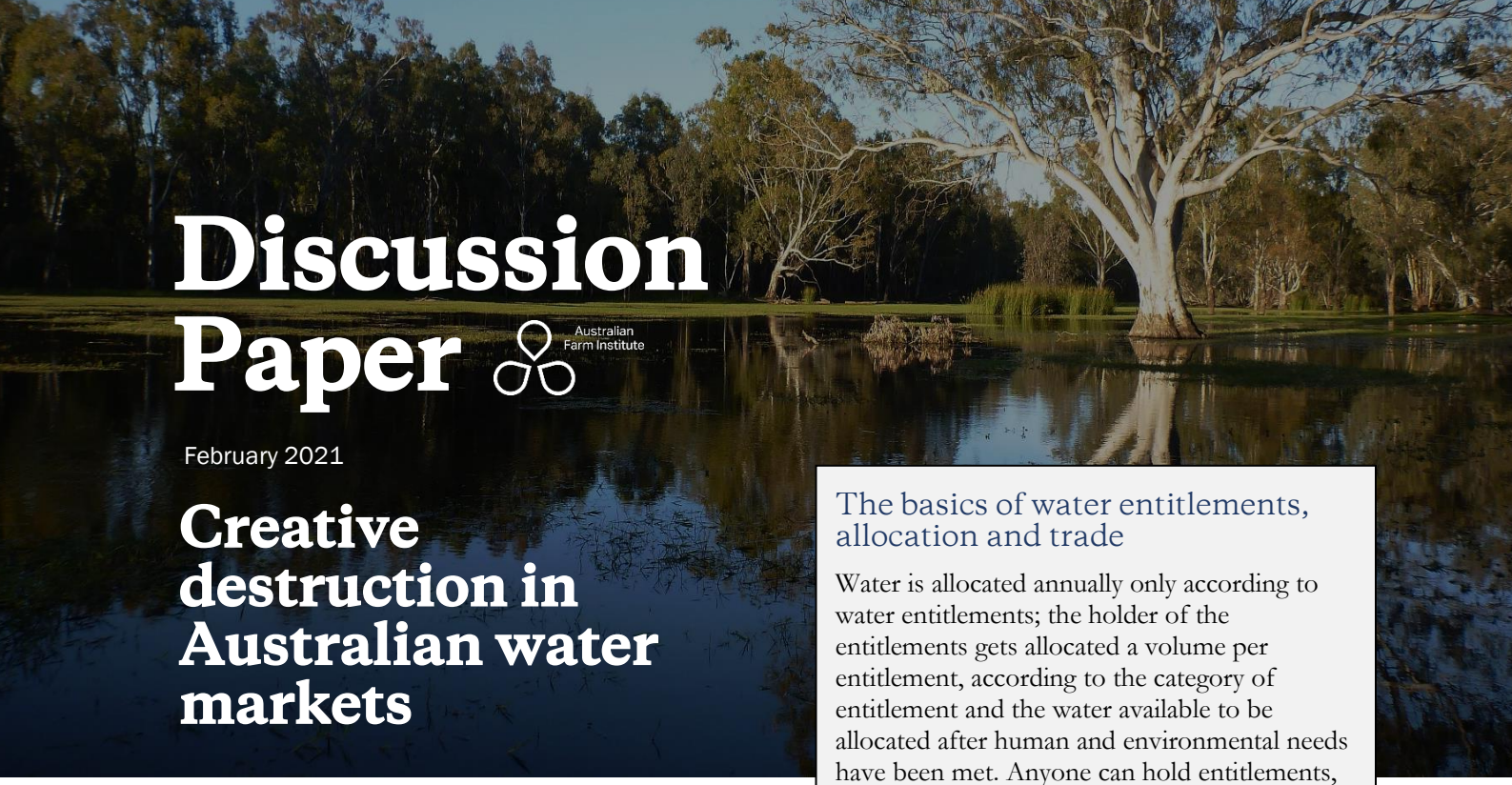

Discussion Paper

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Creative destruction in Australian water markets

Broadacre irrigation in the southern MDB is set to change dramatically: is this the creative destruction we want?

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In discussions about the Basin Plan and re-balancing extractive water rights in favour of environmental needs, one key reform has been consistently underestimated in its significant and permanent effect on irrigation industries and communities: separation of water title from land, and its subsequent tradability.

Separating water ownership from land was the culmination of a broad water reform process consistent with economy-wide micro-economic efficiency reforms undertaken in the 1990s, and brought under a consistent framework by the National Water Initiative in 2004.
To provide a mechanism that allowed the Commonwealth to acquire water for environmental use under the Basin Plan, while protecting irrigators' property rights, the unbundling of water title from land title was a necessary precondition.

As much as environmental water recovery itself, the trading framework that enabled acquisition from irrigators on fair terms will be the reform that has the greatest enduring effect on irrigation

The basics of water entitlements, allocation and trade

Water is allocated annually only according to water entitlements; the holder of the entitlements gets allocated a volume per entitlement, according to the category of entitlement and the water available to be allocated after human and environmental needs have been met. Anyone can hold entitlements, including government on behalf of the environment.

Each water season, entitlement owners and irrigators can buy or sell that season's allocated water on a temporary water market. The price of each megalitre of water on the temporary water market is determined by supply and demand each year: the temporary price is higher in years with lower allocations against entitlements and lower in years with higher allocations. The temporary price is also higher with more demand (more irrigation activities wanting to use the water), and lower with less.

When water entitlements were firmly 'attached' to land; to own those entitlements you needed to own the land to which the entitlements are attached. In the 1990s and early 2000s, regulatory changes decoupled water from land, so that whilst the water entitlements must remain attached to their designated catchment, they can be owned by anyone, anywhere, not just irrigators. It also means irrigators have the choice to own entitlements, just purchase their requirements on the temporary water market, or a mix of both.

Since around 2000, substantial volumes of water entitlements have moved to higher-returning irrigated activities, and each season a greater proportion of traded temporary water also bought and used by higher-returning irrigated activities. In the same time, substantial volumes of water entitlements have been purchased for the environment, meaning there are less water entitlements accruing water for irrigation each season.

communities. In enabling water to be traded to 'highest value' use, the aggregate effects of water recovery and drought have indeed been cushioned by ensuring that what is available in any given season has tended to find its most profitable use.

However, the efficiency dividend has not been spread at all evenly, with profound effects for many irrigators, industries, and communities. In the past 20 years, the opportunity cost of water — i.e. the value of water if put to another use — has risen significantly, driven by the capacity of that water to move to other locations and production systems. There has been substantial change in water ownership (some selling entitlement, some keeping it), demand patterns for water use (some broadacre activities contracting, other broadacre uses and large scale corporate horticultural uses expanding), and in the productive scale of some industries and communities.

A trend of declining broadacre irrigated production and rapidly increasing static water demand in the climatically-volatile southern Basin poses important questions for policy makers. Was this the objective of water reform or an unintended consequence to be addressed via altered policy settings?

The opportunity cost of water is both higher and much clearer than it used to be. The temporary water market now gives a cash value in real time for water to go to another use; settlement within days. The opportunity cost of water is a cash cost for those buying water and a cash reward to sellers. It is also a *foregone* cash reward for those entitlement owners that choose to use their allocated water, rather than sell it. All allocation water has an opportunity cost, whether it is recognised or not.

Every irrigated business seeks reward for water, but also the land, labour and capital applied to the irrigated activity. A business system will only function in some sort of equilibrium if all factors of production get some reward — a concept that was enshrined in Joseph Schumpeter's concept of 'circular flow' first published in 1911. If some factors are not getting adequate reward, the circular flow will be interrupted by Schumpeter's famous 'creative destruction' (coined in his 1942 work); businesses expand and contract, new business models are applied until the circular flow is re-established.

The increased opportunity cost of water currently occupies much more of the average gross margin of broadacre irrigation activity than 20 years ago (Figure 1). This is particularly the case for irrigators earning below-average returns, and/or those within water trading zones with more high-value production alternatives, such as the lower Murray system. This increases financial risk in broadacre irrigated enterprises and, after inflation and overheads are accounted for, much less is left for land, labour and capital.

What is opportunity cost?

The opportunity cost of something is its value if put to another use. It is usually applied to something that exists in limited or finite quantities, but does not necessarily equate its cash cost. Incorporating the opportunity cost into a decision to use a resource allows us to understand the true net benefit in doing so; something was forsaken in order to use the resource.

The opportunity cost of the time you dedicate to work, for example, is the value of an alternate use you could find for that time. It might be something easy to value like what you could earn in another job, or it could be an important but hard-to-value use like recreation or family time.

The opportunity cost of the capital you tie up in the purchase of a boat, for example, is either the interest rate of accessing more capital if that access is limitless, or what could be in earned with another use of that capital, like buying a house or blue-chip shares, if your capital access is limited.

The opportunity cost of water is its value in another use. That might be within an irrigation business, or with today's developed water markets it can be its value to another irrigation business: the current temporary water price. This opportunity cost is often much greater than the cash cost of accessing that water that has been allocated.

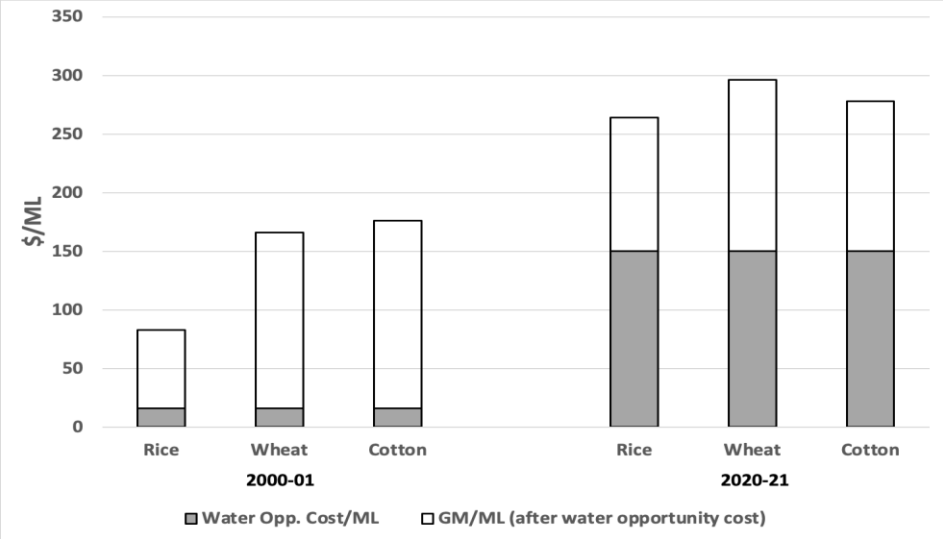

Figure 1: Estimated average gross margins per ML of rice, irrigated wheat and cotton, the opportunity cost of water as represented by the average Murray Irrigation (MIL) temporary market price and the remaining gross margin after subtracting the opportunity cost of water as represented by the average Murray Irrigation (MIL) temporary market price and the remaining gross margin after subtracting the opportunity cost of water, in 2000-01 and 2020-21[1]

Some farm businesses have exited irrigated production, as have some farm businesses outside of irrigation. For example, according to the annual reports of Murray Irrigation, the delivery network it operates serviced 1600 (mostly broadacre) farm businesses on 2400 holdings in 2000/01, but only 1357 businesses on 2164 holdings in 2016/17. Some activities within broadacre irrigated farm businesses have declined or become opportunistic, while others have expanded. Using Murray Irrigation again as an example, Table 1 shows that between two periods from 1992-2002 to 2009-2019, water use on rice has both declined and become more variable, on irrigated annual pasture has declined and on irrigated winter crops has increased.

Table 1: The average, decile 2 and decile 9 seasonal water use ('000 ML) in two time periods (1992/93-2001/02 and 2009/10-2018/19) for rice, annual pasture and winter crops within Murray Irrigation.[2]

	Rice	Annual Pasture	Winter Crops
1992/93 – 2001/02			
Average	**624**	**291**	**58**
Decile 2	521	213	21
Decile 9	768	379	95
2009/10 – 2018/19			
Average	**309**	**123**	**99**
Decile 2	28	57	26
Decile 9	525	165	137

[1] There was 95% allocation to MIL water entitlements in 2000-01 and 50% allocation as of February 2021. The 2020-21 MIL temporary water price is a conservative estimate from the first half of the irrigation season, when summer cropping and wheat spring irrigation decisions were made. Sources: MIL Water Exchange https://www.murrayirrigation.com.au/water/system/water-data/; Rice 2000-01 NSW DPI Summer Crop Gross Margins, SunRice; Cotton 2000-01 NSW DPI Summer Crop Gross Margins; Wheat 2000-01 NSW DPI Irrigated Winter Crop Gross Margins; Rice 2020-21; https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/829330/RGG-accessible-22Aug2018.pdf; Cotton 2020-21 https://www.cottoninfo.com.au/sites/default/files/img/2017-18%20Cotton%20GM%20Furrow%20Irrigated.pdf; Wheat 2020-21 http://archive.dpi.nsw.gov.au/__data/assets/pdf_file/0005/176009/Murrumbidgee-winter-budgets-Wheat-flood-irrigated-conventional-sown.pdf

[2] Source: Murray Irrigation https://www.murrayirrigation.com.au/water/system/water-data-old/

Some irrigated businesses have established or expanded; predominantly horticultural businesses that have a fixed annual demand for water, sometimes on newly developed irrigated land. Whole irrigated regions have expanded and prospered. For example, a 2020 report from water market consulting group Aither estimated that a net 3900 hectares per annum of almond plantations have been planted between 2015 and 2019 inclusive; much on newly-irrigated land on the lower Murray. Consequences of this shift include consistently elevated summer river flows to service the demand, and the likelihood that static demand will exceed available supply in a severe drought.

Some owners of water entitlements have persisted for the time being with broadacre cropping activities that reward little more over the opportunity cost of water. Even with small returns, a range of broadacre crops continue to be grown even in higher water opportunity cost years. From an economically rational perspective, this appears illogical. However, these irrigators likely seek to retain existing systems, infrastructure, skills, lifestyle and community wellbeing. Increasing water and land values enable such water-use decisions. The opportunity cost of water is not a *cash* cost for water owners, which leaves at least a *cash* return for land, labour and capital; enough in the short-term to maintain business operations.

Other owners of water are now ready sellers of their water instead of using it, ready to realise the opportunity cost of water. There was a step change in traded volumes around about 2011 (Table 2).

Table 2: The annual allocation (%), average temporary water price ($/ML) and annual traded volume (ML), 1999-00 to 2019-20, on the Murray Irrigation Water Exchange.[3]

Year	Traded Volume ('000 ML)	Allocation (%)	Average Price ($/ML)
1999-00	34.5	35	43
2000-1	71.6	95	16
2001-2	77.3	105	39
2002-3	60.4	10	228
2003-4	79.3	55	70
2004-5	66.7	64	73
2005-6	95.1	91	45
2006-7	58.9	0	300
2007-8	11.5	0	747
2008-9	54.9	9	308
2009-10	61.5	27	165
2010-11	60.3	100	33
2011-12	136	100	15
2012-13	214.4	100	54
2013-14	219.8	100	66
2014-15	175.3	61	120
2015-16	111.7	23	234
2016-17	202.1	100	50
2017-18	201.4	51	131
2018-19	99.6	0	438
2019-20	34.9	2	539

Water entitlement owners have realised significant capital gains, as the increased opportunity cost of water has been capitalised into the value of entitlements. NSW high security entitlements have increased in value about eight-fold this century. Despite less reliability of yield, NSW general security entitlements have increased in value four to five-fold in the same period.

[3] Source: https://www.murrayirrigation.com.au/water/system/water-data/

The decision for irrigators to either sell or hold entitlement in the aftermath of water title unbundling and in response to Commonwealth purchasing has proven to be profound in a way few realised at the time. Beyond the landscape and industry scale assessments, decisions about allocating capital to water ownership at the individual business level have had enormous implications for the on-farm equity position and capacity for turnover of their business.

Consider two similar hypothetical broadacre irrigation farmers in the NSW Murray Valley: Darren and Larry. They both started the century with 3000 ML of NSW general security water entitlements. Darren chose to sell two-thirds of his water entitlements to the Commonwealth in 2008 as part of Basin Plan recovery purchases, in the midst of the Millennium Drought when many irrigation businesses were under significant financial pressure.

Some funded debt obligations or invested off-farm, others faced succession planning drawing capital out of the businesses, or felt that allocating capital to productivity improvements on farm was a more effective use than the returns from water ownership. Selling made some sense to Darren; free up capital and buy allocation water when he needed it, at average prices that allowed him to achieve an adequate gross margin. Larry chose to keep all of his water entitlements, valuing the greater certainty of the water yield it gave him.

How did the rise in opportunity cost of water since 2000 play out for each of these businesses?

Both Darren and Larry experience the same opportunity cost of water. Darren pays much of it in cash each year; but for Larry it is the ***non-cash*** value of the water he is allocated. Darren's total cash gross margin has reduced; lower than 20 years ago even in nominal terms (Table 3). He is likely to be in loss after paying overheads, so is facing immediate pressure to either invest for greater productivity and/or scale, or exit broadacre irrigation. Larry is earning a much better *cash* total gross margin than Darren; and is probably still in profit.

However, once the opportunity cost of water is accounted for, both Larry and Darren have the same greatly-reduced 'true' gross margin; both are likely in loss. Larry is facing the same long-term pressure to adjust to Darren, but Darren is facing it immediately. Whilst Darren may have derived substantial benefit in using the proceeds from water entitlement sales to reduce debt, make on or off-farm investments, or pay family members to exit the business, Larry has accrued a sizeable capital gain in the last 13 years.

A divide has appeared between the 'water haves' and the 'water have-nots', in on-farm asset values, cash returns, and consequent urgency to adjust.

Table 3: Comparison of water entitlement value - Larry and Darren[4]

	Larry Keeps 3000ML entitlements	**Darren** Sells 2000ML entitlements in 2008
Year 2000 (100% allocation, opportunity cost of water $16/ML)		
Asset value of water ($500/ML)	$1,500,000	$1,500,000
Cash GM using 3000 ML of water ($120/ML)	$360,000	$360,000
'True' GM after deducting water opportunity cost ($104/ML)	$312,000	$312,000
Year 2020 (assumed 67% allocation, opportunity cost of water $150/ML)		
Asset value of water ($1,700/ML)	$5,100,000	$1,700,000
Cash GM using 2000 ML of water ($280/ML using allocation water, $130/ML using purchased water)	$560,000	$360,500
'True' GM after deducting water opportunity cost ($130/ML)	$260,000	$260,000

This is a NSW cropping example, but the effect on asset values has been even more pronounced for holders of Victorian high reliability water shares, particularly in the dairy industry.

As long as broadacre irrigated returns remain modest compared to water opportunity cost, more changes in irrigation activities will occur until land, labour and capital receives a reward. Over time, more broadacre water entitlement owners will seek a better return by selling at the higher water opportunity cost rather than use it on a lower-returning broadacre activity. This could be associated with the purchase and sale of assets or intergenerational asset transfer, when the current value of the asset is reflected.

The following consequences are likely:

- Lesser-rewarding broadacre irrigated activities will continue to decline, and broadacre businesses will continue to exit broadacre irrigation.
- Horticultural and more-rewarding broadacre irrigated activities will keep increasing.
- More broadacre water owners will become ready sellers of their annual allocation, as the real opportunity cost of their water is inevitably honoured.
- Further structural change will be forced upon whole irrigated industries like dairy, rice, and cotton adjusting to a smaller supply base.
- Opportunity cost of use will remain particularly acute for broadacre croppers and dairy farmers on the Murray system below The Choke[5], where competition for water with almonds in particular is strong. As tree-cropping moves to other valleys opportunity cost will also increase there.

[4] Table 3 demonstrates a comparison of water entitlement value, cash gross-margin (GM) and 'true' gross-margin, in 2000 and 2020, of two hypothetical Murray Valley broadacre irrigators with 3000 ML of entitlements in 2000, who chose differing water ownership strategies during the Millennium Drought. The 'true' gross-margin represents the profitability of an irrigated activity after deducting the opportunity cost of water; a cash cost if using purchased temporary water, or the same imputed cost if using allocated water.

[5] The Barmah Choke ('The Choke') is located in the mid-Murray, just upstream of Echuca. It has a limited cross-sectional area that restricts the flow rate that can be conveyed through it without flooding the adjacent Barmah Forest; if it does flood this is considered a 'conveyance loss' unless done with environmental water for forest watering. Hence, the flow rate that can be delivered to the lower reaches of the Murray to satisfy demand without sizeable conveyance losses is limited.

If the changes in broadacre activities result in a net decrease in broadacre demand and/or more broadacre water entitlement owners choosing to sell their allocation, this would moderate the opportunity cost of water. However, projected increases in static horticultural demand, any further water buy-backs or declines in catchment yield, will be a force to increase the opportunity cost of water. Natural water supply constraints will inevitably limit the expansion of permanent tree crops; however, these limits haven't been reached in all southern MDB valleys.

Adaptation and change are perennial in farming, but it has been greatly accelerated during this period of water reform – and there is more to come until land, labour and capital in broadacre irrigation get a better reward. Assuming current policy settings on water trade and productive use remain, absent of interventionist strategies on balancing water use across regions and uses, Schumpeter's creative destruction will continue. Whole industries and regions will come under further pressure to adjust or withdraw, with vastly different irrigation communities and social dislocation.

In time, natural equilibrium in the market will likely be found as perennial plantings reduce in regions that have been overcommitted to adjust for volatile supply and the important place annual broadacre crops play in an efficiently operating water market is recognised. But at what cost in the next decade? Do the benefits of tradable water finding high value uses and associated employment in the short term outweigh the collateral damage of losing established industries and their related employment? Or the social and environmental damage of concentrating static water use in the high value industries of today?

At the heart of this question is two established-but-differing approaches to welfare economics. First, that a competitive market will itself find a social optimum. Second, that only with deliberate (i.e. regulated) redistribution of wealth, property rights, resources, etc. can a competitive market achieve a social optimum.

From an individual perspective, it really depends on your perspective and place in the market. From a policy standpoint, governments across the Basin need to work out what they are aiming for from this reform process. Is it to keep allowing the market to find balance in the long run and assist affected businesses and communities along the way? Or jettison some market efficiency by limiting water tradability or directing its productive use, to buffer against the rapid changes to water use we are observing?

They are difficult choices but a choice needs to be made, and explained with honesty to communities in the middle. Particularly in our rapidly-changing global environment, not all destruction is creative.

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Listen to the 30-minute podcast with Leigh Vial, Andrew Bomm and AFI Executive Director Richard Heath HERE