SUPPLEMENTARY SUBMISSION NO. 170

Key Research Priorities for Rural Water

A response from Land & Water Australia to the House of Representatives Standing Committee on Agriculture, Fisheries and Forestry

1. Accounts of water generation, supply and use across all regional catchments
Australia needs a full account of the water cycle, mapped across each major catchment to underpin water allocation planning, water reforms and water trading. The accounts are needed to accurately assess potential water supply (to all uses, consumptive and environmental) and to map the stores and fluxes of water across regional catchments for a range of conditions. They need to include the use of water by present and emerging industries, and to assess the consequences for water supply of catchment reforestation, land use change and farm dams. The accounts must incorporate the risks to supply posed by climatic variability and climate change and show seasonal patterns to resource availability. Surface water and groundwater both need to be assessed, including losses of surface water to groundwater and conversely the emergence of groundwater into surface river systems.

Mapped water budgets will provide the basis for securable water rights, for investigating the implications of water trades, for monitoring change in the distribution of supply as a result of water trading, and for assessing the implications for water supply of broader natural resource management.

Most of the elements of the budgets (runoff generation, tree water use, irrigation water use, seasonal flow forecasting etc) have been or are currently being researched. The need now is to integrate these components into the terms of water accounts (or budgets); to map the budgets across catchments; and to use the results in predictive modeling of the implications of future water trading, land use change, and climatic variability. That is, we need to take the good knowledge of the elements of the water cycle and build a total system view of the generation, storage, supply and use of water. This will enable the work to date to better inform the major water use issues of the next ten years. The budgets can be captured in spatial models that can be widely applied across Australia and can be used in prediction of future water supply.

Ongoing measurement of the distribution patterns of water will also be required to monitor and evaluate the outcomes of water reform and trading.

2. Measure the ecological benefits of environmental water allocation
The challenge here is twofold: to demonstrate the ecological response to environmental flows in key river, wetland, and estuary ecosystems; and to describe the ecological benefits and services provided by those flows.

The measurement of actual ecosystem response is essential for the community to maintain faith in water reforms. Such work is needed to predict with any accuracy the benefits of environmental water allocation, and to design water allocation strategies that meet society's needs.

A global review of the science behind environmental water allocation has revealed that there are many commendable studies highlighting the degraded state of river systems where flow has been modified or reduced. There is also widespread agreement of the broad benefits of environmental water allocation, and these benefits are routinely incorporated into models of responses to environmental flows. The results of these models are highly uncertain, however, because there has been little systematic research to measure and understand the benefits of environmental flows at an ecosystem scale.

In addition ongoing measurement of key systems is required to evaluate if water policy is meeting its goals.

3. Describe the community benefits and costs of water supply
A full assessment of the benefits and costs of water supply is needed to underpin decisions on water trading and to understand the full consequences of water trading; decisions on water resource allocation; and the impact of climatic variability. This includes the economic, social and ecological benefits of current water supply and the implications of predicted water supply patterns.

The research will need to examine across rural communities the full benefits of present and potential future water supply patterns. Similarly the full costs need to be assessed, such as the assessing the costs of upgrading water supply channels balanced against the benefits of higher quality of water supply and reduced impact from groundwater recharge. The examination will need to explicitly include the interdependence of economic, social and environmental benefits into a single water cost and benefit framework. This will break the current tension of economic and ecological benefits being viewed as mutually exclusive.

4. Define water rights and water markets that meet national objectives.
There is an urgent need to conduct policy and economic research into the likely outcomes and consequences of a range of possible changes to water rights and water markets to design policy and legislation that meets the goals of water reform.

There are broad calls for more effective water rights that give certainty to users and the environment and that reflect obligations in water use. Intimately linked with this is the advocacy of an effective water trade that will allow maximum benefit to be accrued from water use. In the natural resource area such free market mechanisms require careful design and evaluation to avoid failing to meet key needs of society. In addition, a water market has significant physical limitations imposed by the flow patterns of rivers, and there are significant positive and negative environmental consequences of particular trades. In the simplest case, water cannot be traded beyond the capacity of the river channel. For these reasons, possible changes to legislation and trading need full investigation and thorough monitoring and evaluation.

Additional Significant Research Priorities

5. Understand the key drivers of reduced ecological health of aquatic systems
Freshwater ecosystems are dependent on suitable environmental conditions for survival. These conditions can conveniently be grouped into three classes, flow, physical habitat, and water quality. To have successful ecological restoration or protection we need to understand the critical ecosystem requirements in each of the

above classes, and their interaction. In some degraded systems it might emerge that flow is not the critical environmental limit, and that more can be done by improving physical habitat or water quality. The opposite will also apply, but for more effective restoration or protection of rivers we need to know where particular limits apply.

Such knowledge can help underpin strategies to protect rivers of high ecological value in the typical cases where it is not possible, or necessary, to protect the complete catchment of the river.

6. Design systems that use water more efficiently while enhancing primary production

Continued gains are possible in water use efficiency of agriculture in irrigated areas. This can come from improved technologies, better understanding of plant water requirements and improved design at farm and irrigation system level to reflect the inherent limitations of soil, groundwater and climatic conditions.

7. Design improved systems for treatment and reuse of drainage waters and sewage waters

Increased reuse of water can reduce the total demand on water resources while also reducing the amount of contaminants that inevitably enter river systems from drainage waters. The same principles apply to urban effluent waters in rural catchments.

8. Assess the water quality implications of altered water supply and allocation.

Water quality remains a crucial issue for both downstream human water use and for sustainable ecological systems. Changing flow patterns across the landscape will change the quality of water coming from those areas. There is potential for both beneficial and detrimental change. Of particular concern are changes to the relative proportion of groundwater to surface water flow. Consideration needs to be made of both concentration and load of contaminants in both baseflow and flood flow conditions. Contaminants of concern include salt, sediment, nutrients, and chemicals. One of the primary controls on algal blooms in lowland rivers is lack of flow in turbid waters, providing a further interaction worthy of further research.

9. Increase our ability to forecast seasonal flows and water use

With increasing pressure on water use there are demands that resources be allocated more effectively but forward planning of water allocation is made uncertain because water availability and use are so dependent upon seasonal weather conditions. Considerable progress has been made on seasonal weather forecasting for planning of agricultural production and these methods are now being applied to seasonal forecasting of flows. Further work is required to improve the accuracy, quantify the uncertainty, and extend the foresight of these predictions to improve decisions of seasonal water allocation.

10. Understand the implications of flood harvesting of overland flow.

A growing type of water storage is the retention of large volumes of floodwaters on lowland floodplains. The water is retained in extensive shallow reservoirs fed by levees and channels for use in crop production on the floodplain. The alterations to flow from these reservoirs and losses to seepage and evaporation are very different to more traditional reservoir and river supply systems. One can expect that the ecological consequences and water use efficiencies will also differ with these systems but there has been little systematic research on them. Such research is required to inform future policy on this form of water extraction.

For more information see:
Water Resources: Science Priorities for Australia (nine short issue sheets).