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Aboriginal and non-Aboriginal scientist knowledge shared on-country at Toorale: a case study to encourage non-Aboriginal scientists to take their first step

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ABSTRACT

"Beautiful to see the brolgas, they are here to welcome us because they know that we're here to help them, cause they're our people..." Uncle Badger Bates The imperative to incorporate Aboriginal knowledge into Australian freshwater management has never been clearer. The 2024 Menindee fish kill highlight failures in current management and monitoring. Federal and select State Governments have recognised Aboriginal cultural water practices as a component of regional water sharing plans and as an ingredient in sustainable freshwater catchment management. Drawing on stories, experiences and conversations gathered during an 'on Country' knowledge-sharing day at Toorale Station near Bourke, New South Wales, this paper explores the interplay between Aboriginal and non-Aboriginal scientist knowledge. Four major themes emerged from the day regarding the current state and future management of the Warriku (Warrego River) and Baaka (Darling River): 1) the experience of welcome and being on Country; 2) the holism associated with a Country perspective; 3) the threats posed to the Baaka and the Warriku and their peoples by settler-colonial land and water management policies and practices; and 4) future directions. This case study aims to help non-Aboriginal scientists bring Aboriginal peoples and their knowledge into environmental monitoring and management of Australian freshwater environments.

ARTICLE HISTORY

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Aboriginal knowledge; non-Aboriginal science; knowledge sharing; Murray-Darling Basin

1. Introduction

At the end of the day Kularku (Brolga) flew overhead calling. Uncle Badger Bates called back to them, in Baakandji language, he said – they know we are doing something good together here today.

On 17 June 2023 a group of Baakandji Native Title Owners, government representatives and non-Aboriginal environmental researchers met on Toorale Station in western New South Wales (Figure 1). The meeting's purpose was to share ideas and knowledge about the current condition of the Baaka/Darling River (Baaka hereafter) and Warriku/Warrego River (Warriku hereafter) (Figure 1). The gathering continued a dialogue between Traditional Custodians and public (i.e. State Government department/agency and university) and private sector researchers on the compatibility of their knowledge systems regarding the river. In particular, the conversation focused on the potential incorporation of an Indigenous 'caring for Country' approach with non-Aboriginal scientific management stances and vice

versa, thereby braiding Indigenous and non-Indigenous water knowledges (Kimmerer 2012). Genuine dialogue is critical to breaking down the barriers between typical European approaches and the holistic perspective to 'Country' held by Aboriginal Traditional Custodians.

Federal and relevant State Governments have become increasingly willing to formally recognise Indigenous cultural water practices as a component of regional water sharing plans and as a potentially important ingredient of sustainable freshwater catchment management (DCCEW 2023; DPIE 2023). The Toorale event reported in this paper was also intended as one small step forward in a longer journey in support of local/regional Aboriginal people regaining greater sovereignty over the management and use of their Country. Employing the words of Bates et al. (2023, 1), the day could be seen as an exercise in promoting 'water justice': '... a process for transformational changes in relation to water, how it is used, what it is valued for, and who has voice and decision-making authority over how water is allocated over place and time'.

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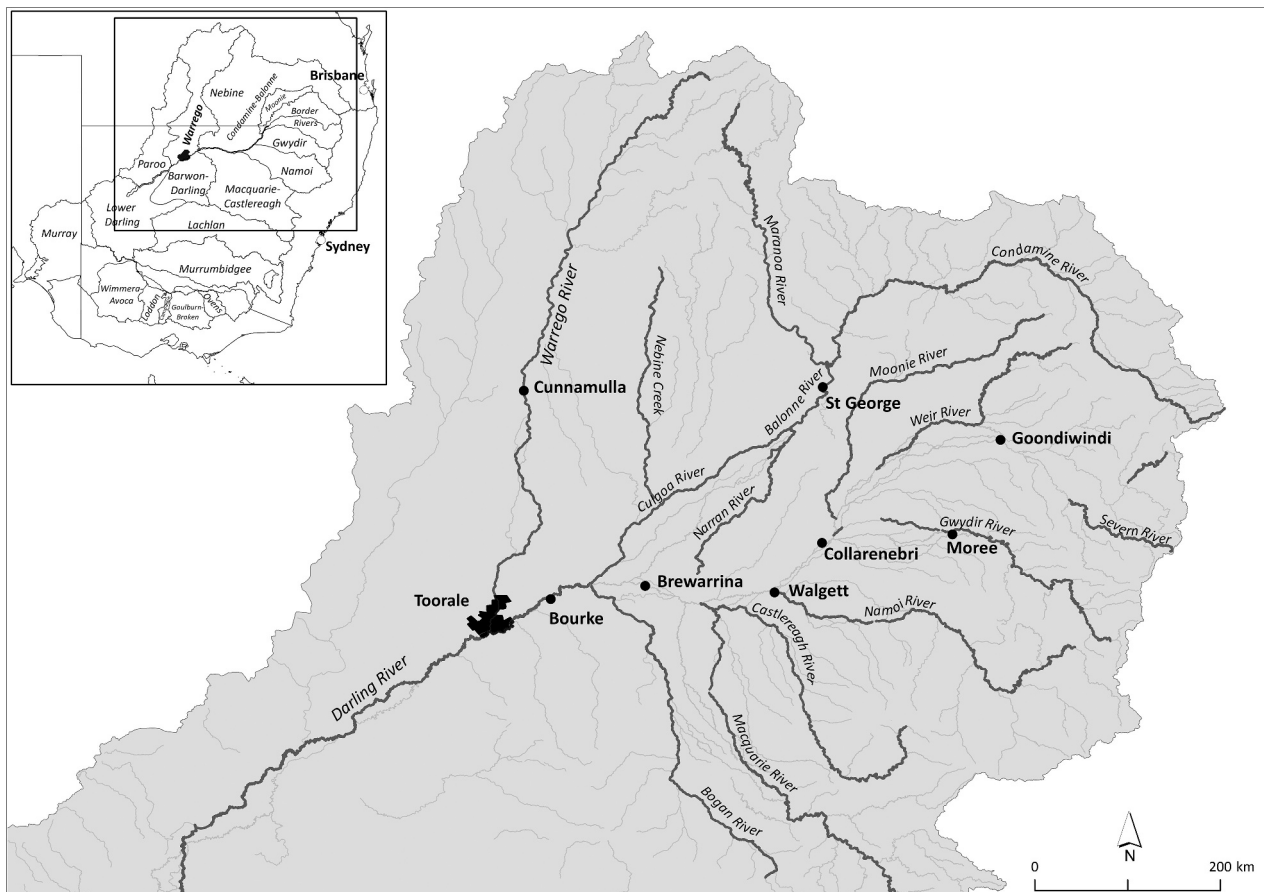


Figure 1. Toorale National Park location in northern Murray-Darling Basin at the confluence of the warrego (Warriku) and Darling (Baaka) rivers.

Drawing on the stories, experiences and conversations shared within the group on the day on Kurnu-Baakandji Country, this paper addresses the following questions: How might the different forms of knowledge/understanding and experience about riverine landscapes held by Aboriginal Traditional Custodians and non-Aboriginal river scientists and managers be integrated to lead to more ecologically and politically just management of the Baaka and its tributaries? What tensions, if any, might exist between traditional approaches to caring for Country and non-Aboriginal scientific understandings? How are these tensions expressed and how might they be reconciled?

This paper seeks to link the current state of the Warriku and Baaka Rivers to the history of regulation and management imposed since settler-led management became dominant. We describe the approaches and outcomes of the combined on-Country sharing event through the perspectives of both the Aboriginal Traditional Custodians and the non-Aboriginal scientists. Key themes that arose are described and evaluated. The reporting of this knowledge sharing case study also aims to document a path to encourage non-Aboriginal scientists to better use their resources to bring Indigenous people and their knowledge into environmental monitoring and management.

1.1. River regulation and river condition

The water resources of the northern Murray-Darling Basin have been increasingly captured and extracted for irrigation development since the 1970s (Thoms and Sheldon, 1997) with growing impacts on natural river resources including internationally reported fish deaths (Chief Scientist 2023; ABC 2023; Vertessy et al., 2019). At Bourke, the Baaka is downstream of several large headwater dams in the Macquarie, Namoi, Gwydir, Severn and Dumaresq rivers that have reduced flows at Brewarrina (upstream) and Wilcannia (downstream) by approximately 25%. The declining ecological health of the Baaka has been reported over the past several decades, in association with decreasing river flows and water quality and restricted movement opportunities for aquatic fauna due to weirs and regulating structures (Mitrovic et al. 2003; Sheldon, 2017; Chief Scientist 2023).

In the Warriku on Toorale, settler-driven development commenced in the late 19th century (Eco Logical Australia 2019) with land clearing and construction of in-stream dams. Many of the in-stream dams remain and are important to the more recent history and activity of the Traditional Custodians (Eco Logical Australia 2019). In 2008, Toorale was purchased by

Table 1. Major legislative and programme initiatives in Indigenous cultural water relevant to Toorale area.

<i>Pre-dominant institutional scale/Initiative or legislation</i>	<i>Year began</i>
<i>- National/Commonwealth</i>	
National Water Initiative (NWI)	2004
National Water Act	2007
National Cultural Flows Research Programme (NCFRP)	2011
Aboriginal Waterway Assessment tool (AWA)	2011
National Agreement on Closing the Gap	2020
<i>- State (New South Wales)</i>	
Water Management Act (WMA)	2000
Aboriginal Water Initiative (AWI)	2012
<i>- Non-Government/Peak Organisation</i>	
MLDRIN and NBAN: Echuca Declaration	2007
Ngarrindjeri Regional Authority: Kungun Ngarrindjeri Yunan Agreement	2009

the Federal Government, partly to acquire the water licences in compliance with the Commonwealth *Water Act 2007* (*Water Act 2007*). The land is now managed by NSW National Parks and Wildlife Service (NPWS) with guidance provided by the Traditional Owner joint management committee (JMC) (DPIE 2021). The JMC consists of elected Traditional Custodians who work with the NPWS to jointly manage Toorale National Park and State Conservation area. Since 2019 several internal dams have been upgraded to improve stability, manageability and the longitudinal movement of biota.

1.2. Access to country

Uncle Kevin Knight (Kurnu-Baakandji elder) tells of being denied access to country until the property came under NPWS management. Prior to that time, only station workers were permitted on Toorale and Aboriginal people were actively excluded and dispossessed, denied access for cultural purposes. Since 2008, though, access has become more open and the JMC has a role in directing current and future use of the area. Uncle Kevin also speaks of the conditions for the 'Old People' who were only permitted to be on their traditional lands if they worked on the property. Payment for this work generally came as food rations and often traditional practices were actively discouraged.

1.3. The shifting institutional landscape of NRM and Indigenous involvement from 2000

The application and acceptance of Indigenous knowledge to the shaping of freshwater ecologies and flow regimes has occurred gradually over the past two decades. The recognition and incorporation of Indigenous values in inland water management have occurred in an incremental and spatially disjointed fashion, with some States moving more rapidly than national-scale initiatives on processes of recognition and active engagement of Indigenous people in water management. Local and regional Indigenous

organisations have actively sought to subvert the doctrine of 'aqua nullius' (Marshall 2017), and, along with an increased engagement of local Indigenous peoples in inland riverine management decision-making, have helped shape the philosophy, policy and practice of water sharing plans (see Table 1).

The New South Wales Government's *Water Management Act 2000* aimed to recognise Indigenous people's prior ownership and management of the natural environment, advocating for the (limited) return of Indigenous peoples' customary rights to Country. The Act observed that Native Title Rights – where legally recognised – extended to rivers, creeks and floodplains of catchments (Moggridge and Thompson 2021). Section 55 of the Act gave recognition to the cultural significance of select riverine sites and their need for water. Special purpose Indigenous access licences facilitated the nurturing of sacred sites and the associated advancement of local Indigenous community development (Moggridge, Betteridge, and Thompson 2019). In addition, the *Water Management Act 2000* enabled the formation of regionally based Water Management Committees, with each committee to include two indigenous representatives (Moggridge, Betteridge, and Thompson 2019). The release of the landmark Boomanulla Statement in 2002 (Moggridge and Thompson 2021) encapsulated Aboriginal groups' intentions to further shape the *Water Management Act 2000* towards Indigenous ownership and cultural resource management.

The 2004 National Water Initiative (NWI), overseen by the National Water Commission (NWC), explicitly recognised the productive, social and spiritual significance of water for Australian Indigenous people (Jackson et al. 2012). The NWI was foregrounded in the domestic political and practical challenges that dogged the implementation of the Murray-Darling Basin Plan, including cross-jurisdictional disagreements over water allocations during the severe and long-running 'Millennium' drought. The Federal Government's formal vote in support of the 2007 UN Declaration on the rights of Indigenous Peoples in 2009 was a catalyst for reforms to the NWI's

legislation and programme (Productivity Commission 2020, 123). Importantly, Articles 25 and 26 of the 2007 UN Declaration stated that ‘... Indigenous people have rights to waters that they have traditionally owned, including the right to own, use and develop those resources’ (UN 2007, 37–38; see also Jackson et al. 2012; Hemming et al. 2017).

The co-signatories to the NWI agreed that Indigenous people must be included in all relevant water planning processes and that their interests be recognised in the formulation of the regionally based Water Plans that would operationalise the NWI (COAG 2004, Escott, Beavis, and Reeves 2015). Sections 52–54 of the NWI acknowledged that the key principles of the *Native Title Act 1993* applied equally to water resources and land. The NWI thus reflected a growing consensus within international legal and regulatory spheres that Indigenous Peoples’ knowledge and experience is fundamental to the ecologically sustainable and socially- and economically-just management of natural resources (Ens et al. 2012). While the NWI was not without its critics (Tan and Jackson 2013), Section 52 of the subsequent national intergovernmental agreement on water formally enshrined the role of Indigenous knowledge in future water planning and management (Escott, Beavis, and Reeves 2015).

The Commonwealth *Water Act 2007* allowed for greater Indigenous involvement in the governance and management of Australian freshwater resources. A key component of the *Water Act 2007* was the development of the Murray-Darling Basin Plan (Basin Plan), a responsibility that necessitated the involvement of the Basin States, the last mentioned given the responsibility for developing regionally-specific water resource plans ‘... in consultation with Indigenous groups’ (Hemming et al. 2017, 13).

In this evolving context, a number of increasingly active and prominent Indigenous organisations emerged. Coinciding with the introduction of the *Water Act 2007*, the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) – around twenty tribal groups or nations within the broad region – released its Echuca Declaration. Effectively a manifesto on Indigenous water needs (Hemming et al. 2017), the Echuca Declaration reflected Indigenous people’s growing frustration with governmental approaches to consultation. As well as introducing the notion of cultural flows into the Australian water resources policy lexicon, the statement emphasised the need for truly reciprocal and equitable relationships between all parties negotiating over the future allocation of water resources. Hemming et al. (2017, 13) stressed that ‘... Indigenous Nations, adequately resourced, are able to build their own capacity to engage in the complexities of the rapidly evolving management realm’ to combat what Robison et al.

(2018) termed ‘water colonialism’ (see also Hartwig et al. 2022).

1.4. From recognition to actively shaping policy and programmes

Recent State and National initiatives have focused on better understanding and elaborating on the notion, and practice, of Indigenous cultural flows. The National Cultural Flows Research Programme (NCFRP), which ran from 2011 to 2018, was jointly managed and overseen by the Murray Darling Basin Authority, MLDRIN and the Northern Basin Aboriginal Nations (NBAN) and consultant organisations, with the development of the Aboriginal Waterway Assessment tool (AWA) a key focus of its work (Mooney and Cullen 2019). Informed by the knowledge and experiences of First Nations people from other countries, the AWA was developed as a practical means of capturing and analysing quantitative and qualitative information about waterways held and managed by local Traditional Custodians, thereby contributing to better informed approaches to allocating cultural flows. Consistent with the shifting tenor of NRM decision-making in Australia, the AWA could be seen ‘... as a process of social engagement and empowerment and a catalyst for improved resourcing and recognition for Indigenous participation in environmental management’ (Mooney and Cullen 2019, 199).

The Aboriginal Water Initiative (2012–17) (AWI) influenced the New South Wales *Water Management Act 2000* and broadly coincided with the NCFRP. The AWI was important for the development of NSW Water Resource Plans, which themselves effectively operationalised the Basin Plan (Moggridge, Betteridge, and Thompson 2019; Moggridge and Thompson 2021). The AWI shared many similarities with the AWA in its determination to gather knowledge from Traditional Custodians on the allocation and management of cultural flows for portions of ‘Country’ within NSW (Moggridge and Thompson 2021). The AWI pioneered the development and application of a consultation process which embraced Indigenous principles of genuine engagement and reciprocity in knowledge generation and sharing (though also see Tan and Jackson 2013).

The implementation and ongoing development of the AWI and the AWA indicate the progress that Indigenous groups and peak bodies made during the 2000s in presenting a more-or-less united perspective on natural resource management and inland riverine and catchment management, in particular. These programmes reflected a hitherto rarely seen receptiveness on the part of Federal and State governments and non-government organisations to the inclusion of Indigenous beliefs and experiences in informing

natural resource management. A fundamental point to be grasped – particularly by non-Indigenous government representatives and researchers – is that many Indigenous people’s encounters with government and mainstream non-Indigenous society have been characterised by race-based discrimination and repression, and concomitant processes of cultural and socioeconomic marginalisation. Unsurprisingly, Indigenous people still often have low levels of trust in colonial governments and settler science and policy.

The National Agreement on Closing the Gap, signed in July 2020, committed all governments to fundamentally transform how they relate to and provide services to Aboriginal people. Greater use of formal partnerships and shared decision-making between Indigenous people and governments were recommended, together with improved access by the Aboriginal population to data and information held by governments of relevance to Indigenous decision-making. Any future Federal or State water policy will therefore be shaped by a different institutional composition and context, with Indigenous groups guaranteed representation in the policy formation process. The Agreement also contains legislated commitments to protect Aboriginal and Torres Strait Islander peoples’ maintenance of their ‘distinctive cultural, spiritual, physical and economic relationship with their land and waters’ (Productivity Commission 2020, 124), and to ‘measure progress towards securing Aboriginal and Torres Strait Islander interests in water bodies inland from the coastal zone under state and territory water rights regimes’ (124). Therefore, hierarchical approaches to inland water resource policy and programme development and delivery which place non-Indigenous scientific models and modes of inquiry at their centre and do little more than reinforce extant patterns of marginalisation and disempowerment will not be accepted by Indigenous Owners nor Federal and State Governments. Via the operations of, *inter alia*, the NWI and the AWA, a set of key principles and guidelines regarding the philosophy and practice of meaningful engagement relating to Indigenous water knowledge has been assembled (see also Woodward et al. 2020).

Genuine informed engagement of Aboriginal and Torres Strait Island people in knowledge gathering and sharing in the field of Indigenous cultural water knowledge necessarily involves a set of steps, approaches and general understandings. These include:

1. Genuine and comprehensive involvement of Indigenous community members through all phases of the research, from conception to completion. Including: an appreciation on the part of non-Indigenous researchers that the deadlines may be culturally unwelcome

to Indigenous people; and that projects should also be appropriately resourced to ensure that Indigenous people are sufficiently financially compensated for contributing their time and knowledge (Ens et al. 2012; Escott, Beavis, and Reeves 2015; Robinson et al. 2016).

In addition, for knowledge partnerships to be successful, protocols covering the conduct of and venues for meetings, conditions for information sharing, publications, community feedback and the like need to be discussed and agreed openly (Escott, Beavis, and Reeves 2015; Robinson et al. 2016), perhaps through the use of an Information Use Agreement (IUA) (Moggridge, Betteridge, and Thompson 2019).

2. Cross-cultural awareness requires non-Indigenous researchers to embrace the ‘double hermeneutic’ of social interaction and ‘... recognise the validity of Indigenous world-views, particularly when working on Indigenous land’ (Ens et al. 2012, 102; see also O’Donnell et al. 2023). Similarly, communication should be as free of academic and bureaucratic jargon as possible, inclusive of and informative to the lay public. Researchers should also be aware of the customary rites pertaining in the communities that they are working in regarding who has the rights to speak on certain matters and who has the right to be physically present in certain landscapes and sites (Ens et al. 2012; Escott, Beavis, and Reeves 2015; Robinson et al. 2016; Hemming et al. 2017; Moggridge and Thompson 2021).
3. Interactive, participatory methods of knowledge gathering and sharing have been shown to foster sharing of cultural knowledge between Indigenous people and also between Indigenous and non-Indigenous people. This method seems to work best when led by local Indigenous people and conducted ‘on Country’ (Moggridge and Thompson 2021).

Closer to the focus of this paper, the Baaka Water Commission Proposal (see <https://barkandjipbc.com/baaka-water>) brings together local Traditional Custodians and relevant Local, State and Federal Government ministries and agencies to collaborate on more effective and equitable management of the water resources within the Baaka Water Community region. However, it is important to note that the Baaka Water Commission Proposal is separate to the exercise reported on in this paper.

1.5. On-Country event planning and research method

The Toorale on-country event emerged from an ongoing process of non-Aboriginal scientists listening to Traditional Custodians and working closely with them over several years. Each time the non-Aboriginal scientists listened and reflected, new steps in engagement and collaboration emerged. The event may have been planned more quickly but Covid-19 travel restrictions in 2020–21 and substantial flooding in 2022 limited access opportunities. However, this delay in timing may have benefitted the overall event as participants were able to interact via joint news articles (e.g. ABC 2023) and meetings of the Toorale JMC.

Planning for the event recommenced in early 2023 and involved members of the JMC and non-Aboriginal scientists. Planning involved discussion of where and what information would be distributed and the event's format. Traditional Custodians had control over what information was shared, who shared the information and how. All JMC members were paid for their travel, meals and time.

Non-Aboriginal scientists brought some of their monitoring equipment and set it up to share with the Traditional Custodians based on interest. Non-Aboriginal scientist equipment included: electro-fishing and fyke nets for fish survey; sweep nets for aquatic macro-invertebrates; large print satellite imagery to show inundation patterns; and tape measures for vegetation quadrat survey. The non-Aboriginal science program is part of the Commonwealth Environmental Water Holder Flow-MER program (CEWH 2023) that has been operating at Toorale since 2015.

Traditional Custodians included:

- Uncle Badger (William) Bates (Elder; Toorale Kurnu-Baakandji JMC)
- Uncle Kevin Knight (Elder; Toorale Kurnu-Baakandji JMC)
- Aunty Lyiata Ballangarry (Elder; Toorale Kurnu-Baakandji JMC)
- Beverley Moore (Toorale Kurnu-Baakandji JMC)
- Uncle Philip Sullivan
- Trevor Elwood-Gillon
- Cassandra Slade-Potts (NSW Department of Climate change, Energy, the Environment and Water) – Wiradjuri-Biripi woman)

Non-Aboriginal scientists included:

- Dr Paul Frazier (2rog Consulting)
- Dr Mark Southwell (2rog Consulting)
- Tamara Kermode (2rog Consulting)

- Dr Leah Macintosh (University of New England, Australia)
- Dr Lindsey Frost (University of New England, Australia)
- Dr Gavin Butler (NSW Department of Primary Industries – Fisheries)
- Dr Leo Cameron (NSW Department of Primary Industries – Fisheries)
- Professor Neil Argent (University of New England, Australia – participant and lead social scientist)

The on-Country event commenced on the 16 June 2023 with an informal meal together at the Bourke Bowling Club. This shared meal allowed people to interact in an informal setting.

On 17 June 2023, participants shared breakfast then travelled in groups to Toorale National Park. The on-Country event commenced with a Welcome to Country and smoking ceremony – led by Uncle Badger Bates, Aunty Lyiata Ballangarry and Uncle Kevin Knight. This was followed by Uncle Badger Bates leading the group to several sites within the park (Figure 2) to highlight aspects of the land and water and the way that people, plants, animals and the environment interact. The non-Aboriginal scientists then demonstrated various monitoring methods and how they were being used to help understand the outcomes of water delivered for the environment. The pace of the day was deliberately 'uncluttered' and meals and hot beverages were shared at morning tea, lunch and afternoon tea. Time was allowed for people to discuss broad-ranging topics of interest in smaller groups as needed and to reflect on the information being exchanged on the day.

With the expressed consent of all present, the activities were audio-visually recorded, and the tapes transcribed. The transcripts were shared with all participants, to check for errors and completeness. At this time, those present were asked to provide their reflections on the day. The transcripts and reflections were analysed in accordance with the key aims of the project, though the researchers were also attentive to any emergent themes in the information. This research project was reviewed and approved by the University of New England's Human Research Ethics Committee (Approval Number HE23-076).

Neil Argent and Paul Frazier (both non-Aboriginal people) co-wrote the first draft of the research manuscript, including researching literature, monitoring projects and legislation. The draft was then reviewed and amended by all participants in an iterative manner until a final draft was achieved.

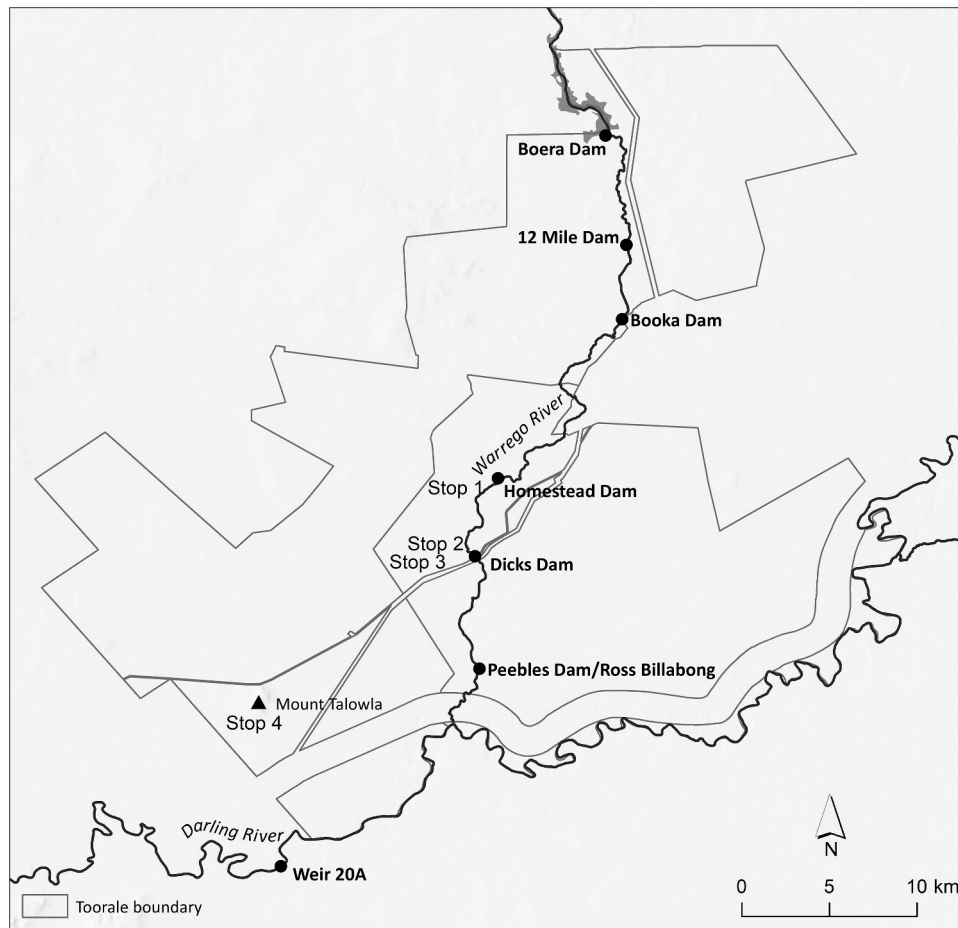


Figure 2. Toorale National Park highlighting key locations and sharing day stops.

2. Results

Four major themes emerged from the analysis of the day:

- Welcome to/on Country – the educative value and importance of showing others (i.e. non-Aboriginal people) how Country ‘works’; how different but related systems operate (e.g. flooding, drying sequences);
- Holism associated with a Country perspective – the interrelatedness of key entities and the special significance of totemic species;
- The failing state of the northern Murray-Darling Basin rivers/existential threats to the Baaka, Warriku and their peoples by recent and current land and water management policies and practices; and
- Together, solutions can be found to heal the land and rivers/the future – what needs to happen next for the Traditional Custodians to achieve justice.

It is recognised that these themes were not new information for the Traditional Custodians but were particularly beneficial for broadening the perspectives of the non-Aboriginal scientists.

2.1. Welcome to Country and being on Country together

Everybody present for the day was welcomed on to Toorale with a traditional smoking ceremony. To commence Aunty Lyiata spoke about the importance of us coming together in a spirit of sharing, co-operation and collaboration, and that knowledge is best shared and not held onto or kept secret. Everyone was welcomed to Country in this spirit; the hosts showed their generosity in welcoming the visitors, who as thankful guests need to reciprocate through open sharing of knowledge and experience. Uncle Phil spoke about another important aspect of the smoking ceremony; that the smoke leaves within us the spirit of Country, the plants and animals, the Old People as well as cleansing us of negativity and bad spirits. Throughout the day, all visitors were introduced to important sites on Toorale to demonstrate how the landscape and its constituent systems function under changing conditions but especially how the Baaka, Warriku and their tributaries sustain the Western floodplain and key species like the Partnu (Murray Cod), Kunpali (Yellowbelly) and the Kularku (Brolga).

All non-Aboriginal scientists noted the generosity of the Traditional Custodians in welcoming them to

Country and protecting them. In the words of one, 'Being made feel so welcome to Country by the Traditional Custodians instils confidence in me that we can all work together, for the greater good of the environment and one another. My experiences are all very positive and I'm grateful both personally and professionally for any opportunity' (Dr Leo Cameron). This generosity is in contrast with the history of mistreatment and adversity faced by the Traditional Custodians since colonisation.

There was also an appreciation that such cross-cultural research engagement requires non-Aboriginal scientists to be being prepared to listen more than speak and to conduct research at a pace and tempo that is comfortable for Traditional Custodians. In the words of one non-Aboriginal scientist:

... from my whole experience engaging with Traditional Owners is the need for time to let relationships develop and the engagement to take place...
(Dr Mark Southwell)

In the words of another: 'We shouldn't try to rush conversations or keep things moving because we have set a plan' (Tamara Kermode). Amongst the non-Aboriginal scientists there was self-recognition that they have their own vernacular forms of knowledge, expertise and 'ways of seeing' (Berger 1972).

The main part of the day was structured around visits to key sites on Toorale, as decided by the Traditional Custodians. At various stops along our drive around the area, Uncle Badger shared his knowledge of Country, reading the country to all present, including the key relationships between climate, weather systems, landforms, animals, plants and people. The life-giving significance of pulses of water through Toorale was presented by Uncle Badger via the prism of the kularku and its needs. At Dicks Dam, where the kularku were first seen that day, we talked about their appreciation of the scientific endeavour:

Uncle Badger: "... beautiful to see the brolgas, they were here to welcome us because they know that we're here to help them, 'cause they're our people".

For Traditional Custodians, these talks on Country provided encouragement for the non-Aboriginal scientists to broaden their focus and consider links such as resource needs of the kularku and how different flow regimes affect the availability of these resources. The Traditional Custodians advised the non-Aboriginal scientists as to what a cultural watering research project might and ideally should encompass:

Uncle Badger: With this stuff over here, when we get a flood I know brolgas eat over there, and again on the Western Floodplain. Okay, but we got to know what

they're eating. I know that there's a little thing that some of the Old People say - these little bulbous things in the ground ... little tuber thing ... they'll eat that but that's in the flooded country. So, we need to know what the flood do, and what a good season looks like. So, I point this out to you and you can do a study on it.

In a demonstration of the inclusivity of the Traditional Custodians' welcome, Uncle Badger stressed the educational and personal development aspects of the day for everybody, regardless of age or indigeneity. As he emphasised, the visit should be enlightening and fulfilling, scientifically and spiritually:

You fellas - our scientists - those things are related to you because that's what makes youse fellas' jobs interesting. Makes your job better doesn't it, cause you gotta know all about this, okay. And it makes then for you young people, makes youse better because you've learnt something today, doesn't matter what colour you are, and I'm not taking credit but, I'm telling you, youse are learning something that's gonna get youse up there. And save the environment.
(Uncle Badger Bates)

2.2. Holism associated with a Country perspective

The day demonstrated the power of a landscape-wide lens on ecological processes and interrelationships. The value of a Country perspective was emphasised, in which all parts of the environment, including humans, exist on the same ontological level, and their supporting terrestrial systems seen as a wholeness greater than the sum of its parts. This is a vision that also reaches back in time/space to the Old People and their ways of living and making sense of the world around and within them but that also projects to future generations who will hopefully carry within them the knowledge and experience of living on Country.

The Traditional Custodians carry deep within them powerfully held and felt senses of attachment to and responsibility for Country, connections that stretch back aeons to the Old People. At one stop, Uncle Badger pointed out an assortment of stones and elaborated on their cultural significance:

This crossing is very important, because a lot of these stones what's lain along here, they come from Mount Talowla or Burrigurry up this way, where we going. Some of that stuff is silcrete, but our Old People used for making blades and that, and cutting things right. It's ah, conglomerate stone, and you'll find silcrete around, okay. And sometime you find silcrete in sandstone, okay. These hills here was good for us black people a long time ago because we got the stone to make tools and that. (Uncle Badger Bates)

This care for and connection to Country is expressed/channelled through a kin-like attachment to particular totemic species, and the need to tend to their needs:

So, remember the endangered plants now – me being a Baakandji, we blackfellas relate to that plant and relate to the birds. My People is Kilpara and Makwara, that's Eaglehawk and Crow. Us Makwara, being from the Eaglehawk, we can't marry an Eagle, we gotta marry someone from the Crow family. So, everything out there is related to us. (Uncle Badger Bates)

During our day on Toorale we learned about three such totemic species: the kularku, the partnu and the kunpali. While the term holistic might not capture the way in which Traditional Custodians consider the landscape and their role within it, for the non-Aboriginal scientists this more integrated total landscape/environment view was a clear and stark difference to the individual indicator focus of much of their own research and monitoring. Each non-Aboriginal scientist had pause to consider their approach and to appreciate the broader perspective of the Traditional Custodians:

We know intellectually that all things are connected but when you get told that a broлга is the best possible indicator of the health of a river system that brings it home. (Dr Lindsey Frost)

Another river scientist noted that '... the more I interact with indigenous people is that as western scientists we tend to be very focused on our particular area of expertise and forget about everything else that is interacting and affecting around us' (Dr Gavin Butler), while another stated that, 'I think it's about recognising that we think/view the system differently, and acknowledging that is OK, and seeing it as an opportunity to understand it, and maybe manage it in a better way' (Dr Mark Southwell).

The potential costs of adhering to a scientific reductionist perspective in river science and management were spelled out by one of the scientists:

I have worked in scientific river monitoring for over 30 years, mostly focussed on the Murray-Darling Basin. Our reductionist scientific methods have failed to inform policy and management to arrest the continued decline of the rivers and floodplains. I actually think in some cases they may have assisted the decline. (Dr Paul Frazier)

2.3. State of rivers and threats to the Baaka, Warriku and their peoples

Sadly, a unifying factor in the conversations during the day was the poor and declining health of the riverine systems in the broad region, brought home powerfully by the news of another massive fish kill downstream at Menindee. The causes of and evidence for the calamitous condition of the Baaka are summarised above but for Traditional Custodians the ecological catastrophe sits alongside longstanding existential threats to their own ways of life by institutionalised racism in the form of land theft and their

formal and informal exclusion from Country. Toorale's public story is largely silent on this brutal chapter of its colonial past. Despite the partial dismantling of the formal mechanisms of dispossession and ongoing marginalisation that occurred with the creation of the National Park and the JMC, Traditional Custodians remain aggrieved by the historic wrongs associated with their expulsion from their lands. A major concern is over their future access to cultural water.

For Uncle Kevin Knight, people and Country are inseparable. 'I think we, the Aboriginal people, worry about the health of the river. It's very important. Like I say, in the Baakandji, if there's no Baaka, there's no Baakandji and that's true. There's nothing'. For him, the origins of the current ecological condition of the river ecosystem lie in the original act of invasion and forceful dispossession: 'I think that we also got to start with everything recent that's happened on the land as they're (the government and private landholders) the ones who stole it from us ...' (Uncle Kevin Knight). Similar sentiments were expressed by Uncle Badger Bates. Reflecting on the ecological damage done in the region by a plethora of introduced species he noted that modern industrial broadacre agriculture posed the greatest threat of all because of its enormous demands on the most limited resource in the area – water:

We need to get rid of the pig, we also need to put the land back to where it was. Remember, the pig – what was he here, for what, since the whitefellas come, about 200 some years ago. They overgrazed, and they done all this, but you could manage them. But you can't manage a plough, and you can't manage a plough because wherever the plough goes it needs water ... and you know where I'm going about cotton. (Uncle Badger Bates)

Several non-Aboriginal scientists noted that the effort to restore the rivers of the Murray-Darling Basin had not been effective. There was a growing awareness that non-Aboriginal science-based solutions may not be able to answer all of the questions for recovery; rather, a combination of approaches and pathways may be needed. Engagement and inclusion of Traditional Custodians in finding and implementing solutions was seen as important and that events like the knowledge sharing day at Toorale were the potential beginning of finding those pathways.

3. The future

The future governance and management of the Baaka and the surrounding landscape emerged as a key theme from the day. For some non-Aboriginal scientists, a holistic focus on the entire riverine system was needed to combat massive fish kill events and the broader problem of fish species decline:

So, for me the big thing is that fish gotta go both ways. You've got 800 kilometres of river that goes all the way to the top ... it's the second longest or third longest river in the Murray-Darling Basin and there's no connection downstream, so you've got a one way passage now ... (Dr Gavin Butler)

This focus on fish passage was supported by others, though with some qualifications:

... water is just one lever to manage these systems and it is the main driver that we can influence but our work continues to show that there's other things that need to be done to improve the system, y'know, improving passage, looking at reintroducing species that have gone missing and all these sorts of things, so I think that a genuine recognition that it's more than just water is critical to how we can effectively manage it into the future. (Dr Mark Southwell)

However, the Traditional Custodians' concern was more focused on gaining secure access to cultural water for Country and enlisting the western scientists' support in this quest:

I was a National Parks officer for 21 years and in my country, our country, me and Kevin, they had us with the flora and fauna, right? You know what I'm saying ... What they're doing now, is saying to us black-fellas, 'We need to give you cultural water'. It's up to you scientists to say – and we're saying is – 'We don't want our cultural water to be mixed with the environmental water'. Remember how I said that we were the flora and fauna? We don't want to go back there. And if you back us by saying, 'The black people – whatever they want to call us - we've got our cultural water and then the environmental water. (Uncle Badger Bates)

On a positive note, and in the words of one non-Aboriginal scientist, 'Days like the Toorale Sharing Event not only offer the opportunity to listen and learn but also set a platform for more regular interactions going forward. Western and indigenous science alone can most likely not solve the issues we are now trying to deal with in the Murray-Darling Basin but together there may be hope' (Dr Gavin Butler).

For another, future interactions require a commitment to genuine knowledge exchange with Traditional Custodians unlike the one-sided 'data gathering' exercises that Aboriginal people have been subject to in the past: 'The "to do" is keep our eyes on the real prize; engage in these relationships as genuine partners seeking a common outcome, and be prepared to reciprocate energy and investment' (Dr Lindsey Frost).

4. Discussion/Conclusion

Mid-afternoon at the cultural centre (old shearers' quarters), Toorale National Park. Traditional Custodians, non-Aboriginal scientists are sitting outside relaxing, and chatting about the day. Suddenly, four kularku appear above the quarters, flying low,

crying, calling out as they soar over us ... Everybody transfixed momentarily except Uncle Badger who runs after the kularku and calls to them in his and their language ... the kularku seem to call back as they fly on. And Uncle Badger's words from earlier in the morning come back to us: "Beautiful to see the brologas, they are here to welcome us because they know that we're here to help them, 'cause they're our people ...".

This paper set out to explore the extent to which local Traditional Custodians and non-Aboriginal scientists held different forms of environmental knowledge and to also investigate the grounds for a possible integration of Aboriginal and non-Aboriginal river management perspectives. It also set out to document a case study to help non-Aboriginal scientists embark on this first step to bring Traditional Custodians and their knowledge to the centre of monitoring and management programs. Building on recent initiatives such as the AWA, and applying the principles of genuine and comprehensive involvement, cross-cultural awareness and interactive, participatory methods of knowledge gathering and sharing set out earlier, the knowledge gathering and sharing day on Toorale was a continuation of a conversation with, and engagement between, various Traditional Custodians from the Baaka and the Warriku and non-Aboriginal scientists on the steps that need to be taken for the Country to be returned to a healthier state. Based on the conversations held on the day, a small number of key themes emerged covering the ecological challenges facing both the river landscapes and Traditional Custodians. Non-Aboriginal scientists readily acknowledged their narrow focus in investigating land/fauna/people interrelationships, a focus that in many respects is an outcome of their education and training. Many conceded that their singular focus, e.g. on a particular species, meant that broader-scale interactions might be overlooked. However, their respect for the Traditional Custodians' holistic understanding of the natural world was palpable, with one noting that, 'Western and Indigenous science alone can most likely not solve the issues we are now trying to deal with in the Murray-Darling Basin but together there may be hope' (Dr Gavin Butler). Non-Aboriginal scientists were also genuinely humbled by the generosity of the welcome provided to them by Traditional Custodians, especially given the long and bitter history of dispossession and dispersal that local Aboriginal groups experienced at the hands of European governments and settlers.

There was also general consensus on the causes of the ongoing poor condition of the region's rivers. Central to all explanations were the historical approaches to river regulation via dams and weirs, etc., the over-allocation of water throughout the system for industrial (including agricultural) and consumptive uses and seemingly unstoppable spread of

European carp. While the utility of fishways, etc. in facilitating greater fish movement throughout the system was debated, there was consensus on the existential threat that a 'business-as-usual' river management approach poses to the habitats of all living beings in the region.

In summary, we argue that what unfolded over this one day on Toorale was a deeply respectful, open and honest discussion across disciplinary fields, generations, genders and cultures. Although this could be seen as one isolated incident of cross-cultural engagement we hope that it will form part of a broader and long-running dialogue between Aboriginal and non-Aboriginal people in support of Aboriginal peoples' ongoing struggle to overturn the implicit *aqua nullius* doctrine that has prevailed in Australia for over 200 years. The spirit of mutual respect, co-operation and collaboration that suffused the Toorale conversation gives us hope and confidence for future joint research endeavours and political and practical advances for Aboriginal people.

We hope this case study encourages other non-Aboriginal scientists to bring Traditional Custodians into their research and monitoring projects.

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