



SAVANNA LINKS

Cooperative Research Centre for the Sustainable Development of Tropical Savannas

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ADF moves to strengthen land care



Photo: Dennis Schulz

Training in the savannas: environmental management looks to regenerate sites used for training, as well as implementing weed, fire and feral controls.

Defence forces from both Australia and the United States are now in Queensland for Stage II of this year's Crocodile '99 exercises. While events in East Timor have resulted in the operation being scaled down, large numbers of troops, particularly from the US, are now training in northern Australia. It's an invasion carrying with it the potential to inflict significant damage to the fragile northern savanna ecology, but the area of concentration has been appraised for the environmental impact the training exercise will bring.

Environmental concerns are now an important aspect of military planning, with Environmental Management Plans (EMPs)—which generally run for five years—in place throughout all Defence properties.

“What the community expected in the '60s is not what they expect in the '90s, and defence is well aware of that,” says Lt Col Peter Sims, the ADF's NT manager of the Defence Estate. “There is a degree of planning and remediation that wasn't done earlier. Now we have environmental experts within defence providing that guidance.”

For specific exercises such as Crocodile '99, however, Environmental Compliance Certificates (ECCs) are also a requirement. Where EMPs are about long-term care of the land and include specific action plans for weed and feral animal control, ECC's are similar to a mini-environmental impact assessment. They detail specific environ-

The Australian Defence Force has enjoyed a presence in northern Australia since before World War II but the past decade has seen a significant change in the way the ADF manages its land—which now covers up to 3 million hectares across Australia.

By Dennis Schulz and Kate O'Donnell

mental constraints—such as the location of sensitive ecosystems, endangered species, cultural or heritage sites and how to avoid them—as well as containing registered creek crossings, and possible remediation for any damage.

For exercises taking place outside military-owned training areas, often on pastoral properties, Aboriginal land or within bush townships, arrangements are made to avoid areas where mustering is taking place or near watercourses where cattle would be disturbed. Sacred sites are identified and avoided.

Fire and weeds in the north

Gwyneth Beasley, acting director of Environment & Heritage in the Defence Estate Organisation says northern Australia has different sets of problems to those in the south.

“For example, fire is a big issue that we have in northern Australia that we might not have to the same extent in southern training areas,” she explains. “So it, and weed infestation, are high up on the list of management issues.

There is a lot more focus on these issues in the Defence Estate's five-year EMPs in the north than elsewhere. The management plans begin with a resource inventory on environmental aspects of an area including endangered species; ecologically sensitive areas/ecosystems; water quality; contamination; fire management, flora and fauna,

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ADF moves to strengthen land care

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weeds, cultural and heritage sites and Aboriginal sacred sites. Detailed land-management plans are then drawn up.

EMPs for training areas

This is precisely what is happening now at Defence's latest acquisition in the Northern Territory: Bradshaw Station. This new training area sprawls over 8710 square kilometres and comprises ecosystems as diverse as tidal mudflats and rugged sandstone hills. More than \$53 million is earmarked for Bradshaw's development once native title issues are agreed upon.

At the ADF's north Queensland training area 50 km west of Townsville, development for a new five-year environmental management plan is now under way. The Townsville Field Training Area (TFTA) covers 230,000 hectares, and incorporates the original High Range Training Area, which was used for military training for more than 30 years, and the former grazing station Dotswood, purchased in 1988. The original EIS was prepared in 1992-94 and the first EMP developed in 1995.

"Five years is a fairly good yardstick to see what impacts we are having, but the plans are reviewed periodically," explains Mrs Beasley. "Obviously environmental management is a dynamic science. Techniques change, our response to the environment changes; the environment's response to our activities change, so we have to be monitoring all the time."

Research on military lands

Because the TFTA training area has two different land-use histories, it provides researchers with a good opportunity to compare the different impacts on land of grazing and military use.

CSIRO has been doing just that at the TFTA for the past three years as part of a wider program of environmental research. The program was initiated by the ADF and funded by LWRDC.

It incorporates five major projects: remote sensing for land monitoring; the relative impacts of military use and grazing on tropical savanna eco-

systems; a database of soil resources; a decision support system that draws the data together; and a communication program to train military land managers in concepts of sustainable land management.

Impact of grazing

Dr Andrew Ash at CSIRO Tropical Agriculture in Townsville says the ADF wanted to analyse both the relative impacts of grazing and military use of the land.

"We've been finding that relatively undisturbed areas are no different to areas used by military but land historically used for grazing has undergone significant changes in botanical composition," he says.

"The TFTA also has many weed problems and we've just finished developing a weed management strategy for the area."

This year Dr John Woinarski, a wildlife ecologist from the NT, began



sampling the area for invertebrate and vertebrate fauna as part of a TS-CRC research project.

"In the most recent sampling in July we collected a pebble mound mouse which had not previously been found in this area," said Dr Ash.

Conservation concerns

North Queensland Conservation Council executive member Margaret Moorhouse while broadly supportive



Photo: Dennis Schulz

On exercises, the military follows ECCs that list constraints such as where sensitive ecosystems, endangered species, heritage sites are located and how to avoid them

of Defence's environmental policy, draws a comparison between Defence and mining: neither, she says, can be described as ecologically sustainable industries, it's more a matter of managing the impacts these two giants create.

"We've had a good relationship with them. The environmental officers have been interested in doing the right thing and we've found them very responsive," she says. "But this is mainly for the smaller issues, practical matters like the best way of getting around wetlands."

"When it comes to the big issues such coming to grips with bombing in the World Heritage (marine) area, it's much more difficult."

"There are fundamental philosophical differences," she says.

"They're so powerful we can't tackle those fundamental differences head on. What we try and do is protect the most highly valuable areas."

 Australian Defence Force
www.defence.gov.au
 Defence Estate Organisation
www.dod.gov.au/demg/
 Defence Estate Organisation, Environment & Heritage
www.dod.gov.au/demg/emrb6/default.htm
 US Army Environmental Policy Institute
aepi.gatech.edu
 US Army Environmental Centre
aec.army.mil/
 US Army Defence Environmental Network
www.denix.osd.mil/denix/denix.html
 US Department of Defence Links
aec-www.apgea.army.mil:8080/prod/links/links.htm

Landholders urged to share management innovations

Sustainable land managers in Queensland—particularly those in the north and west—have an opportunity to demonstrate their talents in a collection of case studies soon to be published by the state government. The book of case studies will document profitable primary production that combines sustainable land management practices. The aim is for graziers and farmers who have adopted sustainable land-management practices to share their knowledge.

“There’s a lot of good practical work happening in the paddocks, but most don’t get the opportunity to pass on their ideas and practices to others,” said Rod Welford, Queensland minister for Environment and Natural Resources. “We’re looking for landholders to show how they’ve combined sound land management and profitable production.” More case studies are needed, particularly from the northern and western areas of Queensland. Interested landholders should contact Geoffrey Smith, Department of Natural Resources, Tel: (07) 3362 9310.

New hope for rare dunnart

This little marsupial is the Julia Creek dunnart: one of many Australian small marsupials under threat because of habitat loss and feral invasions.

However, during a recent field trip by students and lecturers at JCU, it was found at Moorinya National Park—300 km away from where all other records have placed it.

Its habitat is the black soils of the Mitchell-Flinders grasslands and the discovery suggests that it may be more widespread than previously thought. All previous captures have been much further west, in a small area around Julia Creek.

“The discovery is important because it reveals a larger range for the species than was previously known,” says Dr Chris Johnson, senior lecturer on the field trip.

“We have trapped in that area for four years without catching any Julia Creek dunnarts.”

Moorinya National Park, 100 km south of Hughenden, is the former Shirley cattle station.

“This first specimen turned up after a good wet season with no cattle grazing.

This could reflect an increase in numbers as a result of those changed conditions, although of course a single capture can’t possibly prove that,” said Dr Johnson. “However we plan to continue trapping there,



Photo: Greg Calvert

so we may ultimately be able to say something about population trends.”

The Julia Creek dunnart, at 50g and 13 cm long is quite a bit larger than other species of dunnarts which generally weigh in at 20 g and are 8 cm in length.

The beauty pictured here is a female, and after a brief stay in Townsville, is now part of the captive breeding program at Fleays Fauna Sanctuary on the Gold Coast.

While there are encouraging numbers of Julia Creek dunnarts in captivity, the indications are that in the wild it’s in real trouble.

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How to reduce impact of livestock on greenhouse gas

The Bureau of Rural Sciences (BRS) is highlighting the role Australia’s livestock industries can play in helping reduce greenhouse gas emissions. Its new publication *Meeting the Kyoto Target: Implications for the Australian Livestock Industries* details the outcomes of a two-day workshop organised by BRS to update industry, policy-makers and scientists on the implications of Australia’s greenhouse commitments for the livestock industry.

Australia’s livestock sector contributes around 12 to 14 per cent of our greenhouse emissions, and without input from the industry in developing greenhouse policy, the BRS believes it will be difficult for producers to

protect their interests or capitalise on any opportunities. Significant emission reductions could be achieved through the development of new technologies while increasing animal productivity. The workshop recommended that Australia invest in developing and commercialising these technologies rather than wait to buy them from other countries. You can download PDF copies of the book from the BRS website. Hardcopy versions are \$20 from the AFFA Shopfront on Tel: (02) 6272 5550.

www.brs.gov.au/greenhouse/livestock_methane.html
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Bird records reveal history of change

A TS-CRC study of birds on Coomooboolaroo cattle station in Queensland's brigalow region has found about one-quarter of the original bird fauna has been lost or changed. However, this change is not necessarily associated with clearing brigalow, and it may be repeated widely in the tropical savannas. *John*

Woinarski & Carla Catterall report.

Coomooboolaroo is unusual in that detailed wildlife information was recorded on the property from soon after European settlement to the mid-1930s. Established as a pastoral property in the 1850s, it was acquired by Charles Barnard in 1873. He managed this property of about 400km² for about 70 years, after which about half was sold to Keith and Harry Edmestone, and the remainder passing to another long-term local resident, Jim Dunne, in the early 1960s. These three continue to manage these properties, providing a remarkably continuous history.

The study built on this history by sampling as much of the property as possible over a week in February 1999. It also drew on the information collected by the Edmestone and Dunne families over the decades.

Barnard's birdlife records

Charles Barnard, a distinguished ornithologist, wrote a comprehensive account of changes in the birdlife at



Photo: John Woinarski

Extensive areas of tall open forest remain on Coomooboolaroo, although changed fire regimes and grazing may have contributed to changes in their ecological character and bird species



Photo: Greg Calvert

Grassland species like the bustard have increased over 60 years

Coomooboolaroo over its first 50 years, with further notes on subsequent changes in 1934.

In this period Barnard noted that parts of the property were ring-barked, much of the creekside vegetation destroyed by livestock, swamps were dry and prickly-pear had invaded. The impact of stock was compounded by a major drought around 1902. Barnard recorded around 225 bird species from the property, with about 30 of these irregular visitors only (associated with the drought), but noted that many had declined or disappeared completely over the period of his management.

The most notable of these was the paradise parrot, the only bird to have become extinct on the Australian mainland since European settlement. It disappeared at Coomooboolaroo about the time of the 1902 drought, and never returned. Several other species (including squatter pigeon, laughing kookaburra and the red-backed fairy-wren) also disappeared about this time, but came straggling back in the next few decades.

Barnard also noticed that several forest bird species retracted to the "thicker scrubs of the ranges",

presumably as the more accessible lowland forests were cleared. Not all change involved decline, as a few species colonised the region (and property), mostly those associated with grasslands and from more arid areas (such as the crested pigeon and cockatiel).

Changes to the landscape

Much of the landscape and its use has changed over the past 60 years, and these changes are remembered by the three long-term property managers, Harry and Keith Edmestone and Bill Dunne, who also have a good knowledge of their wildlife and its comings and goings.

The proportion of cleared land has greatly increased since Barnard's era. This is especially so for the brigalow scrub, which probably originally constituted about a quarter of the property. Most was pulled or killed by chemicals in the last three decades, and no large stands remain.

Introduced pasture plants (mostly buffel grass and stylo) were widely planted about the same time. Brahman cattle are now run on two of the three subdivisions of the original property. Cane toads have colonised. Fire is rarely used, however a major wildfire



Photo: John Woinarski

Bill Dunne, the current owner of the station, outside Charles Barnard's Coomooboolaroo museum, with researcher Dr Carla Catterall

swept through much of the property in 1951. Also, parts of the property were resumed to state forest and set aside for timber protection and production. These changes are reasonably representative of the region.

Bird records today

We can confirm that about 150 bird species still live on or visit the property. Much of the reduction in this tally since Barnard's list can be attributed to his long period of observ-

ation which produced very occasional records of many vagrant species or species visiting only during exceptional climatic periods.

Over the past 60 years, waterfowl have generally fared well, and there have been major increases in many grassland species including the bustard, pheasant coucal, red-backed fairy-wren, crested pigeon, galah, masked lapwing and cockatiel. Even the squatter pigeon, which declined here to local extinction in the first two decades of the century, is now common. But the "scrub" birds, associated with patches of softwood scrub and other dense vegetation, have almost all disappeared, although a few species (brush turkey, lewin's honeyeater, white-browed scrub-wren) are hanging on in the very small pockets of softwood that escaped clearing.

Complex factors

The loss of brigalow/scrub birds is probably not surprising given the almost complete removal of this habitat, both on this property and regionally, however there have also

been declines in many birds associated with the eucalypt forests and woodlands which comprised the bulk of the property.

Apparently greatly reduced, or missing, since Barnard's day are several species of thornbills, lorikeets, honeyeaters, robins, flycatchers and finches, despite the fact their main habitat has been retained. This range of species suggests that there is no single simple factor involved.

The decline in some of the highly dispersive honeyeaters and lorikeets is probably a regional response, with extensive clearing knocking out some environments on which these birds depended during part of their annual movements. The loss of thornbills, flycatchers and robins may be due to more local factors, most likely involving changes in the vegetation structure (particularly in shrubbiness) and ground layer, due to grazing and fire regimes. The decline in some finch species is most likely also linked to grazing and fire, and possibly also to the spread of exotic plant species.

The loss of around a quarter of the original bird species is somewhat concerning. There is nothing exceptional about this property that would suggest that its biodiversity loss is not typical of the region—indeed, the managers here have probably been unusually sympathetic and attuned to their environments.

By most socio-economic and superficial environmental indicators, the property has been developed sustainably. But in this rare case where explicit and detailed information has been available almost since its inception, it is clear substantial species loss has still occurred. Such a loss is not necessarily because to local loss of brigalow habitat but may be representative of a broader trend across the tropical savannas.

The study at Coomooboolaroo was undertaken by Dr John Woinarski (Tropical Savannas CRC and the Parks & Wildlife Commission of the NT) and Dr Carla Catterall (Rainforest CRC & Griffith University). For more information contact John Woinarski
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Letter to the Editor

I was interested in the article by David Bowman in the last issue (Issue 10, *Introduced grasses, triumph or Trojan horse?*). I have just completed an honours project investigating infestation of gamba grass in Wildman River National Park in the NT. Readers might be interested to know some of my findings.

The bad news: Despite the belief that establishment requires disturbance, gamba grass can grow quite readily in burnt and unburnt savanna habitats, regardless of whether the soil surface is broken. Additionally, it grows well in upland Melaleuca

forests and floodplain margins, but in these habitats disturbance enhances establishment. This finding calls for extensive control measures across a wide variety of habitats.

A mature gamba grass plant in the Darwin region has the potential to produce up to 250,000 seeds in one season. With viability of between 48-64 per cent, that is a lot of seeds!

The good news: Seed viability declines to a minimum within 12 months of seed shed. This is a potential weakness in the plant's reproduction strategy and could be a key to its control. In management terms, it can mean that if a plant or

infestation is removed or poisoned before it seeds, there is a very good chance that the area will be free of gamba within a year or two.

The Eucalypt savannas of the Top End are in danger. Gamba grass is a problem that will affect all rural and semi-rural landowners and any member of the public that expects to appreciate the natural beauty of the Top End. If control measures are not implemented now, the problems are likely to accelerate to a point where these measures are no longer achievable. Let's not sit and wait.

Trish Flores,
Parks & Wildlife Commission of the NT

Late in 1999, the world's population will exceed 6,000,000,000. The pressure this places on resources creates severe environmental problems. In stark contrast, argues *Peter Whitehead*, environmental problems in northern Australia are difficult to manage because we have too few people.

Is it time to fill the north's empty landscapes?

In remote northern Australia a policy of unconstrained exploitation and strong "protection" of smaller areas—by limiting the human presence—is a deeply flawed approach. Both extremes produce damaged landscapes. It would be better to recognise and encourage a greater human role in the active day-to-day management of extensive ecosystems. This is likely to produce healthier landscapes, a healthier biota, and healthier people.

Wildfire

Many areas in northern Australia now have fewer people than they did at the time of European settlement because fewer Aborigines live on their traditional lands. When Aboriginal people lived in the savannas, they lit many small fires as part of their daily activities. Fire was used in hunting or other foraging and lit specifically to protect important habitats like rainforests.

That pattern of fire use, especially burns during and immediately after the wet season, broke landscapes into mosaics of small patches, reducing accumulation of grass and other fuels. This in turn lowered the frequency of large, hot and destructive wildfires.

Unfortunately, now that fewer people are managing fire in their country, late dry-season fires sweep across much of northern Australia, destroying fire-sensitive vegetation and replacing it with fire-tolerant plants.

Feral animals

Many introduced animals found Australian environments to be good places to live and reproduce. Some of the world's biggest populations of wild water buffalo now live in the Northern Territory. In the 1980's, before the Brucellosis and Tuber-



culosis Eradication Campaign (BTEC) required removal of unmanaged (feral stock), more than 350,000 buffalo inhabited the Top End. Populations outside pastoral lands are now making a comeback, and environmental damage to woodlands, forests, swamps and streams is increasing with their numbers. Horses, donkeys, camels, pigs, cats and cane toads add to the mayhem.

But BTEC's costs were high, and funding sufficient to keep numbers below environmentally damaging levels is now unlikely to be available. Economically sustainable solutions to feral animal problems are likely to depend on regular control by people on the ground.

Weeds

Northern Australia is confronted by an array of invasive plants with the potential to alter ecological processes. Even in country lacking resident populations, visitors and their vehicles, feral animals, winds, water and native wildlife can spread their seeds into the remotest corners of the landscape. In uninhabited

areas, these plants can become firmly entrenched before their presence is noticed, making subsequent control difficult and expensive.

Quarantine problems

A largely unoccupied coastline provides entry points for people, their domestic or pest animals and their diseases. Some animal diseases from our near neighbours will put wildlife populations at risk either directly or indirectly through the efforts of animal health authorities to contain and eradicate disease.

These authorities will not be prepared to take chances with animals that could act as disease reservoirs or vectors. Nor will they easily allow potential effects of control operations on non-target native animals to dictate disease control objectives and procedures. Where there is a potential to damage agricultural industries, they are likely to adopt the scorched earth approach to eradicate the threat.

Keeping people on the land

All of these problems and more are best dealt with by people who live in

Sustainability needs a viable economy

Colin Macgregor looks at the decline in population from an economic and historical perspective

As well as listing the problems caused by sparse populations in northern Australia, it is useful to examine *why* populations are declining. One factor looms large, and one that often seems forgotten in debates about sustainability: the importance of economic viability. Essentially, it comes down to the fact that if people can't make a living for themselves and for their family then you're not achieving sustainability.

It is evident that there are marked economic and social differences across northern Australia, just as there are marked environmental contrasts, and this partly comes from the history of the region.

Pastoralism in the north

In Queensland, during the 19th century, rapid pastoral development was pursued energetically. This put people on the land, but it also displaced the indigenous residents. By the first half of the 20th century, management practices had become more exploitative with over-stocking becoming common practice. Exotic plant species were also introduced to help supplement stock dependence on native vegetation.

In more recent times fluctuating trade has resulted in further exploitation as pastoralists attempt to secure enterprise profitability by increasing stocking rates. Poor profit has also forced pastoralists to embrace efficiency which in turn led to declines in the use of station labour, resulting in further depopulation.

However, there are many economists who would actually support this trend; they tell us that many of the smaller Queensland pastoral enterprises are not economically viable, nor sustainable. Amalgamation, flagged as a possible solution, can only bring about further depopulation, exacerbating the problem.

The history of pastoralism in the Northern Territory and Western Australia is a much more recent one and less exploitative in nature. Economies of scale associated with large lease-held enterprises meant that pastoralists have not nearly been so exposed to the fluctuating world markets in the same way as smaller free-held enterprises

in Queensland. Consequently their environment presently shows less degradation. Of course, this does not reduce the threats of wildfire, feral animals and weeds.

History of savanna towns

Regional differences can be found between the towns and small communities of the two states and territory and which reflect the region's economic history.

The majority of towns in Western Australia and the Northern Territory are showing increases in population, some of which is very rapid. Broome for example, had a 50 per cent increase between the Census years 1986-91, while Kununurra a 30 per cent increase over the same period.

While there are exceptions (Wyndham and Derby) many towns in western Queensland are declining; these include Hughenden, Mount Garnet, Richmond and Julia Creek. These towns occur more frequently in the landscape than those in NT and WA, established as they were during the "rail age" when it was important to have short access to railway stations. Towns in the NT and north WA however, were established, or at least grew, during the age of the car and truck. The reduced dependence on rail in Queensland nowadays means that many towns are simply by-passed as people seek out the larger centres for the provision of goods, services and access to markets.

Unfortunately we don't have a crystal ball in which we can view the economic future of the savannas. But one thing history makes clear is that there are potentially many ways of making a living in northern Australia. To look after the natural resources that are endemic to the region might mean a management strategy that includes pastoralism, tourism and mining. But it should also include an industry based on natural resource management, which has no other purpose than to maintain a healthy ecosystem so that future generations have the opportunity to explore new and as yet unimagined natural resource enterprises.

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savanna.ntu.edu.au/education/students/current/colin.html

intimate association with their land, regularly move through the landscape and are concerned for its condition.

People with these qualifications can include pastoralists, park rangers, and Aboriginal landowners and managers.

The nature of government support for pastoralism can lead to damaging practices, such as grazing of marginal land, and no incentives are offered to encourage landholders to adopt a wider view of land management. Rangers employed by government

agencies live on and patrol conservation reserves that occupy a small part of the landscape.

By far the largest group with the desire and the skills to manage the savannas are Aboriginal people. There was support for the outstation movement, which enabled some to return to traditional lands, but it now appears to be dwindling.

Limited support for the people of remote Australia to remain on and actively manage their land is difficult to understand, given the very real conservation and quarantine benefits

available from a more dispersed population.

Cost is undoubtedly a factor, even though recurring costs are likely to be dwarfed by the huge expenditures needed in the longer term to repair inevitable damage to environments, animal or plant production or human health resulting from an open frontier and vacant hinterland.

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Photo: Catherine Seiter

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 Qld Natural Resources Fact Sheets
www.dnr.qld.gov.au/fact_sheets/pestfacts.html
 CSIRO: Biological Control of Woody Weeds
www.ento.csiro.au/research/rr95-97/weedm_tropweeds.html#rw
 Agriculture WA Information Notes
www.agric.wa.gov.au/agency/Pubns/infonote/infonotes/A01290.html
 National Weeds Strategy
www.weeds.org.au/nwsec.htm
 Weeds Australia
www.weeds.org.au/

Study adds fire to arsenal against mesquite

A two-year study has found that fire is an effective weapon in the fight against the invasive woody weed *Algaroba mesquite*.

A team from Queensland Department of Natural Resources conducted studies at sites near Hughenden, north Queensland, where the density of mesquite before burning was about 1760 plants per hectare. Three months after burning only 7 per cent of these were still alive; and these were either in areas that had not been burnt, or had received only minimal damage.

The trial was undertaken on *Prosopis pallida*, commonly referred to as Algaroba mesquite, one of four species currently invading the rangelands of north Queensland. The other three species are *P. velutina*, *P. juliflora* and a hybrid. Studies on how effective fire is on these species have not been done, and the findings apply only to *P. pallida*.

As well as killing adult plants burning also reduced the amount of seedlings that came up in the year after burning, said Dr Shane Campbell, one of the DNR researchers who undertook the study.

“In some species, many of the acacias for instance,

fire will actually help seeds to germinate and can result in increased density of plants,” said Dr Campbell. “So it is important to test for this when undertaking burning trials. Fortunately this was not the case with mesquite.”

Pre- and post-fire grazing management is particularly important, said Dr Campbell. Grazing has to be managed to allow sufficient fuel to build up in order to carry a fire. He warned that if animals introduced after burning come from an area containing mesquite trees with pods, mesquite would be spread in to the clean paddocks once again.

Though fire reduces the amount of seedlings that germinate, those that do come up grow better in burnt areas, Dr Campbell explained. “It is important to keep an eye on them and treat them before they grow too large,” he said. “This might involve using chemicals or a follow-up burn a couple of years after the first burn.

“However, establishing good grass cover is the best way to control seedling regrowth and will keep them under control,” he added. “To achieve this may require reducing the grazing pressure or reseeding in areas where there is little grass.”

Fire map web aims to cut greenhouse and global warming

An international study is monitoring the contribution that fires make to global warming by using satellite images to map fires around the world. The maps are used to work out their impact on global warming—both in terms of greenhouse gas emissions and the destruction of trees that soak up carbon dioxide.

Fires make a significant contribution to the greenhouse effect and may account for 40 percent of annual global greenhouse gas emissions.

The project, named the World Fire Web, involves scientists from 16 countries. CSIRO’s Earth Observation Centre is tracking fires throughout

Australia, New Guinea and parts of Indonesia. Dr Dean Graetz, of the Observation Centre, explains that unlike fossil fuel emissions, at this stage we know comparatively little about where fires are occurring and how much carbon they are releasing.

The Australian research team is also helping correlate what is seen in satellite images with what is actually happening on the ground.

“The most difficult task, not just for us, but for all of the project, is to ‘train’ the computer to automatically recognize and measure burnt areas, while ignoring cloud shadows and other distractions,” says Dr Graetz.

“Over this year’s dry season in Kakadu, we’ve been making measurements from the ground and from aircraft of fires lit by the park rangers. Back in the laboratory, these measurements, along with satellite images, are helping us develop more accurate methods of detecting burnt areas.”

Currently, the World Fire Web covers two-thirds of the globe, but the scientists plan to expand it by the end of this year to provide an almost global coverage of fires.

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Traces of Tracy in tropical trees

TROPICAL Savannas CRC's water and carbon project has estimated that if left on its own (no fire, no insect attacks etc.) a 100m x 100m patch of savanna woodland near Darwin will add around 2.7 tonnes of carbon in the form of extra wood, leaves and grass each year. This is about 5 per cent of the standing biomass. To put this in perspective, the same area of old growth Amazon rainforest puts on about 1 tonne of carbon a year—so the Darwin woodlands are growing relatively rapidly. Of course, fire and other impacts will reduce this figure every few years, but the idea is that over recent decades these woodlands have “bulked up” considerably. Presumably this growth may slow as the canopy thickens, and photosynthesis reduces. It is also thought that every few decades a catastrophe of some sort will thin the woodlands so much, they go back to square one. The last time this happened around Darwin was during Cyclone Tracy, so these woodlands could still be recovering from that event.

l_hutley@banks.ntu.edu.au

Landsat 7 image data sale

THE latest range of enhanced satellite image data products is now available to users at greatly reduced prices. The Australian Centre for Remote Sensing (ACRES) has signed a Memorandum of Understanding with the satellite operator, the United States Geological Survey (USGS). Because of the US Government's decision to reduce fees for Landsat access, ACRES can offer new and previous Landsat image data

Toad Squad serenade lures feral invaders

Northern Territory Parks and Wildlife officers are successfully using tape recordings of cane toad noises to catch more of the pests in Darwin's Nightcliff area. Six cane toads were recently apprehended in the area, the invasion linked to the arrival of a furniture van from Queensland that contained pot plants. As soon as the initial toads were discovered, NT Parks & Wildlife officers asked nearby residents to play tapes of cane toad calls at night to attract any further toads. As a result, another three were found lurking in neighbouring backyards. All the toads were of similar size and therefore not the offspring of the original toad. Nevertheless, cane toads are expected to arrive permanently in Darwin between 2010 and 2020. If you sight the toads before this time call PWCNT for the Toad Tapes. Tel: (08) 8999 5511.

at prices reduced by up to 75 per cent. The Landsat 7 images also feature a new sensor, the Enhanced Thematic Mapper Plus, and means the images will have higher resolution than previous Landsat satellites. ACRES has a network of distributors, both in Australia and overseas.

www.auslig.gov.au

Queensland's ecosystems

QUEENSLAND'S Environmental Protection Agency has published a comprehensive account of Queensland's regional ecosystems with *The Conservation Status of Queensland's Bioregional Ecosystems*, edited by Paul Sattler and Rebecca Williams. The report describes the regional ecosystems of Queensland as the primary basis for planning the conservation of biodiversity. It is also useful for land-use planning. The 13 ecosystems described in the book are derived from landscape patterns, geology and land form and vegetation to provide a robust classification for biodiversity planning at the

landscape scale. The book has detailed maps, photographs, lists of resources and references as well as the summaries of the ecosystems and bioregions. The price is \$79.95 and is available from the state's EPA Information Centre.

Tel: (07) 3227 8186 Fax: (07) 3227 8749
Email: nquic@env.qld.gov.au

Rural women online

AUSTRALIA'S rural women now have their own website. Developed by the Women in Rural Industries Section of the Federal Department of Agriculture, Fisheries and Forestry, the aim is to provide a voice for rural women in developing the government's rural policies and programs. The website provides access to a wide range of information about what the government support for women in rural industries.

Tel: Anne Quinn (02) 6272 5554
www.ffa.gov.au/csg/ruralwomen

Tour operator strategy

PARKS & Wildlife Commission of the NT and Parks Australia North, which run Uluru and Kakadu, are on target for an October release of the new strategy for tour operator licensing and training in the parks. The aim is to ensure tour operators are prepared and qualified to operate tours and guide groups in a safe, environmentally sustainable and culturally appropriate way. The strategy will tackle licensing accreditation compulsory criteria and training assessment procedures.

Mark Sparrow Market Equity
Tel: (08) 8364 2424 Fax: (08) 8364 1151
marksparrow@marketequity.sa.com.au

Niche explored for animal industries

AUSTRALIA'S new and emerging animal product industries, worth more than \$160 million a year, are subject to peaks and troughs. But a new report from the Rural Industries Research & Development Corporation (RIRDC) has gathered information on more than 19 of these industries, to help smooth the development cycle. The research draws together information to develop an analysis for industries from kangaroo to mutton birds and even flying foxes. More detailed analyses also include ostrich, kangaroo and dairy goats. The information allows a critical factors checklist, which affect the performance of new animal enterprises, to be developed.

Marketing of New Animal Products is available from RIRDC for \$15
Tel: (02) 6272 4819 or go to www.rirdc.gov.au

Ecology & Environment

Fixing the Foundations: National Symposium on the Role of Soil Science in Sustainable Land and Water Management

11–12 November 1999, Adelaide

Venue: University of Adelaide, Glen Osmond

For managers of land or water resources, or give advice on land use or the environment, conduct research into land or water resources, or are involved in landcare projects.

Cost: \$285 (Full-time students, \$100).

Contact: Dr Nancy Lane
Communication Manager

Postal Address: Fixing the Foundations: Soil Science Symposium
Australian Academy of Science
GPO Box 783

Canberra ACT 2601

Tel: (02) 6247 5777 **Fax:** (02) 6257 4620

Email: scied@science.org.au

Website: www.science.org.au/
soil.htm

Evaluating Indirect Ecological Effects of Biological Control 17–20 October 1999, France

Venue: Agropolis International,
Montpellier, France

The first two days of the symposium comprises sessions for keynote speakers, proposed papers and posters and the last day, a workshop session. Themes include application of ecological theory and research; case studies and analyses.

Email: iobc.symp@agropolis.fr

Global Biodiversity Forum— South and Southeast Asia 24–26 October 1999, Sri Lanka

Venue: Colombo.

Hosts: Ministry of Forests and
Environment, Sri Lanka

Workshops include alien invasive species; ecosystem approaches to conservation; biodiversity friendly practices and technologies; developing and implementing national strategies and action plans.

Contact: P. Balakrishna
GBF-SSEA Coordinator, IUCN

Postal Address: The World Conservation Union South and Southeast Asia Regional Biodiversity Programme

48, Vajira Road, Colombo 5, Sri Lanka

Tel: +94 74 510517 **Fax:** +94-1 58002

Email: pbala@sltnet.lk

Website: www.gbfc.ch

World Semi-Arid '99-WSA '99 International symposium on sustainable development of semi-arid regions

29 Nov–2 Dec, 1999, Tambaú

Venue: Convention Centre, Hotel
Tambaú

Contact: President of BIOSFERA
Brazilian Society for the
Environment (BIOSFERA),

Postal Address: PO Box 2432, Rio
de Janeiro, RJ, CEP: 20001-970.

Tel/Fax: (+55 21) 221-0155/2217626

Email: biosfera@biosfera.com.br

Website: www.biosfera.com.br

Seeking the balance: use of natural resources and future environmental values

1-3 December, 1999, Hobart

Contact: The Secretariat

Mures Convention Management
Victoria Dock Hobart Tas 7000

Email: conventions@mures.com.au.

Early bird: \$380. Full: \$480.

Website: avoca.vicnet.net.au/~eia/
conf.htm

Modelling and Simulation Society of Australia and New Zealand (MSSANZ), Meeting 6–9 December 1999, New Zealand

Venue: University of Waikato, Ham-
ilton, New Zealand.

Theme: Modelling the dynamics of
natural, agricultural, hydrological,
tourism and socio-economic systems.

Contact: Prof. Les Oxley and Dr Frank
Scrimgeour

Postal Address: Department of
Economics, University of Waikato,
Private Bag, Hamilton, New Zealand

Tel: +64 7 838 4077 **Fax:** +64 7 838 4331

Email: modsim99@waikato.ac.nz

Website:

www.mngt.waikato.ac.nz/depts/
econ/MODSIM99.html

ISEE 2000 People and Nature: Operationalising Ecological Economics 5–8 July 2000

Venue: Australian National
University, Canberra.

ISEE 2000 will focus on operational applications and achievements of ecological economics. The conference is integrated around major conceptual challenges and practical problems.

Contact: Beth Stoodley

Tel: (02) 6249 3806 **Fax:** (02) 6279 8066

Email: beth.stoodley@anu.edu.au

Postal Address: Centre for
Continuing Education

Australian National University
Canberra ACT 0200

Website: www.anu.edu.au/cce/isee/

International Landcare 2000 Changing Landscapes, Shaping Futures 2–5 March 2000, Melbourne

Venue: Melbourne Convention
Centre.

The conference will explore issues such as sustainable agriculture and communities, biodiversity and greenhouse.

Contact: Waldron Smith Convention
Network

Postal Address: 93 Victoria Avenue
Albert Park, Victoria, Australia 3206

Tel: (03) 9690 6744 **Fax:** (03) 9690 7155

Email: wscn@bigpond.com

Website: www.nre.vic.gov.au/conf/
landcare2000/

International Symposium of advances in carbon and nutrient cycling and catchment processes in managed forests 21–25 August 2000, Gold Coast

Contact: Tim Blumfield

Tel: (07) 3875 7494

Fauna

7th Australasian Conference on Grassland Invertebrate Ecology September–October 1999, Perth

A forum for Australian and New Zealand scientists researching the ecology, biology, and management of invertebrates in grassland ecosystems. These include native grasslands, exotic pastures and pasture/crop rotational systems.

Contact: John Matthiessen
Chair, Organising Committee
CSIRO Entomology

Postal Address: Private Bag, PO
Wembley, WA 6014

Tel: (08) 9333 6641 **Fax:** (08) 9333 6646

Email: johnm@ccmar.csiro.au

**ISEE 2000 People and Nature:
Operationalising Ecological
Economics
5–8 July 2000**

Venue: Australian National University, Canberra, Australia
ISEE 2000 will focus on operational applications and achievements of ecological economics. The conference is integrated around major conceptual challenges and practical problems. The conference is being organised by the International Society for Ecological Economics and the Australia New Zealand Society for Ecological Economics.

Contact: Beth Stoodley

Tel: (02) 6249 3806 **Fax:** (02) 6279 8066

Email: beth.stoodley@anu.edu.au

Postal Address: Centre for Continuing Education

Australian National University Canberra ACT 0200. Registration forms available on the website

Website: www.anu.edu.au/cce/isee/

Indigenous Issues

**Languages of Caring for
Country**

Tuesday 12 October, 12-1pm

Venue: CINCRM, Northern Territory University, Building 22:19
Seminar by Djelk Rangers (Bawin-anaga), Rae Flannagan & Greg Williams (FATSIS)

Contact: Leon Morris

Email: l_morris@BANKS.NTU.EDU.AU

**Aboriginal Burning Practices in
the North Kimberley: Past and
Present**

Tuesday 19 October, 12-1pm

Venue: CINCRM, Northern Territory University, Building 22:19
Seminar by Tom Vigilante (PhD Candidate, CINCRM & TS-CRC)

Contact: Leon Morris

Email: l_morris@BANKS.NTU.EDU.AU

**Assisting Aboriginal
Contemporary Land
Management in the Top End
Tuesday 26 October, 12-1pm**

Venue: CINCRM, Northern Territory University, Building 22:19
Seminar by Michael Storrs (Caring for Country Unit, NLC & TS-CRC)

Contact: Leon Morris

Email: l_morris@BANKS.NTU.EDU.AU

Pastoral Interests

**Beef Expo 2000
9–16 April 2000, Central Qld**

Venue: To be announced.

The event will highlight contributions made by the national beef industry to the Australian society. It will focus on opportunities which will allow the beef industry to build a dynamic, secure future into the next millennium. It is organised by the Australian Beef Cattle Exposition Association Inc.

Website:

leaky.rock.tap.csiro.au/Beef2000/
beef2000-structure.html

**Tropical Grassland Society
Conference—Pastures for
Production and Protection
26–28 April 2000, Emerald**

Venue: Emerald Agricultural College
The conference focuses on protecting soil, building fertility, controlling weeds. It also features field trips to inspect legumes and native grass pastures. Sessions include mine revegetation systems, pasture and cropping systems, native pastures and weed eradication.

Contact: Maurice Conway TGS

Tel: (07) 4982 8814 **Fax:** (07) 4982 3459

Email: conwaym@dpi.qld.gov.au
www.powerup.com.au/~tgsaust

To submit posters contact:

Karen Healey, University of Queensland, Gatton College

Tel: (07) 5460 1307 **Fax:** (07) 5460 1112

Email: k.healey@mailbox.uq.edu.au

Tourism

**Ecotourism Association
of Australia National
Conference—The World's
Natural Theme Park
14–17 October 1999,
Fraser Island**

Venue: Kingfisher Bay Resort and Village, Fraser Island.

The EAA conference is an opportunity to explore how the industry can best build on and ensure the sustainability of Australia's unique assets.

Contact: Tony Charters, Conference Convenor, Tourism Queensland

Tel: (07) 3406 5493 **Fax:** (07) 3406 5483

Email: charterst@qtcc.com.au

Website: www.qtcc.com.au/ecotourism/
conference99

Weed Management

**Weedbuster Week
10–17 October 1999, National**

Venue: National

Theme: Weed prevention is the intention

There are hundreds of events around the country during Weedbuster Week. Activities include weed clean-ups, displays, seminars, workshops and competitions. Contact your state or territory coordinator to join in.

National: Salvo Vitelli

Tel: (07) 3406 2859 **Fax:** (07) 3406 2875

Postal Address: Department of Natural Resources, Locked Bag 40
Coorparoo Delivery Centre, Qld 4151

Email: salvo.vitelli@dnr.qld.gov.au

Website: www.weedbusterweek.info.au/

NT: Leslee Hills

Tel: (08) 8999 2349 **Fax:** (08) 8999 2049

Postal Address: NT Primary Industry and Fisheries PO Box 990, Darwin, NT 0810

Email: leslee.hills@nt.gov.au

Website: www.nt.gov.au/dpif/

Qld: Leanne Parkes

Tel: (07) 3406 2867 **Fax:** (07) 3406 2875

Postal Address: Department of Natural Resources Locked bag 40
Coorparoo Delivery Centre, Qld 4151

Email:

Leanne.parkes@dnr.qld.gov.au

Website:

www.dnr.qld.gov.au/land/
landprotection/weedbuster/
home.htm

WA: Sandy Lloyd

Tel: (08) 9368 3760 **Fax:** (08) 9474 3814

Postal Address: Agriculture WA,
Locked Bag 4, Bentley D.C., WA 6983

Email: slloyd@agric.wa.gov.au

Website:

www.agric.wa.gov.au/progserv/
plants/weeds/buster/buster.htm

ACT: Helen Peade

Tel: (02) 6284 7234 **Fax:** (02) 6284 7235

Griffin Promotions, PO Box 1684,
Tuggeranong, ACT 2601

Website: www.ento.csiro.au/
research/weedmgmt/weedmgmt.html

Vic: Kate Blood

Environment Weed Education
Coordinator

Tel: (03) 9785 0111 **Fax:** (03) 9785 2007

Email: Kate.Blood@nre.vic.gov.au

Postal Address: CRCWMS, KTRI,
PO Box 48, Frankston, Vic, 3199

Website: www.nre.vic.gov.au/
plntanml/pests/weedbuster/index.htm

17th Asian Pacific Weed Science Society Conference

November 1999, Bangkok

Venue: Bangkok, Thailand

Contact: Dr Sombat Chinawong

APWSS Secretary, Department of Agronomy Faculty of Agriculture, Kasetsart University Chatuchak, Bangkok 10903, Thailand

Fax: 662 579 8580

Email: agrsbc@nontri.ku.ac.th

Website: www.css.orst.edu/weeds/iwss/Newsletter/0798/dates_events.htm

Weed Science Society of America 5-10 February 2000, Lawrence, US

Venue: Westin Harbour Hotel, Toronto, Canada

Contact: J. Breithaupt

Postal Address: PO Box 1897

Lawrence, KS 66044, US

Tel: 1 913 843 1235 **Fax:** 1 913 843 1274

Email: jbreith@allenpress.com

III International Weed Science Congress

June 6-11 2000, Curitiba, Paraná, Brazil

Venue: Foz do Iguassu, Brazil

Contact: PJ Eventos

Fieras e Congressos

Postal Address: Rua José Risseto, 1023

Curitiba, Paraná Brazil CEO 82.015010

Tel/Fax: 55 41 372 1177

Email: pj@datasoft.com.br

Water Management

International Conference on Tropical Aquatic Ecosystems: Health, Conservation and Management 25-30 October, Nainital, India

The inland freshwater and coastal ecosystems bear the brunt of all human activities. The future of developing countries will be determined by the availability and quality of water.
www.members.tripod.com/nieindia/index.htm

18th Australian Groundwater School 29 Nov-8 Dec 1999, Brisbane

Venue: Union College, University of Queensland, St Lucia Brisbane.

Week 1: Monday 29 November to Friday 3 December: Fundamentals of Groundwater Science, Technology and Management. Week 2: Monday 6 December - Wednesday 8 December: GIS for Groundwater Investigation and Management. Registration by 1 October to Centre for Groundwater Studies.

Contact: Trevor Pillar

Tel: (08) 8303 8700

Email: cgs.training@adl.clw.csiro.au

Website: www.clw.csiro.au/CGS

25-30 October, Nainital, India

Hydro 2000 3rd International Hydrology and Water Resources Symposium 20-23 November 2000, Perth

Venue: Sheraton Hotel, Perth

The symposium will commence with optional workshops on Monday 20 November 2000. The main symposium runs from Tuesday 21 to Thursday 23 November 2000, inclusive. An optional two-day tour on Friday 24 and Saturday 25 November completes the week of information exchange. Sub-themes include: interactions between hydrology and the environment, society, climate, surface water and groundwater; infrastructure, industry and the built environment and interactive hydrology.

Contact: Congress West Pty Ltd

Postal Address: PO Box 1248

West Perth WA 6872

Tel: (08) 9322 6906 **Fax:** (08) 9322 1734

Email: conwes@congresswest.com.au

Website: www.ieaust.org.au/hydro2000/

Don't forget to visit our website which has an extensive calendar section. Go to <http://savanna.ntu.edu.au/news/calendar.html> or just go to our home page and click on the blue heeler.

OUR STAKEHOLDERS



ABORIGINAL COMMUNITIES



PASTORALISM



TOURISM



MINING



CONSERVATION



DEFENCE

Savanna Links is edited and produced by the Tropical Savannas CRC.

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