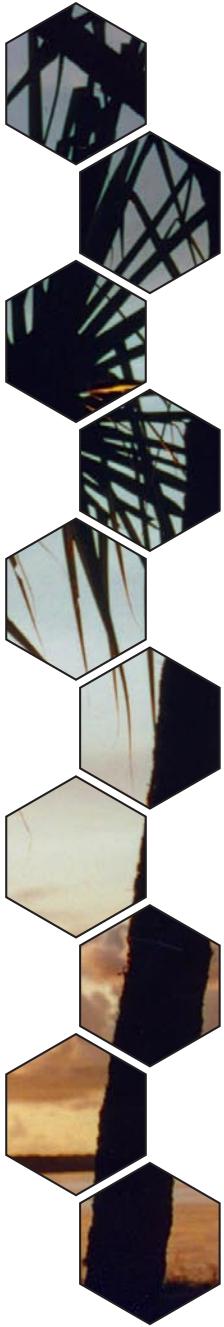




CSIRO Sustainable Ecosystems

***Tropical Savannas
Annual Report
2005***



Rangelands and Savannas Program
CSIRO Sustainable Ecosystems
Darwin Northern Territory

TROPICAL SAVANNAS
Annual Report 2005

MISSION

The Tropical Savannas research team in Darwin has as its vision healthy savanna ecosystems that sustain viable enterprises and livelihoods, and support vibrant and diverse communities.

Our mission is to deliver environmental, social and economic benefits by applying our scientific skills in partnership with the people who influence, use and manage Australia's tropical savannas.

We are part of CSIRO's Rangelands and Savannas Program, which also has laboratories in Townsville, Brisbane, Adelaide and Alice Springs. The Program belongs to the Division of Sustainable Ecosystems, which has its headquarters in Canberra. We are core participants in the Tropical Savannas Management CRC and the Bushfire CRC, with most of our work being done in collaboration with other research institutions, government land management agencies, non-government organisations and local communities.

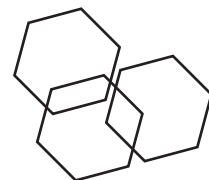


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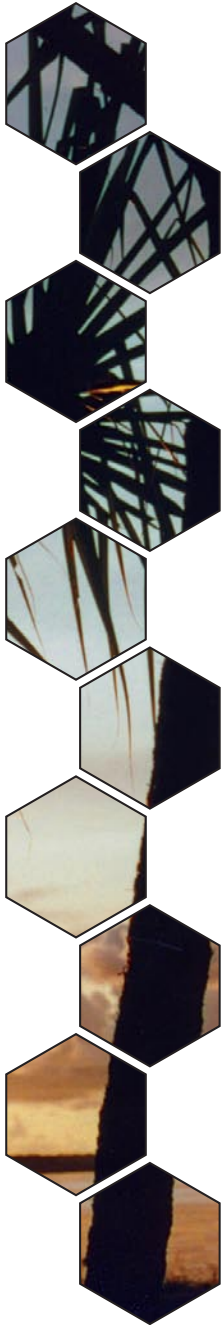
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RESEARCH PROGRAM

Our ecological research aims to predict how savanna ecosystems vary in relation to rainfall and soils, and how they respond to land management, especially fire and grazing. In recent times we have been building our capacity to address socio-economic aspects of natural resource management and regional development, in order to incorporate the full range of ecological, social and economic values of land in its management. We have a particular commitment to engaging effectively with Aboriginal people, and are developing our capacity to do this by recruiting new staff and by enhancing our relationships with Aboriginal organisations and local communities.

Our research addresses three major themes:

1. Savanna ecology
2. Savanna ecosystem management
3. People in savanna environments

1. Savanna ecology

We aim to be a leading centre internationally for research on savanna ecology. Our core ecological strengths are:

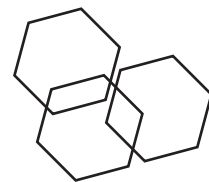
- Fire ecology
- Landscape ecology
- Invertebrate biodiversity
- Vegetation and carbon dynamics
- Grazing ecology
- Simulation modeling

We are developing a predictive understanding of interactions between the bio-physical environment and land

management across the extensive tropical savanna landscapes of northern Australia. We have two particular areas of focus: fire behaviour and its effects on vegetation, biodiversity and carbon dynamics; and the structure and function of invertebrate communities, with a particular focus on ants and termites. To ensure our results are widely applicable, much of our research is conducted along gradients of environmental stress and management intensity, across multiple spatial scales. A commonly used environmental gradient at the biogeographical scale is the North Australian Tropical Transect (NATT), one of several sub-continental scale transects of the International Geosphere Biosphere Program. NATT provides an important linking framework for collaboration with the international savanna research community. We use simulation modeling to explore complex dynamics over space and time.

Key questions:

- How do community structure and function vary in relation to rainfall and soil type?
- What are the relative influences of fire intensity and frequency on savanna biodiversity?
- How does fire affect long-term tree population dynamics and carbon storage?
- What is the significance of landscape patchiness for ecosystem productivity and for biodiversity?
- What roles do soil macro-invertebrates play in the functioning of landscapes?



(i) Fire ecology

Contact: Alan Andersen

Fire is a dominant feature of savanna landscapes, and is the most important land management tool for biodiversity conservation. Our focus is on the effects of fire on biodiversity, but we also have strong research interests in fire behaviour, and effects of fire on vegetation structure and carbon dynamics. We have completed a landscape-scale fire experiment at Kapalga in Kakadu National Park, which investigated ecological responses to a range of fire regimes applied at a landscape scale. As partners in the Bushfire CRC, we have established a new fire experiment at the Territory Wildlife Park that focuses on:

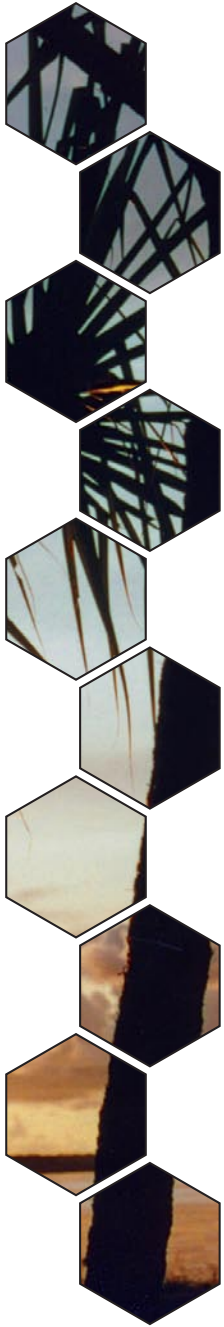
- the roles of fire frequency and time-since-fire
- ecological processes, particularly within the soil
- mechanistic understandings of ecological responses to fire.

Achievements in 2005

- Continuation of experimental burning, research and monitoring at the Territory Wildlife Park, including studies of fire behaviour, soil macroinvertebrates, invertebrate biodiversity, grazing by wallabies, and vegetation and carbon dynamics. Results were presented at a researcher's mini-conference in Darwin in November.
- Acceptance of papers on responses of ant communities to long-term fire exclusion, and submission of papers on patch mosaic burning (*Conservation Biology*) and effects of fire on seed dispersal by ants (*Oecologia*)

- Establishment of 'Burning for Biodiversity' website: www.terc.csiro.au/burningforbiodiversity
- Completion of university unit on fire ecology and management in northern Australia, in collaboration with Bushfire CRC, Tropical Savannas CRC and Charles Darwin University; the unit won the 2005 ASCILITE (Australasian Society for Computers in Learning in Tertiary Education) Award, for exemplary use of electronic technologies in teaching and learning in tertiary education.





(ii) Landscape ecology

Contact: John Ludwig

We are investigating the role of landscape patches (ranging from tussocks of grass to groves of trees) in the conservation and utilisation of scarce resources such as water and nutrients, and the provision of habitat, food and shelter for a diverse biota. We are examining the relationship between landscape patchiness and biodiversity, and the responses of landscape patches to land-use (particularly grazing), in order to develop robust indicators of healthy landscapes.

Achievements in 2005

- Award of an ARC Discovery grant to explore relationships between landscape patchiness metrics and elements of biological diversity, in collaboration with Clive McAlpine (lead Principal Investigator), Stuart Phinn, and David Pullar from the University of Queensland.
- Presentations at international (Ecological Society of America) and national (Ecological Society of Australia) conferences on the role of vegetation patchiness in eco-hydrological processes that regulate the loss of soil from arid and semi-arid landscapes, based on collaborative research with Rebecca Bartley from CSIRO Land & Water.
- Investigation of the patch structure of trees, solar radiation, soil water and temperature in savannas, during a study leave visit by Professor David Breshears from the University of Arizona in the USA.

(iii) Vegetation ecology

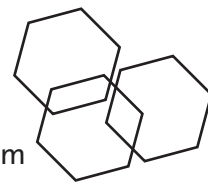
Contact: Garry Cook

Recent legislative changes restricting tree clearing in Queensland have highlighted the need for better information about the extent and nature of woody vegetation change, and about how to manage the structure of woody vegetation in pastoral landscapes. Conversely, in depopulated savanna regions, such as parts of the Kimberley in Western Australia, there is concern about the extent of detrimental thinning of woody vegetation that may be caused by the increasing frequency and extent of wildfire. Changes have also been noted in the density of seedling trees and shrubs in the Barkly Tableland region of the Northern Territory.

Limited case studies to date have demonstrated that woody change varies markedly between regions, with thickening in some areas and thinning or no change in others. This spatial variability needs to be assessed using a set of tools that are applied consistently across the tropical north of Australia. A new Tropical Savannas CRC project jointly led by Dave Gillieson from James Cook University and Garry Cook aims to do this.

Achievements in 2005

- Two project meetings, in Townsville (February) and near Darwin (November).
- Stakeholder workshop as an adjunct to the Queensland Landcare conference in Barcaldine (August).



- Further development of the *Flames* model to simulate the effects of fire management on gross margins of cattle production through understanding the interactions between fire, trees and grass production. This has been done in collaboration with Steven Bray and Bill Holmes from QLD Department of Primary Industry and Fisheries.

(iv) Dynamics of terrestrial carbon stocks and greenhouse gas emissions

Contacts: Dick Williams and Garry Cook

Ecosystem-based greenhouse gas abatement enterprises are likely to become increasingly important due to carbon-constraints on 21st century economies. The tropical savannas of northern Australia will become increasingly important in the emerging carbon economy, as they are both sources of greenhouse gases because of extensive fires (savanna burning accounts for 3 per cent of Australia's anthropogenic greenhouse gas emissions), and potential sinks for carbon. Present indications are that the mesic (high rainfall) savannas are net carbon sinks, even if burnt frequently. To maximise the sink potential, we need more knowledge of the long-term potential sink strength, and how sensitive this is to land use. We are working on these questions in project partnerships with the Tropical Savanna CRC, the Bushfires Council of the NT, and the Australian Greenhouse Office.

Savanna greenhouse gas emissions can be reduced by decreasing fire frequency, but significant gaps in knowledge of fuel dynamics contribute to large uncertainties in emissions estimates. With funding from the Australian Greenhouse Office, we are collaborating with the NT Bushfires Council and Aboriginal traditional owners in Arnhem Land on the Arnhem Land Fire Abatement (ALFA) project, which aims to improve the

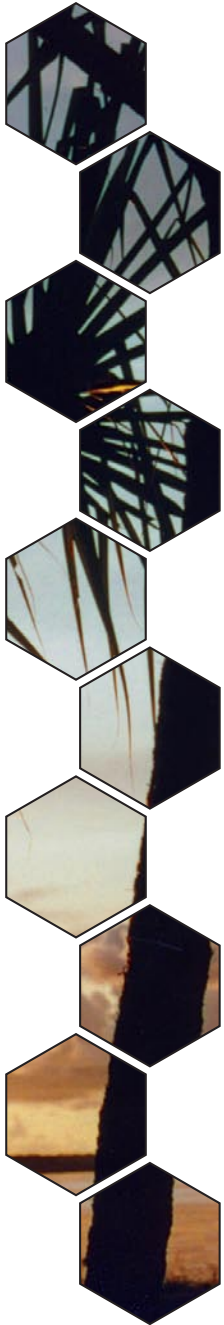
estimates of greenhouse gas emissions from savanna burning. Our role is to improve the understanding of fuel dynamics and the ability to manage greenhouse gas emissions by manipulating fire frequency.



Achievements in 2005

- Estimation of amounts of coarse woody debris at several sites in the Darwin region; estimates range from about 3 to 6 tonnes per hectare, with significant within and between site variation in both the amount present, and the proportion consumed by fire.
- Refinement of estimates of the carbon sequestration potential of the mesic savannas, with four methods providing consistent results - about one tonne of carbon per hectare per year fixed over and above carbon released to the atmosphere by respiration and fire.
- Publication of a Special Issue of the *Australian Journal of Botany* (December 2005) devoted to carbon accounting and land management in savannas, with Dr Williams as managing editor. These results were summarised in a paper presented to the international Greenhouse 2005 Conference in November 2005.
- Completion of three field trips to sample fuel loads as part of the ALFA project





(iv) Soil macroinvertebrates and soil health

Contact: Tracy Dawes-Gromadzki

Soil macroinvertebrates such as termites and earthworms recycle nutrients and carbon in soils, and their activities increase soil porosity critical to the infiltration of water. These processes are vital to sustaining production and biodiversity in tropical savannas. Grazing by cattle and fire can significantly alter macroinvertebrate activity, and consequently change landscape processes and therefore the health of the environment. Understanding the effect of land management on the relationships between soil macroinvertebrates and landscape processes will help develop ways to improve the resilience of healthy systems and hasten the recovery of degraded systems. The Tropical Savannas CRC 'Soil Health in Savannas' and the CSIRO Water for a Healthy Country Grazing Lands Program 'Healthy Soils, Healthy Water' projects led by Tracy Dawes-Gromadzki aim to do this. The research team for both projects comprises Tracy Dawes-Gromadzki, Garry Cook, Gus Wanganeen, Adam Liedloff and Austin Brandis (CSIRO, Darwin) and external collaborators Peter O'Reagain (QDPIF, Charters Towers) and Sue Berthelsen (CSIRO, Townsville).

In 2005 the 'Soil Health in Savannas' CRC project focused on the integration of previously collected biophysical data on the effects of cattle grazing on soil health; and the incorporation of this knowledge into the *Savanna.au* simulation model so that the effects of different grazing management scenarios on soil health can be predicted. The 'Healthy Soils, Healthy

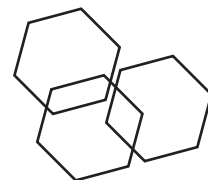
Water' project has focussed on (i) understanding the effects of different stocking rates and perennial vegetation patches on soil ecohydrological processes through changes in soil macroporosity and macroinvertebrate activity; and (ii) the development of indicators that are sensitive to changes in soil health. Both projects are based at the Wambiana Grazing Trial near Charters Towers, Qld (QDPIF, MLA).



Tracy Dawes-Gromadzki sampling wood-feeding termites.

To date, major findings include:

1. Management of grazing pressure through light stocking can substantially increase the proportion of rainfall captured and utilized for pasture growth at fine (cm^2 – hectare) scales
2. Simple indices of macroinvertebrate activity and macropore density may predict the proportion of rainfall captured by small landscape patches
3. Rainfall capture varies across different landscape patches, with carissa/tree patches having the highest macroinvertebrate activity, highest macropore density and greatest capture of rainfall and overland flow.



4. Intense grazing reduced rainfall capture in all landscape patch types, in particular grass and bare patches.

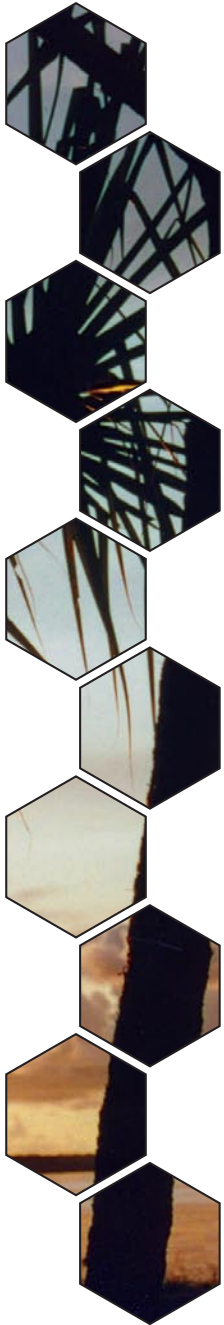
Achievements in 2005

- Completion of three field trips for instrumentation of paddocks and collection of data.
- Development and installation of an automated soil water measurement system in paddocks of different stocking pressures for assessment of grazing impacts on soil ecohydrological function.
- Completion of 2004/05 wet season measurements of patch functionality (e.g. macroinvertebrate activity, macropore density, volumetric soil water content) for different vegetation patch types and stocking rates.
- Collection of climate and soils data for parameterisation of *Savanna.au* and production of Digital Elevation Model for selected paddocks for the ecohydrological *Savanna.au* sub-model
- Preliminary development of algorithms for determination of the effects of grazing on the ability of soils to capture and retain rainfall and runoff water, for input into hydrological models.
- Delivery of research findings about grazing intensity impacts on soil water dynamics and soil health to producers as part of producer (e.g. Queensland Rural Adjustment Authority, Lower Cape Landcare Group, Wambiana Grazier Advisory Committee) visits to the research site and stakeholder workshops (e.g. 'Ecological Principles of Sustainable Land Management' Rural Bankers Forum, Charters Towers) throughout 2005.

- Completion of 2004/05 wet season termite bait assessments and direct search sampling to investigate the effects of fire frequency and seasonal timing on termite community structure.
- Measurement of soil water infiltration and sampled soil macroinvertebrate assemblages across different perennial vegetation patches, to examine the effects of patch type and seasonal timing of fire on soil biota and soil function.
- Documentation of the role of soil macroinvertebrates in dry season litter decomposition across different patch types and burning regimes, and installation of litter bags for wet season assessments.
- Publication of four papers in scientific journals and presentation of papers at international and national conferences.



Austin Brandis installing a soil moisture measurement probe.



(v) Global ecology of ant communities

Contacts: Alan Andersen and Kate Parr

Ants are a dominant faunal group in Australian savannas, contributing up to 30% of total faunal biomass. They play key roles in relation to nutrient cycling, energy flow, and vegetation dynamics. We are developing a predictive understanding of ant productivity, behavioural dominance and community dynamics at biogeographical scales, based on the recognition of functional groups that vary predictably in relation to environmental stress and disturbance.

Achievements in 2005

- Publication in *American Naturalist* of paper on behavioural dominance in ant communities.
- Supervision by Dr Parr of MSc student working on the biogeography and ecology of ants of Purnululu National Park in Western Australia.
- Completion of a draft manuscript on contrasting fire-related resilience of ecological dominant ants in northern Australia.



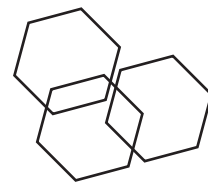
Savanna strobe ant (*opisthopsis* sp.)
Photo: Alex Wild.

2. Savanna ecosystem management

We strive to have our research effectively applied to land management. Our focus is on fire and grazing, as these are the most extensive land management practices across Australia's savannas. We are particularly interested in the development and application of indicators of ecosystem health, incorporating both ecosystem function and biodiversity, at multiple spatial scales. Another important element is understanding the impact of more intensive use of savanna landscapes for productive purposes, and identifying guidelines for achieving sustainable development.

Key questions

- What are sustainable fire management systems?
- How can grazing be intensified while maintaining ecosystem health?
- How are invertebrate bioindicators most effectively applied to land management?
- What are the ecological impacts of pest ants, and how can they be effectively managed?



(i) Aboriginal engagement in fire management

Contact: Alan Andersen

Landscape burning is fundamental to customary Aboriginal land management, serving a variety of cultural and spiritual needs. Although Aboriginal fire management has been severely disrupted following European settlement, it remains an important part of Aboriginal life in many parts of northern Australia; much of the traditional knowledge has been retained, and can be re-applied to landscape management. Through the Bushfire CRC we have been working with a family of traditional owners in Kakadu National Park to examine the biodiversity and cultural benefits of Aboriginal fire management as it is re-applied to floodplains associated with the South Alligator River. Past decades of lack of fire management have witnessed major vegetation change on these Ramsar-listed floodplains, resulting in vast monocultures of dense grass. This has caused a dramatic reduction in biodiversity, severely diminishing the availability of traditional food resources (such as turtles, water fowl and water lilies) that have remained a vital component of the regional Aboriginal economy. The re-application of traditional fire management dramatically enhances biodiversity and the cultural values of these wetlands for Aboriginal people.

Achievements in 2005

- Boggy Plain wetland burning project was a Finalist in the Tropical Knowledge Innovation category at the inaugural NT Research & Innovation awards in May.
- Production of Aboriginal wetland burning DVD and booklet.

- Extension of Aboriginal wetland burning to Yellow Waters in Kakadu National Park.
- Establishment of a partnership with NT Parks, NT Fire and Emergency Services, and Larrakia Nation for joint fire management at Charles Darwin National Park and surrounding land.

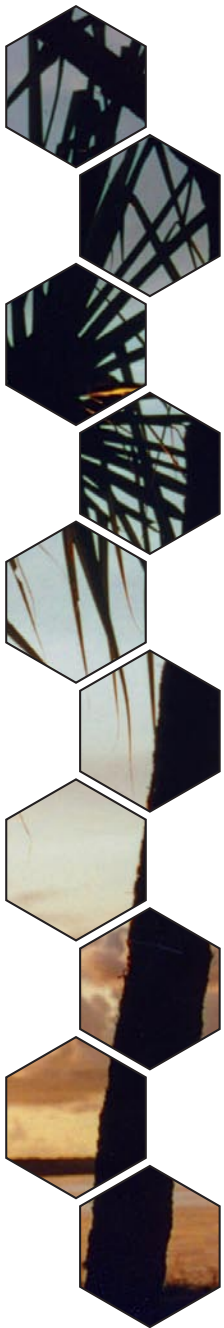
(ii) Sustainable grazing management

Contact: Leigh Hunt

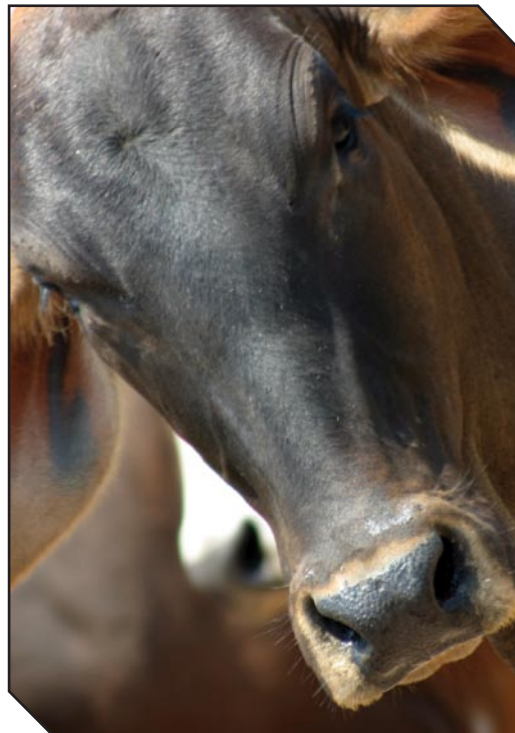
Many beef properties in northern Australia wish to develop their operations to improve productivity in response to increasing cost-price pressures. The challenge is to increase productivity without adverse environmental effects. To address these challenges, the pastoral company Heytesbury Beef is supporting an ambitious research and development program on its property 'Pigeon Hole' in the Victoria River District of the Northern Territory. The research will guide property developments with soundly based information on how to balance increased productivity through more efficient utilisation of pastures, with good natural resource management to achieve sustainability in the northern grazing industry.

Achievements in 2005

- Identification of initial effects of experimental grazing treatments on pasture variables. Expected trends in pasture yield and cover were obtained in relation to variation in utilisation rates, but results for the paddock size and water point configuration treatments are not yet clear. Consistent treatment effects are yet to flow through to animal production.



- Improvement of the reliability of cattle collars containing global positioning systems. These are now producing important insights into the extent and nature of landscape use by cattle. An initial finding is that favoured parts of the landscape are still preferentially grazed despite infrastructure development (increased number of water points and reduced paddock size).
- Attendance by approximately 160 people at a very successful field day held at the study site in August 2005, with considerable interest being shown by pastoralists and state agency staff from across northern Australia.
- Appointment of PhD student Andrew White to work on improved grazing systems for tropical savannas.



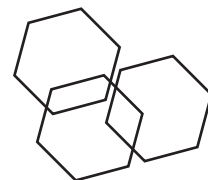
(iii) Indicators of ecosystem health

Contacts: Alan Andersen, Tracy Dawes-Gromadzki and John Ludwig

Indicators of ecosystem health are required at multiple scales. At local scales, our focus is on invertebrates, as they are dominant components of biodiversity, and mediate many key ecological processes - if invertebrate assemblages are in good shape then this is likely to indicate good ecosystem health. We are documenting the responses of key invertebrate groups (particularly ants and termites) to land-use, examining the extent to which these responses reflect broader ecological change, and developing protocols for the most efficient use of invertebrate indicators in land management. At larger spatial scales our focus is on landscape patches that act to conserve scarce resources (see Section 1(ii) on page 6).

Achievements in 2005

- Development of a new landscape metric of savanna health, which indicates the potential of savannas to retain rather than 'leak' soil resources. This new index applies to landscapes with complex terrain and is based on remotely-sensed vegetation cover and elevation data. The work involves collaboration between John Ludwig, Robert Eager and Adam Liedloff, and Alice Springs CSIRO colleagues Gary Bastin and Vanessa Chewing.
- Development by Adam Liedloff of a windows application for calculating the CDLI (Cover based Directional Leakiness Index) from remote sensed imagery and digital elevation maps.



- Award to Alan Andersen of Visiting Professor by the Brazilian Council for Scientific and Technological Development, to lecture on ants as indicators in land management at Universidade Federal Rural do Rio de Janeiro, and to present a paper at the Association for Tropical Biology and Conservation 2005 conference in Brazil.
- Completion of study of the effectiveness of habitat surrogates for monitoring biodiversity (incorporating ants) in Kruger National Park, South Africa, in collaboration with Alaric Fisher from NT Department of Natural Resources, Environment and the Arts and Kruger staff.

(iv) Pest ants

Contact: Ben Hoffmann

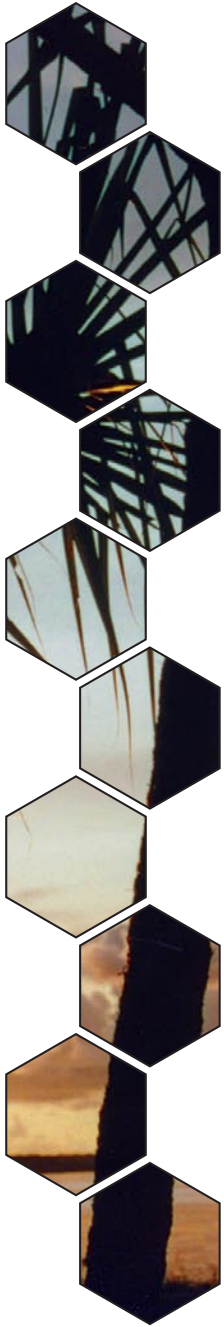
Some of the world's most destructive exotic pests are ants, and several of these have become established in northern Australia. Our research aims to document the impacts of these ants on biodiversity and ecological function, and to develop effective management strategies. In 2002, CSIRO and Parks Australia eradicated African Big-headed ant (*Pheidole megacephala*) and Tropical Fire ant (*Solenopsis geminata*) from Kakadu National Park. CSIRO is now collaborating with many local and regional organisations to effectively manage other invasive ant incursions, especially on Indigenous lands.

Achievements in 2005

- Eradication of African big headed ant from Milikapiti, Melville Island, in collaboration with the Tiwi Land Council.
- Treatment of 81 sites containing Yellow crazy ant in north-east Arnhem Land, in collaboration with Dhimurru Land Management Aboriginal Corporation and Alcan.
- Establishment of ecological impact studies for Yellow crazy ant in north-east Arnhem land.
- Completion of scoping studies for proposed African big headed ant eradications in Daly River, Ngukurr, Tryon Island (Capricornia Cays) and Lord Howe Island, in collaboration with local community and land management organisations.
- Completion of product efficacy studies for Sumitomo and DuPont chemical companies.
- Participation in workshop for the development of the national Tramp Ant Threat Abatement Plan



Ben Hoffmann assisting with African big-headed ant control on Lord Howe Island. Photo: S. Thompson.



(v) Simulation modelling

Contacts: Adam Liedloff and Garry Cook

Information on climate, land-use and landscape change needs to be integrated over multiple spatial scales and long time frames to provide guidelines for sustainable management. We are using simulation modelling to explore landscape change in relation to climatic fluctuations and land-use. This work aims to predict the resilience of different landscape units in relation to land-use, and to explore the relationships between fire, grazing, tree density and grass production, thereby providing options for sustainable management.

Achievements in 2005

- Use of the *Savanna.au* model to investigate the impacts of spatial arrangement of cover on runoff volumes and sediment loads on grazed hill slopes around Charters Towers, in collaboration with CSIRO Land and Water
- Use of the *Flames* model to investigate the structural dynamics of tree populations in Queensland, in collaboration with Queensland Department of Primary Industries and Fisheries.
- Development of a course woody debris simulation model, to investigate how effectively various sampling methods estimate fallen wooden material in the topical savannas, based on field data collected in the carbon dynamics project.

- Presentation at the 2005 International Congress on Modelling and Simulation of the paper ‘Advances and Applications for Management and Decision Making’, which uses *Savanna.au* to examine the trade-off between using models for prediction versus as exploratory tools.

3. People in savanna landscapes

Options for sustainable economic development in northern Australia are currently being explored by governments at all levels, in the context of growing demand for development pathways that match local ecosystems, values and conditions, and that do not compromise future opportunities and values. There is a particular commitment to meeting the needs and aspirations of the significant and growing Indigenous population. Much of the savanna region is Aboriginal land, and a very large proportion of its population is Aboriginal. There is widespread recognition that many Aboriginal communities have been poorly engaged in natural resource management and regional development.

We are committed to improving the effectiveness with which we engage Aboriginal people in our research. In 2005 we secured CSIRO funding to build a dedicated Aboriginal engagement centre at the Darwin site, and Peter Christophersen, Sue Jackson and Bev Sithole represented CSIRO at the Global Research Alliance and World Bank inaugural workshop on Indigenous Ecological Knowledge, held in Johannesburg, South Africa.



Dr Bev Sithole CSIRO, Dr Anna Chaze from Cliff Block Bombo Hospital in Tanzania, Dr Sue Jackson CSIRO and Peter Christophersen CSIRO at the International Indigenous Knowledge workshop in South Africa.

Achievements in 2005

- Completion of Land & Water Australia Scoping Study of Indigenous interests in tropical rivers on behalf of the North Australian Indigenous Land and Sea Management Alliance (NAILSMA).
- Commencement of a desk-top research and field consultation project on the social and economic values of Australia's tropical rivers, funded by Land & Water Australia.
- Production and dissemination of a flyer describing ecosystem services, as part of a project examining the relationships between ecosystem services in the Daly River region and their value to economic and social activities. Preliminary discussions held with regional stakeholders.
- Ongoing field research with language groups from the Daly River region to explore the relationship between certain Indigenous values and river flows.
- Employment of Ms Mona Liddy from the Wagiman language group, to conduct oral history interviews with traditional owners from the Daly River region. This work aims to improve the general understanding of the significance of the river system to the lives of traditional owners.
- Publication of papers in *Australasian Journal of Environmental Management* and *Australian Geographer* that critically analyse the use of the term cultural values in water resource planning.

Key questions

- What are the full range of social, cultural and economic values of land and water?
- How can these values be effectively incorporated into land management and regional development?
- What are the most effective models for Aboriginal community-based natural resource management?
- How can Aboriginal communities most effectively participate in regional planning and development?

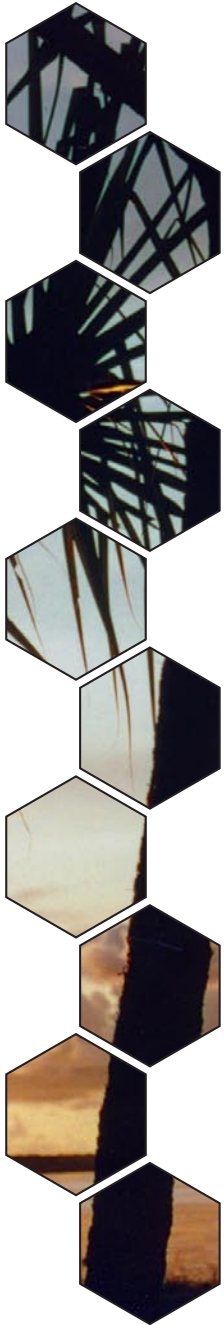
(i) Social and economic values

Contacts: Sue Jackson and Anna Straton

Northern Australian landscapes provide a wide range of uses and benefits that are valued by people, and this full set of values needs to be incorporated into natural resource management. The values held by Aboriginal people, and the uses and benefits of Aboriginal land to the wider Australian community, are particularly important in northern Australia. Our research in this area focuses on tropical rivers, covering (1) the identification and understanding of the full set of values held for tropical rivers and landscapes, and (2) the effective incorporation of these values into environmental decision-making.



Ladies from the Daly River region discussing catchment planning. Photo: Todd Condie.



(ii) Community-based natural resource management

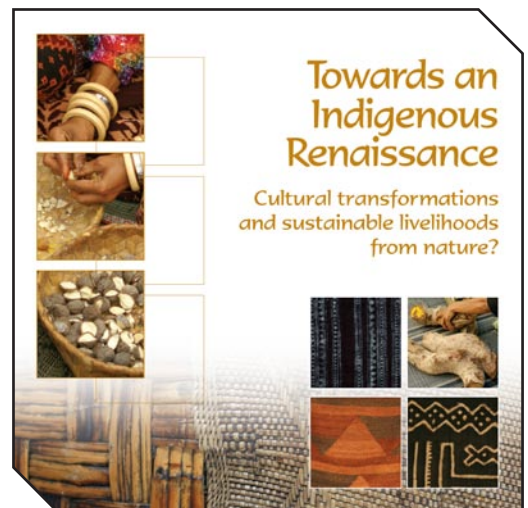
Contact: *Bev Sithole*

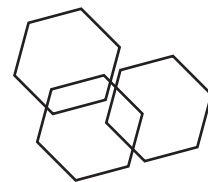
Governments are increasingly recognising that Aboriginal people are best-placed to deliver sustainable environmental and livelihood outcomes in remote northern Australia. There is potentially high compatibility between Aboriginal people's aspirations to manage their country, and the public policy drives to maintain healthy landscapes and improve Indigenous well-being. In the NT, a variety of Aboriginal community-based NRM (CBNRM) models are being developed and applied, but their performance has not been critically assessed. There is a pressing demand to develop an effective framework for Aboriginal NRM, drawing on international experience but well-matched to the circumstances of remote Aboriginal communities in northern Australia.

Achievements in 2005

- Secured funding from the NT Department of Planning and Infrastructure on *a review of Aboriginal community based natural resource management in the NT: lessons learnt and a way forward.*
- Secured funding from NAILSMA to develop *a performance assessment and monitoring plan (PAMP)* for their turtle and dugong project.

- In collaboration with School for Environmental Research, Charles Darwin University and Museum and Art Gallery of the Northern Territory, organized a highly successful exhibition and forum series entitled *'Towards an Indigenous Renaissance – Cultural transformations and sustainable livelihoods from nature?'*
- Established a multidisciplinary Indigenous research group (Donna Jackson, Lorraine Williams, Hmalan Hunter-Xenie, and Jonnie Saegenschmitter) to work on various community-based natural resource management projects.





(iii) Institutional arrangements for regional development

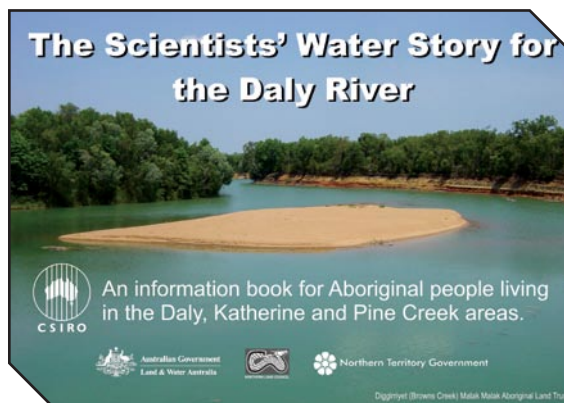
Contact: Anna Straton and Sue Jackson

There is now broad consensus that local participation is a prerequisite of sustainable land management and regional development, and the NT Government has expressed a desire to involve local communities in planning and decision-making. There is a strong interest in developing institutional and governance arrangements that facilitate effective community participation and empowerment.

Achievements in 2005

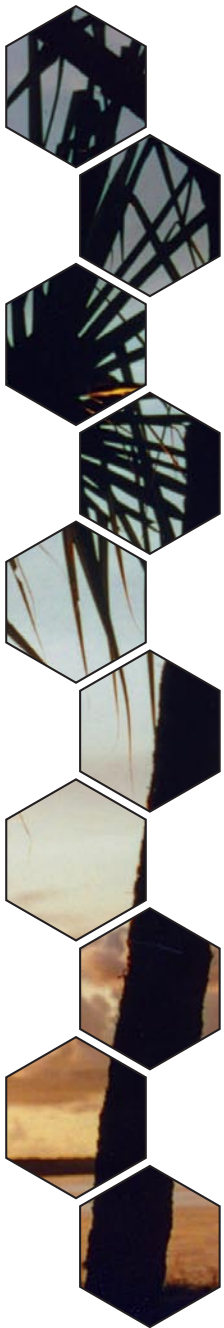
- Commencement of a research project to document traditional knowledge of fish and river flows in the Daly River with researchers from Charles Darwin University, Griffith University and the Museum and Art Galleries of the NT. Participating communities include the Wagiman and Wardaman language groups whose knowledge will be documented alongside the collection of ecological knowledge about fish and their water requirements. The results will contribute to improved water allocation decisions, and transfer of traditional knowledge within and beyond the local Aboriginal communities.
- Provision of ongoing assistance to the Daly River Aboriginal Reference Group through attendance at quarterly meetings and research support.

- Production of a plain English picture book titled *The Scientists' Water Story* to assist Aboriginal people to understand the scientific basis for water decision-making and to assist them to more effectively participate in catchment planning processes.



- Presentation of a poster on communicating hydrological information across cultures at the International Hydrogeologists Conference in May in Darwin.
- Partnership created with NT Horticultural Association, NT Agricultural Association, NT Department of Primary Industries, Fisheries and Mines, and the NT Department of Natural Resources, Environment and the Arts to undertake research on the potential impacts of a water market on economic, social and environmental conditions in Katherine and the Daly River region. This is part of the Outback Institutions project, led by CSIRO Resource Futures and funded by CSIRO Socio-Economic Integration, and the Tropical Savannas and Desert Knowledge CRCs.





CONSULTANCIES

Biodiversity monitoring in the rangelands

Aim

To demonstrate, through the use of case studies, effective approaches to the development of a biodiversity monitoring program.

Client

Federal Department of Environment and Heritage

CSIRO Officer

Dr Hunt

Assessment of social and economic values of Australia's tropical rivers

Aim

To develop an integrated social and economic profile of the tropical rivers region, identify important social and economic values and issues relevant to rivers, explain significant processes and pressure points that will impact on future management, scope future research needs and priorities, and recommend questions and approaches for further research and development.

Client

Land & Water Australia

CSIRO Officers

Drs Straton & Jackson



Outback Institutions

Aim

To analyse the institutions that guide and govern use of water in outback regions using the Institutional Analysis and Development framework developed by Elinor Ostrom, evaluate the usefulness of the framework in the outback context, and design and evaluate institutional arrangements that can achieve social objectives for water use.

Client

Tropical Savannas CRC, Desert Knowledge CRC, CSIRO Social and Economic Integration

CSIRO Officer

Dr Straton

Indigenous interests in Tropical Rivers: a scoping study

Aim

To determine northern Australian Indigenous peoples' interests in, and aspirations for, river use and management, inform northern Australian Indigenous representative organizations, and through them, Aboriginal communities, about the Tropical Rivers Program and its research themes, to scope out Indigenous people's research issues, identify research questions and determine research priorities.

Client

North Australian Indigenous Land and Sea Management Alliance

CSIRO Officer

Dr Jackson

Ant monitoring at Callide Mine, Queensland

Aim

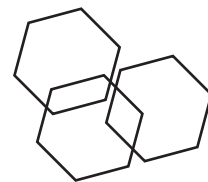
To use ants as indicators of progress in mine site rehabilitation.

Client

Callide Mine

CSIRO Officers

Drs Hoffmann & Andersen



Palatability and efficacy of DuPont Advion Fire ant bait

Aim

To assess the effectiveness of a new product for the control of African big-headed ant and Tropical fire ant.

Client

DuPont Chemical Company

CSIRO Officer

Dr Hoffmann

Controlling invasive pest ants in northern Australia

Aim

To assess the effectiveness of a range of products for control of African big-headed ant, Tropical fire ant and Yellow crazy ant.

Client

Sumitomo Chemical Company

CSIRO Officer

Dr Hoffmann



Participatory evaluation of the Aboriginal land and sea management programs in the Top End of the Northern Territory

Aim

To assess the viability of different land and sea management systems, particularly the ranger programs.

Client

CSIRO, NT Research and Innovation Fund, Northern Land Council, Charles Darwin University

CSIRO Officer

Dr Sithole

A review of Aboriginal community based natural resource management in the NT: lessons learnt and a way forward

Aim

Evaluating the performance of NRM in Aboriginal communities

Client

NT Department of Planning and Infrastructure

CSIRO Officer

Dr Sithole

Dugong and marine turtle management performance assessment and monitoring plan

Aim

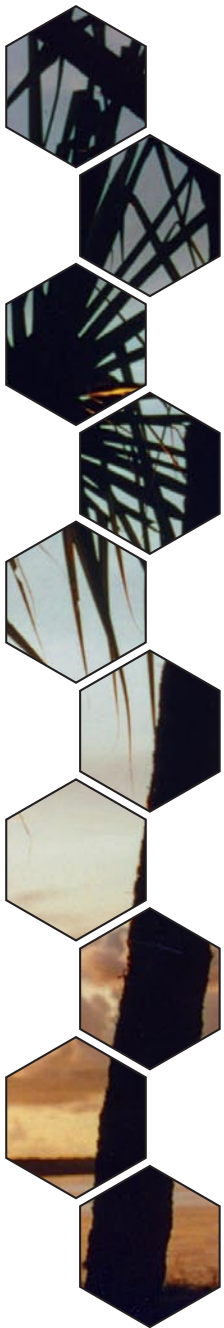
To develop a performance assessment and monitoring plan (PAMP)

Client

North Australian Indigenous Land and Sea Management Alliance

CSIRO Officer

Dr Sithole



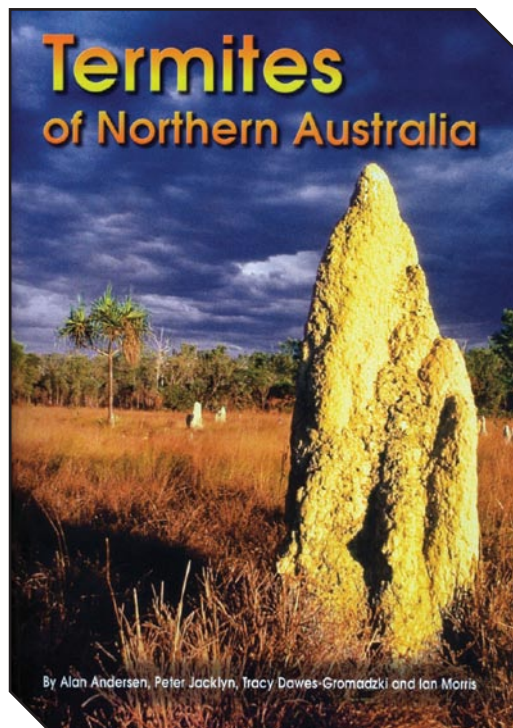
PUBLIC EVENTS

Book Launches

Termites of Northern Australia

In May, *Termites of Northern Australia* by Alan Andersen (CSIRO), Peter Jacklyn (Tropical Savannas CRC), Tracy Dawes-Gromadzki (CSIRO and Tropical Savannas CRC) and Ian Morris (naturalist) was launched in Darwin by His Honour, Ted Egan, Administrator of the Northern Territory.

Termites of Northern Australia is aimed at the many thousands of people – tourists, students, amateur naturalists and researchers, who visit the north and are fascinated by termites. The book covers termite societies and their role in ecosystems, and outlines the species of termites most likely to be encountered and recognised. The book also discusses some of the Aboriginal uses of termites.



Project Launches

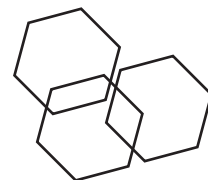
Aboriginal wetland burning in Kakadu

In June a new phase of the Bushfire CRC Aboriginal wetland burning project in Kakadu was celebrated in Darwin. More than 60 people gathered to hear how traditional ecological knowledge has been used to enhance biodiversity and the cultural values of Ramsar-listed wetlands on the floodplain of the South Alligator River in Kakadu National Park.

Kakadu traditional owner Violet Lawson, her daughter Sandra McGregor, and son-in-law Peter Christophersen (both CSIRO Sustainable Ecosystems staff), are re-establishing Aboriginal fire management at Boggy Plain in partnership with Parks Australia, the Environmental Research Institute of the Supervising Scientist, CSIRO and the Bushfire CRC. At the June ceremony all parties involved signed a MOU in Darwin securing the future of the project until 2008. The family has:

- transformed the wetlands from a dense monoculture of grass to a mosaic of habitats that is rich in biodiversity.
- improved its cultural values for Aboriginal people through increased availability of food resources.
- demonstrated the value of applying traditional ecological knowledge in partnership with western science.
- facilitated the transfer of traditional knowledge to younger generations.

The project is an outstanding example of joint management in a World Heritage National Park, and serves as



an internationally significant model for the effective engagement of Indigenous people in natural resource management. A short DVD of the project has been produced by CSIRO Sustainable Ecosystems and CSIRO Publishing.



Sandra McGregor and Peter Christopherson with their children. *Photo: Randy Larcombe*

National Science Week

Top End Science Fair

CSIRO in Darwin hosted the Top End Science Fair in August, as part of National Science Week. CSIRO staff presented a display on the importance of soil health in Top End ecosystems. Over three days, more than 25% of Darwin's primary school students participated in interactive sessions where they learnt about the importance of macroinvertebrates, such as termites, for soil health.



Gus Wanganeen and Tracy Dawes-Gromadzki at the Top End Science fair.

Field Days

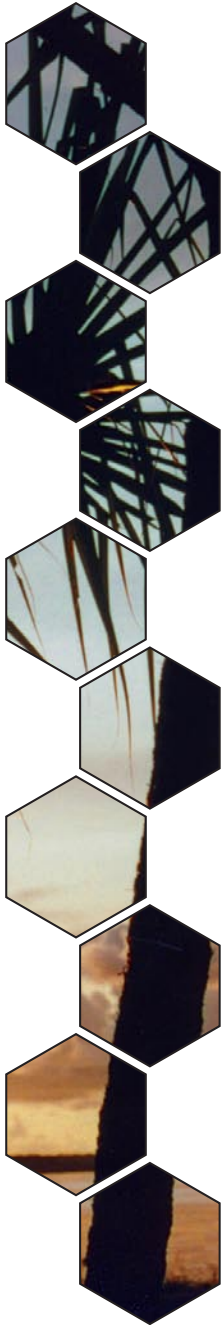
Sustainable Pastoralism

In August, a field day focussing on boosting profits from pastoralism without damaging the environment was held at Pigeon Hole Station in the Victoria River Downs district of the Northern Territory. More than 160 people attended the first major field day for the Pigeon Hole Project. This ambitious grazing and biodiversity research project, which is costing seven million dollars and involves nearly 40 thousand hectares of rangeland, is a collaboration between Heytesbury Beef, Meat and Livestock Australia, CSIRO and the NT Government. The overall aim of the project is to assess ways of improving the productivity of extensive cattle enterprises in the northern tropical savannas whilst maintaining (and potentially enhancing) land condition and biodiversity.

A number of dignitaries attended, including Mrs Janet Holmes a Court (Chairman of the Heytesbury Group, which own Pigeon Hole Station), The Hon. Kon Vatskalis (NT Minister of Primary Industry, Fisheries and Mines) and Mark Spurr (Managing Director of Meat and Livestock Australia). Presentations were given on each of the components of the project, including research on managing grazing distribution across the landscape, improved grazing systems, optimum rates of



Janet Holmes a Court, Chairman of the Heytesbury Group, welcoming guests to the Pigeon Hole Station Field Day.



pasture utilisation, the conservation of biodiversity, and the development of telemetry tools for improving the efficiency of management. Dr Leigh Hunt from CSIRO in Darwin presented results from the use of GPS collars on cattle to better understand grazing distribution.

Forums & Exhibitions

TERC Forums

To celebrate 20 continuous years of the Darwin Seminar Series a series of forums was held during 2005. Topics included Landscape ecology, People in the landscape, Biodiversity conservation, Fire ecology and management, Invasive grasses, Sustainable pastoralism, and Tropical Horticulture. Three speakers presented at each forum; one providing a historical perspective, one a future perspective and the third a policy perspective. Organisations represented in the series included CSIRO, Charles Darwin University, Heytesbury Beef, and the NT Government.

Towards an Indigenous Renaissance. Cultural transformations and sustainable livelihoods from nature?

In November, CSIRO and Charles Darwin University co-hosted an exhibition and forum series entitled *Towards an Indigenous Renaissance. Cultural transformations and sustainable livelihoods from nature?* The exhibition was made up of textiles and woven fibre forms from Africa, Southeast Asia and northern Australia, while the two forums focussed on Indigenous livelihoods based on nature, culture and traditional practices.

The exhibition and forum series were officially launched on November 16,

2005 by the NT Minister for Natural Resources, Environment and the Arts, the Hon Marion Scrymgour MLA. Ms Scrymgour said the issue of how to facilitate sustainable livelihoods among Indigenous communities was very topical in the Northern Territory, and a concern for governments in many countries.

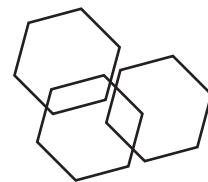


Dr Bevlyne Sithole (left) with the NT Minister for Natural Resources, Environment and the Arts, the Hon Marion Scrymgour.

CSIRO Alumni in Darwin

In September, CSIRO Chief Executive Dr Geoff Garrett hosted a function at TERC to launch CSIRO Alumni in Darwin. The main purposes of CSIRO Alumni are to:

- create Australia's largest network of science, experience and counsel
- address issues and opportunities
- develop partnerships with industry, government and research organisations
- draw on the skills, contacts and resources of former CSIRO staff to assist CSIRO in achieving its goals
- provide mentors in science, commercialisation, management and other fields
- establish networks to help current and former CSIRO staff make or retain contact with one another, and with CSIRO's activities.

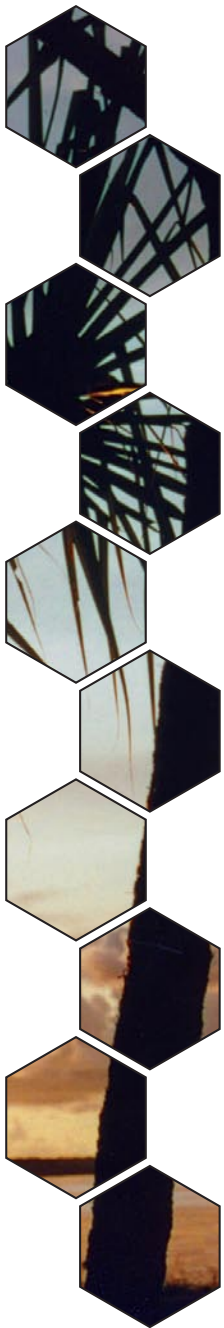


COMMUNICATION

Media

1. Summary of radio coverage of CSIRO Tropical Savannas research in 2005.

Date	CSIRO Officer	Topic	Radio Station
January 14	Dr Straton	Valuing the Daly River region	ABC Darwin Morning show
January 19	Dr Hoffmann	Pest ants in houses	4BC
January 17	Dr Cook	Gamba grass in the NT	ABC Country Hour
January 18	Dr Cook	Soil macroinvertebrates and their role in soil health	ABC Country Hour
March 2	Dr Andersen	African wildlife	ABC Breakfast Show
April 4	Dr Hoffmann	Tiwi Island pest ant control	ABC Canberra
April 12	Dr Hunt	Pigeon Hole pastoral sustainability project update	ABC Country Hour
April 21	Dr Andersen	CSIRO Darwin participation in an international research meeting at Kruger NP, South Africa	ABC Country Hour
April 21	Dr Jackson	People in the Landscape – CSIRO Forum	Top FM Morning Show
April 29	Dr Cook	Gamba grass workshop	ABC Radio
May 25	Dr Andersen	<i>Termites of Northern Australia</i> book launch	ABC Morning Show
May 25	Dr Andersen	<i>Termites of Northern Australia</i> book launch	Top FM Morning Show
May 25	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC Country Hour NT
May 25	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC National Rural News
May 25	Dr Williams	Cattle grazing in the Victorian alps	ABC Country Hour VIC
May 26	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC Radio National Bush Telegraph
May 26	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC National Regional Radio
May 30	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC Regional Radio WA
June 4	Dr Dawes-Gromadzki	The role of termites in soil health and <i>Termites of Northern Australia</i> book launch	ABC Country Breakfast – Radio National

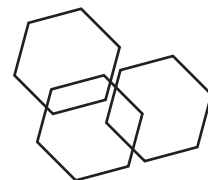


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Date	CSIRO Officer	Topic	Radio Station
June 17	Mr Christophersen	Aboriginal wetland burning in Kakadu	ABC Radio News
June 21	Dr Hunt	NT Workshops on grazing management in July	8HA Alice Springs
August 10	Dr Hunt	Pigeon Hole Field Day – pastoral sustainability	ABC Country Hour
August 17	CSIRO	Pigeon Hole Field Day – pastoral sustainability	ABC Radio National - The Bush Telegraph
August 23	CSIRO	Pigeon Hole Project	ABC Country Hour SA
September 12	Dr Andersen	Fire ecology and management in the Top End	ABC Afternoon Program, Darwin
November 7	Dr Dawes-Gromadzki	Termites of the Top End	ABC Afternoon Program, Darwin
November 16	Dr Sithole	Towards an Indigenous renaissance – exhibition and forums	ABC News
November 30	Dr Andersen	Ant biodiversity	ABC Country Hour
December 1	Dr Jackson	Social and economic values of rivers	ABC Mt Isa
December 6	Dr Cook	Invasive grasses in the NT	ABC Afternoon Program, Darwin
December 9	Dr Andersen	Pest ants in northern Australia	ABC Karratha WA
December 12	Mr Christophersen	Aboriginal wetland burning in Kakadu	ABC Afternoon Program, Darwin
December 13	Dr Andersen	Pest ants in northern Australia	ABC Morning Show, Darwin

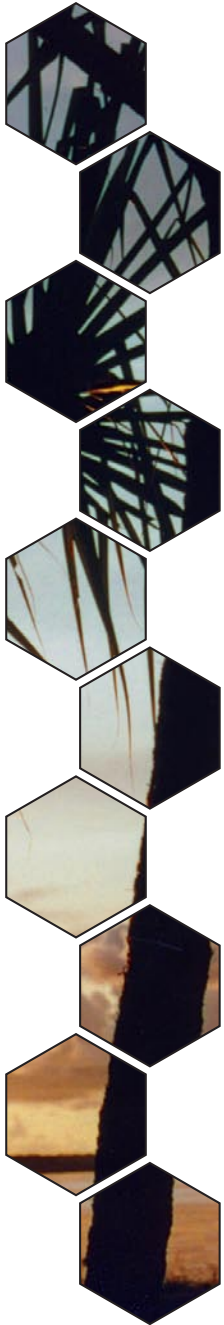
2. Summary of television coverage of CSIRO Tropical Savannas research in 2005.

Date	CSIRO Officer	Topic	Program
February 17	Dr Dawes-Gromadzki	Cathedral termite mounds in northern Australia	Discovery Channel UK
June 17	Mr Christophersen	Aboriginal wetland burning in Kakadu	SBS 6.00 pm news
June 17	Mr Christophersen	Aboriginal wetland burning in Kakadu	SBS 9.30 pm news
September 4	Dr Hunt	Sustainable pastoralism – Pigeon Hole Project	ABC Landline
November 18	Dr Andersen	Fire management in northern Australia	SBS



3. Summary of print coverage of CSIRO Tropical Savannas research in 2005.

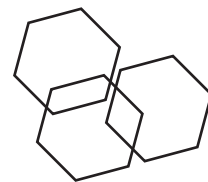
Date	CSIRO Officer	Topic	Publication
February 7	Dr Williams	Alpine grazing and fire management	<i>Border Mail</i>
February 16	Dr Cook	Gamba grass in northern Australia	<i>Darwin Sun</i>
April – June issue	Dr Hoffmann	Pest ants on the Tiwi Islands	<i>Australian Geographic</i>
March 2	Dr Dawes-Gromadzki	Termite ecology	<i>Darwin Sun</i>
May 25	Dr Andersen	Termites of Northern Australia book launch	<i>NT News</i>
Jan – June issue	Dr Andersen	Termites of Northern Australia book	<i>Savanna Links</i>
May 26	Dr Williams	Alpine grazing banned	<i>Stock and Land</i>
May 30	Dr Hoffmann	Yellow crazy ants in Hervey Bay QLD	<i>Fraser Coast Chronicle</i>
June 1	Dr Williams	Alpine grazing / ski resorts	<i>The Weekly Times</i>
June 4	CSIRO	Alpine grazing	<i>Border Mail</i>
June 8	Dr Hoffmann	Yellow Crazy ant eradication	<i>Arafura Times</i>
June issue	Dr Hoffmann	African Big-headed ants in Aboriginal communities in the Daly River region	<i>Australian Landcare</i>
June 15	CSIRO	Alpine grazing	<i>Mansfield Courier</i>
June 29	Mr Christophersen	Aboriginal wetland burning in Kakadu	<i>Koori Mail</i>
August 2	CSIRO	Pigeon Hole Field Day	<i>Katherine Times</i>
August 8	Dr Hoffmann	Ant biodiversity	<i>Canberra Times</i>
August 12	CSIRO	Top End Science Fair	<i>NT News</i>
August 13	Dr Andersen	Profile of Alan Andersen – Innovator series in the Saturday NT News	<i>NT News</i>
August 18	Dr Hunt	Pigeon Hole Project	<i>North QLD Register</i>
August issue	Ms McGregor & Mr Christophersen	Aboriginal wetland burning in Kakadu	National Museum of Australia newsletter
October 6	CSIRO	Pigeon Hole Project	<i>North QLD Register</i>
October 6	CSIRO	Grazing intensification - Pigeon Hole Project	<i>North QLD Register</i>
November 12	CSIRO	Yellow Crazy ant project with Dhimurru	<i>NT News</i>
November 16	Dr Sithole	Towards an Indigenous Renaissance – exhibition and forum series	<i>National Indigenous Times</i>
November 19	Dr Sithole	Profile of Bev Sithole – Innovator series in the Saturday NT News	<i>NT News</i>



Conferences and Workshops

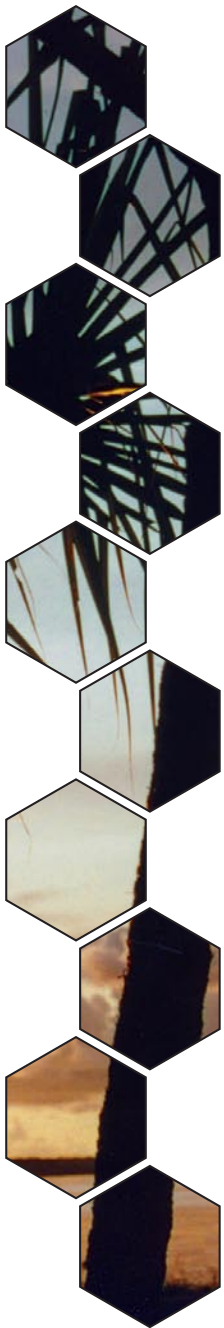
The following is a summary of workshops that CSIRO Sustainable Ecosystems staff from Darwin have participated in, and conferences at which staff have presented papers.

Date	CSIRO Officer	Conference/Workshop
February	Dr Hunt, Ludwig & Liedloff	Modelling animal distribution workshop, CSIRO, Townsville, QLD
February	Dr Straton	AARES 2005 Conference, Coffs Harbour, NSW
February	Drs Jackson & Sithole, Mr Christophersen	Global Scientific Forum, Indigenous Knowledge workshop, Johannesburg, South Africa
February	Dr Andersen	Desert Knowledge CRC Annual conference, Alice Springs, NT
February -March	Dr Straton	Outback Institutions project workshop, Undara, QLD
March	Dr Straton	Elinor Ostrom masterclass, Canberra, ACT
March	Dr Straton	CABM Conference, France
March	Dr Jackson	Applied Natures: Linking Cultural Studies of Nature and Environment to Policy and Practice, NSW
March	Drs Andersen & Parr	Bushfire CRC Program B workshop, Melbourne, VIC
April	Dr Straton	CSIRO Emerging Science workshop, Townsville, QLD
April	Dr Sithole	Joint management of NT parks and reserves, presentation to the NLC, DIPE Steering Committee on Joint Management, NT
April	Dr Sithole	Regional Katherine facilitators' Network meeting, Katherine, NT
April	Drs Jackson & Sithole	National Indigenous Land Management Conference, Ross River, NT
April	Drs Andersen & Parr	Kruger National Park scientific networking meeting, Skukuza, South Africa
April	Dr Ludwig	Fire Management Workshop, Mt Isa, QLD
May	Drs Jackson, Andersen, Cook & Sithole	CSIRO/ANU Indigenous Engagement Workshop, Canberra, ACT
May	Dr Jackson	Groundwater surface water interaction in the tropics
May	Dr Ludwig	Scaling our Science Workshop 2, Mission Beach, QLD
May	Dr Hoffmann	Qld Environment Protection Authority: African big-headed ants in the Capricornia Cays, QLD
June	Dr Sithole	Annual Aboriginal Women's land and sea management conference, Timber Creek, NT
June	Dr Williams	Fire and Biodiversity Conference, Albury, NSW
June	Dr Hunt	International Grassland Congress, Dublin, Ireland
June	Dr Straton	Desert Knowledge CRC CP1 workshop, Alice Springs, NT
June	Drs Andersen & Parr, Ms McKaige	Bushfire CRC Annual Workshop, Beechworth, VIC



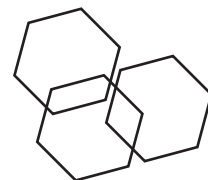
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June/July	Drs Hunt & Dawes-Gromadzki	XXth International Grasslands Congress, Glasgow, Scotland
July	Dr Hunt	Pastoral Systems in Marginal Environments: Satellite workshop of the International Grassland Congress, Glasgow, Scotland
July	Dr Hunt	Animal behavioural principles in grazing management, Katherine, NT
July	Dr Dawes-Gromadzki	Water for a Healthy Country Flagship workshop, QLD
July	Dr Straton	Evolutionary Macroeconomics conference, Brisbane, QLD
July	Dr Andersen	Association of Tropical Biology and Conservation, Uberlandia, Brazil
August	Drs Cook & Liedloff	Tree dynamics workshop, Barcaldine, QLD
August	Drs Cook & Liedloff	Queensland Landcare Conference, Barcaldine, QLD
August	Dr Straton	Choice Modelling Workshop, Adelaide, SA
August	Dr Ludwig	Ecological Society of America's Annual Conference, Montreal, Canada
September	Dr Jackson	International Rivers Symposium, Brisbane QLD
October	Dr Dawes-Gromadzki	Water for a Healthy Country Grazing Lands program workshop
October	Dr Sithole	Enterprise Development workshop, Noonamah, NT
November	Dr Sithole	Monitoring and evaluation for Joint management in the NT workshop, Alice Springs, NT
November	Dr Cook	Vegetation dynamics workshop, Darwin, NT
November	Dr Dawes-Gromadzki	Rainforest Meets Reef Conference, Townsville, QLD
November	Dr Straton	Desert Knowledge CRC CP1 workshop, Alice Springs, NT
November	Dr Williams	Greenhouse 2005, Melbourne, VIC
December	Drs Parr & Dawes-Gromadzki	Combined Australian Entomological Society, Society of Australian Systematic Biologists & Invertebrate Biodiversity & Conservation Conference, Canberra, ACT
December	Dr Straton	ANZSEE 2005 conference, New Zealand
December	Drs Andersen, Parr, Ludwig & Hoffmann	Ecological Society of Australia conference, Brisbane, QLD
December	Drs Ludwig & Liedloff	Modelling and Simulation Society of Australia and New Zealand Congress, Melbourne, VIC
December	Dr Andersen	Ranger Mine rehabilitation workshop, Darwin, NT



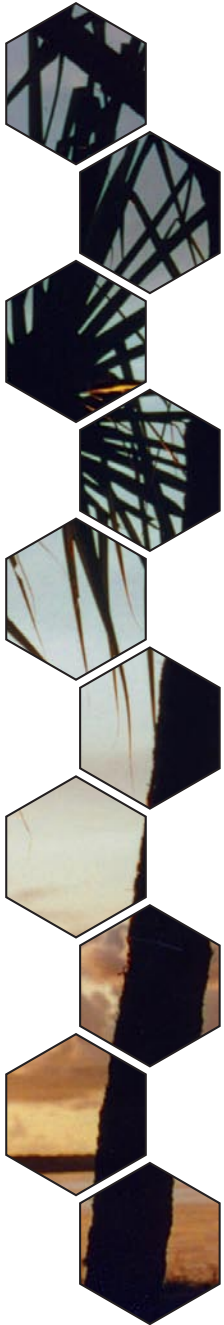
Seminars and Lectures

Date	CSIRO Officer	Seminar/Lecture
January	Dr Hoffmann	Wagiman Rangers: Exotic ants and their management in northern Australia
February	Dr Jackson	Charles Darwin University: Social Impact Assessment: the Alice Springs to Darwin railway
March	Dr Jackson	Wollongong University: Compartmentalising 'culture': a constraint on Aboriginal participation in integrated water management in northern Australia,
March	Dr Ludwig	CSIRO Darwin 20 th Anniversary Forum Series: Landscape Ecology – looking back 20 years
April	Drs Sithole & Jackson	Benchmarking the joint management experience of the NT in relation to world experience, Katherine Workshop
April	Dr Dawes-Gromadzki	Darwin High School Year 12 students: Termite Biology and Ecology
April	Dr Dawes-Gromadzki	Darwin High School Year 12 students: Termite Biology and Ecology
April	Dr Straton	Charles Darwin University: Cost-benefit analysis lecture for Environmental Management course
April	Dr Jackson	CSIRO Darwin 20 th Anniversary Forum Series: People in the Landscape – looking back 20 years
April	Dr Parr	Burning for Biodiversity in Northern Australia, University of Stellenbosch, South Africa
May	Dr Andersen	Charles Darwin University: 'Introducing ants', - ecology lecture
May	Dr Williams	CSIRO Darwin 20 th Anniversary Forum Series: Fire ecology and management – looking back 20 years'
May	Dr Andersen	CSIRO Darwin 20 th Anniversary Forum Series: Burning issues for northern Australia - the next 20 years'
May	Dr Andersen	Kakadu National Park seasonal ranger training: Fire and biodiversity in northern Australia
May	Dr Andersen	Kakadu National Park seasonal ranger training: An introduction to ants
May	Dr Sithole	Participatory ranger evaluations, Healthy people healthy country project seminar, Menzies, Darwin
June	Dr Sithole	NARU/CDU Governance seminar on Communities participation in governance of NRM
June	Dr Sithole	Evaluating Aboriginal and sea management in the NT, Annual Aboriginal women's land and sea management conference, Timber Creek, NT
July	Dr Ludwig	CSIRO Atherton Open House Seminar: Savanna Ecology
July	Dr Andersen	'Using ants as bioindicators in land management', Universidad Rural Federal, Rio de Janeiro, Brazil
July	Dr Andersen	'Fire ecology and management in northern Australia' EMBRAPPA, Rio de Janeiro, Brazil
August	Dr Cook	CSIRO Darwin 20 th Anniversary Forum Series: Invasive grasses, looking back 20 years



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August	Dr Andersen	CSIRO Cutting Edge lecture: Burning for biodiversity in the Top End, Darwin, NT
September	Dr Hunt	CSIRO Darwin 20 th Anniversary Forum Series: Sustainable pastoralism, looking back 20 years
September	Dr Ludwig	James Cook University: Landscape revegetation and Rehabilitation, Cairns, QLD
October	Dr Andersen	'Burning for Biodiversity in tropical savannas of Northern Australia', Organisation for Tropical Studies, Skukuza, South Africa
October	Dr Andersen	'Biodiversity monitoring in Kruger National Park', SANParks Scientific Services, Skukuza, South Africa
November	Dr Hunt	CSIRO Darwin Science Education Centre, Cutting Edge Science lecture series: Sustainable pastoralism research
November	Dr Dawes-Gromadzki	CSIRO Science Education Double Helix Event: 'Crazy about Bugs'
November	Dr Sithole	Charles Darwin University: Traditions, ceremonies, totems and sacred resources: Does selling craft compromise cultural beliefs?
November	Dr Straton	Menzies School of Health Research: Network theory applied to public health and community development
November	Dr Hoffmann	NHT Joint Steering Committee: update of the eradication of Yellow crazy ant in north-east Arnhem Land, NT
December	Dr Liedloff	Queensland Environment Protection Agency: Presentation of the <i>Flames</i> simulation model



AWARDS

Tropical Knowledge Innovation Award

In May, Peter Christophersen and Sandra McGregor were finalists in the inaugural Northern Territory Research and Innovation Awards for wetland fire management project in Kakadu National Park. The project has significantly enhanced biodiversity at Boggy Plain in Kakadu, as well as improved its cultural values for Aboriginal people through increased food resources (see page 20).



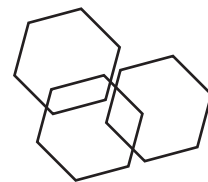
Sandra McGregor, Peter Christophersen and NT Chief Minister, Clare Martin at the Tropical Knowledge Innovation Awards.

ASCILITE Award

The university course 'Fire Ecology & Management in Northern Australia' won the prestigious 2005 National ASCILITE (Australasian Society for Computers in Learning in Tertiary Education) Award for Educational Design & Technology in Tertiary Education in December. The online fire course, the first of its kind in Australia, was developed collaboratively by the Bushfire CRC, the Tropical Savannas CRC, CSIRO and Charles Darwin University. The course tackles a wide range of complex ecological, social, political and historical aspects of fire management across northern Australia.



The 'Fire Ecology & Management in Northern Australia' project team. From left Dr Lesley Instone and Helen Rysavy from Charles Darwin University, Dr Penny Wurm from the Tropical Savannas CRC and Dr Kate Parr from the Bushfire CRC and CSIRO.



RESEARCH VISITORS

Bushfire CRC Board Visit

In August, the Board of the Bushfire Cooperative Research Centre met in Darwin and visited the “Burning for Biodiversity” project sites at the Territory Wildlife Park and Kakadu National Park. “Burning for Biodiversity” is a collaboration between the Bushfire CRC, CSIRO, the Northern Territory Government, and Charles Darwin University. Board members heard from researchers about the effects of fire on soil ecological processes, plant population dynamics, key above-ground ecological processes such as herbivory, seed dispersal, and competition, and invertebrate biodiversity. The Board visited Kakadu and met traditional owner Violet Lawson, her daughter Sandra McGregor (CSIRO), and son-in-law Peter Christophersen (CSIRO). The Board was briefed on the wetland burning project (see page 20) which is a partnership between Parks Australia, the Environmental Research Institute of the Supervising Scientist, CSIRO and the Bushfire CRC.



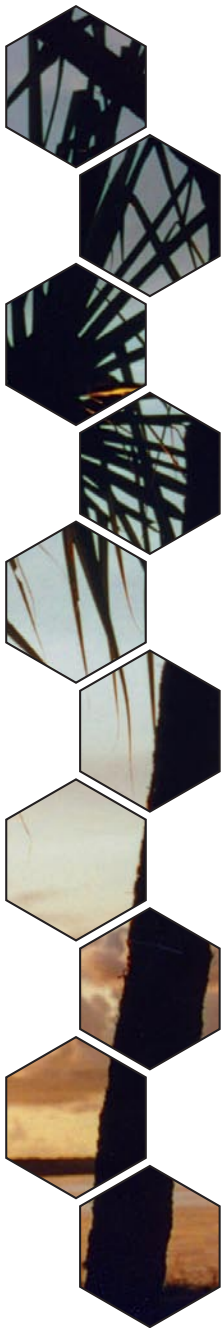
Members of the Bushfire CRC Board with CSIRO staff in Darwin.

CSIRO Sustainable Ecosystems Divisional Executive Committee Visit

Strategic and high level operational management of CSIRO Sustainable Ecosystems is the responsibility of the Divisional Executive Committee or DEC. The DEC comprises the Chief Dr Andrew Johnson, Deputy Chief - Business Integration Mr Allen Kearns, Deputy Chief - Science Integration Dr Brian Keating, Tropical Landscapes Program Leader Dr Chris Margules, Agricultural Landscapes Program Leader, Dr Bruce Pengelly, Rangelands & Savannas Program Leader Dr Andrew Ash, Resource Futures Program Leader Dr Daniel Walker, General Manager, Business Development and Management Ms Melinda Spink, General Manager, Organisational Development Mr Bill Andrew, Executive Officer Ms Jenny Baxter and Executive Assistant to DEC Ms Sandy Heggie. The DEC met in Darwin in mid-June. Their visit included a trip to the ‘Burning for Biodiversity’ Bushfire CRC research sites at the Territory Wildlife Park and coincided with the launch of the Bushfire CRC Aboriginal wetland burning project in Kakadu National Park.

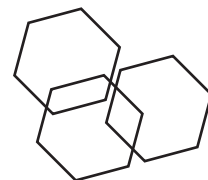


CSIRO Sustainable Ecosystems Divisional Executive Committee (DEC) with Darwin staff.



Research Visitors

Visitor	Date	Affiliation	CSIRO Contact
Ms Janina Gawler	February	Consultant – CSIRO Indigenous Engagement Strategy	Dr Jackson
Dr David Breshears	June	University of Arizona, USA	Dr Ludwig
CSIRO Sustainable Ecosystems Divisional Executive Committee	June	CSIRO Sustainable Ecosystems	Ms McKaige
Prof Fred Provenza	July	Utah State University	Dr Hunt
Dr Jerome Orgeas	August	University of Marseille	Dr Hoffmann
Bushfire CRC Board	August	Bushfire CRC	Ms McKaige
Ms Leanne Ezzy	August to September	James Cook University	Dr Andersen
Ms Jenny Parsons	August to September	James Cook University	Dr Andersen
Mr Tom Weir	September	CSIRO Entomology	Dr Andersen
Mr Simon Attwood	September	University of Southern Queensland	Dr Andersen
Mr Zane Nicholls	September	University of the Sunshine Coast	Dr Andersen
Dr Steven Bray	November	QDPIF	Drs Cook & Liedloff
Dr Bill Holmes	November	QDPIF	Drs Cook & Liedloff



SCIENTIFIC SERVICES AND MANAGEMENT

Refereeing

Publications refereed

Dr Andersen

Australian Biological Resources Scheme (x2)

Austral Ecology

Australian Journal of Agricultural Research

Australian Journal of Experimental Agriculture

Australian Journal of Zoology

Biodiversity and Conservation

Biological Conservation (x2)

Conservation Biology

Diversity & Distributions (x3)

Ecography

Ecosystems

Forest Ecology & Management (x3)

Functional Ecology

Insectes Sociaux (x2)

Journal of Animal Ecology

Journal of Biogeography

Journal of Insect Conservation (x5)

Journal of Tropical Ecology

Journal of Vegetation Science

Myrmecological News (x2)

Oecologia (x2)

OUP book proposal

Rangeland Ecology & Management

Restoration Ecology

Soil Biology & Biochemistry

Wildlife Research

Dr Cook

Ecological Management and Restoration

Australian Journal of Botany

South African National Research Foundation

Acta Oecologica

Journal of Tropical Ecology

Australian Research Council Discovery Grants

Bushfire CRC Fire curriculum

Dr Dawes-Gromadzki

Acta Oecologica

Austral Ecology

Dr Hoffmann

Australian Journal of Entomology

Diversity and Distributions

New Zealand Journal of Zoology

Insectes Sociaux

Dr Hunt

Journal of Applied Ecology

Dr Jackson

Australian Journal of Botany

Journal of Environment, Development and Sustainability

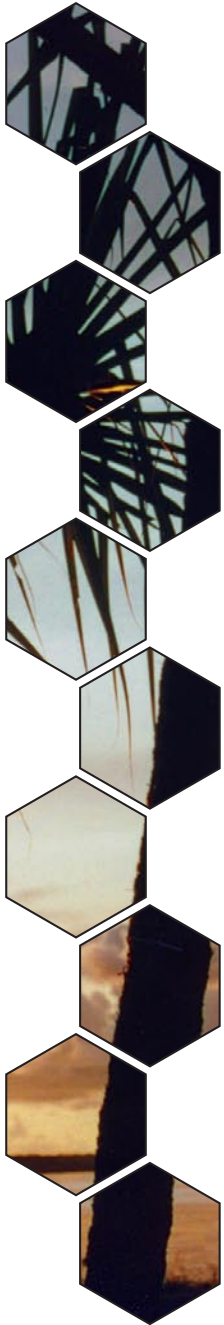
Book chapter for *Planning Australia: an overview of Australian urban and regional planning*

Dr Liedloff

Australian Research Council

BMC Ecology

Environmental Modelling and Software



Dr Ludwig

Agriculture, Ecosystems & Environment

Austral Ecology (x 6)

Ecological Indicators

Ecological Modelling

Ecosystems

Journal of Arid Environments (x 2)

Journal of Vegetation Science

Landscape Ecology (x 7)

Dr Parr

Journal of Biogeography

Journal of Arid Environments

Journal of Insect Conservation

Diversity & Distributions

Oecologia

Insectes Sociaux

Dr Sithole

Ecology and Society

Forest Trees and Livelihoods

Goejournal

Society and Natural Resources

Dr Straton

Ecosystems

Dr Williams

Acta Oecologia (x 12)

Australian Journal of Botany (x16)

Austral Ecology

Ecosystems

Environmental Modelling and Software

Journal of Environmental Management
(x 2)

Journal of Biogeography

South African Journal of Science

External positions held

Dr Andersen

Technical Editor, *Australian Journal of Entomology*

Editorial Board, *Journal of Insect Conservation*

Editorial Board, *Biodiversity and Distributions*

Tropical Savannas CRC Management Group

Fire Ant Scientific Advisory Panel

Chair, Christmas Island Crazy Ant Management Steering Committee

NT Research and Innovation Board

Visiting Professor, Brazilian Council for Scientific and Technological Development

Dr Cook

Tropical Savannas CRC Project Co-leader

Divisional Consultative Committee representative

Dr Dawes-Gromadzki

Tropical Savannas CRC Project Leader

Ecological Society of Australia NT Regional Councillor

Australian Entomological Society NT Regional Councillor

Dr Hoffmann

Board Member, NT Horticultural Association

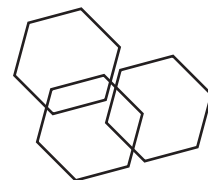
Steering Committee Member – Sustainable Land use in the NT

Dr Jackson

Kakadu Research Advisory Committee

Marine and Coastal Community Network

NT Coastal Advisory Group



Dr Ludwig

Associate Editor, *Austral Ecology*
Coordinating Editor, *Landscape Ecology*
Tropical Savannas CRC Theme 1 Leader
Tropical Savannas CRC Management Group

Dr Sithole

Member, Indigenous Knowledge Core Group,
Global Research Alliance
Trustee, Shanduko – Centre for Agrarian
Research, Zimbabwe

Dr Williams

Member, NT Bushfires Council
Chair, *Australian Journal of Botany* Editorial
Advisory Board
Editorial Board, *International Journal of
Wildland Fire*
Editorial Board, *Acta Oecologia*
Member, Parks Victoria Alpine Grazing
Scientific Advisory Committee Member
College of Experts, Biological Sciences and
Biotechnology, Australian Research Council

Internal Committees

Committee Members

TERC Management

Dr Alan Andersen (TERC Officer-in-Charge
& Sustainable Ecosystems)
Dr Anna Padovan (Plant Industry)
Dr John Woinarski (Biodiversity Conservation
NT DNRETA)
Mr Garry Rabbett (Administration
– Sustainable Ecosystems)

Library

Ms Lesley Dias
Dr Garry Cook

Computing

Mr Austin Brandis (CSIRO IT)
Dr Ping Lu (Plant Industry)

Grounds

Ms Barbie McKaige
Mr Garry Rabbett
Mr Tony Hertog

Occupational Health and Safety

Mr Garry Rabbett (Chair)
Dr Anna Padovan (Scientist representative)
Ms Lyn Lowe (Technical representative)
Mr Tony Hertog (Safety Officer)

First Aid

Ms Lyn Lowe

Thesis Examination

Dr Andersen

MSc – University of Cape Town
MSc – Macquarie University
MSc – University of Wurzburg

Dr Hoffmann

BSc(Hons) - Charles Darwin University

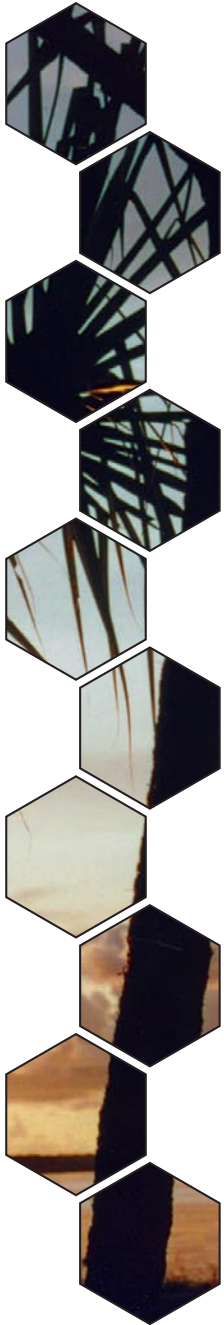
Dr Ludwig

PhD – University of New South Wales

Dr Williams

PhD - University of Western Sydney
MSc - University of Melbourne
MSc - University of Cape Town
BSc(Hons) - Charles Darwin University





RESEARCH SUPPORT

Administration

In late 2005 an organisation-wide review of Research Support Services (RSS) commenced. RSS costs account for approximately 28 per cent of total CSIRO expenditure and 22 per cent of CSIRO's total staff are employed to undertake RSS activities. There are two RSS staff located in Darwin.

The RSS Project's key objective is to centralise the delivery of research support functions, including Finance, People and Culture – HR, Information Services, Property and Facilities, Legal, Commercialisation, and Contract Administration. RSS is one of the six major change initiatives within CSIRO's Strategy in Action.

Changes in service delivery have been proceeding with the introduction of on-line processing by individual staff for Diners and Visa cards. CSOSERVE has been further refined, allowing staff direct access to salary processing functions and improving leave system capabilities.

The sale of the laboratory complex on the southern portion of the site to the Northern Territory Government commenced in 2005 and is expected to be finalised in early 2006. The remainder of the south block, where the accommodation units are located, will then be sold by CSIRO. The Darwin group is investigating alternative arrangements for on-site student accommodation. An application for corporate funding for an on-site Indigenous Engagement Facility was successful and construction will commence in 2006.

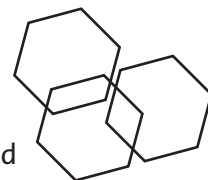
The demand for office space in the Pye Lab increased in 2005. To cater for new staff a proposal to convert one of the existing laboratories to office space has been submitted to CSIRO for approval.

It has been another good year for the site from a health and safety perspective. The site OHSE Committee continues overseeing the implementation of CSIRO Policy and providing a safe working environment for all staff.

Information Technology

June 30 2005 marked the end of the first year of operation for CSIRO IT. All CSIRO staff are now required to log incidents and requests for service via the new CSIRO Enterprise Service Centre. If assistance can not be provided directly by the enterprise service centre, then calls are passed to the relevant Business support Teams across Australia. In the Northern Territory, the Darwin and Alice Springs labs fall under the support of the ACT region.

The introduction of CSIRO IT across CSIRO will also bring a number of changes to the way IT services are delivered. Some of the changes already implemented in Darwin include formal contracts for the supply and support of IT related hardware. These main contracts mainly cover desktops, servers, and printing. Other changes have focused on the standardisation of systems and infrastructure used, as well as the procedures and processes within IT as to how the various systems are managed. A number of the ways in which the Darwin site IT is managed have changed and are now aligned with the management of the ACT region. However, due to the remoteness of the



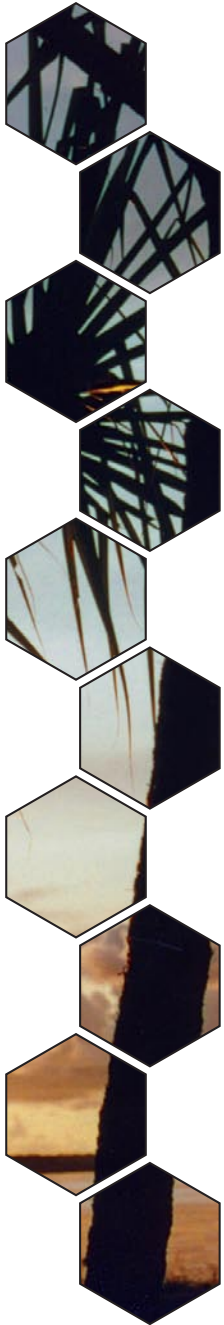
Darwin and Alice Springs laboratories, some of the formalities of the CSIRO IT model have had to be removed to ensure a provision of service consistent with that of the original Divisional-based IT arrangements.

Library Services

During 2005 the OneCSIRO Information Services project, which commenced in 2004, was included in CSIRO's Research Support Services Project. Libraries and other support services will become shared services across the organisation during 2006. The implications for local library services include reducing the on-site collection, but access to more online services. CSIRO will have Major Library Centres in Canberra, Melbourne, Brisbane and Sydney, and service points at other sites, including Darwin.

Over 55 new publications have been added to the TERC publications list. A searchable database of publications from CSIRO Sustainable Ecosystems, including the CSIRO Division of Wildlife and Ecology, CSIRO Sustainable Ecosystems, the Tropical Ecosystems Research Centre in Darwin and the Davies Laboratory in Townsville, Queensland, is available at <http://www.cse.csiro.au/ris/>





STAFF AND STUDENTS

Tropical Savannas Group Staff

Scientists

Dr Alan Andersen (Research Leader, Officer-in-Charge; invertebrate biodiversity)

Dr Garry Cook (soil and landscape ecology)

Dr Tracy Dawes-Gromadzki (termite ecology)

Dr Ben Hoffmann (pest ant ecology)

Dr Leigh Hunt (rangeland ecology)

Dr Sue Jackson (cultural geography)

Dr Adam Liedloff (ecological modelling)

Dr John Ludwig (landscape ecology and modelling)

Dr Kate Parr (fire and ant ecology)

Dr Bev Sithole (governance, community-based NRM)

Dr Anna Straton (ecological economics)

Dr Dick Williams (vegetation ecology)

Research Officers

Mr Peter Christophersen (fire ecology, Indigenous knowledge)

Mr Robert Eager (landscapes/modelling)

Ms Hmalan Hunter-Xenie (resource and environmental management)

Ms Donna Jackson (natural and cultural resource management)

Ms Sandra McGregor (fire ecology, Indigenous knowledge)

Mr Patrick O'Leary (natural resource management)

Mr Jonnie Saegenschnitter (natural resource management)

Mr Jon Schatz (vegetation/fire/pest ant ecology)

Ms Lorraine Williams (natural and cultural resource management)

Ms Emma Woodward (natural resource management)

Research Support

Mr Austin Brandis (IT Manager)

Ms Lesley Dias (Librarian)

Ms Hmalan Hunter-Xenie (Indigenous natural resource management)

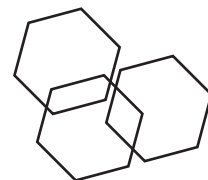
Ms Barbara McKaige (Communication coordinator)

Mr Jonnie Saegenschnitter (Indigenous natural resource management)

Administration

Ms Zenny Ballesteros (Administration assistant)

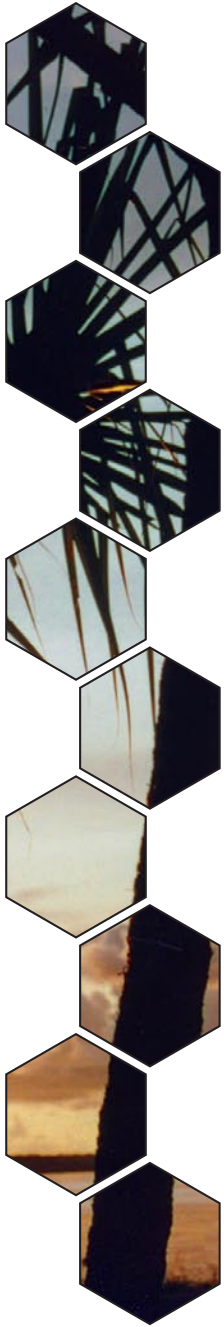
Mr Garry Rabbett (Administration officer)



Student Supervision

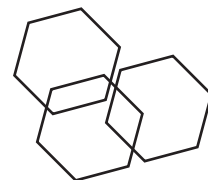
Graduate students

Student	Degree	University	Topic	CSIRO Supervisor
A. White	PhD	University of Queensland	Grazing systems in tropical savannas	Dr Hunt
N. Rossiter	PhD	Charles Darwin University	Impacts of gamba grass (<i>Andropogon gayanus</i>)	Dr Cook
L. Felderhoff	PhD	James Cook University	Fire ecology in semi-arid savannas (Mt Isa bioregion)	Drs Cook & Ludwig
C. Sauerland	Graduate Diploma in Resource Management	Charles Darwin University	Development of a cultural health index for water	Dr Jackson
L. Barrow	MSc	Macquarie University	Ants and fire in Purnululu National Park, WA	Dr Parr
C. Kassier	MSc	University of Stellenbosch, South Africa	Fynbos ant communities and agricultural landscapes	Dr Parr
B. Ryan	Hons	Charles Darwin University	Effects of an invasive grass (<i>Andropogon gayanus</i>) on ant diversity	Dr Parr
E. Poon	PhD	University of Queensland	Savanna nitrogen cycling	Dr Ludwig
I. Hollingsworth	PhD	University of Sydney	Minesite rehabilitation	Dr Ludwig
J. Ryan	PhD	University of Queensland	Savannas as complex systems	Dr Ludwig
G. McCloskey	PhD	Charles Darwin University	Savanna riparian health indicators	Dr Ludwig
L. Valentine	PhD	James Cook University	Savanna riparian weeds	Drs Grice & Ludwig
K. Botha	MSc	Potchefstroom University	Ant biodiversity in relation to shrubs	Dr Andersen
W. Robinson	PhD	University of Sunshine Coast	Exotic ants on Fraser Island	Dr Andersen
S. Clarke	PhD	Adelaide University	Ants as indicators of shrubland restoration	Dr Andersen
F. Jarrad	PhD	University of Melbourne	Climate change and alpine grassland vegetation	Dr Williams
A. White	PhD	University of Melbourne	Climate change and alpine bogs	Dr Williams
D. Rose	BSc (Hons)	Charles Darwin University	Estimating coarse woody debris in savannas	Dr Williams



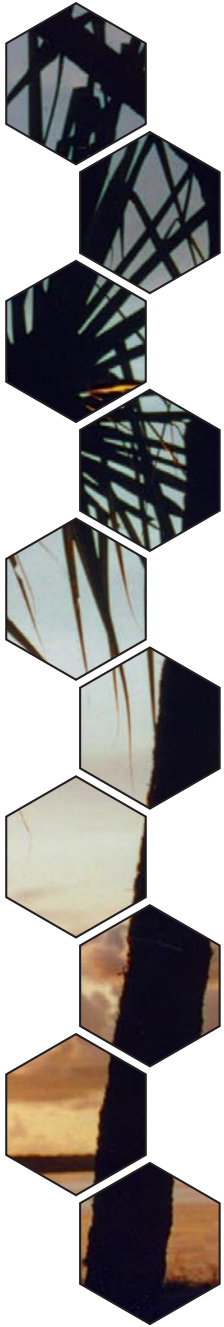
CSIRO Student Research Scheme Students

Student	Date	Educational Institution	CSIRO Contact
J. Burgess	June – July	Marrara Christian School	Dr Cook
D. Freddie	June – July	Marrara Christian School	Dr Cook
C. Taft	June – August	Nightcliff High School	Dr Andersen
M. Hoare	June – August	Nightcliff High School	Dr Andersen
R. Amery	July	Darwin High School	Dr Dawes-Gromadzki
C. Barva	July	Darwin High School	Dr Dawes-Gromadzki
G. Thorpe	July	Darwin High School	Dr Dawes-Gromadzki
E. Templin	July	Palmerston High School	Dr Liedloff



Student Trainees

Student	Date	Educational Institution	CSIRO Contact
J. Germain-Fandre	March – September	ISARA, Lyon, France	Dr Hunt
J. Loinard	March – September	Ecole d'Ingenieurs en Agriculture (ESITPA), France	Dr Parr
J. Limousin	May – September	Ecole Nationale Supérieure Agronomique de Montpellier	Dr Williams
N. Faivre	June – December	Ecole Nationale Supérieure de Chimie et de Physique de Bordeaux	Dr Hunt
R. Mee	June	Darwin High School	Dr Dawes-Gromadzki
C. Chastagnol	June – August	Ecole Nationale Supérieure Agronomique de Montpellier (AgroM), France	Dr Parr
C. Duffaud	June – August	Ecole Nationale Supérieure Agronomique de Montpellier (AgroM), France	Dr Parr
C. Metzger	June – December	Ecole Nationale Supérieure de Chimie et de Physique de Bordeaux	Dr Hunt
C. Obellianne	June – September	Institute Supérieure d'Agriculture de Beauvais, France	Dr Dawes-Gromadzki
J. Payet	July – August	Etablissement National d'Enseignement Supérieure Agronomie de Dijon (ENESAD), France	Drs Parr & Hoffmann
S. Petitcunot	July – August	Ecole Nationale d'Ingenieurs des Travaux Agricoles de Bordeaux (ENITA), France	Drs Parr & Hoffmann
U. Lang	August – December	Universitat Hohenheim, Germany	Dr Dawes-Gromadzki
A. Sire	September – December	Institute Supérieure d'Agriculture de Beauvais, France	Dr Dawes-Gromadzki
S. Bergamaschi	September – December	University of Bologna, Italy	Dr Dawes-Gromadzki
H. Schmidt	October – December	Swiss Federal Institute of Technology, Zurich (ETHZ), Switzerland	Drs Parr & Dawes-Gromadzki



PUBLICATIONS

Tropical Savanna Group scientists published 34 papers in journals, books, conference proceedings and reports, and submitted a further 26 papers for publication during 2005.

(Note: number in brackets is the CSIRO Tropical Ecosystems Research Centre publication number)

Journals and Books

Andersen, A., Jacklyn, P., **Dawes-Gromadzki, T.**, & Morris, I. (2005). **Termites of Northern Australia**. Alice Springs: Barker Souvenirs. 44 pages. (1355)

Andersen, A. N., **Cook, G. D.**, Corbett, L. K., Douglas, M. M., **Eager, R. W.**, Russell-Smith, J., Setterfield, S. A., **Williams, R. J.**, & Woinarski, J. C. Z. (2005) Fire frequency and biodiversity conservation in Australian tropical savannas: implications from the Kapalga fire experiment. **Austral Ecology** 30: 155-167. (1332)

Asafu-Adjaye, J., Brown, R., & **Straton, A.** (2005) On measuring wealth: a case study on the state of Queensland. **Journal of Environmental Management** 75: 145-155. (1375)

Barrett, D., Hill, M., Hutley, L.B., Beringer, J., Xu, J.H., **Cook, G.D.**, Carter, J.O, & **Williams, R.J.** (2005) Prospects for improving savanna biophysical models using multiple-constraints model-data assimilation methods. **Australian Journal of Botany** 53: 689-714. (1330)

Belnap, J., Welter, J. R., Grimm, N. B., Barger, N., & **Ludwig, J. A.** (2005) Linkages between microbial and hydrological processes in arid and semiarid watersheds. **Ecology** 86: 298-307. (1352)

Brown, R. P. C., Asafu-Adjaye, J., Draca, M., & **Straton, A. T.** (2005) How useful is the genuine savings rate as a sustainability indicator for regions within countries? Australia and Queensland compared. **Australian Economic Review** 38(4). (1363)

Cook, G. D., & **Dawes-Gromadzki, T. Z.** (2005) Stable isotope signatures and landscape functioning in banded vegetation in arid-central Australia. **Landscape Ecology** 20: 649-660. (1329)

Cook, G. D., **Liedloff, A. C.**, **Eager, R. W.**, Chen, X., **Williams, R. J.**, O'Grady, A. P., & Hutley, L. B. (2005) The estimation of carbon budgets of frequently burnt tree stands in savannas of northern Australia using allometric analysis and isotopic discrimination. **Australian Journal of Botany** 53: 621-630. (1345)

Cook, G.D., Taylor, R.J., **Williams, R.J.**, & Banks, the late J. (2005) Sustainable harvest rates of ironwood *Erythrophleum chlorostachys* in the Northern Territory. **Australian Journal of Botany** 53: 821-826. (1359)

Dawes-Gromadzki, T. Z. (2005) Bugs beneath the surface: the functional significance of soil macroinvertebrates to landscape health in Australia's tropical savannas. **Insect Science** 12: 307-312. (1362)

Dawes-Gromadzki, T. Z. (2005) The termite (Isoptera) fauna of a monsoonal rainforest near Darwin, northern Australia. **Australian Journal of Entomology** 44: 152-157. (1328)

Fisher, A., **Hunt, L.**, James, C., Landsberg, J., Phelps, D., Smyth, A., & Watson, I. (2005). **Management of Total Grazing Pressure: Managing for Biodiversity in the Rangelands**. Canberra: Department of the Environment and Heritage. 40 pages. (1374)



Hunt, L. P., & Dawes-Gromadzki, T. Z. (2005). Soil, plant and livestock interactions in Australian tropical savannas. In **Pastoral Systems in Marginal Environments : Proceedings of a Satellite Workshop of the 20th International Grassland Congress, July 2005, Glasgow, Scotland.** (Ed: Milne, J. A.). Wageningen: Wageningen Academic Publishers and 20th International Grassland Congress, p. 133. (1364)

Jackson, S. (2005) A burgeoning role for Aboriginal knowledge. **Ecos** 125: 10-11. (1357)

Jackson, S. (2005) Indigenous values and water resource management: a case study from the Northern Territory. **Australasian Journal of Environmental Management** 12: 136-146. (1336)

Jackson, S., Storrs, M., & Morrison, J. (2005) Recognition of Aboriginal rights, interests and values in river research and management: perspectives from northern Australia. **Ecological Management and Restoration** 6: 105-110. (1335)

Ludwig, J. A. (2005). Disturbances and landscapes: the little things count. In: **Issues and perspectives in landscape ecology** (Eds J. A. Wiens, & M. R. Moss). Cambridge: Cambridge University Press, pp. 42-51. (1365)

Ludwig, J. A., & Stafford Smith, D. M. (2005) Interpreting and correcting cross-scale mismatches in resilience analysis: a procedure and examples from Australia's rangelands. **Ecology and Society** 10(2): art. 20. (1135)

Ludwig, J. A., Wilcox, B. P., Breshears, D. D., Tongway, D. J., & Imeson, A. C. (2005) Vegetation patches and runoff-erosion as interacting eco-hydrological processes in semiarid landscapes. **Ecology** 86: 288-297. (1297)

Parr, C. L., Sinclair, B. J., Andersen, A. N., Gaston, K. J., & Chown, S. L. (2005) Constraint and competition in assemblages: a cross-continental and modeling approach for ants. **American Naturalist** 165: 481-494. (1276)

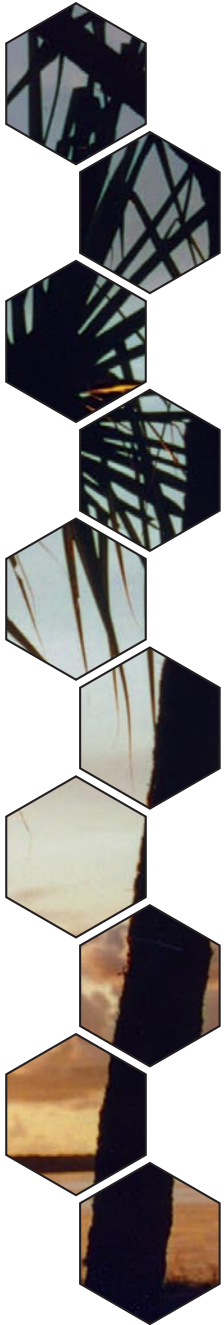
Vella, K. J., **Williams, R. J.**, Walker, D. H., Smajgl, A., & Kirschbaum, M.U.F. (2005) Social and economic dimensions of involving savanna communities in carbon management systems. **Australian Journal of Botany** 53: 741-747. (1371)

Williams, R. J., Carter, J., Duff, G. A., Woinarski, J. C. Z., Cook, G. D., & Farrer, S. L. (2005) Carbon accounting, land management, science and policy uncertainty in Australian savanna landscapes: introduction and overview. **Australian Journal of Botany** 53: 583-588. (1348)

Williams, R. J., & Farrer, S. (Eds). (2005). **Australian Journal of Botany, Special Issue: Carbon Accounting, Land Management, Science and Policy Uncertainty in Australian Savanna Landscapes**, 53(7). (1373)

Williams, R. J., & Wahren, C. H. (2005). Potential impacts of global change on vegetation in Australian alpine landscapes: climate change, land use, vegetation dynamics and biodiversity conservation. In: **Global Change and Mountain Regions: an overview of current knowledge** (Eds U. M. Huber, H.K.M. Bugmann & M.A. Reasoner). Dordrecht: Springer, 401-408. (1242)





Williams, R. J., Zerihun, A., Montagu, K., Hoffman, M., Hutley, L. B., & Chen, X. (2005) Allometry for estimating aboveground tree biomass in tropical and subtropical eucalypt woodlands: towards general predictive models. **Australian Journal of Botany** 53: 607-619. (1246)

Woinarski, J. C. Z., Williams, R. J., Price, O., & Rankmore, B. (2005) Landscapes without boundaries: wildlife and their environments in northern Australia. **Wildlife Research** 32: 377-388. (1327)

Conference Proceedings and Reports

Hoffmann, B. D. (2005). **Palatability and Efficacy of DuPont Advion Fire Ant Bait for Controlling Two Invasive Pest Ants (*Solenopsis Geminata* and *Pheidole Megacephala*) in Northern Australia** (Consultancy Report to DuPont Chemical Company). Darwin: CSIRO. (1367)

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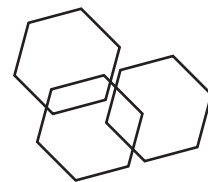
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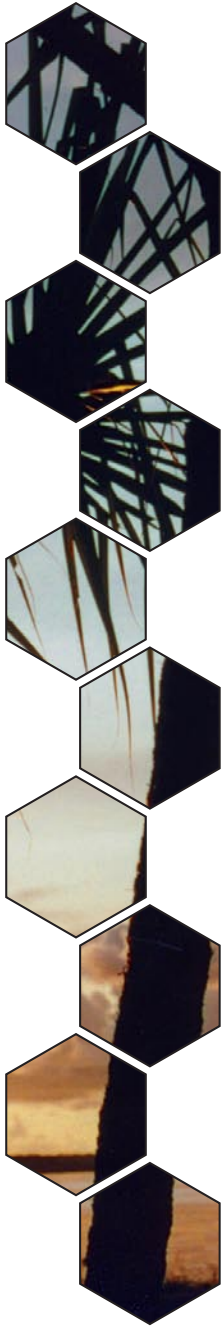
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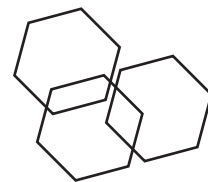
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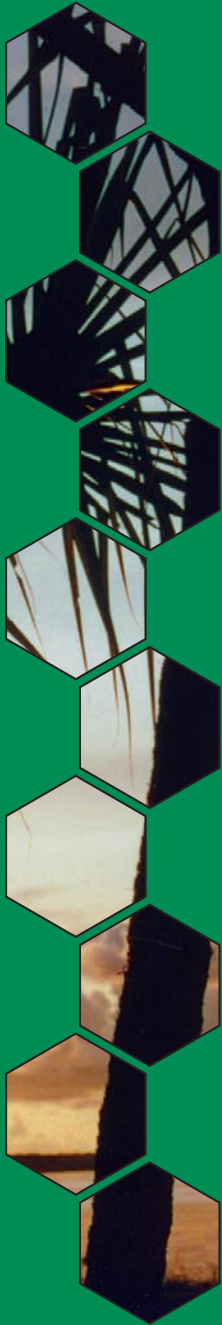
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The Rangelands and Savannas Program is part of CSIRO Sustainable Ecosystems. Program staff are located at Alice Springs and Darwin in the NT, Brisbane, Atherton and Townsville in QLD, and in Adelaide in SA.

Program Vision Healthy rangeland and savanna ecosystems that sustain viable enterprises and livelihoods, and support vibrant and diverse communities.

CSIRO's Purpose By igniting the creative spirit of our people we deliver great science and innovative solutions for industry, society and the environment.

