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ARTICLES

Community-Centred Environmental Discourse: Redefining Water Management in the Murray Darling Basin, Australia

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Abstract

The Australian government's response to the Millennium Drought (1997–2010) has been met with praise and contestation. While proponents saw the response as timely and crucial, critics claimed it was characterized by government overreach and mismanagement. Five months of field research in farm communities in the Murray Darling Basin (MDB) identified two dominant discourses: administrative rationalism and a local community-based discourse I have termed community-centrism. Administrative rationalism reflects the value of scientific inquiry in service to the state and is the dominant research-based problem-solving model used by water and natural resource agencies (Dryzek in The politics of the earth: environmental discourses, Oxford University Press, 2013; Colloff and Pittock in Aust J Water Resour, 23(2):88–98, 2019). Community-centrism was identified through discussions with farmers and represents a bottom-up approach to environmental planning and management that seeks to incorporate local knowledge, planning, and direct participation. This investigation reveals how discourses define problems and policy choices. While market-based government interventions were likely necessary to address the crisis in the MDB, community-centred responses could have enhanced the government's capacity to respond to problems. This paper argues that the long-term sustainability of water management in the Basin will require a reorientation on the part of farmers, academics, and governments to develop a community-centred approach to water policies impacting agriculture.

Keywords Water management · Environment · Local knowledge · Community · Murray Darling Basin · Australia

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Introduction

The Millennium Drought, which lasted from roughly 1997–2010, highlights how competing frameworks of knowledge construction shape critical debates on water management in the Murray Darling Basin (MDB). Governments and farmers often had conflicting views. At the heart of the controversy lies a divergence about the value of certain types of knowledge. There are two major theories about how knowledge is produced in this case. The first reflects the value of scientific inquiry in service to the state. Government agencies harness scientific capabilities to develop evidence-based solutions to policy problems they define (Cleaver & Franks, 2008). This orientation, called administrative rationalism, is the dominant problem-solving model used by water and natural resource agencies (Dryzek, 2013; Colloff & Pittock, 2019). The second, community-centrism, reflects a more 'bottom-up' approach to environmental planning and management that incorporates local knowledge, planning, and direct participation. Farmers tend to rely on information from their own experience and from peers working in similar local environments and conditions. This orientation focuses on how institutional arrangements and policy instruments might be deployed to support community-based goals and capacities (Robinson et al., 2015). This research investigates the policy choices that stem from the problem definitions associated with these two discursive orientations.

Many researchers have looked at the problems with the consultative framework in the MDB. Some argue that consultations were expensive and ineffective. For instance, Crase et al. (2014) argue that the community consultations undertaken by the Murray–Darling Basin Authority (MDBA) produced considerably higher transaction costs than could be justified by the results (Crase et al., 2014). Ross et al. (2002, p. 216) argue that consultations were problematic and that risks may have outweighed benefits. They describe "consultation burnout"; the capacity to "raise unreasonable expectations"; the possibility that the most powerful stakeholders shape the issues thereby limiting input from less powerful (or organized) stakeholders; threats via the abuse of power generally; limitation to the amount of learning and skill transfer, and; the fact that it is often chosen without contemplating more effective forms of engagement all limited the effectiveness of consultations (Ross et al., 2002, p. 216). Similarly, Garrick et al. (2013) believe that the costs of consultations were too high and that if governments had limited public consultation and pursued their agenda of market acquisition unimpeded, there would have been much lower transaction costs associated with the reform process. Other researchers argue the government has the tools and resources to manage water properly; they just need time to perfect the policy instruments they are trying to implement (Grafton & Horne, 2014). They write, "in Australia, developing a clear and transparent regulatory framework has taken about two decades…Time, patience, persistence and effective governance arrangements underpin the emergence of robust water markets in Australia" (Grafton & Horne, 2014, 69). Grafton and Horne (2014) reason that while local expertise can contribute to policies like environmental recovery strategies, local input can

undermine the emergence of strong water markets, "independent development of water resources within each state in the southern MDB led to the over-extraction problem that currently exists. Developing a robust water market that crosses state borders requires "basin-wide thinking' to support basin-wide outcomes" (Grafton & Horne, 2014, 69). While these authors acknowledge the value of local knowledge and better consultation processes, they all emphasize administrative and policy reform under strong government leadership, particularly under the MDBA, as the key to success.

The competing orientation has focused on how institutional arrangements and policy instruments might be deployed to support community-based goals and capacities (Robinson et al., 2015). I refer to this orientation as 'community centrism'. Community-centrism places human social relationships at the heart of environmental decision-making, providing a reconceptualization of environmental problem-solving surfacing economic, environmental, and social opportunities. Building on the insights of Murray Bookchin, Elinor Ostrom and others—and grounded in the voices of the farmers I interviewed—community-centrism focuses on the role of community-based cooperation and engagement.

Community-centrism is a unique discursive framework that can be used to understand the language and practices of actors. First, the discourse envisions a bottom-up, community-based, and localized planning process. Second, the discourse directly challenges state institutions and structures that limit social engagement and that interfere with what constitutes genuinely participatory democracy. Lastly, the discourse highlights the vital role of people as part of effective environmental management. Epistemologically, community-centrism focuses on the role of local knowledge exchange. Farmers have a rich tradition of sharing ecological knowledge to produce alternative policy prescriptions and outcomes (Berkes et al., 2000; Folke, 2002). Farmers also employ a wide range of tools to respond to the demands of local ecological systems, including multiple species management, resource rotation, revegetation, and erosion control, to name a few. Farmers transfer this knowledge within their communities, which helps them maintain best practices and learn from one another. They are constantly responding to the 'real-time' demands of their environment and are thus guided by experience and social networks of knowledge transfer more than other types of knowledge. Their policy solutions often reflect the significant role of social networks at the heart of ecological management. Problems are defined in a way that highlights the role of community support and social networks as critical components of how ecological systems are managed (Berkes, 2009).

Community-centrism is influenced by social ecology, introduced by the anarchist author and environmental philosopher Murray Bookchin. Social ecology points to the significance of human social relationships in determining both economic and environmental outcomes (Bookchin, 1994). Bookchin's approach acknowledges the co-dependent relationships between human societies and natural systems. He proposes that empowering people at the local level and giving them the democratic tools to engage within their communities results in both positive economic and environmental outcomes. Community-centrism adopts the view that positive environmental outcomes depend on engaged and empowered social communities. Similarly, Elinor Ostrom focuses on the role that human societies can have in positively

impacting their environments. In environmental resource management, this is done by gaining knowledge of locally specific contexts and acting according to principles that meet the needs of local communities (Ostrom, 2012). Ostrom works within the confines of the established discourse in ecological management to define eight clear principles for managing common pool resources. Among the eight principles, she argues that the commons need to have clearly defined boundaries, that rules should fit local circumstances, that participation is critical, and that the commons must have the right to organize (Ostrom, 2012). Likewise, community-centrism reflects these principles.

Community centrism does not exclude external expert knowledge. Tania Murray Li makes the case that the relationship between local and expert knowledge can be reciprocal (Murray-Li, 2007). Community-centrism adopts Li's perspective by highlighting how governments can be a part of local community-based decision-making. In community-centrism, while local actors are the major participants, communities can extend outward to government representatives, consumers in urban centres and the broader community. Community-centrism is also influenced by the literature on adaptive governance (Anderies & Barreteau, 2019; Folke et al., 2005; Brunner, 2010). Adaptive governance is an analytic construct for approaching the knowledge generation and decision-making challenges engendered by complex human–environment systems (Rittel & Webber, 1973; Ludwig, 2001) that contrasts conceptually with expert-driven and scientific management approaches to natural resource governance (Steelman, 2016). This approach also emphasizes the role of generalized, predictive science to reduce uncertainty in linear decision-making processes (Holling & Meffe, 1996).

This paper uses discourse analysis of problems in the Basin and looks at how definitions impact the development and implementation of water management policies. Unlike other studies on the MDB, this research is based on in-depth, in-person interviews with farmers whose opinions and ideas have often been overlooked in the reform process. This research reveals how the market-based instruments and the compartmentalization of various issues into multiple layers of bureaucratic organizations often increased the need for government involvement. Administrative rationalism impeded the capacity of governments to gather and include farmers' knowledge in their planning. Further, centralization impacted the character of water buyback programs. Finally, a community-centred approach to designing and implementing buybacks would have resulted in different policy outcomes.

Methodology

From July to December 2016, I undertook twenty-five semi-structured in-person interviews with farmers in central New South Wales.[1] The farms ranged in size from 2000 to 4000 acres. I did not limit the types of farmers in the project because I was interested in gathering various perspectives. Most farmers grew rice and had a

[1] Around the towns of Narrandera, Leeton, Finley, and Griffith.

diverse range of crops in rotation to better manage soils. The farm businesses in my sample were family-run operations and did not include farm operators employed by corporations.[2] This sample allowed me to identify trends, common concerns, and experiences among respondents. I asked farmers questions that would help me better understand their views on the federal and state government's management of the MDB. Referring to specific policies, including environmental buybacks, water trading, and drought assistance, I asked questions to gauge how respondents understood problems in the MDB. In addition, I asked questions to elicit the ecological knowledge of respondents and how this knowledge has impacted their chosen reactions to policies.

I also undertook eight semi-structured in-person interviews with government officials from the MDBA and The National Water Commission. I asked them to explain the rationale for programs related to the management of the MDB, to discuss the effectiveness of those programs, to offer analyses regarding how those programs and policies may be affecting farmers and to find out how farmers were included in the policy-making processes. Interview research was supplemented by a historical investigation of regional archives, newspapers, and other supplementary information.

The research results were evaluated using discourse analysis which explores the construction and content of discourses (Phillips & Hardy, 2002). Discourses are ensembles of ideas, concepts, and categorizations used to make meaning of physical and social realities (Hajer, 1995; Hajer & Versteeg, 2005). Interests are intersubjectively constructed and represented through discourses, which are produced, reproduced, and transformed through social practices (Hajer, 1995: 44). Dryzek (2013) contends that hegemonic discourses can erode and be supplanted by other discourses that may even have emerged in relative isolation from the dominant discourse. In Dryzek's theory, multiple discourses exist simultaneously and have productive and disciplinary effects. In my work, I build primarily on Dryzek's theoretical position. I explore how community-centred discourse challenges the dominant discourse in the MDB, namely administrative rationalism.

Much political contestation is fought at the level of problem definition. Problem definitions narrow the range of possible solutions and the type of knowledge(s) considered relevant for solving problems. Nevertheless, certain forms of new knowledge can make their way into dominant discourses if that knowledge is constructed in a way that is palatable Political arguments may be fought mainly at the level of problem definition (Mehta, 2013). How problems are framed has significant implications for the kinds of policy solutions that emerge. This paper focuses on the role of knowledge construction and values and how this leads to certain types of problem definitions in the context of the MDB. Dominant problem definitions and the overarching discourse of administrative rationalism have focused on the role of expert knowledge and scientific management. Farmers present an opposing discourse that seeks to further local community-based knowledge and decision-making processes by challenging how problems are defined.

[2] Other than companies owned by their own families to organize an inter-generational business.

Environmental Governance in the Murray Darling Basin

The ecological crisis facing the Murray Darling Basin (MDB) is alarming. Wetlands are threatened by long periods of drought between ecologically imperative flood events. Hundreds of forests in the floodplains are dying from lack of water. Water birds that require definite water levels for breeding are threatened with extinction. Native fish populations are rapidly declining, toxic blue-green algae blooms are common, and salinity is becoming increasingly problematic (Pittock & Connell, 2010). As the health of the rivers decline, irrigated agriculture and all the businesses that rely on food production suffer. Rates of poor health, mental illness, stress, and suicide have been increasing rapidly in rural Australia as a result. The MDB is the lifeblood of much of rural Australia, with flow-down effects felt throughout the agricultural sector and rural economy (Pittock & Connell, 2010). However, the continued over-allocation of water resources could mean the complete collapse of the river system. Given the consequences, it is understandable that the water crisis has generated great controversy and criticism of government actions (Harley, et al., 2014, 213–214).

The current crisis has its roots in Australia's history as a colony and its treatment of Aboriginal peoples. In the early days, white settlers eradicated native species, felled trees to increase pasture, and stripped the earth of its natural coverings at an astounding pace (Doyle & Kellow, 1995, 2–3). Aboriginal land practices were viewed as a lower form of cultivation in the eyes of whites. Further, because Australia was a convict settlement run by a powerful colonial empire, the state and not individual settlers set the tone of early development. The form of governance that emerged was known as 'colonial socialism' as government was central to the growth of capital (Doyle & Kellow, 1995, 3).

Early settlers who had begun to plan for irrigation and navigation systems along the Murray in the late nineteenth century quickly recognized that flow patterns along the Murray and its tributaries were much more varied than major river systems on all other continents (Connell, 2005, 85). The other issue was that the bulk of the annual flow came down the Murray at the wrong time of year for agriculture. Peak flows were usually in winter or spring, but plants needed watering in late summer and autumn (Connell, 2005, 85). This meant it was necessary to build a complex network of dams and weirs to control water to suit productive needs (Connell & Grafton, 2011, 85). Massive infrastructure projects were built from the 1920's through the 1960's. The dams reversed the flows of the river system so that water could be released in the summer months. The changes introduced to the system led to dramatic changes in the landscape. There was a significant decline in native flora and fauna and the extinction of countless species. A thirty-year study on the erection of dams and diversions of water showed a seventy percent reduction of bird species during the period (Long-term study of Murray-Darling Basin wetlands reveals the impact of dams, 2017). States manage the water released from the storage dams into the Murray and Murrumbidgee rivers. A massive irrigation scheme, coupled with emerging salinity and sedimentation problems across the Basin, ensured that control by state governments was essential to the system's overall operations. Federal and state governments played

a crucial role in the development of agriculture, and despite emerging environmental problems, Australia grew wealthy under the system.

When the Basin entered a period of severe drought, the problems associated with water storage and management related to large infrastructure projects came to a head. As early as 1991, a 1200-km blue-green algae bloom formed in the Darling River. Further, in 1995, the median annual flows through the Murray mouth were only 21–28% of what they would have been in normal conditions. Drought in the lower Murray occurred in 60% of the years compared to 5% under natural conditions (Review of Water Reform in the Murray Darling Basin, Wentworth Group, 2017). Further, water was found to be over-allocated, meaning that more water was permitted to be taken than was available in the rivers. Concerns over diminishing water resources gained traction in 1994 when a report was prepared by the Murray Darling Basin Commission (MDBC) entitled *Limits to Surface Water Diversion in the Murray Darling Basin.* The report found that the system only limited water diversions during droughts. During non-drought periods, it was found that practices tended to encourage greater diversions. The report indicated that the licensing and allocation system needed revisions to decrease diversions over time (Chenoweth & Malano, 2001, 307–308). Consequently, in 1996, the Ministerial Council agreed to a cap on diversions for NSW, Victoria, and South Australia. The decision to impose the cap was generally backed by scientific evidence presented by the Commission, working groups, and sub-committees. Improvements in water conservation were seen after the cap was implemented, but accompanied by drought, the cap brought severe economic hardship to farmers.

Concerns over the long-term sustainability of the Basin increased as wetlands became increasingly threatened by drought. The millennium drought (1996–2009) was the next major shock to the system. Meagre flow rates caused widespread environmental degradation in the Basin, including hyper-salinization of the Coorong and Lower Lakes region in South Australia and the closure of the Murray's mouth. These impacts had flow-on effects on communities and the regional economy. In 2002, the Murray Darling Basin Ministerial Council (MDBMC) released the *Living Murray* discussion paper, which was meant to start community discussions about whether water should be recovered from consumptive uses to be put toward environmental purposes (Crase et al., 2005, 222). These fears led to the creation of a series of measures meant to give the federal government more control over water and environmental outcomes.

In 2003, the Council of Australian Governments (CoAG) announced that member states of the MDBMC had agreed to allocate AU$500 million over five years to deal with water over-allocation in the Basin. In 2004, state and federal governments agreed to a principle of sustainable water use. This led to the development of programs meant to secure water for environmental purposes. Five hundred billion litres of water would be put toward environmental purposes over five years through the *Living Murray* program (Swirepik et al., 2016). The federal government began a comprehensive program of buybacks that gave the federal government the largest share of water resources in the region. The *National Water Initiative* was created in 2004 with an emphasis on greater efficiency in agriculture and a more comprehensive response to the environmental challenges facing the river system. Most of the

over-allocations at the time lay within the MDB. Given the severity of the drought, the federal government announced that it was better suited than the states to deal with the challenges faced by the MDB. This represented a major turn towards further centralization of planning over water resources. The federal government's new role was controversial from the perspective of farming communities. First, it was seen to undermine the significant progress that states had made on water management issues under the cap. Second, it was unclear how the water would meet the environmental targets of the government. The science around the requirements of water diversions was only in its infancy, and it was not clear what barriers lay before the government in meeting its targets. Most significantly, however, the government said that future water infrastructure must pass rigorous standards, so it adopted a plan to provide funding for irrigation projects in exchange for buying water back from farmers for environmental purposes.

While selling water for environmental purposes appeared to offer farmers an opportunity to relieve their debt burden, it also took significant amounts of water out of production. Many farmers grappled with large debts when the buyback programs were implemented. Therefore, the government's buyback program appeared to be the only solution available to them. Even though it was considered a market-based approach, the program was primarily designed and implemented at the federal level. The federal bureaucracy needed to expand to meet the requirements of its new programs. This placed greater control in the hands of the bureaucracy. In conjunction with severe drought, government water policy brought massive reductions in irrigated agriculture in the region. This was evidenced by the fact that from 2005–2006 to 2007–2008, irrigated land use in the MDB fell from 1,654,000 hectares to 958,000 hectares, representing a decline of 42% (Jiang & Grafton, 2012).[3] As demonstrated through this historical overview, administrative rationalism has defined the discursive orientation of water management policies in the Basin since colonization. Today, the question of whether such an approach can address the current crisis in the MDB needs to be addressed.

Results

The compartmentalization of various issues into multiple layers of bureaucratic organizations created confusion and increased the need for government involvement. These trends are illustrated in the examples that follow.

Local Knowledge Transfer

Local knowledge includes the beliefs and practices surrounding local ecosystem management developed through social interactions and local institutions, handed down through generations (Ruiz-Mallen & Corbera, 2013). Local knowledge

[3] 1 hectare = 2.471 acres or 10,000 square meters.

is critical to producing alternative policy prescriptions and outcomes (Berkes, 2000; Folke, 2002). Farmers interviewed employ a range of tools to respond to the demands of local ecological systems, including multiple species management, resource rotation, revegetation, and erosion control, to name a few. They also formed social connections for transferring knowledge within their communities, helping them to maintain traditional practices and learn from one another.

Current literature suggests that farmer knowledge is integral to sustainable management (Moock & Rhoades, 1992; Berkes et al., 2000; Ruiz-Mallan & Corbera, 2013). However, my research revealed that the knowledge of farmers was undervalued, ignored, and sometimes viewed with derision among government officials. This led to a situation where communication is poor, trust is diminished, and potential sustainable solutions overlooked. Folke et al. (2005) have written that for local knowledge and community-based conservation to be successfully incorporated, social connections need to be strengthened. Suppose the government engages with a community without establishing bonds based on a firm sense of trust. In that case, the policy (no matter how good it may appear on paper) will likely be met with hostility from the communities impacted. Enforcement mechanisms must reinforce trust, encourage a sense of community, and support social networks among the various stakeholders (Ruiz-Mallen & Corbera, 2013). In the MDB, horizontal knowledge transfer is strong among farmers, but knowledge does not tend to transfer vertically to government scientists and experts. Further, diminished trust meant government information was not easily transferred to farmers.

Farmers reported that they found that scientific reports often ignored locally specific contexts, which could be detrimental in terms of generating useful, practical knowledge. In addition, they also said that scientific information was often inaccessible. A common complaint among the farmers interviewed was that the scientific studies funded by the government assumed that the results achieved in one area were universally applicable. The results of scientific studies, however, can only be duplicated if the same soil and moisture conditions apply. For example, efficiencies in rice farming are dependent on the level of clay found in the soil. For this reason, it is understandable that farmers rely predominantly on information received from other farmers. This dynamic demonstrates that the social relationships among farmers are key factors determining the kinds of knowledge that they find helpful.

For instance, farmers Gary, Margaret and their neighbor Chris have learned how much water plants need depending on their stage of growth and the ambient temperature. When it is really hot and close to harvest, farmers know that plants need water to reach their tips. Knowing when to switch from a seven-day watering cycle to a three-day watering cycle is essential, but that knowledge comes almost entirely from experience and shared local knowledge. Likewise, rice farmers want to steward their permanent water allocations carefully, so they must make accurate predictions based on the weather for that week. Making the right decisions about watering is vital for farmers, and there is very little room for mistakes. For corn farmers, if temperatures reach above forty degrees Celsius, the crop can fail in just one day. Not only can the wrong decision cost farmers money, but it can also mean water is not being used efficiently. Timing is essential knowledge that comes from listening to other farmers. As Gary Knagge explains,

> A lot of the knowledge has to come from personal experience, because it's real time, real environment, who made the biggest boo-boo. The farmers are always the ones who have to pay for mistakes, while the scientists and the bureaucrats will still get paid no matter what kind of information they provide. These others will all be there the next year to continue on, but the farmer may not be (Gary. Knagge, personal interview, 2016).

Farmers reported having a great deal of difficulty accessing and understanding the information available from outside sources. Farmers have trouble finding the information they need, and when they find it, they have difficulty breaking it down into terms they can apply (G. Knagge, personal interview, 2016).

Farmers also described the ways they believe governments could support research and innovation in useful ways. Research by the government is, at least theoretically, independent from corporate and private interests. Research can play a key role in advancing the economic interests of farmers, the communities they support, and the environmental interests of farmers, governments, and environmental organizations. Farmer Ian Mason said that farmers have no problem paying for research they expect to profit from, but research institutions should invest in the early stages of basic research. He would like to see the government get more involved with farming communities to see what measures are most needed, thereby providing useful and practical solutions. Inventions like microwave technology and robotics have great potential in identifying and eliminating weeds without using environmentally harmful pesticides (I. Mason, personal interview, 2016). Further, in terms of developing rice varieties, scientists must do the molecular work of figuring out which varieties perform the best. The larger community can bear some of the costs of innovation because the potential advantages of public investments in research- to the environment and human health- make the added costs justifiable.

Community-centrism recognizes the importance of this interchange of knowledge between farmers, experts, scientists, government, local community groups, and the people in the communities. Farmers provide an alternative vision for government involvement, one that begins with community-based planning and focuses on social trust. If policy interventions were centred around social cohesion and trust, it would be easier for governments to co-operate with farming communities. Community-centrism provides an alternative lens that accounts for the contributions of the wider community, including farmers, government experts, and environmentalists.

Environmental Buybacks

The main policy instrument that came to define reform in the Basin was what is referred to as environmental buybacks. The *Federal Water Act* of 2007 included the obligation of the MDBA to develop a basin-wide plan to improve the health of the river and establish sustainable diversions limit (SDL) (Crase et al., 2012). In 2008, the MDBA tried to outline SDLs for the MDB and committed to recovering an average of 2750 billion litres per year from consumptive use toward environmental flows. The plan involved a multi-billion dollar investment in irrigation infrastructure modernization and the purchase of water entitlements (Swirepik et al., 2016). The

resulting framework, *Water for the Future*, invested AU$12.9 billion over ten years (2010–2020), with most of that money directed toward the MDB (Kiem, 2013). In the framework, the MDBA planned that between 3000 and 4000 billion litres of water per year be made available for the environment, primarily for wetlands (Jiang & Grafton, 2012).

This reallocation of water resources represents the largest water reform to ever occur in Australia, in an area that provides roughly half the country's irrigated agricultural production (Grafton & Jiang, 2012, 488). It was forecast that the largest reductions in profits would occur along the Murrumbidgee (32–35% reductions in profit) and the Murray (11–32% profit reductions) (Grafton & Jiang, 2011). The plan involved purchasing water entitlements from willing sellers and providing farmers with subsidies to increase their on-farm water use efficiency. The buybacks were used extensively among farmers and represented the single biggest contributor to SDLs by the beginning of 2012 (Crase et al., 2012).

In conformity with administrative rationalism, the government attempted to implement buybacks in accordance with scientifically grounded, expert knowledge. Buybacks were often incentivized by government investment in on-farm efficiency programs. The Independent Assessment of Social and Economic Conditions in the Basin (Independent Panel, IASEC, 2020), found that buybacks have had net positive economic and social effects in the Basin. The assessment indicated that water reform frameworks have helped secure property rights, created clearer processes for water allocation and transfer between consumptive and environmental uses, and stimulated regional economies through infrastructure investments. Further, on-farm infrastructure investments, reconfiguration of irrigation layouts, border check irrigation, new precision infrastructure, laser levelling, piping, and drip or spray systems to improve in-field application systems are reported to have positive outcomes for many irrigators. There is also some agreement that investments in farm infrastructure in exchange for buybacks are preferable to subsidies (Productivity Commission, 2010; Qureshi et al., 2011; Grafton & Hussey, 2007). Another advantage of water buybacks for the environment in the MDB is that they appeared to support rather than detract from regional economic activity (Dixon et al., 2011). Grafton and Horne (2014) argue that water entitlement allocations were compatible with environmental goals in terms of increasing downstream flows during the Millennium Drought.

Despite the positive results of buybacks from the perspective of administrative rationalism, there were some negative consequences for farmers. Evidence from irrigator surveys shows that irrigators who participated in buybacks found it a positive or neutral outcome for their businesses overall (Wheeler & Cheesman, 2013). Wheeler and Cheesman (2013) identified that, in the period 2008–2011, 60% of those who sold entitlements to the government in the Basin kept irrigating, while 10% remained in farming but switched to dryland farming, and 30% exited farming altogether. However, these buybacks came with significant risk. The main risks identified from recovering water through irrigation include potentially higher operating and asset renewal costs to irrigation infrastructure operators who remain in business, potentially less water coming to irrigation infrastructure operations as a result of competitive advantages going to other regions from new irrigation infrastructure development, and smaller revenues (Independent Panel, IASEC, 2020).

The interim inspector general of Murray–Darling Basin Water Resources has voiced concern that the debates around water reform have become increasingly confrontational. His investigations found little shared understanding between communities, irrigation farmers, and government agencies tasked with managing water (Pollino et al., 2021). The source of these conflicts can be traced, in part, to environmental water recovery, which can lead to reduced availability of water and higher permanent and temporary water market prices. Further, irrigation infrastructure projects can result in higher water market prices, one reason being that these projects have encouraged irrigators to move into the production of crops with higher economic value for water. An example is the recent increase in almond and cotton plantings in the southern MDB (Independent Panel, IASEC, 2020). Further, while it appears that these measures represent a purely market-based approach, in reality, they often meant greater government oversight and a privileging of large-scale industrial agriculture and industries outside agriculture. These changes have had significant community-wide repercussions.

This research reveals that MBIs can lead to unintended social, economic, and environmental problems. Actors who can afford market-based penalties will often engage in activities at a higher cost. Further, the penalties will often be passed on to the consumers (Kiem, 2013, 1621). MBIs are effective at reallocating water resources to 'high value' users, but these high value users often include mining, manufacturing, and electricity production. These industries have high levels of greenhouse gas emissions and cause greater significant damage to the environment and society. On the other hand, 'low-value' users generally include agricultural and municipal water users (Kiem, 2013). Another significant problem with water trading is that it tends to benefit larger irrigators with more access to information and resources, rather than the smaller 'family farm' type operations that often accrue significant benefits to the local communities (Kiem, 2013, 1624).

From a social perspective, the idea of a 'low value' water holder is problematic. Water delivers value to individual holders but also to the other people where the water is located. Water has potential third-party values in the form of employment (direct and indirect), lower prices for water because of its relative abundance in a community, and in natural values such as recreation and fisheries (Sax, 1994). Farming sectors are also more likely to have a number of secondary industries growing up around them, like processing, and the economic benefits of these industries are noteworthy. When water is treated as a commodity, only the formal owner of a water right is compensated when a transfer takes place. While the seller may become enriched (payments for water frequently exceed the profits that sellers could have obtained from using the water for irrigation), others in the community are often made worse off. The water is gone from the community, and other community members receive no compensation for the loss (Sax, 1994). Further, when people sell their water entitlements and exit their communities, numerous economic impacts result. The loss of water entitlements from rural farm communities leads to a further decrease in rural populations, a reduction in rural services like schools, the closing of local businesses that support farmers, and a waning sense of community (Kiem, 2013, 1623). A myopic focus on

moving water to higher-value users is often counterproductive in the larger picture, as it does not account for externalities like environmental costs or job loss.

In the historical account of the MDB, we saw that centralized planning on the part of the federal and state governments allowed for the development of one of the most advanced hydrological systems in the world. We also saw that planning led to the centralization of power. Further, power dynamics can be hidden from view by the appearance of rational expert analysis and the silencing of dissenting opinion. Several of the farmers I spoke with in the MDB felt that the government's approach was both too rigid and too prescriptive, meaning that it did not leave enough flexibility within the system to respond to changes in circumstances, and that it was a system where external actors had too much control over outcomes, with little input from the farming communities most affected. The government's approach has been to shift financial risk onto farmers, which inadvertently undermines farmers' efforts to become more effective environmental stewards. For example, groundwater systems meant to reduce water usage are often developed by private investor money. Farmers spend large sums of money to increase their water efficiencies and even though everyone benefits from such initiatives, governments do not inherit any of the risk from these projects. Governments do not build the channels, dams, and ponds to effectively manage water; this work is done by the irrigation companies and paid for by farmers. Nonetheless, as farmer Tony Piggins puts it, in times of crisis, governments "come in over the top" and significantly reduce allocations without concern for these investments.

In the past, banks lent farmers money based on their water allocations entitlements as security. Huge amounts of money were loaned to farmers based on these water securities for the purposes of developing more sustainable irrigation systems. For example, if a farmer had a 5000 million litre allocation and then the government brought that down to 1500, but the farmer had borrowed against the security of the 5000, then you would be in grave financial trouble (T. Piggins, personal interview, 2016). In this scenario, the farmer could lose the security on their investment, but they may also have to significantly reduce their water usage at the same time. This leaves any new infrastructure as a 'stranded asset.' Ultimately, such government interventions greatly reduce the confidence of both the banks and the farmers to make future investments in infrastructure meant to reduce water usage. Consequently, the impact can be a reduction in water use efficiencies at the cost of buybacks intended to help the environment. In this circumstance, poor foresight and communication have led to economic *and* environmental losses with significant negative consequences for the broader community.

Tony Piggins estimates he has spent between half and three-quarters of a million dollars on his irrigation systems. All the pipes and the entire system are underground, so there are no evaporation losses, and they have several centre pivot irrigation systems which cost about 100,000 each.

> A hundred-acre irrigator is going to cost you in the vicinity of two hundred thousand dollars. If you run out of water and you can't use it, you have all these 'stranded' assets sitting out on the paddocks and you haven't got the water to put through them and you can't grow a crop, and no one wants to

> buy a second-hand irrigator for two hundred thousand dollars. This is the issue that the government had to confront in this area, which was quite a fraught process. There was no way the government could even come close to compensating in the amounts that the farmers had lost (T. Piggins, personal interview, 2016).

Not only do farmers experience serious economic hardships, but the hard work that farmers have put into water conservation is significantly undermined. The financial costs to the farmer and the social costs to the communities that depend on these farms are far-reaching.

As we see from this example, while trying to limit government interventions, purely market-based instruments can create new problems that farmers must navigate with great difficulty. Farmer Hayden Cudmore noted that while the government has facilitated trade through markets, they have also created a whole new level of bureaucracy around water trade that makes it harder for some farmers to know how to navigate the system.

> To some extent they (the government) doesn't quite understand water trade, water is big and heavy, and it is a physical commodity that's difficult to move. It can't be traded like a share, so I don't think that the government has decided whether water is a commodity or a financial instrument. There is not a lot of regulation around trade itself and has been left to brokers and the market to define. The other thing with water is that it is managed by the state, but it has inter-state movement (H. Cudmore, personal interview, 2016).

According to Cudmore, the water can often be moved to be used on higher-value crops or "water moves to the highest gearing of a business." Still, trading may do more to minimize losses than help businesses become profitable. The government's approach does not seriously account for the complex interconnectivity of the irrigation systems in place.

Closer consultations with farmers would have quickly revealed the potential for problems with the market-based approach, particularly stranded assets. An acknowledgement of this problem could have led to opportunities. For example, farmers could have strategically negotiated water acquisitions collectively to minimize losses. Or governments could have offered water buybacks strategically to minimize the potential impacts in fewer regions. Instead, the costs of the buybacks were borne by the farmers who remained in business, creating further incentives for farmers to stop farming altogether. In addition, the productive use of water in certain areas depends on soil conditions. The government's piecemeal approach did nothing to ensure that the most productive areas would remain in production.

Buybacks were the major policy instrument employed by the government and were in line with administrative rationalism. However, I contend that the 'top-down' approach that defines administrative rationalism is insufficient for governing under Anthropocene conditions. In line with other scholars, I argue that administrative rationalism has meant that modern states are inclined towards ignoring or disregarding the local knowledge of people (Scott, 1999; Robbins, 2003; Massicotte, 2010). For example, locally based knowledge of farmers is necessary to apprehend

the connections between ecology and society. Local community-based discourse expands the range of choices that practitioners can draw on.

Discussion

Centring on the role of communities and allowing land managers like farmers to become empowered and manage their own resources (Li, 2007; Ostrom, 2012) is key to effective resource management. Locally based knowledge exchange informs much of the adaptive capacity of farmers who have historically been able to protect biodiversity and improve their livelihoods.

In the case of the MDBA, current processes have not gone far enough to challenge the institutions and structures that have limited social engagement and interfere with a truly participatory approach. For example, farmer Louis Burge explained that while it is good that the government is looking at redesigning flow regimes, she also thinks that the governments of both NSW and Australia could do more to work with local communities. For Burge, this would mean "get the bureaucracy and the consultants out of the picture and [have] key people come into the community and ask farmers how they would like to design a program to work through the solutions." The political process currently in place has driven wedges between communities. According to Burge, several irrigation companies supported the plan because they thought they could not change government policy, and the money was attractive to them. Similarly, many farmers participated in the plan because the short-term gains were attractive. A community-based approach, however, would have focused on the overall impacts of taking water out of the broader farming system, rather than focusing on consequences for individual farmers. A community-centred approach would have also allowed farmers to discuss, among themselves first, how one farmer's action might affect their neighbours, and this could have created new policy opportunities.

In some cases, farmers themselves were able to harness the power of their social networks to manage difficult periods. For example, water reform meant farmers must find ways to do more with less water. Farmers Shelley Scoullar, John Hand, and John Bradford decided to pool their water resources for one year to grow a small rice crop, as opposed to not being able to grow any rice at all. They were determined to grow rice because the crop provided many benefits for their other crops. When they plant a cereal grain on top of ground that is fallow after a rice harvest, it gives the cereal a good start. The rice allows them to maintain a good crop rotation so that they get two crops from the same water (S. Scoullar, personal interview, 2016). The relationships between these farmers allowed them to remain viable and survive through the tough years. Governments could have facilitated bringing farmers together to form their own solutions and pool their resources to remain viable through the dry periods. Such discussions could be facilitated and even guided by the government. These types of efforts would be more effective because they would give farmers ownership and accountability over those solutions. Government agents could have also explored different options they had not considered.

Farmer Richard Sagwood believes that the government's approach has failed because it views the work of farmers in isolation from the communities they support. He explained that many small rural communities are attached to the water supply, "be it the river, be it channel systems, be it tributaries of the Murray River that rely wholly and solely on access to that water and because of the Basin Plan… they've been totally disregarded…a lot of those communities." Focusing on communities and the impacts of these changes could have mitigated the socioeconomic consequences. The effects of removing 'productive' water from the region had serious consequences for farmers, and they expressed disappointment with the government's approach. Community-centrism offers an alternative vision for engagement. The approach highlights the importance of farmers' knowledge, and the values of the broader community when designing and implementing water management policy.

When farmers come together to build social relationships, the impacts can be profound. Strong social networks can lead to both increased knowledge production and transfer. Farmer John Hand, for instance, told me that irrigators are improving the environmental corridors around their properties. A corridor runs through his land along a creek that was once used for flood irrigation. The farmers have been planting trees in this area to develop another environmental corridor. As the trees mature and the corridors are linked, bird species proliferate. Recently, Hand saw at least ten new varieties of honeyeaters he had never seen before, and endangered bitterns returned to the area. The environmental impacts would be greater if farmers worked with governments and environmental groups to ensure these corridors extended to national parks and other private residences. This kind of initiative applied to water and environmental management in the MDB would have significant benefits not only in terms of generating information but also in terms of creating trust and fostering communication between parties.

Community-centrism increases engagement and helps improve trust among parties. Enforcement mechanisms developed within communities tend to reinforce trust, encourage a sense of community, and support social networks among the various stakeholders (Ruiz-Mallen & Corbera, 2013). Community-centred values that support social networks challenge the dominant values of efficiency and productivity. If society values efficiency and low-cost production above all else, these values influence how farmers treat their land. If productivity is valued above all else, farmers have little incentive to increase their environmental efforts. Further, farmers require positive social feedback for their efforts. Successful environmental management requires farmers, government representatives, and environmental advocates to build social communities to communicate their efforts and ideas effectively.

Conclusion

The future of agriculture will depend on the capacity of government and the public to recognize its value to the larger society. Focusing on the social life of rural communities makes it easy to recognize how positive social outcomes have significant economic and environmental consequences. The potential for farmers to provide effective and integrated water management practices is not being realized. Therefore,

it is only through an analysis of the principles that shape bureaucratic planning that we can begin to have a much-needed conversation about water reform that is truly responsive to the social, ecological, and economic needs of communities.

The daily interactions farmers have with the land situate them as some of the most important environmental land managers. Farmers in the MDB routinely employ various ecological management practices; they maintain water sheds, nurture sources of ecosystem renewal, manage local bird and reptile species and maintain ecological processes at multiple scales (Berkes et al., 2000). Nonetheless, without social trust, accomplishing environmental goals will not be easy. Community-centrism foregrounds the relationship between farmers and government experts, asking farmers and government agents to examine their own positionality. Government officials cannot expect to provide advice and services to farmers like they would provide information to other government officials and researchers. Building relationships means looking at how knowledge is shared and if that knowledge is truly accessible. Farmers are a valuable resource in reaching water-related environmental goals, but their contributions are often overlooked. Recognizing the capacity of farmers to play a central part in environmental management will require a recognition of the ways the current narrative limits that capacity. This shift in approach will require a fundamental change in how government officials interact with local farming communities. A concerted effort to respond more to community needs will help facilitate this turn.

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Declarations

Human and Animal Rights This study involved human participants and was in accordance with the ethical standards of the affiliated university.

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