Freshwater biodiversity assessment and conservation planning in northern Australia

Project team

Mark Kennard, Simon Linke, Virgilio Hermoso, Lorenzo Cattarino, Jane Hughes, Dan Schmidt, Doug Ward, Brad Pusey, Josie Carwardine (CSIRO), Vanessa Adams (UQ, Macquarie Uni), Natalie Stoeckl (JCU)

Timeframe

Ongoing

Project description

Northern Australia features a range of significant aquatic ecosystems, including estuaries, rivers, lakes and wetlands. These ecosystems not only provide clean water, food and recreation but have important intrinsic ecological and cultural values. These ecosystems also support high biodiversity, including many unique species of aquatic plants and animals. To increase knowledge about these aquatic ecosystems and improve the conservation and management of their biodiversity, we have led pioneering research in collaboration with government and a range of stakeholders. The outstanding conservation values of northern Australia's tropical rivers, are under increasing pressure from human activities, invasive species and other stressors. Our research has assessed the values of northern Australia aquatic ecosystems and the impacts of development alternatives on the ecosystems and the aquatic biodiversity they support.

We have identified, mapped and classified the various aquatic ecosystem types (e.g. rivers, lakes, floodplains, estuaries) for all river basins of northern Australia. The mapping process revealed the extraordinary diversity and extent of aquatic ecosystems in northern Australia. We have also assembled a comprehensive database with spatially explicit information on species distributions for a range of freshwater-dependent fauna (including macroinvertebrates, freshwater fish, turtles and waterbirds). Because there were substantial data gaps in the availability of species distribution records, we successfully developed models to accurately predict the distribution of these water-dependent species in unsurveyed areas of the study region. Collectively, these datasets provided a comprehensive set of biodiversity surrogates ideal for identifying aquatic conservation priorities in the region.

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Funding

We have developed new approaches to improve adequacy of systematic conservation planning specifically for freshwater ecosystems in northern Australia. This includes:

1) planning for spatial connectivity (to accommodate movement requirements of biota and consider propagation of threats);

2) planning for temporal connectivity (spatial connectivity constrained by the presence of water which is highly variable in strongly seasonal systems of northern Australia);

3) prioritizing aquatic refugia in intermittent systems; and

4) planning for the invisible level of biodiversity – cryptic (genetic) diversity which contributes to resilience of species to environmental change and maintenance of evolutionary potential.

Systematic planning tools can help decision-makers to conserve biodiversity in the most cost-effective way but usually do not directly prescribe actions to remediate threats. We have developed a new decision framework and mathematical tool to identify which conservation management actions to implement in particular areas to maximise the persistence of species with the least cost. Using the Mitchell River (Queensland) and Daly River (Northern Territory) as test catchments, we quantified the distribution of multiple freshwater fish, turtle and waterbird species (using predictive models) and the effects of different threats and management actions on their long-term persistence (using expert elicitation). We linked this information to a spatially-explicit mathematical tool (developed as part of the project) to spatially prioritize the specific actions necessary to remediate the threats affecting these species. Our framework prescribes the nature of the action (e.g., fencing of riparian vegetation for grazing management, shooting of feral herbivores to reduce river bank erosion, chemical or biological treatment for cane toad control, removal of dams or redesign of levee banks for river flow restoration) as well as the spatial location of the action. The framework represents a transferable approach to priority threat management and can aid cost-effective habitat restoration and land-use planning.

Outcomes

Our research on biodiversity assessment, conservation planning and human impacts on aquatic ecosystems is directly contributing to more effective and efficient conservation management of northern Australia's aquatic resources. For example, our research contributed to the Australian Government scientific panel assessment of the International and National Heritage values of Cape York Peninsula and the Kimberley (for the Department of the Environment Heritage Branch). We also contributed to the development and implementation of the High Ecological Value Aquatic Ecosystems Toolkit as part of the Northern Australia Water Futures Assessment for the Department of the Environment and the National Water Commission. In addition, a range of research information outputs (including publications, maps and GIS data layers) arising from our work have been used by the Queensland and Northern Territory governments to inform water resource planning, agricultural resources and threat assessments and the development of aquatic monitoring programmes in northern Australia. Our research activities have also built capacity of Australian government staff (e.g. from the Environmental Research Institute of the Supervising Scientist and Parks Australia).

Funding

- National Environmental Research Program (NERP) – Northern Australia Hub
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- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)
- National Water Commission (NWC)
- Northern Australia Land and Water Taskforce, Office of Northern Australia

- Department of Environment and Resource Management, Queensland Government

For more information, contact

Associate Professor Mark Kennard

Email: m.kennard@griffith.edu.au

Research outputs

Book chapters

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