Northern Australia Environmental Resources Hub

National Environmental Science Programme

2020 Interim Report

Australian Government

National Environmental Science Program

This report should be cited as:

Northern Australia Environmental Resources Hub. 2020. *2020 Interim Report.* Charles Darwin University, Darwin.

Cover photographs

Front cover: Black-necked storks (photo Patch Clapp).

Back cover: Estuarine crocodile (photo Patch Clapp).

This report is available for download from the NESP Northern Australia Environmental Resources Hub website: nespnorthern.edu.au

The Hub is supported through funding from the Australian Government's National Environmental Science Program. The NESP NAER Hub is hosted by Charles Darwin University.

ISBN 978-1-925800-72-2

November, 2020

Printed by Uniprint

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Hub name: Northern Australia Environmental Resources
Host organisation: Charles Darwin University
Key contact: Professor Michael Douglas (UWA)
Contact email address: michael.douglas@uwa.edu.au
Other consortium partners/subcontractors/research organisations:

- University of Western Australia (UWA)
- James Cook University (JCU)
- Griffith University (GU)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- North Australian Indigenous Land and Sea Management Alliance (NAILSMA)
- Northern Territory Department of Environment, Parks and Water Security (NT DEPWS)
- Queensland Department of Environment and Science (Qld DES)
- Western Australia Department of Biodiversity, Conservation and Attractions (WA DBCA)

Hub Leader certification

As Hub Leader, I certify that I have taken adequate steps to reasonably assure myself that:

- each required report component is attached
- the contents of each component of the report are complete and accurate in all material respects
- funds have been used for the purpose for which they were provided and all funding conditions have been met, recipient and other contributions have been received, and appropriate oversight has been maintained of Hub projects, their progress, performance and budgets during the reporting period
- all relevant risks to project delivery have been notified to the Department in this and previous reports and that appropriate steps are being taken to manage those risks
- the Hub and its sub-contractors have current workers compensation and public liability insurances, as required under the Funding Agreement
- any carryover of project funds have been allocated towards Hub activities or identified for refund to the Department.

Signed: 

Hub Leader Name: Professor Michael Douglas
Date: 6 October 2020

Hub Steering Committee Chair certification

As steering committee chair, I certify that any issues of concern or matters raised during steering committee meetings where the interim report was discussed have been adequately resolved, amended or incorporated into the interim report submitted to the department.

Signed: 

Hub Steering Committee Chair Name: John Childs
Date: 6 October 2020

Letter from the Hub Leader

I am pleased to submit this September 2020 Interim Report for the National Environment Science Program (NESP) Northern Australia Environmental Resources Hub.

Progress against research plan

Until Covid-19 impacted on our Hub, and all aspects of life in Australia in 2020, we were tracking towards completion of the final suite of Hub research projects by the end of this year. This portfolio of projects was aiming to deliver a diverse set of research outputs for our policy and management partners. Currently the Hub has 30 active projects (including 7 synthesis projects) underway across northern Australia, in the Kimberley, Top End, Gulf of Carpentaria and Cape York Peninsula. The Hub has an additional 17 completed projects. Together these projects have addressed all of the research priorities originally identified by the Department at the start of the Program in 2015, as well as the revised priorities from 2017. More detailed information is available on the project pages on our website.

Covid-19 impact

On 13 March 2020 we wrote to the Department of Agriculture, Water and the Environment (the Department) requesting an extension to the final deadline for the NESP Northern Australia Environmental Resources Hub to the 30th June 2021. We believed that the Hub would face significant difficulties in completing the majority of its projects in 2020 because of the impact of Covid-19.

A lot of our activity planned for 2020 involved bringing groups of people together for meetings, workshops or joint fieldwork. We did not believe that it would be appropriate for researchers to visit Indigenous communities and risk bringing coronavirus to them, and this was borne out by the subsequent closures of these communities.

Restrictions on interstate travel, organised gatherings and travel to remote Indigenous communities subsequently put in place by State and Territory governments, research institutions and Indigenous organisations have affected all of our active projects. These restrictions impacted the collection of data for 60% of our projects, Indigenous engagement requirements or agreements for 70% of our projects, and face-to-face reporting or other research user engagement activities for 90% of our projects.

The need to postpone data collection for 60% of our projects impacted the timelines and completion dates for these projects. The highly seasonal nature of the environment in northern Australia meant that a delay of 6 months most likely means missed wet season sampling that could require a 12-month extension to ensure completion of the original project deliverables.

For a relatively small number of projects, research is undertaken exclusively by staff on continuing appointments who are able to resume activity and complete projects as restrictions are eased. For the vast majority of our projects, however, essential work in the late stages of projects is being undertaken by staff who have been contracted specifically for this NESP research. Depending on how long restrictions are in place, contracts for these staff can be extended within the current resources of the Hub to ensure completion of the deliverables. At this stage we still expect that all of our projects will deliver on their milestones and outputs within the extended timeframe resulting from Covid-19.

Attachment A provides a project-by-project description of the impact of Covid-19 and our proposed response.

Recent project highlights

The processes of reporting back to co-researchers and sharing final outputs with research users will become critical for the Hub in the coming months. Strengthening and appropriate sharing of knowledge has been an underpinning principle of all the NESP Northern Hub projects.

Our Knowledge Our Way Guidelines

The benefits of this approach were highlighted in the recent release of the Our Knowledge Our Way in caring for Country guidelines from CSIRO and the North Australian Indigenous Land and Sea Management Alliance. These best-practice guidelines give a voice to Indigenous land and sea managers who have found good ways to strengthen their knowledge and build partnerships for knowledge sharing in caring for land and sea Country. The webcast of the release was attended by over 1,100 people and the video of the event is increasing this reach even further. In addition to these guidelines, all our projects have sought to strengthen the capacity of ranger groups, Traditional Owners and other land managers through their involvement in NESP Northern Hub research.

The *Our Knowledge Our Way in caring for Country* guidelines showcase Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management. Indigenous Australians' rights of ownership and management have been recognised over nearly half of Australia and their knowledge systems connect them to their Country and cultures. As significant landowners, managers and custodians, Indigenous peoples are applying their knowledge in caring for Country, generating many benefits. Indigenous peoples are learning from each other about how to build on these successes. Researchers and policy makers tasked with solving Australia's complex environmental challenges are noticing many beneficial outcomes from Indigenous peoples applying their knowledge in management and are seeking ways to grow these positive impacts.

The Guidelines are based on 23 Australian case studies, submitted by Indigenous people and their representative bodies, that show how *Our Knowledge Our Way* in caring for Country can be supported through:

- **Strengthening Indigenous knowledge** – including through creating and maintaining access to land and sea Country; ensuring strong cultural governance of Indigenous knowledge; and keeping and revitalising knowledge, language and culture through programs and practice.
- **Strong partnerships** – that enable the building of respect and appreciation for Indigenous knowledge; development of protocols to guide knowledge sharing; and engaging with the principles of free, prior and informed consent
- **Sharing and weaving knowledge** – Indigenous managers often weave knowledge to manage new and complex land and sea management issues. Indigenous-led and co-developed tools are most appropriate, and those that promote inter-generational transfer of knowledge are highly valued.
- **Indigenous networks** – national and global networks that promote Indigenous knowledge practices are important as they offer peer-to-peer learning opportunities for Indigenous land and sea management practitioners. They support:
    - learning about good partners, projects and approaches to keep knowledge strong
    - learning from others about best-practice protocols and processes for managing partnersh.ips

Over 100 Indigenous individuals and organisations, including partners, co-authors, case-study providers and reviewers, contributed to the development of the best-practice guidelines.

Indigenous rangers mangrove monitoring handbook

Since the unprecedented mangrove dieback in 2015 in the Gulf of Carpentaria, James Cook University's Dr Norm Duke has been leading a multi-Hub NESP project assessing the mangrove dieback and monitoring whether recovery is occurring. To support this, the research team has produced a guide for Indigenous ranger groups to monitor mangrove condition along the northern Australian coastline, using the MangroveWatch standardised shoreline assessment method. This guide establishes all the components and equipment settings required for groups to contribute standardised data to improve understanding of large-scale patterns in the Gulf's important ecosystems.

The sheer scale of the Gulf of Carpentaria coastline means that regular monitoring is a challenge. Through this project, Dr Duke has aerially surveyed 2,633km of Gulf coastline, but ongoing monitoring is critical to understanding mangrove recovery and identifying other unusual dieback events. This work has also been supported by the Earth Systems and Climate Change Hub, the Marine Biodiversity Hub and the Tropical Water Quality Hub.

Using eDNA to track endangered birds

It's one of the great conundrums of conservation management, that often the animal species of most concern are the most difficult and time-consuming to find. Some of these species are rare, while others are cryptic, hiding high in the canopy or deep in their burrows. Some are highly mobile, never staying in one place for too long. Others avoid the traps traditionally used by scientists to monitor animal populations.

Research funded by our Hub has developed a potentially breakthrough tool for one species: a test that detects deoxyribonucleic acid (DNA) within the environment (eDNA) of the Gouldian finch (*Erythrura gouldiae*) in water collected from the small pools where they cluster to drink. It is the first time that an eDNA test has been successfully used to detect a threatened bird species.

Despite their rainbow colouring, Gouldian finches are difficult to find. They are highly mobile and sparsely scattered across the landscape, often occurring in mixed flocks with other seed-eating birds. But, as a listed threatened species, the impact on Gouldian finches and their habitat must be considered in proposals for new developments. The Northern Territory Department of Environment, Parks and Water Security (NT DEPWS) will use the eDNA test as part of their regional surveys that provide baseline information for proposed development activities.

The eDNA test was developed and validated through collaboration between Charles Darwin University (CDU), the University of Western Australia (UWA), NT DEPWS and Jawoyn Rangers. Dr Alaric Fisher (NT DEPWS) says the project exemplified the power of NESP research to foster partnerships between organisations whose expertise ranged from genome sequencing to operational bird surveys to Indigenous knowledge of country.

The research was led by CDU Professor Karen Gibb. UWA Professor Simon Jarman and his team designed the two-in-one quantitative polymerase chain reaction (qPCR) test that recognises and makes multiple copies of a specific region of mitochondrial DNA found in estrildid finches and a species-specific probe to detect Gouldian finch DNA.

Researchers at CDU then further developed the eDNA test in the lab before trialling it in aviaries at the Northern Territory Wildlife Park. The final hurdle was validating the eDNA test under field conditions. In late 2018, researchers from NT DEPWS and Jawoyn Rangers collected water samples from the Yinberrie Hills, where Gouldian finches have been monitored since 1996. This data allowed the validation of eDNA detected in water samples against concurrent observations of the finches drinking.

Using eDNA for early detection of cane toad invasions

New research conducted at James Cook University (JCU) by our Hub has found environmental DNA (eDNA) can be used to detect the presence of a single cane toad for a few days after it arrives at a new location, even if it only visited a waterbody for as little as five minutes.

The research means that Indigenous rangers and citizen scientists in remote areas may be able to help track the invasion of cane toads by collecting a water sample from small ponds and puddles during the day, rather than searching for cane toads at night.

Cane toads have spread through Queensland and the Northern Territory and are rapidly advancing through the Kimberley region in Western Australia. Cane toads are lethal to Australia's native animals when eaten, causing population declines of more than a dozen native predator species in northern Australia, including the northern quoll and large reptiles like goannas.

"Tracking the arrival of cane toads into a new area is a challenge. They are active at night, and the low number of cane toads at the invasion front means they are difficult to detect using traditional survey methods that rely on either seeing, hearing or catching an animal," said research leader, JCU's Dr Cecilia Villacorta-Rath.

In recent years, analysing water samples for a species' eDNA has proven to be a powerful tool for detecting difficult-to-find species. Animals regularly shed their DNA in the environment, through skin cells, slime, urine and faeces.

Although cane toads don't live in the water, they do need to come to water once a day to hydrate, explained co-researcher Professor Damien Burrows. "The average time it takes for a cane toad to hydrate is five minutes. We wanted to know if we could use eDNA to detect a single cane toad that might visit a waterbody for five minutes and then leave," he said.

JCU and the Torres Strait Regional Authority (TSRA) have a long-standing mutually beneficial partnership spanning many years. TSRA provides invaluable assistance to connect JCU scientists with Torres Strait communities. TSRA Chairperson Mr Pedro Papau Stephen said the technique is already helping them monitor cane toads.

"Indigenous rangers collect water samples from islands across the Torres Strait which we send to JCU to test for cane toad DNA. We are trying to stop cane toads from reaching the outer islands so being able to tell from a water sample whether a cane toad has been in a creek is another tool in our efforts to stop the spread of toads."

Productivity sources in Gulf river floodplains

In the Gulf of Carpentaria, wet season floods replenish river channels and floodplain wetlands, and kickstart the growth of algae and other aquatic vegetation that form the base of aquatic food webs. Ensuring environmentally sustainable development of the Gulf's water resources requires an understanding of how proposed water extraction will affect the productivity of floodplain habitats.

In new research published in *Ecological Indicators*, Hub researchers used remotely sensed data to trace how floodwaters create 'hotspots' of aquatic plant growth on the Gilbert River's floodplains.

They found that while both river flows and local rainfall contribute to floodplain inundation, river flows were a better indicator of floodplain productivity.

This means that it is more important to focus on upstream water infrastructure that reduces river flows from the Gilbert's upstream catchment. This may reduce floodplain inundation in the lower catchment, leading to a loss of productivity in the wetland ecosystems that support freshwater fish, such as juvenile barramundi.

Fitzroy River algal sources, WA

New Hub research, published in *Hydrobiologia* and led by Dr Ryan Burrows of Griffith University, has found that algal biofilms thrive in the shallow, warm and light-filled runs and riffles found along the Kimberley's Fitzroy River in the dry season. They are particularly productive in areas where nitrogen-rich groundwater upwells and mixes with river water. (What are Algal biofilms – submerged, nutrient-dense mats of single-celled algae that form the basis of many aquatic food webs.)

With water allocation planning for the Fitzroy River catchment planned, it's important that we understand the conditions that promote the productivity of algal biofilms, and hence the river's food webs, all the way from microscopic algae through to metre-long barramundi. The research found that reductions in dry-season flows along the river, or lowers groundwater levels beneath the river's main channel, are likely to reduce algal production in places identified as biofilm 'hotspots'.

The research is part of a larger Hub investigating the environmental water needs of the Fitzroy River, led by Professor Michael Douglas of The University of Western Australia.

Threatened species data portal

A new data portal from Hub researchers will allow free access to information on more than 1400 rare, threatened and other plants and animals of conservation concern found across northern Australia. The new portal provides access to maps of species distributions and shows where each species is most vulnerable to potential threats such as climate change, disease, changes in fire intensity, invasive species and the expansion of mining and agriculture.

Prior to the project, there was little information available for many species of conservation concern in northern Australia. With proposals for mining and agricultural development increasing across the region, this new information will assist government agencies and Indigenous land managers to make more informed decisions. "The data management system has been designed so that the data and maps can be accessed in a flexible way," said Dr Pintor from JCU, who led the project.

The researchers used statistical models to map where there is suitable habitat for each species and where they are most vulnerable to extinction, based on their exposure and sensitivity to 11 threatening processes. Both the data used to create the models and the maps generated from the models can be accessed via the data portal.

Finance tracking

The Hub's budget and finances are tracking to be fully expended by the end of the program extension of 30 June 2021. With the approval of Research Plan version 6 (RPv6), the Hub has allocated all of its research funds of $19.2 million and we are in a very sound budgetary and financial management position in the final stages of the program's lifecycle (see attached Financial Statement up to 31 August 2020).

As a consequence of Covid-19 and the extension of the program to 30 June 2021 we will utilise what budget flexibility we have remaining to manage this impact. As flagged with the Hub Steering Committee meeting on 6 May 2020, if necessary, we will consider the internal

reallocation of funds within projects and the shifting of any unexpended funds across projects and institutions. At this time all projects are expected to be completed within their approved budget allocations under RPv6. By 30 June 2021, it is expected that the actual project spend will match the total project budgets at 31 December 2020, as shown in the approved RPv 6.

We also plan on extending the contracts of our Hub Leader and Knowledge and Adoption (K&A) team to 31 August 2021 and our three regional coordinators in the Kimberley, Kakadu and North Queensland to 30 June 2021. This will allow for final project reporting post 30 June 2021, and the communication of final project outputs, organisation of seminars and workshops and other logistical support to projects and stakeholders.

Managing final outputs

Our knowledge brokering team has planned a revised schedule for the promotion of outputs that will be progressively delivered up to 30 June 2021. Because of the likely extended impact of Covid-19 restrictions we are not planning on face-to-face meetings or seminars, and instead will have a focus on online delivery accompanied by news media, social media and webinar events. In 2021, travel permitting, we will conduct tailored briefings and short seminars in Canberra with line areas of the Department that are the target audiences of our research.

Effectively sharing knowledge and results from our projects is at the heart of all Hub projects. Our projects were co-designed to meet the scientific needs of research users in northern Australia and recently, we've begun to capture the impact of this work through stories that highlight how our research is being used.

We also have contingency plans in the event that second waves or outbreaks of Covid-19 result in the extension of existing closures or the re-introduction of closures to travel. We will be requesting an updated report from project leaders in October this year that will be considered by the Research Executive Committee (REC) and our K&A team in revising and updating our planning and timetable for the delivery of final project outputs. In the event we have to modify final outputs then this will be done in conjunction with the agreement of our identified research users.

We will prepare a high quality, publishable (online) final report for the program as a whole that summarises major achievements and highlights research impact through case studies. This will be finalised after June 2021 to allow for the inclusion of final synthesis projects, and the summation or reporting against program performance indicators. Our website will continue as the main source of project -evel information and repository for individual project outputs.

Research

Attachment A lists all projects (active and completed) funded under the Northern Australia Environmental Resources Hub and provides detailed information on the project status, information on outputs and links to products for all projects (where available) as at 30 August 2020. A new column has been included that specifically deals with the impact of Covid-19. Exceptions to the NESP Data Management and Accessibility Guidelines are also noted here.

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www.nespnorthern.edu.au

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