



# SAVANNA LINKS

Cooperative Research Centre for Tropical Savannas Management

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## CONTENTS

### NEWS 2–3

- Tourism in Gulf
- Veg laws' review
- North's mining resources

### FIRE 4–5

- Indonesian project

### LANDSCAPE 6

- Photos needed

### INDIGENOUS 7

- NAILSMA forum

### CONSERVATION 8–9

- Mystery macropod

### PESTS 10–11

- Exotic ants in Top End

### SAVANNA BITES 12–13

Online resources | Tropical research gateway | Air quality and bushfires | Infra-red fire management | Yellow crazy ants |

### READING 14

Weed manuals | Climate change | Capacity building | Vegetation | NRM info | Conservation incentives |

### CALENDAR 15–16



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### Links through fire

There are many parallels between eastern Indonesia and northern Australia in terms of landscape and land management—such as a wet-dry monsoonal climate and extensive fire-prone savanna vegetation.

These similarities have now formed the basis for a research partnership between the two countries that is helping to develop better fire management—pp. 4–5.

**Also ...** New report on tourism in the Gulf, NAILSMA runs its first forum; snapshots wanted for a photo history mapping landscape change, and much more.



### No kidding: it's a bug's life

If weeds and feral animals like pigs and toads aren't enough, the north is now threatened by another invasion: exotic ants. Currently, these ants cost Aboriginal communities in northern Australia \$1 million annually.

*Ben Hoffmann* describes the main culprits, and efforts to control them.— pp. 10–11.

### North's wallaroo leaps into sight



The antelope wallaroo is Australia's only large kangaroo that lives entirely in the tropics—but unlike species such as the eastern grey kangaroo, it's not in great abundance. Turn to pages 8–9 to read about a distinctive Australian macropod!

Photos this page, clockwise from top: Rohan Fisher, David Webb, Ben Hoffmann.

# Nature-based tourism under spotlight



Photo: Romy Greiner

A NEW report from the Tropical Savannas CRC summarises the results of research that studied the relationship between tourism and small savanna communities in the Gulf of Carpentaria. The study, funded by the TS-CRC and the CSIRO Sustainable Ecosystems, was carried out with the support of the Carpentaria Shire Council and the Shire’s tourism industry. The project profiled the types of visitors to the region, analysing potential problem areas and options residents could take to address them. It found that tourists typically stay for extended periods of time, have low-cost holidays, and spend most of the time fishing.

The prime focus of tourism in this area—as in much of the savannas—is nature-based. And in the Gulf, it is fishing that is the main drawcard for nearly all the tourists. A large proportion of tourists are retirees, who are part of the ‘grey nomads’ phenomenon. Retirees stay for an average of 10.5 weeks, typically come from southern states, stay in their caravans and are on low incomes.

While they do not spend much per day (only about \$30 compared to \$112 for a ‘typical’ visitor to Queensland), they spend a substantive amount per visitor because of their extended stay. The research estimated that tourism contributes at least \$11 million in direct spending to the economy of Normanton and Karumba.

## Residents’ perceptions

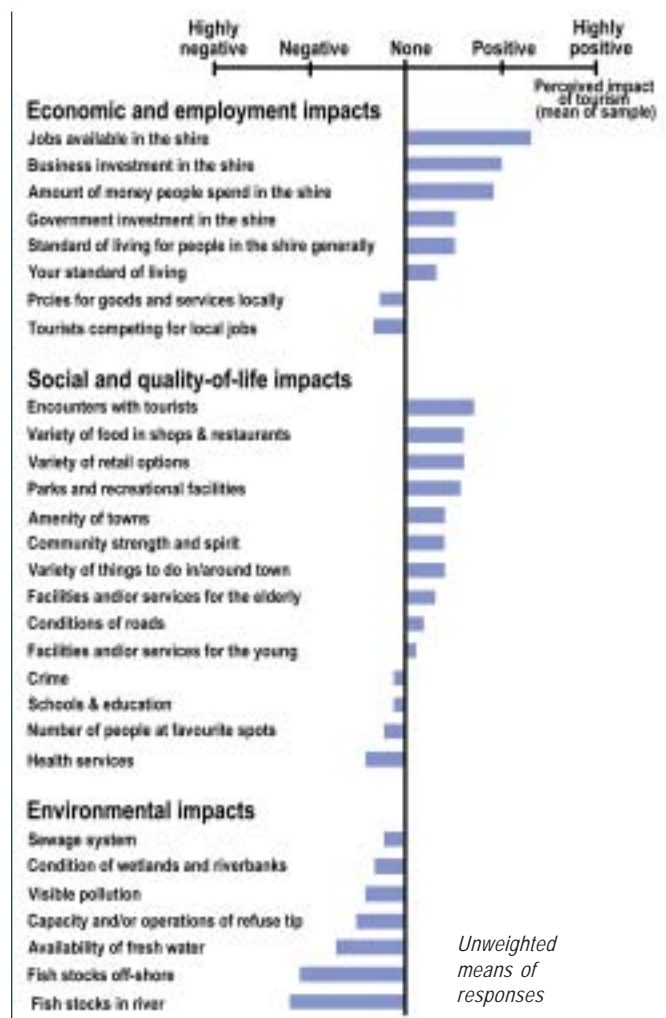
Residents in the shire appreciate the employment and investment benefits that tourism generates. They also appreciate tourism from a social and lifestyle point of view. However, they are also concerned with negative environmental impacts—including the possibility of declining fish stocks—and the availability of fresh water and refuse generation. Tourists add to the population as many as 800–1000 “resident equivalent”, effectively increasing demand for services in the Shire by 25–30% over a calendar year.

In the process of enjoying the natural resources, the report points out, tourists consume them, along with other services and resources, and they have an impact on more intangible aspects such as local culture and the feeling of place. It is essential to consider this resource use in the context of the benefits that tourism generates for host communities.

The implications of the research points to a need for the region to diversify its tourist product to attract more short-stay non-fishing higher-spending tourists. However, in the foreseeable future fishing will remain the prime attraction—so sustainable management of fish stocks is paramount.

The report points out that many initiatives are already under way to support diversification of the tourist market, including the development of a visitor information centre and museum in Normanton. Also, linking the region into a broader savanna context through the ‘Savannah Way’ themed road is a positive step. A major challenge will be to support involvement of the majority Indigenous population in tourism so that they can share in the economic opportunities that tourism provides.

## Perceived impact of tourism in the shire



*Benefits and costs of tourism for remote communities Case study: Carpentaria Shire, north-west Queensland* By Romy Greiner, Colin Mayocchi, Silva Larson, Natalie Stoeckl and Roman Schweigert. Download free (chapter by chapter) from the TS-CRC website: <[savanna.ntu.edu.au/publications/books\\_reports/tourism\\_reports.html](http://savanna.ntu.edu.au/publications/books_reports/tourism_reports.html)> Contact: Romy Greiner, CSIRO Sustainable Ecosystems, Davies Lab, Townsville Tel: (07) 4753 8630 Fax: (07) 4753 8650 Email: <[romy.greiner@csiro.au](mailto:romy.greiner@csiro.au)>

# Vegetation laws unfair, says review

THE Productivity Commission—the Federal Government’s principal review and advisory body on micro-economic policy and regulation—has found that the current regulations governing clearance of native vegetation on private rural land are unfair, imposing substantial costs on many landholders who have retained native vegetation on their properties.

The review, which was released on August 10, confirmed that retaining, managing and rehabilitating native vegetation and biodiversity on private land was needed to protect endangered ecosystems and sustainable natural resource management. It maintained that the existing regulatory approaches were not as effective as they could be and imposed significant costs.

The Commission made several key recommendations, urging more equitable cost-sharing arrangements, and that landholders bear the costs of development that directly contributes to sustainable resource use, but that the wider community should pick up the costs of providing ‘public good’ environmental services such as biodiversity conservation.

The National Farmers Federation welcomed the report saying it provided overwhelming evidence to support its call for governments to provide farmers with security over their land and native vegetation resources through a robust and clear national framework.

NFF President, Mr Peter Corish said that the national approach must be the same mechanism as the one recently agreed on water which was through the development of an inter-governmental agreement.

However, the Australian Conservation Foundation were concerned at what it said could be any weakening of current vegetation management regulations.

“We’re gravely concerned at any suggestion by the Commonwealth to wind back the clock on recent progress in reining-in land clearing,” ACF Land & Water Coordinator Tim Fisher said. “Surely now the challenge is to build on these regulations with financial incentives and other measures designed to promote conservation on farms.”

The review said that the regulatory process was compromised by “a lack of clearly specified objectives; disincentives for landholders to retain and care for native vegetation; and the inflexible application of targets and guidelines across regions with differing characteristics such that perverse environmental outcomes often result.”

It also said that many landholders were prevented from developing their properties, switching to more profitable land use, and introducing cost-saving innovations.

“Arbitrary reclassification of regrowth vegetation as remnant and restrictions on clearing woodland thickening in some jurisdictions are reducing yields and areas that can be used for agricultural production,” it said.

Download the report at: <[www.pc.gov.au/inquiry/nativevegetation/finalreport/index.html](http://www.pc.gov.au/inquiry/nativevegetation/finalreport/index.html)>

Printed copies RRP \$22.00, can be purchased from the Commission’s publications agent: Pirion / J.S. McMillan. Tel: 02 9795 1200

Email: <[custserv@jismcmillan.com.au](mailto:custserv@jismcmillan.com.au)>

## North’s mining potential gets a lift

MORE than 19,000 square kilometres of land on the Barkly Tableland will be opened to petroleum exploration with the full consent of traditional owners, following the formal award of two exploration permits by the Northern Territory Government to Sweetpea Corporation.

Northern Land Council Chief Executive Norman Fry said the new exploration permits resulted from a native title petroleum agreement signed in 2003 between traditional owners and Sweetpea Corporation.

Another explorer, Pardi Pty Ltd, also signed a separate native title petroleum agreement covering land adjacent to Sweetpea’s permits.

“This is a major boost for the Northern Territory’s resources sector and builds on the momentum already achieved with the signing of mining template agreements covering the overwhelming majority of native title land in the Top End targeted by

mineral explorers,” Mr Fry said.

“The native title petroleum agreements are the first ever signed in the NLC’s area and it is to both companies’ credit that they wanted native title issues settled well ahead of exploration.”

The agreements set out the parameters for both exploration and production, and include safeguards for the environment and sacred sites as well as benefits for affected traditional owners. The agreements cover 13 main groupings of traditional owners from language groups including Mudburra, Jingili, Wampaya, Gurdanji, Mangarrayi and Yangman people.

### Alumina in the Cape and Gove

In other news in the north’s mining sector, alumina mining at Arakun in Cape York is set to enter a new phase with the Queensland Government calling for expressions of interest in

the region’s substantial mineral resources, and its bauxite deposits in particular.

The mining lease held by French company Aluminium Pechiney Holdings since 1975 was set aside through legislation enacted by the Queensland Government. The State Government sought surrender of the lease because the company had failed to construct an alumina refinery or begin any work in the region—a key requirement of its original agreement with the Bjelke-Petersen Government was to build the refinery by 1988.

In Gove, Alcan (which recently took over Pechiney) is to spend \$2 billion on expanding its alumina plant, creating up to 1700 jobs over a three-year construction period. Alcan spokesman Richard Yank said the expansion would secure the future of Nhulunbuy as a regional service centre and provide opportunities for Indigenous enterprises.

There are many parallels between eastern Indonesia and northern Australia in terms of landscape and land management—such as a wet-dry monsoonal climate and extensive fire-prone savanna vegetation.

These similarities have now formed the basis for a research partnership between the two countries that is helping to develop better fire management.



Photo: Rohan Fisher

*Villagers establishing a fire break on Sumba*

## Northern fire research links to Indonesia

Over the past decade an effective working relationship on fire management has developed between Prof. Greg Hill (Charles Darwin University), Dr Jeremy Russell-Smith (the Bushfires Council of the Northern Territory and TS-CRC) in Darwin and Dr Siliwoloe Djoeroemana of Wira Wacana University in Sumba, eastern Indonesia. This relationship has resulted in a project in which current savanna fire regimes are being monitored, and recommendations for the appropriate use of fires in savannas is being developed in eastern Indonesia (see box opposite page).

### Fires in eastern Indonesia

In eastern Indonesia savanna fires are frequent and extensive. Villagers battle extreme fires in the late dry season with frequent loss of crops, houses and sometimes life. A breakdown of traditional fire management has contributed to declining land productivity in many areas with a direct impact on plantations and crops, soil loss and nutrient depletion.

Two village communities, at Waingapu on the island of Sumba, and near Bajawa on Flores have been actively involved in the fire project from the start and the project team has established several fire experimental sites in those areas. The villagers have formed discussion groups that describe the impacts of fires on their personal property, natural resources and livelihood. In general they see fire as an inevitable, annual assault on their resources, one that is beyond their control.

### Field days

This year the villagers on both Sumba and Flores received training in safe and effective burning methods from the Bushfires Council and Charles Darwin University project team. Strategic, prescribed early dry-season burning was planned and carried out, with the aim of protecting houses, gardens and agroforestry plantations. Several field days with demonstrations of burning methods were held in May

near the village of Ngaru Kahiri in eastern Sumba for local villagers, who then demonstrated the techniques for government field and technical officers. Similar field days were held in Ngada district on Flores.

### GIS and satellite mapping

The extent and timing of fires on Sumba and Flores were mapped by the project's GIS officers—from the Provincial Development Planning Board (BAPPEDA) on Sumba and Flores and Darwin-based fire researcher, Rohan Fisher. These fire maps were derived from satellite imagery and validated by on-ground observations.

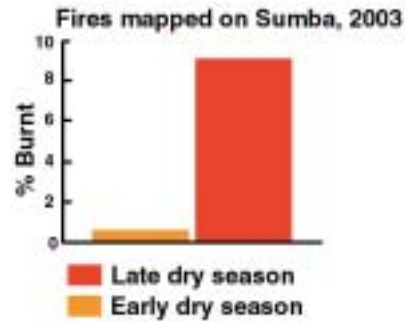
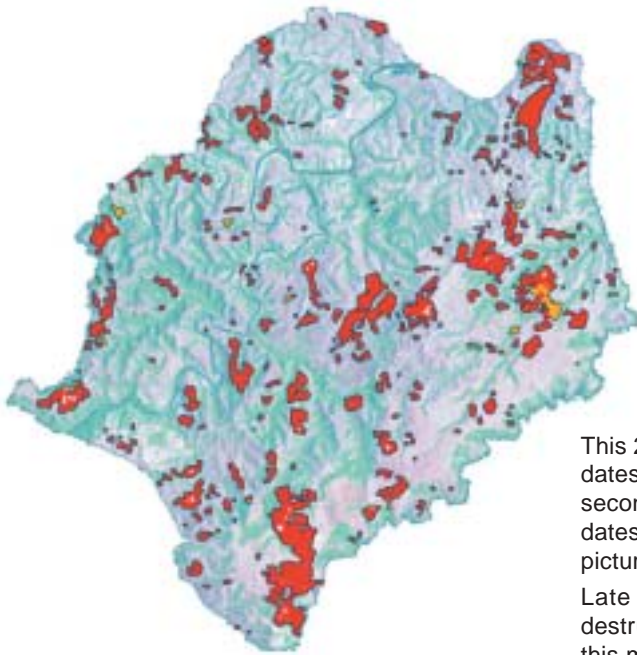
Current mapping indicates that around 50 per cent of the study area in Flores and 19 per cent of the area in Sumba are burnt each year.

The extent of fires was then related to land cover and land use maps. The Indonesian GIS officers received training from Rohan Fisher and from the Centre of International Forestry Research in Bogor. They will spend some time working alongside GIS officers in Darwin next year.

The maps produced by the project were well received as land management tools. The villagers took part in mapping exercises and now refer to the land use maps when planning burning activities. BAPPEDA officials are very enthusiastic about the mapping capabilities developed through the project and are using these maps as regional planning tools.

### Fire regulations and policy

For both countries, the fire policies and regulations were written by their respective national governments and are more appropriate to the forested areas of these countries than to the savannas. In eastern Indonesia, government fire policies are designed for forested areas of western Indonesia. A review is under way to address these inconsistencies and make recommendations relating to fire policies and regulations appropriate to savanna landscapes.



This 2003 fire map of Sumba was derived from two satellite image dates. The first was from early in the dry season (May) and the second from late in the dry season (October). By mapping multiple dates we are able to increase mapping accuracy and produce a picture of the timing of the burning.

Late dry season fires are considered to be potentially more destructive as they are often larger and hotter. We can see from this mapping that most of the fires occur late in the dry season.

### Higher education

The project also aims to provide educational materials at the university level relating to the sustainable management of savannas.

Course materials relating explicitly to tropical savanna ecology and management are currently available in the Masters of Tropical Environmental Management (MTEM) developed by the TS-CRC and taught at CDU. This material is highly relevant to land management in both eastern Indonesia and northern Australia. Dr Penny Wurm, leader of the TS-CRC's higher education program, is working with Satya Wacana Christian University to make materials from the MTEM units available to Indonesian students—currently, most masters students at Satya Wacana University are from eastern Indonesia.

### More information

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 Web: <www.cdu.edu.au/ehs/science/mtem/>



## Research partnership aids villagers

The project on fire management in Indonesia and northern Australia is funded chiefly by Australian Centre for International Agricultural Research with additional support from the Tropical Savannas CRC, the Bushfires Council of the NT and Charles Darwin University, and so extends the work of the TS-CRC in northern Australia internationally.

The main Indonesian partners are the Centre for International Forestry Research in Bogor, Java, working in western Indonesia and Wira Wacana University Sumba, and BAPPEDA (Provincial Planning Board in Sumba and Flores) in eastern Indonesia.

The project activities include:

- describing the impacts of current burning practices in Indonesia,
- mapping current fires, and past and present land-use and land cover,
- reviewing fire policy and regulations across northern Australia and across Indonesia,
- training in effective burning methods for Indonesian land managers and demonstrating these methods to government officers, and
- transfer of educational materials on savanna monitoring and management to Indonesian universities.



*This photo pair was taken near the homestead at 'Boobyjan' in South Eastern Queensland. The old photograph was taken in 1888 and re-photographed in 2002. Vegetation on the hill in the background has become denser. In the foreground, changes to riparian structure are obvious.*

*In 2002, the Tropical Savannas CRC published *Slower than the eye can see*, a history of environmental change in the NT's Victoria River District. Written and compiled by Darrell Lewis, the book looks at the district's environment from the time of the European explorers to the present day, and featuring pairs of historical and modern photographs that reveal how the country has altered.*



## Historic photos needed to track change

**D**o you have old photos of Queensland's woodlands? If so, a team from Queensland's Department of Primary Industries and Fisheries would like to hear from you. They are putting together a photo history of regions right across the state's 14 regional catchments, including the tropical savanna regions of the Burdekin, Cape York and the Gulf.

In Queensland, photos date back as far as the 1800s and can pre-date current woodland studies, offering information about changes in woodlands. Although photo pairs cannot provide rigorous, statistically analysed scientific proof, they can provide graphic visual evidence of landscape change and assessments of change over extended time intervals. Paired photographs will be used to complement other more rigorous woodland monitoring techniques—and by matching historic and modern day photographs taken at the same site, they hope to amass a body of visual evidence of landscape change.

Woodlands contribute to biodiversity, maintenance of landscape function (e.g. hydrological cycle) and are a huge carbon reserve. But the woodlands of northern Australia are changing; there are reports of both woody

plant thickening and thinning. However, measuring the direction and magnitude of these changes is difficult particularly within remnant 'intact' woodlands—those that have not been subjected to broad-scale clearing.

Attempts to characterise these changes have been conducted using direct ground-based monitoring and air-photography techniques. Limitations of these techniques include the short time period they span in relation to modern European-style management and their resolution at site and regional scales. The research team is interested in scanning photos from both private and public collections to build a database. If you're interested in helping out, see the contact details below.

North Queensland DPIF: Marnie McCullough, Tel: (07) 4722 2519  
Email: <marnie.mccullough@dpi.qld.gov.au>; Central Queensland:  
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Southern Queensland: Col Paton, Tel: (07) 4161 3709  
Email: <col.paton@dpi.qld.gov.au>

### Further reading

Lewis, D. 2002, *Slower than the eye can see*, Tropical Savannas CRC.  
<[savanna.cdu.edu.au/publications/books\\_reports/landscape\\_change.html](http://savanna.cdu.edu.au/publications/books_reports/landscape_change.html)>



Above, NAILSMA's first forum attracted around 200 people from across the north. Inset, Traditional Owner Tommy George from Cape York; right, young Wardaman men dance for the visitors



Photos: Todd Condie, Northern Land Council

## Alliance hope for Aboriginal voice on land issues

**T**HE first forum for the North Australian Indigenous Land and Sea Management Alliance was held in August to discuss a way forward for the north's Indigenous people post Land Rights and Native Title. Held at Menngen Aboriginal Land Trust west of Katherine, the forum was co-hosted by Traditional Owner Bill Harney, the Wardaman Association and NAILSMA.

The meeting officially started with the arrival of 200 Traditional Owners just after the grader cleaned up the track into the meeting site: the Wynbarra waterhole on Menngen Aboriginal Land Trust.

In opening the meeting Joe Morrison, Coordinator of NAILSMA, highlighted the role the alliance hopes to perform in ensuring that Indigenous people are present at the negotiating table when it comes to managing country across northern Australia

Indigenous people now hold significant assets in land and knowledge that have been fought for long and hard by their ancestors. According to chairman of the meeting, Peter Yu, Indigenous people across northern Australia are now at a watershed.

"We have the opportunity to assert that traditional ownership, customary and cultural knowledge, is crucial in the future management of northern Australia," he said.

"We have some strong struggles ahead in welfare dependency, health and a rapidly growing population, so we must ensure that these issues get dealt with by ourselves in productive partnerships."

There were vigorous discussions on the alliance's governance arrangements—its structure, how it can engage with researchers, and how Indigenous people can drive a research agenda based on their on-country needs.

NAILSMA's current suite of projects were also up for discussion and comment: Indigenous knowledge, fire, communication, leadership, scholarships and management of turtle and dugong.

Some important questions were raised around Indigenous customary use of turtle and dugong, because of concerns that governments may stop Indigenous people from hunting them. Wardaman culture was also highlighted, with young men from the community—who were getting ready for a local 'culture camp' scheduled for late September—dancing for the delegates.

The forum ended with all attendees agreeing on a meeting statement, which called upon all NAILSMA partner organisations—the Kimberley Land Council, Northern Land Council, Carpentaria Land Council Aboriginal Corporation and the Balkanu Corporation—to:

- Re-affirm their commitment to the development strategy and objectives as stated in the NAILSMA heads of agreement.
- Formally endorse this commitment with the membership of each partner organisation.
- Integrate fully the Land and Sea units of the partner organisations within the NAILSMA strategy.
- Nominate community representatives to the NAILSMA board and NAILSMA steering committee.

Throughout the meeting there were also reports to Traditional Owners on the role of NAILSMA, and its actions through the projects and its staff.

Contact Joe Morrison, NAILSMA Coordinator, Tel: (08) 89466 702, Mob: 0429 695 324 Email: <joe.morrison@cdu.edu.au>

## Unique kangaroo a tropical treasure



Main photo: David Webb

The antilopine wallaroo is Australia's only large kangaroo that lives entirely in the tropics.

Unlike some kangaroo species, its numbers aren't in great abundance and it may even be under threat.

CRC PhD student *Euan Ritchie* is studying its biology so we can develop conservation and management regimes that will help it survive.

**M**acropods are among Australia's most recognisable group of marsupials; they include kangaroos, tree kangaroos, wallaroos, wallabies, rock wallabies, bettongs, potoroos and the quokka. Of Australia's 50 recent macropod species, six are now extinct and 11 are declining (Johnson et al. 1989).

Until recently it was thought that the fauna of Australia's monsoonal tropics remained largely intact. But at present a large-scale mammal decline appears to be occurring throughout this region, particularly within savanna environments. Researchers such as John Woinarski warn that past extinctions in central Australia were extremely rapid, with changes in abundance leading to the loss of species within one to two decades. Further work by Don Franklin details widespread declines of granivorous birds that overlap those areas with reported mammal declines.

Within the vast area of Cape York and the Einasleigh Uplands (Figure 2) lives one of Australia's most distinctive animals: the antilopine wallaroo (*Macropus antilopinus*). When Gould (1842) named the wallaroo he thought they resembled Africa's antelopes: the males have a brick red colour on their back extending all the way to their head, with their front a vivid creamy white. Gregarious, grass-eating and tropical, antilopine wallaroos also occur in smaller numbers in the Top End of the Northern Territory and the Kimberley region of Western Australia.

However, observations in Cape York Peninsula have shown widespread mammal declines, including declines of antilopine wallaroos. So at a time when it seems there are kangaroos everywhere and they are being culled in certain parts of Australia, this particular species is under threat—and it may be the first observed decline of a kangaroo since European settlement.

There are a number of potential causes for these declines: habitat change and clearance, introduced

predators and competitors, intensification of grazing and agriculture, introduction of exotic diseases, changes in fire regimes and overkill.

Of the six living species of kangaroo, none have been listed as endangered to date. Typically kangaroos have prospered as a result of the land management practices associated with livestock grazing, such as permanent water sources being established, woodland being cleared in favour of grasslands and the removal of predators, particularly dingoes. However, like many mammal species of northern Australia there is very little known about the wallaroo: its diet, breeding habits, biology—all are something of a mystery. This means we have no basis to interpret the causes of the declines that have been observed, or to recommend appropriate management of habitat to prevent further declines.

Given that the antilopine wallaroo is harvested as a bush food by Aboriginal communities, our estimates of population size, distribution and reproductive rates will allow us to estimate sustainable harvest rates. The study will also result in a better understanding of recent ecological changes on Cape York Peninsula, and their effects on wildlife.

### Behaviour

The animal is quite striking and beautiful to look at; but over the course of my study, I've noted something even more striking: antilopine wallaroos display a behaviour known as sexual segregation. Outside of the breeding season, these wallaroos separate into single sex groups with large groups of females (5–10 individuals) and bachelor groups comprising large-sized males (3–5 individuals).

Why do they do this? Some theorise that females make different diet choices because their reproductive role and smaller body size means they have higher relative energetic needs—but activity patterns and risk of predation could also play a part.



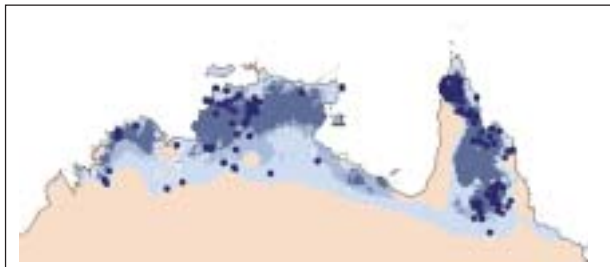


Figure 1: Distribution of antilopine wallaroos: Dark blue represents the species core distribution and light blue the periphery. Dots represent known locations of antilopine wallaroos.

My observations have confirmed that diet choice may indeed play a significant role. While both males (85%) and females (74 %) feed on large amounts of grass, females feed on significantly more forbs, which have a higher nutrient content than grass. Within my study site, forbs were less abundant and more patchily distributed than grass, so this could explain the group splitting between males and females. However, other mechanisms could also offer explanations, so more research is needed.

Because of this split between male and female, males spend long amounts of time with each other, some of which is spent establishing a dominance hierarchy, which seems to be related to reproductive success. The hierarchy determines which male in any chosen group is the strongest, and therefore most likely to succeed in male versus male competition for females, and ultimately who will mate with females in the breeding season.

### Wallaroo snapshot

Over the past 12 months I have recorded almost 3000 wallaroos, and it appears that population numbers are relatively stable in Queensland—interestingly, the area with the highest abundance is on a cattle station that is cell grazed—an unusual grazing practice in Cape York—and has not been burnt for 10 years. This could mean that the antilopine wallaroo is sensitive to fire.

However, my findings are no cause for complacency, because wallaroos are most abundant in the better grazing lands of north Queensland around the basalt belt of Mount Surprise (Figure 2). This could eventually be a problem for graziers who want to expand their business while preserving habitat for native species such as the wallaroo. Numbers in the Kimberley and Northern Territory do not fare as well, but more research is needed to pin down the probable causes for declines in those regions.

### Stakeholder cooperation

The nature of my work requires interaction with a broad spectrum of individuals and communities, including graziers, Indigenous people, and park rangers. The cooperation between these groups has been inspiring, and I am thankful that this is the case, as these are the people who will shape the future of our tropical savannas.

An article on Euan's findings will also appear in the next issue of *Nature Australia*, due out in December.

Contact: Euan Ritchie, Tel: 07 4781 5715 Email: euan.ritchie@jcu.edu.au  
Web: <savanna.cdu.edu.au/education/students/antilopine\_wallaroo.html>

### More reading

Croft, D.B. 1987, 'Socio-Ecology of the Antilopine Wallaroo *Macropus Antilopinus* in the Northern Territory Australia with Observations on Sympatric *Macropus-Robustus-Woodwardii* and *Macropus-Agilis*', *Australian Wildlife Research*, 14(3) 243–256.

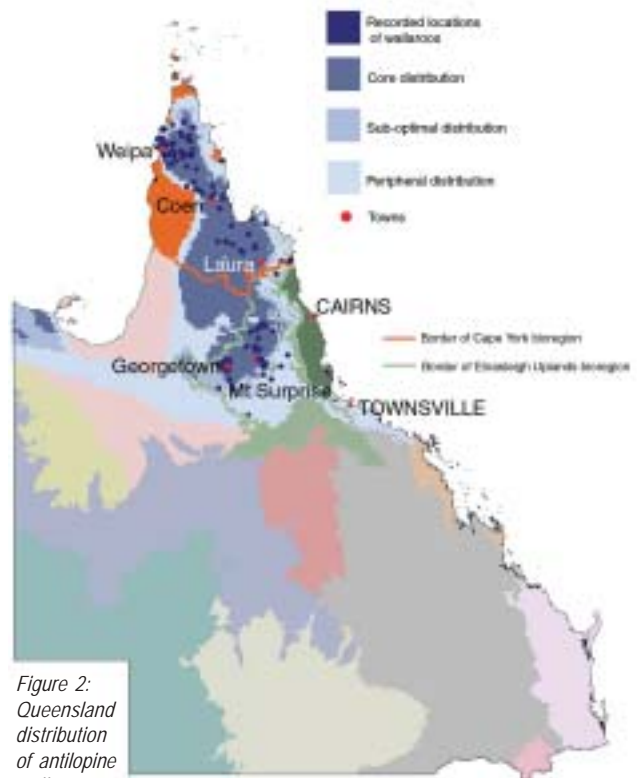


Figure 2: Queensland distribution of antilopine wallaroos

## Cape York biodiversity

Cape York Peninsula is about 13.5 million hectares in size and encompasses a diverse array of habitats and associated flora and fauna. Mammal species recorded as declining include the black-footed tree rat, northern quoll, common brushtail possum, rufous bettong, some rock wallabies and the antilopine wallaroo (John Winter, Christopher Johnson & Peter Johnson, pers. comm., 2002). The study is being conducted at two scales: broadly across the whole of the Cape and Einasleigh Uplands and locally in Mount Surprise (Figure 2). At the broad scale the Cape and Einasleigh Uplands are divided into three regions, southern (Mount Surprise, Georgetown and Chillagoe areas), middle (Laura, Coen, Mungkan Kandju and Lakefield National park) and northern (Weipa and surrounds).

### Wallaroos or kangaroos—what's in a name?

The name 'kangaroo' usually refers to the large macropods of the grassy plains like the red and grey kangaroo. 'Wallaroo' is a name used for macropods that are smaller than kangaroos but larger than wallabies, and that often prefer hillier country. Male antilopine wallaroos can weigh up to 50–60 kilos with females about half that size. Because of their large size antilopine wallaroos are sometimes also called kangaroos.

Johnson, K.A., Burbidge, A.A. & McKenzie, N.L. 1989, 'Australian Macropoidea: status, causes of decline, and future research and management', in Grigg, G., Jarman, J. & Hume, I., (eds) *Kangaroos, wallabies, and rat kangaroos*, Surrey Beatty & Sons, Sydney, pp. 641–657.

Russell, E.M., & Richardson, B.J. 1971, 'Some observations on the breeding, age structure, dispersion and habitat of populations of *Macropus robustus* and *Macropus antilopinus* (Marsupialia)', *Journal of Zoology*, London 165:131–142.

Woinarski, J.C.Z., Milne, D.J. & Wanganeen, G. 2001, 'Changes in mammal populations in relatively intact landscapes of Kakadu National Park, Northern Territory, Australia', *Austral Ecology*, 26:360–370.

Photo: CSIRO



In 2001, outbreaks of African big-headed ants, left, infested 30 hectares of Kakadu National Park. Below, exotic ants “farm” scale insects, for their sugary secretions, protecting them from their natural predators, which in turn results in canopy dieback.



Photo: Federal Dept. Environment & Heritage

Exotic ants cost Aboriginal communities in northern Australia \$1 million annually. *Ben Hoffmann* describes the main culprits, and efforts to control them.

## Exotic ants threaten Indigenous lands

Some of the world’s most successful invaders are ants. Indeed, five ant species are among the world’s top 100 worst invasive pests. Some of these ants have managed to spread worldwide through human commerce to such an extent that their native distributions remain unknown.

Australia now has 13 exotic ant species, 11 of which are found across the northern tropics. Six of these species are of particular concern: the red imported Fire ant (*Solenopsis invicta*), Yellow crazy ant (*Anoplolepis gracilipes*), Argentine ant (*Linepithema humile*), Tropical fire ant (*Solenopsis geminata*), the African big-headed ant (*Pheidole megacephala*) and the Singapore ant (*Monomorium destructor*). All but the first two species were probably introduced around 100 years ago, and as such, their populations are widespread and firmly established.

The most recent incursion into Australia was that of the red imported Fire ant, arguably the world’s worst invasive ant. Two outbreaks were discovered in Brisbane in February 2001, invoking this country’s most expensive ant eradication program. So far more than 50,000 hectares have been systematically treated at a cost of more than \$150 million.

At about the same time, the African big-headed ant and the Tropical fire ant were found within the World Heritage Listed Kakadu National Park. An intensive detection and mapping program throughout the Park identified 24 outbreaks of African big-headed ants covering about 30 hectares and two infestations of Tropical fire ant covering another 3 hectares. All infestations were associated with human settlements and other infrastructure. Every infestation has been chemically treated, and post-monitoring surveys indicate successful eradication.

These high-profile discoveries and subsequent actions have greatly improved public awareness of exotic ants,

and as a result there now appears to be a renewed emphasis on their management in Australia. In particular, a number of indigenous land management organisations have actively searched for exotic ant species, revealing incursions in many remote communities of northern Australia.

While not all exotic ants are significant pests, some could be described as stereotypical invasive species in that they are highly aggressive and numerous, and have environmental as well as economic impacts. It is these species that should be the focus of management action.

### Environmental impacts

Invasive ants can have severe environmental impacts, with their effects cascading through ecosystems. A recent example is the incursion of the Yellow crazy ant on Christmas Island, which has now killed an estimated two million red land crabs (*Gecarcoidea natalis*). The elimination of these crabs has resulted in major structural change to the rainforest vegetation. These terrestrial crabs are voracious consumers of young plants, leaf litter and seeds, thereby keeping the ground layer extremely bare.

A dense understorey has developed in areas where crabs were killed by crazy ants, which changes ecosystem processes and modifies the habitat of all other endemic plants and animals. In addition, the ants “farm” scale insects for their sugary secretions, even taking them to new locations when they reproduce. This protects the insects from their natural predators, which in turn results in canopy dieback. The new gaps in the rainforest canopy then pave the way for a new suite of ecological changes.

The demise of rare and localised invertebrate animals due to exotic ant invasion is already evident in northern Australia, particularly in small isolated rainforest patches that are scattered throughout the savanna. The recently described Gove crow butterfly (*Euploea alcatheae enastri*) is known from only four small locations in north-eastern Arnhem Land, one of which is now infested by the Yellow



Left, Singapore ants on a power point—recent estimates of electrical damage on the Tiwi Islands caused by Singapore and African big-headed ants was around \$100,000 each year. Below, Junior (David) Guy places ant poison Amdro on a Tropical fire ant nest at Milkapiti (Melville Island)

Photos this page: Ben Hoffmann

crazy ant. No specimens of the Gove crow butterfly have now been seen in the infested location for a few years, and it seems likely that they are now locally extinct.

Australia's invertebrate fauna is poorly known, especially in remote Indigenous lands. For example, in a recent survey of Aboriginal land near Katherine, one-third of the ant species recorded had never previously been collected. Given the remoteness of many Aboriginal communities, there is a real threat that locally endemic species may become extinct as a result of exotic ant invasion, even before these species can be described by science. Biological invasions also threaten the traditional food resources of Aboriginal people.

### Economic impacts

Invasive ants have economic impacts ranging from reduced agricultural production to damage to electrical circuits and equipment. Ultimately, ongoing control measures become a further economic burden if pest ants are not eradicated at the early stages of invasion.

In a recent survey of the Tiwi Islands it was estimated that the Singapore ant and African big-headed ant were causing electrical damage costing approximately \$100,000 per year. Using population and infrastructure data provided in the latest Community Housing and Infrastructure Needs Survey, this equates to \$43 per person or \$221 per permanent dwelling. Discussions with residents of many other communities throughout the Top End indicate that these ants and their associated problems are widespread. Using the costings from the Tiwi Islands, these ants can be estimated to cost Top End Aboriginal communities about \$1 million annually.

### Health concerns

There are often health implications for people co-existing with pest ants. Species such as the Tropical fire ant and the pharaoh's ant (*Monomorium phaeonnis*) are known to carry pathogenic bacteria making them vectors for the spread of disease. Direct interaction with other species such as the red imported Fire ant and the Yellow crazy ant also results in painful stings or acid burns, often requiring medical attention.

### Managing exotic ants

Most exotic ant species occurring on mainland Australia have become so widely established that they can't be eradicated. However, these ants could still be prevented



from spreading to remote Aboriginal communities.

The control and even eradication of pest ants from small and isolated locations has been successfully demonstrated. For example, all known infestations of African big-headed ant and Tropical fire ant were recently eradicated from Kakadu National Park and associated leases. This project involved the collaboration of CSIRO, Parks Australia North, traditional Aboriginal owners and all residents of Aboriginal outstations within the park, Environmental Resources Australia (the owners of the Ranger Uranium Mine) and all residents and businesses within the township of Jabiru. This project clearly demonstrated that people from multiple agencies, cultures and languages, with cooperation from public and private sectors, are able to eradicate established populations of some of the world's worst invasive ant species over substantial areas.

### Vigilance needed

While conspicuous invaders such as cane toads (*Bufo marinus*) and giant sensitive plant (*Mimosa pigra*) receive much public attention and therefore attract government funding, the less conspicuous exotic ants are spreading largely unabated throughout the country. The spread of these species should be of concern to us all, and thus vigilance and timely management is all that will keep these exotic invaders from infesting remote communities, and from there to potentially sensitive habitats throughout Australia. Where they are found to be present, their eradication should be given priority before their environmental, economic or social impacts are realised.

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This article first appeared in the July issue of *Australasian Science*  
Web: <www.control.com.au>



1972



1989



2002

Satellite imagery shows that between our bicentenary in 1988 and 2001, 3.4 million hectares of forested land was cleared across Australia. These sample images from the Greenhouse Office above, show that in 1972 most of the area in the sample image is covered by trees; in 1989 some trees have been cleared, and in 2002 further clearing has occurred.

## Landscape change history on view

AUSTRALIANS can now access satellite imagery for a bird's eye view of changes to Australia's landscape over the past 30 years. This new service from the Australian Greenhouse Office allows you to download historical satellite images from its website, and also links you to current online mapping services at the Australian Natural Resources Atlas website. A free DVD can also be ordered which includes a viewing tool and snapshots for the years 1989–2002. *Australia 1972–2002: A Thirty Year View from Space* is supported by NASA, Geoscience Australia and CSIRO and will allow land managers to see how their property has changed over time and, just like the North Australian Fire Information Site, can help with fire management activities by identifying fire scars and fire frequency.

Go to: <[www.greenhouse.gov.au/ncas/aspaces/index.html](http://www.greenhouse.gov.au/ncas/aspaces/index.html)>

North Australia Fire Information: <[www.firenorth.org.au/](http://www.firenorth.org.au/)>

### Australia at a glance:

- 770 million hectares total land area (or 7.7 million square km)
- 5 per cent of the world's land mass
- sixth-largest country
- 20 million people
- 164 million hectares of forest in 2003
- 5 million hectares forest cleared from 1989 to 2002—equivalent to clearing around 75 per cent of Tasmania's land mass

### Online weed identification tool

WEEDS Australia has launched an interactive version of its WEEDeck cards, where the 172 weeds species covered by the cards can be identified online. The tool works through a map interface where you can click on your area of interest. Major weeds of the area are listed, including photos for identification. The pocket-sized WEEDeck cards, published by Sainty & Associates are also available.

Go to: <[www.weeds.org.au/weedident.htm](http://www.weeds.org.au/weedident.htm)>

WEEDeck cards: Sainty & Associates Pty Ltd

Tel: (02) 9332 2661 Email: [geoff@sainty.com.au](mailto:geoff@sainty.com.au)

### National website for NRM groups

REGIONAL bodies involved in Natural Resource Management can now use a website to exchange experiences and information with other groups. The website is supported by the Federal Government to help explain the integrated delivery of the National Action Plan for Salinity and Water Quality and the Natural Heritage Trust. It also provides linkages to existing regional websites to facilitate cross-regional information flow.

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

### Interactive social atlas for regional Australia

A WEALTH of information on rural and regional Australia, including details of population, education, employment, household and income, is now just a keystroke away, following the recent launch of a new website. The new web-based Interactive Social Atlas draws on information collected for the BRS/RIRDC publication *Country Matters—Social Atlas of Rural and Regional Australia*. Go to: <[data.brs.gov.au/mapserv/pdfatlas/index.html](http://data.brs.gov.au/mapserv/pdfatlas/index.html)>

### Landcare forum online

ELECTRONIC forums have been established under the International Landcare Clearinghouse to assist the exchange of landcare information and experiences. Newsletter readers are invited to join and use this facility through the Federal Department of Agriculture, Fisheries and Forestry subscriptions web page.

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

### New science website

SCIENCE Alert is a new website containing science news from some of Australia's leading research organizations featuring a calendar of science events and free articles.

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

### Tropical research gateway

PROFESSOR of Tropical Knowledge at Charles Darwin University, Stephen Garnett, is driving an initiative to create a website linking all businesses conducting tropical research in Australia. The website will serve as a directory and will link businesses and their research activities with customers, clients and potential collaborators around the world.

Prof. Garnett said the website will be searchable by research skill area and will hopefully lead to new opportunities for participating businesses. He is keen to hear from businesses both large and small to find out their research expertise and capacity.

The work is being done in collaboration with the NT Government under an agreement between Western Australia, Queensland and the Northern Territory aimed at increasing cooperation on tropical research.

**Contact:** Prof. Stephen Garnett, Charles Darwin University, Tel (08) 8946 7115 Email: <stephen.garnett@cdu.edu.au>

### Air quality and bushfire smoke

A RESEARCH partnership between the Northern Territory Government, Australian Research Council, Bureau of Meteorology and Charles Darwin University is examining the links between bushfire smoke and the health of Territorians.

The project aims to identify periods when smoke pollution exceeds national standards and relate these to current fire activity; to develop an



Photo: Deb Bisa

## Male crocs share their space

A WORLD-FIRST project which tracked large estuarine crocodiles by satellite, has exploded some myths about their behaviour. The project, conducted by the Queensland Parks and Wildlife Service and the University of Queensland, showed that the satellite transmissions were overlapping, indicating that large estuarine crocodiles appear to be far more tolerant of other large males than previously thought.

It is possible that there are more male crocodiles sharing waterways than expected and that has implications for management and conservation, particularly near urban areas. 'Crocs in Space' was the first project to attempt using satellite telemetry as a tool to track the movement patterns of estuarine crocodiles.

**See:** <[www.epa.qld.gov.au/nature\\_conservation/wildlife/living\\_with\\_wildlife/crocodiles/satellite\\_tracking/](http://www.epa.qld.gov.au/nature_conservation/wildlife/living_with_wildlife/crocodiles/satellite_tracking/)>

historical and geographic picture of fire activity in the region, and to determine the impact of different levels of atmospheric pollution caused by bushfires on lung and heart disease in the Darwin region.

Dr David Bowman, Charles Darwin University; <david.bowman@cdu.edu.au>

### Fire management in infra-red

TINY infra-red sensors could one day help provide warning against bushfires. British research is testing the sensors for early warning of disease, weeds and insects in horticulture. But a West Australian project is investigating their use in fire management.

Profs. Mark Adams and Laurie Faraone of the University of Western Australia are working on a network of infrared sensors set up along the urban-rural fringe of Australia's cities to detect bushfire activity and provide early warning. The sensors monitor the heat of materials, including air, affected by bushfire. Ideally, the detectors will be attached to existing infrastructure such as mobile phone towers.

Another application is to monitor deliberate burn-off operations. Low cost infra-red sensors can be used around the perimeter of planned controlled fires, to reduce the labour costs of patrolling.

Richard Gill, CRC for Microtechnology, Email: <[richard.g@microtechnologycrc.com](mailto:richard.g@microtechnologycrc.com)>  
**Web:** <[www.smartsensors.com.au/](http://www.smartsensors.com.au/)>  
<[www.oliphant.org.au/](http://www.oliphant.org.au/)>

## Yellow crazy ant on eradication hit list



Photo: CSIRO

*Yellow crazy ants attack a native green ant*

A MAJOR eradication program in Arnhem Land is under way to halt the Yellow crazy ant (*Anoplolepis gracilipes*). The program involves Dhimurru Aboriginal Land Management Corporation, local Aboriginal communities, Alcan Gove, the

Northern Territory Government, the Northern Land Council and CSIRO. The Yellow crazy ant has infested more than 350 hectares over a 25,000 km<sup>2</sup> area in remote north-east Arnhem Land, and represents a major environmental and economic threat to northern Australia.

Mark Ashley, NLC Land Management Facilitator, said the ants had the capacity to spread from Broome in Western Australia to Queensland and so it was important that the species was eradicated now before it became a major economic and environmental pest throughout the north.

See page 10 for an article on exotic ants.

## Weed management manuals

**Prickly acacia** infests more than six million hectares of the Mitchell Grass Downs of Queensland and has the capacity to threaten a further 50 million hectares of native grassland ecosystems. *The Prickly Acacia Best Practice Manual* is a reference tool to help land managers develop their skills and knowledge to achieve their individual and collective goals.

Contact: Nathan March, Dept of Natural Resources, Mines and Energy  
 P.O. Box 7, Cloncurry Qld 4824  
 Tel: (07) 4742 8214  
 Email: <nathan.march@nrme.qld.gov.au>  
 Web: <www.nrme.qld.gov.au>

**Rubber vine** is no stranger to northern Australia with infestations covering over 700,000 hectares in Queensland and if left unchecked threatens to invade the Northern Territory and Western Australia.

Rubber Vine Management, an update of the previously published *Managing Rubber Vine*—An experienced-based approach to managing a weed of national significance, includes a comprehensive range of techniques for controlling rubber vine, and a selection of case studies demonstrating landholder approaches and experiences.



Photo: Kate O'Donnell



Photo: NRM&E

Rubber vine along the Burdekin above, and prickly acacia, right

Contact: Land Protection, Department of Natural Resources, Mines and Energy  
 P.O. Box 1762, Rockhampton Qld 4700  
 Tel: (07) 4938 4600  
 Email: <CentralLP@nrme.qld.gov.au>  
 Web: <www.nrme.qld.gov.au>

### Predicting climate change

CSIRO has released climate change simulations and scenarios for northern Australia and the NT in particular. The NT Government's Greenhouse Unit commissioned the study to try and predict likely impacts for this region.

The average output from 8 models was used in the predictions, with results fairly similar to the rest of Australia (and globally), a 2 to 5.8 degree Celsius rise over the next 100 years. Coastal areas will experience less change than inland although storm and cyclone events are expected to increase in intensity.

Go to: <www.lpe.nt.gov.au/enviro/greenhouse/documents/default.htm#climatechange>  
 from TEMs Links, July 2004 Volume 5, Issue 2.

### Capacity building

This RIRDC report, *Growing the Capital of Rural Australia—The Task of Capacity Building*, deals with the third project in the Capacity Building for Innovation in Rural Industries project trilogy—Improving Institutional Support Arrangements for Rural Capacity Building. It is a study in a field where traditional ideas related to extension and adult education

are giving way to new ones and where there is uncertainty about the best way forward.

Go to: <www.rirdc.gov.au/reports/HCC/04-034sum.html>

### Guide on climate change

*Climate Change: An Australian Guide to the Science and Potential Impacts* is the first major publication to focus on the science of climate in Australia and the southern hemisphere. Australia's vulnerability to climate change is intensified by already being a generally dry continent and experiencing high natural climate variability from year to year.

The guide explains research that advances the understanding of global and regional climate change and its impacts on natural and managed systems.

You can download the free guide, chapter by chapter, at the Greenhouse Office website.

Go to: <www.greenhouse.gov.au/science>

### NRM & vegetation info

Greening Australia has recently published an NRM handbook and catalogue called *Bush Tracks: Shortcuts to Vegetation Information for Natural Resource Management*. This 288-page publication is aimed at

people trying to find information on native vegetation and NRM issues. It lists a large number of R&D bodies who contribute to vegetation research; a section of 130 useful NRM publications and contact details and information on non-government organisations; university research schools; online databases; online bookshops and relevant newsletters and magazines.

<exchange@greeningaustralia.org.au>  
 A sample of the publication is available at: <www.greeningaustralia.org.au/GA/NAT/OnGroundAction/NationalPrograms/exchange/resources>

### Conservation incentives

A guide, *Biodiversity Incentive Programs in WA*, draws together the various programs that government and non-governments sources offer for private landholders wishing to manage, protect and rehabilitate bushland and natural wetlands on their properties.

The resources' guide provides financial and technical assistance programs, labour programs, land sales, legal protection, management agreements and training, and offers relevant contacts.

Go to: <www.calm.wa.gov.au/orc/pdf/biodiversity\_incentives.pdf>

## October

### 12th Australasian Remote Sensing and Photogrammetry Conference 18–22 October, Fremantle, WA

**Venue:** Esplanade Hotel, Fremantle

The conference will draw together experts and users involved with the measurement and management of spatial variability under the theme 'To measure is to manage', and focuses on geoscience and environmental spectral remote sensing and photogrammetry.

**Contact:** ACTS Conferencing Pty Ltd  
Conference Secretariat

**Postal:** GPO Box 2200, Canberra ACT 2601

**Tel:** (02) 6257 3299 **Fax:** (02) 6257 3256

**Web:** <[www.rss.dola.wa.gov.au/12arspc/](http://www.rss.dola.wa.gov.au/12arspc/)>

## November

### 16th Australia New Zealand Climate Forum— 'Climate and Water'

**8–10 November, Lorne, Victoria**

**Venue:** Cumberland Lorne Resort, Lorne, Victoria

Biannual forum bringing together researchers of climate sciences and users of strategic climate information. Sessions include: understanding and predicting climate variability and climate change, impacts of climate change and variability on water resources and water management, observations and lessons from southern Australia, applications of climate information for water management.

**Email:** <[anzcf2004@bom.gov.au](mailto:anzcf2004@bom.gov.au)>

**Web:** <[www.bom.gov.au/events/anzcf2004/index.html](http://www.bom.gov.au/events/anzcf2004/index.html)>

### 2nd IWA Leading Edge Sustainability Conference—Sustainability in Water Limited Environments

**8–10 November, Sydney**

**Venue:** Intercontinental Sydney, Sydney

This conference seeks to answer the question "How do we ensure that the systems we design meet the needs of the environments in which they are located?" Water limited environments demand efficiency in water provision – but do we achieve this through demand management, recycling, economic incentives or stormwater reuse (to give but a few examples)? In short, how do we make the best decisions, recognising that probably no one decision is 'right' when measured against all criteria?

This conference will focus on the theme of Sustainability in Water-Limited Environments and will be revisited every second year, alternating with Sustainability in Water Rich Environments. The conference will consist of invited speakers who are leaders in the field of water and wastewater as well as those who have had papers selected.

**Contact:** Noirin Casey, Event Coordinator

**Postal:** IWA, Alliance House, 12 Caxton St, London

SW1H OQS. UK

**Email:** <[les2004@iwahq.org.uk](mailto:les2004@iwahq.org.uk)>

**Web:** <[www.les2004.iwa-conferences.org](http://www.les2004.iwa-conferences.org)>

### 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](mailto:info@ecotourism.org.au)>

**Web:** <[www.ecotourism.org.au/conference/index.asp](http://www.ecotourism.org.au/conference/index.asp)>

### Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Conference: Indigenous Studies—Sharing the Cultural and Theoretical Space

**22–25 November 2004, Australian National University, Canberra**

The aim of the conference is to encourage and provide for discussion of intercultural approaches to research and related matters.

**Contact:** Dr Graeme Ward, AIATSIS

**Postal:** GPO Box 553 Canberra 2601

**Fax:** (02) 6249 7714

**Email:** <[conf2004@aiatsis.gov.au](mailto:conf2004@aiatsis.gov.au)>

**Web:** <[www.aiatsis.gov.au/rsrch/conferences/aiatsisconf2004/firstnotice.htm](http://www.aiatsis.gov.au/rsrch/conferences/aiatsisconf2004/firstnotice.htm)>

### 2004 Healthy Country, Healthy Reef—Joint CRC Reef and Rainforest CRC Conference 23–25 November, Cairns, Queensland

**Venue:** Cairns International Hotel

The Catchment to Reef research program is developing new tools to assess and monitor the health of catchments and aquatic systems in the Wet Tropics and Great Barrier Reef World Heritage Areas.

The Conference will showcase some cooperative approaches, and solutions for farmers and the environment. Seminars will outline practical solutions to on-farm water quality issues.

**Contact:** Shannon Hogan, Communications Officer, Rainforest CRC **Postal:** James Cook University, PO Box 6811 CAIRNS QLD 4870

**Tel:** (07) 4042 1244 **Fax:** (07) 4042 1247

**Email:** <[shannon.hogan@jcu.edu.au](mailto:shannon.hogan@jcu.edu.au)>

**Web:** <[www.rainforest-crc.jcu.edu.au/events/Catchment%20to%20Reef%20Conf.htm](http://www.rainforest-crc.jcu.edu.au/events/Catchment%20to%20Reef%20Conf.htm)>

### Australasian Wildlife Management Society Conference 2004

**29 November–2 December, Kangaroo Island, South Australia**

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

The program includes symposia on: tourism and wildlife management, indigenous people and wildlife management, conservation outside nature reserves, translocation of native species and the implications for conservation, management of marine species.

**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/>

## December

### Ecological Society of Australia Annual Conference 7–10 December, Adelaide

**Venue:** University of Adelaide

The ESA 2004 conference coincides with the 50th Anniversary of the publication of “*The Distribution and Abundance of Animals*” by H.G. Andrewartha and L.C. Birch and will include a special symposium to highlight the impact of this work as well as explore recent developments and future directions for research in the field.

**Contact:** Dr Jose Facelli, School of Earth and Environmental Sciences, University of Adelaide, SA 5005 **Email:** <conference@ecolosc.org.au>

**Web:** <www.ecolosc.org.au/Conference/ESA2004/ESA2004.htm>

## 2005

### 2005 Council for Australian University Tourism and Hospitality Education Conference: Sharing Tourism Knowledge

**1–5 February 2005, Alice Springs, NT**

**Venue:** Alice Springs Convention Centre

Conference aims are to promote the development of tourism and hospitality education and research while providing a stimulating environment to enable the exchange of information, ideas and networking opportunities amongst academics, student researchers, and interested industry organisations and bodies.

**Contact:** Treasure Gordon, Desliens Conference and Event Management

**Postal:** GPO Box 2455, Darwin NT 0801  
**Tel:** (08) 8941 0388 **Fax:** (08) 8981 8382  
**Email:** <d cem@desliens.com.au>  
**Web:** <www.cdu.edu.au/cauthe2005/>

### 8th Queensland Weed Symposium 19–22 June, Charters Towers/ Ayr, Qld

**Venue:** To be announced

The symposium will cover the latest innovations in weed management; weed information; rural and urban initiatives and how state and national weed policies and initiatives affect land managers.

**Contact:** Shane Campbell, Tropical Weeds Research Centre **Postal:** PO Box 187 Charters Towers, QLD 4820

**Email:** <shane.campbell@nrm.qld.gov.au>

**Web:** <www.wsq.org.au>

### North Australian Remote Sensing and GIS Forum (NARGIS) Conference— Applications in Tropical Spatial Science 4–7 July 2005, Darwin, NT

**Venue:** Charles Darwin University

NARGIS 05 aims to review what has gone before, discuss current research and applications, and to come up with a set of future directions for the spatial sciences in Northern Australia. The conference is aimed at all people using spatial information residing or working in the tropics including. Abstracts are currently being called; submit online by November 19, 2004.

**Contact:** Dr Diane Pearson, GIS and Remote Sensing Group, **Postal:** Charles Darwin University, Darwin NT 0909

**Tel:** (08) 8946 6046 **Fax:** (08) 8946 7088

**Email:** <diane.pearson@cdu.edu.au>

**or** Conference Secretariat

The Best Conference and Events Company

**Postal:** GPO Box 2541 Darwin NT 0801

**Tel:** (08) 8981 1875 **Fax:** (08) 8941 1639

**Email:** <thebest@norgate.com.au>

**Web:** <www.nargis05.cdu.edu.au>

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