LIQUID CAPITAL:
WATER MARKETISATION AS AN ACCUMULATION STRATEGY

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In recent decades, water resource management has become a key concern of environmental and economic policy worldwide. The marketisation of water rights through cap-and-trade systems has emerged as a significant policy approach, due to its theoretical promise of protecting the environment while ensuring economically 'optimal' allocation of water resources. Australia's Murray-Darling Basin (MDB) is one of the largest examples of this policy approach in practice. Despite its stated aims, however, the scheme has been associated with environmental damage and worsening social inequality. The durability of market-based water policy in the face of these failures requires critical explanation.

Neil Smith's (2007) article *Nature as Accumulation Strategy?* has provided an influential framework for critical social scientists seeking to account for the roll-out of market-based environmental policy. Smith argues that market-based environmental policy represents an attempt by capital to accumulate *through* its own environmental limits via the 'real subsumption' of nature. Smith posits that by turning environmental externalities into commodities and forming markets for their exchange, states have reconfigured the very environmental limits that constrain capital into new frontiers of capital accumulation.

Against Smith, some critics have countered that the marketisation of nature is not an 'accumulation strategy' that fundamentally reorganises capital's relation to nature, but rather an exercise in 'value-grabbing' (Andreucci *et al.* 2017). These critics argue that markets for ecological commodities do not contribute to value production and are merely a

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vehicle for the zero-sum redistribution of 'ecological rents' (Felli 2014). Influenced by this critique, Bigger (2018: 312) concludes an empirical study of carbon credits, fishing quotas, and water quality markets by arguing:

> [i]n general, tradeable permit systems do not facilitate highly liquid financial markets that might signal the increasing importance of regulatory markets as an accumulation strategy for capital.

This article engages in this debate through the case study of water marketisation in the MDB. In part, it vindicates Smith's 'nature as accumulation strategy' thesis and refutes the 'ecological rent' school of thought. It shows how water marketisation in the MDB developed historically as an attempt to secure ongoing accumulation in the face of ecological limits. It then demonstrates how the roll-out of water markets has facilitated accumulation at the aggregate level (notwithstanding the possibility of a longer-term profit squeeze brought on by ecological decline). This does not necessarily imply the ontological claim that nature itself is *directly* productive of value in the Marxian sense (*e.g.* as debated by Kallis and Swyngedouw 2017). Instead, it shows that water markets can facilitate the reorganisation of agriculture's conditions of production on terms more favourable to accumulation – a more modest claim that nonetheless demonstrates the enduring relevance of Smith's theory.

This article also identifies shortcomings in Smith's thesis, showing that it fails to account for the diversity of ways in which capital instrumentalises water markets in pursuit of profit. Going beyond Smith, this article introduces *fractions of capital* as a key unit of analysis for understanding the marketisation of nature. As the MDB case study will show, different fractions of capital are engaged in eco-social relations through water markets that range from productive to purely redistributive – and in many cases, the distinction is blurred. These interests and relations, by turns competing and complementary, have shaped the ongoing roll-out and evolution of water markets in the MDB.

Furthermore, while the marketisation of water in the MDB drew from an ensemble of existing neoliberal strategies being deployed at the same time in other sectors, it is not reducible to any grand logic of neoliberalism or capitalism *in general*. Rather, like other processes of neoliberalisation, water policy reform was essentially improvised, 'articulated through historically and geographically specific strategies of institutional transformation and ideological rearticulation' (Brenner and Theodore

2005: 102) by various actors vying to stabilise the accumulation of capital in the face of crisis. Thus, in analysing the marketisation of water and other ecological commodities, this article resists imposing Smith's 'nature as accumulation strategy' theory as a teleologically unfolding tendency within the capitalist management of nature: instead, it remains sensitive to historical, political, and geographic specificities. In doing so, it exposes the marketisation of nature as a fragile, contradictory, and therefore contestable project, thereby opening space for alternatives.

Water policy in the Murray-Darling Basin: A brief history

According to Smith's 'nature as accumulation strategy' thesis, the emergence of market environmentalism is a response to historical developments within the capital-nature relation. As capital runs out of external frontiers to conquer, it increasingly moves from 'extensive' to 'intensive' forms of accumulation (Smith 2007: 31). Rather than simply appropriating resources, capital increasingly reorganises nature 'all the way down' and financialises nature 'all the way up' (Smith 2007: 33). For Smith, this transformation, at least superficially, resolves the contradiction between capital and environmental sustainability by producing new frontiers of accumulation even in the face of a shrinking resource base and ecological decline.

As critical geographers such as Swyngedouw (2015: 9) have shown, regimes of water management are always highly *social* in character, shaped by 'diverse political projects, social visions, ecological sensitivities, sociocultural imaginaries, discursive formations, institutional arrangements, economic interests and strategies, and engineering technologies' (Swyngedouw 2015: 9).

The discussion below offers a brief 'hydro-social' (Linton and Budds 2014) history of water policy in the MDB that seeks to take these interwoven forces into account. In doing so, it reveals how the dynamics described by Smith (i.e. the closure of ecological frontiers, intensification, and ecological decline) created a situation in which the state, drawing in an improvised way on an ensemble of existing neoliberal strategies, rolled out water markets to secure ongoing accumulation.

Colonial expansion

In its earliest phase, colonial water policy in the MDB was based on the common law doctrine of *riparianism*, whereby landowners were free to use any water that flowed through or was contiguous with their land (Musgrave 2008: 29). This was an expression of a broader expansion of the colonial economy into the Australian hinterland via land grabs by British officials and, later, the squatter class (McMichael 2002: 60ff.). This expansion was expressed ideologically through representations of 'the bush' as a limitless bounty, a source of wealth, and even a ticket to personal freedom and class mobility (Waterhouse 2005: 165*ff*; McQueen 1976). While popular depictions of pastoral life did focus on the dryness of the Australian interior, they maintained a fatalistic tone, depicting the struggle for survival to tame a harsh and unforgiving nature, rather than reflecting on the inadequacy of British farming practices in an unfamiliar continent (Gibbs 2009).

Agricultural intensification and water licensing

By the mid-19th century, this squatter-dominated, expansionist model of agrarian capitalist development was giving way to a period of intensification which ushered in a new paradigm of water management. Urban radicals of the time agitated for access to land, while members of an emerging urban bourgeoisie sought an outlet for their capital. These two groupings coalesced into a political bloc and waged a campaign to 'unlock the land' from what they perceived as the arbitrary privileges enjoyed by the squatters (Baker 1958; McQueen 1976). This struggle culminated in the passing of the *Crown Lands Acts* in 1861, which diminished the class power of the squatters in New South Wales, with other states soon following. Clearly defined private property rights over land were established, laying the foundations for agricultural rationalisation and intensification.

The states established a program of 'closer settlement' which aimed to populate the countryside more densely through smaller, intensive farms. Water came to occupy a central role within this model of national development, as both a means for transporting commodities and intensifying agriculture across the continent (Gibbs 2009). In 1912, the *Federal Water Act* consolidated 'a system of private water exploitation

under public licence whose essentials still apply today' (Lloyd 1988: 124, as cited in Musgrave 2008). While water use remained linked to land ownership, water resources were now owned by the states, which distributed usage rights via a licensing system. The late-19th and early-20th century also saw the Basin's hydrology transformed through state-led infrastructure projects such as dams and weirs, converting the Southern Basin into a highly regulated hydrological system (Davies and Lawrence 2019; Musgrave 2008: 35*ff.*).

This 'state hydraulic paradigm' (Bakker 2014; Schmidt 2014) had contradictory effects. On one hand, state-sponsored irrigation was promoted on the grounds that it would support smallholder agriculture and closer settlement schemes. This link between irrigation schemes and close settlement continued into the 1950s, when plots of rural land were granted to WWII veterans (Musgrave 2008: 36). On the other hand, technological intensification in agriculture created economies of scale and drove up operating costs in agriculture, making smallholder operations less viable. As a result, irrigation projects often facilitated larger cash-cropping operations. For example, the success of rice farming in the Murrumbidgee Irrigation Area between the 1920s and the 1980s led to a continuous consolidation of land into larger holdings (Musgrave 2008: 37). This trend towards consolidation would eventually contribute to the decline of smallholder agriculture, as well as the model of government assistance that underpinned it.

Neoliberalisation and water markets

In line with Smith's argument, the third and most recent phase of colonial water management in the MDB emerged from a collision between environmental decline and neoliberal economic strategy. On the economic side, the second half of the 20th century was marked by the rise of agribusiness and large-scale corporate farming. Gray and Lawrence (2001: 8) describe this model of agriculture as follows:

> By using the inputs of corporate agribusiness firms, farmers achieve increasingly high levels of output. When markets have been buoyant… productivity has translated into profit. In such circumstances increased income can be used to purchase adjacent lands thus allowing, through economies of scale, ever-greater machinery to be applied.

Industrial agriculture drastically increased farm output. However, this productivity came at a price. As capital-intensity (and therefore production costs) increased, owner-operated 'family farms' were pushed out and agricultural labour displaced. In 1947, self-employed farmers in Australia outnumbered commercial farm employers at a ratio of 4:1 but, by 1971, this had dropped to less than 3:1, illustrating the declining viability of smaller farms (Lawrence 1984: 78). Agriculture accounted for around 10% of total employment in Australia in the 1950s but dropped to less than 5% by the turn of the century (Pollard 2000).

At the same time, rising agricultural output was not readily absorbed on the domestic market. This problem became particularly clear following the entry of Britain into the European Economic Community in 1973, and the resulting decline in its trade relations with Australia (Campbell and Dumsday 1990: 166). Larger producers began to view agricultural protectionism as a hinderance, as it barred their access to foreign markets. Beginning in the 1980s, a process of neoliberal restructuring began whereby some forms of agricultural protection were rolled back, and competition between producers was intensified to increase efficiency and orient agriculture towards exports (Gray and Lawrence 2001: 58-61). This reinforced the existing tendency towards land consolidation and the vertical integration of farm industries by agribusiness firms (Lawrence, 1987: 139-58).

These economic transformations coincided with the realisation that further irrigation licences could not be granted indefinitely. The Millennium Drought (2004 – 2009) brought into focus the problem of over-allocation of licences in the MDB. Over-allocation threatened not only the Basin's ecological character, but also to the property rights of existing irrigators, whose water entitlements were becoming less and less secure as on-paper allocations diverged from available volumes of water (Crase *et al.* 2004). Ongoing accumulation in agriculture now required capital to produce more with less – in Smith's (2007: 46) terms, nature had to be produced more intensively.

These intersecting economic and environmental conditions necessitated a new approach to water management. In forging this new approach, the Australian state drew on an existing ensemble of neoliberal strategies that had already been deployed across other sectors: specifically, the tightening of market discipline as a means of increasing productivity, and the privatisation of functions previously managed by the state to create new

outlets for capital. It is significant that the strongest early push towards water marketisation occurred between 1994 and 2004 under the Council of Australian Governments' 'national competition policy', which also oversaw a wave of privatisations in the water sector (McKay 2008: 50).

The explicit aims of water marketisation, aside from protecting water resources, were to drive up productivity in agriculture through the imposition of competitive pressure and to create opportunities for private investment (McKay 2008). Marketisation certainly catered to the demands of agribusiness firms seeking new outlets for their capital, with many of these firms going on to play a major role in the MDB's water markets, as both market intermediaries and institutional investors. It also, as discussed below, allowed agribusiness to turn towards *more* water-intensive crops if they were sufficiently profitable, at once propping up accumulation while also undermining the policy's ecological justification. In Smith's (2007: 20) terms, the bias of water marketisation in the MDB towards the interests of capital was never 'accidental nor simply an unintended consequence of otherwise well-meaning environmental legislation'; it was, from the very start, a strategy for securing accumulation in the face of crisis.

Hydrology of the Murray-Darling Basin

The geomorphology of the MDB has been drastically altered by two centuries of high-impact colonial economic practices. Over this period, the

> native vegetation of trees, shrubs and grasses has largely been removed […] and replaced with exotic cereal crops and fodder grasses. Linear earthworks and paved surfaces span the region and divide the land surface into geometric blocks. Gullying and erosion have transformed stream morphology and dramatically increased rates of sediment transport and floodplain storage […] The entire surface hydrology of the MDB has been constrained and controlled by a vast network of weirs, dams, canals and levees (Davies and Lawrence 2019: 200).

This transformation has not been uniform across different regions. In the Northern Basin, which constitutes the main catchment area for the Darling River and spans from northern New South Wales to southern Queensland, there remains a mix of 'regulated' and 'unregulated' hydrological systems. Much of the region is relatively dry, and many of its watercourses are ephemeral; as such, some areas do not lend themselves to large engineering projects. The Southern Basin, encompassing the catchment

areas of the Murray and Murrumbidgee Rivers, is more intensively regulated through engineered structures, ensuring a high degree of hydrological connectivity within the region. More than 95% of surface water entitlements in the Southern Basin fall within regulated systems, where water flows are 'managed through artificial structures such as large dams and weirs' (Australian Competition and Consumer Commission [ACCC] 2021: 54).

Water infrastructure in the MDB is administered by both public and private entities. Most infrastructure situated on major rivers is managed by state-owned organisations, such as WaterNSW, Goulburn-Murray Water, and Sunwater (ACCC 2021: 124). However, private Irrigation Infrastructure Operators (IIOs) also play a major role in distributing water within certain catchment areas. Some of these IIOs developed independently, as in the cotton-growing regions of Northern NSW (Musgrave 2008: 38), while others are the product of privatisation in the 1990s (*cf*. Murray Irrigation 2020). Private dams also play a role in the physical regulation of water in the MDB, storing water both for use and for future sale. Over the past decade, infrastructure subsidies have driven a boom in private dam construction, increasing the volume of water available for irrigation and reduced environmental flows (Slattery *et al.* 2019; Wheeler *et al.* 2020).

Water market institutions in the Murray-Darling Basin

Even within the most engineered hydrological systems, the conversion of water into a tradable commodity is not straightforward. Critical geographers have shown that 'some natures "resist" complete commodification […] while others are more readily subsumed' (Castree 2003: 289). Critical geographers have described water as an 'unruly' resource, to the extent that it possesses a form of 'agency' (Jones and McDonald 2007; Bear and Bull 2011).

As noted, rainfall patterns in the MDB are highly variable. From the perspective of capitalist agriculture, water is frequently in the 'wrong' place at the 'wrong' time, which in extreme cases is experienced as drought or flood. Furthermore, unlike most commodities, water is neither easily transported (like a consumer good) nor completely immobile (like land). Whether moving through regulated or unregulated watercourses, water is often lost in transit via evaporation, seepage, and overflow (ACCC 2021: 452-9). The transformation of water into a commodity for exchange thus

depends on a complex set of institutions designed to reconcile the spatio-temporal unruliness of water flows with the demands of capitalist agricultural production.

In the MDB, the spatial and temporal variability of rainfall is reconciled with the commodity form through the implementation of a capacity-sharing model of water licensing. Under a capacity-sharing system, rather than claiming ongoing ownership of a specific volume of water, users own the right to a proportional share of available water in a catchment area (Dudley 1992). This right is known as a water 'entitlement'; trade in these entitlements is commonly known as 'permanent trade'. Water entitlements are sorted into asset classes based on their reliability and level of priority over other licence-holders (ACCC 2021: 60-1). In this sense a water entitlement is more like a financial asset than a material commodity.

Entitlement holders receive water 'allocations' based on rainfall, and the volume and priority level of their holdings. These allocations are also tradeable. This is known as 'temporary trade' (Murray Darling Basin Authority [MDBA] 2021a). Trade occurs relatively freely within 'water trading regions', geographic units with a high degree of internal connectivity that often correspond to a catchment area. 'Inter-valley trade' (transactions between water trading regions) is more complicated; under some circumstances, limits have been imposed on inter-valley trading to accommodate hydrological realities. For example, one narrow section of the Murray River, the Barmah Choke, can only pass 7000ML of water per day without flooding. Upstream-downstream trade across the Barmah Choke is therefore restricted during summer and autumn months to prevent unseasonal flooding and conveyance losses (MDBA 2021b).

Trade in both entitlements and allocations is largely overseen and approved by the MDBA, a regulatory agency established by the federal government in 2007 that operates across all Basin states and territories. However, in some catchment areas, regulatory responsibilities have been delegated to private IIOs. These organisations purchase large volumes of water entitlements on the official market, then distribute allocations directly to their customers through internal networks. These latter transactions are not fully captured in existing statistics on water trading (ACCC 2021: 88).

In addition to regulatory agencies and IIOs, water markets are shaped by a variety of market intermediaries, such as brokers (*e.g.* Ruralco Water, Wilks Water, Elders) and exchanges (*e.g.* Waterexchange, H2OX and

Waterpool Trading) (ACCC: 71). These intermediaries facilitate trading by connecting buyers and sellers, as well as navigating legal and bureaucratic complexities. Other organisations offer market information; some are publicly owned, such as the Bureau of Meteorology (BOM), while others are private and offer information and consultancy for a fee (*e.g.* WaterFlow 2019; Aither n.d.).

Within the Murray-Darling water markets, mechanisms have been introduced to reserve a share of water for the environment. Environmental water holders are government-owned entities that hold permanent water entitlements to divert water from consumptive use and manage the release of water to meet ecological targets (Department of Agriculture, Water and the Environment 2021). The share of water reserved for environmental use is established by the MDBA through the setting of 'sustainable diversion limits' (SDLs), which are, in principle, constructed with reference to historical rainfall and flow data (Basin Plan 2012: s.6.01–6.12C). Environmental water holders attempt to meet SDLs through voluntary buybacks of entitlements by environmental water holders and through the subsidisation of infrastructure upgrades, though the latter method is more costly and less effective (Wittwer and Dixon 2013; Loch and Adamson 2015).

Fractions of capital in the water market

Smith's 'nature as accumulation strategy' thesis has become the target of critique on the basis that it identifies ecological markets as new frontiers of accumulation. Critics like Felli (2014) and Andreucci *et al.* (2017) argue that ecological markets are simply a new mechanism for the distribution of rents – in other words, the circulation of value through ecological markets is zero-sum, and does not facilitate accumulation at the aggregate level. The case of the MDB demonstrates that this 'ecological rent' critique is reductive because water marketisation *has* fuelled accumulation by facilitating the material reorganisation of agriculture's conditions of production.

However, neither Smith nor his critics account for how *fractions of capital* mobilise ecological markets in diverse and sometimes competing ways. Market-facilitated accumulation in agriculture has existed *alongside* the specific rent-seeking strategies of intermediaries and investors; the latter does not negate the former. Furthermore, some strategies which resemble

rent-seeking in isolation interact with production in complex ways, potentially having positive-sum effects on accumulation at the aggregate level. These interactions between fractions of capital and their strategies for pursuing revenue, by turns complimentary and contradictory, are key to understanding the ongoing evolution of water policy in the MDB.

To define class fractions, this analysis draws on Marx's analysis of the 'circuit of capital'. In the first volume of *Capital*, Marx (1976: 255) defines capital as a process of 'self-valorisation' whereby value, through its metamorphosis from money, into commodities, and back into money, expands itself through the appropriation of surplus-value. This 'general formula for capital' is expressed as M–C–M' (Marx 1976: 257). However, on a more concrete level, individual firms tend to be functionally differentiated, operating within particular moments in this circuit. We may distinguish, for example, between capital deployed in the production of commodities and capital operating within the sphere of circulation. In the second volume of *Capital*, these distinctions are further refined, with capital operating in the sphere of circulation divided into commodity capital and money capital (Marx 1978). Furthermore, landed property, which lacks a direct role in the production or circulation of capital, may also be counted among the key determinants of wealth distribution due to its capacity to appropriate value from both capital and labour (Marx 1981: 960; Collins 2018).

The bearers of these functional relations may be identified with class fractions – the industrialist as bearer of productive capital; the wholesaler as bearer of commodity capital; the banker as bearer of money capital; the landlord with landed property, etc. While each is necessary for the reproduction of capitalism as a whole, they may also possess individual interests that are antagonistic. This interplay of fractional interests is central to understanding the struggle for hegemony within the ruling class and the dynamic stabilisation of capital accumulation as mediated by the state through successive policy regimes (van der Pijl 2012).

In the case of the MDB water market, the main holder of productive capital is the irrigator, for whom water is an input into the production process. Water markets, when combined with engineering interventions, facilitate accumulation for irrigators by 'smoothing out' the spatial variability of water supply. Water markets have also been used to tame water's *temporal* variability using 'carryover allocations', whereby unused water accrued

during previous seasons can be claimed in the future, and even traded through a practice known as 'carryover parking' (ACCC 2021: 89).

In the sphere of circulation, two dominant fractions operate: water market intermediaries and institutional investors. Intermediaries capture a portion of the surplus produced in agriculture by facilitating water market transactions. Institutional investors extract surplus by holding a portfolio of water entitlements and selling allocations, while in the long-term expecting their portfolio to appreciate. While to some extent institutional investors fulfill the role of the ecological rentier as imagined by Felli (2014) and Andreucci *et al.* (2017), innovations in derivative-style water contracts complicate this analysis. By creating instruments such as water futures, institutional investors exert additional spatio-temporal effects on water markets that transform agricultural organisation on a material level, thus facilitating accumulation while also bringing about new types of risk.

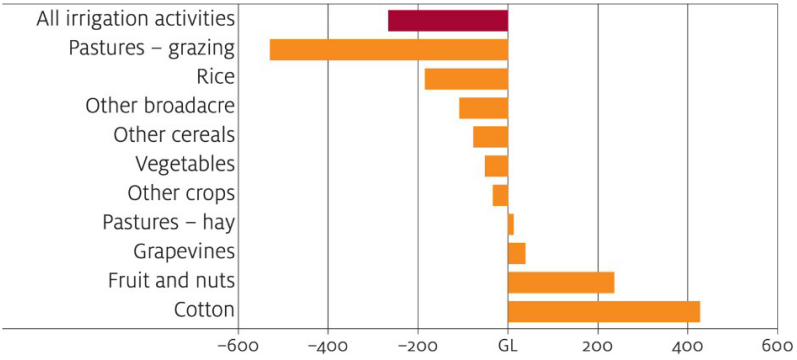
Water markets and irrigators

Establishing how water marketisation in the MDB has changed the behaviour of irrigators is not straightforward because of the many factors that affect trends in agriculture. However, available data shows that there has been a significant expansion in the production of certain water-intensive crops, even during dry periods. During the 2017-2018 financial year, the most recent period for which data is available, 'cotton' and 'fruits and nuts' accounted for the largest share of gross value of irrigated agricultural production (GVIAP) in the MDB (ABS 2019). The growth of the fruit and nuts sector has been particularly striking; between 2011-12 and 2019-20 there was a nearly continuous increase in the area of land irrigated, while the volume of water jumped from 475,286 to 757,093 megalitres (ABS 2021).

These trends are not solely driven by water marketisation; they are also a product of the increasing global integration of Australian agriculture since the mid-20th century and, more recently, by strong demand for these commodities on the world market, driven particularly by the growth of the Chinese economy (*cf.* Australian Bureau of Agricultural and Resource Economics and Science [ABARES] 2020). However, the shift towards water-intensive crops such as cotton and tree nuts could not have occurred at such a scale without the institutional support of water markets.

Figure 1 shows ABARES modelling of long-run changes in water use at a set price point of $100 per megalitre. Between 2002-03 and 2016-17, while almost all other sectors saw stable or declining use, 'cotton' and 'fruits and nuts' increased their use by more than 400 and 200 gigalitres respectively. In other words, there has been a transfer of water away from less profitable to more profitable sectors, fulfilling water marketisation's aim to facilitate 'water reaching its most productive use' in economic terms (Basin Plan 2012: s.5.07). Concurrently, the water-intensiveness of the more profitable crops undermines the scheme's stated ecological purpose.

Figure 1. Long-run change in water use (2002–03 compared with 2016–17) at a price of $100/ML



Source: Gupta and Hughes (2018).

The expansion of the fruit and nut sector exemplifies how water markets work with the re-engineered waterscape to reconcile the spatio-temporal rhythms of capitalist production and of nature. The production time for crops such as tree nuts, which dominate the sector, is particularly long. Almond trees, for example, take 5 to 6 years from planting to reach full yield. If an almond plantation is not adequately watered during this time, its value is never realised and the owner's capital is destroyed. Investment decisions in perennial horticulture therefore involve much longer time-horizons than annual crops. Whereas an annual crop may be substituted or abandoned during a drought year, permanent plantings require a consistent supply of water to avert downside risk.

A comparison of water usage in cotton production and in 'fruit and nuts' horticulture illustrates this point. The area irrigated for cotton production in the MDB declined from 320,175 hectares in 2017-2018 to 44,034 hectares in 2019-2020 in response to drought. During the same period, the volume of water applied to cotton crops dropped from 2,420,296 to 287,750 megalitres, and the application rate from 7.8 to 6.5 megalitres per hectare (ABS 2021; *cf.* BOM 2021).

By comparison, the fruit and nuts sector has been far less responsive to water price changes. During the same drought period of 2017-18 to 2019-20, the area irrigated for fruit and nut production in the MDB increased from 87,562 to 101,077 hectares. At the very peak of the drought in 2018-19, water use in the sector hit a historic high of 769,066 megalitres (ABS 2021).

This inelasticity of demand for water demonstrates that, in permanent horticulture, the costs of accessing water through the market are outweighed by the profitability of water-intensive crops. This problematises the notion that water markets induce behavioural change among irrigators to transition towards more ecologically sustainable crops.

Furthermore, it illustrates how water markets can operate as an accumulation strategy for capital: by smoothing over spatio-temporal variations in water supply, water markets have facilitated accumulation by allowing irrigators to mitigate the downside risk of planting perennial, water-intensive crops.

Water market intermediaries

Recent years have seen the proliferation of intermediaries within the Basin's water markets. Already, survey data from 2008-09 indicated that 77% of respondents who had participated in a water trade over the year had used a water market intermediary (Ashton 2010). Expanding water market participation suggests an increase in intermediary activity since then (ACCC 2021: 85).

Intermediaries include water exchanges and water brokers. Water exchanges are digital platforms for matching buyers and sellers, fulfilling the role of a central marketplace that is currently absent from the MDB's formal water market architecture. Water exchanges appropriate a portion of the surplus produced by irrigated agriculture by charging a flat fee or

commission on transactions: for example, one of the major exchanges, H2OX, charges users $2.20 per megalitre on all allocation trades (Xpanisiv n.d.).

In addition to exchanges, around 80 water brokers operate in the MDB, concentrated particularly in the Southern Basin (ACCC 2021: 127). Brokers tend to intervene more directly in the circulation process than exchanges, with many organising trades via their own water accounts. Price differentials between water trading regions, owing to differences in rainfall, demand and regulatory frameworks, are exploited by some brokers as opportunities for arbitrage.

These brokers have come to dominate inter-valley trade by developing methods of expediting the application process so that their transactions are approved before the inter-valley trade limit is reached. One method involves aggregating water allocations so that they are approved as a single transaction. Digital technology is also increasingly used to automate the application process (ACCC: 249-52).

While spatio-temporal unevenness is a precondition of these arbitraging practices, inter-valley trade itself has a 'smoothing' effect on the distribution and pricing of water in the MDB. At the same time, intermediaries use their control over the circulation process to extract a portion of the surplus produced in agriculture. Thus, it appears that intermediaries may act as *ecological rentier* while *also* playing a part in reorganising the conditions of production on terms favourable to accumulation. This contradictory and ambiguous role refutes the 'ecological rent' critique of Smith (Felli 2014; Andreucci *et al.* 2017) and shows that this critique suffers from a narrowly production-focused view of Marxian value theory.

For Marx, while the circulation of commodities is not itself directly *productive* of value, it is essential to the *realisation* of value; thus, production and circulation form an organic unity. The spatial extension and temporal compression of water trade, as facilitated by water market intermediaries, allows for transformations in the production process that are favourable to accumulation (*cf.* Harvey 1990) – these effects are *not* ruled out by the fact that intermediaries also extract rents.

Water market investors

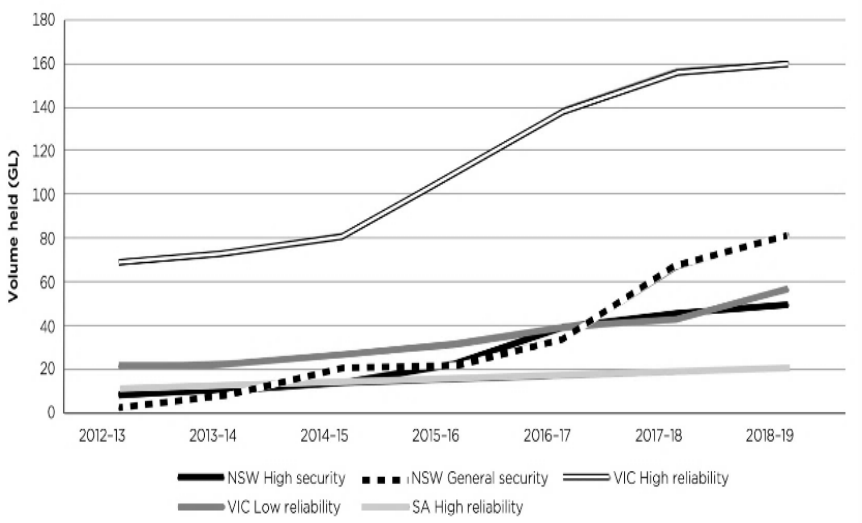
Since the unbundling of water rights from land ownership in the Basin states, investment in water rights by non-productive users has been increasing (Seidl *et al.* 2020).

Non-productive holders of water rights range from large institutional investors through to retired irrigators (ACCC 2021: 126). Investors pursue a variety of strategies for appropriating value through the ownership and circulation of water rights. The crudest of these strategies is short-term *speculation* on the temporary allocation market. One version of this practice involves the deliberate creation of a hoard to influence future price movements. Although the magnitude of short-term speculation is hard to assess due to the decentralised character of water trading and reporting in the MDB, it appears to be undertaken mainly by smaller investors (ACCC: 163). The available evidence does not suggest that allocation hoarding exerts a significant influence on water price or availability (Loch *et al.* 2021).

Of probably greater influence is ownership of permanent water entitlements as a common profit-making strategy by institutional investors. On 30 June 2019, the four largest investors (Argyle Group, Aware Water, Duxton Water Ltd, Kilter Rural) collectively owned 7% of all high-security entitlements issued in the Southern Basin (ACCC 2021: 167). Figure 2 below shows more details about the volume and type of water entitlements held by these four investors during the period between 2012-13 and 2018-19. It shows that, in aggregate, their holdings of the water entitlements more than doubled during that 6-year period.

Investors buy water entitlements as a speculative asset in anticipation that their value will increase over the long-term, an expectation that is particularly warranted during dry periods: according to water consultancy firm Aither (2020: 34), between 2015-16 and 2019-20, the total value of water entitlements in the MDB almost doubled from $13.5 billion to $26.3 billion. More frequent and severe periods of water scarcity due to climate change, as well as the 'demand-hardening' effects of the recent expansion of perennial horticulture, will likely lead to further appreciation in the future (Loch *et al.* 2021). Institutional investors tend to hedge risk by purchasing entitlements from different water trading regions and from different reliability classes, although with a strong bias towards high security entitlements (ACCC 2021: 176).

Figure 2: Volume of MDB water entitlements held by the four largest investors, by class and year



Source: ACCC (2021).

Additionally, investors derive short-term income from selling the allocations that accrue to their water entitlements. Non-irrigator investors account for a disproportionate share of trades-out within MDB allocation markets (ACCC: 171). Revenue derived from these channels (*i.e.* the asset appreciation of entitlements and the sale of allocations) is based on a set of socio-ecological relations that is distinct from both irrigated agriculture and market intermediary activities. Water investors can operate entirely outside the productive process. But, unlike water market intermediaries who appropriate a portion of the surplus by charging fees for their services or exploiting price differentials between geographically dispersed markets, water market investors derive their social power from their ongoing control over a finite resource. Like landed proprietors, institutional water investors can bar agricultural capital's access to an essential condition of production, and through this relation are able to extract from productive capital a portion of its surplus (*cf.* Fine 2016).

In this sense, water investors form an ecological rentier class. However, this does not entirely refute the 'nature as accumulation strategy' thesis, as

Felli (2014) and Andreucci *et al.* (2017) claim. Water investors are also engaged in the creation and circulation of derivative-style water products such as water futures and entitlement leases. These products represent more than a zero-sum redistributive relation; rather, they mark a shift in the way that finance and agriculture value nature and organise risk, with concomitant effects on the organisation of production itself. The term 'derivative-style' is used because, since 2014, these products have been excluded from the definition of derivatives under Australian law, exempting them from the regulatory oversight (Treasury 2014). Functionally, however, they are indistinguishable from other derivative products, and so will be referred to simply as 'derivates' hereafter.

The most recently available data shows only around 7% of irrigators are engaged in lease contracts, and even fewer make use of derivatives (ACCC 2021: 123). However, leases and derivatives account for a large share of the incomes of some institutional investors. As of June 2021, 43% of Argyle Capital's water entitlement portfolio was leased, and 23% of expected 2021-22 allocations had been sold in the form of forward contracts (Argyle Capital 2021: 16). Duxton Water's latest figures indicate that, as of July 2021, 68% of its entitlements were leased and a smaller, undisclosed proportion of allocations had been sold in forward contracts (Duxton Water 2021).

Individual capitalists and firms use derivatives to redistribute risk in pursuit of specific goals. Derivatives can be used to hedge against a particular vulnerability; for example, irrigators wishing to reduce their exposure to water allocation price increases may take out a forward contract with a water investor. Conversely, derivatives can be used to speculate; in the scenario just mentioned, the investor increases their exposure to allocation price movements in the hope of earning a premium upon the contract's expiry.

Entitlement leases, while distinct from derivatives, serve a similar purpose by *shifting exposure to risk*. Water entitlements are akin to shares, in that they represent an unknown yield. When an entitlement lease is signed, the lessor (usually an investor) receives a contractually agreed-upon payment, while the lessee (usually an irrigator) is exposed to potential changes in the volume of water allocated to that entitlement.

While derivatives are used to shift risk, their overall function cannot be reduced to the hedging and speculative strategies of individual capitals. While a single derivative contract represents a zero-sum relationship

between counterparties, in the aggregate, derivatives can be seen to involve a positive sum. By permitting the better planning and organisation of production and trade, derivatives may generate positive effects on resource allocation and accumulation (Bryan and Rafferty 2006: 41; see also Parsons 1988). Modelling by Bayer and Loch (2017) supports this view in the case of water markets, finding that the introduction of forward contracts improves efficiency to a greater extent and at lower cost than entitlement trading.

Empirically, the degree to which derivatives have altered the organisation of irrigated agriculture in the MDB is difficult to assess, as forward contracts are traded 'over the counter' and irrigators tend not to disclose the makeup of their water portfolios. But. while uptake currently appears low, there is significant incentive for irrigators to make greater use of forwards and options in the future. Australian farmers rank climatic variability as their highest risk, setting them apart historically from those in other advanced economies (Nguyen *et al*. 2007). Climatic variability produces price volatility within allocation markets (Grafton and Horne 2014: 66) and represents a risk to entitlement holders in the form of reduced allocation volumes during dry years. Some irrigators have found that this risk outweighs the benefit of owning any entitlements at all. For example, agribusiness firm Boundary Bend Limited lost revenue in 2007 when allocation volumes were reduced to 35% of its nominal entitlements – subsequently, the company sold its entire entitlement portfolio and sourced water solely from the temporary market (Boundary Bend 2019).

As discussed earlier, water marketisation provides irrigators with a way of mitigating the risks associated with water's spatio-temporal variability. Derivatives represent a radical deepening of this project. Forwards, futures, and options contracts 'bind the present to the future by reconciling prices today with prices tomorrow' (Bryan and Rafferty 2006: 39). Water entitlements may yield different volumes of water each season and spot markets for water allocations are volatile. But derivatives, through their temporal 'binding' function, have the potential to anchor future water prices to a predicted value; and to this extent, they play an active role in the *valuation of nature* itself.

Of course, predictions about the future value of water can deviate from material reality. This is not inherently a problem for accumulation – rather, the 'contestability' of fundamental value is integral to how derivatives operate (Bryan and Rafferty 2006: 37). But extreme deviations may have

destructive effects across both finance and the material economy. For example, in the event of an unforeseen dry period, an overexposed investor may struggle to access the volume of allocations required to meet their forward obligations. Irrigators who have factored the delivery of water through forwards contracts into their production decisions may find themselves facing serious losses should their counterparties fail to settle these contracts in kind. Furthermore, if water derivatives become further developed, standardised, and enmeshed with other financial products, the chances of contagion in the event of a localised shock may increase.

The emergence of derivatives contracts between investors and irrigators therefore problematises the narrative of 'productive' irrigators and 'rentier' water investors (*cf.* Felli 2014; Andreucci *et al.* 2017), because the effects of derivatives are irreducible to a zero-sum game between hedgers and speculators. Forward, futures, and options contracts, through their temporal 'binding' effect, play a role in valuing water and mitigating price uncertainty, allowing irrigators to reorganise production towards new profit-making strategies, and providing finance with a potentially profitable source of exposure. At the same time, derivatives may introduce new forms of systemic risk into finance and agriculture.

Water market reform and intra-capitalist competition

As the above discussion demonstrates, water marketisation in the MDB emerged not merely as a policy response to environmental pressures, but also as a strategy for propping up accumulation. Moreover, these markets are instrumentalised by different fractions of capital in pursuit of diverse and sometimes conflicting goals. The resulting tensions that arise continue to shape the policy evolution of water marketisation in the basin.

A contradictory relationship can be observed between irrigators and market intermediaries. Irrigators have raised concern, for example, that intermediaries manipulate market prices by exploiting information asymmetries, misrepresenting prices on their public registers, and dominating inter-valley trade by aggregating trade applications and automating the submission process (see ACCC 2021: 233). Conflicts of interest have also arisen whereby brokers have themselves been the buying or selling party in a trade without informing their clients (ACCC: 236-9).

However, there is also some degree of complementarity between irrigators and water market intermediaries. The use of intermediaries is widespread

in the Southern Basin, where allocation trades are most prevalent (ACCC: 127). According to a survey of irrigators across the whole MDB, 77% of irrigators had used a water market intermediary in the 2008-09 water year, only 14% of which reported having any problems; and, within this group, most complaints related to delays and mistakes rather than misleading conduct (Ashton 2010: 8). A *Water Market Intermediaries Code* is under development to further harmonise the activities of intermediaries with the interests of irrigators (Department of Climate Change, Energy, Environment and Water 2023).

There is a sharper antagonism between irrigators and non-farm investors. Naturally, water investment firms take a positive view of their own role within water markets, arguing that they provide 'important risk management tools' to irrigators in the form of derivative-style contracts (Riparian Capital Partners 2019: 4). Ultimately, however, water investors' economic power derives from their ability to exclude potential users from access to a finite resource. While it may be true that some irrigators purchase and lease water products from investors to increase their flexibility or hedge risk, investors nevertheless extract surplus from irrigators through their control over an essential condition of production.

This kind of social relation – akin to (but *not* reducible to) a rent relation – confronts the irrigator as a barrier to accumulation. The activities of non-farm investors have therefore been a cause for considerable angst among some irrigators, who accuse 'professional speculators' of 'influencing market prices […] by deliberately holding back supply' and have called on regulators to 'move immediately to create market rules that discourage the participation of professional speculators' (NSW Farmers' Association 2019: 5). The conflict between irrigators and water investors is a common theme in the media, with coverage contrasting the productive character of irrigation with the unproductive activity of speculators. Medium-sized irrigator Ryan Marr, when interviewed by ABC news, put it this way:

> We have all these ticket-clippers who come along who are making a living from all the in-between. Is that fair and right when it is the grower at the end of the chain who has to do all the hard work to grow the crop, carry the risk, to actually make it worth money? (Sullivan 2019).

Rob McGavin, co-founder of Boundary Bend (one of the largest agribusinesses in the Basin), accuses speculators of precipitating rural decline:

> Every day [speculators] are in the market bidding against the irrigator means the irrigator has got to pay more, which means they don't have as much to spend in town, which means the whole community suffers (Sullivan 2019).

Such claims about water speculation have been empirically contested (*e.g.* Loch *et al.* 2021). It may be that irrigator's cries of foul play over water prices may be misplaced or self-interested; but whatever the reality, these statements reveal an anxiety rooted in a real antagonism between the interests of irrigators and water investors. These tensions have reached such a pitch that the government's recent water market roadmap report has tried to hose them down, claiming that:

> [although] market participants are concerned about investor speculation […] investors make up only 7% of high-reliability entitlements in the Southern Basin and provide several benefits – including new sources of capital for irrigated agriculture and water products for the market (Quinlivan 2022: 27).

Unlike irrigators, it is in investors' interests for the price of water to appreciate, whether due to real scarcity (due to drought and over the longer-term, climate change) or due to future revaluations and buy-backs by government agencies. As such, water investors tend to adopt neutral or positive stances towards environmental protection.

By contrast, irrigators have lobbied aggressively against environmental protection, substantially influencing the trajectory of water market reform in the Basin. Initial consultations around the establishment the *Basin Plan* were rife with 'reactionary' rhetoric from irrigation lobbyists, who downplayed the benefits and emphasised the dangers of reduced extraction (Crase *et al.* 2011). Irrigation lobbyists instead advocated 'additional public investment in purported water-saving irrigation infrastructure and a major downward revision of the SDLs' (Crase *et al.* 2011: 196).

The subsequently published draft *Basin Plan* responded to these concerns by scheduling a review of SDLs for 2015, which would consider the water-saving impacts of 'works or measures', 'river management and river operational practices', new 'methods of delivering water', as well as economic and social considerations (MDBA 2011: 26-7). Furthermore, while the initial *Guide to the Proposed Basin Plan* determined that between 3000 and 7600 gigalitres of water would have to be recovered for the environment to restore key ecological functions, this was revised to 2750 gigalitres in the final *Basin Plan* without any scientific explanation (Walker 2019: 54, 188, 215-21).

Despite these concessions, irrigation lobbyists continue to advocate for increased extraction. In a submission to a Productivity Commission inquiry into water management, the National Farmers' Federation (NFF) (2020: 9) argued that:

> Governments must shift from solely focusing on achieving volumetric outcomes to maximising social, economic and environmental outcomes with existing water […] In respect of the Murray-Darling Basin, the NFF has a long-standing position to focus on enhancing environmental outcomes through complementary measures, or maximising environmental outcomes through non-flow measures.

This ongoing attack on environmental caps, in addition to threatening the Basin's ecology, has meant that the scope for investors to use the market for financialised forms of accumulation has been curtailed. It is unclear whether the market will continue to 'mature', as the government's water market roadmap predicts (Quinlivan 2022: 43), or whether its development will continue to be hampered by the short-term interests of irrigators seeking to access cheap water.

This does not refute the core claim of Neil Smith's 'nature as accumulation strategy' theory. Rather, it shows that the marketisation of nature is not an inevitably unfolding logic that determines capital's relation to nature but, rather, a hegemonic project shaped in its development by the interplay of group interests and strategies. As the above discussion shows, using class fractions in political economic analysis assists in understanding the different types of eco-social relations that are interwoven through the MDB water market – and how their actions have shaped the evolution of Australian water policy.

Conclusion

Consistent with Neil Smith's 'nature as accumulation strategy' thesis, the development of water markets in Australia's Murray-Darling Basin has been largely subordinate to the interests of capital. Water markets did not simply emerge as an evolution of water policy towards ever greater efficiency and environmental responsibility, as official histories imply (*e.g.*Musgrave 2008). Rather, marketisation emerged as an 'unholy alliance' between environmental protection and neoliberal economic strategy.

Furthermore, contrary to the critique put forward by Felli (2014) and Andreucci *et al.* (2017), marketisation has not merely led to the emergence of the ecological rentier. Instead, water marketisation has served to shore up accumulation at the aggregate level. Irrigators use water markets to manage the spatio-temporal variability of water flows, facilitating a transition to water-intensive perennial crops where profitable. Market intermediaries such as water brokers and exchanges exert control over the circulation of water, allowing them to capture a portion of the surplus produced by agriculture. However, their role is not reducible to ecological rentier – by allowing irrigators to access more water, in more places and more of the time, intermediaries reorganise nature to annihilate spatial and temporal barriers to accumulation (*cf.* Harvey 1990). Institutional investors most closely resemble the 'ecological rentier' imagined by Smith's critics, but even they may facilitate accumulation by offering derivative-style products such as entitlement leases, forward, and futures contracts, redistributing risk in ways that materially reorganise agricultural production.

While this analysis demonstrates the ongoing relevance of Smith's 'nature as accumulation strategy' argument, it also exposes its shortcomings. The marketisation of water cannot properly be understood as the inevitable unfolding of a new logic of capital. Instead, as we have seen, the various fractions of capital have sought to mobilise water markets in distinct and sometimes conflicting ways. The interplay of these competing interests and practices has shaped, and continues to shape, the evolution of water policy in the MDB. By exposing these conflictual social processes associated with the dominant paradigm and policy of water marketisation, this political economic analysis reveals its ultimate fragility and contestability.

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