

WATER POLICY IN AUSTRALIA: OLD DILEMMAS AND NEW DIRECTIONS

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Introduction

Australia has a tradition of vigorous public debate on water policy that belies the limited water resources of the country on any world scale. Professional discussion of water policy is sophisticated, as witness the essays in a book edited by Lin Crase (2008a). The debates and discussions have been sharpened recently with a severe drought in south eastern Australia where most Australian irrigation is located. Nevertheless, the widespread perception that water policy issues are of fundamental importance to Australian society and the economy is debatable. Frequent assertions that Australia faces a water 'crisis' are out of kilter with reality, however much fears about water have captured popular imagination.

Australia has abundant water resources in relation to its (small) population. Australia does not have problems of water quality for urban residents. Consumption of bottled water by the young is an affectation not a necessity. Despite a century long political infatuation with irrigation, the dry land farming areas of Australia are more than adequate to satisfy the food requirements of the local population. The small share of agriculture in the contemporary Australian economy should mean that problems surrounding irrigation could be readily tackled. Like other rich countries, however, the politics of agriculture and water turns out to be convoluted and difficult. Many water policy issues remain intractable.

The Australian debate over water policy is probably at its most useful when it provides insights that are relevant in countries where the stakes are higher. In countries like China and India, water shortages and associated environmental damage could impose a check to economic growth. Recent Australian successes and failures in implementation of water policy innovations might be of wider significance. Examples include permitting trading of irrigation water, regulation of water prices, and various experiments in environmental management and institutional arrangements.

Ultimately, although it is seldom explicitly stated, or perhaps recognised, frequent changes in policies and institutional arrangements for water in Australia reflect a belated quest for a modest contraction of an overstretched and over-allocated irrigation system that is the legacy of previous political excesses. While the recent history of Australian water policy exhibits ingredients of genuine reform, there are manifestations of recidivism and/or nostalgia for an unhealthy past. Age-old problems are resurfacing in new guises. Previous reckless expenditure on irrigation without proper evaluation is being repeated with ill-judged expenditure on projects intended for water saving and environmental remediation.

Not just an impressionistic, chronological or anecdotal account is needed. Behind the superficialities of day-to-day events in Australian water policy lie some conundrums of economic theory and policy that apply elsewhere. It is these shared conundrums that give Australian water policy its broader significance. Water infrastructure is characterised by natural monopoly. Irrigation has public, private and common property aspects. There are unpriced environmental services provided by waterways. Combining technical and economic information in the selection and sequencing of environmental projects is not straightforward. Subtly, there are stock/flow issues to be contemplated once water is stored and redistributed in time and space. All these features make rigorous consideration of the appropriate roles of government and the private sector a central issue of water policy. The intricacies of water policy are ill suited to romanticism and preconceived solutions that ignore local circumstances. Instead, detached analysis and careful empiricism are required.

When government action is required, decisions are needed as to which level of government should be involved: national, state (provincial) or local. And how actions by different levels of government are to be coordinated. The hierarchy of government control has to be matched with responsibilities for raising revenue and project selection. Australia is a federation with division of powers and responsibilities for taxing and spending. Cost shifting – literally, buck passing – between tiers of government is rampant. Arguably, ambiguous roles and conflicts between governments have made it easier for irrigators to avoid what should be private obligations to maintain the irrigation system and minimise environmental damage.

The economics of urban water infrastructure and supply is mainly determined by geography. The efficacy of various proposals for recycling wastewater and desalination are location-specific, even though this feature of urban water is often ignored in Australian discussions and actions by governments. Uniform solutions are proposed for cities with different climatic, demographic and hydrological features. There is more commonality between countries in the economics of irrigation. Apart from brief remarks in the next paragraph and an example of how urban water users in Victoria are supposed to benefit from water savings in irrigation, this account concentrates on issues arising from Australian irrigation.

Water is now scarce in almost all Australian urban areas. Restrictions apply to water use outdoors for gardening, washing cars and driveways that are deemed non-essential. The scarcity of urban water should be attributed to the policy milieu not water shortage as usually understood (Productivity Commission 2008). Under-investment in infrastructure has occurred over years for a raft of reasons, including the reluctance of government-owned entities to take on debt to fund long-lived investments. Australian governments have also succumbed to the green hair shirt views of those who oppose new dams in all circumstances. From another direction, political resistance to transfer of water from irrigation to urban areas has proved effective. Restrictions are not the only consequence of the urban water shortages brought about by past under-investment and compounded by low rainfall. Most Australian cities are contemplating desalination plants, along with encouragement of private storage in rainwater tanks and elaborate recycling schemes. All these panicky policies are increasing costs of water to urban households and businesses, not to mention the inconvenience of quantity-based restrictions on the use of urban water. Older people who like gardening and children who enjoy sport are the main sufferers from the failures of Australian urban water policy.

Water shortage in irrigated areas is compounded by the ongoing drought, not unprecedented for Australia but up there with the most serious recorded since European settlement. The poor public policy of the past is catching up with new generations of irrigators and politicians. The notion of Australia having a mature rural water economy – rapidly increasing costs and environmental damage as extractions from rivers for irrigation press against sustainable yields – first highlighted by Watson and Rose (1980) and Randall (1981) was slow to be taken seriously. The existence of the mature water economy should be regarded now as one of the received truths against which the adequacy of water policies in Australia should be judged; a fortiori, in the context of climate change.

Prima facie, as analysts from Campbell (1964) and Davidson (1969) onwards have argued, irrigation is unsuited to Australia's resource endowments – with land abundant, and labour and capital scarce. Irrigation is labour intensive. Markets for many Australian irrigated products are limited by transport costs. Such observations are reinforced once the extreme variability of the Australian climate is accounted for. Much greater investment in irrigation headworks is required to store water for irrigation than other countries (Cruse 2008b). Irrigation was developed carelessly in Australia for mainly social reasons with the emphasis on settlement rather than thinking through the consequences of Australia's unique hydrology for the economics of irrigation. Modern concepts of risk management were not on the radar.

Further exacerbation of water shortages in the era of the mature water economy has followed from the consequences of the hydrological cycle, broadly considered. Increased groundwater extraction, greater investment in farm dams for supplementary irrigation, regrowth after recent severe bushfires, investment in water saving diminishing return flows, plantations in upper catchments have all reduced the amount of water available for irrigation and environmental purposes (Young and McColl 2008). This has placed further strain on water planning and regulatory processes. Reconciling the hydrology, the economics, the history and the ecology of Australia's river systems is an intellectual and political challenge.

Disputes between governments over water policy have been acute in Australia in the last couple of years. Conflicts between the organized environmental movement and the irrigation industry have also emerged in the last decade. The details, parochialism and banalities of the disputes are unlikely to be of much interest to an international audience. Nor for that matter have the fixed positions and posturing of politicians and lobby groups been much help in resolving the issues in Australia. Of more interest are questions of economic principle and public administration that should inform the issues in contention in Australia and elsewhere. How should we define and resolve the associated empirical issues? Three related issues suggested by Australian experience are tackled in succeeding sections of this paper.

First, what should be the organizational arrangements for rationalising public, private and common property in irrigation? Second, what are the roles of investment in water saving or buyback of entitlements if it is concluded irrigation should be contracted in a mature water economy? Related to that question, what is the precise meaning of water saving given the physical and economic characteristics of water? An example of a proposed water saving initiative in Victoria is discussed. Third, what lessons can be learnt from the Australian experiment with water trading? A brief conclusion follows.

Organizational Aspects of Australian Irrigation

Political Machinations and the Search for Answers

Australia is engaging in an experiment in irrigation management. Not that the frequent comings and goings of government policy on water in Australia is acknowledged by those directly involved as being like an experiment. Successive government initiatives are announced as if governments continue to have all the answers. The now obvious mistakes that governments made in managing irrigation and closer settlement in the past are politely and conveniently over looked. In reality, poor public management over decades is the inconvenient truth of Australian irrigation. Even if most of the decisions taken were a reflection of once widely shared public attitudes, the harsh fact is that they were hasty, ill considered and wrong (Watson 2007).

Policy and administrative changes still appear to be made in a piecemeal, opportunistic and shoddy fashion ignoring professional opinion and public service advice. This is true of both Commonwealth and state governments. There is no clear statement of policy objectives. Nevertheless, it is possible to understand better the past and present intentions of politicians and their advisors by examining the interplay of ideas and interests concerning Australian irrigation.

It is easier to engage in political posturing and constantly revise administrative arrangements with seemingly endless negotiations and consultants' reports than it is to face up to the Realpolitik of the mature water economy, and the 'real science' as well. Nevertheless, patience is needed to unravel past mistakes. Not as long, perhaps, as the almost fifteen years it took to negotiate the original River Murray Waters Agreement early in the twentieth century following Australian Federation.

Australia now has two opposing vocal and influential alignments in the forefront of the political debate over irrigation. There is an entrenched group of irrigators resisting change, not surprisingly thoroughly convinced of their own rectitude, given previous experience of government subsidisation and support in the era of irrigation expansionism. As pointed out by Crase (2008b), the pursuit of national development via irrigation has 'bred a form of agrarian fundamentalism that spread beyond agricultural communities -- many metropolitan constituents remained convinced of the nobility of agriculture and struggled to conceptualise the finite nature and fragility of water resources.'

The other influential group, of more recent origin, is the campaigning wing of the environmental movement, who are not always aware of, or willing to admit, the complexities of assessing environmental damage and the costly and difficult path to environmental remediation. Their opposition to the status quo is different in character from earlier critics of irrigation in Australia whose attitudes were based on the fiscal costs of government support to irrigation and the legacy of low income and adjustment problems left by settlement schemes in irrigated areas, rather than the environmental consequences of irrigation. A serious research effort and professional literature exists on environmental policy in Australia (Bennett 2008, Hillman 2008) but dispassionate analysis struggles for a hearing confronted

with the denials of the pro-irrigation lobby and the simplifications of parts of the environmental lobby. These radicals overwhelm the more refined peak organizations of farmers and conservationists who are not exciting enough for journalists and politicians. With rare exceptions, the standard of journalistic commentary on water policy in Australia is poor, lacking rudimentary understanding of the geography and history of water use and irrigation. Journalists are even troubled by water measurement.

What the pro-irrigation lobby and the politically active group from the environmental movement have in common is a shared mendicant, almost predatory, attitude to financial support from government. Government (taxpayers) are expected to support their objectives with grants-based funding from public revenue, as of right. A growing body of evidence from public audit agencies that Commonwealth and state support for environmental projects are wasteful and ineffective is ignored (Pannell 2008). The rationale for favouring grants-based funding to all and sundry vis-à-vis traditional research-based public agencies is unquestioned. The old engineer-dominated state water bureaucracies of Australia have plenty to answer for but their constantly reconfigured replacement institutions are yet to bed down, to put it most charitably. Traditional water bureaucracies were stronger with respect to subject matter expertise in scientific disciplines necessary to manage water resources effectively than their successor organizations.

Central Direction?

In principle, land and water resources in Australia are supposed to be administered by the states not the central government. Section 100 of the Australian Constitution says as much. The Howard-Turnbull *National Plan for Water Security* of January 2007 intended to overturn established arrangements by giving more power to the Commonwealth Government, and most of the states agreed. The bait was the \$10 billion the Commonwealth intended to spend over ten years, mostly on modernising irrigation infrastructure. The subsequent change of government at the Commonwealth level has made little difference to these centralising tendencies although it remains to be seen whether the content of policy will change in the direction of more emphasis on buyback of irrigation entitlements with disciplined scrutiny of proposals for investment in on-farm and off-farm infrastructure, and environmental projects.

Cruse (2008b) has observed that 'current national policies broadly comprise a road map for a "trip back to the future."' And that 'the expansion of the water bureaucracy into farm-level decisions is reminiscent of the intrusive regimes of past eras, when engineers knew best and governments were driven by a sense of nation building.'

Central direction by the Commonwealth runs the risk that local differences will not be accounted for. For example, important differences have emerged between states in ownership of irrigation authorities. Some irrigation authorities were privatised in New South Wales with ownership passing to farmer shareholders. Victoria prefers to stick with government ownership and control of regional water authorities set up as state-owned corporations. Irrigation Trusts are common in South Australia. If the Commonwealth chooses to go down the route of investment in irrigation infrastructure, it will be negotiating with entities in the states with different legal structures, resources and bargaining strengths. Arguably, this is a recipe for rent seeking and favouritism.

Moreover, states have gone down different paths in the way climatic risks are managed via storage and allocation policies. Victoria has an enduring bias in its irrigation management in favour of perennial horticulture and dairying based on irrigated pastures. New South Wales and Queensland favour interruptible annual crops like rice and cotton that can be readily matched to variable water supplies.

The Commonwealth would do better to stick with the genuine issues of public policy for rivers shared between the states – the total amount of water abstracted from rivers, and off-site and downstream effects of irrigation – than become embroiled in the nitty gritty of the management of the Australian irrigation system; especially since they lack the technical expertise to do so. In a situation of uncertainty about the best steps to take in water policy, experimentation rather than the elusive search for national consistency should be encouraged. Some states and groups of irrigators will be more receptive to new ideas. Local circumstances differ. If policy innovations are successful in one state, others including the central government will follow. Diversity in ideas and policies is better than one shoe fits all.

Local Management of Irrigation

Recently there has been more interest in the local management of irrigation and of environmental issues associated with irrigation. This is a part of a worldwide phenomenon. Governments have sought to shift responsibility for irrigation management to irrigators. There is often an element of fiscal opportunism in advocacy of self-management of irrigation by governments. The fashion for irrigation management transfer coincided with a weak financial position of irrigation institutions and new priorities for government expenditure. Deteriorating irrigation infrastructure and the inability to collect sufficient revenue from irrigators to maintain infrastructure is a feature of many countries, not just Australia.

Australia is fortunate in that it has a comprehensive tax-transfer system capable of handling welfare issues affecting irrigators and others in irrigation areas following adverse events in irrigated industries, or changes in water policy. Equity issues are important but there is no need to compromise broader issues of environmental and economic policy for irrigation by attaching specific welfare measures.

Improved pumping technology and the advent of rural electrification around the world exacerbated open access problems associated with groundwater irrigation. Some form of collective action is required in groundwater management that emphasises the common property features of groundwater. Allowing common property resources to be treated as open access is the source of well-known ‘tragedy of the commons’ problems. While the empirical significance of problems in groundwater management is much greater for countries like China and India, Australia has a weak performance in taking the connectivity of groundwater and surface water into account when managing water resources (Evans 2007).

Scholarly interest in the impact of irrigation in human history reached its zenith in the writings of Karl Wittfogel on Oriental Despotism and Hydraulic Societies. Syme and Nancarrow (2008) point out that consideration of social factors associated with water is most evident when mismanagement of water has been linked to the failure of past civilizations and,

contemporaneously, conflicts within and between nations over water. Australian experience with disputes over irrigation pales into insignificance on a world scale. More accurately, the political dispute over irrigation in Australia is like bald old men fighting over a comb.

There is a lot of difference between traditional irrigation as practised in countries like India and Indonesia where elaborate rules for allocating water were established by consent over centuries and lands of recent European settlement like Australia where the state was intimately involved in the establishment of irrigation development, especially in the southern-connected Murray-Darling system. There was more private involvement in irrigation development of the Northern Valleys on tributaries of the Darling River that, in effect, had to wait until technical improvements in pumping and water harvesting technology were available. Government built the headworks but irrigators provided most of the other infrastructure. The remarkable variability of rainfall in northern New South Wales and Queensland has led to a quasi-hunter gatherer system of irrigation on large farms based on intermittent irrigation of annual crops (Frontier et al. 2008).

Important policy issues in the Northern Valleys are the effects of water interception on downstream towns and irrigators, and protection of ephemeral wetland systems. The Northern Valleys are not plagued with the chronic small farm and low-income problems of the old irrigation settlements of the southern-connected Murray-Darling system. This is another reason for doubting whether the Commonwealth Government can successfully manage the irrigation system in different parts of Australia. Many of these areas are remote and sparsely populated and beyond the reach of officials based in the national capital.

Be that as it may, the rigid management of irrigation and irrigators by State-owned water corporations until late in the twentieth century is the closest Australia has come to collective farming and casts a shadow over the political economy of Australian irrigation to the present day (Watson 2003). Irrigation was created in Australia through political patronage and remained that way until the last couple of decades. In the opinion of the writer, such facts of Australian political history make a mockery of attempts to depend on consultative mechanisms and cooperation with small local groups of irrigators to solve the environmental problems of Australian irrigation, at reasonable cost. In a different way, the past neglect of economic considerations in irrigation development challenges naïve ideas about applying 'full cost' recovery in water pricing that have been bandied about by officials in the era of water reform.

Optimism about farmer behaviour would be scarcely countenanced if the policy context were product markets where the ethos of grower control and orderly marketing of agricultural products has been exposed and roundly condemned in Australia as a euphemism for monopoly. Grower control is recognized as a barely concealed attempt to transfer income from consumers and taxpayers to farmers. Why would farmers' organizations behave differently if they were given substantial influence over public expenditure on environmental projects? A similar observation could be made about local involvement in spending public funds on irrigation infrastructure. In other countries, 'stewardship' and 'multi-functionality' have turned out to be agricultural assistance with other names.

The international fashion for self-management in irrigation expressed itself in Australia over the last decade or so with the establishment of catchment management authorities in all states. At first blush, catchment management is an odd organising principle for providing public good environmental services to land managers in an extraordinarily flat country. There is a lot of land between the rivers. In some states, catchment authorities extend over vast areas with gross differences in climate and farming systems, and with different non-water related environmental issues. Parnell (2008) and his collaborators have demonstrated convincingly that the research basis for selecting environmental projects by catchment authorities is inadequate. Subject matter expertise is spread too thinly. Spending the money available from whatever source as best they can, and then becoming enmeshed in bureaucratic procedures imposed by funding agencies, is the lot of catchment management authorities in Australia. The reality is a long way from the hopes of some that local collaboration via grass-roots organizations was the way to go in environmental management.

In their defence, the lack of independent sources of revenue condemns catchment management to a dependent status. Ideally, catchment management authorities would collect rates from local landholders and residents. Without independent revenue, catchment management is caught up in the crossfire of cost shifting and rivalry between the Commonwealth and state governments. Catchment management stands in an ambiguous relationship to advisory bodies set up by rural water authorities. Rural water authorities now rely more on local water service committees for assistance with water allocation decisions, environmental projects and compliance than did their predecessor organizations with their previous top down orientation.

Institutional arrangements for water, the policies followed by those institutions and the quality of their administration will always be contentions. Water is a complex resource with public, private and common property aspects (Marshall 2008). Regulatory, market and educational policies will need to be pursued simultaneously. Emphasis on private rights is not sufficient (Musgrave 2002). Often governments will only be able to achieve their objectives via financial inducements. This then raises issues of public accountability.

Water Saving: Reality or Chimera?

Further Background

Heightened concern with water shortages and the environmental effects of irrigation in Australia has come from several directions and brought forth various responses. The unusually long run of poor seasons has seen water storages in the southern-connected Murray-Darling Basin at record low levels, to the extent that even permanent horticultural plantings have been at risk in the last couple of years. There have been numerous indications of the increasingly deleterious environmental effects of irrigation. Increasing salinity has been recognised as a serious issue in Australia at least since the 1970s – for irrigated land, dryland farming and waterways. Of course, salinity has been an issue for irrigation since time immemorial, although apparently not enough of an issue for early Australian irrigation schemes to be developed taking account of timeless knowledge about the threat of salinity (Barr and Cary 1994). Hustlers were then in the ascendancy (and they still are). Parts of Victorian irrigation schemes were out of action because of salt damage within a generation.

The city of Adelaide relies on the Murray for much of its water supply. Water quality, and latterly water quantity, are serious issues for South Australia, The Murray-Darling Basin Commission, and its predecessor organization the River Murray Commission, have dealt with salinity via comprehensive monitoring programs and salt interception schemes. New developments have been restricted to less salt prone areas in the last fifteen years or so with zoning rules based on local government planning powers. All these measures should be regarded as successful. The test will come for salinity management if a return to wet years mobilises accumulated salt from land adjoining the river system.

From the early 1990s, it was generally accepted that the environmental problems of irrigation went beyond salinity and were even greater than previously acknowledged. A spectacular blue-green algal bloom over 1000 km long occurred in the Barwon-Darling River system in October and November of 1991. The mouth of the Murray River has been closed on several occasions in the last decade requiring expensive dredging. The Lower Lakes of the Murray and the associated Coorong ecosystem have been damaged. Red gum forests that rely on intermittent flooding have deteriorated. Native fish populations have continued to decline.

The spectre of long-term climate change has also influenced the debate over water policy. That recent climatic experience is a forerunner of long-term climate change reducing rainfall and runoff is widely accepted in official circles (Wong 2008a). While climate change obviously increases the sense of urgency, the first steps necessary in response to existing environmental damage should be much the same irrespective of the long-term situation.

Following earlier discussion in this paper, a defensible reaction by policymakers to the current drought and evidence of environmental damage would be to openly admit that there is already too much irrigation in Australia. This would help define the problem as one of reducing both the amount of irrigation water used and the number of irrigators. The strategy and time path of reducing the amount of irrigation would have to be determined. Questions of compensation would come into play. Instead, the almost universal official reaction to water shortages in Australia is to assert that irrigators could and should save water by using more efficient techniques of irrigation. What is more, governments have offered to pay for water savings. And this reaction is a reasonable summary of public attitudes and reflected in newspaper and television reports. A variant of the emphasis on water use efficiency (WUE) is the belief that the commodity composition of irrigated output should be modified so that irrigation water is used to produce high value commodities.

Water Saving – Financial and Hydrological

An official report by a leading Australian investigatory body concluded that it is difficult and costly to achieve water savings in irrigation by investing in off-farm and on-farm irrigation infrastructure (Productivity Commission 2006). Most professional commentators share this opinion. This is further evidence of the continuing gulf between public and specialist opinion on irrigation policy that goes back to the critiques of Campbell (1964) and Davidson (1969). The cult of amateurism in water policy plumbed new depths when Treasury advice on the Howard-Turnbull *Plan* of 2007 was not just ignored – it was not sought.

Some of the opposition to the mantra of WUE is related to differing views on the appropriate role of government and questions of who should pay. Making irrigators stand on their own feet has been official policy since the early 1990s. Government investment in infrastructure is contrary to that objective and is a return to the era of subsidised irrigation. What is supposed to happen when the infrastructure needs to be replaced? The already difficult task of price regulators of incorporating capital charges in the price of water is made more difficult if governments provide the capital for new infrastructure, especially when the investment has not passed rigorous investment tests.

Another objection to government involvement in investment in irrigation infrastructure relates to the information needs of an interventionist policy. Are their defensible criteria to separate competing claims for assistance by water authorities or irrigators? If such criteria are unavailable, then the integrity of administrative arrangements is strained. A legitimate question is why irrigators are not choosing appropriate techniques of production based on their own knowledge of the cost of irrigation equipment, prices of commodities, costs of other inputs, the price of water and their own situation? Farmers already have incentives to save water, especially in the era of water trading when on-farm decisions depend on opportunity costs of water as revealed by water trading. Government provision of infrastructure discourages farmers from investing in water saving practices on their own account and penalises farmers and water supply authorities that have already acted.

Other resources are used in the production of irrigated commodities. Detailed studies of irrigation in practice revealed that labour saving was just as important in choosing water saving techniques like laser levelling as water saving per se (Cary and Wilkinson 1997, Cary et al. 2002). Concentration of water on its own is an example of the dangers of taking a narrow view of the complexities of farmer decision-making. The implications of sunk costs are usually ignored. The costs of retrofitting elaborate capital equipment and irrigation layouts are easily underestimated.

Especially with flood irrigation, one farmer's drainage water or return flow is another farmer's irrigation entitlement or an environmental flow. Perhaps the trickiest point to come to terms with in the entire literature on water savings is what constitutes savings. Eliminating return flows is not water saving but transferring water in the landscape (Gyles 2003). Most studies of losses in irrigation systems count outfalls (tail water) that flow to waterways or distribution systems, seepage and measurement errors as losses, when most of that water is available, or potentially available, to irrigators in other parts of the irrigation system. Such losses are then aggregated across the system creating the misleading impression that large savings can be readily achieved. Elimination of outfalls and measurement errors should not be counted as water savings from the viewpoint of the system as a whole. If outfalls are reduced within an interlinked system, additional water has to be released from storages to supply downstream irrigators. Savings from eliminating metering losses are not savings but losses to the irrigators who were previously using the water in irrigated production. Avoiding seepage may or may not be a saving, according to what happens when it connects with groundwater. If the accessions were to saline groundwater, for example, then genuine savings have occurred if seepage is reduced. Otherwise, if surface water and groundwater were part of the same connected system, no saving has occurred.

Unfortunately, part of the attraction of the doctrine of WUE is that the political and financial costs of enhanced environmental flows are temporarily avoided. Buyback of irrigation entitlements for environmental purposes, a cheaper option that would be administratively straightforward, is politically unpopular in irrigation areas even though trading has already allowed substantial amounts of water to transfer between irrigation areas (Frontier et al. 2007). In the era of water trading, the market price of water provides the best indication of what it worth paying for water savings. This should be the test applied before any public money is spent on off-farm or on-farm irrigation infrastructure. More emphasis should be given to water recovery via buyback of entitlements, supported by economic analysis and scientific data on how and where environmental improvements will be achieved.

The Food Bowl Modernisation Project of Northern Victoria

The vagueness of the concept of water savings and the perils of its seductions to politicians, journalists and other lay observers are illustrated by the so-called Food Bowl Modernisation Project (FBMP) being implemented in the Goulburn Valley of Northern Victoria. About half of Victoria's water is used in the self-styled Food Bowl. Anticipated savings from the FBMP are to be split between irrigators, the environment and Melbourne consumers. 'Food Bowls' are popular in irrigated Australia. The term is also applied to the Murray-Darling Basin as a whole and the Sunraysia district on the Murray,

The FBMP aims to use the Australian-developed total channel control (TCC) system designed to fully automate open channel irrigation delivery systems, provide service levels commensurate with a fully enclosed pipe network, and substantially reduce channel outfalls. TTC uses computer software and automated control doors within a defined radio network to manage water distribution.

Several variants of age-old Australian water policy dilemmas are exhibited in the debate over the FBMP. The proposal threatens to repeat some previous errors in the history of irrigation in Australia. A report by the Victorian Auditor-General's Office (VAGO) indicates the haste with which decisions were reached to go ahead with the FBMP (VAGO 2008). The Victorian Water Plan of June 2007 – incorporating the FBMP, a pipeline to Melbourne and a desalination plant – was prepared in six months, with minimal consultation with those affected. This is an echo of the way drought-induced panics triggered Australian adventures with irrigation in earlier times. The old saw that 'when there is an election, politicians feel a dam coming on' has reappeared in modern dress.

Even though audit agencies are (rightly) concerned with the evaluation of administrative processes followed by the elected government and not the content of government policy, it is interesting that VAGO have homed in on two issues of concern to economists – justification of the costs of the FBMP, and the evidence for the alleged savings. Cost estimates for the FBMP were based on estimates provided by the *Food Bowl Alliance*, the lobby group agitating for government funding of the project. VAGO (2008, p 32) noted that 'information provided on the food bowl project did not adequately explain the basis for the water savings estimates.'

Not that such estimates could be readily derived. It is hardly surprising that opponents of the project have focused on this aspect of the proposal. A related problem in estimating savings is deciding the starting position or base case for measuring water savings. The base case is conceptually and empirically contentious. Much has already happened on farms and in water distribution systems over the recent extremely dry period through the efforts of farmers and water supply authorities. Comparisons with the distant past are not relevant.

As so elegantly portrayed by Leslie (2006), big irrigation projects have always appealed to engineers and politicians. Australia is part of this worldwide phenomenon. While the FBMP is more space age than highly visible concrete and steel, it is redolent of the monumentalism that has plagued irrigation through the ages. Harder to attach a plaque, but a similar turn of mind applies to FBMP backers. Open channel irrigation is unfashionable but gravity is low cost and reliable. TCC might be the technology of choice for new irrigation developments. Retrofitting is another story. The logic of Davidson (1969) is still relevant. The pattern of irrigated output, other input costs and potential product markets does not justify expensive technology in Australian irrigation. Invention should not be the mother of necessity.

The FBMP reflects dilemmas of public finance that apply to WUE generally. Original plans shifted most of the cost on to Melbourne consumers who are supposed to benefit from the savings. The question of who should pay is now even more controversial after the FBMP became a bargaining chip in the argument over Victorian participation in national plans for irrigation and urban water. Victoria has signed up to the new *Water for the Future Plan* in the expectation that an additional \$1 billion will be provided by the Commonwealth for the FBMP. This is subject to 'due diligence' by the Commonwealth (Wong 2008a, 2008b). The \$1 billion is apparently part of the originally promised \$10 billion by the Commonwealth (Milne 2008). Given existing Victorian commitments, the bill for the FBMP is now at least \$2 billion. Moreover, other states will be lining up with their pet water infrastructure projects to be funded by the Commonwealth (Wong 2008b).

It will be inequitable if there are Commonwealth contributions to the FBMP in Victoria. Coleambally irrigators have already paid out of their own pockets for TCC. Conceivably, TCC could be a goer for the more modern Coleambally irrigation scheme with much larger farms than the benighted Food Bowl of the Victorian Goulburn Valley that has so many small farms and an intricate delivery system where ostensibly wasted water shows up in other parts of the network. Pondered irrigation of rice has different implications for the economics of TCC than flood irrigation of laser-levelled pastures in the Goulburn Valley.

A full benefit cost analysis of the FBMP should account for any changes that are made necessary for on-farm irrigation layouts. TCC has lower flow rates in channels and thus slower irrigation on farms. Slow irrigation results in waterlogging problems, slower pasture growth, lower quality pasture and increased groundwater accessions. Because TCC allows more accurate measurement, there will be equity issues. TCC irrigators will receive less water than their counterparts using traditional measurement systems based on the Dethridge wheel.

The forthcoming 'due diligence' exercise of the Commonwealth on the FBMP is awaited with interest by aficionados of Australian irrigation policy.

Water Trading in Australia

Origins of Water Trading

Although water trade had been occasionally conducted on an informal basis between neighbours, formal water trade emerged in Australia in the 1980s in response to increasing pressure on water resources from irrigators and for the environment. A defining event was the introduction of a Cap on extractions for irrigation from the Murray-Darling Basin in the mid-1990s. Australia has gone further down the track of water trading than other countries. It is interesting to contemplate why this is so?

Part explanation lies with the legal arrangements for property rights in water adopted in the early stages of irrigation in Australia. When irrigation schemes were developed in Australia, water was tied rigidly to land. Property rights to irrigated land included the rights to use water that was under licence from the state. Late in the nineteenth century, Australia abandoned the common law riparian doctrine of water ownership with vesting of water property rights in the state (Musgrave 2002). The riparian doctrine is not suited to areas with limited and variable water supply. The solution in the western area of the United States was to adopt the prior appropriation doctrine. Alfred Deakin, the Victorian politician and doyen of irrigation enthusiasts, had studied US experience and observed that the prior appropriation principle led to litigation that could be avoided with state ownership. Deakin was also concerned that prior appropriation could lead to concentration of water ownership, which was inconsistent with the egalitarian objectives underlying Australian closer settlement schemes and irrigation development.

As mentioned elsewhere in the paper, irrigation settlements in Australia ran into problems of low farm incomes because farms were too small. Environmental damage occurred because locations were carelessly chosen. Subsidised water prices that barely covered operational costs let alone maintenance and capital encouraged excessive watering with waterlogging and salinisation of land and waterways. Early irrigation areas were tied to particular commodities by the choice of farm size. Settlers shared marketing and processing infrastructure as well as irrigation infrastructure. Many of the commodities chosen experienced marketing problems on export markets – for example, dried vine fruits, stone fruits, wine and dairying. Special pricing arrangements had to be introduced. Irrigation was often a case of producing subsidised outputs with subsidised inputs. Somewhat ironically, given that traditionally higher levels of assistance to irrigated industries encouraged changes to irrigation policy, prices of irrigated commodities have been favourable in the last couple of decades, apart from a slump in wine grapes. Product-related assistance has been eliminated. Water shortages rather than commodity prospects have been the key issue for irrigators in recent times.

Water Trading in Principle

When the tide turned against protectionism in Australia in the last quarter of the twentieth century, irrigation was an obvious candidate for attention and reform. Water trading was a key ingredient in the package of measures chosen. The basic idea behind water trading is to allow water to move to higher value uses. 'Higher value uses' should be broadly interpreted.

It certainly does not mean higher priced commodities, as sometimes advocated. Market prospects for specialised commodities are limited. Water will be of higher value on larger farms in the same industry because the scale of farm operations is matched to other inputs with modern irrigation technology.

Water is of different value throughout the irrigation season. Allowing farmers to carryover water from season to season or borrow against future entitlements provides flexibility in farm operations. The idea of higher value use should incorporate environmental use. Trading allows water to move away from less productive land, including land vulnerable to environmental damage. Although resisted by irrigators, gradually environmental managers are being given access to formal water rights that have the same status as other rights. Under the most recent *Water for the Future Plan*, this will be undertaken by the Commonwealth Environmental Water Holder (Wong 2008b).

A legitimate grievance of the conservation movement is the starting point or base case adopted when the Cap was introduced in the mid-1990s. Purchasing water on the open market provides a mechanism for redressing this grievance, analogous to buyback of quotas and licences in overstressed fisheries. Not all environmental uses require more water. Timing is an issue. Management of wetlands needs long periods of drying out to mimic the natural conditions of an unregulated river system.

Water trading also enhances risk management for farmers and lessens the burden of drought. By breaking the nexus between land and water, water trading has considerably increased the flexibility of farm financial management by creating a new class of negotiable asset with similarities to cash and other liquid assets. As the water market evolves, more sophisticated instruments will emerge to assist farm financial management.

Water trade is of two types, permanent trade in water entitlements and temporary trade in annual allocations determined by the amount of water in storage. Irrigation industries vary in the extent to which they can be interrupted – on a continuum from permanent horticulture to annual crops. Dairying is an intermediate case because purchased feed can be substituted for irrigated pastures.

Water Trading in Practice

Water trading in practice has brought forth predictable results (Frontier et al, 2007). The market has allowed a re-allocation of water in a way that government agencies could not. Fortunately, governments have resisted the temptation to favour particular industries during recent water shortages. Commodity prices are far too unpredictable to make such decisions. The ranking of industries can change rapidly.

New irrigated industries have developed on greenfields sites using private irrigation infrastructure. The higher environmental standards imposed on these new developments by planning approvals are offset by some advantages. Land is much cheaper in former dry land farming areas. Redevelopment by amalgamating properties in existing irrigation areas is costly. Existing plantings have to be removed. Redundant irrigation infrastructure and housing has to be written off. The other side of the infrastructure coin is that social

infrastructure (education, health and housing) has to be provided – by taxpayers – in the areas to which water is moving. Pointedly, in an era when local participation in irrigation management is lauded, new developers deliberately avoid the tortuous irrigator politics and bureaucracy of water supply authorities in the old irrigation districts.

Research in Victoria has revealed that the main sellers of entitlements are the mixed farming and dairy sectors while the main purchaser of entitlement is the horticulture sector (Frontier et al. 2007). The dairy sector has been the main purchaser of seasonal allocations. Within the horticulture sector, there has been substantial transfer of water (permanent and seasonal) from the old irrigation districts to greenfields sites.

Despite its overall benefits, trade is not always well regarded in irrigation districts especially those subject to long-term loss of permanent entitlements. Much of the opposition comes from town-dwellers rather than the irrigators actually engaged in voluntary water trade. Trade has probably encouraged further polarisation of commercial and non-commercial parts of the irrigation system, within industries and between areas. Governments have responded by placing limits on the amount of water that can be traded permanently each year. Water supply authorities in New South Wales have applied exit fees on sales of permanent water outside their districts to the chagrin of officials. Temporary trade in allocations is viewed more favourably, even though the two types of trade are close substitutes. There are few restrictions on temporary trade suggesting that constraints on permanent trade are not as damaging as often claimed. Crase (2008b) has observed that 'the accompanying hysteria about water leaving agricultural districts undoubtedly explains the return to favour of engineering solutions in policy circles.'

To a large extent, water trading has become a scapegoat for climatic and economic events occurring independently – drought, commodity price movements, decline of small country towns and structural adjustment. The latter is relevant because of the chronic small farm and low-income problems of the old irrigation districts. Water trading may accelerate economic changes but should not be regarded as the proximate cause. The growth of corporate horticulture is especially unpopular, in part because of exaggerated views on the taxation advantages of managed investment schemes that have funded many new developments. Economies of size is the main reason for the growth of large-scale horticulture.

The economists' preference for market solutions rather than command and control notwithstanding, water trading has not been without its difficulties. The best-known case is the phenomenon of 'sleepers' and 'dozer' licences. Sleepers were inactive licences and dozers under utilised licences held for drought insurance purposes before the introduction of water trading. Trading gave these assets a value. Sleepers and dozers could be traded on the temporary market with no effect on their insurance value. In effect, the introduction of water trading reduced the security of actively operated water licences.

Access to information is key to the operation of markets. Like other markets, announcement effects are important in water markets. Information on changing seasonal allocations in dry periods needs to be available to participants on equal terms. Insider trading is a potential problem. Interstate trade has been encouraged by successive Commonwealth governments, who should take responsibility for enforcing reasonable conduct in water markets.

Concluding Comments

In his seminal paper on environmental economics and the Murray-Darling river system, John Quiggin (2001) interpreted various economic theories and their policy implications – the idea of externalities associated with Pigou, ideas about property rights originating with Coase and contemporary developments flowing from the idea of sustainability. Quiggin argued that all these theories are applicable to aspects of environmental management.

The work of Pigou leads to an emphasis on taxes and subsidies to align private and social incentives. In principle, taxes could be applied to parties damaging downstream water users but the complex hydrology of the Murray-Darling makes identification of offenders nigh on impossible. Further, the state has been intimately involved in the creation of the environmental problems. Their belated involvement in their correction should be carefully handled. The history of Australian irrigation gives a sharper political edge to the belief that 'government got us into this mess, now it can help get us out of it' (Watson 2008).

The analysis of Coase is the basis of the property rights approach. Coase challenged the reliance of Pigou on government intervention. Quiggin explains how the approach of Coase cannot cope with situations where ownership of rights needs to change because of difficulties with their initial assignment. Interest in property rights has led to research on the implications of common property in the irrigation system and the potential for local management (Marshall 2008). Australian interest in water trading is in part derived from adherents of the property rights school.

Interest in sustainability is not associated with a particular person or school of economics. Sustainability principles lead to thinking about discount rates and the development of rules that will maintain natural systems. The river system has multiple environmental attributes, flow and non-flow related. Development of sustainability rules for river systems requires cooperation between scientists in several disciplines and economic analysis. Environmental policy should recognise the difference between reversible and irreversible environmental damage; separate on-site and off-site effects; distinguish public and private responsibilities for the environment; and, consider the division of financial responsibilities between Commonwealth, state and local governments (Watson 2008).

Quiggin concluded that an eclectic approach drawing on externality, property rights and sustainability approaches is appropriate for Australian irrigation policy. Musgrave (2002) reached much the same conclusion. While this conclusion is appealing and intellectually defensible, a problem with eclecticism is that it is hard to maintain the administrative discipline and rigour necessary to sustain an eclectic approach. It is easy to slide from eclecticism to ad hoc decision-making. The best defence is strong public agencies keeping their distance from special interests. Environmental policy making is often compromised by well-intentioned concerns for the welfare of farmers and other rural people. The size of farms is pertinent for farms to undertake environmental remediation on their own account. The 'triple bottom line' is an inadequate criterion. Social concerns that often are interpreted as requiring Government support of small farms may be inimical to the resolution of environmental problems.

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