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Water trading by Aboriginal organisations in NSW, Australia

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ABSTRACT

Markets are a contentious way to manage demand for water because they can produce or exacerbate inequities for small and more vulnerable water holders, including Indigenous peoples. In Australia, which has the world's largest water market in the Murray-Darling Basin (MDB), settler-colonial governments have transformed water law and policy to enable water trading with negligible consideration of the effects on Aboriginal peoples. We present the first Australian study of Aboriginal peoples' interactions with rural water markets, the possibilities, and pitfalls of market participation, enabling and limiting factors, and the power relations underpinning the establishment and ongoing operation of this water allocation mechanism. From interviews with representatives of 13 Aboriginal organisations who held water entitlements, including ten that participated in MDB water markets during 2004–2018, we found that water trade activity and the number of individual Aboriginal water sales generally increased. Organisations traded as sellers on the (temporary) allocation market, generating revenue that was valued because it was relatively easy to obtain, with fewer external restrictions than income from government grants. Aboriginal organisations aspired to use their water on their own estates and for their own purposes, however, due to what we term a 'water trading trap', this was rarely feasible. In addition to increasing the water holdings of Aboriginal organisations, water rights restitution programs and policies need to address the lack of capital (including productive land and infrastructure) and capacity that prevents Aboriginal organisations from using their water to pursue wider aspirations, including building an asset base or using water for environmental and cultural purposes.

1. Introduction

Throughout the twentieth century, the dominant state-led approach to managing water relied on expanding water supply options, primarily via dam construction and river regulation. With greater awareness of the effects and costs of hydraulic development and coincident with the rise of neoliberal environmental policy, water governance regimes have significantly shifted (Bakker, 2014). Attention has turned from managing supply to managing demand and in some regions most new demands for water have had to be satisfied by re-allocating existing supplies (Cosgrove and Loucks, 2015). Market mechanisms have been a prominent and controversial way to do this (Bauer, 2010).

Water trading[1] is well embedded in rural regions of Australia, Chile, Mexico, the US, Canada, and China, and as many as 37 countries have water allocation systems in place based on the issuance of water rights, which is an essential precursor for water markets (Richter, 2016; Wheeler et al., 2017). Water trading may be on the rise, but it is contentious and has not yet been widely adopted across the world (Hadjigeorgalis, 2009; Richter, 2016). Many remain sceptical of water markets as a means of managing scarce supplies, primarily because of concerns about uneven economic impacts, particularly the effects on poorer and smaller water users or other vulnerable groups such as women and Indigenous peoples (Hadjigeorgalis, 2008; Harris, 2009; Budds, 2009). For example, while the UN acknowledges that demand-side policies are likely to be more effective than the supply-side policies, private water markets are a 'questionable solution' that have not protected the interests of the poor or equitably distributed water resources (United Nations Development Programme, 2006). Based on this evaluation, the UN concluded that there were limits to markets for countries with weak institutional capacity.

The UN's position is reinforced by academic research that reveals how some groups are disadvantaged by the power dynamics and

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[1] Referred to as water marketing in the United States.

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injustices of water markets. Opponents of markets argue that they result in the appropriation of water resources and the environmental commons 'for private profit, which … deepens, rather than reduces or resolves, socioenvironmental problems' (Bakker, 2014, p. 470). In places such as Chile, which has the world's most liberal water market and where neoliberal reforms have privatized access to individuals or corporations, the inequity in water rights distribution has increased over time (Boelens et al., 2007; Macpherson, 2017). For these reasons, state supported systems of water rights accumulation have met resistance from local communities dependent on customary systems of water access and management.

By virtue of their marginal political position and disadvantaged economic status, Indigenous peoples across the world have relatively restricted access to productive land and water resources and are especially vulnerable to distributive regimes that accentuate inequity (Jackson, 2018). Water markets advantage water users with greatest capacity to accrue realisable value from water (financial resources, high value production opportunities, knowledge, technology) (Hadjigeorgalis, 2009; Bakker, 2014; Hasselman and Stoker, 2017) and may thereby encourage the accumulation of water rights. This structural position calls for evaluations of the circumstances in which Indigenous peoples might engage with markets. From the literature, it appears that Indigenous peoples in countries that allow fully transferable water property (e.g., Australia, Chile, and USA) have not participated in the design of water markets, nor do they have any formal role in market regulation, although some do engage in trading (Nyberg, 2014; Prieto 2016a, 2016b; Hartwig et al., 2020).

Water markets exist in historical contexts shaped by specific political and economic forces (Bauer, 1997, 2015). In the case of Australia, which has one of the world's largest water markets in the Murray-Darling Basin (MDB) (Grafton et al., 2016), settler colonial relations have been determinative (Marshall, 2017). Settler-colonial governments assumed control over water upon British occupation and they have since transformed water law and policy to enable water trading with negligible consideration of the effects on Aboriginal peoples[2] (Morgan et al., 2004; Hartwig et al., 2022). While the law of native title in Australia now commonly recognises Indigenous rights to take and use water for personal, social, domestic, and cultural purposes, a native title right to take and use water for commercial purposes is yet to be recognised (O'Donnell, 2013). Land rights legislation applying to our case, the state of New South Wales (NSW), does not include any explicit water rights provisions, but in a small number of cases it has enabled some Aboriginal organisations to acquire water entitlements attached to land (Hartwig et al., 2020).

Until recently little was known about rates of Aboriginal water entitlement ownership in Australia (Hartwig et al., 2020), and researchers had not examined the extent to which Aboriginal water holders are involved in water trading in the MDB, how they perceive the benefits and costs of participating, or how they negotiate the power asymmetries that shape the terrain of water distribution in this region.

In this paper we explore these outstanding matters, adding to the few studies that have analysed Indigenous peoples' interactions with rural water markets and the power relations underpinning the establishment and ongoing operation of these allocation mechanisms. We consider the experiences and perspectives of Aboriginal peoples in NSW who participate in the water market and the factors that shape the benefits they obtain by participating.

In Australia, Aboriginal people frame water rights and access questions through the lens of self-determination (Morgan et al., 2004; Hemming et al., 2019; O'Donnell et al., 2021), an accepted norm of international Indigenous rights law (Robison et al., 2018). Thus, whether water market participation improves opportunities to determine or influence water uses within Indigenous territories, as well as how income from water is generated and expended, are critical questions that we address. With this framing in mind, the degree to which Indigenous water ownership may increase political influence over water governance is also a pressing issue, but beyond the scope of this paper (see Diver et al., 2019; Hemming et al., 2019).

The paper is organised as follows. In the next section we provide an overview of the international literature on Indigenous peoples and water markets. We then turn to our case study region, the NSW portion of the MDB, and describe its water governance context and our methods before presenting the empirical evidence, our analysis of a water trading dilemma we refer to as the 'water trading trap', and then the conclusion.

2. Water markets and Indigenous peoples

Indigenous perspectives on water privatisation, commodification and marketisation are influenced by locally defined values and customary institutions and by the wider rationalities and orthodoxies of the dominant society and its water governance system (Babidge, 2016; Brandshaug, 2019). Views on the suitability or acceptability of water marketisation (and privatisation) across Indigenous communities are diverse and varied, being dynamic and responsive to new interpretations and evaluations, as well as opportunities and risks arising from changes to institutional arrangements that are conducive to commodity relations (Babidge, 2016; Bischoff-Mattson et al., 2018; Jackson et al., 2019). Engaging in water trade may be motivated by the pursuit of income to meet individual and community goals and objectives, including improving a community's overall standard of living and socioeconomic position (Nikolakis, 2011; Carrasco, 2016).

Available literature reveals that Indigenous peoples tend to be involved in water trading in two ways. First, through the sale of water to government and non-government parties for an array of uses, including urban water supply (Alderman, 2013; Nyberg, 2014; Carrasco, 2016), industrial uses including power generation and mining (Nyberg, 2014; Babidge, 2016; Carrasco, 2016), and farming (Jackson and Langton, 2012). Many of these trades are time-limited, temporary sales or leases due to either group preferences (Jackson and Langton, 2012) or regulations (Nyberg, 2014). A second, less common, type of water sale occurs when Indigenous peoples or organisations buy or lease water exclusively from other Indigenous peoples or organisations who hold water rights (Prieto 2016a, 2016b). Our review of the literature did not find instances of Indigenous peoples or organisations buying water in other circumstances.

The literature confirms that the effect of water trading on Indigenous peoples is contingent upon the legal, institutional, and social settings in which the water market mechanisms operate (Bauer, 1997; Hadjigeorgalis, 2009; Hartwig et al., 2020). Markets are not automatic or self-regulating and so their operations and effects need to be understood in context (Bauer, 1997), as do the responses of Indigenous peoples which will vary according to cultural prerogatives, livelihood options, and institutional arrangements, particularly the state water entitlement systems. Chile's experience is exemplary at one extreme.

Changes made to Chilean water law in 1981 to privatise water rights and institute a water market with few regulations exacerbated long-standing inequities, adversely affecting the socioeconomic and political standing of Indigenous communities (Budds, 2009; Molina Camacho, 2016). In Bauer's (1997) early assessment of the impact of the 1981 Water Code on social equity among peasant farmers in central Chilean basins, he concluded that peasant farmers were rendered worse off than

[2] Consistent with the United Nations Declaration on the Rights of Indigenous Peoples, we use the term Indigenous when referring to those communities, peoples and nations who have a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, and who consider themselves distinct from other sectors of the societies now occupying those territories, or parts of them. In Australia, a range of terms is used, including Indigenous, Aboriginal and, more recently, First Nations. The last two tend to be preferred locally in the study area (Jackson et al., 2021), and we use the same terminology.

commercial farmers due to inadequate infrastructure, limited influence in water users' organisations, a lack of social power, and a general tendency to avoid legal and political bureaucracies (see also Budds, 2009).

By contrast, more recent research provides evidence of Indigenous agency and strategic gain in water market activity. This has in part been facilitated by (a) the Indigenous Law (introduced in 1993) which afforded Indigenous water rights greater protection, (b) the creation of a Land and Water Fund which financed Indigenous peoples to acquire private water (and land) rights to be held under collective tenure, and (c) a resurgence of Indigeneity and other expressions of self-determination (Macpherson, 2017; Prieto 2016a, 2016b). For example, Prieto (2016a, b) examined how Indigenous communities in some northern Chilean basins purchased water rights – including in some cases, rights privately held by individual community members – describing these creative and strategic market decisions as 'recollectivising' and 'decommodifying' water rights. In such cases, Indigenous communities apply customary norms and rules to the management of this reclaimed water, including prohibiting the sale of water for mining, and in doing so, both secure communally agreed outcomes and subvert the logic of water marketisation (Prieto, 2016b).

Despite a concentration of research efforts in Chile, the extent to which markets are responsible for the accumulation of water rights among wealthier parties remains an important research gap. Recent research by Hartwig et al. (2020), from which this paper stems, identified a significant loss of Aboriginal water holdings in the rural regions of the Australian state of NSW in the last decade, concurrent with water market growth. Almost one fifth of Aboriginal water holdings by volume were lost over 2009−18 as organisations permanently sold their entitlements (ongoing rights to extract water). Most of these organisations were facing bankruptcy and were compelled to sell, emphasising the importance of understanding the context in which trading occurs. This suggests that water markets can contribute to further dispossession rather than self-determination and, in this case, it is the ability to sell water entitlements which may be detrimental to the long-term capacity of Indigenous peoples to retain control of water. Once water entitlements are sold, any land-based development dependent on water would require the purchase of a water allocation (a temporary use right) or an entitlement.

It is therefore important to consider just how water markets work in practice for Indigenous water holders, noting that the effects depend not only on the legal or economic design of the relevant markets, but also whether Indigenous communities can access other resources, including information, capital, and legal support (Budds, 2009; see also Ribot and Peluso, 2003). The values, goals, and collective bargaining power of Indigenous water holders can also be influential, as the Chilean example above shows (Prieto, 2016b).

In addition to the distributive effects of water markets, researchers attuned to the social and cultural impacts of different water governance regimes are interested in how markets restructure nature-society relations, especially the tendency for markets to frame water as an alienable resource, divisible from land, and disembedded from hydro-social relations (Bakker, 2014). When water(s) are converted into discrete objects (tradeable entitlements) that are privately owned and traded between entities for economic gain, they are 'abstracted from the socio-ecological context' (Bakker, 2014, p. 481).

Water markets restructure relations between humans and nature because they assume commensurability, where all waters are treated the same (see Bakker, 2005). Commodification and its logic of efficiency over-simplifies complex hydro-ecological and social relations, and abstracts water from its context, as Australian studies that include Indigenous relationships to water show (Davies et al., 2021; Jackson and Head 2020; Laborde and Jackson 2022; Marshall, 2017). Unfettered market logic normalises the prioritisation of certain uses (e.g., commodity production for export) over others that may be of ecological, social, or cultural importance (Budds, 2009; Bakker, 2014) and this bias may be particularly detrimental to Indigenous peoples. For instance, traditional or customary ways of knowing and managing water can be portrayed as passive, inefficient, outdated, and even wasteful, if they are acknowledged at all (Davies et al., 2021; Lein, 2004).

With such concerns in mind, many scholars of Indigenous water governance emphasise an antagonism between the conceptualisation of water as a commodity and Indigenous peoples' ontological and epistemological understandings and relationships with water (Carter, 2008; Carrasco, 2016; Molina Camacho, 2016). Carter (2008, p. 18), for example, argues that the notion that water can be a fully tradeable commodity saleable to the highest bidder is viewed by some Indigenous peoples as 'culturally repugnant'. In contrast, other researchers have observed that Indigenous peoples' understandings and responsibilities to water are not irreparably harmed or lost when participating in water markets (see Babidge, 2016; Bischoff-Mattson et al., 2018). As Brandshaug (2019) explains, it is necessary to 'challenge the idea that commodification automatically entails a break with other practices and relations' (p. 548). For example, in Babidge's (2016) Chilean case study, the Atacameños value water 'in terms of essential forms of indigenous identity' (p. 93) and as 'an economic resource with "market" value at small volumes' (p. 97). In this case and others, water trading may enable Indigenous peoples to influence any or all the following: who will buy their water, the uses to which it is put (Babidge, 2016; Prieto, 2016a), the benefits that arise from that water's use, and the income generated by its sale. The exchange may also build or reinforce relationships that are valued by Indigenous communities. This observation is consistent with Seemann's (2016) argument that formalised water rights can be powerful and strategically useful in day-to-day struggles over water access.

In sum, the literature on water trading by Indigenous peoples shows diverse and equivocal possibilities and outcomes. Water trading can, in some contexts, help bring about the re-collectivisation of water resources, re-building Indigenous commons governed by customary and communally agreed upon rules and norms. It can also result in the permanent loss of water holdings by Indigenous people; another expression of colonial dispossessive logics. Water trading can reflect and exacerbate existing forms of structural disadvantage; it can also be a site for the expression of Indigenous agency and bargaining power. The commodification of water can suggest an alienation of water from Indigenous land, culture, and social relations; the water market may also sit in navigable tension alongside, not supplanting, Indigenous ontologies of water. It is crucial, then, to look to the lived experiences of Indigenous peoples navigating the water market and explore the structures within and beyond the market that shape these experiences. Following Seemann's (2016) call for research that 'shed [s] light on possible pitfalls and successes, such as strategies to overcome power asymmetries between actors, or to overcome bureaucratic and logistic challenges' (p. 187), our research takes a particular focus on the possibilities and pitfalls of water trading as a means of supporting Indigenous self-determination.

3. Methodology

3.1. Case study context: the NSW portion of the MDB, and its water governance arrangements

The MDB encompasses the territories of more than 40 autonomous Aboriginal Nations and contains 15.1% of the total Australian Indigenous population (Hartwig et al., 2021). Colonial law did not originally recognise Aboriginal occupation and, as so-called 'landless' people, Aboriginal communities were not entitled to exercise either riparian rights (part of the common law from colonisation to the 1880s) or to access water entitlements issued under state systems of administration operating in this region from the 1880s–1980s (Morgan et al., 2004). The occupation and development of the Basin has left Aboriginal Nations in possession of less than 1% of its land base, representing a higher

level of dispossession than many other Australian regions (Arthur, 2010). The Native Title regime has not markedly strengthened the water rights of Aboriginal people in this region either, as customary attachment is very difficult to prove and even when this hurdle is met, determinations have not yet included a commercial right to use or extract freshwater. In 2016, the Indigenous population was 5.4% of the total MDB population, having nearly doubled since 2001 (Hartwig et al., 2021). Indeed, the population composition of the MDB is becoming more Indigenous over time, a trend that is likely to continue (Hartwig et al., 2021).

The MDB occupies one seventh of the Australian continent (1.06 million km^2), draining waters from four States (NSW, Victoria, Queensland, and South Australia) and the Australian Capital Territory (see Fig. 1). The MDB contains important groundwater systems and more than 20 major rivers linking 23 catchments and 30,000 contiguous wetlands (Alexandra, 2018). These water systems support 42% of the total gross value of Australia's agricultural production, including 44% (A$8.4 billion) of the gross value of irrigated agriculture (Australian Bureaua of Statistics 2022a; 2022b), making the Basin Australia's most productive agricultural region.

Water markets are seen as a key demand management strategy to address water scarcity in this region. Since inception several decades ago, MDB water markets have continuously evolved and matured such that they are now considered the most advanced in the world (Seidl et al., 2020). Most trades occur within the southern portion of the Basin where rivers are more highly regulated. The major water entitlements in the southern Basin were recently estimated to be worth A$30 billion, while the commercial water allocation market for the same entitlements was valued at A$94 million (Aither, 2022). The market has also been used to restore environmental quality and increase stream flow. A major restoration effort is underway based on acquisition of water entitlements for the environment via direct (through reverse tenders) and indirect methods (infrastructure upgrade subsidies) (Grafton et al., 2016).

We selected the NSW portion of the MDB as the study area for the following reasons. Of the State and Territory jurisdictions that overlap with the MDB, the NSW portion has the largest share of the Basin's Aboriginal population (65.1%) and largest total population (37.4%) (Hartwig, 2020). NSW has the largest long-term average sustainable extractive limit of any jurisdiction within the Basin, and the Basin's water trades involve a significant number of water entitlements issued by NSW (ABARES, 2018). Additionally, 75% of known entitlements held by Aboriginal organisations across Australia were identified within NSW in a 2009 study (Altman and Arthur, 2009), most of which exist within the MDB. More recently, Hartwig et al. (2020) calculated that within the study area 25 Aboriginal organisations held 55 water entitlements totalling 12.1 GL in 2018. These entitlements were estimated to be valued at A$16.5 million in 2015–16 terms, or about 0.1% of the value of the entitlement market at that time.

Rights to accessing water that can be subject to market trade can be categorised as: 1) water entitlements (permanent water – an ongoing right to extract water from a watercourse/body); and 2) water allocations (temporary water – the seasonal allocation received by water entitlements) (Wheeler et al., 2014). In regulated rivers in NSW (those where flows are controlled through infrastructure that stores and releases water), water entitlements come in two main forms: high security, and general security, reflecting the probability of receiving a full water allocation. For example, in most years historically high security entitlements yielded close to, if not completely, full allocations (Wheeler et al., 2014). For unregulated systems, where water use is controlled less by infrastructure, water entitlements generally have no formal reliability (Wheeler et al., 2014).

Proprietary rights to land and water acquired through the colonial period (1780s–1980s[3]) have strongly conditioned Aboriginal peoples' water access rights during subsequent eras. This continues to be the case for the contemporary era (1980s to present) when Australian governments separated land and water titles and capped water use as part of a series of reforms to address water scarcity. The analysis by Hartwig et al. (2020) also shows that all water entitlements held by these Aboriginal organisations in NSW within the MDB were secured or inherited via limited transfers of both land and water through state and federal land rights schemes.

3.2. Methods

We used several methods to obtain the data upon which this paper relies.[4] We focused on water held by organisations and entities, referred to as 'Aboriginal holdings', because information on the water holdings of individuals identifying as Indigenous is not readily available anywhere in Australia (see Altman and Arthur, 2009). Organisations were invited to participate in semi-structured interviews where they held commercial surface water entitlement(s) (general security, high security, or unregulated) that had been traded and/or where we considered they had what we termed 'water trading potential' (defined as water entitlements of 15 ML or greater). These organisations were predominantly identified by revisiting a dataset of water holdings built by Altman and Arthur (2009) and by searching the NSW water register.

Of the 21 organisations that met these criteria, 13 agreed to participate and were interviewed in person and/or via telephone during 2017–2018, sometimes multiple times. These 13 organisations held 22 entitlements with water trading potential, with volumes ranging from 15 ML to 1,944 ML and a median entitlement size of 241.5 ML.[5] These entitlements are for water sources across the Barwon-Darling, Intersecting Streams, and Macquarie-Castlereagh systems in the north of the MDB, and the Lachlan, Lower Darling, Murray, and Murrumbidgee systems in the south.

Interviews were transcribed and subjected to thematic qualitative analysis based on the approach of Ribot and Peluso (2003). Interviews were supplemented with water entitlement and trading data obtained from searching the NSW water register (NSW Department of Planning, 2021; WaterNSW). The study period for examining water trading activities was 2004–05 (or from the date of the first relevant Water Sharing Plan) to 2017–18. All interviews were undertaken in accordance with the Human Research Ethics protocol of Griffith University (Reference Number, 2015/470). Representatives of Aboriginal organisations expressed different preferences for how they were to be identified and we have observed these preferences when citing them.

Finally, the case study area encompasses parts of both the northern and southern sub-units of the MDB which have distinct water market features and are often treated separately for management purposes (Wheeler and Garrick, 2020). We have elected to treat these regions as one in our study of NSW because there has been no prior empirical research on the experiences of water trading by Aboriginal people or organisations anywhere in Australia and to compare and contrast across

[3] The colonial era might more conventionally be considered to have ended by 1900 when Australia federated; however, Indigenous peoples were not able to claim all citizenship rights until the 1960s and land restitution mechanisms were not introduced until the 1970s and 1980s, hence the dates we give for this period.

[4] Data collected and analysed in this paper are based on doctoral research conducted by L.D. Hartwig (2020).

[5] Some organisations also held other entitlements such as stock and domestic entitlements, which are of high reliability, but allocations are not subject to trade.

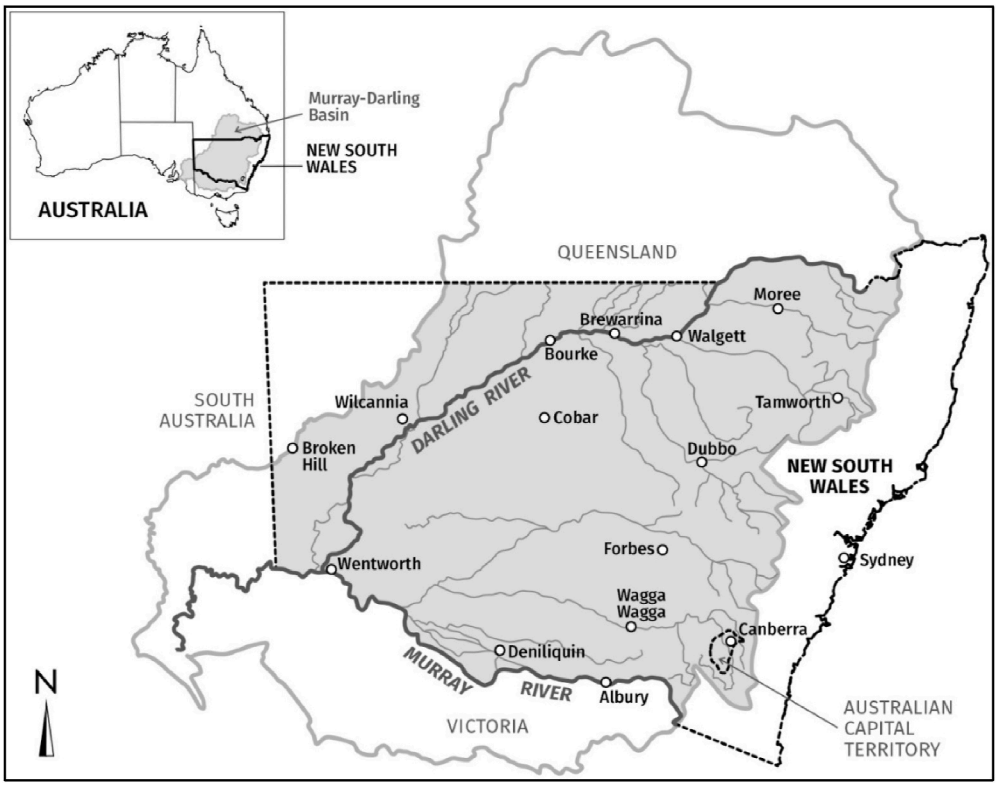


Fig. 1. Map of Murray-Darling Basin showing the NSW portion shaded.

the Basin sub-units would significantly expand the size of the paper.

4. Results

4.1. Water trading activity

Within the study area, 10 of the 13 Aboriginal organisations had engaged in water trading. These trades are associated with sixteen individual water entitlements. The estimated market value of these 16 entitlements was at least A$9.5 million in 2015–16 terms.

The most common form was short-term or temporary trades, with water already allocated and available for immediate use sold on allocation markets. Between 2004–05 and 2017–18, nine organisations sold water through 110 separate allocation market sales.[6] Volumes sold ranged from 7.6 ML to 3,000 ML per individual sale, with a median of 167 ML. Selling prices ranged from $4.50/ML to $1,050/ML, with a median of $100/ML and a volume-weighted average price of $95.50/ML.

Fig. 2 shows the number and frequency of individual water allocation sales (per quarter) by Aboriginal organisations between 2004–05 and 2017–18. Red boxes denote the quarter in which each Aboriginal organisation completed their first sale, with green boxes denoting any quarter in which a sale occurred after the first occurrence. Numbers in red and green boxes indicate the number of water sales completed in that water quarter, with totals presented per year listed below, along with total allocation volumes traded. This figure reveals that both the number of Aboriginal organisations engaged in allocation sales and the number of individual sales generally increased over the 14-year period. These upwards trends are consistent with NSW irrigators' growing acceptance and adoption of water allocation trade more broadly (Wheeler et al., 2014).

Analysis of the prices received by organisations shows that they generally achieved market prices that were consistent with the volume-weighted average price (VWAP) for the quarter in the regional market concerned. Fig. 3 illustrates this for four indicative allocation markets across the southern (NSW Murray, Murrumbidgee, and Lachlan) and northern Basin (Macquarie) portions of NSW, in which 89% (98 out of 110) of the separate allocation sales occurred.

Temporary water sales also occurred, though less commonly, through combined land and water arrangements. This form of water sale included commercial land and water leases and share farming.[7] Only two organisations (Nari Tribal Council [NNTC] and Local Aboriginal Land Council [LALC] B[8]) sold water in these arrangements during the research period.

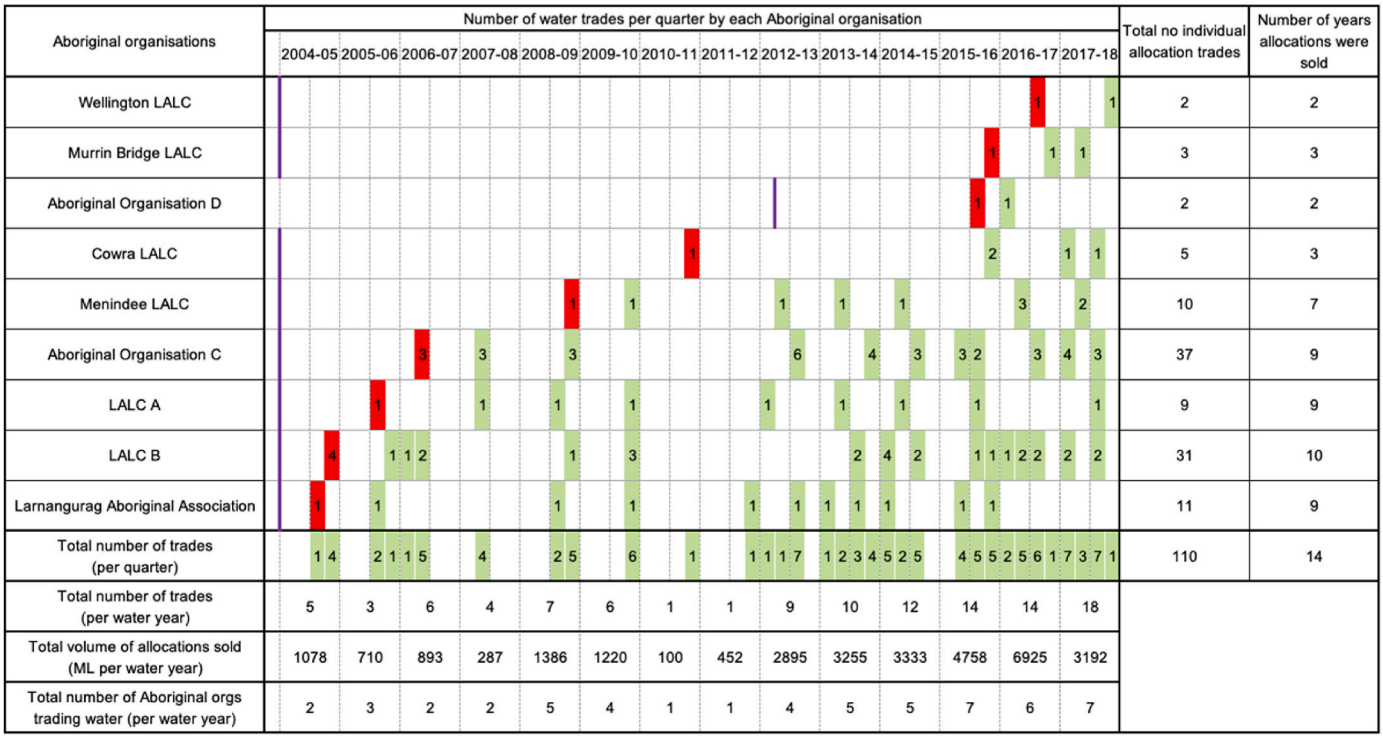
Both kinds of temporary water sales were generally prompted, and always facilitated, by water brokers or some other intermediary. Interviewees disclosed that by engaging brokers, they rarely encountered obstacles or delays during the administration or processing of water transactions, which generally required little effort from them and entailed a swift transfer of funds once the exchange took place. The commission earned by water brokers was not raised as an issue by any respondents.

We found that no organisations interviewed for this study purchased water (allocations or entitlements), and none traded water as part of an asset portfolio management strategy, as employed by large agri-corporates or financial investors (Seidl et al., 2020). At the time of data collection, we found only one organisation had sold a share of their permanent entitlement. Larnangurag Aboriginal Association (LAA) sold a small portion (22 ML, or 5%) of their entitlement in February 2013 as

[6] Market sales are those that incurred at least $1/ML. One organisation sold water in 2017–18 through a forward contract arrangement.

[7] Share farming is where 'both the share farmer and the landowner share in the risks of farming. Whoever has the greater share of costs takes the greater risk and thereby takes a greater share of income' (GRDC, 2014, p. 1).

[8] LALC B participated in share farming on their property for several years, and during other years sold water on the allocation market.



Aboriginal organisations	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Total no individual allocation trades	Number of years allocations were sold
Wellington LALC													1	1	2	2
Murrin Bridge LALC												1	1	1	3	3
Aboriginal Organisation D												1	1		2	2
Cowra LALC							1					2	1	1	5	3
Menindee LALC					1	1			1	1	1		3	2	10	7
Aboriginal Organisation C			3	3	3				6	4	3	3 2	3	4 3	37	9
LALC A		1		1	1	1			1	1	1	1		1	9	9
LALC B	4	1 1 2			1	3				2	4 2	1 1 1 2 2	2	2	31	10
Larnangurag Aboriginal Association	1	1			1	1		1	1 1	1 1	1	1 1			11	9
Total number of trades (per quarter)	1 4	2 1 1 5		4	2 5	6	1		1 1 1 7	1 2 3 4	5 2 5	4 5 5 2	5 6 1 7	3 7 1	110	14
Total number of trades (per water year)	5	3	6	4	7	6	1	1	9	10	12	14	14	18		
Total volume of allocations sold (ML per water year)	1078	710	893	287	1386	1220	100	452	2895	3255	3333	4758	6925	3192		
Total number of Aboriginal orgs trading water (per water year)	2	3	2	2	5	4	1	1	4	5	5	7	6	7		

Fig. 2. Aboriginal organisations' water allocation trading patterns, 2004–05 to 2017-18
Source: Compiled using data from WaterNSW (n.d.).
Notes: Purple lines indicate the commencement of the first Water Sharing Plans (WSPs), and thus, the date from which water trading data became available.

part of the Australian Government's irrigation efficiency upgrade program which saw their irrigation channels and paddock infrastructure upgraded in exchange for this water. The LAA Secretary recalled, "We would never have saved the money to do that [upgrade] without selling that water" (May 2017). This upgrade reduced water run-off and evaporation, enabling LAA to grow wheat and seed more efficiently and reduce their water costs. The same infrastructure is also used to deliver environmental water to a wetland on their property that is of ecological importance and spiritual significance. At the time of interview, the LAA Secretary said they were waiting for another government-funded scheme to secure more funds to further improve irrigation infrastructure.

All those interviewed were otherwise strongly opposed to the sale of part or all their water entitlements. The reasons given were that permanent sale would truncate an ongoing income stream and preclude benefits that could perpetually flow to their organisations and communities. Several also reported not wanting to sell their entitlements because they wished to use the water themselves at some time in the future.

4.2. *The value of water trades to Aboriginal organisations*

The importance and significance of revenue from water trading for Aboriginal organisations cannot be over-emphasised. To varying degrees, this revenue has helped organisations to remain operational and, in some cases, to achieve other outcomes. Interviewees reported that water trade revenue is easy to access and comes without external restrictions. There are no onerous reporting requirements typical of other income sources, like grant funding. Water trades thus afford a degree of flexibility and financial independence. For example, the representative from Aboriginal Organisation C reflected:

> Whilst we budget for [water trade income], we don't have to report on it … essentially the water sales represent our only source of tradable income, or revenue, that we can do anything with (October 2017).

Another commented:

> At the end of the day, it's Aboriginal money. And that's the thing—we want to start having our own money where we can make our own decisions and don't have to rely on anyone. That's how I sometimes see our money from selling water. (LALC B Chief Executive Officer [CEO], May 2017)

The revenue derived from water trades was put to a range of uses. The most frequently reported was offsetting immediate and future organisational running costs, including property rates, electricity costs, and maintaining plant and equipment. Ironically, interviewees stated that they often use water trade income to pay water entitlement fees and domestic water rates. For example, the Wellington LALC CEO reported that selling the allocation associated with its 20 ML general security entitlement "doesn't give us a great deal of income but what it has been able to do is cover the cost of holding our licences.[9] So that alone has been beneficial". Indeed, the main reason organisations gave for not wanting to sell their water entitlements was because the revenue generated by selling the associated annual allocations is essential for paying ongoing costs, and therefore vital for their continued financial viability. As LALC A Representative (May 2017) noted "We'd never sell it [our entitlement] because when it's gone, it's gone! … You wouldn't be able to pay your running costs!"

In some cases, water trade income enabled organisations to not only stay afloat but build a modest financial base to support community, employment, and/or enterprise outcomes. For instance, a portion of the Menindee LALC's most recent sales was used to complete the installation of an industrial kitchen and accommodation facilities for community

[9] Some participants refer to water entitlements as water 'licences' because these instruments are called 'Water Access Licences' in NSW legislation.

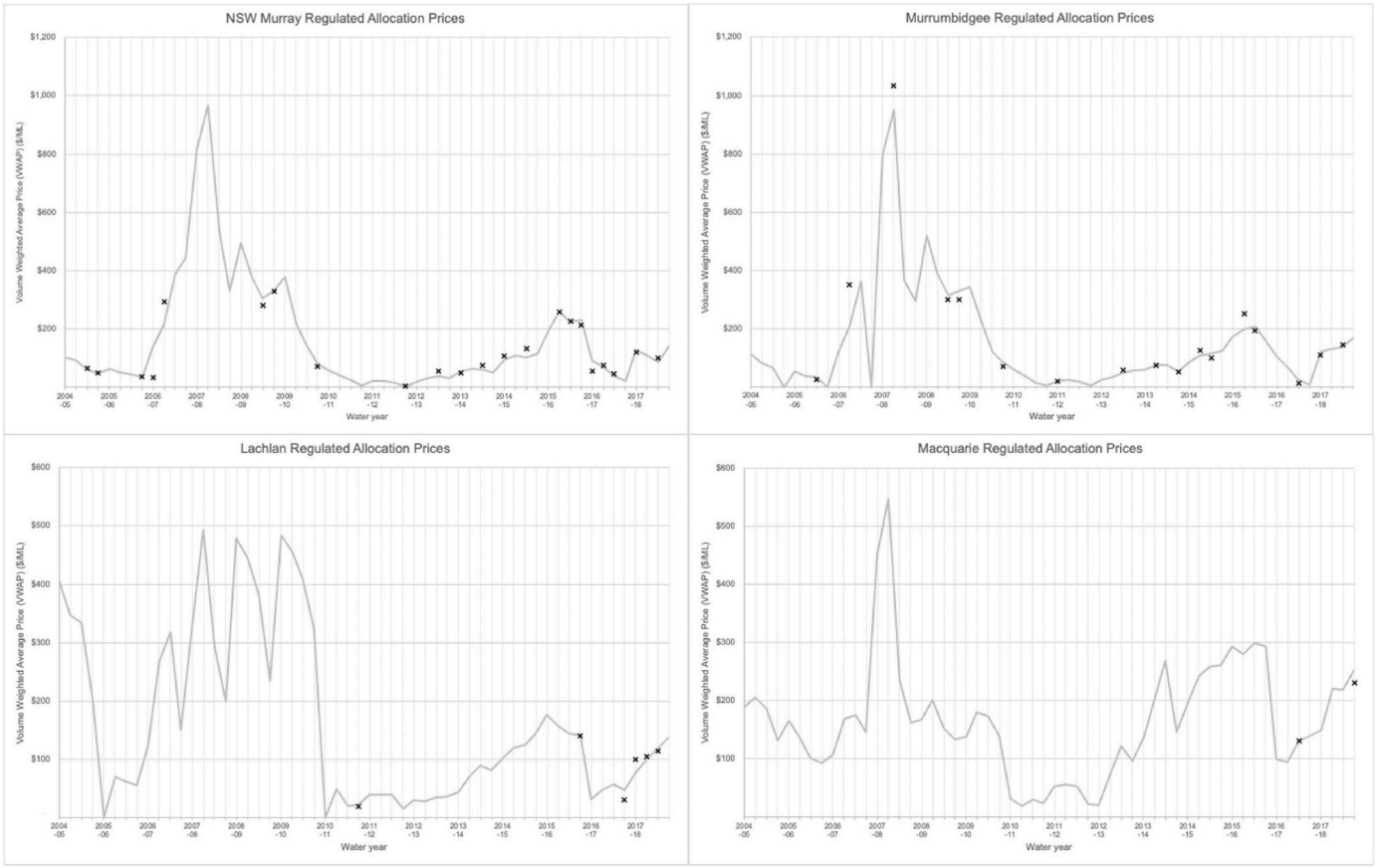


Fig. 3. Prices from water allocation sales in four indicative valleys, 2004–05 to 2017–18. Grey lines show VWAP per quarter, with black crosses denoting VWAP for allocation sales by Aboriginal organisations.
Source: Compiled using data from NSW Department of Planning & Environment (2023) and WaterNSW (n.d.). Data sourced from NSW Department of Planning & Environment (2023) is provided as supplementary data.
Notes: Upper plots have a maximum vertical scale of $1,200/ML while lower plots have a maximum vertical scale of $600/ML.

celebrations and camps on one of their properties. In another case, water trade income enabled the employment of a part-time local groundskeeper and community projects:

> We had a grant from the NSW Aboriginal Land Council to upgrade our community hall… [but] we needed another $20,000. Money from selling water, that helped, and that helped the community. This money also helps us to have a NAIDOC Day [Celebration] so we don't have to go to the government and ask for a grant or anything. (LALC B CEO, May 2017).

For the NNTC, the income from their combined land and water lease arrangement (supplemented with funding from the Australian Government) contributes to meeting the costs associated with their on-site environmental management and conservation activities, including employment and water infrastructure upgrades (Jackson and Langton, 2012).

Some groups reported having specific longer-term plans in mind for investing their income from water trades to generate diverse community, employment, or other outcomes. For instance, the Murrin Bridge LALC planned to "improve on what we've got" by putting some of their water trading income towards buying their own office building (CEO, May 2017). Not all organisations had specific purposes in mind, however. For example, interviewees also talked about the income "sitting in the bank" in term deposits that generate interest, available for use in emergencies, or on projects yet to be determined. Having spent some of their trade income to complete the abovementioned works on one of their properties, the Menindee LALC was unable to identify a useful way of spending a sizeable amount earnt from one of their initial water allocation sales, saying:

> It's not for anything at this point. It just sits there and rolls over every year. It collects interest and goes back into the investment account and grows over time. We've got no plans for it at this stage, we just watch it grow (CEO, February 2017).

These comments suggest that there are forces constraining Aboriginal organisations from pursuing their broader aspirations, even when they could be realised more immediately with the income generated from water trading, a point we will return to later.

4.3. *Factors influencing short-term benefit from trading water*

Research on the MDB water market indicates that selling water allocations can bring significant returns or windfall gains, but under considerable uncertainty (Wheeler et al., 2016). Windfall gains is a term that describes unexpected income or profit and/or income that requires little to no effort to secure (Dalgaard and Olsson, 2008, p. 175). Five Aboriginal organisations received what could be considered windfall gains from water sales on the allocation market during the Millennium Drought (2001–2009) when prices were high, particularly in 2007–08 and 2008–2009 (see Fig. 3). Of these, three organisations achieved sale prices three times higher (per megalitre) than any other they received during the study period. Conversely, in extremely wet periods when the market is saturated with available water, prices drop. This is evident in 2010–11 to 2012–13 when record low water allocation prices were recorded in many NSW catchments (see Fig. 3).

While water sale income is relatively easy to access and flexible to

use, this does not mean that Aboriginal water traders accepted any prevailing price. Interviews revealed awareness of and responsiveness to price fluctuations, with one interviewee comparing fluctuating water prices to the stock market (LALC B CEO, May 2017). Interviewees said they were less willing to sell water allocations when prices fell in wet conditions knowing that in the past, when conditions were drier, their water attracted higher prices. Some talked about holding out "for a half reasonable price" within a season (Anon, February 2017), or even delaying water sales to the next water year (where possible) to maximise their income.[10] The CEO from LALC A, for example, stated: "At the moment, the price is only about $20/ML, so we aren't going to trade the water. Then again, it might be worth trading it because you still get some money for it, don't you?" (May 2017). A subsequent review of water trade data revealed that this organisation did hold off, and in the following water year received (gross) $140/ML instead. As the CEO explained: "You've got to think whether it's worthwhile to sit on it or sell. And it's a gamble you take. But the more knowledge you acquire, the better equipped you are" (May 2017). These examples show Aboriginal organisations exercising choice and seeking more favourable prices, based on their knowledge of previous water trades and advice from their water brokers.

Water availability influences not only demand and thus water allocation prices, but also the allocation volumes that can potentially be sold at any given location and point in time. Interviewees were generally aware of this relationship. The LALC B CEO (May 2017), for example, stated that in comparison to extremely wet or extremely dry years, they prefer "moderate" seasons because this attracts favourable prices and decently sized water allocations to sell. By contrast, the NNTC whose water trade occurs through combined land and water arrangements, does not see this fluctuation because the price is set in a multi-year contract, regardless of water availability (increasingly annually with CPI). This arrangement provides "certainty" regardless of market prices (Chair, NNTC, July 2017).

Fig. 3 shows intra- and inter-catchment water allocation price volatility over the study period. As described above, the interplay between volatile water pricing and allocation volumes, injects considerable variability into the value Aboriginal water holders obtained from trade. The effect of this variability was reportedly felt most strongly by those organisations that rely heavily on water trading for their overall income, who, this research indicates, tend to hold larger volumetric entitlements. For example, among those interviewed, Aboriginal Organisation C holds significantly sized water entitlements including a high security entitlement. The representative from this organisation highlighted the tensions between the significance of their income from water trading and the limits and unpredictability of that income, which they described as "very, very volatile":

> Possibly in some past very dry years we've traded water and probably done quite well but you get a wet spring, and a few other environmental, climatic things work against you, and you can have a very poor year in terms of income … I can't forecast that. You can't budget for that with any great certainty. So, we only trade it because it's one of our main sources of income. I think for an organisation that's been around for so long, it's a little bit disappointing that they haven't been able to create more business opportunities for themselves, than relying on water, [and] the volatility of the water market (Aboriginal Organisation C Representative, October 2017)

This and other comments suggest that even as some Aboriginal organisations generate income from water trading – including what could be classified as 'windfall gains' – they have not invested the returns to generate more secure income or employment opportunities.

As noted above, most interviewees engaged – or in some cases, relied upon – water brokers or other intermediaries to negotiate their water sales. Some also sought support from the NSW State Aboriginal Land Council and/or NSW government water agency staff. A major reason for this engagement was to address the complexity and technical nature of the water market, which most interviewees reported as the only major obstacle to trading they encountered, particularly when making the initial decision about whether to enter the market. As the Murrin Bridge LALC CEO explained, "Once you register with [the water broker], it becomes quite simple after that" (May 2017). In some cases, though, individuals (and wider organisational Boards) had only recently become aware that their water allocations could be sold, highlighting the importance of good water literacy, expertise, and market confidence in generating favourable outcomes (Hasselman and Stoker, 2017). New entrants require such skills (Australian Competition & Consumer Commission ACCC, 2021), but Aboriginal people who have been excluded from water planning and governance (MLDRIN, 2017) and may not have experience in operating water-based businesses will likely be at a disadvantage.

This research indicates that engaging a trusted broker can help address many of these initial and ongoing obstacles to participating in water trading. However, as one CEO observed, "you've [still] got to be pro-active enough to ask the right questions, find the right broker and feel comfortable with them and let them do the work" (Aboriginal Organisation C Representative, October 2017). Moreover, different knowledge sets are necessary for shifting to alternative water uses and/or investing the income generated through water trading in activities that offer more consistent income, employment, and wider community outcomes into the longer-term. We return to these points in the discussion.

4.4. The multivalent nature of water

Representatives of Aboriginal organisations valued the short-term income generated through water trading, and the opportunities this creates. Interviews revealed that they value their water entitlements for other reasons as well. Aboriginal water traders hold 'many versions of water' and these views are not mutually exclusive (Brandshaug 2019, p. 538; see also Hemming et al., 2019; Moggridge et al., 2019; Hartwig et al., 2022). Some Aboriginal water traders were conscious that others in society use and value water differently and saw that water trading was a means to contribute to a variety of needs, while others raised concerns about environmental impacts of water trading for irrigated agriculture.

Interviewees were asked if they knew who had purchased their water allocations and/or how buyers used their water. Only the NNTC, the organisation with the combined land and water leasing arrangement, knew this information (as anonymity of buyers is a condition of using a broker to facilitate trade). Representatives were also asked if they had preferences for, or were opposed to, certain buyers and/or kinds of water uses to which their water might be put. Som e stated that they would prefer their water to be used for growing food, crops, or for grazing stock (LALC A; Murrin Bridge LALC). Others preferred that their water not be used for irrigation (cotton specifically), mining, or used with chemicals (Murrin Bridge LALC; Wellington LALC; NNTC). Another disagreed with the principle of allowing trade upstream, saying:

> we can trade our water to users up the river, above us. Property holders can dig a hole on their property and store the water there, and so that water doesn't flow through the river here. I don't really agree with the fact this can happen, but we did those trades because we really needed the money at the time (Anonymous, February 2017).

With one exception, representatives with these preferences said they had not sought to give effect to them in their water trading activities,

[10] Carry over is not possible for water allocations against NSW high security entitlements, and so holding out like this is constrained to within water years for these entitlement holders. One high security entitlement holder explained their strategy as: 'you may as well trade whatever's left up to June' (Murrin Bridge LALC CEO, May 2017).

and most were unsure if they could.

While some suggested that knowing how the water they sold was used may influence their decision to trade, others were sceptical about any difference their actions might make in the wider scheme of water management. For example, the Murrin Bridge LALC CEO stated: "If I knew it was going to be for cotton that might change my decision [to trade the water]. But they'll grow the cotton whether they can get our water or not! So, I don't know" (May 2017). Similarly, another CEO commented: "If I had it my way, I'd sell our licence to the government, so the water can stay in the river. But we know they wouldn't keep it. They'd just sell it to someone else!" (Anonymous, February 2017). Some appeared surprised by this line of questioning. A pointed example is the Wellington LALC CEO's response:

> I haven't even thought of that … I mean, if our whole purpose is to protect land and culture and all the rest of that, and potentially that water that you're selling is going to destroy all of that and be used as a form of doing that, I think we wouldn't do it. … I mean, I guess it was envisaged that it would be used by farmers and primary producers to generate crops and keep their livestock alive. I didn't give it any more thought to mining or anything like that. That's been a very good thought-provoking question (July 2017).

A total of five groups expressed no preference for how their water should be used once sold.

Interviewees did not see that their participation in the water market compromised their commitments to environmental protection or health. LALC B's CEO for example, described the environmental problems arising from over-allocation of water and irrigators' behaviour (May 2017). Yet they offered the following reflection on water trading:

> For us as an Aboriginal organisation, I don't see it as a problem as us taking water and selling it …. For us selling water—and this is my personal opinion—we're doing it so that Aboriginal people are not five steps behind. We're up the front and the money we're collecting, it's going back to our community and helping our people out. I don't know how that's different or wrong, but that's how I see it.

Murrin Bridge LALC CEO (May 2017) also shared concerns about water quality impacts, stating:

> We're all still disgruntled from an Aboriginal point of view in that the quality of our river systems now is just [awful]—I think you get an attitude like, 'Well the farmers take water out for cropping cotton, and this is an arid country anyway. Our water's precious. So, if they're doing it, we may as well jump on the bandwagon too!'

These responses suggest that interviewees may be motivated to participate in water trading for a fear of missing out, but this conclusion risks overlooking the nuance and complexity of underlying socially embedded views on the value of water. We see a similarity here with the observations of Brandshaug (2019) from Peru in that Aboriginal water traders in NSW simultaneously see water as a commodity that can generate much needed income and the opportunities that might follow, and as a common good.[11] Interviewees not only saw water as a common good that they value for its part in meeting their aspirations for environmental, cultural, and social sustainability, but also as a limited resource that wider non-Indigenous communities need and value. Thinking about water in its broader social context at least in some part contributed to Aboriginal water traders' decisions to trade. The Menindee LALC CEO neatly captured this interconnected societal and financial value of water, and the possibilities of mutual exchange, when they said:

> Someone else needed the water and we needed the money. It was just sitting there, and we weren't doing anything with it. We thought, 'If it's just sitting there and not being used and we could make some money off it, then why not?' (February 2017).

4.5. Trading to a valued end

Some saw trading water as a step that could complement the efforts of their community as they worked towards directly using water on their estates. The current level of water trading was regarded by representatives from 7 of the 10 trading organisations as a temporary measure to be undertaken until they established the capability to use some or all their water on their own 'Country',[12] and preferably by their own community members, whether that be for agricultural use or environmental or socio-cultural outcomes (or a mixture). Almost all water holding organisations (11 out of 13) ultimately wanted to use the water to which they were entitled on Country. Ten of these 11 wished to use water in ways that (further) develop farming, irrigation, and grazing practices at various scales (i.e., community to commercial). Five hoped to generate employment opportunities for communities with their water holdings – through farming or other practices like watering Country. Six hoped their water could enable camps and other events, and therefore generate community or cultural benefits; and three hoped their water could be used for watering wetlands on their properties.

The data however reveal a significant gap between these aspirations and reality. Of the three organisations whose water had been used on their Country at some point during the 14-year period examined, only LAA reported that their community or organisation members carried out these activities (specifically, irrigation). In the two other instances, non-Aboriginal 'third parties' used Aboriginal-held water for irrigation on Aboriginal land (accessed via combined land and water leases).[13] Lack of access to financial capital, physical infrastructure, suitably productive land, resources, capacity, and support were given as the limiting factors, and these are discussed further as foundational issues in limiting the benefits that Aboriginal water holders can hope to derive from water trading.

5. Discussion

We found that Aboriginal organisations are engaged in water trading in the NSW portion of the MDB, predominantly as sellers on the allocation (temporary) market, and that this activity has increased over time. We also described the factors that influenced the income derived from trades, the conditions under which these trades occur, and the key factors shaping trading behaviour. Aboriginal water traders reported that financial income is the primary direct benefit they derive from water trading because it is fungible and 'liquid', facilitating access to quick cash; requiring minimal effort (when facilitated by a broker); and placing little burden on their time or capacity.

Trade revenue can be considerable, though unpredictable, and is free from onerous reporting. It also has the potential to generate a suite of subsequent flow-on benefits and can be used for any purposes as determined by each Aboriginal organisation, although that potential has been rarely realised. Interviews revealed trade revenue allows these organisations to operate more freely, beyond the confines of bureaucracies (and even some non-government organisations) that have funding and associated reporting arrangements that can undermine

[11] We focused these interviews on aspirations for water use and trade activities, and not the broader social or cultural meaning of water. This may account for the fact that no one explicitly mentioned water's spiritual significance in these interviews. For studies that address this dimension within the MDB see, for example, Hartwig et al. (2022), Moggridge et al. (2019) and Weir (2009).

[12] 'Country', as used in this paper, is the Aboriginal English term that represents Aboriginal peoples' holistic and sacred understandings of their territories, including land and water, and their relations with them (Rose, 1996).

[13] Two organisations used government-held environmental water for wetland watering. See, for example, Jackson and Nias (2019, p. 291).

Aboriginal peoples' autonomy and self-determination (Chew and Greer, 1997). This finding points to the contrast in the 'transaction costs' for each, with government programs having higher associated costs than water trades.

Our research also revealed that Aboriginal organisations strongly aspire to use their water locally, on their customary estates, and for their own purposes. However most Aboriginal organisations and communities find themselves in a situation where they are effectively 'stuck' in a cycle of temporarily selling their water allocations rather than directly using their water to build wealth or pursue other outcomes. There was little evidence that water trading brought them closer to achieving their aspirations for a wider array of local water uses or benefits and for this reason we term this dynamic a 'water trading trap'. The types of decisions that representatives from Aboriginal organisations face when choosing whether to sell their allocations or directly use their water on their Country are depicted in a decision tree below in Fig. 4.

Fig. 4 shows there are many points at which organisations may decide that they are unable to use water and therefore resort to selling their allocations. Selling water allocations on the market presents opportunities to generate quick, easy, and potentially sizeable revenue, which can help Aboriginal organisations meet their financial obligations and commitments, including operational costs and bills, and sometimes supplement other community-scale, economic, and/or environmental projects. Importantly, these costs must be paid regardless of whether a water allocation is received (noting here the injustice of the state levying fees on Aboriginal peoples who never ceded their rights to land or water to the Crown). The fact that most organisations are not using—or are not in the position to use—their water on their Country forces or simplifies this decision.

Financial and human capital is required to install and/or maintain water access infrastructure (and develop larger commercial projects that rely on water more broadly) but these resources are already limited or stretched for most Aboriginal organisations (see Moggridge et al., 2019). For example, only two of the 13 organisations reported having operable water infrastructure (i.e., irrigation-scale water pumps), an essential requirement for delivering water to fields or wetlands. Similarly, the burden of fees and charges associated with holding entitlements and extracting water for on-Country uses renders water entitlements in some ways as a 'liability' (O'Donnell et al., 2021), further disincentivising investment in developing such projects. At the same time, difficulties accessing other reliable and predictable income sources, a common challenge for Aboriginal landholding organisations (Chalk and Brennan 2015), can increase the attraction (indeed, necessity) of water trading, particularly in years when conditions are conducive to windfall gains.

Thus, Aboriginal water holders face a complex set of factors, or 'critical thresholds' (Maru et al., 2012), that together form the self-reinforcing feedback loops of this water trading trap. First, the requirement for cash income to pay the annual fees for land and water levied by government on all water entitlement holders. Second, the requirement to meet pressing organisational expenditure needs. Third, insufficient stocks of the (multiple) capitals required to make beneficial use of water allocations on-Country. These thresholds are all products of the broader historical, structural, and relational settings and contexts within which Aboriginal organisations operate (Maru et al., 2012; Ribot and Peluso, 2003).

The effects of historic colonial land policies and their legacies are observed particularly in relation to the third threshold. The distribution, quantity, and quality of Aboriginal land and water holdings is a direct consequence of historical patterns of land and water titling and usage, as well as selective approaches by the state to restitution. Little of the current Aboriginal land estate in Australia is suitable for profitable irrigated agriculture (Holmes, 2006) and Hartwig et al. (2022) contend that for most Aboriginal-held lands in the NSW portion of the MDB, particularly the largest properties, the marginal economic productivity of water is likely to be low. In some cases, leaseback arrangements, zoning and other restrictions also prevent agricultural uses of Aboriginal landholdings (Behrendt, 2011; Norman, 2015). Apart from properties purchased more recently, this is largely by design. Land rights restitution mechanisms were intended to only return those lands that were surplus to the requirements of settler capitalism (Altman and Markham, 2015; Norman, 2015). Hartwig et al. (2022) confirmed this pattern whereby Aboriginal people have been excluded from holding productive land and water entitlements as key agricultural inputs, thus correlating with low levels of Aboriginal private benefit from agricultural economies, and thereby limiting accumulation of financial and other forms of capital.

In our portrayal of the water trading trap (Fig. 4), thresholds occur in tandem and reinforce each other, working to reduce the feasibility of developing and using water on Country and simultaneously increasing the appeal of water trading. As a result, most representatives of Aboriginal organisations (10 out of 13) chose to sell their water allocations. Structural factors – particularly lack of land suitable for profitable irrigated agriculture – are in effect contributing to a level of dependence on water trade income from which it is difficult to break free (see Carrasco, 2016). But this is not the only threshold to overcome, as demonstrated by the Wellington LALC example:

> We have no experience in primary production. We don't have the tools or expertise, so we need to be able to engage someone and potentially go in partnership in the near future, and one of our partnership elements would be, 'We have the land, we have the water licence, but we don't know how to do it!' (CEO, July 2017)

In other words, to escape the water trading trap most effectively and see Aboriginal water holders use water on-Country, simultaneous threshold improvements are needed (Maru et al., 2012). This situation is particularly challenging given that many of the impediments described here arise from the asymmetrical power relations of contemporary settler-colonialism and the interventions required are outside the control and power of Aboriginal organisations (see Maru et al., 2012).

Across Australia, there is now growing momentum to reform government policy and increase Aboriginal water holdings. For example, Australian governments recently committed to improve access to freshwater under the Closing the Gap policy (Hartwig et al., 2021), and the NSW Government is expected to prioritise access and ownership of water for cultural and economic purposes under its State Water Strategy (NSW DPIE, 2021). In actioning these reforms, governments will need to address the dynamic of the water trading trap and its threshold limitations, such as lack of financial resources and high value production opportunities, as well as the need for knowledge, technology, and infrastructure. Entitlement fees and other management costs could be waived or made more affordable relatively easily. More substantive change would involve increasing access to productive land and financial capital (Hartwig et al., 2022; Woods et al., 2022). These interventions are essential if Australian governments are to equip and empower more Aboriginal water holders to pursue and achieve their aspirations for water use and management.

Victoria's recent Traditional Owner water policy commits to addressing some of these issues (Department of Environment Land, Water and Planning, 2022) and could see necessary threshold improvements. While much of this policy is still to be implemented, it presents lessons for Australian jurisdictions. Crucially, though, while addressing the challenges described here is an important part of any policy response, governments must be cautious about focusing excessively or exclusively on this sphere of commercial access at the expense of enacting wider changes to the management and governance of Country (Davies et al., 2021; Nelson et al., 2018; O'Donnell et al., 2021). Reforms underpinned by restorative justice must support Aboriginal people to uphold their obligations and pursue their preferences for using, managing, and caring for water in all its forms and the wider landscapes of which it is part. To achieve this wider societal change will require changes to Australian systems of environmental governance.

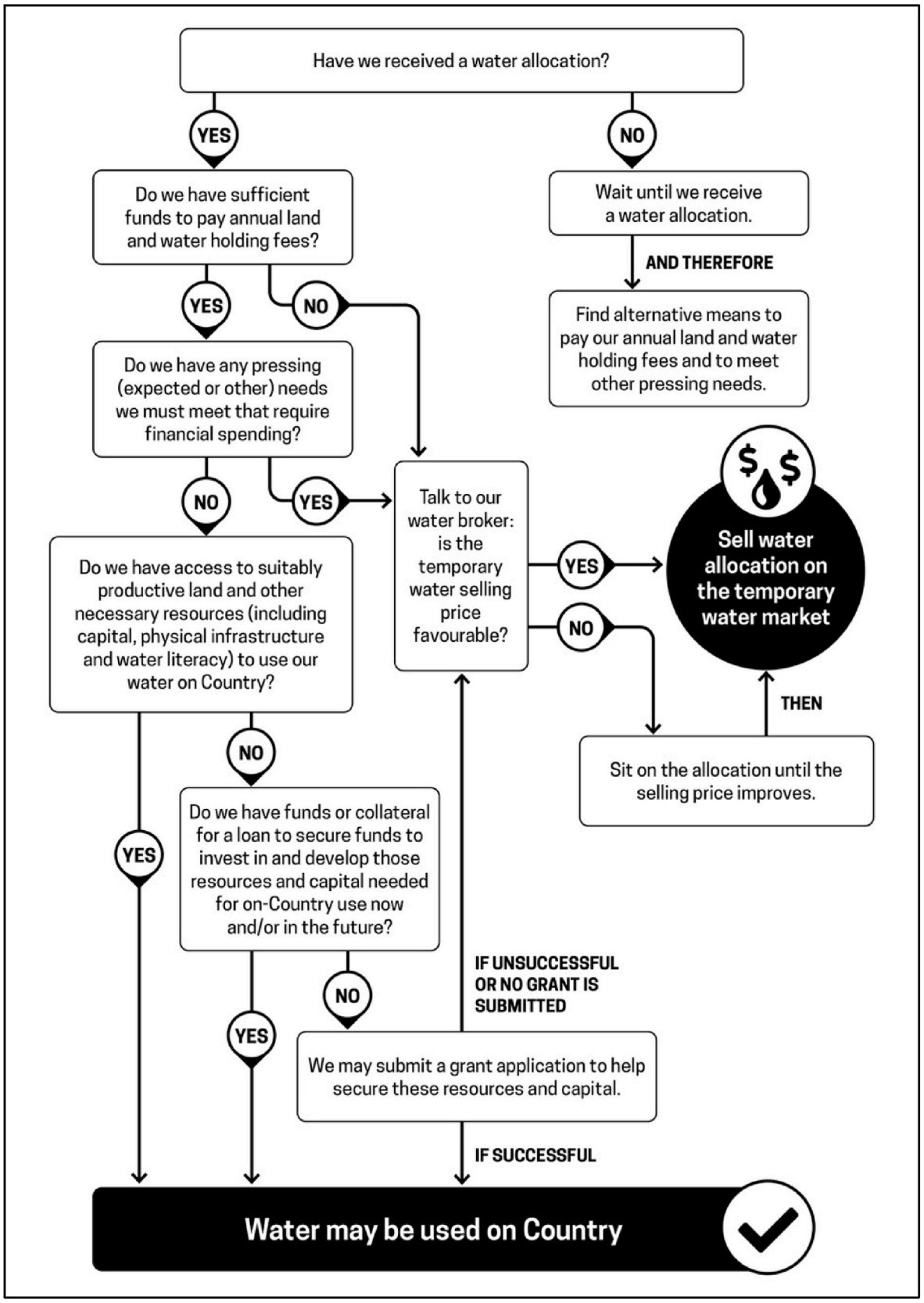


Fig. 4. The water trading trap.

6. Conclusion

Revenues generated from water trading provide an important source of income for under-resourced Aboriginal organisations. The income was often vital for the maintenance of day-to-day operations and especially valued because it was easy to access with fewer external restrictions than income from government grants. Aboriginal organisations did not, however, always sell at the first opportunity: some exercised choice in delaying trade until prices were more favourable, based on their knowledge of previous water trades and advice from water brokers. This study found that water brokers are fulfilling an important role in enabling Aboriginal organisations to access this income stream.

In addition to exploring the factors that enable or constrain water trading by Aboriginal organisations, our study set out to ascertain whether water market participation improves opportunities to determine or influence water uses within First Nations territories. We found that while water allocation sales generate valuable income for Aboriginal communities, and that this sometimes enabled the maintenance of existing land and water holdings, most organisations have not yet generated more enduring income streams from water trades, or significantly increased Aboriginal employment, or satisfied wider aspirations for using their water on their Country. The water trading trap demonstrates that saleable water rights alone do not necessarily support the achievement of Indigenous peoples' livelihood aspirations or their demand for self-determination in water management. Indeed, in the absence of financial resources and high value production opportunities, knowledge, technology, and infrastructure, the benefits from water trading may be limited to a quick injection of cash.

The existence of this trap points to the need to analyse the effects of water trading from within the political (settler-colonial) and neoliberal economic context that currently constraints Indigenous efforts to exercise self-determination. To meet Indigenous peoples' aspirations more fully, any policies and programs designed to advance Indigenous water rights must be more expansive. At the least, they will need to grant or return Indigenous people property rights to productive land and water, waive fees and charges associated with returned water (and land), and dramatically improve access to human and manufactured capitals including education a healthcare, together with transport and water infrastructure.

Authors statement

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Declaration of interest statement

The authors do not have any conflicts of interest to declare.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrurstud.2023.03.005.

References

ABARES, 2018. Australian Water Markets Report 2015-16. Retrieved from. https://data.gov.au/data/dataset/australian-water-markets-report-2015-16.
Australian Bureau of Statistics, 2022b. Water Account, Australia FY2020-21, 4610.0, Table 13.1 Gross Value of Irrigated Agricultural Production.
Aither, 2022. Aither Water Markets Report: 2021-22 Review and 2022-23 Outlook. Retrieved from HYPERLINK ". https://aither.com.au/2022-water-markets-report. https://aither.com.au/2022-water-markets-report.
Alderman, J.H., 2013. Winters and water conservation: a proposal to halt "water laundering" in tribal negotiated settlements in favor of monetary compensation. Va. Environ. Law J. 31 (1), 1–43.
Alexandra, J., 2018. Evolving governance and contested water reforms in Australia's Murray Darling Basin. Water 10 (2), 113. https://doi.org/10.3390/w10020113.
Altman, J.C., Arthur, W.S., 2009. Commercial Water and Indigenous Australians: A Scoping Study of Licence Allocations. CAEPR working paper no. 57/2009). Retrieved from Centre for Aboriginal Economic Policy Research website: HYPERLINK ". http://caepr.cass.anu.edu.au/research/publications/commercial-water-and-indigenous-australians-scoping-study-licence-allocations.
Altman, J.C., Markham, F., 2015. Burgeoning Indigenous land ownership: diverse values and strategic potentialities. In: Brennan, S., Davis, M., Edgeworth, B., Terrill, L. (Eds.), Native Title from Mabo to Akiba: A Vehicle for Change and Empowerment? The Federation Press, pp. 126–142.
Arthur, W.S., 2010. The Murray-Darling Basin Regional and Basin Plans: Indigenous Water and Land Data. MDBA, Canberra, Australia. MDBA publication no 20/12).
Australian Competition & Consumer Commission [ACCC], 2021. Murray-Darling Basin Water Markets Inquiry: Final Report. Retrieved from HYPERLINK o. https://www.accc.gov.au/system/files/Murray-Darling%20Basin%20-%20water%20markets%20inquiry%20-%20Final%20report_0.pdf.
Babidge, S., 2016. Contested value and an ethics of resources: water, mining and indigenous people in the Atacama Desert, Chile. Aust. J. Anthropol. 27 (1), 84–103. https://doi.org/10.1111/taja.12139.
Bakker, K., 2005. Neoliberalizing nature? Market environmentalism in water supply in England and Wales. Ann. Assoc. Am. Geogr. 95 (3), 542–565. https://doi.org/10.1111/j.1467-8306.2005.00474.x.
Bakker, K., 2014. The business of water: market environmentalism in the water sector. Annu. Rev. Environ. Resour. 39 (1), 469–494. https://doi.org/10.1146/annurev-environ-070312-132730.
Bauer, C.J., 1997. Bringing water markets down to earth: the political economy of water rights in Chile, 1976-95. World Dev. 25 (5), 639–656. https://doi.org/10.1016/S0305-750X(96)00128-3.
Bauer, C.J., 2010. Market approaches to water allocation: lessons from Latin America. Journal of Contemporary Water Research & Education 144 (1), 44–49. https://doi.org/10.1111/j.1936-704X.2010.00073.x.
Bauer, C.J., 2015. Water conflicts and entrenched governance problems in Chile's market model. Water Altern. (WaA) 8 (2), 147–172.
Behrendt, J., 2011. Some emerging issues in relation to claims to land under the Aboriginal Land Rights Act 1983 (NSW). UNSW Law Journal 34 (3), 811–834.
Bischoff-Mattson, Z., Lynch, A.H., Joachim, L., 2018. Justice, science, or collaboration: divergent perspectives on Indigenous cultural water in Australia's Murray–Darling Basin. Water Pol. 20 (2), 235–251. https://doi.org/10.2166/wp.2018.145.
Boelens, R., Bustamante, R., de Vos, H., 2007. Legal pluralism and the politics of inclusion: recognition and contestation of local water rights in the Andes. In: van Koppen, B., Giordano, M., Butterworth, J. (Eds.), Community-based Water Law and Water Resource Management Reform in Developing Countries. CABI, Oxfordshire, UK, pp. 96–113.
Brandshaug, M.K., 2019. Water as more than commons or commodity: understanding water management practices in Yanque, Peru. Water Altern. (WaA) 12 (2), 538–553.
Budds, J., 2009. The 1981 Water Code: the impacts of private tradable water rights on peasant and indigenous communities in Northern Chile. In: Alexander, W.L. (Ed.), Lost in the Long Transition: Struggles for Social Justice in Neoliberal Chile. Lexington Books, Plymouth, UK, pp. 41–61.
Carrasco, A., 2016. A biography of water in Atacama, Chile: two Indigenous community responses to the extractive encroachments of mining. J. Lat. Am. Caribb. Anthropol. 21 (1), 130–150. https://doi.org/10.1111/jlca.12175.
Carter, N.C., 2008. American Indian water rights: law and research. Leg. Ref. Serv. Q. 27 (1), 1–48. https://doi.org/10.1300/02703190802128442.
Chalk, A., Brennan, S., 2015. The relevance of statutory land rights to native title and empowerment. In: Brennan, S., Davis, M., Edgeworth, B., Terrill, L. (Eds.), Native Title from Mabo to Akiba: A Vehicle for Change and Empowerment? The Federation Press, pp. 143–157.
Chew, A., Greer, S., 1997. Contrasting world views on accounting: accountability and Aboriginal culture. Accounting. Auditing & Accountability Journal 10 (3), 276–298. https://doi.org/10.1108/09513579710178089.
Cosgrove, W.J., Loucks, D.P., 2015. Water management: current and future challenges and research directions. Water Resour. Res. 51 (6), 4823–4839. https://doi.org/10.1002/2014WR016869.

Dalgaard, C.J., Olsson, O., 2008. Windfall gains, political economy and economic development. J. Afr. Econ. 17 (Suppl. 1), 72–109. https://doi.org/10.1093/jae/ejm033.
Davies, S., Wilson, J., Ridges, M., 2021. Redefining 'cultural values' – the economics of cultural flows. Aust. J. Water Resour. 25 (1), 15–26. https://doi.org/10.1080/13241583.2020.1795339.
Diver, S., Ahrens, D., Arbit, T., Bakker, K., 2019. Engaging colonial entanglements: "Treatment as a state" policy for indigenous water co-governance. Global Environ. Polit. 19 (3), 33–56. https://doi.org/10.1162/glep_a_00517.
Grafton, R.Q., Horne, J., Wheeler, S., 2016. On the marketisation of water: evidence from the Murray-Darling Basin, Australia. Water Resour. Manag. 30 (3), 913–926. https://doi.org/10.1007/s11269-015-1199-0.
GRDC, 2014. Leasing and share farming land [Factsheet]. Retrieved from: HYPERLINKhttps://grdc.com.au/~/media/documents/resources/publications/fact-sheets/8113-leasing-and-share-farming-land-fs-pdf.pdf" o "https://grdc.com.au/~/media/documents/resources/publications/fact-sheets/8113-leasing-and-share-farming-land-fs-pdf.pdf"https://grdc.com. .
Hadjigeorgalis, E., 2008. Distributional impacts of water markets on small farmers: is there a safety net? Water Resour. Res. 44 (10), W10416 https://doi.org/10.1029/2007wr006527.
Hadjigeorgalis, E., 2009. A place for water markets: performance and challenges. Rev. Agric. Econ. 31 (1), 50–67. https://doi.org/10.1111/j.1467-9353.2008.01425.x.
Harris, L.M., 2009. Gender and emergent water governance: comparative overview of neoliberalized natures and gender dimensions of privatization, devolution and marketization. Gend. Place Cult. 16 (4), 387–408. https://doi.org/10.1080/09663690903003918.
Hartwig, L.D., 2020. Aboriginal Water Rights in New South Wales: Implications of Water Governance Reform for Self-Determination. (Doctor of Philosophy). Griffith University, Brisbane.
Hartwig, L.D., Jackson, S., Osborne, N., 2020. Trends in Aboriginal water ownership in New South Wales, Australia: the continuities between colonial and neoliberal forms of dispossession. Land Use Pol. 99 https://doi.org/10.1016/j.landusepol.2020.104869. Article 104869.
Hartwig, L.D., Markham, F., Jackson, S., 2021. Benchmarking Indigenous water holdings in the Murray-Darling Basin: a crucial step towards developing water rights targets for Australia. Aust. J. Water Resour. 25 (2), 98–110. https://doi.org/10.1080/13241583.2021.1970094.
Hartwig, L.D., Markham, F., Jackson, S., Osborne, N., 2022. Water colonialism and Indigenous water justice in south-eastern Australia. Int. J. Water Resour. Dev. 38 (1), 30–63. https://doi.org/10.1080/07900627.2020.1868980.
Hasselman, L., Stoker, G., 2017. Market-based governance and water management: the limits to economic rationalism in public policy. Pol. Stud. 38 (5), 502–517. https://doi.org/10.1080/01442872.2017.1360437.
Hemming, S., Rigney, D., Bignall, S., Berg, S., Rigney, G., 2019. Indigenous nation building for environmental futures: murrundi flows through ngarrindjeri country. Australas. J. Environ. Manag. 26 (3), 216–235. https://doi.org/10.1080/14486563.2019.1651227.
Holmes, J., 2006. Impulses towards a multifunctional transition in rural Australia: gaps in the research agenda. J. Rural Stud. 22 (2), 142–160.
Jackson, S., 2018. Indigenous Peoples and water justice in a globalizing world. In: Conca, K., Weinthal, E. (Eds.), The Oxford Handbook of Water Politics and Policy. Oxford University Press, New York, NY. https://doi.org/10.1093/oxfordhb/9780199335084.013.5.
Jackson, S., Hatton MacDonald, D., Bark, R.H., 2019. Public attitudes to inequality in water distribution: insights from preferences for water reallocation from irrigators to Aboriginal Australians. Water Resour. Res. 55, 6033–6048. https://doi.org/10.1029/2019WR025011.
Jackson, S., Head, L., 2020. Australia's mass fish kills as a crisis of modern water: understanding hydrosocial change in the Murray-Darling Basin. Geoforum 109, 44–56. https://doi.org/10.1016/j.geoforum.2019.12.020.
Jackson, S., Langton, M., 2012. Trends in the recognition of Indigenous water needs in Australian water reform: the limitations of 'cultural' entitlements in achieving water equity. J. Water Law 22 (2–3), 109–123.
Jackson, S., Nias, D., 2019. Watering country: aboriginal partnerships with environmental water managers of the Murray-Darling Basin, Australia. Australas. J. Environ. Manag. 26 (3), 287–303. https://doi.org/10.1080/14486563.2019.1644544.
Jackson, S., Woods, R., Hooper, F., 2021. Empowering first nations in the governance and management of the murray–darling basin. In: Hart, B., Bond, N., Byron, N., Pollino, C., Stewardson, M. (Eds.), Murray–Darling River System, Australia. Elsevier, pp. 313–335.
Laborde, S., Jackson, S., 2022. Living Waters or resource? Ontological differences and the governance of waters and rivers. Local Environ. 27 (3), 357–374. https://doi.org/10.1080/13549839.2022.2044298.
Lein, H., 2004. Managing the water of Kilimanjaro: irrigation, peasants, and hydropower development. Geojournal 61 (2), 155–162.
Macpherson, E., 2017. Beyond recognition: lessons from Chile for allocating Indigenous water rights in Australia. Univ. N. S. W. Law J. 40 (3), 1130–1169.
Marshall, V., 2017. Overturning Aqua Nullius: Securing Aboriginal Water Rights. AIATSIS, Canberra, Australia.
Maru, Y.T., Fletcher, C.S., Chewings, V.H., 2012. A synthesis of current approaches to traps is useful but needs rethinking for Indigenous disadvantage and poverty research. Ecol. Soc. 17 (2) https://doi.org/10.5751/es-04793-170207. Article 7.
Moggridge, B., Betterridge, L., Thompson, R., 2019. Integrating Aboriginal cultural values into water planning: a case study from New South Wales, Australia. Australas. J. Environ. Manag. 26 (3), 273–286.
Molina Camacho, F., 2016. Intergenerational dynamics and local development: mining and the indigenous community in chiu chiu, el loa province, northern Chile. Geoforum 75, 115–124.
Morgan, M., Strelein, L., Weir, J., 2004. Indigenous water rights within the Murray Darling Basin. Indigenous Law Bulletin 5 (29), 17–20.
MLDRIN, 2017. National water reform public inquiry – issues paper Murray lower darling rivers indigenous nations (MLDRIN) submission. Retrieved from HYPERLINK. https://www.pc.gov.au/_data/assets/pdf_file/0018/217125/sub060-water-reform.pdf.
Nelson, R., Godden, L., Lindsay, B., 2018. A multi-layer plan for cultural flows in Australia: legal and policy. Retrieved from HYPERLINK. https://culturalflows.
Nikolakis, W., 2011. Providing for social equity in water markets: the case for an Indigenous reserve in northern Australia. In: Grafton, R.Q., Hussey, K. (Eds.), Water Resources Planning and Management. Cambridge University Press, Cambridge, UK, pp. 629–646.
Norman, H., 2015. What Do We Want? A Political History of Aboriginal Land Rights in New South Wales. Aboriginal Studies Press.
Nsw Department of Planning & Environment [Dpe], 2023. Trade Dashboard. Retrieved from HYPERLINK ". https://water.dpie.nsw.gov.au/licensing-and-trade/trade/trade-dashboard.
NSW Department of Planning, 2021. Industry & environment [DPIE]. NSW Water Strategy. https://water.nsw.gov.au/_data/assets/pdf_file/0007/409957/nsw-water-strategy.pdf.
Nyberg, J., 2014. The promise of Indian water leasing: an examination of one tribe's success at brokering its surplus water rights. Nat. Resour. J. 55 (1), 181–203.
O'Donnell, M., 2013. The National Water Initiative, native title rights to water and the emergent recognition of Indigenous specific commercial rights to water in Northern Australia. Australas. J. Nat. Resour. Law Pol. 16, 83–100.
O'Donnell, E., Godden, L., O'Bryan, K., 2021. Cultural Water for Cultural Economies. Retrieved from. https://law.unimelb.edu.au/_data/assets/pdf_file/0008/3628637/Final-Water-REPORT-spreads.pdf.
Prieto, M., 2016a. Bringing water markets down to Chile's Atacama Desert. Water Int. 41 (2), 191–212. https://doi.org/10.1080/02508060.2015.1107400.
Prieto, M., 2016b. Practicing costumbres and the decommodification of nature: the Chilean water markets and the Atacameño people. Geoforum 77, 28–39.
Ribot, J.C., Peluso, N.L., 2003. A theory of access. Rural Sociol. 68 (2), 153–181.
Richter, D.B., 2016. Water share: using water markets and impact investment to drive sustainability. Retrieved from The Nature Conservancy website: HYPERLINK ". https://www.environmental-finance.com/assets/files/research/WaterShare_Fin_Web_Med.pdf.
Robison, J., Cosens, B., Jackson, S., Leonard, K., McCool, D., 2018. Indigenous water justice. Lewis & Clark Law Review 22 (3), 841–921. https://doi.org/10.2139/ssrn.3013470.
Rose, D.B., 1996. Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness (Australian Heritage Commission).
Seemann, M., 2016. Water Security, Justice and the Politics of Water Rights in Peru and Bolivia. Palgrave Macmillan, New York, NY.
Seidl, C., Wheeler, S.A., Zuo, A., 2020. Treating water markets like stock markets: key water market reform lessons in the Murray-Darling Basin. J. Hydrol. 581 https://doi.org/10.1016/j.jhydrol.2019.124399. Article 124399.
United Nations Development Programme, 2006. Human Development Report 2006 - beyond Scarcity: Power, Poverty and the Global Water Crisis. Retrieved from. https://hdr.undp.org/content/human-development-report-2006.
WaterNSW. (n.d.). NSW water register. Retrieved from https://waterregister.waternsw.com.au/water-register-frame.
Weir, J.K., 2009. Murray River Country: an Ecological Dialogue with Traditional Owners. Aboriginal Studies Press, Canberra, Australia.
Wheeler, S.A., Loch, A., Zuo, A., Bjornlund, H., 2014. Reviewing the adoption and impact of water markets in the Murray-Darling Basin, Australia. J. Hydrol. 518, 28–41. https://doi.org/10.1016/j.jhydrol.2013.09.019.
Wheeler, S.A., Rossini, P., Bjornlund, H., Spagnoletti, B., 2016. The returns from investing in water markets in Australia. In: Ramiah, V., Gregoriou, G.N. (Eds.), Handbook of Environmental and Sustainable Finance. Elsevier, London, UK, pp. 371–384.
Wheeler, S.A., Loch, A., Crase, L., Young, M., Grafton, R.Q., 2017. Developing a water market readiness assessment framework. J. Hydrol. 552, 807–820. https://doi.org/10.1016/j.jhydrol.2017.07.010.
Wheeler, S.A., Garrick, D.E., 2020. A tale of two water markets in Australia: lessons for understanding participation in formal water markets. Oxf. Rev. Econ. Pol. 36 (1), 132–153. https://doi.org/10.1093/oxrep/grz032.
Woods, R., Woods, I., Fitzsimons, J.A., 2022. Water and land justice for indigenous communities in the lowbidgee floodplain of the murray–darling basin, Australia. Int. J. Water Resour. Dev. 38 (1), 64–79. https://doi.org/10.1080/07900627.2020.1867520.