NATIONAL PROGRAM FOR Sustainable Irrigation

Research Bulletin

Northern Australia Irrigation Futures

By Justin Story, Keith Bristow and Jeff Camkin

The Northern Australian Irrigation Futures (NAIF) project has worked closely with the WA, NT, QLD and Australian governments, researchers and stakeholders, to deliver new knowledge, tools and processes to support debate and decision making regarding irrigation in northern Australia (see Figure 1).

NAIF has highlighted the importance of developing a system-wide understanding of the context for irrigation in northern Australia and a shared vision for its future. NAIF has also demonstrated that while no single framework can hope to ensure sustainability, it is possible to deliver knowledge, tools and processes that can help governments and catchment communities make decisions about these complex issues.

Key messages from the research:

- Research processes which effectively contribute to the integration of science, policy and stakeholders are highly valued by a wide range of stakeholders.
- The land and water resources of northern Australia are already being used and decisions are about whether to redirect these resources to different uses.

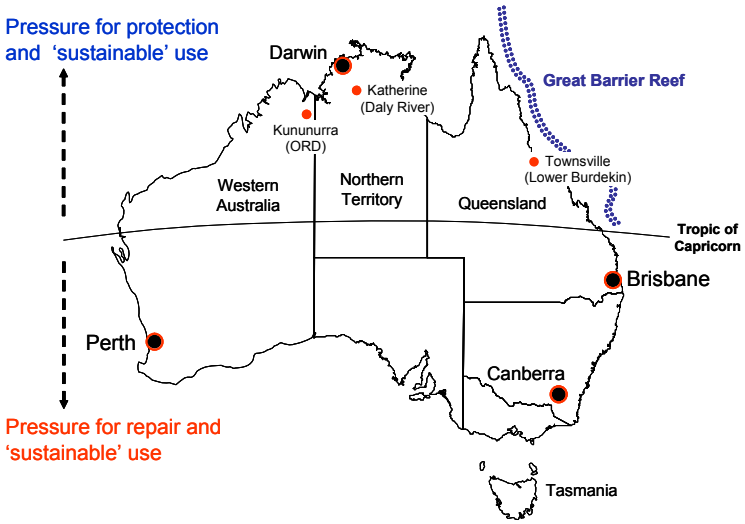

Figure 1: Map of Australia showing the Tropic of Capricorn, the three NAIF study sites as well as capital cities of influence for northern Australia.

- Generating localised short term benefits from irrigation is 'easy', delivering catchment scale long term sustainability is the challenge.
- We need to develop the capacity to view, understand and manage northern Australia through a 'northern lens' which takes account of the national and international context.

Above all else, decisions about the future of irrigation in northern Australia are about people and relationships.

Northern Australia and the NAIF Project

Northern Australia holds an iconic status for many Australians. The interplay between the landscapes, rivers, groundwater and strongly monsoonal weather patterns has resulted in unique and diverse ecological systems. At the same time, with 60 to 70 per cent of Australia's fresh water discharging from tropical rivers, the region faces significant environmental challenges associated with increasing pressure to develop land and water resources, catchments and coastal environments, as well as managing existing threats, including weeds, pests, feral animals and fire.

There is a unique and historic opportunity to ensure that management and use of Australia's northern land and water resources takes place within a strategic, ecologically, culturally and economically sustainable framework. Deciding on whether to expand irrigation in northern Australia, and if so what irrigation should look like, where it should be located, and how it should be managed, requires an improved understanding of northern groundwater, river and catchment attributes and of the risks and benefits associated with irrigation.

The NAIF project was divided into two stages. Stage 1 focussed on engaging with clients to:

(i) identify a broad range of project stakeholders

(ii) identify data required and data sources

(iii) determine the willingness of stakeholders to participate in project activities

Stage 2 focussed on the key research areas:

(i) the hydrology, context and history of irrigation in northern Australia

(ii) irrigation mosaics as an approach to irrigation in northern Australia

(iii) developing a framework to support debate and decision making regarding irrigation, which became known as a 'sustainability framework'

This research bulletin focuses on the outcomes of the Stage 2 research (see Figure 2) as well as findings about the NAIF project overall.

NAIF established three case study areas as part of its research effort (see Figure 1):

- the lower Burdekin catchment
- Ord catchment
- Katherine-Douglas-Daly catchment

By using case study areas the project was able to test ideas and frameworks during their development, gaining important feedback directly from the communities to help ensure the frameworks were practical, suitable and likely to be adopted.

NAIF Key Research

The hydrology, context and history of irrigation in northern Australia

Cultivated agriculture and irrigation developments are not new to northern Australia. Several irrigation schemes, such as the lower Burdekin, Pioneer and Mareeba schemes in north Queensland are more than 100 years old, and irrigation at the Ord River in Western Australia has been in operation for more than 40 years. Other irrigation developments collapsed soon after they commenced operation (e.g. Humpty Doo). Numerous studies and reports have examined the reasons for European based development either failing or never starting in the north of Australia. A much cited factor is a failure to understand the northern environment.

NAIF has laid foundations for understanding the hydrology of northern Australia by providing a broad overview of the surface and groundwater resources with respect to irrigation development. The literature on the hydrology of the north was reviewed and some key biophysical issues, opportunities and constraints for irrigation identified. Particular emphasis was placed on illustrating the differences between water systems in northern Australia, which are tropical, and those of temperate southern Australia.

Key messages from this research include:

- Groundwater can be critical to base flow and maintenance of ecological function
- Water quality is as important as quantity, especially in meeting ecological needs
- Water availability and storage needs for irrigation in event-driven tropical systems are poorly understood
- We need to ensure policies and management strategies make sense for event-driven tropical systems

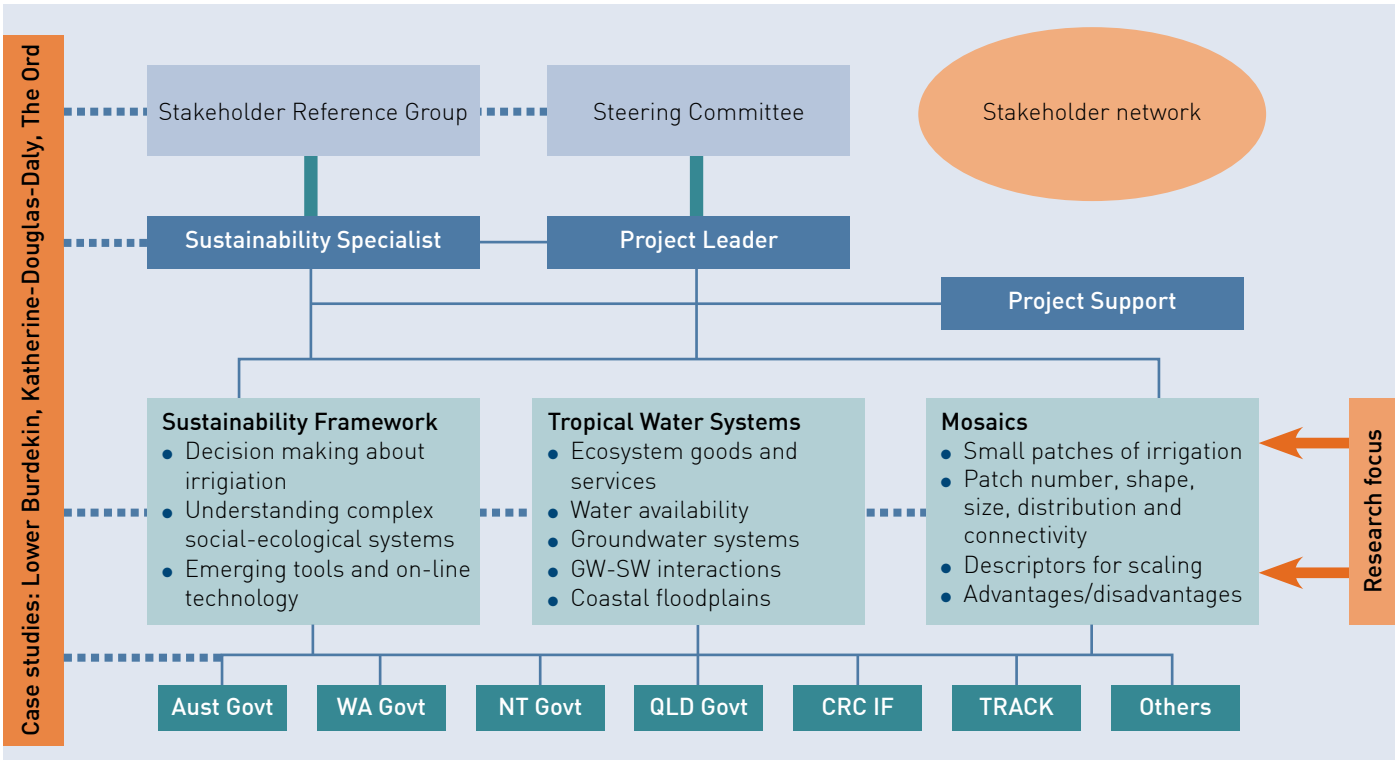

Figure 2: NAIF project structure, key research areas and major inputs.

- Irrigation must be preceded by catchment-scale water, salt and nutrient management plans to deliver on long term sustainability objectives
- We must set and meet groundwater quantity (level) and quality targets in irrigated systems and adjust management practices to meet those targets
- "Efficiency" is not the answer to everything; the aim is to build and maintain resilience in irrigated systems

Irrigation mosaics: a possible alternative approach to irrigation

Most irrigation areas in Australia are characterised by large-scale contiguous irrigation areas. Irrigation mosaics, involving discrete patches of irrigated land dispersed across the landscape, may offer an alternative and could be particularly attractive for delivering improved social and economic opportunities for rural and remote communities (often indigenous) in northern Australia. However, the longer-term environmental impacts of irrigation mosaics are still largely unknown. NAIF examined some of the issues associated with irrigation mosaics, focussing on their bio-physical effects compared to large scale contiguous irrigation systems.

Key messages from this research include:

- There is growing interest in irrigation mosaics as an alternative approach to traditional large-scale contiguous irrigation systems.
- Irrigation mosaics may have both negative and positive biophysical effects compared with more traditional systems, with a possible net positive impact.
- Further research is required on the biophysical, ecological, social and economic advantages and disadvantages of irrigation mosaics.

Frameworks to support irrigation decision-making

Water and irrigation decisions are complex and there are many uncertainties. Recent experiences in the Murray-Darling Basin, for example, have increased awareness of the risks and consequences of water use decisions. Communities now expect developments to not only have acceptable environmental impacts but also deliver social and economic benefits to the community. Non-government organisations and individuals are better trained, connected and equipped to monitor decisions and demand accountability. Together, these trends are increasing pressure on decision makers.

NAIF initially aimed to "*...deliver a framework based on sustainability indicators and management criteria at a range of scales...*". The focus of the framework changed as issues of complexity, uncertainty, resilience, risk and adaptive management emerged through the research. Instead of a simple set of biophysical indicators, the framework developed with a focus on supporting communities and decision makers deal with complexity and uncertainty in a comprehensive, transparent and inclusive way. A prototype framework was developed for the lower Burdekin consisting of an Ecologically Sustainable Development (ESD) Component Tree system, a web-based catchment knowledge platform and processes for improving the integration of science, policy, management, community stakeholders and industry.

Key messages from this research include:

- Dealing with complexity, uncertainty and risk in irrigation decision-making emerges as a shared need and responsibility for catchment communities, proponents and governments.
- Dealing successfully with the complexity of irrigation in northern Australia to achieve long term ecologically sustainable development will require decision-making and irrigation management systems that better utilise existing and emerging technologies and approaches.
- Implementing frameworks, including catchment knowledge platforms and ESD Component Tree systems, which effectively integrate science, policy, management and other stakeholders will support more comprehensive, transparent and consistent planning and decision-making.

Future Directions for NAIF

The context in which NAIF was conceived has changed significantly since 2003 and the project has adapted to that changing environment. The NAIF project has been highly collaborative and there is now a 'brand' with a shared vision and processes to transfer experiences across jurisdictional boundaries.

Issues and opportunities that arise from the NAIF experience to date are:

- The need for these sorts of projects to bring teams together with understandings of science, policy, management and stakeholder perspectives
- The need to work across disciplines and scales simultaneously. This means working within a catchment context and feeding into larger visions and objectives while also connecting with local landholders and other decision makers
- The need to deliver tools that aid understanding of the difference between uncertainty and risk so that communities and governments can make decisions with reasonable confidence while knowledge gaps are progressively addressed

- The need to develop fundamental understandings about how northern Australia functions ecologically, socially and economically

Although the NAIF project has identified and investigated important questions and issues for irrigation development, several knowledge gaps identified as research priorities include:

- Understanding northern Australia water systems including surface water-groundwater interactions
- Ecosystem water needs
- Indigenous and other cultural values of water
- Identification of key policy issues relating to irrigation in northern Australia
- Understanding irrigation mosaics, their long-term impacts and potential to contribute to ecologically sustainable development
- Catchment-scale water, salt and nutrient planning and management in northern irrigation systems
- Development and application of frameworks to support irrigation decision-making
- Potential for sustainable development linking mine water and irrigation in remote rural communities of northern Australia
- Water storage needs and the use of supplementary water sources (including overland flow, flood harvesting and aquifer recharge) to support sustainable irrigation

The key message is that decisions about the future of irrigation in northern Australia are about people and their relationships with each other and their environment and as such it is vital to include this in any future research.

For more Information

NAIF reports can be found at **www.npsi.gov.au** or visit the NAIF website at **www.clw.csiro.au/naif**

CONTACT

- **Keith Bristow**
  keith.bristow@csiro.au Ph: (07) 4753 8596
- **Jeff Camkin**
  jeff.camkin@csiro.au Ph: (08) 9333 6398
- **Justin Story**
  justin.story@csiro.au Ph: (08) 9333 6232

NAIF is a collaboration between the National Program for Sustainable Irrigation and:

Australian Government
Department of Agriculture, Fisheries and Forestry

NAIF
Northern Australia Irrigation Futures

CSIRO

Cooperative Research Centre for Irrigation Futures

Government of Western Australia

Northern Territory Government
Department of Natural Resources, Environment and the Arts

Queensland Government
Natural Resources and Water

North Burdekin Water Board

SunWater

About the Program

The National Program for Sustainable Irrigation defines and invests in research on the development and adoption of sustainable irrigation practices in Australian agriculture. The aim is to address critical emerging environmental management issues, while generating long-term economic and social benefits that ensure irrigation has a viable future.

The Program has 16 funding partners: Australian Government Department of Environment and Water Resources, Cotton Research & Development Corporation, Gascoyne Water Asset Mutual Co-operative, Gascoyne Water Co-operative, Goulburn-Murray Rural Water Corporation, Grains Research & Development Corporation, Harvey Water, Horticulture Australia Limited, Land & Water Australia, Lower Murray Water, Ord Irrigation Asset Mutual Co-operative, Ord Irrigation Co-operative, South Australian Research and Development Institute, Sugar Research & Development Corporation, Sunwater, and Western Australia Department of Water.

NPSI is managed by Land & Water Australia on behalf of the Partners.