Ranger uranium mine in the Northern Territory.

Northern Australia Environmental Resources Hub

National Environmental Science Programme

nespnorthern.edu.au
nesp.northern@cdu.edu.au
/NESPNorthern
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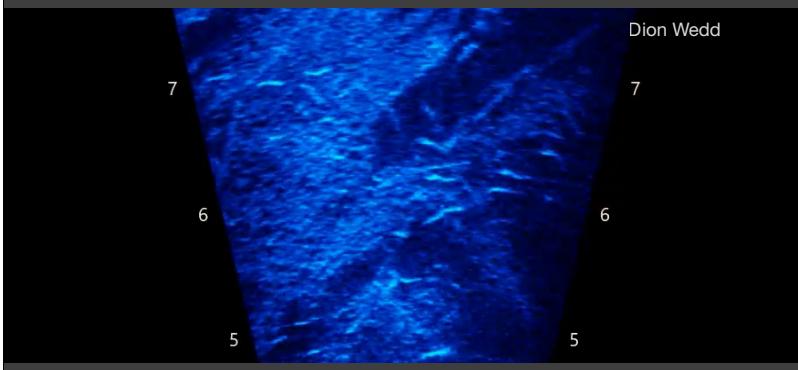
IMPACT STORY 2019

Filling knowledge gaps for the rehabilitation of Ranger uranium mine

How do you restore the site condition of a former uranium mine so it can be included in a national park? NESP researchers are tackling this restoration challenge at Ranger uranium mine, producing new knowledge about the possible impacts on fish and riparian vegetation from potential leachate into creeks, and developing guidelines and targets for the return of local native fauna and flora to the site.

Find out more about these projects

Investigating plant sensitivity to magnesium sulfate.



Sonar allows identification of fish species and size.

Invertebrates such as ants are an important inclusion in rehabiliation standards.

Ranger uranium mine lies entirely within World Heritage-listed Kakadu National Park. In January 2021, processing operations at the mine will cease and rehabilitation works are planned to be completed by 2026. The rehabilitation must "establish an environment similar to the adjacent areas of Kakadu National Park such that … the rehabilitated area could be incorporated into the Kakadu National Park" (Commonwealth of Australia 1999).

Over the mine's lifetime, the Australian Government's Supervising Scientist Branch (SSB) has undertaken a comprehensive monitoring and research program to ensure that mining operations did not adversely affect the surrounding environment and the people who live within it.

> "Over the 40 years that we've been collecting environmental data we've been able to demonstrate that the environment, including Kakadu National Park, has remained protected. It's equally important now that the environment remains protected over the very long term."
> – Keith Tayler, Supervising Scientist, Department of Agriculture, Water and the Environment

Scientific collaboration with the Australian Government's National Environmental Science Program has played an essential role in informing the successful rehabilitation of Ranger and the long-term protection of Kakadu, Mr Tayler says.

In 2015, the Alligator Rivers Region Technical Committee asked SSB and mine operator Energy Resources Australia Ltd (ERA) to identify the key knowledge needed to ensure successful rehabilitation of the site, and to better understand and mitigate the risks to the off-site environment.

One knowledge gap was the potential impact of elevated levels of magnesium sulfate ($MgSO_4$) leaching from mining waste rock into nearby Magela Creek, either through overland or groundwater flows.

There is a risk that a salty plume of water laden with $MgSO_4$ could be a barrier to fish migration from the escarpment billabongs into Magela Creek and its floodplain, and then back again, as the wet season waxes and wanes.

Charles Darwin University (CDU) Associate Professor David Crook developed a conceptual model of how fish move through Magela Creek, based on data collected from sonar imagery of fish assemblages and acoustic tracking of individual fish. The model will help SSB understand the conditions under which fish migrate and how salty run-off could affect this.

Mr Tayler says that the information will be used as part of SSB's impact assessment, based upon a model of the water quality in Magela Creek for hundreds of years after rehabilitation.

There was also little knowledge of the sensitivity of riparian vegetation to elevated concentrations of $MgSO_4$ in soil and groundwater. Experimental trials on how seven of the most common species of riverbank tree respond to $MgSO_4$ are being undertaken at the University of Western Australia and at CDU, under the supervision of Associate Professor Samantha Setterfield and Professor Lindsay Hutley, respectively. Results to date suggest that impact on sapling growth may be limited, although the trials are ongoing.

> "The work that has been done by NESP is critical in ensuring that we have an understanding of the sensitivity of all key vegetation species."
> – Keith Tayler

Another knowledge gap was how to set appropriate targets for the return of animals to the rehabilitated site as habitat develops over time.

> "We're looking to develop criteria that will give us confidence that the environment that's created at Ranger will be suitable for the range of fauna that typically would inhabit the national park,"
> – Keith Tayler

CDU Professor Alan Andersen collaborated with scientists from the NT Department of Environment and Natural Resources (DENR) to develop five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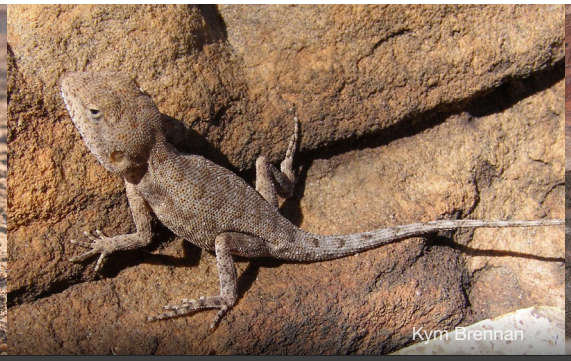
Kym Brennan


Kym Brennan

Birds, reptiles and mammals are also important inclusions for faunal restoration standards for minesites.

specifications for fauna rehabilitation standards at the site. The specifications were based on data collected over decades from the DENR's Kakadu-based Three Parks Fire-plot Monitoring Program.

The structured approach used to recommend fauna rehabilitation standards for the Ranger mine is transferable to other hard-rock mine-site rehabilitation projects, and to restoration projects more generally. The expected incorporation of the Ranger Project Area into Kakadu National Park means that rehabilitation standards for the site will likely differ from those set for other mine sites. Although the particular specifications of the rehabilitation standards will vary on a project-by-project basis, the principles used to develop a robust and meaningful set of standards will be the same.

The high standard of ecosystem restoration required at Ranger is not something that would be typically expected of a hard rock mine, explains Mr Tayler. It presents unique and interesting scientific challenges.

> "The Northern Hub has done some really fundamental work for us, which will help us greatly in our assessment of the likely impacts to the environment during rehabilitation."
> – Keith Tayler

References

Commonwealth of Australia. 1999. Environmental requirements of the Commonwealth of Australia for the operation of Ranger uranium mine.

Research outputs

Scientific paper

- Effect of elevated magnesium sulfate on two riparian tree species potentially impacted bymine site contamination (February 2020)

Reports

- Recommended faunal standards for the rehabilitation of Ranger uranium mine (August 2019)
- Invertebrate assemblages at Ranger uranium mine's trial revegetation sites compared with natural reference sites (August 2019)
- Rehabilitation of vertebrate assemblages at Ranger uranium mine: Assessment standards and monitoring methodology (August 2019)

Video

- Fish movement and sensitivity (August 2019)
- Faunal requirements for rehabilitated mine sites (October 2020)

Factsheets

- Recommended standards for fauna recovery at rehabilitated mine sites (wrap-up factsheet, September 2019)
- Fish movement and sensitivity to contaminated mine water (project update, August 2019)
- Tree water use and sensitivity to contaminated mine water (project update, April 2020)
- Tree water use and sensitivity to contaminated mine water (start-up factsheet, July 2018)
- Rehabilitated mine sites and Top End animals (start-up factsheet, July 2018)
- Fish movement and sensitivity to contaminated mine water (start-up factsheet, July 2018)

Dataset available on request

- Effect of elevated magnesium sulfate on two riparian tree species

Project webpages

- Tree water use and sensitivity to contaminated mine water
- Rehabilitated mine sites and Top End animals
- Fish movement and sensitivity to contaminated mine water

Attributions

- Project leaders: Lindsay Hutley, Alan Andersen, David Crook (CDU)
- Keith Tayler, Chris Humphrey, Renee Bartolo, Andrew Harford, Tom Mooney, Lisa Chandler (SSB)
- Brendan Adair, Diego Alvarez-Cortez, Adam Bourke, Clement Duvert, Stefanie Oberprieler, Dion Wedd (CDU)
- Samantha Setterfield, Caroline Canham, Ornela Cavalieri, Fiona Freestone (UWA)
- Alaric Fisher, Luke Einoder (NT DEPWS)
- Ping Lu (Energy Resources of Australia Ltd)
- Gundjeihmi Aboriginal Corporation and Djurrubu Rangers
- Peter Christophersen (Kakadu Native Plants)

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