CRAWFORD SCHOOL
OF ECONOMICS AND GOVERNMENT

THE AUSTRALIAN NATIONAL UNIVERSITY

POLICY BRIEFS

Dry Water

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Karen Hussey

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Policy Briefs 3

Crawford School of Economics and Government
The Australian National University

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About the Policy Briefs

The Crawford School of Economics and Government presents 'Dry Water' as the first issue in 2007 in its series *Policy Briefs*. Each Policy Brief includes three opinion pieces by researchers on a theme/topic of importance to Australia and its neighbours in the Asia and Pacific. Previous issues are available free to download at
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In this issue, we provide three perspectives on water. The first is an economic evaluation of the national plan for water security announced by Prime Minister John Howard on 25 January, the second is an a insightful review of how to assess the trade-offs between water use and environmental flows, and the third contribution examines an often neglected issue in water policy—the social dimension.

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An economic evaluation of the National Plan for Water Security

R. Quentin Grafton

The 'big dry' in Western Australia and southeast Australia has focused policymakers on what is wrong with water policies in Australia. Building on the 2004 National Water Initiative and an earlier vision to 'Secure Australia's Water Future', the Prime Minister, John Howard, on 25 January 2007 announced a major funding and policy initiative to help address the problems of too little water.

The National Plan for Water Security (the Plan) includes 10 key points and a proposed expenditure of A$10 billion by the Commonwealth over the next 10 years, conditional on the states agreeing to a proposed set of governance arrangements in the Murray–Darling Basin. Much attention has been focused on the politics of the plan and, in particular, on the request for referral of state and territory powers to manage the Murray–Darling Basin in the national interest. Although the governance issues are important, the economics of how the proposed A$10 billion will be spent is critical to the plan's success.

In this review, we provide an economic evaluation of what is proposed under the Plan. Our purpose is to provide constructive advice to guide policymakers and managers, who will be charged with implementing the plan should the states and the Australian Capital Territory agree to the new governance arrangements. The focus of this review is on the potential economic pitfalls associated with the proposed A$5.885 billion expenditure on modernising irrigation in Australia and the A$3 billion budgeted for addressing over-allocation in the Murray–Darling Basin (see Table 1).

Table 1 **National Plan for Water Security—proposed expenditure** (A$ billion)

	Proposed expenditure (A$ billion)
Modernising irrigation in Australia (total)	5.885
Delivery system efficiency gains	3.130
On-farm efficiency gains	1.635
Metering, monitoring and accounting	0.620
Improving river operations and storage	0.500
Addressing over-allocation in the MDB (total)	3.000
Reforming the MDB Commission	0.600
Set and administer a new cap	0.100
MDB Commission operations	0.500
Water information (total)	0.480
Modernising and extension program	0.080
Information management and reporting program	0.120
Analysis and forecasting services	0.120
Investigations program and strategic data procurement	0.160
Northern Australia and the Great Artesian Basin (total)	0.085

Source: Howard, The Right Hon. J., 2007. *A National Plan for Water Security*, Commonwealth of Australia, Canberra: Attachment A. Available from www.pm.gov.au/docs/national_plan_water_security.pdf (accessed 10 February 2007).

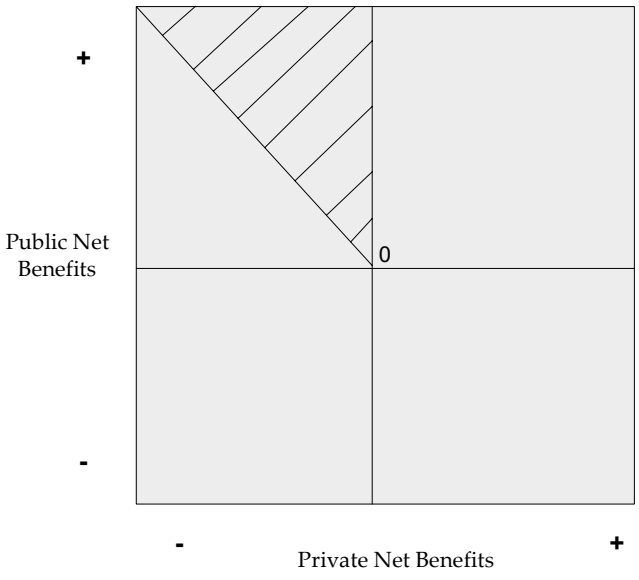
Public and private benefits

The justification for spending collectively almost A$9 billion on modernising irrigation and buying back water entitlements is that it should yield at least the same amount in public benefits. If it does not, then it would be better to spend the money on alternatives (such as schools and hospitals), or to tax less. Public benefits arise from what economists call 'market failures', where the actions of individuals impose costs on others and these actions are not accounted for in individual decision making and, thus, the costs cannot be resolved without some intervention. For instance, a farmer who diverts water to irrigate his or her crops imposes cost on others that are not included in the price paid for delivering and using the water. This could arise from evaporation in irrigation channels that reduces the water available to downstream users and for environmental purposes, or from water seepage that could contribute to salinity affecting other farmers.

The key for decision makers is to ensure that when intervention is required that the public expenditures generate the highest possible net benefits. A template to guide public investments is given in Figure 1 and can be adapted to evaluate the proposed expenditures in the Plan. On the vertical axis are public net benefits ($) that accrue to society (other than irrigators) where above the horizontal line that bisects the figure they are positive, and below are negative. On the horizontal axis are private net benefits ($) that accrue to individual irrigators that are positive to the right of the vertical line that bisects the figure, and are negative to the left. The centre of the box is the point where both public and private net benefits are zero.

Figure 1 illustrates that different interventions to current practices generate different combinations of net public (that accrue to everyone but the irrigators) and private (that accrue directly to the irrigators) benefits. Infrastructure investments that generate negative net public benefits are to be avoided as the public funds could be used for other purposes that would generate a higher and positive rate of return. Consequently, no projects used to modernise irrigation should be located in the bottom half of the box (the south-west and south-east squares). Public funds should also not be used to pay for infrastructure projects that would occur in the absence of public intervention, or those infrastructure investments that already generate positive net private benefits. In other words, using public funds to subsidise investments that irrigators would pay for anyway simply 'crowds out' private investment and fails to increase net public benefits over what would have occurred in the absence of the infrastructure subsidy. Thus no public funds should fund infrastructure investments in the right-hand side of the box (the north-east and south-east squares) because such interventions would be undertaken privately without any need for taxpayer dollars.

Figure 1 **Template to guide public investment for water efficiency benefits**



Source: Pannell, D., 2006. 'Public benefits, private benefits and the choice of policy tool', Pannell Discussions No. 73, May. Available from http://cyllene.uwa.edu.au/~dpannell/pd/pd0073.htm (accessed 21 March 2007).

The only 'policy space' in which to spend the funds allocated for modernising irrigation is in that area of the box (north-west square) that generates positive net public benefits from projects that would not occur without the Plan. In other words, this north-west square denotes investments that generate positive net public benefits (such as from increased environmental flows), but in the absence of subsidies would result in negative net private benefits to irrigators. Within this north-west square, the interventions needed to generate efficiency gains by irrigators should generate net positive public benefits at least as large as the net private costs that the projects impose on irrigators. This condition ensures the overall (public and private) net benefits from modernising Australian irrigation are positive, denoted by the shaded triangle area within the north-west square of the box.

The challenge for decision makers charged with spending almost A$6 billion over the next 10 years on modernising irrigation infrastructure is to ensure expenditures are made in the appropriate area of the public/private net benefit combinations (shaded triangle area of the box). To ensure the public receives the highest net return per dollar spent, policy makers will need to resist calls by self-interested landholders to direct public investments into projects that generate the highest net private (rather than public) benefit.

Diminishing returns

A major challenge in the national water plan is to determine the trade-offs between the costs of action (such as infrastructure improvements) designed to overcome water problems (such as too much water seepage and evaporation) with the public benefits (such as larger water flows downstream) of such actions. Quantifying these public benefits is difficult, but is possible within some confidence limits (Jeff Bennett, in this issue, describes why and how economists value the environment). It is also true that whatever the action chosen to generate the public benefits, the marginal public returns will eventually decline with the amount invested. For example, it could be technically feasible to achieve very low rates of evaporation in irrigation delivery but at a cost many times higher than using alternative measures, which would save the same amount of water. The point is that whether a particular intervention is warranted or not depends very much on the expected returns from such an intervention, and also on the alternatives available—what economists call 'opportunity costs'.

The notion of diminishing returns from water infrastructure investments is illustrated in Figure 2. On the vertical axis is the 'marginal return' on infrastructure investments measured in gigalitres (GL,

Figure 2 **Diminishing marginal returns from water infrastructure investments**

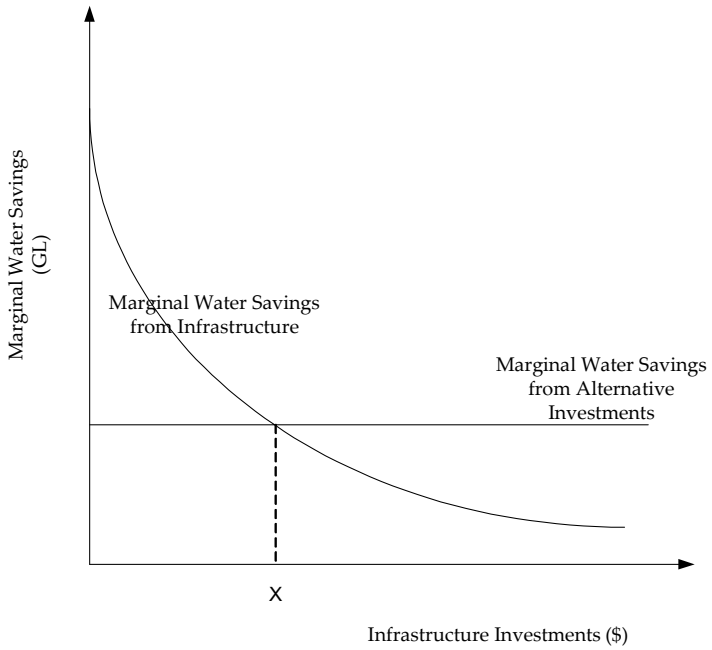


Table 2 **Final summary of flow management options for the Murray River and the probability of success**

Management options	Probability of having a healthy, working River Murray system
Do nothing more (current operations)	LOW
A. Improved operations	LOW
B. Improved operations plus 350 gigalitres new environmental flows per annum (Murray source)	LOW
C. Improved operations plus 900 gigalitres new environmental flows per annum (basin-wide source)	LOW–MODERATE
D. Improved operations plus 1,630 gigalitres new environmental flows per annum (basin-wide source)	MODERATE
E. Improved operations plus 3,350 gigalitres new environmental flows per annum (basin-wide source)	HIGH

Source: Jones, G., Hillman, T., Kingsford, R., McMahon, T., Walker, K., Arthington, A., Whittington, J. and Cartwright, S., 2002. *Independent Report of the Expert Reference Panel on Environmental Flows and Water Quality Requirements for the River Murray System*, February, prepared for the Environmental Flows and Water Quality Objectives for the River Murray Project Board, Canberra.

or billion litres) of water that would otherwise be lost through evaporation or seepage. On the horizontal axis is the amount spent on infrastructure investments to modernise irrigation. There is an inverse relationship between marginal water savings and the amount invested (the curve is downward sloping) to reflect the fact that there exists potentially large water savings from initial investments in 2007–08, but as more money is invested and delivery systems are progressively improved the water savings per dollar invested in will likely decline. The straight horizontal line in Figure 2 illustrates that alternative approaches, such as different land-use practices that are not currently eligible for funding under the Plan, would, at some stage, generate equal or higher marginal water savings than infrastructure investments. This is illustrated in Figure 2 by point 'X', where further investments in infrastructure yield lower marginal water savings than alternative approaches.

The key point is that expenditure of public money for public benefits, as announced in the water plan, should not be constrained to particular investments or infrastructure, but should be allocated to those approaches that generate the highest marginal water savings.

Buying back water access entitlements

The National Plan for Water Security includes expenditure of up to A$3 billion to buy back water entitlements held by irrigators in the Murray–Darling Basin, which is intended to reduce water use. It represents a major funding injection to support a June 2004 Council of Australian Governments Intergovernmental Agreement on Addressing Water Over-Allocation and Achieving Environmental Objectives in the Murray–Darling Basin. The plan greatly expands the scope of this 2004 initiative, which set out arrangements for a 'Living Murray' with a budget of A$500 million to return 500 gigalitres of water per annum to the Murray River by 2009. The plan also builds on a 2006 Commonwealth initiative that provided an additional A$500 million for a Basin Salinity Management Strategy, and also for a voluntary tender of water entitlements to farmers who undertake water efficiency improvements equal to the amount of water tendered for sale.

A justification for the public purchase of statutory water entitlements is the over-use of water—too much is consumed and not enough is left to maintain healthy river systems. For instance, a 2002 Expert Reference Panel (see Table 2) predicted that without increased flows of 1,630 gigalitres there was little chance that the Murray River could be returned to a healthy state. A second reason for the purchase of water entitlements is that there is over-allocation of water entitlements whereby the combined amount of water that is held by water users exceeds the amount available for use. Over-allocation is different from over-use, but it can contribute to less than desirable environmental flows because decision makers could be less inclined to reduce water use allocations (or increase environmental flows) in an over-allocated river system because of the costs it imposes on water users.

Purchasing water entitlements to reduce over-allocation provides private benefits to holders of water entitlements because it will increase the price due to

the increased demand brought about by the government purchases. To illustrate this impact, we can use an analogy from the housing market. Suppose the Commonwealth government decided to purchase privately owned houses that it subsequently removed from the housing stocks and set aside for environmental purposes. Those selling their houses would benefit from an increased sale price, and all other house owners who chose not to sell would enjoy unrealised capital gains. No one proposes such an intervention in the housing market because such purchases would generate very few public benefits. Similarly, under the national water plan, the purchase of water entitlements will be worthwhile only if they generate public benefits at least as great as the proposed expenditures. Such public benefits in terms of water, however, can arise only if the purchases result in reduced water use or increased environmental flows.

A major challenge in generating public benefits from the purchase of water entitlements under the plan is that there exist a substantial number of 'sleepers' (entitlements that have never been used) and especially 'dozers' (entitlements that have previously been used but are not currently in use). Purchases of sleepers or dozers under the plan would not provide public benefits in the form of increased environmental flows. Moreover, the greater the over-allocation of water entitlements, the larger the potential that the plan will end up simply purchasing 'dry water' (water entitlements not currently in use).

The extent of the over-allocation of water is difficult to determine with accuracy. Where it exists, it has the potential that water entitlement purchases will fail to deliver public benefits. Using aggregate data compiled by the Australian Bureau of Statistics. We note that in 2004–05 there were some 76,000 surface-water access entitlements across Australia with a combined total volume of water of almost 23,000 gigalitres (Australian Bureau of Statistics 2006a). For the same period, however, total water consumption in agriculture (which includes ground water use) was some 12,000 gigalitres (Australian Bureau of Statistics 2006b)—just more than half the total volume of surface-water access entitlements. In other words, there is a very large over-allocation in surface-water entitlements and there exists a very real possibility that much of the money targeted under the plan to buy water rights could simply end up purchasing 'dry water'.

The role of economics

The National Plan for Water Security offers a major step forward in terms of the willingness of the Commonwealth government to invest in a better water future. It would be a great pity if the proposed funds were not spent in a way that generated the largest public benefits per dollar of expenditure. In addition to good governance, the successful implementation of this plan will require careful economic analysis and planning.

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Water and the environment

Jeff Bennett

Until relatively recently, water flowing from rivers into the sea was regarded by politicians, engineers, farmers and the general public as a 'waste'—a resource that could otherwise have been used to generate wealth through irrigating crops, processing minerals, watering playing fields and so on. There is now a growing recognition that such flows provide a range of benefits to society. They are the sources of wealth from industries such as fishing. They enable the continued functioning of a wide range of ecosystems including wetlands that help mitigate floods and improve the quality of our drinking water. And they provide recreational opportunities including swimming, boating and riverside picnicking. Without them, a range of plant and animal species would be pushed to extinction.

New phrases have emerged in our language to express this recognition: 'environmental flows' provide us with 'ecosystem services'.

Thirty years ago, water planners deliberated over the allocation of water between irrigated crops, industrial requirements and domestic use. Now, an additional element of water demand has to be factored into the allocation decision: the environment. The already complex trade-offs required in choosing between supplying water to grow more grapes, to wash coal or to keep the local sports oval green through summer are further complicated by considerations such as the amount of water required to trigger a bird breeding event in a wetland, to maintain the health of riverside vegetation or to ensure the spawning of fish in an estuary.

Governments are faced with the challenge of how these water allocation choices are to be made. Commonly, markets for entitlements are now being used to allocate water between competing uses. The party willing to pay the highest price for the available water secures the right to use it. A problem with this approach is that the water market is unlikely to receive many bids for environmental flows. This is because most of the ecosystem services so generated don't provide any profit-making opportunities to anyone thinking about buying water for an environmental flow. They are what economists call public goods. A role for government is, therefore, to step into the market process to ensure that environmental flows are allocated to maximise society's well-being from the overall use of its scarce water resources.

The practical issue that follows is to determine how much water should be allocated to environmental flows. This is necessarily a complex and controversial matter. While the value of environmental flows may have been recognised in broad terms within society, it remains the case that to provide them causes a cost. That cost takes the form of the value that is otherwise generated by using the water for irrigation, mineral processing and other 'extractive' uses. Put simply, environmental flows come at a cost. It could be realised in the form of lost irrigation farming profits or more expensive electricity because of less water being available for power station cooling towers or more frequent and stricter water use restrictions in towns and cities.

How much water to allocate to the environment therefore involves the balancing of these costs against the ecosystem service benefits generated by the environmental flows.

Governments, in making this type of decision, will generally have good access to information about the costs created by taking water away from farmers and industry. Market data on these costs are readily available. We know the price of grapes and the costs of producing electricity, for example. Information on the value that society places on the benefits produced by environmental flows is, however, harder to come by. Markets for those ecosystem services rarely form to allow people to express their values through buying and selling activities. Yet without knowledge of the costs and the benefits, decisions about allocating water to the environment are unlikely to be made in the best interests of society as a whole. They are likely to be the object of political wrangling in which the relative strength of vested interest groups is the deciding criteria.

Economists have sought to fill this information vacuum by developing valuation techniques designed to work outside existing markets. One of these techniques—known as 'choice modeling'—has recently been applied to estimate the values of improved river health potentially resulting from increases in environmental flows allocated to Victorian rivers.

Choice modeling involves a representative sample of people being asked in a survey to make a sequence of choices between alternative future river management options. Each option is described to the survey respondent in terms of the ecosystem services they will produce: the number of fish species present, the length of the river with healthy riverside vegetation, recreational opportunities available, and so on. Because each management option comes at a prospective cost to the respondents, their choices between alternatives demonstrate their willingness to pay for the outcomes. This is a measure of the value they hold for those outcomes.

The Victorian rivers study found that Melbourne households, for example, were each willing to pay on average about A$4.50 for an additional fish species in the Goulburn River. Respondent households to the survey in Geelong indicated an average value of A$22 for additional bird species along the Moorabool River. An array of values for other environmental attributes of other rivers held by other subgroups of the Victorian population was estimated.

This type of information can be used to construct estimates of benefits arising from additional environmental flows. River ecologists and water managers can assist by predicting the ecosystem service consequences of a proposed environmental flow regime: for example, what are the impacts on the number of fish species and streamside vegetation of an extra 20 gigalitres of water flowing down the river? These impacts can then be valued using the choice modeling results to provide an estimate of the benefits to the community so arising. This benefit estimate can then be compared directly with the costs of providing the environmental flow. A decision rule for allocating water can then be devised: if the benefit of the extra environmental flow is greater than its costs, water should be reallocated to the environment. The reallocation should not, however, be made if the costs are greater than the benefits. That result would indicate that society does not value the ecosystem services arising from the environmental flow sufficiently to give up the value of using the water for extractive purposes.

Declines in river health, coupled with greater levels of knowledge and awareness have contributed to growing levels of community demand for environmental flows in Australian rivers. This has added a complicating dimension to the water allocation process. Knowledge of the values generated for the community from competing water uses—including the environment—will assist in ensuring that the available water is used to best effect.

Without information on the values of ecosystem services, government decisions regarding water allocations are more likely to be influenced by the lobbying of vested interest groups, rather than by the goal of improved societal well-being. Decisions about how much water should be bought back from irrigators would otherwise be made without reference to the extent of the benefits such purchases would yield.

Is 500 gigalitres too much, too little or just the right amount of additional water to release down the Murray River, noting of course that irrigators could use that water to generate wealth from crops?

Is A$10 billion too much, too little or just the right amount to spend on a national plan for water security, noting of course that the A$10 billion could otherwise be spent on hospitals and schools?

The answer at the moment to both these questions is: we don't know. Only with information on the value of the ecosystem services derived from environmental flows will we be able to address these questions with any confidence. In the mean time, we run the risk of making poor water allocation decisions that will be detrimental to the well-being of the nation.

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Recognising and reconciling social equity issues in contemporary water policy

Karen Hussey

As population and development pressures have grown within many of the world's river basins, securing sufficient and safe water resources for consumptive purposes has become one of the most significant challenges of the twenty-first century. The fight for scarce water resources has become a source of conflict at the local and regional scales (for instance, between landholders, and between the urban and rural sectors), as well as at the global scale, as attested by disputes between Arabs and Israelis, Indians and Bangladeshis, Americans and Mexicans, and among all 10 Nile Basin co-riparians (Wolf 1999). At the heart of such conflicts are questions of allocation priorities, legal rights, economic efficiency, environmental sustainability and, inevitably, considerations of justice, equity and human rights. But the dynamic nature of water resource management—including highly variable climatic conditions, terrain, land use and development priorities, and gaps in scientific understanding of surface and ground water systems—means that developing and implementing policy is no mean feat.

To date, consideration of human rights and social justice issues in water policy has been restricted largely to the developing world context, where populations' access to water to fulfil basic human needs is severely limited. In that context, the Rio Declaration and the more recent Millennium Development Goals form the principal framework. Alternatively, attention has focused on the international dimensions of water resource management, incorporating the challenges of trans-boundary waterways and the equitable allocation of water between nation-states. The interface between human rights, social equity and environmental resources—particularly for water—exists at a number of different levels and recent water policy reforms in industrialised countries raise important questions that also demand attention.

In Australia, we have moved to a system of natural resource management that is governed by the principles of neoclassical economics, underpinned by the belief that the individual pursuit of self-interest will reallocate water to the most efficient and highest value uses. There is now a reliance on property rights (crucially, their durability and security) and market-based instruments. In the water domain, the policy framework is focused principally on two instruments for allocating scarce water resources: water trading and full-cost recovery pricing. The shift in policy, however, to one advocating market solutions raises important questions in relation to how basic resources should be distributed and redistributed. As Connor and Dovers (2002:120) state

> [u]nder PRIs [property rights instruments], ecological integrity and economic efficiency achieve parity with, and may altogether trump equity, as the traditional first priority in distributional logic of resource access.

Thus, while implementation of Australia's water reform agenda does necessarily focus on the legal and economic implications, there is also a social equity dimension. In this brief, I focus particularly on two issues in the context of Australia's 2004 National Water Initiative (NWI), but, as the underlying principles for that reform agenda are mirrored elsewhere (for instance, in the European Union, South Africa and Canada), the points made have salience beyond our own borders.

The social equity dimension of water trading

The NWI is designed to help address critical issues of over-allocation, inefficiencies, inconsistencies and lack of coordination across jurisdictions, and inadequate water planning. The establishment by 2007 of compatible institutional and regulatory arrangements to facilitate intra and interstate water trading was the key objective of the NWI, from which everything else will follow. The economic principle behind competitive markets for water is that they allow water to be traded so that those users with the highest marginal value (after accounting for transport and

transaction costs) are able to purchase water from lower-value uses. This exchange is welfare enhancing to the buyer and the seller and it promotes efficiency. Trading establishes the market price—which changes with environmental conditions and economic circumstances—signalling to all water users its relative value.

In a recent study of the impacts of water trading on the rural sector, McKay and Bjornlund (2002) found that economic efficiency had indeed been improved by water trading as water had moved from irrigators producing low-value commodities to those producing higher-value commodities. In other words, water has moved from irrigators with less efficient irrigation technology to those with more efficient technology. The authors also identify three, consequent effects on rural communities

- water is moving from 'lifestyle' farmers to commercial farmers
- water markets have caused a consolidation of irrigated farmland into larger, profitable family operations
- water markets have polarised the irrigation community into two different classes of irrigators: a 'water-rich' class, which will continue high production during drought; and a 'water-poor' class, which will be exposed to reduced production during periods of drought.

These trends raise important questions about the equity of water trading and its long-term social impacts. If markets do not operate effectively then the price signal and the incentive it provides to water users is distorted. For example, if a large purchaser of water has market power in the sense that its actions affect the price paid then it is possible that sellers of water could receive less for their water than if the market were competitive. This benefits the buyer at the expense of sellers, it can reduce the amount of water traded and could also distort the price of other goods that use water as a factor of production.

The first consequence of this market failure relates to small and medium-sized enterprises that are effectively squeezed out of the market by large agribusiness that benefits from economies of scale. While the high volume of trade in seasonal allocations in the southern Murray–Darling Basin suggests this will be less of a concern on the seasonal market, the lower volume of trade in permanent entitlements could provide an opportunity for this kind of opportunistic behaviour (Grafton and Peterson forthcoming). This squeezing out of small and medium-sized enterprises—while clearly respecting the principles of economic efficiency—is an area to which social equity research could contribute.

A second, direct consequence of water trading is the so-called 'stranded-asset' problem, which occurs when inefficient producers are forced out of the market by the price of water, but the remaining, efficient farmers are left with enterprises that are not viable owing to a lack of critical mass to sustain the farming community. For example, a farming community of 50 farms enters the market for water. Of the 50 farms, 20 are inefficient producers and it is economically unviable for them to continue in the industry, so they are forced to down tools and leave the area. The remaining 30 farms are left with a community half the size, without sufficient economic activity to sustain the community's infrastructure (such as schools and banks). Now, in this new situation, the efficient farmers are left with assets that cannot be sold (except to large agribusiness, exacerbating the problem further), owing to the lack of a community and social infrastructure: stranded assets. In some jurisdictions, authorities have introduced 'exit fees' to discourage farmers from leaving the community, but, again, this raises interesting questions in relation to social justice.

A third consequence of water trading relates to the environmental provisions of the NWI. The NWI requires the complete return of all currently over-allocated or over-used surface and ground water systems to environmentally sustainable levels of extraction (Hussey and Dovers forthcoming). In this way, the NWI is a major step forward in Australia's approach to environmental management. To achieve environmentally sustainable levels of extraction, however, state and territory governments are required to claw back annual licences from farmers in fully or over-allocated systems, for environmental flows. Where and when these allocations are to be clawed back is determined by water planners and the position of governments is simple: annual licences entail no permanent property right, so there is no legal requirement to compensate irrigators for water clawed back to provide sustainable environmental flows or for other public purposes. But the position facing water planners in the pertinent regions was that it was considered economically, socially and politically unacceptable to claw back more than a marginal amount of water without some form of adjustment assistance. By and large, the states did not have such programs in place to deal with the scale of adjustment required in severely over-allocated systems, or in areas suffering significant adverse landscape change (for example, salinity or waterlogging). As Gentle and Olszak (forthcoming) put it: 'across the country, officials knew never to mention the "C" word—"compensation"—and farmers continue to argue their "right" to compensation.'

Certainly, from an economic perspective, these examples illustrate that the market is doing what it is designed to do in allocating a scarce resource in the most economically efficient way possible. From a social equity perspective, however, it leaves something wanting and there is a disconnection between the goals of water management professionals and the communities they serve. These underlying concerns provide fertile ground for disaffected groups and disadvantaged interests seeking to block worthwhile change (Syme and Hatfield-Dodds, forthcoming). In this respect, an incentive exists for policymakers to understand better the equity and distributional effects of any given environmental policy in the policy formation and implementation phases.

Pricing signals in the urban sector

In addition to facilitating urban–rural trades, the NWI stipulates that urban water pricing reforms are needed to account for the large temporal variations in supply that are currently managed with quantitative water restrictions. In keeping with economic principles, pricing urban water to balance demand with available supply is economically efficient, and also provides the appropriate signals to users as to the value of the water they are using (Sibley 2006). Such pricing also promotes innovation in terms of supply.

The use of pricing signals in the urban sector, however, again raises social equity considerations. A Brotherhood of Saint Laurence study on price changes in Victoria showed that price changes were regressive, with the major losers being tenants and larger, low-income families. Moreover, the study found that consumers perceived risk to themselves from price deregulation, with great support for the public provision of water. This is not to say that pricing instruments in the urban sector are necessarily a bad thing—and the projections for population and water supply suggest that we might not have much choice—but in designing pricing signals, policymakers need to consider whether some form of basic or minimum entitlement for domestic purposes be granted, and/or whether there should be a form of redistribution to families lower on the socioeconomic scale from the increase in water revenues generated (possibly through the tax system) (Grafton and Kompas 2006).

It is interesting to note that in the European Union—where full-cost recovery pricing is a central tenet of the Water Framework Directive (WFD)—the fear of the commodification of water has prompted calls for a similar redistribution scheme (Hansjurgens 2002). Article Nine of the WFD requires of the member states that, by 2010, 'water pricing policies provide adequate incentives for users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive'. In addition, price reductions for special customers such as big companies or irrigators are no longer compatible with EU water legislation, and river-basin authorities are expected to increase their revenues after the shift to full-cost recovery water pricing. It is still unclear, however, which institution should receive the additional revenue from water prices, and whether it is possible to transfer the funds collected to other catchment areas for water efficiency or environmental measures (Kuckshinrichs and Schlor 2005). Australian policymakers and commentators could benefit from analysing the European Union's experiences in full-cost recovery pricing.

Conclusion

Contemporary Australian water policy places enormous store on the merits of neoclassical economic principles, and implicit in this is the assumption that other, subsidiary goals will be 'better able to take care of themselves if we get the economics right' (Connor and Dovers 2002:120). It is clear from this paper, however, that while the NWI and the instruments contained therein present obvious benefits for the allocation of water resources, there are a number of social equity and social justice issues that will need to be dealt with.

In the rural sector, the introduction of water trading has two possible consequences: 1) owing to the monopolistic power of large agribusiness, the possibility exists that small and medium-sized farming enterprises will be squeezed out of the market, with consequent impacts on the rural community; and 2) less efficient agricultural producers will be forced out of the market, which will in turn leave efficient producers in a stranded-asset scenario. Granted, these outcomes are largely the point of water trading, but the long-term social impacts of such restructuring need to be better understood. In the urban sector, the introduction of pricing signals could disadvantage low-income earners and there is a need for greater research on the potential redistribution of funds from water utilities or industry to the lower economic strata of society.

Furthermore, a decision needs to be made as to whether there should be a basic, minimum right to water for domestic purposes at lower or even zero cost. Ultimately, the commercialisation and corporatisation of our chosen model for natural resource management—and water resource management in particular—means that there is a significant need to incorporate a human rights and social justice dimension in policy analysis.