



# SAVANNA LINKS

Cooperative Research Centre for Tropical Savannas Management

<environorth.org.au><landmanager.org.au><savanna.org.au><firenorth.org.au>

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## Bringing back the fire mosaic: Arnhem project revitalises country

Photo: John Schatz



Since the loss of Indigenous people from the Arnhem plateau, extensive wildfires have been free to spread over these unique landscapes—a situation seen across northern Australia.

However, Indigenous fire managers in the West Arnhem Land Fire Abatement (WALFA) Project are using the Two Tool Kit approach to re-establish a more benign fire pattern. Pg. 8–13.

This could be the last issue of Savanna Links—Do you want it to continue? See pg. 2 and Insert to fill out our survey inside.



Photo: Jenny Martin

### Between hope and despair

John Woinarski reflects on the environmental challenges facing the savannas. Pg. 17



### Science fair and exhibition

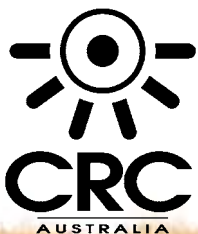
Daleks steal savannas' show Pg 5.



Photos: Hiroshi Suwa, Ian Dixon

### GIS and river research

A GIS tool promises a new way to classify rivers which will help both land managers and researchers. Pg. 14



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

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## Savanna futures symposium

To all those interested in northern landscapes and industry, you are invited to be part of the 2009 Savannah Symposium. Held by Savannah Way Limited, the Savannah Guides and the Tropical Savannas CRC, this conference and optional field workshop will look at future opportunities for northern Australia.

The symposium's main theme, 'How can we do sustainable business in the bush together?', will run in two streams: a conference at Charles Darwin University from 17-19 November and then an optional workshop from 20-21 November in Kakadu National Park and Arnhem Land. You can join for either or both.

The conference will present new ideas and programs as well as successful case studies and developments in three streams: *Sustainable Communities*, *Conservation Business*, and *Ecotourism*.

Presenters from government agencies, business, and diverse organisations will discuss regional opportunities—but please consider sharing your experience with our delegates.

Time for presentations will be 20 minutes, with extra time for questions. PowerPoint facilities are provided. The symposium will also feature a showcase

in the auditorium foyer, where achievements, projects or products can be exhibited. Partnership and promotional packages are also available.

The field workshops in Kakadu and Arnhem Land will showcase a behind-the-scenes look at the iconic Park and Injalak. Meet Traditional Owners and see how tourism business interacts with culture, and visit rock art, Cooida and Kakadu Culture Camp, or cruise Yellow Waters.

The symposium will bring together many key stakeholders including:

- Local councils
- Researchers and consultants
- Territory and State government
- Indigenous organisations
- Small businesses
- Australian government
- Savannah Guides
- Conservation organisations
- National parks
- Regional development
- State and regional tourism
- Remote area service suppliers

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### Savanna Links: the final issue could be up to you

The Tropical Savannas CRC is a joint venture of the major organisations involved in land management of the savannas of northern Australia.

The CRC will officially end this year on December 31, though some activities will continue, including the FireNorth, Land Manager and EnviroNorth websites—check the CRC website for updates.

Another of these continuing activities could be *Savanna Links*, though it partly depends on you, the reader.

If you are interested in the future of the newsletter, please fill out the survey inserted in this issue—or drop us a line via phone, email or letter.

The survey outlines some of the options and issues: moving to online editions, ceasing publication, and future content. *Savanna Links* has aimed to keep you up to date with research from across the region, and information on the challenges we all face living and working in the savannas. If it is our last issue, thank you for your support, and we hope we have gone some way to achieving these aims.

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Project Manager Sarah Legge and Chopper Pilot Butch Maher review prescribed fire lines

## EcoFire wins recognition

**EcoFire**, a major fire management program in the Kimberley, has won the Overall Western Australia Environment Award 2008 and the Award for Community Achievement. The award honours individuals, community groups and businesses who have shown outstanding achievement in protecting Western Australia's environment.

EcoFire project manager Sarah Legge said it was exciting to be part of a project bringing people with diverse interests together in a positive way to achieve something great for conservation.

"We hope this award will help increase

awareness of the fire management issues we face in the Kimberley," she said "and demonstrate that with relatively modest funding, the Kimberley community can improve the region's fire patterns."

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*Savanna Links*, Issue 35, 'Kimberley coordinates fire management':

<[www.savanna.org.au/news1/savanna-links\\_35.html?tid=592249](http://www.savanna.org.au/news1/savanna-links_35.html?tid=592249)>

## Team scoops award for excellence

CONGRATULATIONS to Drs Samantha Setterfield, Michael Douglas, Lindsay Hutley and Natalie Rossiter-Rachor who are recipients of the annual Charles Darwin University Vice-Chancellor's Awards for Exceptional Performance in Research.

Taking out the Research Team Category, the researchers were awarded for their exceptional contribution at the local, national and international level to research on native and exotic grass dynamics in Australia's tropical ecosystems and weed risk assessment.

The team's work builds on their CRC research that investigated gamba grass's biology and impact on ecosystem invasion. In 2007, the Qld and WA governments declared the grass a weed, with NT declaring it in 2008. These decisions were based on the evidence largely arising from the team's research.

The researchers are now incorporating spatially explicit modelling and economic evaluation into risk weed management; developing a weed risk system for the NT; and have secured \$1.5 million to continue research on weed risk management.

*Evidence in on the impact of gamba grass:*  
<[www.savanna.org.au/news1/savanna-links\\_34.html?tid=434373](http://www.savanna.org.au/news1/savanna-links_34.html?tid=434373)>

## Project develops connectivity in the Brigalow Belt

A NEW project in the northern Brigalow Belt—an area in the Burdekin Dry Tropics region that encompasses Townsville, Bowen, Collinsville and Eungella—aims to enhance biodiversity values in core areas of the belt.

The northern Brigalow Belt is one of 15 national biodiversity hotspots in Australia.

Graziers in the area are being encouraged to incorporate environmental stewardship and create corridors of native habitat across the region.

NQ Dry Tropics NRM (formerly Bur-

dekin Dry Tropics NRM), in partnership with Greening Australia, the Environmental Protection Agency and landholders will be undertaking the project, which is funded by the Australian Government's Caring for our Country program.

Doug Willis, Data Manager for NQ Dry Tropics NRM, said the project recognises the efforts of graziers in protecting habitat on their properties and encourages them to commit to perpetual voluntary conservation agreements over their properties, and thus increase the National Reserve System.

"The aim is to have a network of connected habitat areas protecting biodiversity in the region but also complementing the existing grazing operations," he said.

Property activities include protecting remnant vegetation, particularly threatened ecosystems and riparian areas; and managing total grazing pressure to encourage a healthy environment for native plants and animals.

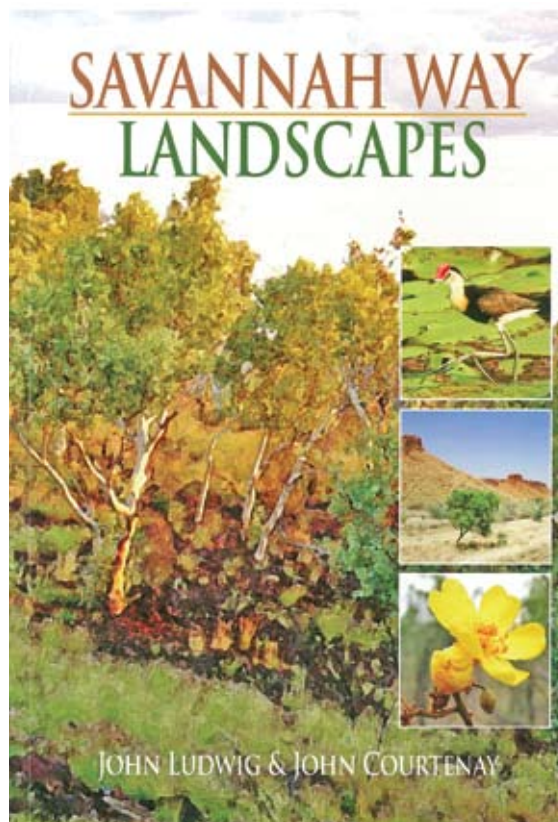
NQ Dry Tropics: <[www.nqdrytropics.com.au/projects/biodiversity/current-projects/landscape-connectivity.html](http://www.nqdrytropics.com.au/projects/biodiversity/current-projects/landscape-connectivity.html)>

# Travellers' guide to wonders of savannah

The word "savanna" as researchers tend to use, or "savannah" as the tourism industry uses, covers a range of strikingly different landscapes in Australia—from the Pindan scrub near Broome to the woodlands around Katherine and the Mitchell Grass plains of Normanton. It's not hard to see these differences, but it can be difficult to describe precisely what you're looking at and why the landscape changes.

Now, there is an easy-to-read book on the different landscapes of Australia's savannas. *Savannah Way Landscapes* was written by two of the foremost authorities on savannas and savanna tourism: former CSIRO landscape ecologist John Ludwig and tourism pioneer John Courtney.

The book is a travellers' guide to the landscapes encountered from



Cairns to Broome along the Savannah Way. The glovebox-sized book takes you west from Cairns through the same broad regions described on the *Savanna Explorer* website: North East Queensland, the Gulf Country, Darwin to Kakadu, VRD-Sturt and the Kimberley.

Not only are the geology and vegetation communities found in each region described, but national parks and tourist attractions, local histories, townships, industries and campgrounds.

The book is full of photos and maps and a handy species list and a guide to further reading.

Available from Visitor Information Centres at Mary River and Katherine in the NT, and Burketown, Normanton and Undara in Queensland. Order online from Savannah Way Ltd.

E: [info@savannahway.com.au](mailto:info@savannahway.com.au)

## Safari hunts trialled for NT crocodiles

CROCODILE safaris may soon be a reality after the Northern Territory government released a draft management plan for estuarine or salt water crocodiles in the NT.

Coming after three attacks on humans, two fatal, in the last few months, the plan attempts to balance the ecological and conservation needs of the crocodiles with the safety of all residents and visitors to the NT. Hunted to dangerously low levels until protected in 1971, crocodile populations have recovered and have started to expand into new areas.

A zero tolerance policy towards nuisance and problem crocodiles is already in place in the Darwin Harbour region where up to 200 crocodiles are culled



Crocodile hunting safaris on the agenda?

Photo: Mark Bancroft

or removed each year. The new plan will expand the area to cover much of the rural Darwin area, including parts of the Katherine and Adelaide Rivers, and will increase the quota to 500 adults and up to 50,000 eggs for harvesting.

The draft also addresses the balance

between conservation goals and public safety; a 'Living with Crocodiles' education and awareness strategy will be developed focusing on the dangers of crocodiles in NT's waterways. The strategy will incorporate education within schools and awareness to the broader community.

A trial of crocodile safaris, with strict regulations to ensure humane methods and environmental protection, is likely to go ahead. The emphasis will be on providing opportunities for Indigenous landholders who already host safari hunting of ferals such as pigs, banteng and buffalo. The safaris will provide landholders with economic incentives to protect crocodiles and habitats.

**Go to:** [www.nt.gov.au/nreta/wildlife/programs/crocodile/index.html](http://www.nt.gov.au/nreta/wildlife/programs/crocodile/index.html)

## Caring for our Country projects off the ground

More than \$403 million in Caring for our Country funding has now been approved in the 2009–10 CfoC Business Plan. Around 1300 organisations submitted proposals and a number of projects in the savannas were funded.

Announcements on the remaining funding will be made in the near future to cover cane toads, Landcare, World Heritage, the National Reserve System and Indigenous Protected Areas. The next round of funding under the Caring for our Country Business Plan is anticipated to be announced later in 2009.

Successful projects in the savanna area were:

- North Australian Indigenous Land and Sea Management Alliance (NAILSMA): Indigenous partnerships for better management of Australia's remote northern coastal and aquatic environments: The Saltwater People Network.
- Northern Gulf Resource Management Group Ltd: Local Indigenous Solutions for a Global Problem in Northern Australia.
- Southern Gulf Catchments Ltd Biodiversity Enhancement: Weeds of National Significance (WONS) targeted across Northwest Queensland.
- South Cape York Catchments Inc. Community Solutions for Managing Natural Resource Challenges in South Cape York.
- Northern Gulf Resource. Community Capital: Enhancing biodiversity and land management practices in the Northern Gulf region through investing in community engagement, skills and knowledge.
- Burdekin Solutions Limited trading as NQ Dry Tropics: Protecting the Ramsar wetland of Bowling Green Bay.

However, two CRC-based projects were unsuccessful: Dr Gabriel Crowley's Knowledge for Northern Australia and Dr Jeremy Russell-Smith's Biodiversity and Social Benchmarking.

**Full list of successful projects:** <[www.nrm.gov.au/](http://www.nrm.gov.au/)>



### Daleks move on savanna display

*THE recent Amazing World of Science exhibition was the first and probably last time that the Tropical Savannas CRC and Daleks shared the same stage. The CRC had a display at the May exhibition in Canberra, when the floor of the exhibition was overrun by Daleks. The CRC's display on the West Arnhem Land Fire Abatement project and the School education modules attracted a great deal of interest—although not quite the level of excitement created by the mutant life-forms from the planet Skaro that travel around in giant salt-shakers. CRC staffers Peter Jacklyn and Julie Crough also had the rare privilege of 'inhabiting' two of the salt-shakers for an afternoon, though their activities as infamous space villains remain confidential.*

## Buffalo impacts in Kakadu overrated

A NEW study has examined the ecological effects of feral buffalo in Kakadu National Park by investigating changes in woody vegetation in both floodplains and eucalypt savanna over a 40-year period. The study concluded that the role of buffalo in this change may not be as great as people had thought.

The paper by Dr Lynda Prior, Research Fellow with CDU's School for Environmen-

tal Research (SER), Prof. David Bowman, Adjunct Professor SER, Dr Guy Boggs, Lecturer GIS, and Caroline Lehmann, SER PhD candidate, recently published their paper in the *Journal of Biogeography*.

The study analysed sequences of digitised and geo-rectified aerial photographs acquired from dates up to 2004 to chart changes in woody cover on the floodplain and in the savanna. Dr Prior said the work

revealed that although the density of woody vegetation on the floodplain had increased during the study period, buffalo were not the major cause.

"Rather, the increases in woody cover in both savanna and floodplains concords with regional trends," she said, "and may be related to increasing rainfall, increased levels of atmospheric CO<sub>2</sub>, and changing fire regimes during the study period."

# CRC pilot research bridges gap

WHILE the Tropical Savannas CRC was unsuccessful in gaining a third round of operations in 2008, it did secure bridging funds until the end of 2009. The extra funding made it possible this year for the CRC to explore future directions for north Australian cooperative research. Consequently, five pilot projects were selected and are currently under way, and will be completed by December 2009. The projects are:

## North Australian political economy

*Objectives:*

- Produce a set of policy prescriptions to address inefficiencies in the northern Australian economy.
- Produce/publish material to contribute to debates on northern Australian development.

## Climate change response and adaptation

*Objectives:*

- Assemble data on land and water capability, vegetation pattern, agricultural options and incomes in the high-rain-fall regions of the NT in forms suitable for aggregation and analysis at different spatial scales.
- Estimate the land area potentially subject to development by catchments and by tenure.
- Identify vegetation types affected by developments and estimate GHG emissions associated with land clearing, taking account of additional carbon storage or emissions associated with projected developments.
- Estimate potential incomes available from areas identified as subject to development under various scenarios.
- Identify areas warranting more comprehensive analysis and develop proposals for more comprehensive analysis.

## Fire management and greenhouse gas abatement

*Objectives:*

- Continue to develop savanna burning GHG emission abatement projects across the north, particularly in association with a project to be funded federally, and to be coordinated through NAILSMA.

- A key focus is to further Indigenous economic development opportunities associated with savanna burning. A broader objective concerns the development of regional fire management partnerships involving the development of regional multi-tenure commercial partnerships.

## Best practice grazing in northern Australia

*Objectives:*

- Gain the full value of past and recent investments in grazing trials and other R&D through its analysis and integration, targeted at addressing key management questions.
- Identify the best mix of practices for an enterprise, based on bio-economic modelling and consultation with producers and other specialists.
- Demonstrate the 'current best bet' combinations of practices in each region through use of 'implementation' sites on-property.
- Further develop the 'future best bet' combinations of practices in each region through use of on-property research.

## Carbon accounting and environmental services

*Objectives:*

- Review the present situation with regard to global carbon markets and the developing national market.
- Review the present situation with regard to biodiversity credits, potential environmental issues related to sequestration/biodiversity trade-offs, and our current understanding of carbon storage in different ecosystems and management regimes.
- Produce a scoping document on carbon trading and carbon/social/biodiversity credits.
- Identify the key research questions for establishing carbon trading ventures in northern Australia.

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**W:** <[www.savanna.cdu.edu.au/research/projects\\_09.html](http://www.savanna.cdu.edu.au/research/projects_09.html)>

## Revamp extends northern fire website's tools

**NAFI**, the North Australian Fire Information website has been extensively updated to make it easier to maintain into the future and to provide extra tools for northern fire managers. This site displays maps of active fires and previously burnt country and is widely used by landscape-scale fire managers in the north.

The NAFI site was developed by the Tropical Savannas CRC and is no longer

just a research platform, but a fully functional site that delivers a valued service. With the winding up of the CRC at the end of 2009, the NAFI site will need to rely on funding from its main users and beneficiaries.

With this new situation in mind, the new NAFI site is much simpler behind the scenes and uses more standard programming, making it easier to maintain.

The updated site also has new tools that perform a range of useful tasks including the upload and viewing of fire lines; highlighting areas on the maps and extracting NAFI maps for use in GPS units.

The new site also has a larger set of map layers including more fire history maps and a revised layout that makes the tools easier to use.

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

# Recognition for Top End science teacher

CONGRATULATION to Jenni Webber who was recently named Northern Territory Science Teacher of the Year for the BHP Billiton Science Awards.

These national awards recognise teachers who engage students in the study of open-ended investigations and work consistently within their school community and wider professional arenas to make an outstanding contribution to science education in Australia.

Jenni, a teacher at Humpty Doo Primary School, is passionate about environmental education.

"I believe that teaching students science through their local environment is the way to work towards a sustainable future," she said.

Jenni has played an integral part in the Tropical Savannas Knowledge in Schools project <[www.environorth.org.au](http://www.environorth.org.au)> both inside and outside the classroom for the last five years. She is also a very active and enthusiastic member of the Top End science community. As part of her award, Jenni travelled to Melbourne for the BHP Billiton Science Awards Camp and to Perth for the Greenhouse 2009: Climate Change and Resources Conference earlier this year.

**Go to:** <[www.scienceawards.org.au/teacher\\_awards/](http://www.scienceawards.org.au/teacher_awards/)>



Science teacher Jenni Webber with Year 7 students at Taminmin High School

## Climate change mapping for north

THE risks and impacts of climate change on Indigenous communities in Australia's tropical north is the subject of a new scoping study funded by the Federal Department of Climate Change. The study will assess the vulnerability and adaptive capacity of hundreds of Indigenous communities to climate change impacts across an area spanning the Kimberley, Arnhem Land, Cape York and the Torres Strait.

Led by Dr Donna Green, research fellow at the University of NSW's Climate Change Research Centre (CCRC), the team will use a range of regionally focused climate change projections to assess impacts in the years 2030 and 2070.

"Climate change impact studies have largely ignored Australia's tropical north, despite the vulnerability of many of the communities living in unique ecosystems in this vast region so it will be important work," says Dr Green.

The study will be undertaken by a multi-disciplinary research team from the CCRC, CSIRO and the North Australian Indigenous Land and Sea Management Alliance (NAILSMA).

The researchers will use spatial information to report on key areas of concern such as vulnerability to extreme weather events and temperature change. They will generate maps showing 'hotspot' communities and locations that are more likely to be impacted by the direct and indirect effects of climate change.

"These 'vulnerability maps' will reveal the capacity and resilience of these communities to withstand and adapt to climate change impacts. They will also show what further research needs to be performed," said Dr Green.

According to Joe Morrison, CEO of NAILSMA, once the vulnerability maps are produced, talks will begin with Indigenous leaders and government agencies


to engage them to 'ground truth' the impacts and begin discussions for further research direction and policy options.

"Indigenous communities face many serious consequences from climate change", he said, "including impacts on community infrastructure from cyclones and flooding, and effects to their customary estates from salt water intrusion and changes to sea levels and rainfall patterns.

"It is imperative that we start to consider these scenarios and to prepare already vulnerable communities with the means to respond".

The Department of Climate Change, the Western Australia Department of Environment and Conservation, the Northern Territory and Queensland Governments all support the scoping study.

**Go to:** <[www.nailsma.org.au/news/nailsma/mapping\\_climate\\_change.html](http://www.nailsma.org.au/news/nailsma/mapping_climate_change.html)>



*For millennia Indigenous fire management and the rocky terrain of the West Arnhem Plateau in the Northern Territory protected cultural sites, bush tucker and rainforest patches from the ravages of frequent fire that swept over the surrounding savanna lowlands.*

*Recently, with most Indigenous people having left the Plateau, extensive wildfires have been free to spread over this unique landscape, a situation seen across northern Australia.*

*Using an innovative approach that draws on traditional and western knowledge, Indigenous fire managers working with the West Arnhem Land Fire Abatement (WALFA) Project have now returned to the plateau.*

*They are now restoring one of Australia's iconic landscapes and generating much-needed jobs, writes Peter Jacklyn.*

# Fire brings back country

*Photo above: A wildfire spreads through sandstone habitat on the West Arnhem Plateau (Di Lucas)*

*This photo: The West Arnhem Plateau ravaged by wildfire showing whole canopies of trees burnt.*

*"There are areas that used to have large stands of cypress pine—some are sites where a lot of people lived in the past and because of the fires, all that is left now are the stumps."*

*—Dr Jeremy Russell-Smith, fire ecologist*

# Arnhem fire project revitalises country

Photo: John Schatz



*Researchers and young men from local Indigenous communities have been working together monitoring fire management in the WALFA project. Left to right: Peter Brocklehurst, Campbell Wood (pilot), Emanuel Namarnyilk, Andrew Edwards, Dick Djogiba, Ray Nadjamerrek.*

Because the West Arnhem Plateau has been protected from uncontrolled fires for so long, it abounds in rich assemblages of fire-sensitive plants and animals as well as many other species. This country is also home to hundreds of traditional rock painting sites—many date back thousands of years and the Arnhem Land rock art galleries have been described as “one of the world’s supreme art galleries”. In recent times however, the plateau has been no refuge from fierce dry-season fires, and both plants, animals and historic art are at risk.

According to fire ecologist, Jeremy Russell-Smith, some of the art sites are getting blasted.

“Because of build up of fuel on the outside, an intense fire will burn the leaves and bark of trees and the outer surface of the rock itself—sheets of it peel off,” he says.

So why is this plateau now ravaged by frequent fire? For thousands of years Aboriginal people managed this country by lighting fires for various purposes which created a patchwork of differently burnt areas across the region. In the late dry season (August–December) when hot, windy conditions and dry grasses can lead to extensive wildfires, such fires were stopped in their tracks by the mosaic of burnt patches of grass that probably stretched across the Arnhem plateau and much of northern Australia.

This situation changed when Europeans arrived in northern Australia in the late 19th and early 20th century and Aborigi-

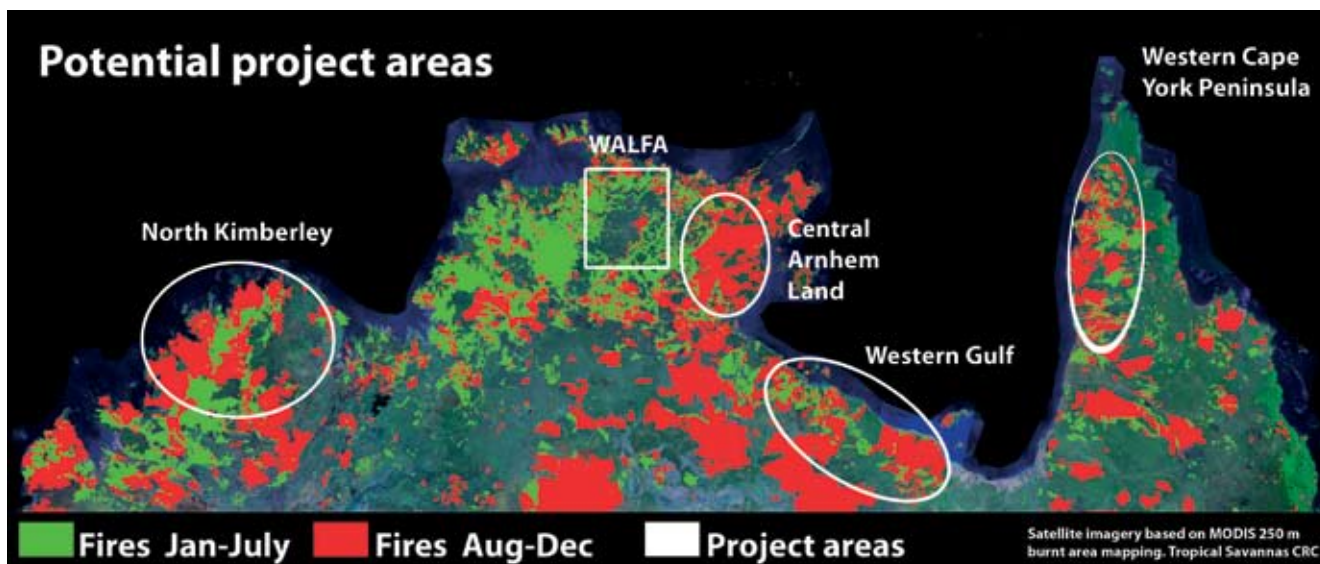
nal people were driven out of, or left much of remote north Australia, including the Arnhem plateau.

In recent decades large parts of the deserted plateau remained unburnt in the early dry season, and without burnt patches acting as breaks, they were swept by wildfire later in the year. Most of these wildfires grew from smaller fires that were still lit by people for various purposes in the communities, mining and hunting camps that surrounded the plateau. Northern Australia now has frequent, extensive wildfires that are free to spread across empty landscapes and as a consequence large areas of country are frequently burnt.

## Two Tool Kits

Although they no longer lived for long periods on the plateau, Traditional Owners like Lofty Bardayal Nadjamerrek, AO, were still regular visitors and were dismayed by the fire damage they saw. In the late 1990s Lofty and other Traditional Owners in the area assisted by researchers allied with the Tropical Savannas CRC, the Northern Land Council and the Northern Territory Government decided to try and re-establish a more benign, patchier fire pattern on the plateau: a pattern that would see less destructive wildfires.

So the West Arnhem Land Fire Abatement (WALFA) Project was born. They realised from the start that they would not be able to use only traditional burning practices as there were not enough traditional fire managers available to manage



The methods used by the West Arnhem Fire project have potential application across fire-prone tropical Australia and other fire-prone savannas of the tropics. Indigenous land management groups, major companies and governments are investigating the feasibility of entering into greenhouse gas and biodiversity offsets agreements using this approach. Four new potential greenhouse gas abatement and biodiversity projects are being planned in the fire-prone savannas of north Australia as shown above.

→ Pg. 9 fire across tens of thousands of square kilometres of plateau. And even though using helicopters to light fires could cover the extensive areas involved, it was too coarse a technique to reproduce the mosaic of burning the land required.

Instead new methods of fire management were developed that used techniques drawn from both traditional and western toolkits: Indigenous rangers would create a mosaic of small patchy fires on foot, carefully choosing the location and the conditions drawing on their traditional knowledge; the rangers would also use satellite data to track the location of fires and burnt country using websites <[www.firenorth.org.au](http://www.firenorth.org.au)> and would use helicopters and fixed-wing aircraft to help create the patchy fire breaks.

### Fire in the Greenhouse

While the Two Tool Kit fire management techniques were being refined on the ground, another opportunity emerged: better fire management could also reduce the large quantities of greenhouse gases (carbon dioxide, methane and nitrous oxide) emitted by savanna fires.

As these fires are largely anthropogenic—caused by people—the greenhouse gases emitted by savanna burning are covered by the Kyoto Protocol and are listed in Australia's National Greenhouse Gas Inventory (NGGI).

Several years were spent refining the Two Tool Kits approach, and developing techniques for measuring the greenhouse emissions from savanna fires that were considered robust enough to be accepted by the Australian Greenhouse Office (now part of the Department of Climate Change).

The studies showed that the current fire regime dominated by large, frequent, intense late dry-season fires emitted significantly more greenhouse gases than a more traditional

### Carbon dioxide not counted for now

The Kyoto Protocol considers that the carbon dioxide from savanna burning is effectively re-absorbed by new plant growth following burning (although a growing body of recent evidence indicates that in those areas of the northern savannas subject to frequent intense fires there is actually a net emission of CO<sub>2</sub>). Consequently only the methane and nitrous oxide are accounted for in the official figures for greenhouse gas emissions from savanna fires.

burning regime of patchier, smaller fires (see box above). So by introducing the patchier fire pattern, the WALFA Project could not only reduce the on-ground destructive impact of fires, it could reduce the greenhouse gases emitted across a large area of country.

In late 2006, an agreement was reached between the Northern Territory Government and the energy company ConocoPhillips, the developers of a large LNG facility in Darwin harbour. Greenhouse emissions from the facility needed to be offset by initiatives that reduced those emissions. The NT Government proposed that the WALFA Project be funded by ConocoPhillips as a way of achieving these offsets. The company agreed to pay Indigenous land managers more than \$1 million a year for the next 17 years to reduce wildfires in return for greenhouse gas emission reductions.

### Achievements

The WALFA project started off in a small area around Kabulwarnameyo, an outstation in the north east of the plateau, to test →

## How fire management cuts greenhouse gas emissions



*Typical early (left) and late (right) dry season burnt areas in the WALFA region*

At first glance, replacing late dry season fires with ones that burn earlier in the year might not seem an obvious way to reduce the greenhouse gas emissions produced by fire. However, on-ground and satellite measurements have allowed researchers to estimate that the early dry-season fire pattern will produce significantly less greenhouse gas emissions because of a number of factors.

- The early burns are less intense and more patchy, leaving plenty of the grassy layer unburnt, whereas later burns occur at a hotter time of year often with drier fuel making them more thorough and able to burn the branches and leaves of the trees. So in a given 'burnt' hectare as detected by satellites, a late fire will tend to burn more of the available fuel—as shown in the images above.
- In the late dry season there tends to be more fuel on the ground due to leaf litter from trees, which drop their leaves later in the year. So apart from the higher intensity of the later fires, there is generally more fuel available to burn.

One of the biggest factors is that of scale. Planned fires earlier in the season tend not to spread very far due to their low intensity and their placement: they will be stopped by rivers and other barriers. Late dry-season fires fanned by stronger winds spread much further, eventually burning more hectares and fuel than early-season fires.

A more complex factor is the mix of greenhouse gases emitted by early and late dry season fires. Fire scientists divide burning into two types: flaming combustion in which the fire has plenty of oxygen and in which carbon dioxide forms a

relatively high proportion of the emissions; and smouldering combustion in which there is less oxygen available and in which higher proportions of methane and carbon monoxide are emitted. As methane is an important accountable gas the way combustion changes during the year could have an impact on the emissions abated by the WALFA project.

As Dr Garry Cook, a CSIRO fire ecologist who works with the WALFA Project, explains: "there may be significant smouldering combustion very early in the dry season with green grass, but more will also occur late in the dry season when stumps, branches and twigs get burnt—so the proportion of methane emitted from a given amount of burning fuel may vary during the year.

"While some overseas studies have indicated that emissions of the other accountable gas, nitrous oxide, may be greater when the fuel is green, it is not yet clear if this occurs in Australian savannas," he says.

This seasonal variation in the mix of methane and nitrous oxide emitted from Western Arnhem Land fires will be thoroughly investigated by an international team of researchers in the 2009 fire season.

According to Garry Cook, "the new data should be important as it will allow us to refine the emission estimates.

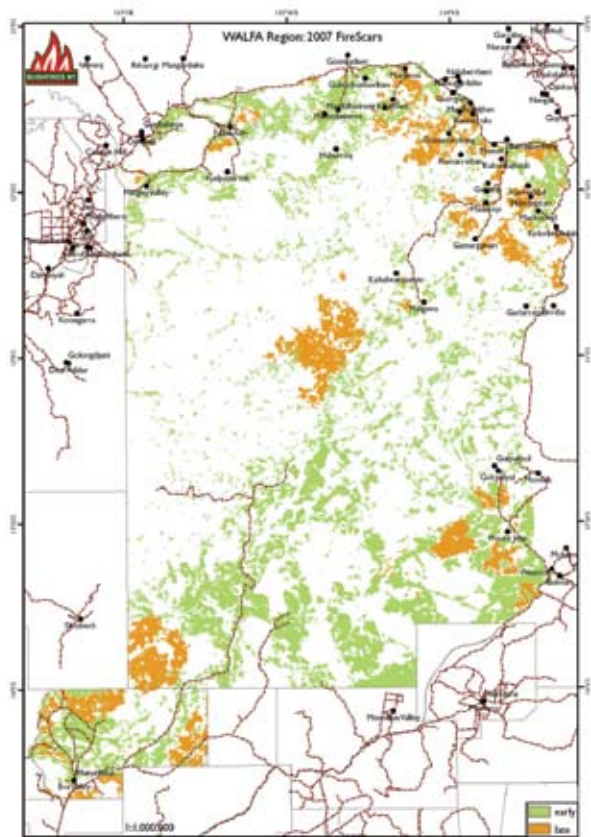
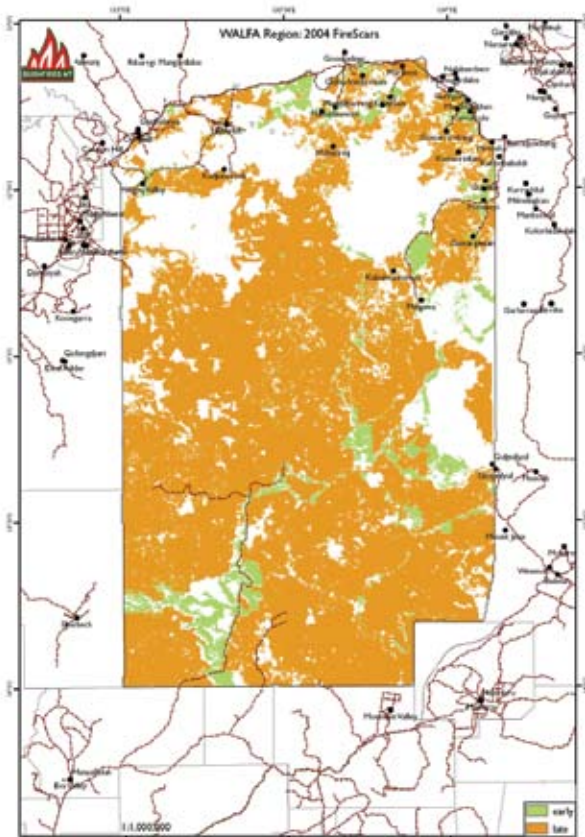
"However, it is unlikely to change them much given that the grassy fuel is already quite dry when much of the early dry season burning occurs in late June and July, and that the major difference between early and late dry season fire emissions is the sheer amount of fuel burnt by the late fires."

→ the Two Tool Kit approach. As it proved successful, they took on adjacent ranger groups as collaborators in the fire mitigation work, ending up with five ranger groups from across Western Arnhem Land cooperating to manage fire across an area of 28,000 square kilometres—around half the area of Tasmania.

This collaboration is highly valued by Traditional Owners

in the region as Paul Josif, a consultant who has worked with Indigenous people in Western Arnhem Land for some time, explains.

"They see this as being really successful," he says. "I was talking to senior Traditional Owners out at Weemol—around 350 km east of Katherine on the central Arnhem



Areas burnt by fire in WALFA project area in 2004 (left) and 2007. Late dry season fires (after July 31) shown in orange, early dry season fires shown in green

## Arnhem fire project revitalises country

→ Pg. 11

Highway—and they were now thinking and operating over a very large area.

“They were talking about burning in sequence with how people were burning in Ngukurr and in relation to how people were burning north of them in Kabulwarnamyo, and subsequently how people would be burning in Kakadu and Oenpelli—more than 100 kilometres away.”

Paul also points out the broader social and economic benefits of the project. “What people are saying is that there are more people back on country; there are jobs on country and good jobs, full-paying jobs now under the working on country program, and also through the ConocoPhillips agreement.

“There are also younger people learning from older people about country so that cultural knowledge is being re-established.”

### A new fire pattern

The result of this coordinated approach was that by 2007, the ranger groups were able to put in place hundreds of patchy burns lit in the early dry season running along creek and cliff lines—and this had a major impact on limiting late dry season wildfires.

The map on the left (above), shows the pattern of fires in 2004, the year before the WALFA project began—note the

enormous area of more intense late dry season fires in orange almost covering the plateau.

The map on the right shows the fire patterns achieved since the project became fully operational in 2007 characterised by many patchy early dry season burns, few late dry season wildfires and large areas that are unburnt.

The graph on the next page shows the fire patterns in the WALFA Project area over the last 19 years and it shows that in 2007 and 2008, for the first time since before 1990, a new fire pattern has emerged with a low total area burnt, dominated by burning in the early dry season.

If these more patchy fire patterns can be maintained over many years, then the project will have succeeded in establishing a new fire regime on the West Arnhem Plateau—a regime characterised in many places by less frequent fire than before. Such a fire regime should have a beneficial effect on the fire sensitive plants and animals of the plateau, however, it will take several years for the evidence to emerge. Nevertheless there are some encouraging signs with many seedlings of vulnerable cypress pines surviving in the new fire patterns.

### Emission cuts

Using the methodology developed by the WALFA Project, the new fire patterns on the plateau in 2007 and 2008 have →

# Rekindling the Wurrk tradition

*Culture, Ecology and Economy of Fire Management in North Australian Savannas: Rekindling the Wurrk Tradition*

Edited by *Jeremy Russell-Smith, Peter Whitehead and Peter Cooke*

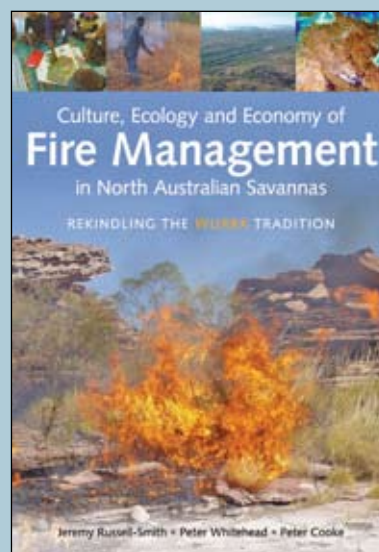
AVAILABLE from September 2009, this book documents some of the collaboration and knowledge underpinning the West Arnhem Land Fire Abatement (WALFA) project featured on these pages (pg 9–13).

Topics include the history of fire use in the savannas, post-settlement changes that altered fire patterns, personal histories of a small number of people who lived most of their lives on the Arnhem Land Plateau and, critically, their deep

knowledge of fire and how to apply it to care for country. Uniquely, it shows how such knowledge and commitment can be deployed in conjunction with rigorous scientific analysis, advanced technology, new cross-cultural institutions and the emerging carbon economy.

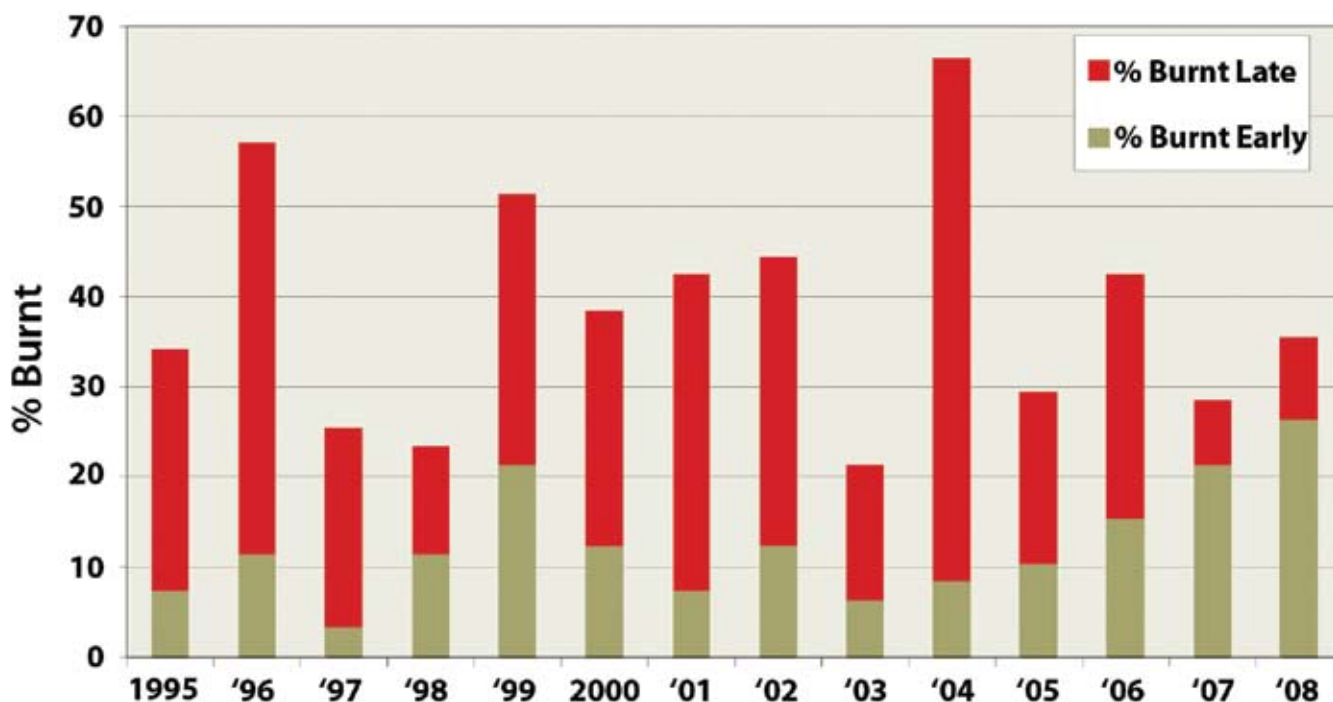
The WALFA project has shown how to build partnerships for controlling fire—the collaborative, cross-cultural ‘two toolkit’ approaches and commercially supported environmental services programs—at scales that were, until this demonstration, thought beyond effective intervention.

**Price:** \$99.95 **ISBN:** 9780643094024



Rekindling the Wurrk tradition, go to Web: [www.publish.csiro.au/nid/21/pid/6056.htm](http://www.publish.csiro.au/nid/21/pid/6056.htm)

## Early/late fire comparison in WALFA area



→ emitted significantly less greenhouse gases than has been the average for the 10 years before the project started—equivalent to 166,000 tonnes of carbon dioxide a year.

Although the assessment methodology will be further refined (see story previous page, *How fire management cuts greenhouse gas emissions*) this represents one of the most significant greenhouse gas abatement projects in Australia.

### More information

**Web:** [www.savanna.org.au/all/walfa.html](http://www.savanna.org.au/all/walfa.html)

North Australian Fire Information: [www.firenorth.org.au](http://www.firenorth.org.au)

Land Manager: [www.landmanager.org.au](http://www.landmanager.org.au)

Peter Jacklyn, Tropical Savannas CRC, **Tel:** (08) 8946 6285

**Email:** [peter.jacklyn@cdu.edu.au](mailto:peter.jacklyn@cdu.edu.au)

*How fire cuts greenhouse gases:*

Garry Cook, CSIRO Sustainable Ecosystems

**Email:** [garry.cook@csiro.au](mailto:garry.cook@csiro.au)



Clockwise from main image: Male wallaroos dispute, photo: Jenny Martin; Gouldian finch, photo: Stephen Garnett; Alaric Fisher holds a northern quoll; Sandstone towers at Broadme Station, NT Gulf, photo: Alaric Fisher; Clearing in the Daly Basin, photo: Brooke Rankmoore; Alex Kutt with research trap.

## Narrow path between hope and despair: The north's environmental future

*John Woinarski led the Tropical Savannas CRC's various research programs on savanna biodiversity for more than 10 years. Here is a talk he gave to the Savannas Future Forum\* reflecting on the programs' achievements and challenges for the future. By John Woinarski and Alaric Fisher.*

There has been a substantial savanna biodiversity program for the lifetime of two iterations of the Tropical Savannas CRC (1996–2008). There were a number of general objectives: some were to increase our basic knowledge of the distribution and conservation status of savanna biota; others to investigate the impacts of a range of land management regimes on biodiversity. We worked to better incorporate biodiversity conservation considerations into land management planning and decision-making; and to develop robust techniques for assessing and monitoring biodiversity 'health'.

We also worked to provide information about biodiversity in useful forms to a wide array of land managers and other stakeholders.

Over the past 15 years, these objectives were largely achieved, resulting in a great increase in understanding and appreciation of the biodiversity of the tropical savannas, on lands of all tenures and across a wide range of stakeholder groups. Near-comprehensive databases of the known locations for vertebrate and plant species were compiled across the tropical

savannas. A large number of systematic biodiversity surveys addressed substantial gaps in this baseline information or, where they have resampled areas where historical data exists, been very important in highlighting changes in biota, particularly declines in the small mammal and bird fauna.

Research projects also clarified the impacts on biodiversity of grazing pressure from cattle; of clearing and fragmentation, and thickening or thinning, of vegetation cover; of the spread of introduced pasture grasses; and of changes in fire regimes. Robust biodiversity monitoring programs have been implemented in some areas, and we have a much greater understanding of the value, and inadequacies, of various surrogates and indices for biodiversity condition.

We have developed robust principles or guidelines for biodiversity-friendly land-management practices, and had substantial input to jurisdictional conservation planning and regional natural resource management plans.

Our projects have generally been collaborative efforts with Indigenous ranger groups, local landcare organisations, conservation agencies, non-government conservation organisations,

natural resource management regional bodies, and individual land managers. We have also attracted considerable complementary funding from many sources, including Land & Water Australia, Meat and Livestock Australia and the Natural Heritage Trust, and several ongoing projects will continue to address the objectives of the TS-CRC after its demise.

The wealth of biodiversity information and the effects of land management compiled during this program is now widely available to land managers and the general public via user-friendly websites such as Land Manager and Biodiversity Info-Net ([www.landmanager.org.au](http://www.landmanager.org.au)) and ([www.infonet.org.au](http://www.infonet.org.au)). Additionally, the program was associated with more than 200 scientific papers, reports and books relating to savanna biodiversity and sustainable land management, which have extended to a national and international audience.

### Critical juncture

These achievements, and much other fine work by those both within and outside the CRC umbrella, have not secured the future for Australia's tropical savanna biodiversity. Rather, we feel that we are now close to a critical juncture for this future. There is a narrow and diminishing path between hope and despair for the environmental future of northern Australia.

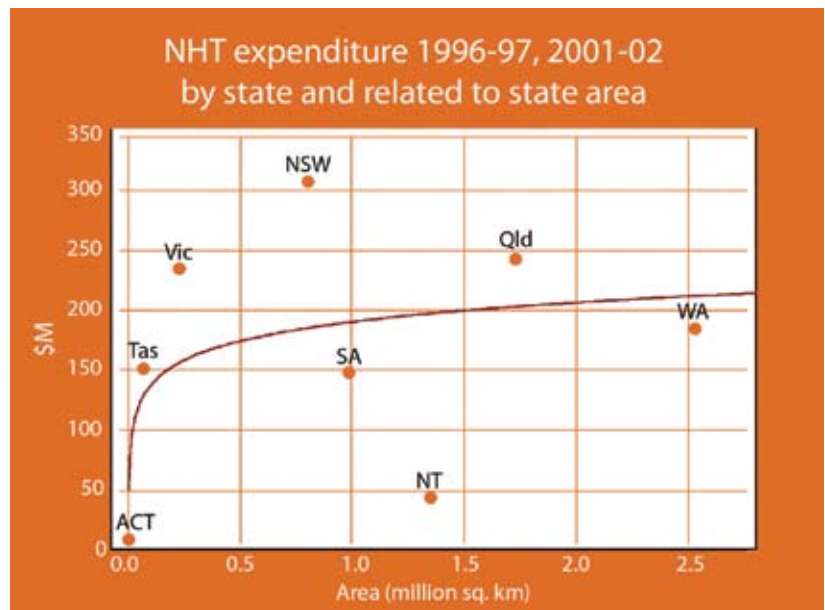
As development and degradation continue and accelerate, we may slide further down the familiar path of biodiversity decline followed over the past two centuries in our southern landscapes. Alternatively, we may recognise and embrace the opportunity to maintain and nurture our largely intact savanna landscapes and to better value and safeguard their magnificent biota.

### Key needs for the future

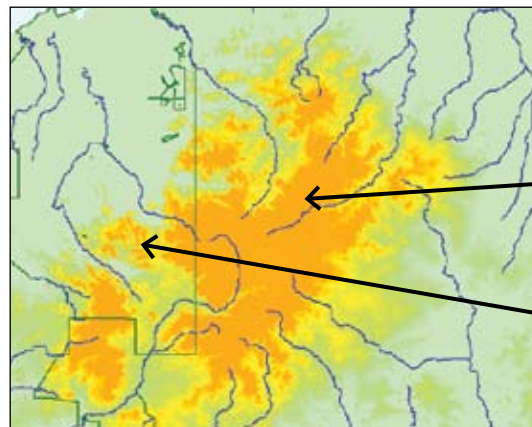
Following is an attempt to describe some key requirements to realise a future where savanna landscapes are valued and nurtured. These are far broader than a strict research agenda, but this reflects the essential need for a general change in attitude to how the savannas, and their biodiversity, are perceived, and to the national priorities for natural resource management.

#### *Correction of the distortion in the national environmental perspective and resourcing for environmental management*

The tropical savannas are alien to most Australians, inadequate attention is paid to their future by southern decision makers, and resourcing for environmental management is minuscule in relation to their size and significance for biodiversity. While low population density and limited capacity may be impediments to natural resources management, greater investment in maintaining relatively healthy systems will ultimately be



Natural Heritage Trust expenditure: the graph shows the discrepancy between expenditure on environmental management and geographical area; the trend in spending in this graph and below is similar in the late 2000s.



Left, the difference in environmental spending between Kakadu and Arnhem Land in early 2000s

Arnhem Plateau: expenditure \$0.83/km<sup>2</sup>

Kakadu National Park: expenditure \$725/km<sup>2</sup>

far more cost-effective than attempting to restore decimated landscapes and rescue species on the cusp of extinction.

#### *Systematic long-term land use planning that recognises and retains conservation values as the foundation of a sustainable future*

The integrity of the tropical savannas and the underlying ecological processes should be recognised as an essential component of the future of this region. Development should proceed only where it does not diminish this essence, and land use planning should be built around maintaining the connectivity and functioning of savanna landscapes.

#### *Broad-scale programs to staunch ongoing decline in biodiversity*

While a number of factors have been implicated in the insidious decline of some components of the savanna biota, a sustained research program is required to better elucidate the causes of decline, linked to carefully targeted management and a program of monitoring biodiversity and its responses to management intervention.

#### *Implementation of robust, landscape-scale biodiversity monitoring programs, linked to adaptive land management regimes*

There needs to be recognition that biodiversity monitoring

# The north's environmental future

→ **Pg. 15** should be a foundation for measuring environmental sustainability and a key component of adaptive land management, with adequate, long-term resourcing. The efficacy of land management interventions needs to be assessed by such monitoring programs across all land tenures.

## *Mitigation of the impacts on biodiversity of pastoral land use*

As the dominant land use in the tropical savannas and with virtually complete hegemony over many savanna ecosystems, impacts from pastoralism will continue to be critical to the long-term fate of savanna biodiversity—more so with continuing pressures to intensify pastoral production across this region.

These impacts must be mitigated through improved representation of productive landscapes in the protected area system; a combination of appropriate incentives and legislative requirements for the retention of biodiversity on pastoral lands; and tight regulation of land clearing and use of introduced pastures.

## *Secure long-term resourcing for conservation land management by Indigenous people*

Indigenous people manage large areas of the tropical savannas, including many of the areas of outstanding conservation significance. Much of this management responsibility has been formalised through the recent development of indigenous land management organisations and Indigenous Protected Areas, as well as joint management arrangements of conservation reserves, but the impediments of limited capacity, inadequate resourcing and insecure or short-term funding must be addressed. As in other tenures, it is important to link funding for environmental management to explicit outcomes and assess the efficacy of management through adequate monitoring.

## *Implementation of a carbon-trading scheme that rewards retention of native vegetation and application of benign fire management*

Active management of land to maintain or improve biodiversity values is most likely to occur if landholders receive a tangible benefit from doing so. One mechanism by which this could

occur is through carbon offset schemes, which may apply both to retaining native vegetation (which may otherwise be cleared for pastoral or agricultural development), and landscape-scale programs to reduce the frequency and severity of fires.

## *A strategy to safeguard the biota most susceptible to impacts of global climate change*

We have done little to address this threatening process during the savanna biodiversity project. While the direct effects of climate change may not be ameliorated, it is essential we understand the risks that it poses to savanna biodiversity, develop strategies to protect the most susceptible elements, and retain intact ecosystems over broad scales in order to maximise options for species' adaptation to these changes.

## *Development of research and management program for understanding and maintaining tropical savanna dynamics*

The dynamic nature of tropical savannas, both spatially and temporally, is important for many components of biodiversity. While we have been very good at studying pattern, we are less advanced in understanding these processes, and this needs to be addressed through 'big picture', long-term research.

## *Elaboration of international linkages to other tropical savannas*

There is a substantial opportunity to increase our understanding of tropical savannas through better communication and collaboration with researchers and land managers internationally, and we can also better contribute to better management of tropical savannas globally.

## **Acknowledgements**

*We gratefully acknowledge the participation of many staff, students, collaborators and volunteers in savanna biodiversity projects over the lifetime of the Tropical Savannas CRC. The CRC played a crucial role in advancing conservation of tropical savannas biodiversity, both through financial support and by facilitating communication and partnerships between a diverse array of agencies, organisations, researchers, land owners and managers. — John Woinarski.*

## Window to further information

\* Savannas Future Forum <[www.savanna.cdu.edu.au/news/futures\\_forum.html](http://www.savanna.cdu.edu.au/news/futures_forum.html)>

### **Research publications**

<[www.savanna.cdu.edu.au/publications/publications\\_from\\_r.html](http://www.savanna.cdu.edu.au/publications/publications_from_r.html)>

### **Monitoring Biodiversity Reports**

<[www.savanna.cdu.edu.au/publications/monitoring.html](http://www.savanna.cdu.edu.au/publications/monitoring.html)>

### **Biodiversity Publications**

<[www.savanna.cdu.edu.au/publications/managing\\_biodiversity.html](http://www.savanna.cdu.edu.au/publications/managing_biodiversity.html)>  
*The Nature of Northern Australia—Natural*

*values, ecological processes and future prospects*, Australian University Press: <[epress.anu.edu.au/nature\\_na\\_citation.html](http://epress.anu.edu.au/nature_na_citation.html)>

*Lost from our Landscape—Threatened species of the Northern Territory*

<[www.savanna.cdu.edu.au/publications/lost23.html](http://www.savanna.cdu.edu.au/publications/lost23.html)>

### **Sites of Conservation Significance in the NT**

<[www.nt.gov.au/nreta/environment/conservation/map.html](http://www.nt.gov.au/nreta/environment/conservation/map.html)>

### **Research projects**

<[www.savanna.cdu.edu.au/research/projects/conservation.html](http://www.savanna.cdu.edu.au/research/projects/conservation.html)>

### **PhD projects**

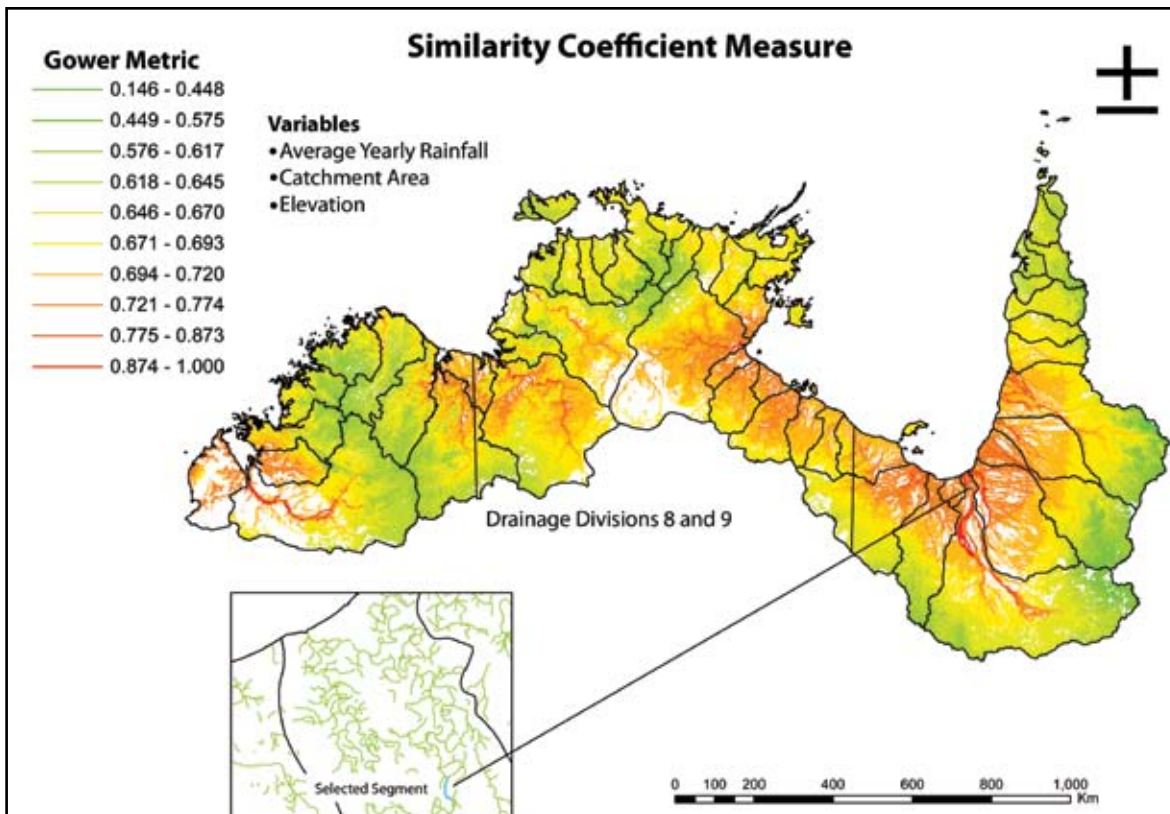
<[www.savanna.cdu.edu.au/education/phd\\_projects\\_2001\\_2007.html](http://www.savanna.cdu.edu.au/education/phd_projects_2001_2007.html)>

### **Mammal Decline**

<[www.savanna.org.au/all/decline\\_fauna.html](http://www.savanna.org.au/all/decline_fauna.html)>

### **Information for schools**

EnviroNorth: <[www.environorth.org.au/learn/savanna\\_walkabout/index.html](http://www.environorth.org.au/learn/savanna_walkabout/index.html)>



**Figure 1.** The GIS-based geomorphic classification tool highlights that there are major differences between rivers in the Southern Gulf country and in the Kimberley.

In this example, streams that are similar to the selected section of river are shown in red. Streams that are dissimilar are shown in green.

## GIS tool instrumental in river research

*TRaCK—Tropical Rivers and Coastal Knowledge—has around 1.2 million square kilometres of land within its research area in tropical northern Australia, much of it remote and inaccessible. A new GIS tool promises a dynamic and flexible way for researchers and land managers to examine river data. By Mary O’Callaghan*

With such a large research area, it is easy to see why scientists can’t visit each river reach. For this reason, TRaCK research focuses on four catchments: the Daly in the Northern Territory, the Fitzroy in Western Australia, and the Mitchell and Flinders in Queensland. But how do we know whether we can confidently apply the findings from field work in one catchment to other catchments across the north?

“There are some fundamental differences between, for example, the Mitchell and the Daly Rivers,” says Dr Andrew Brooks from Griffith University (see pictures and caption, page 19).

“So, it’s important to get the message across that, just because we’ve done a lot of detailed work on the Daly, for example, this doesn’t necessarily mean that it’s applicable across Australia.”

Dr Brooks and his team set out to develop a method for describing the similarity, or dissimilarity, of the region’s riverine landscapes, as part of a method for legitimately extrapolating information from one segment of river to another.

What they’ve come up with is a way of classifying rivers that Dr Brooks believes could make other classification systems redundant.

### Overcoming scale and subjectivity

In the field of geomorphology—understanding landscapes—there is a long history of classification systems.

“Just about every government program doing research over large scales uses some sort of classification,” explains Dr Brooks. “The problem is that any classification system has a lot of subjectivity; and they are often designed for specific purposes.”

Understanding that different people use classifications for different reasons, Dr Brooks and colleague John Spencer thought they could develop a better, more flexible approach using large spatial data sets.

### Driven by the users’ needs

What John Spencer has developed is an interactive GIS-based tool where you select a specific segment of river, choose one or more variables—such as stream slope, valley width, catchment area, drainage density, geology—and you are presented with a measure of similarity between your river segment and all others. For categorical data, such as geology, where there

# Flow regime and ecology

In a separate TRaCK project aimed at understanding how flow variability can affect aquatic habitats and biota, Griffith University's Dr Brad Pusey and Dr Mark Kennard have classified all rivers in Australia by ecologically important flow characteristics: a first for Australian river research.

Dr Pusey suggests that Dr Brooks' physical classification and the flow regime classification can be used together to help determine whether data can be extrapolated from one catchment to another: "For example, you could say: river A has a flow regime X, but geomorphology Y. What does that mean to ecology?"

Allocating water for environmental flows, testing scenarios, analysing the risks of management options, and planning for the impacts of climate change all need to be based on predicted changes in flow regime.

So we need to understand how much flow regimes vary between rivers and regions and the extent to which the variation affects plants and animals.

Flow regime is affected by combinations of climate, catchment geology, topography and vegetation, influencing habitat for aquatic and riparian (streamside) animals and plants, refuge availability, food distribution, movement and migration, reproduction and recruitment.

Dr Pusey analysed daily discharge data from 830 stream gauges across Australia to come up with 12 classes of ecologically important flow regimes. Like the physical classification, all the data underlying the flow regime classification are available for analysis.

While this is a static classification—if there's no stream gauge, there's no data—the team has developed a decision tree to help to determine what class a new stream gauge falls into, based on either its key environmental or hydrological characteristics.

Dr Pusey explains how water managers and people responsible for allocating water will find the classification useful.

"They can identify rivers that require special consideration or aspects of regime that typify those rivers they manage," he said.

"Up to now there has been no quantified rigorous way of putting rivers into context with other rivers; there have just been a lot of case studies."

It will also be useful for aquatic ecologists.

"We can put our study area in a context," said Dr Kennard, "and hypothesise about differences in ecology due to differences in flow regime, design studies to test those hypotheses or validly use the results of other case studies."

**Go to** Land & Water Australia to download the flow technical report and classification:

[lwa.gov.au/products/pn22591](http://lwa.gov.au/products/pn22591)

**Contact:** Dr Brad Pusey, Griffith University,

**Email:** [bpusey@westnet.com.au](mailto:bpusey@westnet.com.au)

**Contact:** Dr Mark Kennard, Griffith University

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## GIS tool instrumental in river research

→ Pg. 17

are no degrees of similarity, river segments that are the same show up in red on the map; those that are different show up in green. For data that is continuously variable, such as elevation, river segments that are similar are shown in varying shades of colour that reflect the degree of similarity. From there you can define how many classes you want and, at the click of a button, the system will generate your user-defined classification.

And, unlike most GIS-based classifications, you can save the specification for how you made it, in case you ever want to run it again or compare it to another version. You can also download the underlying layers of data that the classification comprises.

### Not just another classification

According to Dr Brooks, this is not just another classification. "It's dynamic and flexible, and allows people to explore the data. It really is a quantum leap from other classifications," he said.

"To my knowledge this is the first time anyone's developed

such a system anywhere in the world. And you can build on it—that's the beauty of it. It's not set in time, which is the major constraint with a lot of other classifications. We can update it as new data becomes available."

The system is already providing insights.

"It is obvious that there are major differences between the Southern Gulf country and the Kimberley—really fundamental differences that people need to understand," says Dr Brooks (Figure 1). "If you've got a study on the Flinders River floodplain, it's probably not going to be a lot of use to someone in the Kimberley."

Dr Mark Kennard, a fish ecologist and senior research fellow at Griffith University, says the system's advantage is its flexibility. "There is no single correct classification as it really depends on the particular environmental features the user is interested in," he said, "so being able to do things on the fly and then quickly try again with a different combination of variables is great."

"I think it's a really useful tool for the public, for scientists →



Photo: Hiroshi Suwa



Photo: Ian Dixon

**The Mitchell and the Daly, two very different rivers:** *The Mitchell (pictured left) has a 1.5 kilometre-wide channel in its lower reaches which flows through an alluvial floodplain. When it is choked with sand it can shift sideways by 50–100 metres in some years. Large pools (up to several kilometres in length) form one year and disappear the next. By contrast, the lower Daly (pictured right) has a relatively narrow (about 100 metres wide) and stable channel, largely bounded by bedrock. Pools in this river tend to ‘stay put’.*

## GIS tool instrumental in river research

➔ and for people doing field surveys where they need to stratify sites, comparing like with like.”

Because it’s so flexible, Dr Brooks is keen for different groups with different objectives to try it out.

“The plan is to make the system available on the web so that people can run it from anywhere,” explained Dr Brooks. “We need to know it is meaningful on the ground, that we are not just generating pretty maps. It has to be able to usefully distinguish one type of river from another.”

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*TRaCK brings together leading tropical river researchers and managers from Charles Darwin University, Griffith University, University of Western Australia, CSIRO, James Cook University, Australian National University, Geoscience Australia, Environmental Research Institute of the Supervising Scientist, Australian Institute of Marine Science, North Australia Indigenous Land and Sea Management Alliance, and the Governments of Qld, NT and WA.*

## Guide to carbon market for North’s Indigenous Australians

**A** *Carbon Guide for Northern Indigenous Australians* provides a short guide on the impacts of and responses to climate change, particularly market and financial mechanisms for reducing greenhouse gas emissions, often referred to as the carbon market, emissions trading and/or carbon financing.

Published by United Nations University Institute of Advanced Studies (UNU–IAS) and the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), the guide is intended as a first edition.

The report is divided into four sec-

tions: Section 1 explains what climate change is and outlines the international response to this problem.

Section 2 describes the carbon market and the different activities that may generate emissions reduction credits or offsets. It also outlines the current situation with regard to the carbon market in Australia and opportunities for accessing carbon financing, before discussing the possible impacts of emissions reduction activities on Indigenous people.

Section 3 looks at the role of Australian Indigenous fire management practices in greenhouse gas abatement.

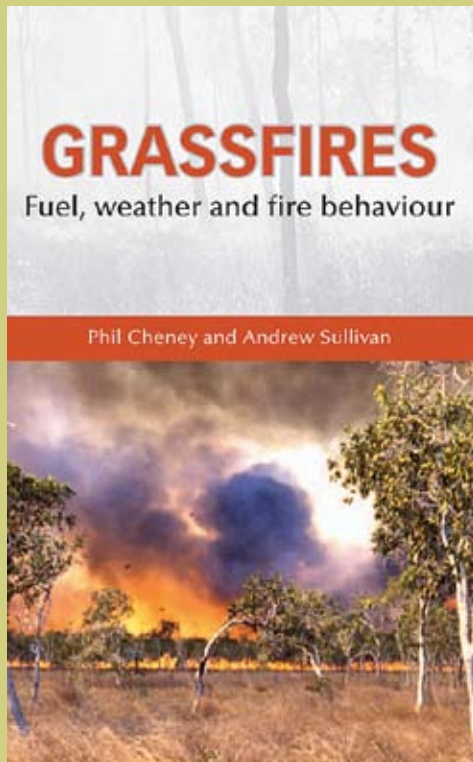
Section 4 provides short case studies of Indigenous engagement with emission reduction activities both within Australia and beyond.

Comments, case studies and more information are welcome for coming editions.

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**Email:** <[jessica.lewfatt@cdu.edu.au](mailto:jessica.lewfatt@cdu.edu.au)>

**Download guide:** <[www.nailsma.org.au/publications/carbon\\_reports/carbon\\_guide.html](http://www.nailsma.org.au/publications/carbon_reports/carbon_guide.html)>



*The updated edition on the behaviour of grassland fires debunks dangerous myths surrounding fires; it also looks at predicting fire danger and fire spread, and reconstructing the scene of the fire.*

### **Grassfires: fuel, weather and fire behaviour**

*Phil Cheney and Andrew Sullivan 2008. Grassfires: Fuel, Weather and Fire Behaviour, CSIRO Publishing.*

The second edition of this book includes updated information on combustion of grassy fuels, the effect of weather and topography on fire behaviour, Aboriginal burning practices in grasslands, and more historical bushfire events. It also discusses the CSIRO meters for predicting fire danger and fire spread in Australia, different fire-fighting strategies and how to reconstruct grassfire spread after the fact.

The book looks at some of the myths that surround grassfires and how these myths can compromise personal safety and survival. For example, it is widely believed that a grassfire can become self-perpetuating by generating its own wind. While it is true that convection caused by the heat of a bushfire draws in air that can increase or decrease the effect of the prevailing wind, sometimes to quite violent levels, the effect is relatively localised and a grassfire can't spread independently by this wind. Instead it will spread in a direction and at a speed determined by the prevailing wind and topography.

Myths that suggest fires are like an atomic bomb, can use all of the oxygen in the air so that people can't breathe, that there is a danger of being boiled alive if taking refuge in shallow water bodies, or that a grassfire can outrun a speeding car are all dangerous. They make grassfires appear much worse than they really are and may cause people to panic and make unsafe decisions. The book explains these and other myths and their implications for personal safety. It is recommended for rural landholders, students and the fire-fighting community.

**Cost:** A\$39.95, CSIRO Publishing

**Go to:** <[www.publish.csiro.au/nid/21/pid/5971.htm](http://www.publish.csiro.au/nid/21/pid/5971.htm)>

### **Burdekin grazing management**

*Managing for water quality within grazing lands of the Burdekin Catchment—Guidelines for land managers*

These guidelines, released by NQ Dry Tropics NRM — Land and Water Solutions (formerly Burdekin Dry Tropics NRM) were developed to ensure the longevity of the beef industry. They aim to maximise water quality and minimise soil loss from the runoff of sediments and nutrients to waterways.

The work, which was carried out over a number of years, is the culmination of a partnership between NQ Dry Tropics and key stakeholders, including graziers. A comprehensive consultation process was undertaken with landholders, industry bodies, government agencies and the scientific community.

The guidelines give graziers an opportunity to see how they rate according to best practice techniques and to identify areas of improvement.

Information includes best management practices for managing land away from water, managing land adjacent to water such as riverbanks, fencing land adjacent to water, managing water bodies, and property-wide management. The guidelines also identify different types of runoff and threats associated with each of them.

**Go to:** <[www.nqdrytropics.com.au/resources/downloads/Grazing-Land-BMP-Guidelines-low-res.pdf](http://www.nqdrytropics.com.au/resources/downloads/Grazing-Land-BMP-Guidelines-low-res.pdf)>

### **Taking the pulse of rangelands**

THE Australian Collaborative Rangelands Information System (ACRIS) Management Committee has released a major report on the changes in Australian rangelands from 1992 to 2005. *Rangelands 2008 – Taking the pulse*, describes these under a number of biophysical and socio-economic themes. Reporting is mostly by the 52 bioregions wholly or partly in the rangelands.

The report title reflects the dynamic

and sometimes fragile nature of the rangelands, and the need to monitor the way in which this large part of Australia—81% of land area—responds to human impacts.

ACRIS is a partnership between the Australian Government, rangeland states and Northern Territory agencies responsible for assessing and understanding change in rangelands areas used for pastoral activity and other land uses.

There are two versions: complete printed report (254 pp.) including a CD with a hypertext-linked version of the complete report plus summarised information for each of the 52 bioregions wholly or partly within the rangelands.

Highlights from the complete report are also available and include the CD.

#### **For a copy of either report contact:**

John Lumb, Dept Environment, Water, Heritage and the Arts.

**E:** <[John.Lumb@environment.gov.au](mailto:John.Lumb@environment.gov.au)>

**W:** <[www.environment.gov.au/acris](http://www.environment.gov.au/acris)>



## The quoll's Island Ark

*Quoll*, by Darwin author, artist and illustrator, Sandra Kendell, captures the spirit and hope of the Island Ark program (see link below). This beautifully illustrated book, inspired by the program, describes the journey of a mother quoll's family in search of safe haven from the cane toad.

"In trying to find out how to protect her family from the cane toad invasion, she receives council from a Thylacine spirit (he is a symbol of extinction which threatens the quoll) who sends her to the coast where she finds a beautiful leaf boat and rows to safety to an island the toads can't reach," said Sandra.

"The Island Ark team, including Dr John Woinarski, advised me about northern quoll behaviour and habitat so that even though the story is fanciful, the

text and illustrations are educative by showing elements of the quoll's actual environment," she said.

"The other animals in the book live in the quoll's habitat too, and I wanted to give some indication of how they are affected in different ways by the cane toad invasion."

*Quoll* also includes an information page for parents and teachers about the project and its partners.

**Publisher:** Windy Hollow Books,

Melbourne

**Web:** <[www.sandrakendell.net/](http://www.sandrakendell.net/)>

<[www.windyhollowbooks.com.au/](http://www.windyhollowbooks.com.au/)>

*Savanna Links*, Issue 35: 'Quolls make

comeback on offshore islands',

<[www.savanna.org.au/news1/savanna\\_links\\_35.html?tid=592568](http://www.savanna.org.au/news1/savanna_links_35.html?tid=592568)>

### Woody weed control and management guide

The *Woody Weed Control Guide* from Dow AgroSciences identifies weeds, control methods and herbicide recommendations. The guide also promotes a 3 Cycle Plan with sample paperwork, weed identification, control methods, follow up action and reference tables. Dow AgroSciences Freecall 1800 700 096 or go to: <[www.dowagrosciences.com.au](http://www.dowagrosciences.com.au)>

### Sharks and Rays of Australia: more species

Spookfish, numbfish, stingarees, fiddler rays and cookie-cutter sharks are just some of the 322 shark, ray and chimaerid species in this definitive reference by Peter Last and John Stevens of CSIRO's Wealth from Oceans National Research Flagship. This updated edition of *Sharks and Rays of Australia* includes 29 species discovered since its first publication in 1994, and the more than 100 species named and formally described. *CSIRO Publishing*, \$120. **Tel:** 1300 788 000 (within Australia)

### Invasive animals reports

A NEW report on invasive animals paints a dark picture of the threat they pose to native ecosystems. *Assessing invasive animals in Australia 2008*, (Peter West, NSW Dept Primary Industries) points out that invasive species inhabit all areas of mainland Australia, and many islands and cost an estimated \$1 billion a year.

Released by the National Land & Water Resources Audit and the Invasive Animals Cooperative Research Centre, the report assesses the extent and impacts on 10 of Australia's top invasive species, including feral pigs, feral goats, rabbits, foxes, feral cats and cane toads, which are all listed as key threatening processes to Australian wildlife.

The aim is to provide information about the abundance and distribution of invasive animals allowing ongoing monitoring and evaluation of management policies and programs. Its release coincides with the decision to list as Vulnerable the Brush Tailed Rabbit Rat, which has suffered a major decline, mostly due to predation by feral animals.

A further report by the same author *Significant invasive species (vertebrate pests)* reports on the status of information relating to the distribution and abundance of significant invasive vertebrate pests and the impacts of significant invasive vertebrate pests. Updated Threat Abatement Plans for feral goats and cats as well as foxes and rabbits have also been released. The plans take into account recent research and advances in managing invasive species and outlines a plan to manage them across Australia over the next five years.

*Assessing invasive animals in Australia 2008:* <[www.invasiveanimals.com/downloads/NLWRA\\_Invasive20Animals20WEB-READY.pdf](http://www.invasiveanimals.com/downloads/NLWRA_Invasive20Animals20WEB-READY.pdf)>

Significant invasive species (vertebrate pests): <[www.invasiveanimals.com/downloads/NLWRA\\_Invasive20Animals20-Booklet20WEB-READY.pdf](http://www.invasiveanimals.com/downloads/NLWRA_Invasive20Animals20-Booklet20WEB-READY.pdf)>

Threat Abatement Plans: <[www.environment.gov.au/biodiversity/threatened/tap-approved.html](http://www.environment.gov.au/biodiversity/threatened/tap-approved.html)>

# Cool interaction on NAILSMA's website

Some interesting new features on NAILSMA's (North Australian Indigenous Sea and Land Management) website are bringing a more dynamic experience to users. For example, you can watch selected videos from the Dugong and Marine Turtle Project's Message Disk DVD which highlights several sea management projects across northern Australia. <[www.nailsma.org.au/projects/nailsma/md3.html](http://www.nailsma.org.au/projects/nailsma/md3.html)>

If you want to know more about NAILSMA's Dugong and Marine Turtle Project, you can view an interactive network map <[www.nailsma.org.au/projects/network\\_map.html](http://www.nailsma.org.au/projects/network_map.html)> and browse through the project's newsletter online.

There are also editions of the newsletter where you can listen to people



talking by clicking on voice bubbles. <[www.nailsma.org.au/projects/newsletter.html](http://www.nailsma.org.au/projects/newsletter.html)>

The website allows you to subscribe to a variety of newsletters, and email

alerts as well as *Kantri Laif* Magazine and Message Disk DVD so you can keep up to date on NAILSMA's activities:

<[www.nailsma.org.au/publications/nailsma/subscribe.html](http://www.nailsma.org.au/publications/nailsma/subscribe.html)>

## View Australia's geology

A HUGE map that seamlessly links the whole of Australia's surface geology has been completed. The national map, which replaces a 1:2.5 million scale version, stands almost four metres tall when printed, and will be primarily used as a digital tool in computer-based Geographic Information Systems.

The digital information associated map will be provided as Australia's contribution to OneGeology: a web resource which is creating an online geological map of the world.

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

## Atlas for energy resources

The Renewable Energy Atlas provides information on Australia's renewable energy resources, providing wind, solar, geothermal, ocean energy and bioenergy resources. There is also contextual data such as energy infrastructure, transmission lines and power plants, roads, land tenure and climate information. Developed and maintained by the Department of the Environment, Water, Heritage and the Arts, with data provided by specialist service

providers, the atlas is the first stage of a more comprehensive product.

**Go to:** <[www.environment.gov.au/settlements/renewable/](http://www.environment.gov.au/settlements/renewable/)>

## Australian Vegetation Information

A NEW website for vegetation policy makers, planners and researchers, provides a nationwide perspective on the latest vegetation information with a heavy slant towards native vegetation. The site was developed by the Executive Steering Committee for Australian Vegetation Information (ESCAVI) and focusses on consolidating broad-scale maps and data (e.g. landscape, catchment, regional, continental) as a basis for setting management priorities and for reporting on status and trends.

**Go to:** <[www.environment.gov.au/land/vegetation/nvip/index.html](http://www.environment.gov.au/land/vegetation/nvip/index.html)>

## Seabeds and the surface of Mars

GOOGLE has launched its latest addition to world mapping coverage with Google Ocean and Google Mars 3D. Google Ocean tracks wildlife including sea turtles and dugong and includes seabed maps and underwater imagery. You can also view articles and videos about marine science contributed by scientists and organizations such as the National Geographic Society. With Google Mars 3D, users can view three-dimensional, satellite imagery of the red planet taken during NASA space expeditions.

<[www.wildlifetracking.org/googleocean.shtml](http://www.wildlifetracking.org/googleocean.shtml)> <[earth.google.com/ocean/](http://earth.google.com/ocean/)>

## Finch recovery team launches website

THE Black-throated Finch Recovery Team (BTFRT) now has its own website where you can find information on the threatened bird and the activities of the recovery team. The finch's current range has shrunk significantly, and is now confined to around the Townsville region. While the site is still under construction, you can sign up for newsletters and updates, report sightings, and learn about the finch.

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

## SEPTEMBER

**Interpretation Network New Zealand (INNZ)/  
Interpretation Association Australia (IAA) Interpretation  
Conference: Some Like it Hot**  
15–18 September,  
Venue: *Distinction Hotel, Rotorua, New Zealand*

Conference streams are technology and trends, exceptional guides and story telling; and cultural capital and controversy. Topics within the streams include interpreting in the electronic age and harnessing and mastering new technologies; how research informs future practice; training, managing and retaining guides; interpreting controversial and topical issues; and celebrating success in Indigenous cultural interpretation

**Web:** <[www.innz.net.nz/Conference09/Conference09.html](http://www.innz.net.nz/Conference09/Conference09.html)>

**Charles Darwin Symposium 2009**  
22–24 September, Darwin, NT  
Venue: *Darwin Convention Centre*

The year 2009 marks the 200th anniversary of the birth of Charles Darwin and the 150th anniversary of his work *The Origin of Species*. The symposium will provide an opportunity to appreciate, debate, and even challenge Darwin's findings, and will bring together a range of speakers from around the globe. Opportunities are provided for the public to comment, question and critique the experts, as well as present their own perspectives on the matters at hand.

**Tel:** (08) 8946 6202

**E:** <[cdss@cdu.edu.au](mailto:cdss@cdu.edu.au)> **Web:** <[www.cdu.edu.au/cdss2009/](http://www.cdu.edu.au/cdss2009/)>

**Spatial Sciences Institute Biennial International  
Conference**  
28 September – 2 October 2009, Adelaide  
Venue: *Adelaide Convention Centre*

The Surveying and Spatial Sciences Institute (SSSI) is the national body combining the professional disciplines of surveying, mapping, engineering and mining surveying, remote sensing and photogrammetry and spatial information.

The biennial conference will present developments in the application of spatial science to a diverse set of disciplines, communities and people. These include in the industries where spatial information is so important - environment, mining, defence, land administration, agriculture, disaster management and more. The conference has plenary and keynote presentations, technical papers, symposia, workshops, competitions, awards, site visits, dinners, lunches, coffee, exhibitions, breakfasts, walks and talks.

**Conference organiser:** ICMS Pty Ltd  
84 Queensbridge St Southbank, VIC, 3006

**Tel:** (03) 9682 0244 **Fax:** (03) 9682 0288

**Email:** <[ssc2009@icms.com.au](mailto:ssc2009@icms.com.au)>

**Web:** <[www.ssc2009.com/](http://www.ssc2009.com/)>

## OCTOBER

**Queensland Landcare Conference 2009: Legends,  
Larrikins and Landcare**  
15–17 October, Longreach, Qld  
Venue: *Longreach Cultural and Civic Centre*

This year's program will showcase land and water management practices from water-wise gardens, control of woody and exotic weeds, to feral animal control and the rehabilitation of our natural water courses.

**Contact:** International Conferences and Events  
183 Albion Street, Sydney NSW 2010

**Tel:** (02) 9368 1200 **Fax:** (02) 9368 1500

**Email:** <[qldlandcare09@iceaustralia.com](mailto:qldlandcare09@iceaustralia.com)>

**Web:** <[www.iceaustralia.com/qldlandcare09](http://www.iceaustralia.com/qldlandcare09)>

**ASEAN Conference on Biodiversity 2009 (ACB2009)**  
**Biodiversity in Focus: 2010 and Beyond**  
21–23 October  
*Singapore, Venue to be announced.*

**Theme:** The conference aims to report the status of the ASEAN region's biodiversity regarding the 2010 target; discuss key biodiversity issues in the region, including gaps and challenges in member states' conservation efforts; and recommend the way forward in addressing biodiversity challenges beyond 2010.

**Contact:** Amy Lecciones, Conference Coordinator

**Tel:** (+63-49) 536 1738 **Fax:** (+63-49) 536 2865

**Email:** <[amlecciones@aseanbiodiversity.org](mailto:amlecciones@aseanbiodiversity.org)>

or <[ACB2009@aseanbiodiversity.org](mailto:ACB2009@aseanbiodiversity.org)>

**Web:** <[www.aseanbiodiversity.org/](http://www.aseanbiodiversity.org/)>

**Native Title & Cultural Heritage 2009**  
26–27 October 2009, Brisbane, Qld  
Venue: *Brisbane Marriott*

The conference will provide a closer look at recent Native Title and Cultural Heritage undertakings within the mining industry. Sessions include:

- A traditional owner's perspective.
- Addressing Native Title and Cultural Heritage in land use planning.
- The popularity and conduct of ILUA negotiations in Queensland.
- Enhancing socio-economic conditions through Native Title; Agreement about Native Title—Ocean and Land Torres Strait Regional Authority.
- Native Title Reform: Towards a better system.
- The role of the State Government in resolving claims.

**Contact:** IIR Conferences

**Tel:** (02) 9080 4300 **Fax:** (02) 9290 2577

**Email:** <[info@iir.com.au](mailto:info@iir.com.au)>

**Web:** <[www.iir.com.au/conferences/mining-resources/metals-minerals/native-title-cultural-heritage-2009](http://www.iir.com.au/conferences/mining-resources/metals-minerals/native-title-cultural-heritage-2009)>

## NOVEMBER

**Wild 9—9th World Wilderness Congress: Feel, Think, Act.****6–13 November, Merida, Mexico**

Major themes are freshwater; climate change; fire; trans-boundary and connectivity issues; large landscapes and seascapes; and human communities in transition.

**Email:** <[info@wild9.org](mailto:info@wild9.org)>**Web:** <[www.wild9.org](http://www.wild9.org)>**Barks, Birds and Billabongs: Exploring the Legacy of the 1948 American-Australian Scientific Expedition to Arnhem Land International Symposium****16–20 November, Canberra, ACT****Venue:** National Museum of Australia

The Centre for Historical Research at the National Museum of Australia is hosting this symposium to investigate the 1948 expedition's legacy. This symposium focuses on three themes: Histories, Legacies and Methodologies, with a particular emphasis placed on Indigenous perspectives.

**Contact:** Margo Neale, **Tel:** (02) 6208 5370**Email:** <[MNeale@nma.gov.au](mailto:MNeale@nma.gov.au)>**Web:** <[www.nma.gov.au/research/centre\\_for\\_historical\\_research/conferences\\_and\\_seminars/barks\\_birds\\_billabongs/](http://www.nma.gov.au/research/centre_for_historical_research/conferences_and_seminars/barks_birds_billabongs/)>**2009 Savannah Symposium****17–19 November: Conference, Charles Darwin University****20–21 November, Field workshops, Kakadu National Park and Arnhem Land**

The conference and optional field workshop will look at future opportunities for northern Australia. How can we do sustainable business in the bush

together? The conference will look at new ideas and programs, successful case studies and developments in three streams: Sustainable Communities, Conservation Business, and Ecotourism. The field workshops feature a behind-the-scenes look at the iconic Kakadu National Park and Injalak.

**Contact:** Russell Boswell, Manager, Savannah Way Limited **Tel:** 0408 772 513**Email:** <[info@savannahway.com.au](mailto:info@savannahway.com.au)>**4th International Fire Ecology and Management Congress: Fire as a Global Process**  
**30 November – 4 December,**  
**Venue: Savannah, Georgia, USA**

The Congress, hosted by the Association for Fire Ecology, will provide a forum on global wildland fire research and management. Primary themes will cover a broad range of topics, including fire effects; integrating science and management; fire behaviour; climate change; and the role of technology including GIS.

**W:** <[www.fireecology.net/Congress09/Overview](http://www.fireecology.net/Congress09/Overview)>

## 2010

**International Society for Ecological Economics (ISEE): 11th Biennial Conference—Advancing Sustainability in a Time of Crises**  
**22–25 August, 2010, Germany**  
**Venue: Uni. of Oldenburg and Uni. of Bremen**

Preliminary themes include climate change and adaptation; biodiversity and ecosystem services; governance; knowledge and social learning for societal change; business strategies for sustainable management; land use patterns; evolutionary, institutional and post-autistic economics; sustainability science and trans-disciplinary research designs.

**Web:** <[www.ecoeco.org/news\\_isee2010\\_conference.php](http://www.ecoeco.org/news_isee2010_conference.php)>**Our Stakeholders**

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Mining

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