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Economic issues in the efficient provision of future water supplies for rural Australia

ABARE submission to the House of Representatives Standing Committee on Agriculture, Fisheries and Forestry Inquiry into the Provision of Future Water Supplies for Australia's Rural Industries and Communities

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Australian Bureau of Agricultural and Resource Economics
GPO Box 1563 Canberra 2601

Telephone +61 2 6272 2000   Facsimile +61 2 6272 2001
Internet www.abareconomics.com

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Summary

In this submission, the problem of future water supplies to rural Australia is examined in the broader context of natural resource management. This approach offers the flexibility to consider the nexus between production and the environmental objectives of water use and management in the context of land use change and land degradation, and their influence on rural production and income opportunities. Drawing on previous ABARE research, examples are presented of economic approaches that guide efficiency in water supply and use and highlight the linkages between water management, land use change, environmental quality and their rural income implications.

The key challenges facing policy development are examined in this submission and the impediments to achieving an efficient use of water in all sectors of the rural economy are identified. This process highlights the Commonwealth's ongoing role in clarifying property rights and coordinating natural resource management policies to enhance the role of markets in ensuring efficient water resource development and use into the next century. The role of research as a mechanism for addressing information deficiencies and for guiding policy and innovation is recognised. The following key points have been identified in this process:

1. Despite some difficulties, progress has been made on implementing full cost recovery charging. However, the current regime of uniform pricing for water delivery is still not adequate to guide efficient resource use.

2. Pricing needs to reflect the increasing social costs in water supply and use and to take account of capacity constraints in delivery systems that may impart costs to all irrigators. Alternatively, infrastructure access rights need to be clarified.

3. Marginal cost pricing linked to long term contracts is a more efficient way of setting water charges than the current system based on average pricing.

4. In allocating water between competing demands, the economic rule is to allocate water to each activity to the point that the benefits achieved from the last unit of water in each activity are equalised.

5. Many of the benefits provided by environmental flows are not valued in a market, and allocation of water to the environment has become a government activity.

6. Maximum social benefits from environmental allocations can be gained by:

   – withdrawing water from low value uses; and
   – allocating water to high value environmental uses.

7. A water market that does not account for the environmental impacts of irrigation will be an impediment to obtaining environmental flows at minimum social opportunity cost.

8. On-farm water harvesting and storage may have significant economic and environmental implications because of forgone downstream opportunities.

9. Trading of water entitlements, with external impacts considered, is the best way to determine the value and productivity of water in alternative uses.

10. At times, changes to water use patterns resulting from water trading may have an impact on downstream salinity and water quality, potentially undermining the benefits of trade in water.

11. A number of policy instruments can be used to correct for these external impacts of water trade; for example:

    – taxes and subsidies may be used to change the private benefits from irrigation to better reflect social benefits;
    – water use may be limited by the use of direct quotas or pollution permits where applicable; and
    – establishing site specific tradable water use rights between regions may be one means of improving water allocations when there are site specific differences in the external costs of water use.

12. Changing property rights may have an impact on the wealth of irrigators and the wider community. Care needs to be taken to avoid special interest or rent seeking activities

1. Introduction

Water is essential to sustaining life and supporting economic, environmental and social systems. The goal of water resource management is to maximise the net social benefits from water use, where the net social benefits includes the public and private benefits flowing from water use activities less any private and public costs associated with such activity. The policy and institutional framework that governs water storage, distribution and use affects the net social benefits by influencing the productivity of water — the rate at which water that is used is converted to useful output — as well as access to economic opportunity, incentives for investment and the quality of the rural environment.

The national Water Reform Framework introduced in 1994 by the Council of Australian Governments (COAG) provided a collective basis for developing water resource management policy through a process of market oriented institutional reform concerning the storage, delivery and use of water. Moreover, the policy framework linked water use to the principle of full cost recovery, and sought to establish clearly specified and transferable rights to water, allocations to the environment, and a process of engaging the community in the efficient management of the nation's water resources. A key element in this reform was the promotion of a market for water as a mechanism to capture the full value of water in competing uses. This market would allocate the available supplies of water to their highest value uses.

The COAG water policy reforms over the past decade have laid the foundation for enhancing the value of water as natural capital, an economic good and a tradable commodity. Consequently, allocations of water among competing needs are increasingly negotiated on the basis of forgone benefits, with prices indicating the scarcity value of water at times of need and at different points. Such market-based resource allocations are intended to lead to better resource use outcomes and greater public benefits. For instance, the rising price of water has offered incentives to use water more efficiently and attracted investment by both the public and private individuals in water saving technologies.

Such savings are being directed through trade to meet shortfalls in water during droughts, thus reducing impacts on production (O'Kane 2000). Future policies need to consolidate these gains and address any remaining impediments that hinder the efficient use of Australia's water resources to sustain social wealth and safeguard ecosystem health. An area needing particular attention is the external costs of water use and charging structures for water delivery. The other ongoing issue is the allocation of water to the environment — that is, how to determine the optimal level of use between production and conservation uses.

ABARE has actively contributed to water resource management at the Commonwealth level as a provider of economic advice on the efficient use and management of land and water resources in Australia. ABARE's land and water research is concentrated in three areas: the collection and analysis of data relating to resource use, management practices and economic returns; the development of economic and statistical models to identify the key drivers of and influences on resource use and management across Australia, focusing particularly on the externalities between competing resource uses; and the development of policy and program solutions, such as indicating which economic instruments are both practical to implement and efficient in delivering robust outcomes.

ABARE has research programs that investigate the economic issues in land, water and vegetation management in Australia. Using ABARE's farm survey infrastructure, data are collected on a range of issues such as vegetation cover and clearing, irrigation and water management, and Landcare and resource management practices. Customised regional surveys are also conducted periodically. These data are integrated with other production, financial performance and farm household information in ABARE's farm survey database to provide ABARE with an unparalleled research resource. These data are then analysed, often in conjunction with economic or statistical models that incorporate the best available science, to provide a fully integrated perspective on resource management issues.

Several new issues have emerged since the 1994 COAG water reform agreement and 1995 National Competition Policy (NCP) arrangements for implementing water reform. Those of particular interest to this inquiry are:

- land use impacts on water quality;
- in-stream salinity;
- security of water entitlements; and
- on-farm water harvesting and storage.

These issues have broadened the scope of water reform and government intervention on natural resource management as they represent areas of growing conflict between competing users of water. These issues will be returned to later on in the submission.

In this submission, the problem of future water supplies to rural Australia is examined in the broader context of natural resource management and economic development. This approach offers the flexibility to consider the nexus between production and environmental objectives of water use and management in the context of land management, their linkages to land degradation and their influence on rural production and income opportunities. Drawing on previous ABARE research, examples are presented of economic approaches that guide efficiency in water supply and use and highlight the linkages between water management, environmental quality and their rural income implications.

Background

There is a steady increase in the demand for water each year. The gross water supplied in Australia grew from 16 000 gigalitres in 1983-84 to 20 000 gigalitres in 1995-96. Much of the increase was been in irrigated agriculture, which consumes around 72 per cent of total water used in Australia (AATSE 1999). Two-thirds of this increase was sourced through licensed private diversions and ground water extraction and from unregulated streams and farm dams. While this increased use of water has contributed to an increase in farm production, environmental implications of changing patterns of water withdrawals from surface and underground systems present an important policy dilemma.

Over the past eight years, Australian governments have adopted a set of water reforms endorsed by COAG in 1994. A gradual move to a pricing regime based on full cost recovery and the allocation of water to the environment was pursued to achieve greater efficiency in water use in the irrigation sector and to restore ecological values in the riverine environment. Movement of water within existing uses and to the environment was facilitated by the implementation of a trading system for water entitlements that were previously attached to land titles. Breaking the link between the titles for land and water, and the introduction of a basinwide cap on irrigation diversions were expected to create a well functioning market for tradable water entitlements in the Murray Darling Basin. Although trades have become more frequent and instrumental in directing water to higher value uses in general, uncertainty in property rights, a lack of full information and the presence of institutional restrictions on trade have constrained the development of water markets in irrigations regions of the Murray Darling Basin. The need to somehow account for the environmental impacts of water use and trade so that the water market delivers an efficient outcome is also now more widely understood.

The value of irrigated production varies between regions, reflecting differences in enterprise mix. The gross value of returns from irrigated agriculture in 1996-97 was estimated to be $7.3 billion, or 26 per cent of the gross value of farm production in Australia (ABS 2001). The demand for urban and environmental uses of water is likely to rise and this water will have to be sourced from existing allocations for irrigation. Hence, the social costs of providing enhanced environmental and urban flows will be influenced by the value of activities from which water is withdrawn.

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A key issue for natural resource management is to provide for multiple uses of water within an integrated scope that addresses the reliability of water supplies, the processes that threaten water quality such as sediment and nutrient enrichment, and downstream impacts of land use (National Land and Water Resources Audit 2001).

Australia's ability to manage the interdependent processes that constitute the water cycle will determine our ability to adjust to the changing weather and climate patterns and the changes in ecosystems that affect the natural service flows that underpin the economic, ecological and environmental affluence of our society. Understanding these interconnections on many scales requires careful study. Processes that occur simultaneously on different scales determine the behavior of the system. Conducting studies on a farm, catchment and basin scale has allowed ABARE to gain valuable insights into the management implications arising from processes within these complex systems. The management of these complex systems for productive use can be improved by rational application of technology and economics, and by decision making at the right scale.

Past approaches to address the issues of water allocation and use have focused heavily on infrastructure development and related investments to capture, regulate and deliver water supplies. Attention is now focusing on economic approaches to encourage efficient water use patterns and develop efficient decentralised solutions that improve the overall productivity of natural resource use.

'Many uncertainties remain about the physical, practical and economic potential of soft-path alternatives. But these uncertainties can be reduced through modest investments in data collection and analysis, consistent regulations and standards, and appropriate application of economics' (Gleick 2002).

The insights presented in this submission, drawn from such investments by the Commonwealth, other institutions and ABARE collaborators, highlight the strategic need to further such initiatives.

2. Water charging – recovering the full cost of water through efficient pricing

Water charging

Pricing reform to achieve full cost recovery charges in water delivery is the first step in the reforms introduced in 1994 under the COAG process. Despite some difficulties, progress has been made on implementing full cost recovery charging (Shadwick 2002). In all states, some irrigators have assumed responsibility for the running costs in most of the previously state owned irrigation systems.

The level and structure of charges varies between irrigation authorities. However, the typical fee structure for water delivery is still a form of uniform (socially equalised) pricing, where the total cost of delivering water to all farms in a region is shared equally among all irrigators subscribing to the system. In a typical system, various components of fixed costs are apportioned among users based on a small fixed fee to cover office administration, and an allocation fee based on the level of the water entitlement. Variable costs are recouped through a volumetric fee based on actual consumption (Goesch 2001).

It appears that this form of pricing offers a convenient way of distributing fixed and operating costs of water delivery among irrigators. In particular, for an existing irrigation system, owned and operated by a single provider of irrigation services (a natural monopoly), average cost pricing may seem attractive.

However, pricing based on average costs may contribute to a number of problems:

- It neglects the differences in delivery costs associated with the location of farms. Farms located closer to the headwaters are likely to have lower delivery costs than farms located downstream (Hafi, Kemp and Klijn 2000).

- It can lead to possible underuse or inefficient use of irrigation infrastructure, and expose an irrigation authority to stranded assets. Excessive delivery charges arising from a declining pool of irrigators may force the remainder to sell their entitlements away from the region.

- It acts as a deterrent to new investment in infrastructure. Potential investors are unable to gauge the likely rate of returns because the use value of water is distorted by the pricing structure.

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Pricing to reflect actual costs

Pricing needs to reflect the increasing social costs in water supply and use and to take account of capacity constraints in delivery systems that may impart costs to all irrigators. As an alternative to pricing mechanisms, Beare, Bell and Fisher (1998) suggest infrastructure access rights as a way to deal with capacity constraints in delivery systems.

ABARE studies in the Murrumbidgee Irrigation Area have shown that a (marginal) pricing system that better reflects the cost of water delivery to each farm could enhance the efficiency of water application by encouraging the adoption of more efficient drip irrigation systems. The increasing value of water with distance from the source makes investment in water saving technology more profitable under efficient pricing (Hafi, Kemp and Alexander 2001). This in turn leads to an overall increase in the efficiency of agricultural production.

Marginal cost pricing also has distinct advantages with respect to infrastructure management (Goesch 2001). For example, linking marginal cost pricing with carefully constructed long term contracts may:

- extract maximum use (economic benefits) of existing infrastructure, by minimising possible exposure to stranded asset problems;

- provide a market test for investments in new/refurbished infrastructure, which should address potential underinvestment problems;

- minimise the third party impacts from trade, such as salinity, water quality and capacity constraint issues.

Asset renewal

Levies to fund asset replacement and charges to generate a return to the public investment in infrastructure have been introduced in some irrigation regions. The economic logic for such charges is not clear. In particular, the logic of establishing an appropriate rate of return on existing assets is circular, as the current charges for water are used to determine the value of the asset while the rate of return on the asset is used to determine the charge. Solving this circularity requires a more efficient approach to pricing and allocation of rights to infrastructure services.

Similar to investments in other infrastructure, replacement decisions should be based on the expected benefits of the services provided. In the case of water, the market price for water provides a clearer indication of value. As discussed later, the determination of prices in water markets needs to reflect all costs. However, the interdependence of various sources of costs adds to some complexity to the process of moving to full cost recovery prices (OECD 2002) (box 1).

Box 1: Costs of irrigation water

The costs of irrigation water use are difficult to ascertain and treat under clear categories. Water authorities use water charges to cover the costs of supplying water to irrigators. Supply costs are influenced by the operation and maintenance costs and the capital costs of constructing the system. Water diversions and use also impose opportunity costs on third parties (externalities), and full cost recovery thus requires water charges to reflect the longterm marginal cost (the cost of supplying an additional unit of water), including the social cost of externalities.

Moreover, optimal water use requires water charges to capture the scarcity value and to equalise opportunity costs across all uses. If markets were functioning well, where water moves from least productive to most productive uses, across regions and over time, the scarcity value, opportunity costs and the long term marginal costs of supply should move in the same direction and eventually equalise. In the early stages of market development, and to facilitate the functioning of the market, the full cost recovery charges should reflect longterm marginal costs. It may not be practical to include the full range of social cost of water supply and use in the 'full cost recovery' prices, but it would certainly be in the interest of society to identify them and attempt to reduce them where possible (OECD 2002).

Key points

- Despite some difficulties, progress has been made on implementing full cost recovery charging. However, the current regime of uniform pricing structure for water delivery is still not adequate to guide efficient resource use.
- Pricing needs to reflect the increasing social costs in water supply and use and to take account of capacity constraints in delivery systems that may impart costs to all irrigators. Alternatively, infrastructure access rights need to be clarified.
- Marginal cost pricing linked to longterm contracts is a more efficient way to set water charges than the current system based on average pricing.

3. Competition between users: environmental flows

Maintaining sufficient water in rivers and streams that provide for irrigation uses as well as meeting the ecological needs of the riverine environments is a growing public policy issue. In terms of maximising social welfare in the presence of competing demands for water, the economic rule is to allocate water to each activity to the point at which the benefits achieved from the last unit of water in each activity are equalised.

Many in rural and urban Australia see allocation of water between consumptive and environmental uses as a critical issue. This is based on a belief that existing institutional arrangements have resulted in an inefficient allocation of water to production and inadequate provision of water for conservation of the environment. However, in terms of efficient use of water, environmental allocations are only one of a wide range of factors that affect the net social benefits of water use. When aiming to maximise net social benefits, the provision and use of water must be seen in the broader context of economic development and natural resource management.

Many of the benefits provided by environmental flows are not valued in a market, and are therefore unlikely to be provided by individuals or private entities seeking to make a profit. Hence, the COAG reforms committed Australian governments to allocating water to the environment. In most cases, an increase in environmental flows will have to be sourced from existing or potential irrigation uses. Governments can achieve this in several ways, including:

1. withdrawing water entitlements from irrigators;
2. purchasing water entitlements in water markets; and
3. retaining some or all of the water savings from improved irrigation efficiency, through, for example, reducing conveyance losses.

The choice of clawback mechanism largely dictates who bears the cost of the change in resource access. Regardless of the clawback mechanism used, achieving social efficiency requires that withdrawals be made at the least cost. This may be achieved by targeting low value uses. Moreover, if the water so withdrawn is to be used to achieve the highest possible benefit, it needs to be targeted at high value environmental uses with multiple benefits.

Minimising the costs

An immediate implication of allocating more water for the environment is a reduction in water available for other users. However, with a reduction in availability, the marginal returns to water will increase and this may change the profitability of investments in water use efficient technologies. The opportunity cost of water will thus influence the adoption of water saving measures in agriculture. An improvement in water use efficiency in response to an increase in the marginal return to water may mitigate the effect on the extent of irrigated activity. However, it will only reduce, and never fully offset, the opportunity cost of enhanced environmental flows.

ABARE studies indicate that a well functioning water market may significantly reduce the opportunity costs of environmental flows. For example, without trade, a 2 per cent withdrawal of water entitlements over ten years for each irrigation region in the Murray River system would result in direct costs of forgone agricultural production of about $975 million. Allowing for trade between regions was estimated to reduce these direct costs by over a third or $360 million over the same period (Heaney, Beare and Goesch 2002).

However, reductions in water use can affect water uses in irrigation regions other than where water use is reduced through changes in the quantity or quality of available irrigation water. These external costs also need s to be taken into account in determining the full social opportunity cost of environmental flows.

External impacts

Increasing environmental flows can generate a mixture of external benefits. Increased environmental flows may dilute existing salt loads in a river system to the benefit of remaining irrigators. Further external benefits may be generated if a reduction in irrigation also reduces the level of salt exports to the river from surface and subsurface drainage. These benefits can be substantial. Heaney, Beare and Goesch (2002) report the results of a scenario where these external benefits offset more than 40 per cent of the value of forgone agricultural production.

A direct implication is that institutional arrangements for water trade that do not account for the environmental impacts of trade will be an impediment to obtaining water for the environment at lowest social opportunity cost.

On-farm water harvesting and storage

The ownership of water that falls on farms has been a heavily contested issue in recent times. While the use of farm dams to capture rainwater for domestic and stock use is widely permitted, the issue in conflict is the use of farm dams to capture runoff for irrigation. The underlying issue is whether capturing water at the point of precipitation provides the best means of maximising net benefits from water over time, when the forgone opportunities for water use downstream and the linked environmental impacts are also taken into account.

For these reasons various state governments have enacted regulations that govern the level of access to on-farm water harvesting, with a view to reducing downstream impacts. While the limits imposed by such regulations tend to be arbitrary, allocative efficiency is enhanced by allowing farmers wishing to harvest water in excess of their predefined limits to purchase water from existing irrigators in catchments where water use is capped. This flexibility has been introduced in Victorian farm dam legislation, for example. Alternatively, licence fees for water harvesting could be set in the light of water demand downstream, to better reflect the scarcity value of water.

Key points

- In allocating water between competing demands, the economic rule is to allocate water to each activity to the point where the benefits achieved from the last unit of water in each activity are equalised.

- Many of the benefits provided by environmental flows are not valued in a market, and allocation of water to the environment has become a government activity.

- Maximum social benefits from environmental allocations can be gained by:

  - withdrawing water from low value uses; and
  - allocating water to high value environmental uses.

- A water market that does not account for the environmental impacts of irrigation will be an impediment to obtaining environmental flows at minimum social opportunity cost.

- On-farm water harvesting and storage may have significant economic and environmental implications because of forgone downstream opportunities.

4. Water trade – dealing with externalities

Progressive implementation of the COAG water reforms has created a heightened awareness and interest in water trading. This has been magnified in the Murray Darling Basin by the introduction of the cap on irrigation diversions in 1995. But as alluded to in the previous section, irrigation in different regions can have very different environmental impacts which create a range of external costs and benefits for other water users. Consequently, as the volume of water trade grows, particularly in the southern Murray Darling Basin, then it can also be expected to have noticeable salinity impacts on the Murray River system.

If the maximum social benefits from the use of limited water resources were to be realised, then changing the institutional arrangements for water trade would appear to be a high priority.

Sources of externality

The external impacts from water trade arise from changes in the quality and quantity of water available to other users. Heaney and Beare (2001) investigated this in detail and the following discussion draws heavily on that work. They point out that trading water between irrigation regions affect the pattern of surface runoff, irrigation drainage and ground water discharge that, in turn, alters the composition of return flows from irrigation. External benefits or costs arise as return flows affect the quality and quantity of Murray River flows used for irrigation, thus having an impact on users not directly engaged in the trade. The impacts of trade on return flows depend on the agronomic and hydrological characteristics of each irrigation area and, as a result, may produce external benefits or costs that vary continuously along the river system.

The example provided by Heaney and Beare (2001) highlights the underlying relationships. Trade that moves water from an irrigation area with relatively low recharge rates and low ground water salinity to a downstream irrigation area with high recharge rates and ground water salinity can produce a series of impacts on water quality. Immediately downstream of the seller, the transfer may increase stream flows and reduce salt concentration in the Murray River to the benefit of users between the source region and the destination region. However, as ground water salinity is higher in the destination region, salt concentrations will increase as more salt is transported to the river system negatively affecting users further downstream.

Volume effects from changes in return flows may occur – for example, if downstream trade moves irrigation water from an area with high volumes of surface water runoff to one with high recharge rates and/or high levels of irrigation efficiency. As a result of the reduction in the surface runoff component of return flows, there will be less water available for users downstream of the source area.

The analysis of Heaney and Beare (2001) provide an indication of the potential economic benefits of developing institutional arrangements for water trade that account for these effects. They estimated that the external cost of a trade from the Goulburn-Broken region to a farm located between Lock 3 and Lock 2 in the South Australian Riverland close to the river is around \$300/ML compared with reported trading prices of around \$1000/ML for the region. In contrast, a trade from the Goulburn-Broken region to other areas of the lower Murray system can generate external benefits.

Externalities from water trade are also a potential problem in ground water systems. Trade of water rights into (or out) a region may increase local use, which could lower the water table. It is widely recognised that this could increase pumping costs for neighboring irrigators (Mues and Hardcastle 1998).

The impact of changes in the pattern of return flows on water quality arising from trade has been considered for the Murray River system (MDBC 2001). The Murray Darling Basin Salinity Management Strategy requires that the salinity impacts of interstate trade be accounted for in a system of state level debits or credits. In Victoria, high impact areas have been identified and water trade into these areas has been prohibited. In addition, a levy has been introduced on water transferred into the Sunraysia district in the Victorian Mallee near Mildura (Young et al 2000). However, there are different, possibly more comprehensive, policy approaches that could deliver further economic benefits.

Possible policy approaches

The results of the simulation experiments conducted by Heaney and Beare (2001) highlight that the magnitude of the external impacts associated with trade that does not take into account return flows is highly site specific. They conclude that it would be infeasible to fully internalise return flow impacts on others through a system of private property rights.

Establishing water regions and administering a set of regulations on water trade is a potential solution. These regulations may take the form of either exchange rates or a set of taxes and subsidies on water trade (Heaney and Beare 2001).

Beare and Heaney (2002) have critically examined the potential to use price and quantity based instruments to address the externalities associated with water trade. Price based instruments include taxes and subsidies that are used to change the private returns from irrigation to reflect overall social benefits.

Quantity based instruments can also be used to limit water use to the point where additional irrigation would reduce the overall social benefits from water use. Quantity restrictions can be direct, in the form of a quota, or indirect. Indirect instruments include pollution permits or credits, such as a salinity credit.

They conclude that when dealing with a spatial externality, like that generated by water trade, a fixed price instrument is preferred to quantity based restrictions. This is especially so when demand is variable. That is, a fixed tax may still be an efficient instrument when demand increases but a fixed quantity restriction will impose losses. This is because the fixed quantity restriction is absolute. Irrigation water use above the restricted level is not permitted even though there would be overall social benefits from doing so. The transaction costs of regularly varying the quantity restriction tend to rule out this approach.

The fact that the optimal level of a tax or quantity restriction depends on the difference in the external costs between regions implies that trades between irrigation regions must be considered on a bilateral basis if an efficient outcome is to be achieved. As water entitlements are not necessarily tied to the location where water is used, changes to the rules for temporary or permanent trade in entitlements will not, on their own, be able to efficiently address the impact of trade on water quality.

Establishing site specific tradable water use rights between regions may be one means to improve water allocation when there are site specific differences in the external costs of water use. With well-defined trade in water use rights, an appropriate set of bi-lateral taxes and subsides on trade can minimise the negative externalities associated with water use and achieve an optimal regional allocation.

The analysis of Beare and Heaney (2002) provides a useful initial insight into the institutional reform that could be introduced to address the issue of salinity in the southern Murray Darling basin. The principles underlying this analysis and the issues likely to arise from the implementation of these reforms need to be discussed further if progress is to be made toward implementation. Other policy approaches may also be developed with additional research focusing on the economic principles and issues of practical implementation.

Key points

- Trading of water entitlements, with external impacts considered, is the best way to determine the value and productivity of water in alternative uses.
- Because, at times, changes to water use patterns resulting from water trading may have an impact on downstream salinity and water quality, potentially undermining the benefits of trade in water.

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- If the maximum social benefits from the use of limited water resources were to be realised, then changing the institutional arrangements for water trade would appear to be a high priority.

- A number of policy instruments can be used to correct for these external impacts of water trade:

  - taxes and subsidies could be used to change the private benefits from irrigation to reflect social benefits;
  - water use could be limited through direct quotas or pollution permits where applicable; and
  - establishing site specific tradable water use rights between regions many be one means of improving water allocations when there are site specific differences in the external costs of water use.

- Changing property rights may have an impact on the wealth of irrigators and the wider community. Care needs to be taken to avoid special interest or rent seeking activities.

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