



# SAVANNA LINKS

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## CONTENTS

### NEWS 2–3

- NAILSMA future
- Public good CRCs
- Burning for education
- xxx
- Correction

### RIPARIAN 4–6

- Rapid appraisal

### PESTS 7

- The green stalker
- Animal impacts
- Cape York strategy

### CONSERVATION 8–9

- Island defence

### CLIMATE 10–12

- Figuring out the weather

### SAVANNA BITES 12–13

Online resources | Landcare coordinator | ACF's & the north | East to west linked | Tourism in parks | Riparian research |

### READING 14

Burdekin | Agroforestry review | Small-town strategies | Social atlas | Tax effects | Social capital | Seed guide |

### CALENDAR 15–16



CRC

AUSTRALIA

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#### Rapid appraisal of savanna riparian zones

The habitats alongside rivers, waterholes and streams are highly vulnerable to disturbance—weed invasion, feral animals, fire and overgrazing all take their toll. But the first step in efforts to maintain or restore health is to understand what condition the area is actually in.

A new method to do this, both fast and practical, has been developed by CRC researchers: the Tropical Rapid Appraisal of Riparian Condition. Read about TRARC and its first test case—page 4.

#### Future on track

Public good CRCs were under the spotlight in May as some missed out on future funding.

CEO of the Tropical Savannas CRC, Prof. Gordon Duff, talks about our future aspirations and plans—page 2.



#### Island refuges take centre stage

A new collaborative project has re-surveyed at-risk mammals on some of our northern islands. The results may help us understand the threats facing those on the mainland—page 8.



#### Outlook uncertain: wild weather

What drives the north's unpredictable and variable weather? Jacqui Balston explains some of the basics. — p. 10.

The North Australia Indigenous Land and Sea Management Alliance sets goals for the future; New coordinator for Landcare NT; Fire education and much more.

#### Counting the costs to the bottom line

Two new reports examine the cost to Australia of invasive pests, both plant and animal. Also read about the work of a feral plant and animal program in Cape York Peninsula — page 7.

Photos this page: Ian Dixon, Michael Douglas, John Woinarski



Photo: Bevan Bessen



*Agenda-setting workshop: The North Australian Indigenous Land and Sea Management Alliance has been meeting with its partners to work out a framework for the future. Pictured from left are Peter Yu, Jim Davis, Ari Gorring, Michael Storrs, Peter Cooke, Joe Morrison, Lisa Binge, Paul Jenkins, Kelly Gardner and Paul Josif.*

## NAILSMA sets northern agenda

THE North Australia Indigenous Land and Sea Management Alliance (NAILSMA) has been preparing for a crucial period of development in the north—a workshop held in Darwin recently brought together the north's Indigenous land councils to discuss how they will collaborate.

It was also agreed that the first north Australia Land and Sea Management Forum will be held at Mennegen Outstation on Innesvale Station west of Katherine in August, hosted by Traditional Owner Bill Harney, and the Wardaman Association.

The workshop discussed current and future projects including Indigenous knowledge conservation, turtle and dugong management, fire management, leadership support and the need to begin working on water issues across the north. An important outcome was the development of an operational framework and governance arrangements. CRC co-Theme Leader and NAILSMA coordinator Joe Morrison said that the workshop was very much needed.

"It is a time when development across the north is at a crucial period for Indigenous people," he said. "Indigenous people need to have meaningful engagement and their aspirations met on their terms."

"Each land and sea unit manager also gave a report on their regional activities—which made for interesting collaborative decision making with a north Australian focus," said Joe.

Held from 25–26 May, the meeting was attended by representatives from the Northern Land Council, Balkanu Cape York Development Corporation, Kimberly Land Council (KLC), Carpentaria Land Council Aboriginal Corporation, Indigenous Land Corporation and staff from the Tropical Savannas CRC. The workshop was chaired by former KLC director, Peter Yu, and all participants expressed their desire to continue to work with Peter.

More information: Joe Morrison, Tel: (08) 89466702, Email: <joe.morrison@cdu.edu.au> or Lisa Binge Tel: (08) 89466754; Email: <lisa.binge@cdu.edu.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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## Public good CRCs: on track for future savanna management

CRCs came under the public spotlight in May, when the future of so-called 'public-good' CRCs appeared uncertain. Several environmentally oriented CRCs (e.g. Reef, Rainforest and Coastal) were unsuccessful in applying for third-term funding from the Commonwealth, and a number of people have asked what this means for the Tropical Savannas CRC.

Recent discussions with our Board, Advisory Committee and Management Group have all affirmed our current direction, and the intention to continue the good work of the CRC into a third term.

There is extremely strong stakeholder support for this commitment, which will lend considerable weight to our future aspirations.

This CRC has secured external funds for a range of management, implementation and communication projects, highlighting our growing reputation as the organisation of choice for supporting a range of collaborative, cross-sectoral and cross-jurisdictional natural resource management activities that extend across the north.

We have recently been developing activities that engage more closely with the private sector, including activities that lead to direct economic benefit for industry, and for remote savanna communities and enterprises.

This has largely been a planned response to the aspirations of our partners and stakeholders, rather than a reaction to changes in emphasis in the Commonwealth guidelines. We will be considering priorities for our future directions, as planned, during the second half of 2004. All members of the Tropical Savannas CRC community will have an opportunity to contribute to this process over the next year. — CEO, Prof. Gordon Duff

More info: EARTHBEAT: Environmental CRCs cut: <audio file at: www.abc.net.au/rn/science/earth/>

Stateline Queensland, transcript on funding woes for CRCs: <www.abc.net.au/stateline/qld/content/2004/s1103777.htm>



From left: Alan Andersen CSIRO, NT Chief Minister Clare Martin and Bushfire CRC CEO Kevin O'Loughlin at the launch of the Northern Territory's new fire education facility. Burns will be conducted each year so the public can observe the effects of fire on the environment at first hand.



Photos: Adam Liedloff

## Fiery experience for research and education

A NEW fire research and education facility, the first of its kind in Australia, was launched in the Northern Territory in May. Each year part of the Territory Wildlife Park, near Darwin, will be burnt, allowing the public and students to experience the effects of fire on the environment first hand.

The facility was developed with the support of a new Cooperative Research Centre, the Bushfire CRC, which is taking an integrated approach to fire research. Its research program covers aspects of fire behaviour, fire ecology and management, and community education.

Territory Wildlife Park Manager Michelle Monsour said visitors to the park would be able to learn about fire as they walked through burnt bush at special fire demonstration sites.

“For students, these demonstration sites will provide unique open-air ‘classrooms’ for studying the effects of fire on the environment,” she said. “Nowhere else in Australia will students have this sort of opportunity.”

CSIRO ecologist Dr Alan Andersen said a series of plots in the Park would be used by researchers from CSIRO, Charles Darwin University and other organisations to

study the effects of different types of fires on habitat, soil health and biodiversity.

“Results from the research will be continually incorporated into interpretative displays at the public demonstration sites, as well as being a significant input to the Bushfire CRC’s national program,” he said.

Bushfires Council of the Northern Territory Chief Fire Control Officer Brent Williams said community awareness and understanding was critically important for managing fire in the north.

“This new facility will play an important role in educating the public about the need for active fire management across northern Australia,” he said.

Further information: Ms Michelle Monsour, Territory Wildlife Park, Tel: (08) 8988 7219 Dr Alan Andersen, CSIRO Sustainable Ecosystems Tel: (08) 8944 8431 Email: <alan.andersen@csiro.au>

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Web: Bushfires Council of the Northern Territory <www.nt.gov.au/bfc/> Bushfires CRC <www.bushfirecrc.com/>

Suggestions for story welcome.

### Correction

Last issue the story *Project aims to beef up sustainability*, page 3, omitted the names of the Northern Territory government agencies that are research partners in the Pigeon Hole Project: the Department of Business, Industry and Resource Development and Department of Infrastructure, Planning and Environment. Results from the project will underpin future development in the northern beef industry. Apologies for the omission!

# Riverbank health: a rapid assessment

Land managers in northern Australia will soon have a standard method for rapidly appraising the condition of one of the most vital areas of savanna landscapes: the vegetation surrounding their rivers, creeks and streams.

By *Ian Dixon* and *Michael Douglas*



Photo: Ian Dixon

*Traditional Owners of Kakadu National Park are interested in understanding how some riparian zones have changed, such as Barramundie Creek in the south of the park (above). Here we can see some indicators of good condition, such as a mix of tree, shrub and ground covers minimal weed species and some woody debris*

**R**iparian zones—the habitats alongside rivers, waterholes and streams—are critical elements of the savanna landscape. They help maintain water quality, the shape and form of streams as well as biodiversity in streams and surrounding savanna, thereby making major contributions to biodiversity, cultural values and the economy.

However, savanna riparian zones are highly vulnerable to the effects of disturbances such as weed invasion, feral animals, fire and overgrazing. Threats to riparian health are compounded by the fact that these areas are the focus for much activity related to the development of northern Australia (such as grazing, agriculture and tourism) and the concentration of use in these habitats is likely to increase in the future. Consequently, there is a growing need for practical techniques to assess and monitor the condition or health of savanna riparian zones.

### Rapid riparian appraisal methods

Methods to appraise riparian condition rapidly have been developed for other regions in Australia but no method has been developed and tested for use across the savannas.

Two existing rapid appraisal techniques (Jansen *et al.* 2004, Werren and Arthington 2002) were trialled by researchers and land managers in the Northern Territory. Both methods have valuable characteristics but these initial trials identified the need for a number of modifications for use in savanna regions.

The Tropical Savannas CRC held a workshop in Townsville in October 2003 where riparian ecologists from Charles Darwin University, James Cook University and CSIRO agreed on a framework for developing a Tropical Rapid Appraisal of Riparian Condition (TRARC).

### How TRARC works

Workshop participants determined which vegetation indicators would be significant to northern Australia's tropical riparian zones. Eighteen indicators were selected

and categorised into five groups: vegetation and debris cover; habitat; weed cover; evidence of native plant regeneration; and evidence of disturbance. Methods of how to measure these indicators were formulated to provide a balance of accuracy, time, cost and ease of use.

During a rapid appraisal, indicators are given a rating of 1 to 5 from visual estimates within points or along transects. Results for each indicator are then averaged and combined to give a relative condition score. Scoring categories are based on a comparison between the site and a predetermined reference condition. Riparian zones that may qualify as being in excellent or reference condition may vary between biogeographic regions, catchments and stream sizes.

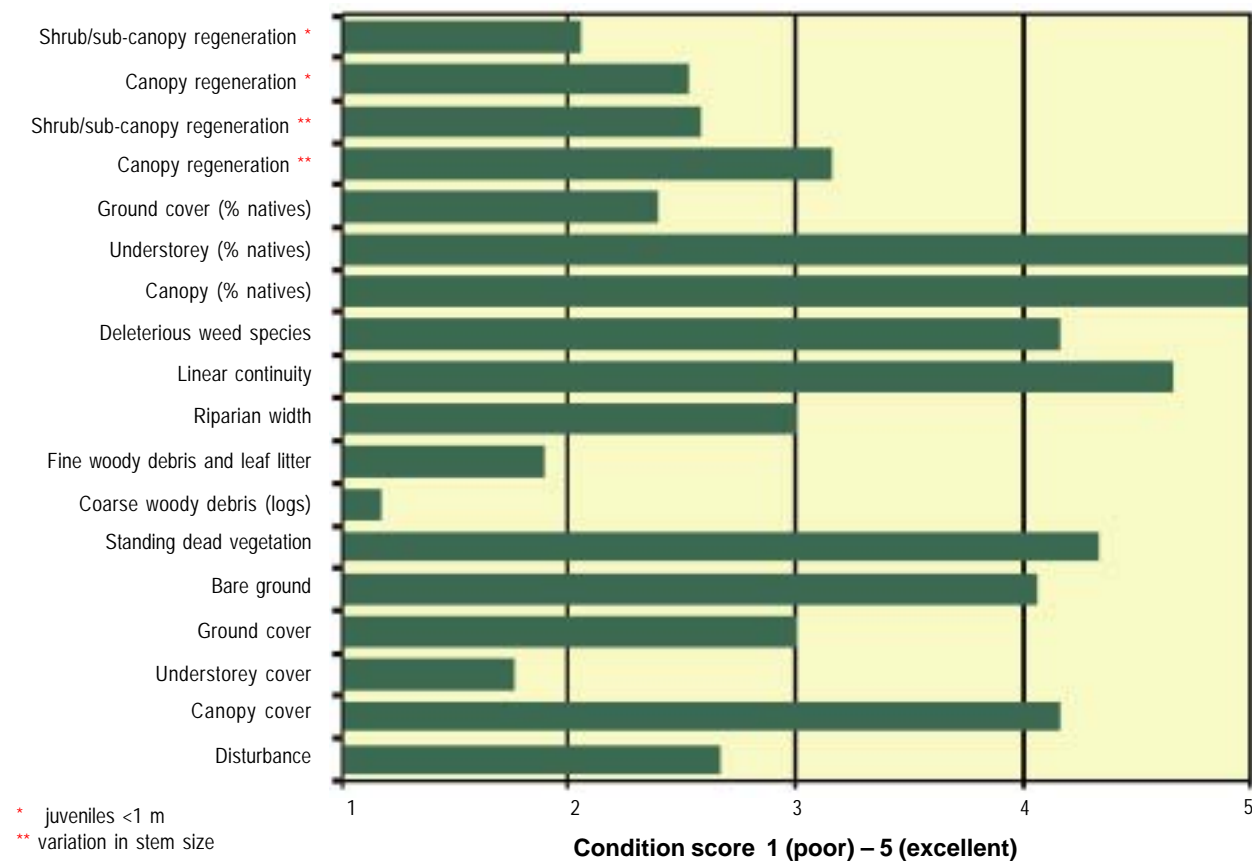
Comprehensive testing of the method began in late 2003. In the Northern Territory this took place in the Douglas/Daly catchment and in rivers flowing into Darwin harbour (see page 6 for results for Rapid Creek in Darwin). This work was done collaboratively between Charles Darwin University and the Water Monitoring Branch of the Department of Infrastructure, Planning and Environment. A trial of the method was also implemented in the Burdekin River catchment, west of Townsville in Queensland. Land & Water Australia funded the Australian Centre for Tropical Freshwater Research at James Cook University to trial the new methods and preliminary results will be presented in a future article.

### What's in store for TRARC

Further development of the rapid appraisal method will consider the potential variation between different users, seasons and sites. For example, do different people who use the TRARC at the same site achieve significantly different results? By how much does the score for a particular riparian zone vary between wet and dry seasons? How many sites would be required in a reach to obtain a fair representation of riparian vegetation condition?

Trials have been designed to address these questions and subsequent findings will be published. When the trials are completed, the Tropical Savannas CRC and Land

Figure 1: Average vegetation indicator scores for six sites at Rapid Creek using a trial method of the Tropical Rapid Appraisal of Riparian Condition



## TRARC case study: Rapid Creek, an urban waterway

The Tropical Rapid Appraisal of Riparian Condition (TRARC) was applied to Rapid Creek, an urban waterway in Darwin. Six sites were assessed along the freshwater section of the stream and included a range of urban land uses and disturbances. Each site was 100 m in length and covered the entire width of the riparian zone.

On average, all sites scored poorly for a lack of coarse woody debris (logs); fine woody debris and leaf litter; understorey vegetation cover; native ground cover; and, shrub/sub-canopy seedling regeneration (Figure 1).

Final scores for each site varied between 54 and 75 out of 100 (Figure 2 — see overleaf). However, these results are derived from preliminary methods only and once refined, a different outcome may eventuate.

More trials will be conducted in a range of land uses and disturbances across the region, including urban areas, those under conservation management and cattle grazing lands. Results from these preliminary trials will be compared with results from detailed surveys of the bird, ant and vegetation communities in the Victoria River District and Kakadu National Park.

& Water Australia will produce a user-friendly manual with descriptive field methods to complement the appraisal method.

Savanna land managers in northern Australia will soon have a standard method for rapidly appraising the condition of their riparian vegetation. By using the rapid appraisal method as a monitoring tool, land managers will be able to recognise how each of the indicator ratings has changed over time and thus assess their performance in maintaining and improving riparian vegetation condition.

The Tropical Rapid Appraisal of Riparian Condition is part of the Tropical Savannas CRC Riparian project, Savanna Riparian Health: [savanna.cdu.edu.au/research/projects/savanna\\_riparian\\_he.html](http://savanna.cdu.edu.au/research/projects/savanna_riparian_he.html)

### References

Jansen, A., Robertson, A., Thompson, L. and Wilson, A. (2004) *Development and application of a method for the rapid appraisal of riparian condition*, River Management Technical Guideline No. 4, Land and Water Australia, Canberra.

Werren, G. and Arthington, A. (2002) The assessment of riparian vegetation as an indicator of stream condition, with particular emphasis on the rapid assessment of flow-related impacts, In *Landscape Health of Queensland*, (Eds, Shapcott, A., Playford, J. and Franks, A.J.), The Royal Society of Queensland, St Lucia.

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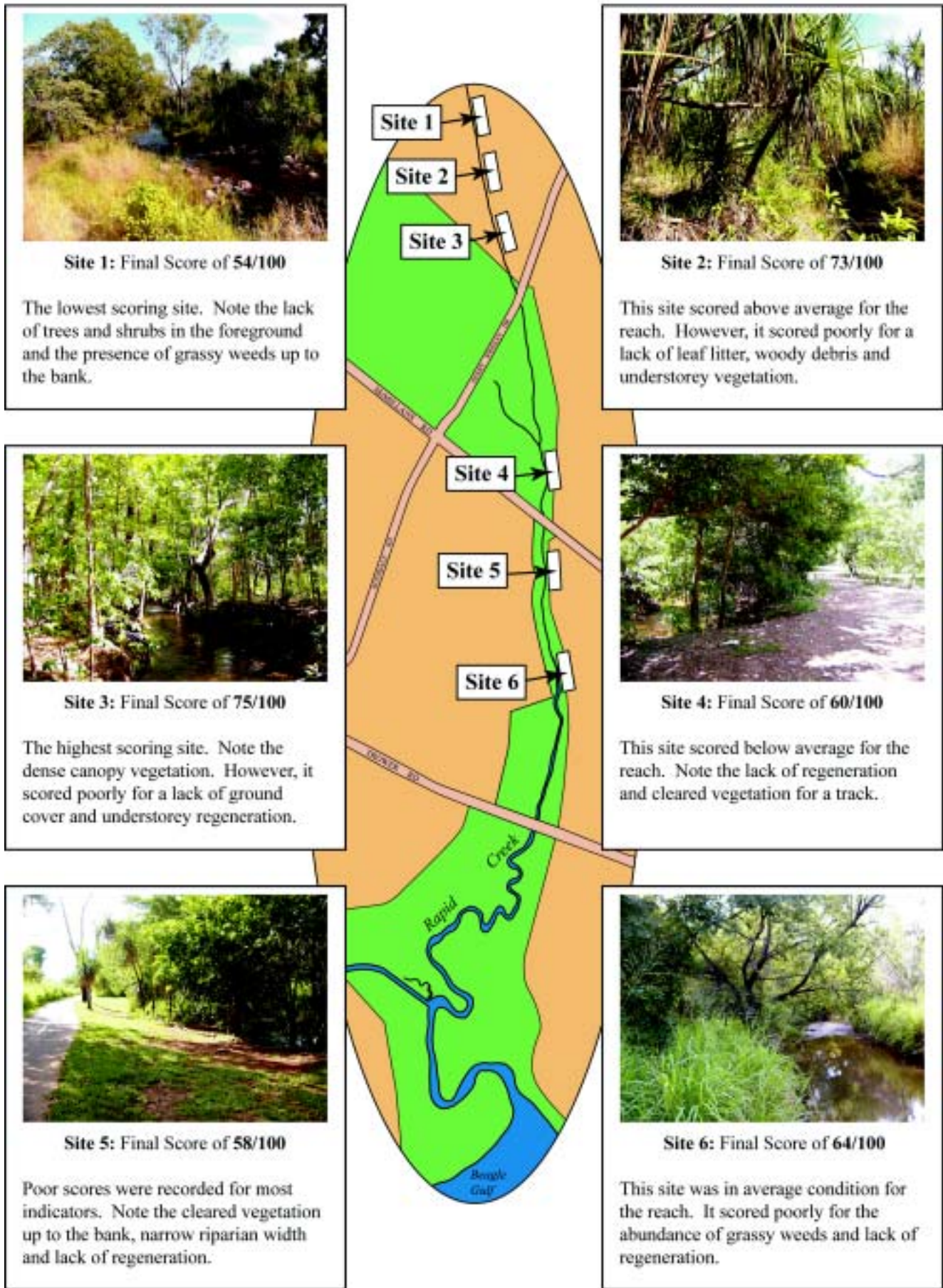


Figure 2: Six sites along Rapid Creek were surveyed using a trial method of the Tropical Rapid Appraisal of Riparian Condition (TRARC)

# Australia's green stalkers—a call to action

by Peter Martin

THIS new report from the CRC for Weed Management is designed as a tool to heighten the level of weed awareness amongst policy makers, the public and the media. The report, *Killing us softly—Australia's green stalkers*, points out weeds now cost Australian agriculture around \$4 billion per year, while also undermining ecosystems in valuable wild areas.

Dr Rachel McFadyen, CEO of the Weeds CRC notes in her foreword that more than 2500 species of introduced plants are now established in the wild in Australia—and that measures to control exotic plants need to be put in place now. She compares the problem of weed invasion to salinity, arguing however, that weeds may present a larger problem.

While a study by the Centre for International Economics in 2000 showed that available control measures for many invasives were highly cost-effective, they require education, long-term strategy and investment.

*Killing us softly* also outlines \$286 million worth of programs it says are needed over the next 10 years to



Photo: Greg Calvert

Removing guinea grass from the banks of the Ross River in Townsville

carry out a National Weeds Action Plan. The booklet is available free in hardcopy or as a PDF from the Weeds CRC website, see contact details below.

Sally Vidler Tel: (08) 8303 7209 Email: <sally.vidler@adelaide.edu.au>  
Websites: CRC Weeds: <www.weeds.crc.org.au/publications>

## How invasive animals affect the bottom line

THE CRC for Pest Animal Control has released what is Australia's first attempt to count the cost of 11 major introduced pests to Australia in terms of economic, environmental and social impact. *Counting the Cost: Impact of Invasive Animals in Australia 2004*, is a "springboard", according to the Dr Tony Peacock, the CRC's CEO, into a program of further research that would gain the greatest dividends in managing invasive animals.

The report also identifies knowledge gaps in how we can quantify impacts, particularly environmentally and socially. The pests examined were foxes, pigs, rabbits, mice, goats, carp, dogs, cane toads, camels, feral cats and wild horses. There is a section on each animal, its geographical range, and the impact costs of each using a triple bottom line, as well as the costs and challenges of managing them.

For example, the report found that rabbits, foxes, feral pigs and feral cats inflicted the greatest cost impact on the Australian economy. However, feral cats and foxes also inflict large environmental costs through preying on native fauna—with the report's authors using 'per bird killed' cost estimates taken from New South Wales' EPA. The report's authors urged surveys of community attitudes to the loss of native fauna so more accurate definitions can be used. The full report, as well as an executive summary, is available online at the CRC Pest Animal Control website, as well as free hard copies.

Hard copies: CRC for Pest Animal Control, GPO Box 284, Canberra ACT 2601. Email: <office@pestanimal.crc.org.au>  
Tel: (02) 6242 1768 Fax (02) 6242 1511  
Web: <www.pestanimal.crc.org.au/hot2.htm>

### Integrated strategies: focus on Cape York

FOR one instructive case study in managing both pest animals and plants, look no further than Cape York Peninsula. Over the past five years, the Cape York Weeds and Feral Animals Project has slowly built community support for an integrated pest management strategy across its vast region.

When the project began in 1999, there was almost no information on the distribution of pests in the Cape. Accordingly, the project team and landholders mapped areas of weed invasions to be entered on a Geographic Information System. Most stakeholders in the region can now identify the region's priority weeds and project staff receive reports of new weeds and new outbreaks.

Feral pigs are a huge problem on Cape York; they are prolific breeders and omnivorous feeders—they damage habitat, are vectors for disease and impact agricultural areas (Lakefield and Endeavour Valley), and native flora and fauna (one autopsy found 303 native sand frogs in the pig's stomach). Four aerial feral pig control programs were undertaken over three years.

One successful and continuing aerial shooting program took place on Rutland Station on the Cape's west coast. Pig density before the first program took place was 3.74 pigs per km<sup>2</sup>; over three days more than 3000 pigs were shot—after which density was 1.2 per km<sup>2</sup>.

The integrated strategy will eventually comprise the existing three shire pest management strategies, along with 13 Indigenous strategies, which are currently under development—all but three of the 13 are in progress.

You can read about the project's achievements—and significant challenges—in a *Summary of Achievements 1999–August 2002*, by contacting the CYWFAP office.

Project manager: Cathy Waldron, Tel: (07) 4069 5020 Fax: (07) 4069 6997  
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# Island defences help at-risk mammals

In their isolation, plants and animals on Australia's islands are protected from many harmful factors that may affect their mainland relatives. A new collaborative project has re-surveyed at-risk mammals on some of our northern islands, and the results may help us understand the threats facing those on the mainland.

The project team\* reports

Australia's islands are extremely important for conservation. Largely because feral cats and foxes and other exotic plants and animals have not reached them, many islands have served as refuges for animals that have disappeared from extensive mainland ranges.

While many of our native mammals have become totally extinct over the last 200 years, at least nine more were saved from extinction solely because they retained small populations on offshore islands free of exotic predators such as cane toads, cats and foxes.

Many additional species have maintained only a claw hold on their mainland range, but persist still in good populations on one or more islands. In the tropical savannas, one example is the golden bandicoot *Isoodon auratus*. Just 200 years ago, this small bandicoot had an almost continental range, including deserts and tropical woodlands. Now it is present only on one island in the Northern Territory (Marchinbar), two islands off the Kimberley (Augustus and Bigge), Barrow Island (off the Pilbara), and a couple of small areas of the rugged Kimberley mainland.

Islands can give a glimpse of what our land was like before the advent of cats and foxes, pigs, cattle, horses and the myriad other plants and animals we released onto the Australian mainland. But of course, it is always a somewhat distorted glimpse, because each island has its own peculiarities.

### Fragility of the island refuge

While the conservation value of many islands is high, experience has shown that this value is easily destroyed. Dodos disappeared rapidly from Mauritius Island; moas from New Zealand. Islands are small, and support generally small numbers of individuals of any species; and they generally offer no escape from newly introduced threats.

Northern Australia has many islands, including (after Tasmania) Australia's second (Melville), fourth (Groote Eylandt) and fifth (Bathurst) largest islands. The island groups from Torres Strait to the Kimberley support some of the premier conservation assets in northern Australia. These values have recently been recognised through the



*Lianthawirriyarra Sea Rangers, above from left: Richard Dixon, Damien Pracy and Allan Charlie, and landowner Samuel Evans on South West Island \**



*Above: Damien Pracy (left) and Rob Taylor mark a captured Carpentarian antechinus before releasing it*



*Left: a northern brown bandicoot, from Centre Island*

Photos: John Woinarski

NT's Island Ark program (see box, page opposite).

### Sir Edward Pellew Islands

One of those important island chains is the Sir Edward Pellew group off Borroloola, in the Gulf of Carpentaria (Figure 1). These Aboriginal-owned islands harbour important populations of some mammals regarded as threatened in the Northern Territory. These include the Carpentarian antechinus, which until recent discoveries around Mount Isa was thought to occur only on the Pellew islands; the canefield rat, a predominantly Queensland species known in the Northern Territory only on the Pelles; and the brush-tailed tree-rat, brush-tailed phascogale and northern quoll. We know these last three species have declined on the Northern Territory mainland, and to attempt to understand that decline, we have started a study of the populations of these five mammals on the Pellew Islands. Are these island populations also in decline? If not, what factors that operate only on the mainland have affected these mammals?

This is a collaborative project, involving the Tropical Savannas CRC, Parks and Wildlife Service of the NT, the Threatened Species Network, and the Aboriginal landowners and residents of these islands, through the Lianthawirriyarra Sea Ranger Unit of Mabuñji Aboriginal Resource Association. In October 2003, we visited the five main islands in the Pellew group, sampling mammals



through trap and release, and talking with the Islands' residents. We could compare our results with those of two similar previous surveys, undertaken in 1966–67 and 1988.

### Ocean defence breached

We found both good and bad results. The good is that we found more Carpentarian antechinus, and that northern quolls are still present on the one island from which they were previously known.

But the not-so-good news is that populations of most mammals were down substantially from the two previous surveys (Figure 2). We failed to record the canefield rat, brush-tailed phascogale and brush-tailed tree-rat, but these were not recorded frequently in the earlier surveys, so our lack of records may not necessarily mean decline or loss.

We also found that cane toads had colonised all of the large islands, having floated tens of kilometres out to sea on floodwaters in the 2000–01 wet season (you really have to admire their design!). Feral cats are now present on most of the large islands, whereas they weren't two decades ago. The isolation of these islands has been breached and it is likely that their previously protected native mammal fauna will decline. In particular, we expect that the northern quoll will be lost from these islands within the next two years, because this marsupial predator is so susceptible to cane toad toxin.

Our work here will continue; and we hope to pin down the status of all mammal species with further field-work over the next year. A feature of the work is the collaboration of scientists with Aboriginal traditional landowners and rangers, and the increasing awareness amongst residents and visitors to these islands of their conservation values, and of the shared responsibility and need to manage and protect these values.

#### \* Project team

John Woinarski (Biodiversity group, NT Department of Infrastructure Planning and Environment);

Rob Taylor (NT Parks and Wildlife Service); Allan Charlie, Richard Dixon, Damien Pracy and Felicity Chapman (Lianthawirriyarr Sea Ranger Unit, Mabunji Aboriginal Resource Association).

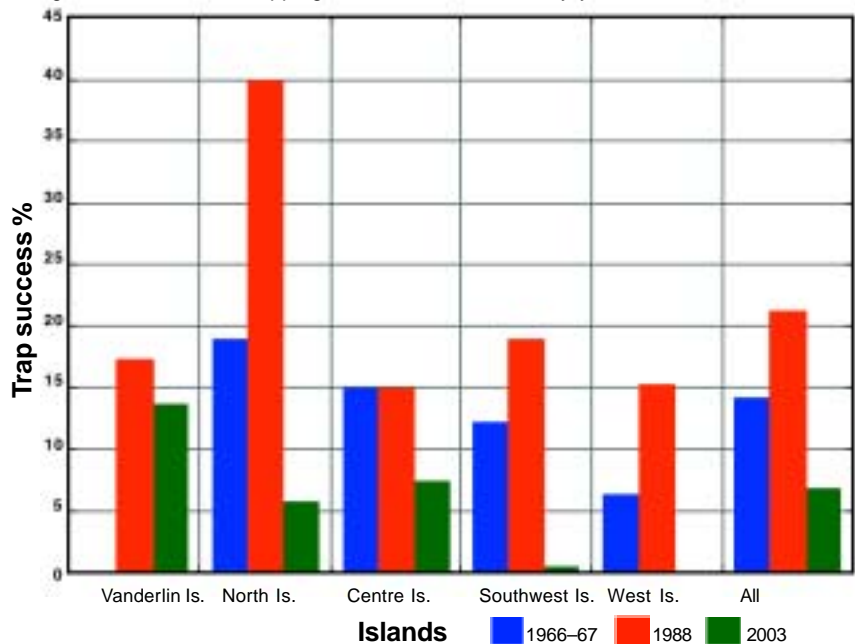
\* This survey was undertaken collaboratively with Aboriginal rangers and landowners

Figure 1, right: Location of main survey sites during this survey (crosses) and the 1988 survey (dots).



Figure 2, below: Relative trapping success for each island, and over all islands combined, for 1966–67, 1988 and 2003 surveys. Note Vanderlin Island was not sampled in 1966–67.

Figure 2: Variation in trapping success between survey years for each main island



## Ark saves fauna from the cane toad flood

The Island Ark program was set up by the Northern Territory Government to assist the conservation of native fauna threatened by cane toads. The program includes projects that:

- support captive breeding of selected species at Territory Wildlife Park.
- translocate populations of selected threatened species to islands.
- inform Aboriginal owners of the ecological value of their islands and work with them to maintain these values in the long-term.
- assist development of Indigenous Ranger Programs to manage these areas for conservation.
- establish agreements with traditional landowners for long-term conservation.
- assist with procedures for guaranteeing biosecurity of islands.
- develop a cane toad awareness campaign for the general public.
- work with partners to develop short-term local control mechanisms and long-term control methods (e.g. biological control).
- set up a national task force to coordinate and prioritise work on controlling cane toads.

One success was the 2003 translocation of northern quolls to Pobasso and Astell islands (see Savanna Links, Issue 26, p. 7). Follow-up trapping surveys have shown that the quolls are thriving in their new habitat. They have maintained their weight and condition, and have bred.

Contact: Rob Taylor, Parks and Wildlife Service NT, PO Box 496 Palmerston Tel: (08) 8999 4400

# Uncertain outlook: figuring out our weather



Floods, droughts, El Niño and La Niña—Australia has one of the most variable climates in the world. In June this year, Darwin experienced its wettest June on record: 51 mm by 7 June. The Top End’s usual weather for the dry season has now returned, but what drives the north’s unpredictable weather? Jacqui Balston\*, an applied climate research scientist, explains some of the basics that affect us all.

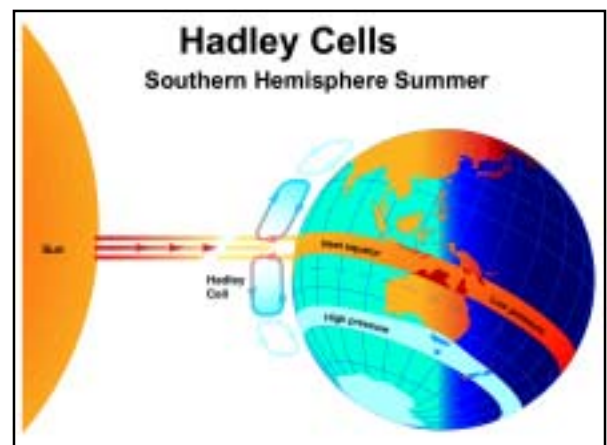
**T**he greatest variability in any climate system is generated by seasons, which are created as a result of the angle of inclination the north-south axis of the earth has relative to the sun’s rays. In summer, the rays of the sun are directly overhead the tropic of Capricorn in the southern hemisphere and in winter they are at an inclined angle. The more perpendicular the sun’s rays are to the surface of the earth the more heating occurs (see Figure 1). Air above the heated surface expands and rises condensing out moisture and often generating rainfall. Hence the wettest places on earth are in the tropics at the zone of maximum heating by the sun’s rays—which is also why summer in the tropics is a wet season.

## Southern Hemisphere summer

Above this zone of maximum heating the warmed, rising tropical air forms a band of low pressure around the earth. As it rises the air cools, moisture condenses and falls as rain, before moving away from the tropics. Once it reaches higher latitudes the air becomes dense enough to sink to the ground. This air is now of higher pressure and relatively stable. As it warms in its descent cloud formation is discouraged—producing the good weather characteristic of the high pressure bands in temperate areas.

This high pressure air then flows to the lower pressure equatorial regions as the south-east trade winds (in the southern hemisphere) to complete a circulation called the Hadley Cell. There is a Hadley Cell extending out on either side of the equatorial band of heating. In summer the zone of convergence where the two Hadley Cells meet lies over northern Australia and generates immense uplift and wet-season rainfall.

In addition, the heating of the Australian continent in summer enhances the flow of air from the Indian sub-continent generating the monsoon winds and increased instability and rainfall in the region. During the winter months the Australian continent is relatively cool compared to India and the monsoon winds flow north.



Figures 1, 2: Courtesy Australian Rainman Graphics Library

Figure 1: Hadley Cells generate equatorial troughs of low pressure and subtropical ridges of high pressure. The more perpendicular the sun’s rays are to the earth, the more heating occurs.

Across Cape York, the Top End and the Kimberley, it is the monsoon and the Hadley Circulations which bring the majority of rainfall as great thunderstorms in the build up, and constant wet season rain under the monsoon.

During the winter, or dry season, both these influences have moved to the northern hemisphere and conditions are dry. However, along Queensland’s east coast the south-east trade winds will bring some showers through the dry season to the coastal regions, as warm, moist air is lifted off the ocean and up over the Great Dividing Range. In the Northern Territory and the Kimberly region the south-east trade winds are dry having travelled over extensive savanna and desert and subsequently dry season rainfall is very low in these regions.

## La Niña /El Niño, Southern Oscillation

Most of us are familiar with the causes of seasonal changes, but what factors are responsible for the changes in climate we see from one year to the next? The greatest variability between years in northern Australian climate, is generated by the El Niño Southern Oscillation (ENSO), an ocean / atmospheric circulation in the Pacific Ocean.

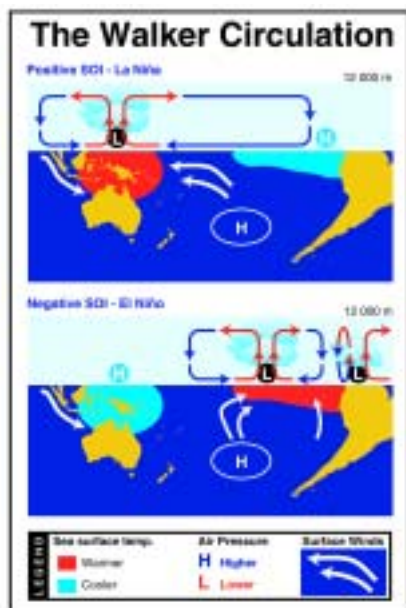


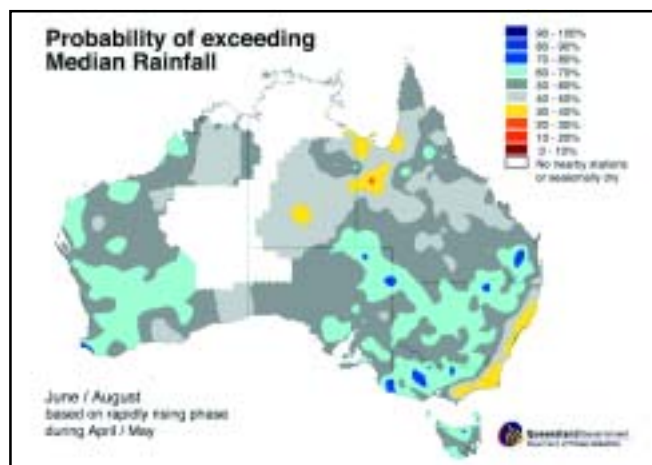
Figure 2: The El Niño southern oscillation, or Walker Circulation, shows how the sea surface temperature, air pressure and surface winds can interact to form either an El Niño or La Niña pattern.

The oceans of the western Indo-Pacific region around northern Australia are in most years relatively warm—because of shallow seas and warm land masses nearby—resulting in low air pressure as the warmed air rises generating cloud and rainfall. This air then travels at higher altitudes as upper level westerlies to the eastern Pacific, a region of cool, dry descending air and low rainfall. The atmospheric circulation is completed by low-level easterlies along the equator which form a positive feedback loop by pushing warm surface water along the equator to the western equatorial Pacific warm pool, exposing an area of cool sea surface temperatures (SSTs) in the eastern equatorial Pacific (see Figure 2).

If this circulation intensifies, the eastern equatorial Pacific SSTs around Tahiti become cooler and the western equatorial Pacific becomes warmer than normal. This scenario is known as a La Niña pattern which generally brings an increased chance of above average rainfall to northern and eastern Australia, Indonesia and other western Pacific regions, and drier than average conditions to the eastern Pacific and central Americas.

La Niña represents one phase of the Southern Oscillation, the other of which is El Niño. During an El Niño event a mass of surface warm water in the western equatorial Pacific moves eastward along the equator, depressing the surface cold water in the eastern equatorial Pacific. The resulting changes in the sea surface temperatures are reflected in the atmosphere with moist, rising air and a region of convection moving towards the eastern Pacific and cooler, drier, descending air falling over the western Pacific around Australia. The trade winds that normally bring rain along the east coast slacken, and may revert to westerlies, and upper level winds blow towards the east. Rainfall across northern and eastern Australia tends to be below average as the monsoon is also depressed and there is an increased chance of drought conditions. In the eastern Pacific the chance of above average rainfall increases and flooding is common.

What kicks off an El Niño event is complex and not yet fully understood. Early signals of an impending El



Rainfall outlook: The rapidly rising SOI has improved the possibility of rainfall in the south east, but the outlook is neutral for the north.

The Southern Oscillation Index (SOI) is a measure of the difference in air pressure between Tahiti and Darwin relative to the long-term mean. Records extend back to 1882. Positive values of the SOI represent a La Niña event and negative values an El Niño. Values near zero are indicative of a 'neutral' situation—neither El Niño or La Niña. The relationship between the SOI and rainfall are strongest in winter and spring and weaker in summer and autumn, due perhaps to influences from the monsoon. Determining how the SOI is changing from one month to the next (the SOI phase) allows us to forecast rainfall across northern and eastern regions of Australia affected by ENSO.

The phases of the SOI are: consistently positive, consistently negative, rapidly rising, rapidly falling and near zero.

Niño include a series of westerly wind bursts along the equator (possibly as a result of a pair of twin cyclones forming either side of the equator), changes in upper level winds, a slackening of the south-easterly trade winds, a build up of warm water in the western equatorial Pacific, and a movement of warm water eastward along the equator.

During El Niño events the northern Australian monsoon trough is displaced further north and is weaker, due probably to changes in the upper atmosphere and warmer SSTs around northern and north-western Australia, and maximum rainfall tends to occur slightly earlier in the season. Tropical cyclone activity is reduced off the north-east coast but increased off the north and north-west coasts for similar reasons, and the subtropical ridge or high pressure belt over southern Australia is stronger. An El Niño event typically occurs every two to seven years and has a tendency to be locked into a seasonal cycle similar to a financial year.

### Current forecast

The SOI at the end of May was +13.0, up from -16.1 at the end of April which is a “rapidly rising” phase. This has

\* Jacqui Balston works with Queensland's Department of Primary Industries and Fisheries' in Cairns. Research over the past 10 years by the Department, the Bureau of Meteorology and overseas centres has helped clearly define these climate influences and how they affect us. El Niño developments can be followed at the BOM El Niño Wrap Up website: <[www.bom.gov.au/climate/enso/](http://www.bom.gov.au/climate/enso/)> For the latest climate rainfall forecasts go to the OCCA Long Paddock: <[www.longpaddock.qld.gov.au/](http://www.longpaddock.qld.gov.au/)>

**Online plant database:** A comprehensive database on thousands of Australia's plants is now available online through the Australian Biological Resources Study, part of the Department of Environment and Heritage. Key words can be entered into the database and a list, using scientific names, will be produced of the species.

Launched in March, the database also features botanical sketches, distribution maps and the conservation status for all plants listed. Australia's oceanic islands are also covered. Also check out Western Australia's Conservation agency's online flora database.

Go to: <[www.deh.gov.au/biodiversity/abrs/online-resources/abif/index.html](http://www.deh.gov.au/biodiversity/abrs/online-resources/abif/index.html)> Then ABIF Flora

WA Florabase: <[www.florabase.calm.wa.gov.au/](http://www.florabase.calm.wa.gov.au/)>

**Wavefront:** Free news digest for sustainability professionals, from Atkisson Inc., an international network of professional consultants, trainers, facilitators, researchers, writers and designers, with bases in the US and Europe.

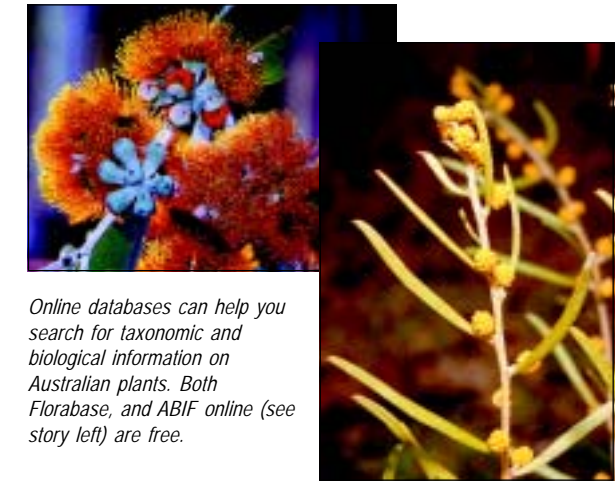
Go to: <[www.atkisson.com](http://www.atkisson.com)>

**Biodiversity toolbox:** This site provides a single location on the Internet to link users to a range of resources and information about biodiversity conservation. Useful to anyone involved in the planning and management of biodiversity conservation, the website has examples of strategies developed by councils—and also includes legislation or policies relevant to biodiversity conservation, listing these by commonwealth, state and territory. The site contains links to organisations and groups with biodiversity conservation interests and to regional bodies with responsibility for developing natural resource management plans and priorities.

Go to: <[www.deh.gov.au/biodiversity/toolbox/index.html](http://www.deh.gov.au/biodiversity/toolbox/index.html)>

Above items from *Bush*, May 2004.

**Rural skills Australia's Good Times Hard Times:** Focuses on providing crisis management advice to farmers. Sections include financial aspects of farm management; farm decision making; reducing financial impact in crisis circumstances; types of government



Online databases can help you search for taxonomic and biological information on Australian plants. Both Florabase, and ABIF online (see story left) are free.

Photos: Michael Douglas and D. Halford

assistance available at both state and federal level; lists of financial institutions including alternatives to banks; guide to natural crises and the impact of climate change.

Go to: <[www.ruralskills.com.au/](http://www.ruralskills.com.au/)>

**Digital Earth—GeoWeb:** GeoWeb is part of SRI International's DARPA-sponsored Digital Earth Project. Drawing from search engines like Yahoo Maps, MapQuest, or TerraServer, the GeoWeb is aims to make geographically referenced, or georeferenced, data available over the Web. The infrastructure allows for open, global, and scalable Internet searches associated with a specific latitude/longitude locations. Users can query the GeoWeb to discover relevant metadata and use web-based or peer-to-peer communications to retrieve the actual data.

Go to: <[www.dotgeo.net/](http://www.dotgeo.net/)>

**National Council for Science and the Environment: PopPlanet:** Partnership between the US National Council for Science and the Environment and the Population Reference Bureau, this site is a resource of country-specific information on population, environment and health.

Go to: <[www.popplanet.org/popplanet/](http://www.popplanet.org/popplanet/)>

Above items from *Sci-Info Bulletin*, Qld Dept. Natural Resources.

## Uncertain outlook: northern weather

### From page 11

improved the probability of above median rainfall for the next three months compared to conditions at the end of April (see map above) for the south east of the country while the northern regions tend not to show a strong signal towards either above or below median rainfall.

According to the Bureau of Meteorology El Nino Wrap Up (See text box) the Pacific Ocean currently remains in a neutral sea surface temperature pattern.

However, there remains an increased risk of an El Niño developing this winter. Part of the reason for the

concern is because a strong westerly wind burst in the second half of March initiated a Kelvin wave in the Pacific Ocean, which in turn has produced some subsurface ocean warming in the western Pacific. During autumn and winter Kelvin Waves can be considered to be somewhat of an early indicator that there is an increased risk of an El Nino developing.

They take about two months to cross to the eastern Pacific, and can trigger warming of the subsurface ocean temperatures in the Pacific as they go.

However, it's too early to say just how strong this subsurface ocean warming in the Pacific will be, and how

far east significant warming will be found. Sea temperatures remain cooler than average across the central to eastern Pacific for the time being.

Ocean and coupled ocean/atmosphere forecast models are used to show likely SST development out to nine months. Of 11 models that forecast out to October, nine indicate a neutral SST pattern continuing, while two suggest the potential for an El Nino (or warm) SST pattern.

Most of these models drop away in their forecasting skill over March to June, so caution is advised in considering the longer-term forecasts.

### ACF's northern Australia

THE Australia Conservation Foundation launched a northern Australia program in May to partner local Indigenous peoples in protecting their environments and strengthening communities. The program will run across the entire north, from Cape York Peninsula to the Kimberley.

Its three main areas of focus will see ACF working with: 1. local groups to manage land, improve sustainability, oppose conservation threats and advocate for land rights. 2. governments to encourage greater support for the region, lobby for government support for greater land protection with appropriate recognition of Indigenous rights and 3) partners on a comprehensive communications program to ensure that all Australians are aware of the crucial importance of the region.

Go to: <[www.acf.org.au](http://www.acf.org.au)>

### East to west linked

THE Savannah Way—the 3700 km route spanning northern Australia—was officially launched in June. More than 80 per cent of the road that links Cairns to Broome through Katherine in the Northern Territory is now sealed. Further, the route has been developed so that is 'tourist friendly' with directional road signage and interpretive panels along its length. Travellers can also browse a dedicated route brochure map or visit the Savannah Way website. The road was jointly funded under the Drive Tourism and Federal Government Regional Tourism programs.

Go to: <[www.savannahway.com.au](http://www.savannahway.com.au)>

### Tourism in parks

QUEENSLAND has unveiled a tourism management plan for national parks that aims to create more eco-tourism opportunities and jobs. The current system of issuing permits to tourism operators will be scrapped and replaced by commercial arrangements which the Environmental Protection Agency, through the Queensland Parks and Wildlife Service, will enter into with tourism operators. The new agreements will begin to take effect later this year. All operators will have to be licensed and the commercial agreements will set clear guidelines in terms of visitor numbers and their activities. The agreements will run for up to 10 years

Go to: <[www.epa.qld.gov.au/](http://www.epa.qld.gov.au/)>



## New coordinator for landcare program

MATT Bolam, a former cattle veterinarian in the Northern Territory and Kimberley, has taken on the role of NT coordinator for the National Landcare Program. Matt will be assisting primary producers and Landcare groups to undertake sustainable natural resource management (NRM) activities across the rangelands of the Territory.

Matt has worked as a vet in the NT and Kimberley since 1988, but over the past few years has been consulting for the pastoral industry—focusing on sustainable grazing and natural resource management and human resource issues.

"I believe that the key issues for a sustainable future in the rangelands are those of NRM and human resource management," said Matt.

"The Landcare movement is all about people and NRM and that's why I see this move as simply a natural progression for me.

Matt will be working closely with the Australian Government NRM facilitators, regional and local Landcare facilitators (funded through the Natural Heritage Trust).

"The plan is to assist the Landcare movement where I can to continue to build on its significant achievements by encouraging greater community and industry involvement in Landcare activities," he said.

Matt urges anyone who is interested in NRM and Landcare issues to contact him.

Contact: Matt Bolam

National Landcare Program State Landcare Coordinator NT  
Northern Territory Cattlemen's Association

1 Buffalo Crt, (PO Box 4845), DARWIN, NT, 0800

Tel: (08) 8981 5976 Fax: (08) 8981 9527

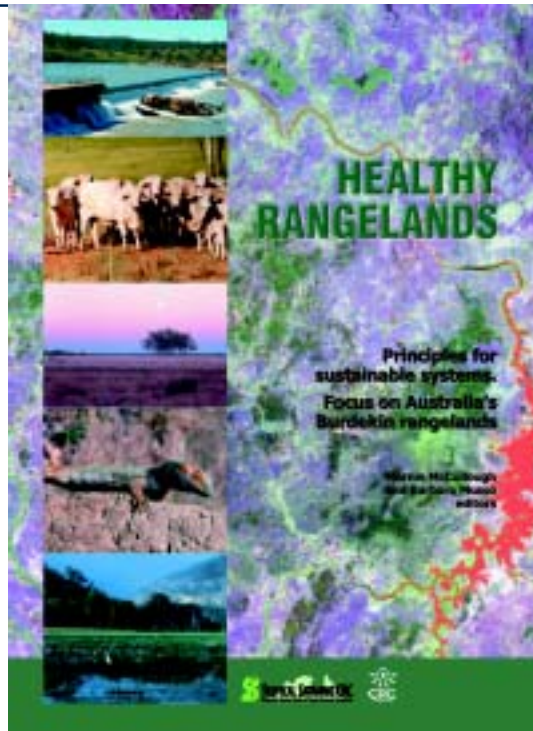
Mob: 0428 330 131 Email: <[mattbolam@bigpond.com](mailto:mattbolam@bigpond.com)>

### Riparian survey

GRAZIERS in the Upper Burdekin Catchment of Queensland have an opportunity to give their opinions on riparian management over the next few months to James Cook University Masters by Research student, Ally Lankester. Ally is exploring the 'hows' and 'whys' of riparian management,

as well as the challenges and constraints by surveying the district's graziers. If you'd like to take part, Ally's contact details are below. The study is supported by the CRC, Land & Water Australia as well as the university.

Ally Lankester, James Cook University  
Tel: (07) 4781 6430



Price: \$49.95 (\$45.41 +\$4.54 GST). ISBN: 0 9581014 1 8  
 Contact: DPI Book Stores, or see Publication Order Form, this issue. Website: <[savanna.cdu.edu.au/publications/](http://savanna.cdu.edu.au/publications/)>  
 DPI Website: <[www.dpi.qld.gov.au/shop/](http://www.dpi.qld.gov.au/shop/)>

## Focus on Burdekin rangelands

AT more than 240 pages, this new book on Queensland's Burdekin rangelands brings together an extensive array of information on its land use, management and biophysical systems. Of the many areas that make up the tropical savanna landscapes, the Burdekin Catchment stands out as an important component of the pastoral estate in the north Australian rangelands, and one that plays a significant role in the regional economy.

The book's purpose is to take an integrated approach to sustainable management based on knowledge of the various landscape components and their complex interactions.

Issues facing natural resource managers in the catchment are both localised, such as the long-term sustainability of the resource base for grazing and other land uses, and external, such as the relationship between the catchment and the neighbouring Great Barrier Reef lagoon.

Healthy Rangelands takes a carefully structured, systematic approach to the management of the upper Burdekin rangelands, drawing on the best available knowledge from a wide variety of sources. Information is presented in a way that links sophisticated scientific insight with practical management approaches, focusing on the special features and challenges of the Burdekin catchment. — Gordon Duff

## Agroforestry review

THIS review examines the potential of developing new industries in the savannas based on timber plantations, tree crops, grazing systems and sustainable management of native forests. Benefits such as long-term employment and sustainable ecological development in regional economies is also explored.

Report summary: <[www.rirdc.gov.au/reports/AFT/04-025sum.html](http://www.rirdc.gov.au/reports/AFT/04-025sum.html)>

Full report: <[www.rirdc.gov.au/reports/AFT/04-025.pdf](http://www.rirdc.gov.au/reports/AFT/04-025.pdf)>

Introduction to Tropicana agroforestry for Indigenous communities:

<[www.rirdc.gov.au/reports/AFT/03-109sum.html](http://www.rirdc.gov.au/reports/AFT/03-109sum.html)>

## Small-town strategies

FORMER Topical Savannas CRC PhD student Colin Macgregor, has published a paper: *Working towards sustainability in small towns: perspectives from northern Australia*, in the International journal of Environment and Sustainable Development 2(4, 2003) pp 342–63. The paper's questions include the role of local governments in initiating sustainability strategies; what constitutes sustainable communities; and initiatives that can expect to find support.

from *Environment in the News*, 24 February 2004. Contact Colin by Email: <[cjm27@st-andrews.ac.uk](mailto:cjm27@st-andrews.ac.uk)>

## Social atlas

PRIMARILY drawing on data from the Australian Bureau of Statistics' Population and Housing Censuses for 2001 and 1996, the atlas examines changes in these factors over time in Statistical Local Areas. It contains 70 maps describing the population, employment, household, income and education characteristics of rural and regional Australia.

Go to: <[www.affa.gov.au/content/publications.cfm](http://www.affa.gov.au/content/publications.cfm)>

Hard copies may be purchased from the Bureau of Rural Sciences for \$56, including postage and handling. Tel: 1800 020 157 Email: <[salesbrs@brs.gov.au](mailto:salesbrs@brs.gov.au)>

## Tax effects on NRM

This report, *Taxation of Primary Producers and Landholders—Improving NRM Outcomes*, provides a summary and analysis of the income and other tax laws in Australia that are likely to affect investment and management of natural resources. It also provides an overview of tax policies and recommends changes to tax laws, which are targeted at in-

creasing investment in NRM.

Report summary: <[www.rirdc.gov.au/reports/Ras/04-026sum.html](http://www.rirdc.gov.au/reports/Ras/04-026sum.html)>

Full report: <[www.rirdc.gov.au/reports/Ras/04-026.pdf](http://www.rirdc.gov.au/reports/Ras/04-026.pdf)>

## Measuring social capital

*Measuring Social Capital—An Australian Framework and Indicators*, examines what social capital is and the way it might be measured. The framework proposed, which is produced recently by the Australian Bureau of Statistics aims to enable planners and policy makers to make better use of all the available statistics and help the ABS to address gaps in data coverage.

ABS (Catalogue No. 1378.0); \$10 <[www.abs.gov.au/](http://www.abs.gov.au/)>

## Native seed field guide

*WHAT Seed is That?* (revised edition), by Neville Bonney, is a field guide to the identification, collection, germination and establishment of native plant species for central southern Australian landscapes.

Price \$68.50 includes GST and \$7 p/h within Australia. Will also be available on CD ROM. Enquiries and book orders to Neville Bonney, PO Box 37, Tantanoola, SA 5280, Tel: 0419 803 189; Email: <[nbonney@senet.com.au](mailto:nbonney@senet.com.au)>

## July

### 3th International Soil Conservation Organisation Conference: Conserving soil and water for society—sharing solutions 4–9 July, Brisbane

**Venue:** Brisbane Convention Centre

Staged by the Australian Society of Soil Science Inc. and the Australasian Chapter of the International Erosion Control Association, the conference will cover activities from research to facilitation, from modelling to measurement, from science to policy and practice that moves us forward in meeting society's needs. There is likely to be increased emphasis on the role of women and Indigenous groups in conservation; management and consideration of arid and semi-arid lands; conservation in urban and infrastructure development; carbon sequestration; and rehabilitation and management of mining and other extractive industries.

**Contact:** Conference Secretariat: ICMS Pty Ltd  
**Postal:** 82 Merivale Street SOUTH BANK Qld 4101  
**Tel:** (07) 3844 1138 **Fax:** (07) 3844 0909  
**Email:** <isco2004@icms.com.au>  
**Web:** <www.isco2004.org>

### Australian Rangeland Society 13th Biennial Conference 2004 5–8 July, Alice Springs

**Venue:** Minnamurra Hall, St Philips College

**Conference theme:** 'Living in the Outback'

The theme covers isolated people, with a wide variety of values and needs, creating opportunities within the unique characteristics and capabilities of rangeland environments. Issues to be canvassed by the conference include: incorporating wider community values into management programs; establishing unique and viable business systems and better risk management.

A heavily discounted registration fee will be offered to rangeland land managers and students.

**Contact:** Sarah Nicholson, Conference Secretariat  
Intercomm Event Coordination  
**Mobile:** 0419 815 864 **Email:** <intercomm@ozemail.com.au>  
**Web:** <www.austrangesoc.com.au/conferences.asp>

### International Conference on Storms 5–9 July, Brisbane

**Venue:** Mercure Hotel

The conference will be held in conjunction with the annual national conferences of the Australian Meteorological and Oceanographic Society (AMOS) and the Meteorological Society of New Zealand. Multidisciplinary themes include science of storms, observations, dynamics and prediction, impacts and risk assessment, and mitigation.

**Contact:** Organising Committee  
**Postal:** AMOS International Conference on Storms  
Bureau of Meteorology, GPO Box 413, Brisbane Qld 4001  
**Tel:** (07) 3239 8679 **Email:** stormsconf@bom.gov.au  
**Web:** <www.stormsconf.org.au/>

### International Conference on Sustainability Engineering and Science 6–9 July, Auckland, New Zealand

**Venue:** Sheraton Hotel and Towers

The International Conference on Sustainability Engineering and Science will bring together those from industry, business and government, along with engineers and scientists to discover the leading edge of sustainable technologies, the application of sustainability engineering and the tools that can be used to measure sustainability.

**Contact:** Vicky Adin Conference Manager  
**Postal:** PO Box 272.1460 Papakura NZ  
**Tel:** +64 9 299 7538 or +64 25 230 5365  
**Fax:** +64 9 299 6738 **Email:** <vickya@kiwilink.co.nz>  
**Web:** <www.nzsses.org.nz>

### AgForce State Conference: Marketing for Tomorrow's Consumer Today 25–27 July, Townsville

**Venue:** Townsville Entertainment & Convention Centre

Consumers, overseas and domestic, will be the focus of this year's AgForce State Conference in North Queensland in July. Speakers include Samantha Jamieson, Meat and Livestock's (MLA) regional manager Japan; Australian Wool Services chairman Trevor Flugge; MLA's general manager marketing David Thomason; and Canadian Cattlemen's Association past president Neil Jahnke.

**Contact:** Wendy Allen, AgForce conference coordinator  
**Tel:** (07) 3236 3100 **Email:** conference@agforceqld.org.au  
**Web:** <www.agforceqld.org.au/agforce/events/?conferences=home>

## August

### 3rd National Conference: Tourism Futures – Wealth Creating, Growth Sustaining 4–6 August, Townsville

**Venue:** Southbank Convention Centre

The conference will explore challenges to the growth of tourism through a combination of keynote speakers and concurrent sessions with an emphasis on interactive workshops. Themes include sustainable development, competitive advantage, strategic partnerships and alliances, and marketing.

**Contact:** Melissa Webster, Tourism Queensland  
**Postal:** GPO Box 328, Brisbane, QLD 4001  
**Tel:** (07) 3535 5275 **Fax:** (07) 3535 5445  
**Email:** <melissa.webster@tq.com.au>  
**Web:** <www.tq.com.au/tfconf>

## September

### Queensland Landcare Conference 1–5 September, Toowoomba

Around 600 delegates are expected at the Queensland Landcare Conference which is being hosted by the Toowoomba Landcare Group. The conference theme, 'Get your hands dirty,' aims to encourage hands-on participation in natural resource management issues from

clean water to safe food and bush land relaxation.

**Contact:** Marien Stark **Tel:** 0427 952 336

**Email:** <conference@landcare.org.au>

## 14th Australian Weed Conference 6–10 September, Wagga Wagga, NSW

**Venue:** Charles Sturt University; **Theme:** Weed Management: Balancing people, planet and profit

This conference will be of interest to those involved in research, extension, education, agribusiness, environmental management, farming or horticulture or students. To cater for the diversity of weed information, the program consists of a wide range of oral presentations and posters.

**Contact:** Andrew Hennell, Event Manager

**Postal:** Charles Sturt University, Locked Bag 588, Wagga Wagga NSW 2678

**Tel:** (02) 6933 2606 **Fax:** (02) 6933 2643

**Email:** <eventsw@csu.edu.au>

**Web:** <www.csu.edu.au/special/weedsconference/>

## Second South African LandCare Conference, September, Cape Town, South Africa

It is planned that there will be an International LandCare day at the conference as in the case of Darwin.

**Contact:** Francis Steyn, Provincial LandCare Coordinator

**Email:** <francis@elsenburg.com>

## Seagrass 2004 25–27 September, Townsville International Seagrass Biology Workshops No. 6 (ISBW6) 28 September – 1 October, Magnetic Island

**Venue:** Jupiters Hotel and Casino

The international seagrass conference will be followed by the ISBW6 at Magnetic Island from 28 September – 1 October. This meeting will

incorporate an open conference format and ISBW6. Interested parties can put forward proposals for symposia or workshops. Topics should encourage a active discussion and be topical.

**Contact:** Michelle Waycott **Fax:** (07) 4725 1570

**Email:** <seagrass2004@jcu.edu.au>

**Web:** <www.tesag.jcu.edu.au/seagrass2004/>

## November

### Ecotourism Leading Innovation, Driving Sustainability Conference 8–13 November, Leura, Blue Mountains

**Venue:** Peppers Fairmont Resort, Leura

**Postal:** GPO Box 268, Brisbane, QLD. 4001

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

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

**Web:** <www.ecotourism.org.au/conference/index.asp>

### Australasian Wildlife Management Society Conference 2004 29 November – 2 December, Kangaroo Island, South Australia

**Venue:** Kingscote Town Hall, Kangaroo Island,

The 17th AWMS Conference is open to all those interested in wildlife management including scientists, land managers, policy formulators, educators and interested community groups and individuals. Call for papers—Abstracts required by 1 September, 2004

The emphasis of these conferences is on participation and discussion among delegates, so time slots for spoken papers will be limited. Poster presentations will be on display and can be viewed during teas and discussions can be held with the authors.

**Contact:** Doreen Culliver, Conference Organiser

**Postal:** PO Box 3711, Weston ACT 2611

**Tel/Fax:** (02) 6288 3998 **Mob:** 0408 883 998

**Email:** <culliver@webone.com.au>

**Web:** <www.awms.org.nz/>

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