



Top End wetland, photo Michael Douglas.



**Northern Australia  
Environmental  
Resources  
Hub**

National Environmental Science Programme

# Research overview

## Top End

May 2017

### Our regional focus

In the Northern Territory, most of our research focuses on the Daly River catchment, greater Darwin region and Kakadu National Park. In the Daly catchment, we need to know how much water can be made available for agriculture development without exposing the river's unique aquatic ecosystems to significant risk. Weeds and fire in the Daly catchment, as well as in the greater Darwin area, are also research priorities. In Kakadu, our focus is on research that supports the recovery of small mammals by addressing threats such as fire, cats and feral herbivores, both across the landscape and in riparian areas. We are also working closely with the Park's Traditional Owners to identify and undertake action-research partnerships.

Other Hub research across northern Australia, on topics such as Indigenous land management, environmental monitoring techniques, fire and carbon, is also generating information to support the management of environmental resources in the Top End.



### What is the Northern Hub?

The Northern Australia Environmental Resources Hub supports sustainable development in northern Australia and is assisting decision-makers to understand, use, manage and safeguard northern Australia's outstanding natural environment through world-class science. Current research focuses on:

- Landscape-scale studies covering savanna and freshwater ecosystems and biodiversity.
- Land and water planning for new developments, e.g. agriculture and infrastructure.
- Indigenous land management including Indigenous Protected Areas.

The \$24 million Hub collaborates with government, Indigenous, environment and industry bodies. Projects build on past work by the Tropical Rivers and Coastal Knowledge research hub and the National Environmental Research Programme, and link with other research in the region.

## Projects in the Top End

### Environmental water needs for the Daly River

The amount of water in the Daly River, particularly during the dry season, as well as the timing of flow pulses in the wet season, are important for supporting the river's health, including the fish and turtles living there. This project will determine the water requirements of key environmental assets within the river and improve our capacity to predict the impact of current and future water allocations. The outcomes will inform water policy, water allocation planning and fisheries policy and management of the Daly River.

### Fire and weeds in the Top End

Land clearing, weed invasion and changed fire regimes have the ability to significantly alter ecosystem processes within the greater Darwin region and Daly River catchment. This project will draw on existing information about the combined impacts of these threats on the natural landscape. Researchers will collect additional data where necessary and use this information to model the likely scenarios of changes in ecosystem function over the next 30 years in the Darwin and Daly regions. This information is critical to land use planning and management to predict, and hopefully prevent, ecosystem failure.



Current project  
(due 2019/20)



Complete project

### Indigenous natural resource management in Kakadu National Park

Traditional Owners have a widely recognised role in environmental management in Kakadu National Park. Since the park was declared, it has been jointly managed by Bininj/Mungguy and Parks Australia. While this management structure facilitates shared decision-making and prioritises an exchange in knowledge, skills and information, there is room to bring the interests of Kakadu's Traditional Owners, park managers and the public into closer alignment. This project will identify, implement and evaluate action-research projects to support Indigenous natural resource management in Kakadu National Park.

### Kakadu National Park's threatened species

This project is working to help protect threatened species and other native animals which have dramatically declined in number in northern Australia due to mix of feral cats, inappropriate fire regimes and feral animals. Working with Traditional Owners, Parks Australia staff will manage fire extent and frequency, and reduce numbers of feral herbivores such as pigs and buffalos, in discrete areas of the Park. Researchers will then monitor how native mammals, as well as feral cat and dingo numbers,



Daly River, photo Michael Douglas.



*Kakadu National Park, photo Michael Douglas.*

respond to these management measures. This will allow us to know how effective the measures are for recovering threatened species in the Park and similar northern Australian landscapes.

### **Managing savanna riparian zones**

Riverbank (or riparian) zones are critical to the health of surrounding savanna landscapes and support significant economic and cultural values. However, savanna riparian zones are highly vulnerable to a number of pressures such as invasive plants, feral animals and fire, which in places are being compounded by new development pressures. The project involves three complementary case studies in Kakadu National Park and Geikie Gorge National Park. It will deliver improved knowledge on the health of riparian zones in these key areas, and recommend where management and resources should be directed to protect them. Research findings will be applicable to many savanna riparian zones across northern Australia.

### **Knowledge brokering for Indigenous land management**

In this project, researchers will support Indigenous land managers across the north to develop their use of scientific

and traditional knowledge for improved environmental conditions and land-use decision making. Collaborative case studies in the Fitzroy catchment (WA) and Gulf of Carpentaria (NT), and pan-northern Indigenous knowledge workshops, will design and test culturally tailored knowledge-exchange and participatory modelling tools. The project will produce "Our Knowledge Our Way" (Guidelines for Knowledge Brokering with Indigenous Land Managers) together with diagnoses of the conditions under which knowledge brokering can improve Indigenous adaptive management of environmental assets.



*Bush tucker, photo Glenn Campbell.*



## Investigating the role of feral cats in small mammal declines

In an intensive effort to understand how to better manage feral cats, Hub researchers trialed two predator-proof exclosures in Kakadu National Park near Kapalga. Motion detection cameras and cage traps were used to monitor native animals and data collected from the fenced sites was then compared with four other unfenced control sites. This research showed that mammals make up 75% of the diet of feral cats, and that cat density in the park is about one cat per 5 km<sup>2</sup>, which is similar to the other areas of northern Australia. While the numbers of small mammals recorded weren't at levels high enough for the researchers to effectively compare between the study areas, they did discover that reptile populations are negatively impacted by feral cats. See also the follow-up project '[Kakadu's threatened species](#)'.

## Other projects relevant to the Top End



### Savanna carbon sequestration method

This project aims to improve our ability to calculate the carbon benefit in dead organic matter from changed fire regimes in lower rainfall savannas across northern

More Hub projects, or extensions of existing projects may occur in the Top End depending on northern Australian priorities. For updates, visit [nespnorthern.edu.au](http://nespnorthern.edu.au) or email [nesp.northern@cdu.edu.au](mailto:nesp.northern@cdu.edu.au)

Australia. By accounting for carbon stored in dead grass, leaves, twigs and coarser woody debris, as well as the non-CO<sub>2</sub> greenhouse gases, we can better quantify the value to greenhouse gas abatement of improved fire management. This has the potential to increase the incentive for land managers to adopt improved fire practices, by allowing them to earn additional carbon credits.



### Prioritising threatened species in northern Australia

This research will guide improved management and investment to reduce the impact of threats on threatened species and to bolster their recovery in high-priority areas of northern Australia. The team will model and map the distribution of threatened species, and the pressures on these species, across the north. This can be used to help prioritise investment and to inform assessments for future development. The project team will provide guidelines and training so models and maps can be updated and applied in everyday management activities.



Controlled burn, photo Michael Douglas.



Ranger in Kakadu National Park, photo Michael Douglas.

### **Multiple benefits & knowledge systems of Indigenous land management programs**

The importance of Indigenous ecological knowledge is globally recognised and supported by investments in a variety of Indigenous land management programs (ILMPs). Aside from generating ecological benefits, these programs generate many social, cultural and economic co-benefits. While we have some understanding of the monetary value of some of these co-benefits, we lack information about other less tangible co-benefits or those relating to culture. Funding agencies such as governments, businesses and NGOs would like to know if their investments represent ‘value for money’. This project will provide quantified, comparable data about the co-benefits of different types of ILMPs, with case studies in the upper Gilbert/Mitchell and the Kimberley.

### **Multi-objective planning in northern Australia**

This research will create a toolkit to assist planning and management decisions in northern Australia. The toolkit will allow users to assess the potential impacts of current and future development and management regimes on terrestrial, freshwater, and coastal and marine species and communities. It will also facilitate an assessment of the benefits and costs of implementing different management interventions to mitigate biodiversity threats associated with different land and water uses. The toolkit will be designed using the Fitzroy River catchment in WA, but can also be used in other areas in northern Australia.

### **Developing eDNA methods for tropical waters**

Analysing environmental DNA (eDNA) is a relatively new technique for detecting the presence of aquatic species from DNA in small water samples. The technique has a number of advantages over traditional monitoring, including increased efficiency, better accuracy, ability to detect many species, detection of targeted species and greater safety when sampling in the field. This project will develop eDNA technology and trial field methods for several northern Australian aquatic species of conservation and management significance. It aims to significantly improve the efficacy of field surveys and monitoring, hence providing a cost-effective tool to dramatically improve our knowledge and management of aquatic biodiversity in northern Australia.

### **Research priorities for the north's Indigenous Protected Areas (IPAs)**

In collaboration with IPA managers and research stakeholders across northern Australia, the project team undertook literature reviews, interviews and workshops to identify research priorities for IPAs. The priorities were found to be context-dependent, integral to priorities for Indigenous land management (ILM) broadly, and focused on multiple values of and benefits from country. These priorities are for research that: 1. Uses models that enable Indigenous people to be centrally involved and gain greater benefit from research; 2. Better values the economic contributions of ILM; 3. Enables both Indigenous knowledge and science to be more accessible and useful to Indigenous decision makers; 4. Supports ILM to be more financially sustainable;

and 5. Develops participatory methods that enable protection of country in response to new impacts such as development proposals. A complementary sub-project examined how the benefits of IPAs have been valued. It found that some IPA benefits are much more easily, and therefore frequently, quantified in monetary terms than other benefits that may be just as important. Unquantified benefits are often overlooked by decision-makers and to address this gap researchers need to work with local people to determine the valuation method best suited to their needs.

### **Lessons and protocols for Indigenous fire management partnerships**

Fire has played a key role in the land management practices of Aboriginal Australians for millennia. Today, Indigenous communities are applying, adapting and rejuvenating this knowledge through a range of land management and enterprise activities. This project worked with fire program practitioners, partners, stakeholders and resource providers to review how Indigenous knowledge is being used in northern Australian fire projects. It identified lessons and developed protocols for effectively and appropriately incorporating Indigenous knowledge into fire management goals and practices. The six protocols aim to ensure Indigenous fire management partnerships are based on culturally and scientifically sound decisions.

### **Waste and marine debris in remote northern Australian communities**

This project investigated waste management issues in the Lockhart River, Mapoon and Pormpuraaw communities on Cape York Peninsula. Each community faces unique local challenges to progressing waste management, but all are growing in size, receiving increasing numbers of visitors and tourists, and dealing with increasing marine debris washing up on their beaches. The research highlights current best management practices and found that opportunities exist for a networked regional recycling

effort which could reduce local waste, generate new or repurposed resources and create new jobs and enterprises.

### **Methods to measure temporal change in soil carbon**

This research project reviewed the current state of knowledge on measurement and modelling methods for estimating soil carbon and change in soil carbon stock in northern Australia. It assessed the applicability and cost of current and proposed methods in the context of soil carbon levels and the response of soil carbon to changes in management practices, as they occur across north Australia. The research findings will be released later this year.

### **Remote environmental monitoring techniques**

This project identified emerging environmental monitoring technologies and techniques best suited to northern Australia. It summarises what we know about them, how they're currently used, their potential future use, their pros and cons, and the research needed to more fully utilise each technique. Project participants identified technologies such as fine-scale aerial photos, drones, satellite imagery and genetic techniques as most likely to be useful in the future, as well as camera trapping, tracking telemetry and remote listening stations. See also the follow-up project '[Developing eDNA methods for tropical waters](#)'.

### **Supporting development decision-making in northern Australia**

This research identified nine categories of models and tools and assessed the suitability of each one for supporting different types of development decisions in northern Australia. Real-world case studies, many from northern Australia, show how these models have been used in the region. A decision tree was also developed to help practitioners in choosing the most appropriate model for their needs. This and other resources will be made into an online tool.



*Northern sunset, photo Michael Douglas.*



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For further information, including our North Queensland and West Kimberley factsheets, visit [nespnorthern.edu.au](http://nespnorthern.edu.au) or contact Clare Taylor ([clare.taylor@cdu.edu.au](mailto:clare.taylor@cdu.edu.au), 0405 730 999).



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