MURRAY-DARLING BASIN ESSAY

Essay #9 in a series of nine by Australia's leading water experts

Achieving a healthy, resilient and sustainable Murray-Darling Basin

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Above: Gouburn Weir near Nagambie, Victoria. tracielouise, iStock.

EXECUTIVE SUMMARY

Wheeler states that continued focus is essential to ensure water governance structures are strong. Though there are a few welcome efforts to improve MDB water governance, policy reforms and continued invigilation are essential for strong governance, and to ensure that monitoring, compliance and enforcement are followed by all states — otherwise there is a real danger of further reduced environmental sustainability.

Wheeler also states that there is considerable room for improvement in rural development and structural adjustment programs within the MDB, mainly the water recovery program. Based on Wheeler's review, there are three key water recovery and economic development policy lessons that need to be considered to mitigate the hydroclimate issues in the Basin: proper structural and economic development policies, avoiding policy instruments that have substantial unintended consequences, and using buybacks as the most effective and efficient form for water recovery among all the water recovery programs in the MDB.

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Achieving a healthy, resilient, and sustainable Murray-Darling Basin

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Abstract

This article provides an overview of recent water policy in the Murray-Darling Basin (MDB or Basin) and discusses water recovery issues (and their economic impact) in further detail. A vision for a healthy, resilient, and sustainable Basin in fifty years is put forward, with three key water recovery and economic development policy lessons detailed, including:

1. Of all policy instruments for environmental (community) water recovery, (institutional/regulatory change, Buyback, infrastructure modernisation), generally the most effective and efficient instrument is Buyback.
2. The need to avoid policy instruments that have substantial unintended consequences (e.g., irrigation infrastructure subsidies).
3. To achieve healthy, resilient and productive rural communities, proper structural economic development policies, and essential social service spending, are needed.

Introduction

The issues of future climate change impacts and increasing water scarcity (and variability) are some of the biggest global risks facing humanity (WEF, 2019). Indeed, predictions are that many agricultural regions face drier and more volatile climate futures (IPCC, 2019). Coupled with changing economic circumstances and variable markets, this means that rural societies face a highly uncertain future. Farms will need to improve productivity (i.e. produce more crops with less inputs) to remain profitable. The drive to increase farm productivity, along with the decline of quantity and potentially, quality of water resources, requires the production of more crops with less water – without compromising ecosystems (Perry et al., 2017).

Plans for future adaptation within rural communities include a suite of strategies which expand, but also those that contract, various agricultural activities (Seidl et al., 2021). Irrigated agriculture will be one of those activities that will probably be forced to contract, or at least adapt considerably. Individual farm and regional adaptation will require a diverse range of policy strategies – both demand and supply management focussed (Wheeler et al., 2013; 2014; Rey et al., 2019; Wheeler, 2023). Nowhere will this be more needed than in irrigated production within the MDB.

The Murray-Darling Basin (MDB)

The MDB is Australia's largest agricultural region – an area of major environmental, economic, social, cultural, and recreational significance. It has many key environmental assets, including internationally important Ramsar-listed wetlands. Agricultural production across the Basin is diverse: ranging from primarily broadacre farming and grazing livestock in the north, to dairy and horticulture in the south. The MDB generated 42% of Australia's $70.9 billion gross value of agricultural production in 2020-21 (ABS, 2022a), encompassed 64% of Australia's irrigated area, and was home to around 42% of all irrigating businesses (ABS, 2022b). The majority (around 60-65%) of Australia's agricultural production is exported overseas. One of the worst recorded droughts in the MDB's history occurred in the 2000s, and widespread fears about environmental collapses led to significant water policy reform (Quiggin et al. 2010).

The MDB provides a perfect case study as an example of a region that faces a multitude of extreme challenges - hampering its ability to achieve a healthy, resilient, and sustainable future. Some of these challenges include climate change, in the form of increasing temperatures, more extreme droughts, reduced water allocations and more variable rainfall increasing the risk of severe flooding (Chiew et al., 2011; Zhang et al., 2020); environmental problems and increased extinction (SoE, 2021); water licence over-allocation (Grafton and Wheeler, 2018); inequitable land and water property right distribution to First Nation groups (Jackson et al., 2019; O'Donnell et al., 2021); falling farm numbers and reduced agricultural terms of trade (Wheeler et al, 2020b; Wheeler & Zuo, 2017); reduced social, education and other economic services (Alston, 2004; Wittwer and Young, 2020); and increased mental health challenges (Wheeler et al., 2018; Yazd et al., 2020; Xu et al. 2023).

Many of these challenges have resulted in considerable water policy reform and innovations, with the Basin leading the world in implementing a range of reforms. In particular, the over-allocation of water licences and climate variability have prompted a series of water policy changes over recent decades (Quiggin, 2001; Crase et al., 2004; Lee and Ancev, 2009). These reforms include the development of formal water markets, establishing caps on water use, the *Water Act 2007* and the development of the MDB Plan (Wheeler, 2014; 2022). Indeed, water sharing has been an issue between States in the Basin for a very long time, with formal arrangements put in place since the early 1900s. Wheeler (2014) provides an overview of all the major water policy changes that have occurred in the Basin, beginning with the *1914 River Murray Waters Agreement* between NSW, Victoria, and South Australia. In the last couple of decades, other major funding programs and policies have been implemented (driven by the region's worst recorded drought – the Millennium drought), with the biggest reforms including the *Water Act 2007,* followed by the MDB Plan in 2012.

The Water Act and the MDB Plan

At the height of the Millennium Drought in the 2000s, the Australian Government implemented the *Water Act 2007*, which involved substantial legislative, regulatory and stakeholder water reform (Grafton and Wheeler, 2018). The reforms included the creation of the Murray-Darling Basin Authority (MDBA) to replace the former MDB Commission, and federal entities responsible for managing water entitlements on behalf of the Australian Government. Importantly, the *Water Act 2007* established the parameters for a future *MDB Plan* with key objectives: "3d(i) to ensure the return to environmentally sustainable levels of extraction for water resources that are over-allocated or overused"; and "3d(ii) to protect, restore and provide for the ecological values and ecosystem services of the MDB" (*Water Act 2007*, pp. 2-3).

Passed into law in 2012, the Basin Plan has since been the framework determining the relationship between consumptive and environmental use of MDB water resources (MDBA, 2020), and its aim was to specify long-term levels of sustainable water use – known as Sustainable Diversion Limits (SDLs). After a lengthy process and much controversy in the lead up to implementation, the Basin Plan stipulated the recovery of 2,750 GL from both a) willing sellers (the *Restoring the Balance* program, otherwise known as "buyback" of water entitlements); and b) subsidised irrigation infrastructure (the *Sustainable Rural Water Use and Infrastructure program*). To ensure the state government of South Australia did not proceed with legal objections to the Plan, and provide for smooth passage of the legislation, a further 450 GL of water for the environment was to be secured through 'supply infrastructure efficiencies' (Grafton and Wheeler, 2018), bringing total recovery to 3,200 GL.

Water Recovery and Reform Post the Plan

After the Plan was legislated, water policy reform in Australia stalled and, in many respects, went backwards (Wheeler, 2014) – largely as a result of concentrated lobbying and rural community backlash (Grafton and Williams, 2020). A change of Federal water minister in 2015 also resulted in many negative changes. For example, an amendment to the *Water Act 2007* in 2015 limited the voluntary purchase of water entitlements ('buyback') to a total of 1,500 GL. This halted the most effective instrument the country had in recovering water, leaving water recovery only possible through irrigation infrastructure upgrades (Grafton and Wheeler, 2018). Other policy changes included: the axing of the National Water Commission in 2015; the relocation of the water portfolio from the federal Department for the Environment to the Department for Agriculture; the abandonment of the Sustainable Rivers Audit in 2012; and states providing far less emphasis and attention to water monitoring, metering, enforcement, and compliance.

To top all these reversals off, in 2018 the parliament legislated the MDBA's proposed sustainable diversion limit (SDL) Adjustment Mechanism, which in effect decreased the need to recover 605 GL of water entitlements within the Plan through 'an equivalent reduction in surface-water diversions' through proposed water supply (e.g., installing regulators or building levee banks) and efficiency projects (e.g., improving on-farm and off-farm water infrastructure). The effectiveness of these supply measures has been highly criticised (Colloff and Pittock, 2019) and, to date, very few of these projects have been successful or even implemented. Physical water recovery in the northern Basin was also reduced from 390 to 320 GL. The SA MDB Royal Commission strongly criticised the MDBA for these amendments, along with federal and state government actions with regards to water policy post-legislation of the Plan (Walker, 2019).

Common Community Perceptions about the MDB Plan and Reality

A range of economic instruments and water demand management strategies are being introduced worldwide to deal with water scarcity problems (Wheeler et al., 2017; Wheeler, 2021; 2023). The impact of rural socio-economic development and population dynamics on agriculture, the environment and water resource use has become a challenging issue globally (de Sherbinin et al., 2007; Hibbard and Lurie, 2013) – largely due to dwindling rural populations (Winkler et al., 2012). Despite this, many rural communities have experienced significant economic transformations, resulting in greater rural economic diversity, less interdependence and greater income parity with urban regions, developing exurban areas and amenity-led rural growth (Irwin et al., 2010).
Over the past decade and a half, the most common concerns with the MDB Plan (and water recovery in general, which began in the 2000s) raised by rural communities are fears around reduced agricultural output and economic activity – leading to farm exit (e.g., Kiem, 2013, numerous submissions to parliament enquiries, etc). This consequently is believed to have an external impact on the surrounding community in general, resulting in a decrease of services, jobs, farm numbers and population sizes. Wheeler et al. (2023) provides further detail on this discussion and the validity of much of the modelling done.

However, the causal impact of reduced water allocations on production, farm and community outcomes is incredibly complex, because of the many factors in play. For example, community perceptions regarding the MDB Plan are intrinsically linked with an ongoing worsening agricultural and rural community situation. Following on from the challenges identified in the Basin earlier, Figure 1 provides a longitudinal view of what many in rural communities view as a negative consequence – the loss of farmers in rural communities over time.

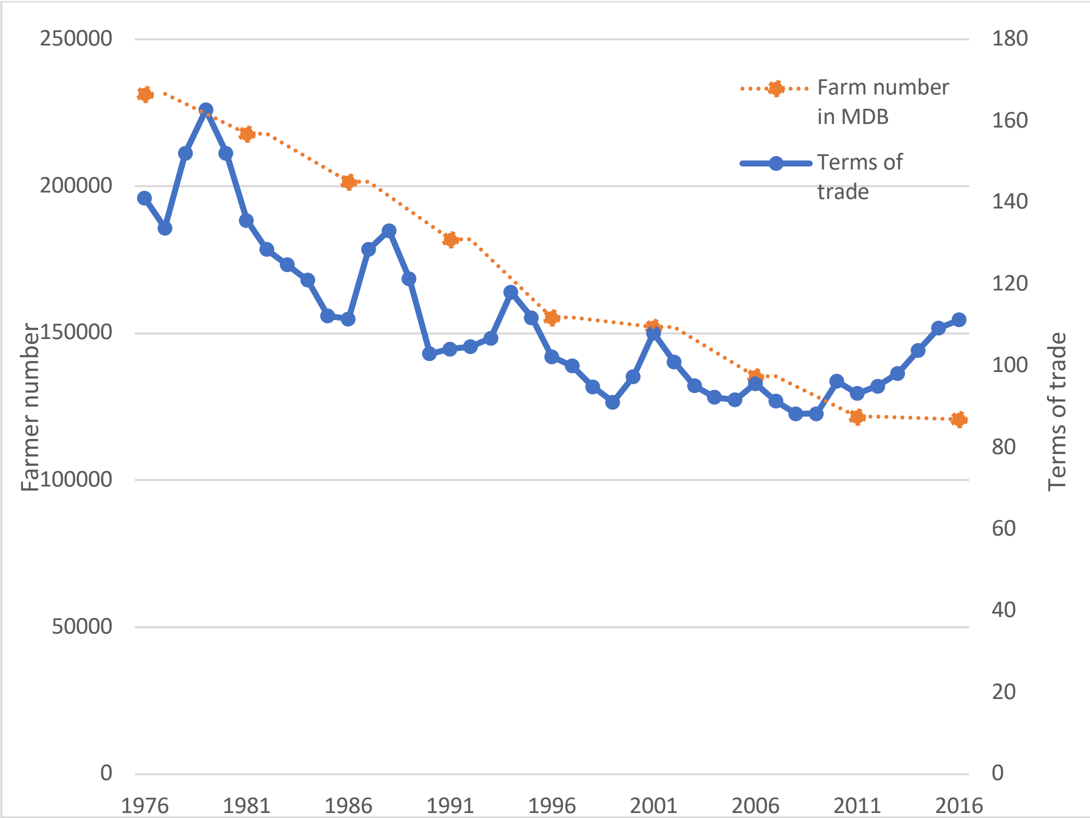

Figure 1. Farmer numbers in Murray-Darling Basin States
Updated from Wheeler et al. (2020b). Farmer numbers come from the ABS population census, specialised request and TableBuilder used for 2016 numbers. Australian farmers terms of trade from ABARES (undated).

There is debate over how much farm exit is desirable – on one hand it allows farmers to consolidate and become larger, more productive and efficient; and on the other hand, it may lead to a loss of people and consequently services in a region. Farm numbers have steadily decreased for decades, which has been coupled in general with a worsening farmers' terms of trade. Of note, it does seem that the improving terms of trade situation from 2008 onwards may be related to a slowing in the number of farmers leaving in Basin states.

When times are difficult, whether it be because of trade sanctions, drought, flood or disease – it is easy to have false attribution regarding water policy issues. Economists attribute farm number changes to labour market restructuring, technological change, terms of trade change, trade sanctions, economies of scale, changes in agricultural production, economic return and weather/drought/climate change pressures, and a withdrawal of public and private sector services (Wheeler et al., 2020b; Wittwer and Young, 2020).

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What defines a healthy, resilient, and sustainable MDB?

Everyone will have differing criteria as to their own personal preferences about what makes a healthy, resilient, and sustainable MDB. The National Farmers Federation's future goal is that by 2030, agriculture will be a $100 billion industry (note: Australia was at $82 billion gross value of agricultural production (GVAP) in 2021-22). The five pillars on which this goal rests includes (National Farmers Federation, 2022):

1) *Customers and the Value Chain*: Deep engagement with customers and competitive connections to markets (measured by trust in industry, freight costs and tariff barriers to exports).
2) *Growing Sustainably*: Increased environmental stewardship, carbon neutral approach, smart water policy, reduce farmland and food loss (measured by food waste and farmland loss, water use efficiency, ecosystem services to be 5% of farm revenue).
3) *Innovation*: Public and private R&D, increased technology, and renewable adoption (measured by energy sources, adoption, and innovation efficiency).
4) *People and Communities*: Trained workforce, increased available workforce, gender equity, strong communities, decreased workplace injuries (measured by fatalities, increased wellbeing, gender parity measures, available trained and general workforce).
5) *Capital and Risk Management*: Increased farm planning; increased investment, increased use of innovative tools for risk management (measured by adoption, investment and farm equity levels).

Although all of these goals are worthy, many are private agricultural-only focussed goals. The $100 billion industry goal by 2030 is an example of this, whereby the target has become a proxy for other wider goals within the five pillars (given it's one of the easiest goals to measure and track). We do need to question whether the $100 billion is a goal that should be pursued – a turnover goal is not necessarily indicative of higher farming profitability or wellbeing, or of gains spread across all farmers.

Apart from the need to try to change the climate trajectory (e.g. address higher temperatures and more variable rainfall) in the Basin, this essay proposes the following criteria (in no particular order):

1. A healthy environment – greater surface water flows, groundwater reserves and sufficient water quality for environmental, cultural, community, agricultural, industry and domestic use.
2. Reduced level of farm exit from current trends (recognising that stopping farm exit or consolidation altogether is not desirable).
3. Reduced suicide and mental health problems in rural societies[6].
4. Reduced irrigated land footprint and a consolidated industry (albeit one that is more productive and profitable).
5. Minimal agricultural food waste or other distributional problems.
6. Increased ownership of water by First Nation groups.
7. Profitable farms – that can earn money from natural capital assets (soil, water, land, vegetation) as well as traditional agricultural outputs.
8. Transparent, data-driven and increased sustainable investment in economic and social services and structural adjustment programs that positively influence wellbeing within regions whilst mitigating pork-barrelling.

Given length restraints, it is not possible to provide detailed analyses of how to try to achieve all the objectives above. Hence, this essay will concentrate on water recovery policy in the Basin, and what is required to help meet these objectives in future.

[6] For a recent analysis on the impact of drought and temperature on suicide in the MDB – see Xu et al. (2023).

Water Recovery Policy in the Basin

As a society going forward, there is a need for water to be 'shared' more effectively, with mitigation and adaptation encouraged wherever possible. It is important to understand where there is market failure and, given overallocation, we then need to work out the most effective way of returning water from consumptive to environmental/cultural/community use.

Given that climate change was not accounted for in the first Basin plan, and that there exist considerable arguments over whether a sustainable form of extraction has been achieved, coupled with the call for more cultural water (Alexandra, 2022; Grafton and Wheeler, 2018; O'Donnell et al., 2021), means that arguments over the need for more water recovery will continue.

Water can be recovered from consumptive uses through three primary methods - institutional; buyback; and irrigation infrastructure:

1. **Institutional changes (i.e., changing the rules of the game).** Includes resetting entitlements to a lower yield level, or changing rules over their use, hence changing existing property rights. Other changes could include having downstream flow targets needing to be met before extraction upstream, giving legal rights to rivers or having minimum river flow requirements (Alexandra, 2022; Young, 2019). If a strategy were chosen to cut allocations to entitlements across the board by the same percentage, two approaches (uncompensated vs compensated) could be chosen by states:
    - ***An uncompensated and permanent percentage cut to water allocations:*** Hence offering the environment a greater share to water resources. This scenario has happened in a number of places, for example, groundwater in the South-East of South Australia.
    - ***A compensated and permanent percentage cut to water allocations:*** This scenario happens regularly in other situations, such as compulsory land acquisition for transport infrastructure projects.
2. **Direct purchase of entitlements from willing sellers ('Buyback')**. This method protects existing property rights and includes:
    - ***A voluntary buyback of entitlements:*** This was the prime focus of the *Restoring the Balance program*, which is the program where most water has been recovered to date through voluntary offers of water by multiple sellers via an open tender process (Grafton and Wheeler, 2018).
    - ***A strategic buyback of entitlements:*** This involves strategic purchase of water entitlements via direct negotiation with the seller, a strategy that has only been occasionally used (DAWR, 2018). The 2017 purchase of Lower Darling entitlements from the Tandou property provide one such example.
    - ***Buying temporary water allocations:*** It is possible for the Commonwealth Environmental Water Holder (CEWH) to supplement environmental flows from permanent entitlements by buying water allocations in areas where needed. Using temporary trade – rather than permanent trade - has been shown to be preferred by many irrigators (e.g. Wheeler et al, 2013). However, to date trade has been used rarely (and CEWH are more likely to sell water allocations than buy them).
3. **Irrigation Infrastructure Subsidies/Modernisation**: This also protects existing property rights and includes on and off-farm programs:
    - ***On-farm subsidisation of irrigation infrastructure in return for water entitlements*:** This is the *Sustainable Rural Water Use Infrastructure Program*, where the most money to date has been spent, for the smallest amount of water recovered. On-farm projects include converting flood irrigation systems to drip irrigation systems or deepening on-farm storages to reduce evaporative losses. Some irrigation water recovery programs (e.g. in South Australia) allowed expenditure on other farm investments, beyond irrigation infrastructure.

- ***Off-farm subsidisation of supply projects to achieve environmental outcomes (or 'offsets'):*** Off-farm projects include lining delivery channels to reduce seepage or decommissioning underutilised parts of an irrigation network. The irrigation infrastructure operator provides a share of the saved water to the Australian Government, and the entitlements of irrigators are unchanged. Many have argued that very little environmental outcomes have been achieved to date, and significant issues surround existing projects (Colloff and Pittock, 2019; Williams and Grafton, 2020; Grafton and Wheeler, 2018). Non-irrigation infrastructure modernisation projects include environmental or other farm works that return water to the environment (such as the South Australian Riverine Recovery Project).

As we move towards the Basin Plan Review in 2026, it is important to consider all these policy options, and what must be implemented to achieve this essay's key overall objective: healthy environments and communities. The remainder of this essay makes three key water recovery and economic development policy points, namely:

1. Of all the policy instruments (institutional, buyback, modernisation), generally the most effective and efficient form for water recovery is **Buyback**.
2. The need to avoid policy instruments that have substantial unintended consequences (e.g., irrigation infrastructure subsidies).
3. To achieve healthy, resilient, and productive rural communities, proper structural and economic development policies are needed.

1. Of all the policy instruments, generally the most effective and efficient form for water recovery is Buyback

Of the three broad instruments outlined above, allowing for a voluntary buyback of water entitlements from willing irrigators represents the most effective and efficient method. A straight cut to water allocations across the Basin (uncompensated or compensated) technically is not as efficient, as it involves transfers from those who do not wish to participate. However, the efficiency of buyback can be challenged as compared to a straight water allocation cut across the board, if transaction cost issues are considered. For example, a straight regulatory cut could be implemented in one hit, causing significant upheaval for a number of years, but achieving the reallocation goal much sooner – as compared to a voluntary buyback situation where buying back over time can lead to rising opposition and successful attempts to block and change policy (all which happened when buyback was limited to a 1,500GL cap purchase in 2015 (Parliament of Australia, 2015)).

The *Restoring the Balance* buyback program has achieved notoriety in the MDB, with irrigators and rural communities regularly blaming the buyback of water entitlements for higher water prices, farm exit, and the subsequent decline of rural society – although these factors were found to be primarily caused by drought and worsening terms of trade for farmers (Wheeler et al., 2020b; Wittwer, 2011). Others find little relationship between water trade movements and regional economic indicators (Haensch et al., 2021). Wheeler (2022) provides a review of the water trade literature in the MDB, and summaries findings in the literature that water scarcity is the biggest driver of water prices (not water recovery programs).

Indeed, the economic scientific consensus is that water buybacks are the most effective, low-cost method of recovering environmental (community) water, resulting in the least impact on third parties (Productivity Commission, 2010; Dixon et al., 2011; Wheeler et al., 2012; 2013; 2014; 2023, Wheeler and Cheesman, 2013; Grafton and Wheeler, 2018).

Using data provided by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in late 2022, to date it has cost Australia just over $2,100 per megalitre (in long-term average annual yield equivalent (LTAAY)) to recover water through buybacks, and over $6,550 per LTAAY megalitre to recover through irrigation infrastructure subsidies. As of 30 June 2022, the total volume of water entitlements recovered to achieve environmental outcomes was 2,107.4 GL (MDBA, 2022). This represented 77% of the original 2,750 GL diversion target reduction in the Basin Plan. Around 64% of these water volumes were recovered through the *Restoring the Balance* buyback program, with the remainder achieved through infrastructure upgrades. Implicitly there is a cost differential of more than three times per megalitre for water recovered through infrastructure upgrades as compared to buyback.

This cost differential in water recovery methods will only worsen. The projects put forward by states are now quoting huge amounts – regularly figures over $20,000 per megalitre for water recovery are being asked (e.g. Ley, 2022). Allowing for return flows and other issues, the cost differential between the methods increases substantially (Williams and Grafton, 2020).

Strategic purchases of water have also been criticised due to their lack of transparency, potentially inflated values and negative environmental externalities (Seidl et al., 2020). Furthermore, a review has found that it is near impossible that the additional 450GL will be recovered in time (DAWE, 2021). On the 22nd February 2023 it was announced that open, competitive and transparent buybacks (up to 49 GL in total) over 7 targeted catchments in the Basin would open in March 2023. Commitments to feasible off-farm infrastructure and supply projects were still reinforced (Plibersek, 2023a). In August 2023, the Minister was formally recognising that water recovery targets of the MDB Plan would not be met, and that legislative change would be needed (both in amending timelines, and in allowing buybacks to be used for the recovery of the additional 450GL) (Plibersek, 2023b). Continual arguments by irrigator groups about how much it will cost to use buybacks to achieve water recovery targets often miss the point, especially in regards to a) the money that has currently been wasted on other supply and on-farm and off-farm projects for little (sometimes none) water recovery or offsets; and b) the alternative money that would need to be spent on other methods except buybacks to recovery the water.

2. The need to avoid policy instruments that have substantial unintended consequences (e.g., irrigation subsidies)

The intended, and unintended, consequences of water recovery policies need to be taken into consideration. As first summarised in Wheeler et al. (2020a), the main justifications put forward for subsidising irrigation infrastructure in order to recover environmental (community) water include: 1) *farm productivity*: increases farm productivity and income (Hughes et al., 2020; Perez-Blanco et al. 2020) and hence makes recovery more politically acceptable; and 2) *water quality*: upgrading irrigation infrastructure can reduce saline return flows into the rivers (Wang et al., 2018). On the other hand, the negative consequences of irrigation infrastructure subsidies include:

- *Cost – actual direct recovery and transaction costs*: as noted – subsidies cost at least three times more per dollar per megalitre recovered, compared with buyback (Grafton and Wheeler, 2018), partly because of the increased transaction costs of subsidy programs.
- *Governance*: irrigation infrastructure programs have been plagued with a lack of transparency, with some schemes subject to corruption charges (e.g., Victorian Ombudsman, 2011).
- *Return flows – additionality issue*: reduces seepage into groundwater and flows to streams and rivers and hence there is a percentage of environmental water that is ‘double-counted’ in the system – namely it was already available for the environment and does not represent additional total environmental water (Williams and Grafton, 2020).
- *Rebound effect on irrigated land area*: rising water values from upgraded irrigation infrastructure often increases the area of land under irrigation or the area of land growing

crops, potentially increasing water extractions (Wheeler et al., 2020; Perez- Perez-Blanco et al. 2020). For example, in Perez-Blanco et al's (2020) review, they found that water consumption increased in 83% of the studies, and also found a positive correlation between income and water consumption in 87% of the 134 case studies analysed. The higher income followed the increased benefits from increasing irrigation or changing crops. Note: these are private level farm benefits, but not necessarily community level benefits if irrigation and water consumption increase, especially in a closed or capped system.

- *Utilisation*: increased utilisation of water entitlements and allocations (Wheeler et al. 2014; Perez- Blanco et al. 2020). In the context of the MDB, this is a salient issue, given that surface and groundwater are often interconnected – yet accounted for and regulated quite separately (Wheeler et al., 2021).
- *Substitution*: groundwater substituted for surface-water (Wheeler et al., 2021).
- *Equity*: benefits are not evenly spread, with large corporate entities having a much higher probability of securing irrigation subsidies over family farms (Wheeler et al. 2020a). In addition, the amount paid per ML varied considerably in irrigation infrastructure programs, with some farmers paid very little.
- *Floodplain harvesting*: some programs (e.g., Healthy Headwaters program in Queensland) fund new dams (or fund dam walls to be raised), with the aim of not increasing capture but reducing evaporation in existing take. However, there is no monitoring to check if increased take occurs, with existing evidence suggests that increased water diversion has happened (Four Corners, 2019; Slattery et al., 2019).
- *Resilience*: changing the value of water – coupled with changes in output prices, this can encourage a shift towards higher value and more water intensive crops – as due to modernisation there is now more things that can be done. This therefore increases the incentive to convert from annual production to permanent crops, increases both electricity costs and demand for water during drought (Wheeler et al., 2018; Perez-Blanco et al. 2020)) and reduces community resilience. High electricity costs have been shown to be a key contributor to stress within rural communities (Wheeler et al., 2018). Perennial production reduces flexibility to adapt to climate change or drought, given plant assets need to be kept alive to avoid substantial capital loss.

It should be noted that there are at least 13 different irrigation infrastructure programs to recover water across states that were funded through the *Sustainable Rural Water Use Infrastructure Program.* They all contain differing criteria, objectives, budgets, and methods/activities allowed. At least one of these schemes – the SA River Murray Sustainability Program – allowed for other (non-irrigation infrastructure) farm activities to be subsidised instead. For example, irrigators could use the money to subsidise various farm productive activities (e.g., netting fruit/nut trees), and transfer some of their water entitlements as part of the program. There is the strong potential that such programs may have less unintended consequences on water extraction and water behaviour than other irrigation infrastructure programs (e.g. the Healthy Headwaters program noted above).

However, even in such programs as the example above, there are still rules about what farmers can spend the money on, and hence farmers cannot simply choose the option that suits them the most (e.g., they may prefer to claw back debt, or provide for farm succession, or invest in off-farm activities). Buying water directly back from farmers allows farmers total freedom in investing the money as they desire – hence – this implicitly maximises social welfare. Arguments regarding the impact of buyback on the rural community ignore real world evidence, and over rely on studies that have minimal internal and external validity (Wheeler et al., 2023).

As outlined by Wittwer and Young (2020), the problem with infrastructure upgrades is that they seek, with a single instrument, to address two policy objectives at once, namely water recovery and to maintain jobs and incomes within the Basin. However, it is much more efficient to use separate policies to address each objective, as discussed further next.

3. To achieve healthy, resilient and productive rural communities, proper structural adjustment and economic development policies are needed

As Wittwer (2019) outlines, when designing rural water policy, the following factors must be considered:

1) Irrigated farming in the MDB only represents around a third of all agricultural output – hence dryland agriculture provides a greater share of GDP.
2) Drought has a much larger impact on MDB farming output than water recovery or recovery through buyback itself – but it is common for buybacks to be blamed for drought and other impacts.
3) For every dollar 'lost' in irrigation output, there is an increase in dryland production value of about half a dollar – hence it is not a 'zero-sum' calculation.
4) Irrigation infrastructure subsidies have little multiplier or economic impact within the economy, if money was spent on social services (rather than, for example, drip irrigation) it would generate up to four times more jobs (Wittwer 2019; Wittwer and Young 2020).

Within the Basin, downstream processing of food and beverage products accounts for around 5.5% of the income base, with approximately 75% of the income base in industries other than agriculture and downstream processing. A healthy and resilient community and their quality of life depends on adequate access to services such as health, education, childcare, utilities, aged care, roads, internet connectivity and recreation. Reduced provision of essential services places people in rural communities at a disadvantage relative to other regions (Wittwer and Young, 2020).

Wittwer and Young (2020), in an updated version of the TERM-H2O CGE model, modelled investing $4 billion over five years in irrigation infrastructure upgrades in the MDB between 2020 and 2024 to procure around 500 GL of water for the environment. The results indicated a net present value (NPV) welfare loss of almost $1.8 billion, although jobs will increase as a result of this investment (compared to a no investment scenario). The investment in upgrades increases jobs in the Basin by around 1,000 relative to no investment for each of the five years of upgrades. Thereafter, Basin jobs increase by around 100 relative to no upgrades, based on estimated productivity gains arising from the upgrades. Hence, the irrigation infrastructure subsidies increased jobs.

However, the study also indicated the opportunity cost of this investment in infrastructure, relative to spending on other public services. For example, the marginal impacts of increased public spending of $4 billion over ten years on essential services in the Basin would create four times as many jobs as spending on infrastructure upgrades. Namely, jobs rise relative to the no investment scenario by between 1,800 and 2,100 over the decade of additional spending. The NPV of the welfare loss is $0.13 billion.

The key point is that putting money in rural activities such as subsidising irrigation infrastructure really only creates **short-term jobs**, versus investing in essential social services like roads, childcare, education, health, telecommunications etc, that creates more **long-term jobs**. In terms of enhancing farmer productivity, policies that encourage adaptation, reward farmers for provision of public goods and build farmer social and financial capital will also help. In addition, increased public policy agricultural research (and extension) that investigates (and facilitates) ways of coping with climate change is essential given declining research and extension dollars over time.

Recent work (Wheeler et al., 2023) established an internal and external ranking validity method to judge quality of water economic studies conducted in the MDB. Key findings suggested that studies that have been used as showing evidence of significant socio-economic harm from water recovery (e.g. consultancy studies using methodologies such as input-output analysis or basic assumptions/scenarios) – have very little reliability and are all ranked as low quality, **hence should not be relied upon for policy decisions**. The broad assumption that a 1% decrease in water allocations equals a 1% reduction in production, with assumptions linked to other socio-economic consequences is just plain wrong, and misleading.

Hence, prioritising irrigation subsidy programs over buybacks for water recovery can be viewed as a short-term strategy to address political risk and the preferences of powerful vested interests, rather than a policy to create healthy, resilient rural societies (Grafton and Williams, 2020). Indeed, buyback as a policy has a lot more support from irrigators than is recognised (Loch et al, 2014), as evidenced by the number of farmers in late 2022 that approached and tried to sell water to the Commonwealth. The March 2023 open tender will provide more indication on the current depth of willingness to sell water to the Commonwealth. Irrigation infrastructure subsidy programs may ultimately cause significant, long-term negative effects – especially within prolonged drought scenarios and a more volatile climatic future driven by climate change.

Structural adjustment policies in the Basin

The aim of structural adjustment policies is to improve growth in targeted areas by helping existing firms to expand their businesses, or by attracting new firms, often in the context of major cultural or social transitions. Evaluation of the success of such programs is often difficult, and questions are frequently raised regarding transparency, fair assessment, pork-barrelling, displacement of activities and hence social deadweight loss (Falck et al., 2019; Grafton and Williams, 2020).

To date, there has been four structural adjustment proxy programs implemented in the MDB since water recovery began. These include:

- ***The Strengthening Basin Communities Program*** (2009-2011 with $200 million allocated): aimed to mitigate the effects of water reallocation and help communities adjust to a future with less water, using funding to promote regional economic diversification. Contained a water planning and water saving component. Around 100 projects funded. Productivity Commission (2020) noted that $64m had been spent as of 2020.
- ***South Australia River Murray Sustainability Program*** (2013 onwards) with $25 million allocated): aimed to increase economic diversification and adjust to a water constrained environment (Productivity Commission 2018).
- ***Murray-Darling Basin Regional Economic Diversification Fund*** (2013 onwards to June 2019 ($73 million): this program is being administered by the Australian Department of Infrastructure, Regional Development and Cities to fund projects selected by Basin States, with aims to increase economic diversification and adjust to a water constrained environment, for the states of Qld, NSW and Victoria.
- ***Murray-Darling Basin Economic Development Program*** (2019–2023 with up to $73 million allocated): Assist eligible communities to develop their economies, increase job opportunities and enhance their resilience to manage economic challenges, administrated by DCCEEW (Sefton et al., 2020).

There has not been that much evaluation of the success of such programs, although the Australian National Audit Office (2014) found a lack of clarity regarding eligibility requirements, along with the need to appropriately document decisions relating to the assessment and selection of applications. A Senate Select Committee on the Multi-Jurisdictional Management and Execution of the MDB Plan (2020) report also criticised how money was allocated within the schemes and questioned the checks and balances around whether the money was used wisely. The Productivity

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Commission (2018) and Sefton et al. (2020) found little evidence that the transition assistance provided through these programs was well targeted or helped in transition through Basin water reforms. Upon evaluation of where the money had been spent, it was found there had been expenditure in areas outside the Basin.

It is clearly evident that there is considerable room for improvement in rural development and structural adjustment programs within the MDB. Indeed, in an era of climate change and falling water availability, further rationalisation of irrigation areas will need to be increasingly considered, with perhaps large amounts of area removed from the system. This will require an understanding of the best way to facilitate this – which will then mandate the need for proper structural adjustment and regional community packages – not band-aid or pork-barrelling programs.

So, what is required moving forward?

Much has been written about regarding next steps for water policy in the MDB. As summarised in Wheeler (2022), what is clear is that policy must focus on both meta-governance institutional as well as specific water recovery, policy reforms.

Institutional reform recommendations include items such as: paying greater attention to monitoring, detection and enforcement; understanding substitutability between ground and surface water resources; estimating historical and current water extraction (and consumption) information from satellite and thermal imaging; water pricing; water accounting; stronger water resource plans; rationalisation of existing irrigation regions; greater water banking investigation; a reinstated National Water Commission; a Water Market Information Platform; and the establishment of an independent Water Markets Agency. Walker (2019) provides further recommendations.

Continued focus is essential to ensure water governance structures are strong, and that monitoring, compliance and enforcement are followed by all states – otherwise there is a real danger of further reduced environmental sustainability. It must be noted that there are some welcome recent efforts to improve governance – such as the Parliament of Australia (2021) passing legislation to establish the Office of the Inspector-General (IG) of Water Compliance, aimed at strengthening compliance and enforcement powers in the MDB by creating new water theft and illegal water trading offences and penalties. The Natural Resources Access Regulator in NSW (formed in 2018) is also leading the way with combining both satellite imagery for potential detection of offences with on-the ground investigation. Scaling up these investigative activities into a Basin body (whether it be the IG or a reinstated National Water Commission) is an idea worth considering. Carmody and Chipperfield (2021) argue that factors such as how the IG chooses to exercise its discretion; resources allocated to the office; and its ability to remain independent will determine its future success in policing water extraction and policy in Australia. The rise of greater legal rights for rivers may also force a revision of how we allocate water in our river systems, and the insights of Young (2019) will be valuable to consider. Current ongoing work (Seidl and Wheeler, 2023) has also made a number of water compliance recommendations regarding: 1) improving compliance data and reporting; 2) increasing the probability of detection and prosecution; and 3) increasing penalties and reforming legislation.

Water recovery policy reform includes moving away from off-farm and on-farm subsidisation of irrigation infrastructure as a means to recover water (plus the removal of other inappropriate subsidies causing negative externalities). Alternative choices that may need to be on the table include mandatory cuts to water allocations across the board (compensated and uncompensated). Voluntary buyback will be preferred by many farmers as an alternative to such a policy. It is likely that the recent open buyback tender in March 2023 will see many farmers offering to sell water to the government. Reduction and/or consolidation of some irrigated areas and districts will also need to be considered, along with facilitating appropriate farm exit.

A decoupling of economic development and water recovery programs as one policy instrument is clearly required, which will involve much more investment in MDB regional essential services, as well as more targeted, open, and transparent economic regional adjustment and development funding.

Finally, but most importantly, policy reform will need to address two most pressing issues: 1) allowing for climate change in the Basin Plan; and 2) the need to reallocate water for cultural reasons. Hardwig et al. (2020) found water ownership by Aboriginal entities represented just 0.2% in the NSW segment of the MDB, while Jackson et al. (2019) revealed there is a strong public willingness to support reallocating more water to indigenous stakeholders. Along with dealing with climate change, this will be the next significant challenge facing water reallocation efforts in the MDB.

My vision of the Basin in fifty years' time

Hard choices will need to be made regarding water policy in the future, as well as many trade-offs between competing demands. Water will be required to be shared, creating 'new' water sources will be expensive – and limited primarily to recycled water management and desalination in urban settings – although we will probably see increased use of small-scale desalination units for groundwater in high value agricultural industries, and also more managed aquifer recharge schemes used for water storage purposes.

In rural settings, greater competing demands for water, along with increased value given to environmental and cultural uses of water, will mean that further sharing and adaptation to a hotter and more variable future will be essential. It is hoped that such hard choices will mean a more sustainable environment, as well as greater equity for all stakeholders and water users in the MDB. Environmental (namely community) water provides benefits to all Australians.

As a community, if we focus on using the most effective and efficient policy in recovering water (namely buyback of entitlements from willing sellers) and invest in the optimal way to improve rural community viability (though both valid structural adjustment programs and funding ongoing critical social services), this remains our best chance to succeed in obtaining a healthy, resilient, and sustainable MDB for all.

In fifty years' time, the Basin must adapt to a reduced irrigation footprint (in terms of land and extraction overall) and a consolidated irrigation industry – yet an industry that I hope is even more productive and profitable, with better mental health and still world leading, with a reduced level of farm exit. With proper economic assistance, and appropriate rural community investment and environmental policies, rural communities will hopefully be more viable – and areas where people will choose to live.

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