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Doing Better with Less:

Lessons for California from Australia's Water Reforms

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Reason Foundation



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Foreword

Lessons for California from Australia's Water Reforms

by Julian Morris

California is in the midst of a water crisis that threatens to do enormous damage to the economy and ecology of the state. Meager rains earlier this year did little to alleviate a years-long drought that has reduced agricultural output, depleted reservoirs and put a severe strain on urban water supplies. Unfortunately, the response of policymakers thus far has done little to address the problems that caused the crisis.

From the late 19th century until the 1960s, private companies and public agencies built dams, reservoirs and pipelines in order to store water and transfer it from areas of relative abundance (primarily in the north part of the state—and from other states) to areas of relative scarcity (primarily in the south part of the state). Since the 1960s, however, there has been too little investment in updating and upgrading the state's water infrastructure.

Proponents of supply expansion have used the crisis to push for taxpayer-financed infrastructure development. In November of 2014 California's electorate passed a ballot initiative authorizing the issuance of a \$7.5 billion bond to finance various water projects. But most of these are short-term in nature and would not result in long-term supply increases.¹

At the same time, many water users have perverse incentives to over-consume water, so a good case can be made for introducing a system of water management that encourages consumers to use water more rationally. Unfortunately, this idea has been misapplied by proponents of demand restrictions, who think they know best whose water use should be limited—and how. They got their way on April 18th, 2015 when Governor Jerry Brown signed an executive order requiring a 25% reduction in domestic potable water use, to be implemented through the water companies and utilities supplying municipalities, along with subsidies to convert 50 million square feet of lawns and turf to “drought tolerant landscapes.”²

As this brief shows, there are better ways to manage water that experience shows would be more efficient, more equitable and more sustainable, and would require neither additional taxpayer-financed investment nor the imposition of arbitrary restrictions by government.

The brief outlines water reforms undertaken in Australia in the 1990s and their results, which in many ways are applicable to California today. The author, Professor Jeff Bennett,

one of the foremost authorities on Australia's water rights system and the author of numerous papers on the subject, emphasizes the importance of establishing clearly defined, readily enforceable property rights to all available sources of water, and enabling those rights to be traded without undue fetters.

Like California, Australia has a highly variable climate and has been plagued by droughts. Also like California, for most of its history successive Australian governments sought to address increases in demand for water through taxpayer-funded infrastructure projects and mandated diversions (for environmental demand, such as maintaining flows to conserve fish species). But the infrastructure projects failed to keep pace with demand, especially during droughts, while the mandatory diversions resulted in conflicts, especially between agricultural users and environmental pressure groups.

The brief describes how, in response to a water crisis of similar proportions to that being experienced by California, Australia reformed its system for allocating water, creating better defined and more readily tradable rights. The result has been water prices that better reflect its scarcity value as well as delivery cost. As a result, farmers have stronger incentives to invest in water conservation practices and are less likely to grow water-intensive crops in arid areas, which is one of the primary stated goals of environmental pressure groups.

Such a solution harks back to the approach taken early in California's history, when miners and farmers developed highly functional and effective systems of water ownership and trading, enabling water to be used by those who valued it most and both incentivizing the enabling development of private irrigation projects.³ Even today, in some cases, Californians who place a high value on water, including cities and some farmers, have been able to purchase water from those with rights to water but who value the water less.⁴

Unfortunately, however, a series of interventions going back to the late 19th century have tilted the "playing field" by undermining property rights and impeding market transactions in water, with the result that today only a small fraction of all the state's water is eligible to be traded, prices have become distorted, and entrepreneurs have neither the ability nor the incentive to provide solutions. The main problems are:

1. The "use it or lose it" provision. The requirement that appropriative water rights be subject to a "beneficial use" restriction, established through court decisions and subsequently codified in 1879 as Article X Section 2 of the California Constitution, incentivizes water rights holders to use their entire allocation during wet years, lest they lose their rights. If this requirement were removed—or at least expanded to include storage for later use—water rights holders would have incentives to store some of their water (for example, in underground aquifers) and either use it or sell it during dry years.

2. Bureaucratic control. In 1914, the allocation of new water rights was put in the hands of a government regulator now known as the State Water Resources Control Board (Water Board). One of the main motivations for establishing the Water Board was a concern that water rights had been allocated in an arbitrary and uncertain manner, based on inadequate analysis of water availability. The Water Board was supposed to ensure that allocations were made more scientifically. Yet, recent research shows that the number of water rights allocated since 1914 is about five times the amount of water the state receives in an average year.⁵ Rather than being part of the solution, the Water Board is now part of the problem.

3. Public sector ownership of water rights. The vast majority of water rights allocated since 1914 have gone to various federal, state and other government agencies—the largest share of which is held by water and irrigation districts.⁶ These agencies lack incentives to ensure that the water is utilized in the most effective way possible. The price they charge for water is often lower than the price that would emerge through market transactions, resulting in waste and uses that might not always be the highest value (such as growing alfalfa in the desert). Government agencies also lack appropriate incentives to make cost-effective investments in water storage and conveyance, and they charge arbitrary prices for those services.

4. Government restrictions on water trades. The price of water varies considerably from one part of California to another in large part because transfers of water, even when they are in principle possible, have been limited by various regulatory agencies. The problem is particularly acute when those transfers would involve federal agencies (whether as seller, buyer or conveyer), since all such transfers are subject to permitting under the National Environmental Policy Act (NEPA). Given that it can take years to obtain a NEPA permit—if it is issued at all—most short-term trades are simply impossible.

5. Mandated allocation of water for “environmental” uses at a zero price. State and federal agencies have decreed that nearly half the state’s water should be allocated to “environmental” uses. The main driver has been two decisions by the California Department of Fish and Wildlife, each requiring tens of millions of gallons of water to be diverted into the Sacramento-San Joaquin delta instead of being used for irrigation.⁷ Another significant driver is the required diversion for “Wild and Scenic Rivers” in Northern California.⁸ The problem is not the use of the water for environmental uses per se; it is that the uses have been mandated, rather than being voluntary, and existing water rights holders have not been compensated for these uses. As a result, water rights holders have even less incentive or ability to develop means of storing and transferring water.

California's water regime shares many characteristics with that of Australia's pre-reform: excessive centralization of control, over-allocation of rights, restrictions on trading, and conflicts between environmental, agricultural and urban water users. California can thus potentially learn much from Australia's reforms and their effects. Bennett adumbrates the three fundamental reforms that were implemented in Australia:

1. Separate water title from land title
2. Develop water markets
3. Allocate water for environmental flows

Building on these three reforms, six specific changes to the allocation and control of California's water that would enable the state to achieve similar successful reforms to those undertaken in Australia follow. If enacted, these changes would ensure that water goes to its highest and best uses, resulting in more equitable, efficient and sustainable use of water in the state. The first and second of these would help to establish clear, defensible and transferable title to water rights. The third and fourth seek to enable the development of water markets by removing existing barriers. The fifth is not directly inspired by Australia's reforms but is intended to enhance the effectiveness of reforms by creating stronger incentives for the sustainable management of municipal water. The sixth would help to achieve proper allocations of water for environmental flows.

First, remove the "beneficial use" requirement as it applies to water rights, or at least expand its meaning so that storage is permitted. As noted, this would incentivize water rights owners to conserve water during wetter years, so that it might be available for use during years of drought. Given the preponderance of dry to wet years in California, such a reform would seem to be a high priority.

Second, establish a quick, simple and inexpensive means of determining the actual amount of water allocated to each appropriative rights holder. Any such rights system must take account of the fact that the amount of precipitation varies from year to year, so rights should be shares of the total rather than absolute amounts. One way to do this might be to convert watersheds into private companies (along the lines of the old private irrigation companies) and allocate shares to all the existing private rights holders in accordance with their current nominal allocation and priority.

Third, remove bureaucratic restrictions on trading water. Currently, a whole range of restrictions on trades exists, many justified putatively on "environmental" grounds. But such restrictions fail to acknowledge environmental and other trade-offs that exist for different sources of water. For example, if instead of transferring water from central and northern California, municipalities in southern California build and operate desalination plants, the impact on resource use and aquatic species is likely to be considerable. The

point is not that moving water is “better” or “worse” than desalinization per se; it is that currently there is no way for the relative effects of the two alternatives to be properly considered because the restrictions on trade described above effectively eliminate the option of moving water. Once the existence of such trade-offs is recognized, it becomes clear that the removal of many of the existing regulatory restrictions on water transfers (for example, by exempting them from the requirement of prior authorization under NEPA) will actually enable those trade-offs to be better addressed.

Fourth, sell or lease the water storage, transfer and supply infrastructure held by state and federal agencies to private companies (which might be the watershed companies, or they might be independent companies that sell their services to those watershed companies). These companies would then have incentives to ensure that the infrastructure is maintained and improved, in order to be able to profit from moving water from one place to another.

Note that the objective should not be to maximize profits for the companies that buy the infrastructure; it should be to create incentives to improve supply at the lowest cost to consumers, so it is important to arrange the sale or lease in such a way as to achieve those objectives. In many places, production and supply of electricity has been “unbundled,” with mixed success. So, one important decision concerns whether to follow that model or to keep/re-integrate the supply infrastructure with water storage and ownership.⁹

Fifth, convert municipal water agencies into private, mutual companies. Such companies would then have strong incentives to charge a market price for water (and by structuring them as mutuals, prices would be determined by the shareholders, i.e. the users). In addition, they would have incentives to contract out the management of water infrastructure development and delivery to private companies that have relevant expertise. Tenders could be competitively bid, thereby ensuring sustainable access to water, even during droughts, at the lowest cost.

Sixth, end the practice of mandating diversions of water for environmental purposes and in its place introduce mechanisms that enable the purchase of water rights by groups concerned about protecting habitat and species. Money that has been allocated by the state and federal agencies for environmental protection and remediation (including endangered species protection) could then be used to match funds raised by private groups to purchase water rights. In addition to providing compensation to water rights holders—and thereby enabling them to invest in the development of alternate water sources, if they desire—this would incentivize environmental groups to identify the most cost-effective means of conserving species.

This last point is a most significant conclusion of Professor Bennett's analysis of Australia's reforms, in which he notes that changes to the management of "environmental" water have resulted in improvements but remain far from ideal. Initially, caps were imposed on the use of water for extractive purposes but, "this did not achieve the goal of allocating more water to the environment." In response, the government did two things: first, it subsidized water conservation; second, it created an agency that purchased water from other users and reallocated it to environmental purposes. While this was certainly an improvement, the agency charged with buying and reallocating water is highly centralized and does not necessarily allocate water to the environmental uses that citizens might prefer.

California can learn from Australia and go one better by decentralizing the management of environmental water to groups that have an interest in identifying the best use of that water. Those groups might continue to prioritize conservation of the delta smelt and native salmon species, or they might choose to use at least some of the water for other purposes. In some cases, environmental groups might even sell or lease water to agricultural or municipal users, if they believe the money thereby generated can be used more effectively for other conservation efforts.

Bennett notes that "Temperate Australia has a highly variable climate both seasonally and over decadal cycles. The result has been an ecology that is well adapted to fluctuations. River ecologies are no different. Hence, in dry times, the ecosystem is adapted to drying out. But irrigation crops are not. Hence in dry times, water stored in reservoirs is highly valued by irrigators and not so much in the environment. And in wet times, irrigators don't want more water, yet the addition of stored water may be highly beneficial to the environment. These opposite movements in relative value indicate the potential for strong gains from trade between irrigators and the environment."

California also has a highly variable climate, with frequent droughts and associated fires helping to shape its ecology.¹⁰ Changing land use patterns and the introduction of dams and reservoirs have affected the ecology in various ways. Given this history, it is not obvious that diverting water stored in reservoirs to maintain flows during droughts is ecologically preferable to allowing the riverbed to dry up. Indeed, the evidence suggests that such diversions are likely harmful.¹¹ Some environmental pressure groups have argued for the removal of dams altogether, in part in order to restore the natural flow of rivers and streams. If water rights were better defined and readily tradable, groups seeking to move California closer to a "natural flow" regime would be able to put their money toward that end. In some cases this might result, as in Australia, in the sale of water rights during droughts, in order better to replicate the low flow that would otherwise have occurred.

In many respects, California's government, the Water Board and other state and federal government agencies seem to be heading in precisely the opposite direction, asserting

increasingly centralized control over the state's water resources both above and below ground. This does not augur well for the sustainable use of the state's water, or for the peaceful resolution of disputes between competing users.

However, Australia was in very much the same boat in the early 1990s. Then, finally, in response to the evident failure of centralized control over water, it did the only thing left to do: it enabled the market to operate.

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Introduction

Australia is geographically large (around 80% of the area of the USA), spans latitudes between 10 and 44 degrees south, and has a wide range of climates, from tropical monsoonal through to temperate. The center of the continent is a desert. The majority of the nation's 23 million people live in the temperate south-east coastal belt, including its two largest cities, Sydney (population: 4.3 million) and Melbourne (4.2 million), which have typical Mediterranean climates characterized by cool damp winters and hot dry summers.¹²

In addition to the wide variability in climates across the country, Australia experiences periodic droughts interspersed with flooding rains. As a result of this spatial and temporal climatic variability, natural water supply conditions range from plenty to extreme scarcity, depending on location and time. Meanwhile, since European settlement in the late 18th century, human demand for water has increased dramatically, as a result of a combination of population growth, agricultural, mining and industrial uses.

Mismatches between water supply and demand over both time and space were historically met through engineering works, including dams and pipes that have enabled storage and diversion of water from inland and coastal rivers. However, over the last two decades, two factors have constrained this approach to expanding water supply in response to growing demand. First, there has been a growing recognition that the diversion of river flows to meet extractive demands had caused declines in the ecological health of many river systems. Second, a series of droughts, one of which (the "Millennium Drought") was among the worst in recorded history.¹³

This combination of rising demand for water, concern regarding the impact of declining availability of water for environmental uses and an all-time low in natural supply, created conditions for reform of the way water was allocated between competing users. This policy brief provides an overview of those reforms, which began in the 1990s, focusing primarily on the supply of water to the major urban centers of southern continental Australia (Sydney, Melbourne, Brisbane, Canberra, Adelaide and Perth) and the agricultural areas of south-east Australia, most notably the Murray Darling River Basin (a region of over 400,000 square miles covering much of the south-east of the country). The intention is to

offer insights into the kinds of reforms that might take place in other jurisdictions with similar climate and demand characteristics, such as California.

The brief begins with a description of the context in which the reforms took place. This is followed, in section 2, with an outline of the reforms themselves. Section 3 describes the results of the reforms. Section 4 offers some thoughts on the prospects for further reforms, and section 5 draws conclusions.

The Context of Reforms

Prior to the 1990s, state governments allocated entitlements to water for irrigation using an approach that was relatively consistent across all jurisdictions. Water use rights were tied to the title of the land on which the water was to be used, so there was little opportunity to transfer them to alternate uses or users.¹⁴ (In addition, some farmers retained “riparian” ownership of surface water flowing across or abutting their land and were permitted to make reasonable use of that water. But, as with the irrigation entitlements, these riparian rights ran with the title to the land.¹⁵)

Centralization of the power to allocate entitlements resulted in the politicization of such allocations. This, in turn, resulted in “rent-seeking”—i.e. the expenditure of (financial) resources by farmers and others seeking water allocations—and allocations intended to buy the votes of farmers. For decades, governments responded to these political incentives by committing public funds to infrastructure projects and then allocating water use licenses to favored parties. The consequence was a massive over-allocation of water rights, which contributed substantially to the deterioration of the health of the nation’s rivers.¹⁶ The price the government charged agricultural users for water also failed to reflect its scarcity, thereby effectively subsidizing irrigation and ensuring that irrigators had little incentive to use water efficiently.

The 1990s and 2000s saw a prolonged period of dry conditions across much of southern Australia, capped off by two separate El Niño events in 2002–03 and 2006–07.¹⁷ The consequences were dire for rural and urban communities alike. Farmers dependent on irrigation had to rely on severely diminished access to their water entitlements and city-dwellers saw the imposition of stringent water restrictions. The media featured images of dried out wetlands and stands of dead River Red Gum trees along the Murray River. In response, the national government instituted numerous reforms in an attempt more effectively and sustainably to reduce the mismatch between supply and demand.

Part 1

The Reforms

In 1994, federal and state governments agreed at the annual Council of Australian Governments (COAG) meeting to initiate reforms in the irrigation sector to:

1. Separate water title from land title;
2. Develop water markets; and,
3. Allocate water for environmental flows.¹⁸

The process of title separation proceeded smoothly and was greeted by the irrigation sector with limited disquiet. The ability to trade entitlements was beneficial to both buyer and seller and a new sector in the rural sector emerged: the water brokers.

Environmental Water

The allocation of water for environmental flows was not so smoothly implemented. Initially, “caps” were set on the allocation of entitlements for extractive uses. However, this did not achieve the goal of allocating more water to the environment. In the river basin where most of the demand pressure was being felt—the Murray-Darling Basin in southeastern Australia stretching across the states of Victoria, New South Wales (NSW) Queensland and South Australia—the federal government then adopted two complementary approaches to re-allocate water from irrigation to the environment. First, it allocated public funds to subsidize the installation of water-saving irrigation systems (e.g. drip systems to replace flood irrigation) and improve water delivery systems (e.g. open irrigation canals were converted to pipelines to reduce “transmission losses” from evaporation and seepage). Second, the federal government created a new agency—the Commonwealth Environmental Water Holder (CEWH)—which purchased entitlements from existing irrigators. Neither the infrastructure subsidies nor the buy-back scheme were subjected to cost benefit analysis, with the amounts of public funds dedicated to the tasks being determined primarily on a political base.

The subsidies for water efficiency improvements were welcomed by irrigators. However, the water rights purchases were more divisive. Those irrigators who sold their entitlements

were satisfied. But those who did not sell and others with businesses in irrigation districts were much less supportive. Remaining irrigators feared an extra burden of system maintenance costs because those fixed costs would be spread over fewer contributors, despite the existence of regulations that such charging could not occur. With fewer customers, regional businesses feared loss of livelihood and diminished access to services as rural communities shrank. Rowdy public meetings and bonfires of copies of the Murray-Darling Basin plan (the document containing details of the above-mentioned approach) were the result. Nonetheless, the government pressed on with its reform agenda.

Urban Water

The concurrent changes in urban water allocations hardly deserve the label “reform.” They are better referred to as supply expansions. Most cities had already installed water meters and were charging for volumetric water use by the 1980s. However the prices charged for water were regulated by independent advisers to government to be more in line with the engineering costs of supply rather than to reflect opportunity costs or the marginal value of the water.

By the turn of the century, water rationing measures, such as restrictions on types of use (such as washing cars and watering lawns) and times of day/week when watering was allowed (typically between 10pm and 6am and/or on every second day), were prevalent in all southern capitals. Media outlets broadcast announcements regarding the remaining volumes in reservoirs. Free timing devices were even distributed so that people could monitor and restrict the time they spent showering. As the dry period extended further and further, reservoir levels dropped to the extent that emergency provisions were planned and longer term supply expansion projects were fast-tracked.

Primary among those projects was a sequence of desalination plants in the major capitals. In addition, waste water recycling schemes were initiated and subsidies for small-scale, household-based supplementation investments (e.g. water tanks) were introduced. Households were also given subsidies for water-saving devices such as low volume shower heads.

Only one of the drought-affected cities, Canberra, planned to expand its reservoir capacity to improve supply security by raising the height of one of its supply reservoir dam walls. All the other cities were unwilling to confront the environmental lobby groups that decry the loss of habitat caused by catchment inundation.

Three cities (Melbourne, Adelaide and Canberra) took advantage of the water reforms underway in the rural sector to purchase water from irrigators so that it could be diverted to

urban areas. To enable the diversions, significant additional infrastructure was required in Melbourne and Canberra. The schemes proceeded smoothly in Adelaide and Canberra but in Melbourne, the threat of loss of water for irrigation resulted in farmers protesting in the streets outside state parliament.

Thanks largely to a sequence of relatively wet years following the Millennium Drought, irrigators have been able to gain access to their full entitlements of water for their crops, city people have been relieved of most water restrictions, and riverine wetlands have revitalized.¹⁹ The desalination plants were either mothballed or operated at maintenance levels, only having been completed largely after the drought had receded. Such is the cyclical nature of Australia's climate.

Part 2

Reform Results

The use of water for irrigation in the Murray-Darling Basin has been transformed due to the property rights regime change. Separating water rights from land title and the development of a robust set of institutions within which trade could take place has seen a number of impacts. These were analyzed in 2010 by the National Water Commission (NWC), a federal government agency specifically established to oversee the water reform process.²⁰

Economic modeling commissioned by the NWC estimated that the nation's GDP in 2008–09 was enhanced by AUD220m as a result of water trading. Much of this improvement arose because gains from trade were secured as lower value users of water sold rights to higher value users. As more and more irrigators became accustomed to the possibilities afforded by water trading, the extent of trade, and consequently the gains from trade have expanded. Trades in water allocations (the seasonal “leasing” of an entitlement) increased from 537 gigaliters (GL) in 1998–99 to 764GL in 2007–08.²¹ Initially, there was only weak trade in entitlements themselves (known as “permanent trades” even though they can be sold). For example only 36 GL of entitlements were traded in 2006–06. However this type of trading has subsequently expanded to account for 388GL in 2007–08.

The nature of these trades has varied over time. For instance, at the height of the drought, dairy irrigators sold allocations to enable the purchase of fodder from less drought-affected areas while orchardists and wine grape growers bought water in order to keep their asset base alive. Sellers received cash injections to manage the difficult times and buyers were able to save their long-established plantings. As the drought has receded and an oversupply of wine grapes has emerged, wine grape growers became water sellers.

This changing pattern of use illustrates the flexibility afforded by trade. Irrigators are better able to respond to seasonal variations in water availability but also to external factors such as changing commodity prices and government policies. As a result, farmers in the Murray-Darling Basin have benefited from better cash flows, better debt management and better risk management.

While water trading did not immunize irrigated agriculture against the effects of drought, it provided much greater flexibility to deal with it. Hence, the costs of drought were significantly reduced compared to what would have been the case without trade.

Much of the disquiet in irrigation-dependent regions regarding the potential for negative consequences of water trading has also been dissipated. Associated non-farm businesses that had feared losses in trade as water left their region have found that the increases in water use efficiency afforded by the government-subsidized investments on farm have enabled productivity improvements. More generally, the increased production resulting from water trading has also seen regional centers growing rather than contracting as feared. Structural change in the irrigated agriculture sector has occurred but cash injections from water sales have helped to cushion the impacts. But even more significantly, the farming sector has demonstrated a strong adaptive capacity. Where losses have occurred, they have not been of the magnitude anticipated because other opportunities have been taken. In some cases, water trading has merely accelerated structural changes that were already underway and cash flows from entitlement sales have been an important buffer.

The reforms in the agricultural sector also had environmental impacts. First, the increased price paid for water allocations meant that farmers had stronger incentives to improve the technical efficiency with which they used water. For instance, in the Goulburn Valley irrigation scheme in Victoria, the price per mega liter (ML) of temporary water allocation increased from AUD50 in 1997–98 to AUD702 in 2007–08. Murray River water in South Australia went from AUD22.50/ML to AUD679/ML in the same time period. The price of temporary allocations is, however, not a complete indicator of the impact of reforms over the long term. The price differential between 1997–98 and 2007–08 in temporary trade prices reflected the impact of short-term climatic variations, in this case, the incidence of drought. A better indication of long-term price change comes from trades in permanent entitlements. The price per ML in the Goulburn River system for example went from AUD450 to AUD1602 in the decade from 1997.²²

An important impact of this price rise was the substitution of capital (both physical—such as the use of computerized monitoring and delivery systems—and human) for water as the relative price of water increased. That meant less irrigation-induced salinity and also more water available for sale to the CEWH.

The impacts of the purchases of water for the environment are more complex to assess. The CEWH has been active in providing environmental flows throughout the Murray-Darling Basin but it is difficult to tease apart the impact of those flows from those that have occurred because of the breaking of the drought. The relationships between flows—defined in terms of extent, duration and timing—and the environmental condition of the rivers and their floodplains have yet to be well understood. Nevertheless, a monitoring

program conducted by the Murray-Darling Basin Authority will allow for an improved understanding, which in turn will enable the refinement of the overall level of allocation and the ways in which the water is used.

In the cities, improvements in supply infrastructure came on line after the breaking of the drought. Hence, their impacts are also difficult to assess. It is clear however, that the measures taken to deal with the drought in the absence of supply expansions were very inefficient. For instance, the costs associated with water savings achieved through subsidizing water-efficient shower heads and household water tanks were higher than alternate supply options, such as purchasing from water from irrigators.²³ For instance, household rainwater tanks provide water at a cost of AUD5.60 per kiloliter and non-potable water recycling costs AUD6 per kiloliter. This compares with AUD1.30 per kiloliter when water supplies are purchased by urban users from irrigators. Similarly, the cost per liter of supplying water by desalination is higher than alternatives. The Productivity Commission estimated the cost of Melbourne's 150 GL desalination plant at an initial cost of about AUD3.5 billion.²⁴ Recent estimates have put the cost of continuing to operate the desalination plants in Sydney on "stand-by" mode at AUD500,000 per day.²⁵ Older estimates from Marsden Jacobs Associates put the cost of desalination at AUD3.00 per kiloliter.²⁶

Furthermore, the costs of water use restriction, while difficult to estimate, were nonetheless significant. Avid gardeners tried to maintain their displays by carrying buckets of water when hose watering was banned. The famed "bucket-back" complaint resulted in brisk business for chiropractors. One confrontation between two Sydney-siders regarding water restrictions left one of them dead from a heart attack.²⁷ Yet despite these and other costs of inconvenience, public support for universal water restrictions remained strong throughout and even after the drought. The egalitarian ethic prevailed, requiring all to bear the same imposition resulting from the drought even though the water restrictions had very different impacts on different people. For instance, people living in apartments bore no cost as there were no restrictions to indoor water use, while garden lovers suffered a lot. Put simply, some very low value uses of water continued throughout the drought while other high value uses of water were stopped. For example, some people continued to have very long showers while others saw their prize roses wither and die.

With continuing population growth in the major cities and concomitant expansion of cities beyond their historic limits, urban water demand is continuing to grow. Water supply authorities are thus still working to expand supply through new schemes such as waste water recycling. Very little attention is paid to managing the demand side of the picture. This is despite the cost difference advantage offered by demand management. Marsden Jacobs and Associates (2006) estimate the cost of an additional kiloliter of water supplied through demand management at AUD1.45 (compared to recycling at AUD6).²⁸ Prices are

set bureaucratically by state-based independent tribunals where the focus is on recovering the short-run and long-run marginal costs of supply. The price-setting structure thus is not targeting a demand management role for price and the price-setting process is so codified that flexible, fast changes in price to reflect changes in supply or demand conditions are impossible.

Part 3

Prospects

Significant progress has been made in the use of water in the irrigated agriculture sector through the precise definition of water titles and the stimulation of conditions for trade. That progress has been well documented and is widely accepted as positive. Irrigators have become increasingly familiar with the mechanics of water trading and the opportunities it provides them. Internet-based electronic trading systems have become standard fare. Water is now seen as a farm input much the same as fertilizers and seeds as well as a significant capital asset to be managed accordingly.

However, the situation with water use for environmental flows and for urban domestic purposes is less clear. Opportunities for improved water use efficiency remain to be taken to their full advantage. The advances in irrigated agriculture water use efficiency were largely generated because of farmers being able to trade with each other. Gains from trade were made when lower valued uses made way for higher valued uses. The same logic in principle applies to water use within environmental use and urban water use. It also applies to trades between the three sectors. Unfortunately, these gains from trade remain largely unrealized.

Consider urban water use. During the drought there were clearly large differences in the value of water held by different people in cities. The potential was for those who value water relatively highly to access more of the available water and those with relatively lower values to give it up. This type of exchange could have been achieved through the removal of water restrictions and increasing the price of water until the overall demand was equal to the amount available for release. Those with higher values would have been willing to pay more and so would have accessed the water while those with lower values would have decided not to buy as much water.²⁹

One possible alternate system of allocation that may not be so sensitive to criticisms of inequity would be to assign each household a “quota” for their water use. Those who want more could trade in “quota” to access more with those who don’t want as much as they were allocated.

In either system, trade would reallocate water so that its overall value in use was maximized. In the first, priced-based system, setting the price becomes a focal point.

Prices, which emerge through trade between willing buyers and willing sellers, transmit information regarding the relative scarcity of the water resource. However, for prices to take values that result in efficient use of water (or indeed any resource), it is necessary for the water being exchanged to be subject to well-defined and readily defensible property rights, as well as few if any restrictions on exchange. Under such circumstances, competition typically emerges between buyers and sellers, thereby ensuring that a “market” price emerges.

But in the case of urban water, there is rarely any competition between sellers of water; such competition is precluded either by direct political control of the urban water supply or by the regulation of urban water infrastructure companies. One way to overcome this problem would be for cities to have multiple sources of water, each owned by separate competing entities, as well as multiple “retailers” of associated utility services.³⁰ Buyers would then have the freedom to contract with any of a range of alternate suppliers. Electricity and telecommunication service markets have moved significantly in this direction and water could readily follow. The result would be a water price that would respond to supply conditions (droughts and flooding rains) and send accurate signals of relative scarcity to consumers who could respond according to their preferences. Hence, with the onset of dry conditions and forecasts of an El Niño event, water prices would start to rise as reservoir levels began to fall.

For price to have an effective role as a scarcity signaling device, information regarding the price and its fluctuations would need to be much more readily available than it is currently. Most water users don't know the price they are paying for each liter of water they use, and usually price information is only transmitted retrospectively by quarterly water bills. This could be remedied by regular media announcements of water price changes or, ideally, signaled electronically to read-outs in each household.

The biggest impediment to price taking on a stronger role in rationing water demand as scarcity increases appears to be one of equity. Public disquiet emerges when it appears that the poorer households in the community are going to be forced into paying more for water. One potential solution to this criticism is to structure a two-tiered system where a “base load” of water—sufficient for the fundamental needs of a household (adjusted to account for the characteristics of that household)—is allocated free of charge. The pricing system only comes into effect when household use exceeds that minimum threshold.

Trade and competition have also failed to emerge in the environmental uses of water. The majority of water for environmental flows is held by government and distributed at the discretion of a monopoly supplier, the CEWH, based on a series of criteria established by legislation. This is a system fraught with inefficiencies. Like any monopoly, the CEWH is likely to be costly to operate and inflexible to the demands of its customers (those who

enjoy the environment). As a centralized agency, information flows regarding possible environmental advantages that could be achieved by allocating additional water—say, to a wetland—are slow. Cumbersome bureaucracies are then slow to act, especially as the knowledge they hold is not necessarily “localized.” Being able to know where the highest value uses for environmental water are at any point in time is an information-rich task and one that a bureaucratic monopoly will find hard to achieve.³¹

One alternative is to break up the CEWH monopoly and reallocate its water entitlements to a myriad of local environmental trusts dedicated to the health of their part of the river system. Ownership of entitlements would provide opportunities for trade between the trusts. This could generate gains from trade in entitlements—both temporary and permanent. For instance, if in one part of the river basin, the environment has experienced a good season, the local trust may decide to sell some of its allocation to a trust where conditions have not been so good. Both parties would be better off from the trade. The buyer would have secured water perhaps to see enough water kept in a wetland to allow the completion of a bird breeding event. The seller would have generated a cash reserve so that he could buy allocations when conditions required it to maintain ecosystem health.

Trade in water should not be viewed as only being possible within the same categories of water users (e.g. trade among urban users or trade among irrigators). Gains from trade can also be enjoyed from exchanging water entitlements between water use sectors (e.g. trade between urban users and irrigators). Because there can be bigger differences in the marginal values of water use between sectors than there are within them, inter-sectoral trades can generate even larger gains. Evidence of such gains was observed during the Millennium Drought when Adelaide, Melbourne and Canberra water supply authorities entered irrigation water markets to boost the urban water supply. Urban water users demonstrate higher values for water than irrigation farmers. Again, the exchange between buyer and seller makes both parties better off. Often, geographic separation of water supply systems for the different categories of users makes inter-sectoral trade complex: New infrastructure may be required to make it even possible, as was the case with the Sugarloaf Pipeline that diverts inland irrigation water to coastal Melbourne’s urban supply.

Trade has also commenced between irrigation use and environmental flows. Initially, the CEWH entered irrigation water markets to secure their holdings. However, with its asset bank across the Basin predominantly full, the CEWH has embarked on the occasional sale of water allocations (seasonal leases) to irrigators. The rationale is that when the riverine environment is sufficiently healthy without the use of its entitlements, the CEWH can sell allocations to irrigators in order to establish a cash reserve. When seasons are such that the CEWH wants more than its available entitlements, the cash reserve can be used to buy allocations from irrigators.

The nature of the Australian ecosystem is that such trades between the environment and irrigators could generate gains from trade on a regular basis. Temperate Australia has a highly variable climate both seasonally and over decadal cycles. The result has been an ecology that is well adapted to fluctuations. River ecologies are no different. Hence, in dry times, the ecosystem is adapted to drying out. But irrigation crops are not. Hence in dry times, water stored in reservoirs is highly valued by irrigators and not so much in the environment. And in wet times, irrigators don't want more water, yet the addition of stored water may be highly beneficial to the environment. These opposite movements in relative value indicate the potential for strong gains from trade between irrigators and the environment. The prospect then is for local environmental trusts that own water entitlements to be regularly engaged in trades with irrigators with day-to-day and week-to-week variations in conditions triggering movements of water allocations between the alternate uses.³²

Trade and competition between users from across all sectors would deepen the emergent markets for water entitlements and allocations. The greater flexibility to manage variable conditions, both physical and social, which has been observed in the markets for irrigation water, would be extended into the urban and environmental sectors. Gains from trade would be witnessed in terms of increased GDP in irrigated agriculture, lower overall urban water costs and healthier riverine environments.

There is no way that the reforms proposed here will “drought proof” Australia. That is an impossible dream given the highly variable nature of the continent's climate. However, what the proposed reforms would allow is for the allocation of an increasingly scarce natural resource to generate the best outcomes that are possible given the constraints imposed by the climate.

Part 4

Conclusions

As described above, the evolution of water markets in Australia has proceeded apace over the last few decades in response to the increasing conflict between increasing demand and limits on available supply. In the agricultural sector, the allocation of available supplies has been significantly reformed, particularly in the nation's largest river basin, the Murray-Darling Basin. Reforms have focused on a push toward the introduction of an allocative system based on freely tradable property rights or "entitlements." Trading in water for irrigation has taken the place of inflexible regulatory allocation. The change transformed the sector and delivered significant efficiency dividends.

However, governments have retained ownership and management of the major irrigation dams. Privatization of these key pieces of infrastructure would improve accountability and result in more efficient pricing and allocation.

Reforms in the management of water in urban contexts have been less dramatic. Supply has largely remained a public sector responsibility and concerns continue to surround the efficacy of supply expansions and shortage rationing strategies.

Similarly, allocations of water to meet "environmental flow" demands remain questionable, given that they were initially made by governments on limited scientific and economic knowledge. In particular, the relationships between additional flows and subsequent environmental conditions are not well understood, and even less is known regarding society's values for any resultant environmental improvements.³³ Furthermore, the subsequent management of environmental flows has become the responsibility of a new public sector bureaucracy raising questions as to the efficiency of on-going environmental water allocation processes and decisions.

Given that numerous challenges remain in Australian water management, especially in the management of environmental and urban water, there remains much to be done. How further progress is to be achieved remains an open question given the public fears regarding the further insertion of markets and prices into the management of water. Reluctance to change has also been encouraged by established water management authorities. Their vested interest is to maintain or strengthen the status quo of centralized control. Encouraging competitive markets by the splintering of those centralized agencies

into competing supply corporations would mean reduced power and greater operational challenges.

The certainty is that further droughts will occur in the future. Given that current management strategies, especially in the urban sector, are not focused on demand management, water shortages are bound to occur again. Perhaps in the next round, there will be sufficient public support and hence political will to take the next major steps on the water reform pathway in the urban context.

In the interim, some smaller steps can be taken, particularly in trade between the sectors. The initial trades between irrigators and the CEWH are encouraging in that regard. Pursuing that further by the transfer of the CEWH entitlements to local water trusts would be highly advantageous.

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Endnotes

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- ⁹ See e.g. the various reports produced by Reason Foundation over the past 20 years: <http://reason.org/news/show/a-guide-for-divesting-governme-1>; <http://reason.org/news/show/127615.html>; <http://reason.org/news/show/infrastructure-outsourcing>
- ¹⁰ See for example the papers in last year’s symposium on the subject held by the Ecological Society of America: <http://www.esa.org/esa/history-of-fire-and-drought-shapes-the-ecology-of-california-past-and-future/>
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to competition from invading species that lack adaptations to extreme flows. Although life-history strategies can sometimes evolve rapidly in response to novel conditions (in as few as 13 generations for some fish), adaptation in response to a human altered flow regime remains to be demonstrated for any species.” (David Lyttle and N. LeRoy Poff, “Adaptation to Natural Flow Regimes,” *Trends in Ecology and Evolution*, 2004, pp. 94–100.)

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