality studies of northern inland river systems ever undertaken.

The data will also contribute to a joint ACTFR and TS-CRC project that aims to aid landholders protect and manage sensitive riparian zones. Damien emphasised that such management would not require permanent exclusion from a waterhole, only exclusion at times when impacts on water quality were most likely.

Water-quality problems are most commonly caused by livestock and feral animals, such as pigs, during the dry season. During the wet, large volumes of rain means many streams have a surface flow. In addition, cattle also tend to be dispersed away from waterholes at this time.

However, as the dry progresses water levels fall, surface flow ceases, and pressure from cattle increase. If cattle have access to vulnerable waterholes during the dry, they stir up bottom sediments, reducing water clarity which affects the penetration of light and in turn the growth of aquatic plants.

This situation affects all food chains based on the productivity of these plants. Much productivity occurs around the waterhole edges because of the beneficial algae that grow on the sediment.

However, livestock only cause significant water quality problems sometimes—and only in some locations.

“The trick is to know where and when,” said Damien. “In variable environments such as the tropical savanna grazing lands, there is

rarely a fixed ‘when and where’, but rather it is something that changes all the time.”

Waterholes in different parts of the catchment require different levels and types of management depending on the time of year, the rainfall and water flow of different years.

Waterholes only take up a small percentage of a watercourse, and dry-season spelling only has to occur where the waterhole is located.

Damien said many landholders had constructed new off-stream watering points to enable water to be pumped from the waterhole without allowing cattle direct access to the natural water body.

Contact: Damien Burrows, Australian Centre Tropical Freshwater Research
Tel: (07) 4781 4265 Fax: 07 4781 5589
Email: damien.burrows@jcu.edu.au

Australian rangelands in position to lead

The world's largest rangelands conference was held in Durban in July this year. CEO of the Tropical Savannas CRC, *Prof. Gordon Duff*, presented at the conference.

With more than 140 spoken papers delivered at the VII International Rangelands Conference, up to six sessions running concurrently for four days, plus in excess of 400 posters, it is impossible to try to summarise the entire conference. Instead I will attempt to provide a few observations and lessons gleaned that may be relevant to researchers and land managers in northern Australia.

Relative to most of the rest of the world's rangelands, Australian systems are not experiencing the huge levels of social and political pressure to produce food irrespective of the longer-term sustainability of production or biodiversity implications. This may be stating the obvious, but the contrast is overwhelming. Our opportunity to develop sustainably in northern Australia isn't just greater than that of the rest of the world's rangelands—it's in a class of its own. This, to me, hammers home the truly unique position occupied by Australian rangelands and the Tropical Savannas CRC.

Monitoring variables such as range condition in South Africa, and probably many other parts of the world, is much more reliant on labour-intensive, on-ground data collection, and less on remote-sensing based technologies. This should be no surprise, but the extent to which we use these technologies contrasts more strongly than I expected. For example, Kruger National Park, with well in excess of a million visitors a year and a tourism-driven, foreign exchange revenue base that probably rivals that of the Great Barrier Reef, nevertheless relies almost entirely on field observations by Parks' staff for their fire-scar mapping, despite the fact that the Park covers 20 000km². There should be an opportunity to export some of our more cost-effective technologies and approaches.

I was particularly keen to see some good working examples of participatory and adaptive management, either in systems focusing on conservation or on production, but while progress has been made, there is still a way to go.

Kruger National Park

A visit to Kruger National Park, and some surrounding game reserves, culminated in a one-day workshop on fire, vegetation, erosion and related monitoring themes, hosted by the South African National Parks Service and conducted by Dr Harry Biggs, Program Manager for Systems Ecology at Kruger.

Our guides were Prof. Pete Zacharias, Dean of Science at University of Natal, and Mike Peel from South African National Parks (SANParks). The workshop was a useful and interesting exchange of ideas and approaches to monitoring, indicators and linking research to management objectives (adaptive management).



Australian and South African Scientists inspecting a soil and vegetation monitoring site in Kruger National Park

The workshop was linked to field days investigating monitoring sites and discussing approaches to monitoring. Some issues were common to management of Australian rangelands (managing grazing pressure, fire, weed invasion), and some were not (managing elephant impacts, poaching and cross-border incursions). SANParks invest heavily in monitoring, and gather huge amounts of ground-based data from monitoring plots, enclosure experiments (an elephant-proof fence has to be seen to be appreciated), fire-exclusion experiments etc. Some of these studies date back 40 years or more, with continuous data available over the entire history.

Monitoring approaches were reasonably well-coupled to management decision making, using a threshold of probable concern strategy that is well institutionalised. This is an area where the South Africans demonstrate a sophisticated approach to adaptive management that could be quite instructive to some of the work being carried out by the Tropical Savannas CRC and its partners. There are some useful models that will be applicable to some of our fire-management and knowledge-building projects.

Collaborative activities

With respect to biodiversity monitoring, historically most of the emphasis in South Africa has been placed on game animals, and only recently has more interest been shown in more representative biodiversity monitoring of both fauna and flora. Much of the historic emphasis on the latter has been on pasture condition, relating to the support of game populations.

Recent interest in landscape health and monitoring of system-wide biodiversity has provided opportunities for several Australian scientists to contribute advice and expertise, including a number who work with the TS-CRC (including CSIRO SE's Alan Andersen, David Tongway, Garry Cook, Tracy Dawes-Gromadski, Adam Liedloff and Chris Margules).

Despite this ramping-up of collaborative activity, I believe a significant opportunity exists to both export, and to test/validate in a different context, some of the insights that Tropical Savannas CRC has developed in defining, measuring and monitoring healthy landscapes. Certainly an opportunity for greater collaboration exists.

Short-lived seeds provide hope for vine's control

New research has found a loophole in the biology of rubber vine that will help in the fight to contain the weed

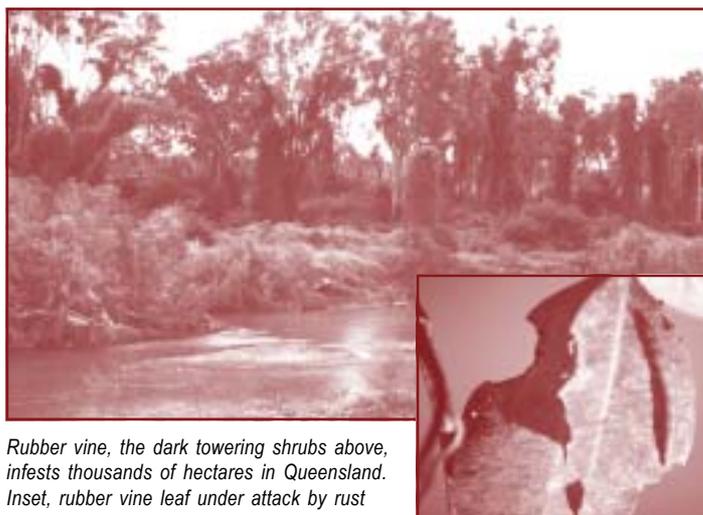
Researchers at the Tropical Weeds Research Centre, located at Charters Towers, have found that the exotic weed rubber vine lacks a persistent seed bank—under normal rainfall conditions, seeds live in the soil less than 12 months. Even though seeds will survive up to two years or longer under drought conditions, the weed contrasts markedly with other weeds such as prickly acacia, mesquite and parthenium, whose seed bank can survive for many years.

Fresh rubber vine seeds, which fall to the ground after maturing in pods on the plant, were found to be highly germinable. This means that virtually all seeds will germinate and develop into seedlings if they receive sufficient moisture. This is unusual for weeds, as many have a mechanism that prevents all seeds from germinating at once. Prickly acacia and mesquite have a hard seed coat that has to be broken down before seeds will germinate, which means some seeds will survive for many years even if there is a great deal of rain. Parthenium, for example, has a seed bank that will last more than eight years.

This is potentially a major weakness of the plant, and provides an opportunity for land managers to contain the widespread weed. Rubber vine infests thousands of hectares in Queensland, establishing itself along riverbanks and creek lines, and has the potential to spread to other areas of northern Australia.

Management implications

An introduced rust pathogen has proven very effective in reducing the amount of seeds the plant produces. When



Rubber vine, the dark towering shrubs above, infests thousands of hectares in Queensland. Inset, rubber vine leaf under attack by rust

there is adequate moisture to help the rust spread and work effectively, the number of pods in an area will be greatly reduced. If the rust has been present for a couple of years, and there has been a normal wet season, the rubber vine soil seed bank will be very low. Under these circumstances, if control activities are performed to kill the initial infestation, seedling regrowth should be minimal.

However, in areas where the rust is not effective (such as around Hughenden and some areas of the lower Gulf) or in locations which have experienced a number of dry years that have prevented the rust from re-establishing, it is likely that large numbers of live rubber vine seed will be present. Eradicating rubber vine in these situations is much harder as substantial seedling regrowth may occur even following control activities. Nevertheless, because the seed bank is so short-lived, follow-up control should only need to be undertaken for one to two years after the initial infestation has been treated.

Dr Faiz Bebawi, Weed Scientist, Tropical Weeds Research Centre, Charters Towers Department of Natural Resources and Mines
Tel: (07) 4787 0616 Email: Faiz.Bebawi@nrm.qld.gov.au
Fact sheets on pest plants in Queensland:
<www.nrm.qld.gov.au/factsheets/groups.php?group=Pest+plants>
Weeds Australia: <www.weeds.org.au/>

Guiding principles for biodiversity monitoring

A REPORT that aims to help people plan effective biodiversity monitoring in the rangelands has been published by Environment Australia and CSIRO Sustainable Ecosystems, with support from Tropical Savannas CRC. *Biodiversity Monitoring in the Rangelands: A Way Forward* builds on the work done by a previous report¹ that outlined the issues involved and is based on a workshop held in Alice Springs late last year. The report:

- brings together experts from all rangeland states and Territory
- considers and reviews recent un-

published research relevant to rangeland biodiversity monitoring

- develops a common 'state-of-the-art' view and an understanding of the complexity of rangeland biodiversity monitoring
- develops a shared view on the most appropriate set of attributes and techniques for use by different clients to monitor changes in biodiversity
- highlights limitations of particular sets of attributes and techniques
- identifies interim guiding principles

It is aimed largely at a technical audience and regional-level groups. A future publication is planned that will serve the needs of land users.

The report is available free of charge in hard copy from Environment Australia or online.

Environment Australia

<www.ea.gov.au/biodiversity/publications/index.html>

TS-CRC: <savanna.ntu.edu.au/publications/books_reports/>

1. *Developing an analytical framework for monitoring biodiversity in Australia's Rangelands*, a report by the Tropical Savannas CRC for the National Land and Water Resources Audit. TS-CRC Darwin 2001



Photo: Ian Morris

After release the quolls dispersed over the islands. Brooke Rankmore radio-tracks a quoll located on the edge of the peninsula.

The islands are Aboriginal land and strict conditions apply to visits. Contact the Northern Land Council: (08) 8920 5100

New life on island refuge

From page 6

Settling-in process

We returned to the islands in late July to monitor the quoll populations. The results were very heartening. On both islands, the quolls were doing well. Almost all quolls re-caught had put on weight and were in great condition. All the female quolls caught had pouches full of babies. Quoll tracks and other evidence were found over most of the island, well away from release points. At this stage, the translocation program appears to be a remarkable success. We plan to visit the islands next February, when we will investigate the recruitment of this year's young into the population, and hence whether the population is likely to be self-sustaining.

While this program should benefit the quoll, we acknowledge that many species may be affected by cane toads, and translocation programs may not be achievable for these.

Aboriginal engagement is a vital part of this project, and much interest has been stimulated among the Aboriginal landowners. Apart from their importance now for refugee quolls, the islands off north-eastern Arnhem Land have many other natural and cultural values of local and national significance. But there are few resources available for their management.

The quoll project may be an important catalyst for continuing collaborative work between scientists, land councils and Aboriginal landowners, and may help foster an Aboriginal ranger scheme to help maintain the wildlife and traditional management of these beautiful islands.

Contact: Brooke Rankmore, Tel: (08) 8944 8458
Email: <brooke.rankmore@nt.gov.au>

Environment Australia

<ea.gov.au/biodiversity/threatened/information/factsheets/quoll/northern.html>

Commonwealth Acts to save quolls

<www.deh.gov.au/minister/env/2003/mr02apr03.html>

Quolls decline with advance of toads

From page 6

season is normally a time of high quoll abundance and high mortality as the juveniles become independent and compete for the limited number of territories, so these deaths had little impact on the population as a whole.

The dry season arrived, the toads became less obvious as they retreated to shelter sites near water and the quoll population followed the usual pattern of slight decline as the dry season progressed. The mating season was normal, all of the females had pouch young and by October, the young were kept in nursery dens. In October the population was similar to that of the previous year, at its lowest abundance for the year. But then the rains began, the toads began dispersing again and it appears that as mothers died from poisoning, whole litters of young starved to death. By December, the population had crashed with only three individuals detected during trapping. In January 2003, there were still only three. In March, there were none. No quolls were caught in May and July. Toads are still increasing in numbers.

Are toads the cause?

How can we be sure that this sudden decline is due to toads? To begin with, quolls that appeared to have been poisoned by toads, began dying the same month and in the same area that toads were first observed at the site. These individual quolls had been monitored intensively, being trapped every two weeks, and they were healthy with no disease and no heavy parasite infestations. At death, they had no signs of predator damage or accidental injury, the only unusual sign being red irritation on the

lips in some animals. There were no obvious changes in the habitat at the time except for the arrival of the toads. The most compelling evidence is that the toad-free East Alligator area still has a super-abundant quoll population.

The quolls at East Alligator are currently being intensively monitored in preparation for the cane toad invasion, which may occur this coming wet season. We expect that the pattern of decline will probably be similar. This is very sad as East Alligator has the highest density of quolls that I have ever observed in 12 years of working on this species.

This massive decline of quolls to the point of local extinction was also observed in Michelle Watson's study in Kakadu which found that quolls were not recorded at all in quadrats invaded by toads, though they had been present the year before⁷. So, it certainly appears that in the short-term at least, the arrival of the toads has been disastrous for the northern quoll. Quolls were already declining throughout the Top End and the toad has certainly hastened the process. So, will numbers bounce back as predicted by Dr Freeland? Only time will tell.

We will re-trap at Mary River at least once more this year, and hope to continue to monitor the site (and East Alligator) throughout 2004. The only way to address the question of long-term impact, is to conduct methodical long-term monitoring, so hopefully we will be able to revisit these sites at least once a year until about 2010.

7. Watson, M., and Woinarski, J. 2003. Vertebrate monitoring and re-sampling in Kakadu National Park, 2002. Report to Parks Australia North.

Journey into the rhythms of Kakadu

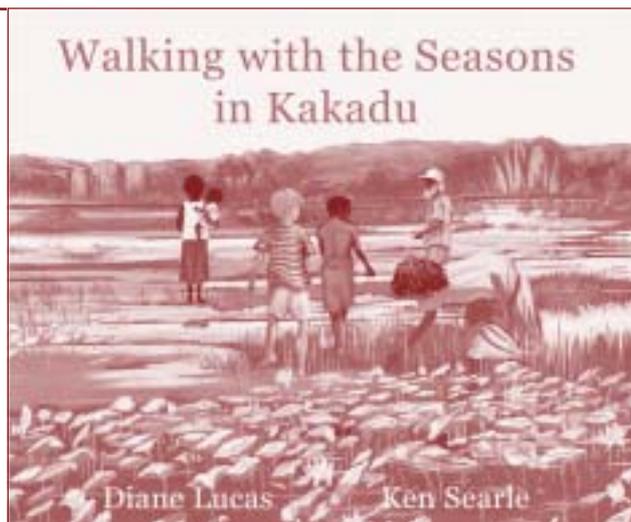
IN *Walking with the Seasons of Kakadu*, author Diane Lucas takes the reader on an enchanting journey of the six seasons in Kakadu, speaking in English and the Gundjeihmi language. Her rich text is complemented by Ken Searle's beautiful illustrations, with a different colour representing every season.

"Each season reveals wind patterns, insects, animals, birds, flowering and fruiting plants and some seasonal indicators that relate to these," Diane explained. "There are activities to draw you closer to the bush and celebrations within each season."

Diane lived in Kakadu in the early '80s where she was a teacher in the community school and again in the '90s when she continued to work with some of the older people, documenting traditional knowledge of the South Alligator River floodplain country.

The book is introduced by a group of Gundjeihmi-speaking people of the Murrumburr clan and reflects how well it is accepted and appreciated in the community:

"This is a story that has got to be told to children so they know country—no good just sitting in the classroom all day. You've got to get outside and discover the bush, feel the changes, see what's there."



"Using Gundjeihmi language in this story shows people our language is part of our culture, our lives."

This cross-cultural and educational picture book is for anyone, regardless of age.

RRP \$29.95, Allen and Unwin. Parent and teacher notes offering creative ideas across the curriculum relating to the seasons are available at: <www.allenandunwin.com>

Tourism financial guide

ABORIGINAL Tourism Australia has published a guide to encourage new and existing indigenous businesses to improve management and planning of their operations. *Financial Management Guide: the Business of Indigenous Tourism* is specifically written for Indigenous tourism businesses as well as trainers, business development agents and financial advisors to use as a training tool to help people, families or communities setting up their businesses.

The 204-page guide includes discussion on the nature of business operations in the tourism industry, an environmental overview of business viability and planning, borrowing, sources of finance, preparing a loan application, day-to-day operations and avoiding financial crises.

Copies are available through ATSiS offices and the ATA website: <www.aboriginaltourism.com.au>

Environmental weeds

THE 560-page *Invasive Plant Species of the World: A Reference Guide to Environmental Weeds* by E. Weber, is a reference guide to 450 major environmental invasive plant species of the world. Each species has an entry providing information covering life form, synonyms and commercial

use, geographic distribution, habitats invaded, description of morphology, ecology and control. Key references to each species are also provided.

The book also includes an analysis which shows that ornamental species are the largest pool for species that subsequently become invasive.

ISBN: 0851996957; Published by: Geobotanical Institute, Swiss Federal Institute of Technology, Zurich, 560 pp. RRP: \$AUD375 DA Information Services Tel: (03) 9210 7777 Fax: (03) 9210 7788 Email: <service@dadirect.com.au> Web: <www.dadirect.com.au>

Biodiversity planning

DRAFTING a Conservation Blueprint—A practitioner's guide to planning for biodiversity by Craig Groves, presents a step-by-step planning process for conserving the biological diversity of entire regions.

The book explains how to develop a regional conservation plan, and offers essential guidance that brings together disparate information from the fields of ecology, conservation biology, planning and policy.

US\$35 (softcover), US\$70 (hardcover), 457 pages, publisher Island Press

Protecting natural heritage

THIS illustrated, 144-page book is a user-friendly guide to the conservation and protection of natural heritage

sites, whether desert or coastal, untouched or degraded. Produced by the Australian Heritage Commission, the guide contains local case studies, and is free of charge.

Email: <ahc@ea.gov.au>

Postal: Australian Heritage Commission GPO Box 787, Canberra ACT 2601.

Landcare vision for agriculture

LANDCARE farming will be the key to the future of profitable, sustainable agriculture, according to a report by Australia's science and agribusiness leaders.

The report, *Landcare Farming: Securing the future for Australian Agriculture*, calls for the adoption of landcare practices by all farmers across Australia and financial incentives for landcare farmers for on-farm nature conservation consistent with regional objectives.

The report was authored by Prof. Peter Cullen CSIRO, Dr John Williams CSIRO Chief of Land and Water, and Dr Allan Curtis, Bureau of Rural Sciences. Recommendations include environmental certification of produce, the continued funding of local landcare coordinator positions and a focus on promoting the wider adoption of landcare farming practices.

Go to: <www.landcareaustralia.com.au>

Resources for land managers

THREE years' field work collecting soil, plant and site information, and a further 18 months developing a land resource database, will finally come to fruition in November when researchers formally hand over the database to communities of Queensland's Desert Uplands bioregion.

The 'Desert Uplands Strategic Land Resource Database' will be launched in Barcaldine in the first week of November, along with the region's new Rangelands Resource Management and Interpretative Centre. The centre features photo displays highlighting the region's key flora and fauna and aims to increase public awareness of the natural heritage of the region.

The database contains information for land managers that can be used for both regional land-use planning and land-management issues at the property level. Land types, soil and vegetation have all been mapped to the scale of land units and a user-friendly computer program allows easy access to the information.

CDs of the database will be lodged in all of the region's shire offices, as well as the office of the Desert Uplands Build-Up and Development Strategy Committee in Barcaldine. Mal Lorimer of Queensland's Environment Protection Agency led the project which was initiated by the committee in 1996.

Desert Uplands Build-Up and Development Strategy Committee:
<www.desertuplands.org.au/> or Tel: 1800 007 807
Drop in to the Interpretive Centre in Oak Street, Barcaldine

NHT bilateral agreement for Territory

A NATURAL Heritage Trust bilateral agreement will inject up to \$20 million into extensive environmental work throughout the Northern Territory over the next four years. Under the agreement, Federal Government funding of up to \$20 million will be matched by existing NT contributions to manage and improve biodiversity, sustainable natural resource management and build community capacity to manage the environment.

Interim funding of \$3.8 million for this financial year will be invested in projects aimed at improving environmental skills and natural resource management. Of this, \$1.63 million will support 14 priority projects that the NT Landcare Council has identified in the interim while an integrated natural resource management regional plan is developed. The plan will be finalised by July 2004.

Go to <www.nht.gov.au/>

Cultural heritage protection

ABORIGINAL and Torres Straits Islander cultural heritage will be afforded greater recognition and protection under new laws introduced to Queensland State Parliament. *The Aboriginal Cultural Heritage Bill 2002* and *Torres Strait Islander Cultural Heritage Bill 2002* are Queensland's first laws to provide blanket protection of Aboriginal and Torres Strait Islander cultural heritage in the state. The new legislation aims to provide recognition and protection

Young researcher wins award

Kate Richardson, pictured right, from the Northern Territory's Department of Infrastructure, Planning and Environment, is the NT winner of the 2003 Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry.

Kate, a researcher in the agency's Tropical Savannas' Grazing Management project, won an \$8000 grant towards her BSc Honours' project on how technology can be applied to the pastoral industry.

Her project is examining how data from MODIS (a new generation satellite, see story p. 2) can deliver land-condition change information that can be used by pastoralists at a property management scale.



Kate Richardson with her trophy at the 2003 Science and Innovation Awards

of Aboriginal and Torres Strait Islander cultural heritage and establish practical and workable processes for managing impacts. The laws will be important in cultural heritage negotiations between traditional owners and the mining industry.

CRCs world-class role model

THE Australian Government's Cooperative Research Centres Program has received strong stakeholder support according to a national evaluation report recently released. The global and Australasian editions of *New Scientist* magazine (16 August 2003) echo the finding describing CRCs as "the role model for collaborations between business, academia and government the world over."

The evaluation assessed the program's performance and whether changes were needed to reach its objectives. Go to evaluation report: <www.crc.gov.au/program_evaluation.htm/>

Cool-headed cattle

RESEARCHERS at CSIRO's Rendel Laboratory in Rockhampton have found a positive relationship between 'good' cattle temperament, improved productivity levels and overall meat quality whereas cattle with poorer temperaments have comparatively lower average daily weight gains and reduced carcass weights.

The research was conducted by CSIRO Livestock Industries and the CRC for Beef and Cattle Quality. The research team used a flight-time test that electronically records the time it takes an animal to cover a fixed distance after it is released from a cattle crush. The slower the flight time, the better the temperament. Other Beef CRC research has found temperament has a positive effect on weight loss during long-distance transport and a favourable relationship to improvements in meat quality.

Producers can measure cattle temperament with a commercial prototype flight-time machine developed by Ruddweigh Australia. Machines may also be loaned from beef research and extension agents, or breed societies.

Dr Heather Burrow, CSIRO Livestock Industries / Beef CRC
Email: <Heather.Burrow@csiro.au> Tel: 07 4923 8139
Beef CRC: <www.beef.crc.org.au/>

2003

In Search of Sustainability: Online Conference February–October, online

Papers (1500 words) are invited for an internet conference being held from February to October. The aim is to exchange ideas on the long-term sustainability of Australia. Different themes are addressed each month. In November a face-to-face review will be held in Canberra.

Web: <www.isosconference.org.au/>

Indigenous Issues in North Australia May–November

Venue: North Australia Research Unit, Darwin

Contemporary Indigenous Issues in North Australia is an initiative of the Australian National University's Institute for Indigenous Australia, Centre for Aboriginal Economic Policy Research, and the North Australia Research Unit. The series is held in collaboration with the NTU's Centre for North Australian and Asian Research. 12.30–2 pm: Seminar Room, North Australia Research Unit, Lot 8688 Ellengowan Drive, Brinkin, Darwin

November

Invasive Plants in Natural Managed Systems: Linking Science and Management 3–7 November, Florida, USA

Venue: Wyndham Bonaventure Resort, Florida

Plenary Session Themes include: Prevention, Early Detection and Rapid Response; Control, Management and Restoration; Policy, Science and Management; Synthesis and Global Issues. Topics include: biological weed control; managing invasive species; restoring desired plant communities; ecological impacts of invasive plants; global change and invasive plants.

Email: <ipinams@esa.org>

Web: <www.esa.org/ipinams-emap7/>

Soil and Groundwater Pollution: Investigation, Remediation and Risk Assessment 4–6 November, Sydney

Venue: New College, University of NSW

Cost is \$1500 (plus GST)

Web: <www.groundwater.com.au/conf/registration/A4-Flyer-1st-Soil-GWPollution.pdf>

2003 Ecotourism Australia 11th National Conference

10–14 November, South Australia

Venue: Adelaide and the Riverland

This year's theme is Ecotourism—Leading Innovation, Driving Sustainability. The 2003 conference builds on the successful outcomes and innovations achieved at last year's conference. Case studies of successful ecotourism enterprises, community, partnerships and indigenous involvement will be a feature of the program.

Contact: Stephen Pahl, CEO, Ecotourism Australia

Postal: GPO Box 268, Brisbane QLD 4001

Tel: (07) 3229 5550 **Fax:** (07) 3229 5255

Email: <mailto:info@ecotourism.org.au>

Web: <www.ecotourism.org.au/>

2003 Women in Research Conference 13–14 November, Rockhampton

Venue: Central Queensland University

CQU Women in Research (WiR) are hosting a conference under the themes of discovering research, discovering teaching and learning and discovering self.

Key speakers at the conference are: Professor Vicki Sara CEO Australian Research Council; Prof. Amy Zelmer Central Queensland University; Prof. Elizabeth Deane Macquarie University; Prof. Gail Whiteford Charles Sturt University.

Contact: Mrs Kim Gohdes

Central Queensland University, Rockhampton, Qld

Tel: (07) 49309813 **Email:** k.gohdes@cqu.edu.au

Web: <www.cqu.edu.au/wir/events.htm>

AWA Catchment Management Conference 26–27 November, Sydney

Venue: University of Sydney

Conference themes include: management of land-use impacts; water rights, water allocation and water reform; capacity building and community involvement; waterway restoration and integrated catchment planning.

Tel: (02) 9330 9458

Email: icam2003@awa.asn.au

December

3rd International Wildlife Management Congress 1–5 December, Christchurch, NZ

Venue: University of Canterbury, Christchurch

The congress will have a strong Pacific and southern hemisphere focus, contrasting perspectives on wildlife management.

Contact: Wildlife Congress Secretariat

Postal: University of Canterbury, Private Bag 4800, Christchurch, New Zealand

Tel: 64 3 364 2915 **Fax:** 64 3 364 2507

Email: <wildlife@cont.canterbury.ac.nz>

Web: <www.conference.canterbury.ac.nz/wildlife2003/wildlife.html#invitation/>

ESA Ecology 2003

8–10 December, Armidale

Venue: University of New England

Symposia include ecological functions and values of native vegetation in managed landscapes; disturbance regimes; revegetation schemes; ecology of salinity; biodiverse production systems; sustainable woodlands and ecological connectivity at various scales.

Contact: Conference Secretariat

Postal: University New England ARMIDALE NSW 2351

Tel: (02) 6773 2154 **Fax:** (02) 6773 3766

Email: confco@metz.une.edu.au

Web: <www.ecolsoc.org.au/conferences.html>

2004

Southern Connections International Conference: Towards a Southern Perspective

19–23 January, Cape Town, South Africa

Venue: University of Cape Town

Southern Connections is a large group of scientists from all continents who study aspects of biology and earth history of the southern continents. The program includes themes on ecology, biogeography, phylogeny, phylogeography, history and utilisation.

Postal: Southern Connections 2004

PO Box 2760, Clareinch, 7740, South Africa

Tel: +27 21 683 5522 Fax: +27 21 674 3269

Email: <sc2004@botzoo.uct.ac.za>

Web: <www.uct.ac.za/conferences/sc2004/>

National Forum on Tropical Futures 4–5 March, Darwin

Venue: TBA

The forum aims to identify issues and possible initiatives to progress under the Cooperative Framework on Tropical Science, Knowledge and Innovation between the Northern Territory, Queensland and Western Australian Governments, and is sponsored by all three.

Proposed themes are: Sustainable production systems and products for tropical regions; tropical health; Sustainable environments; Tropical living; and Climate change.

Contact: Joanne Trienen, Principal Policy Officer, Science, Research and Innovation

Dept. Innovation and Information Economy

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Email: <joanne.trienen@iie.qld.gov.au>

Enviro 04 Convention and Exhibition 28 March – 1 April, Sydney

Presented by the Australian Water Association, Waste Management Association of Australia,

Australian Business Council of Sustainable Energy, Environment Business Australia and Clean Air Society of Australia and New Zealand. Comprises six conferences on sustainable industry, water, waste, sustainable energy, business of the environment, and odour.

Contact: David Bates, Quitz Event Management

Tel: (02) 9410 1302 Email: quitz@bigond.net.au

Web: <www.enviroaust.net>

Sharing Indigenous Wisdom: an international dialogue on sustainable development

6–10 June, Wisconsin, USA

Venue: Radisson Hotel and Conference Center, Green Bay

The Sustainable Development Institute will host the conference. The conference will explore successful models of sustainable development that allow for the preservation of indigenous lands, sovereignty and culture, while also allowing for the integration of economic development, institutional capacity building and technological advancement.

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Postal: College of Menominee Nation

PO Box 1179, Keshena, WI. 54135

Tel: 715 799 5600 Fax: 715 799 5951

Email: <dkundin@menominee.edu>

Web: <www.sharingindigenouswisdom.org/>

3th International Soil Conservation Organisation Conference: Conserving soil and water for society—sharing solutions

4–9 July, Brisbane

Venue: Brisbane Convention Centre

Contact: Conference secretariat: ICMS Pty Ltd

82 Merivale Street SOUTH BANK Qld 4101

Tel: (07) 3844 1138 Fax: (07) 3844 0909

Email: <isco2004@icms.com.au>

Web: <www.isco2004.org>

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