Canegrowers

The water eaters

Australians are adopting an enlightened approach to water management, but atoning for past mistakes will require major shifts in food production and a new reverence for water catchments. **Dr Wayne Meyer** explains how things might change.

Dr Wayne Meyer, sustainable agriculture program leader at CSIRO Land and Water.

Australians take perverse pleasure in laying claim to the driest inhabited continent. The paradox though is that our use of water, until recently, has been anything but conservative.

Fortunately, this attitude to water use is changing. In southern Australia, we have moved away from the romantic notions of 'greening the inland and drought proofing', past the engineering concepts of 'taming and training' rivers and beyond the strident mining mentality that any water flowing past in a river is 'wasted'.

Water is now recognised as a finite but renewable resource, and there is an increased awareness of the ecological value of rivers and the impact of excessive water withdrawal.

This attitude shift, from pioneering exploiter to long-term custodian, predisposes us to more responsible water management. Amid the legacy of neglect and mismanagement, we are rediscovering that we cannot live in blissful contempt of the environment around us.

Rivers turned upside down

The history of water exploitation in Australia goes back a long way. The withdrawal of water from rivers for irrigation, particularly in the south-east and south-west of Australia, has been excessive, causing considerable damage to river ecosystems.

Water control has massively reduced the number of small to medium floods and their ecological influence on the riverine floodplains. It has instigated high flows in the upper reaches for irrigation supply in summer and a change in the mix of water temperature, energy cycling, sediment, nutrients and chemicals. Little wonder then that many native species adapted to a very different environment are out-competed by introduced species.

Even with some decrease in water withdrawal – and therefore an increase in environmental flows – rivers will not be returned to their previous highly variable flow regime. Town needs, flood mitigation measures and recreational demands will preclude this possibility.

Further damage has resulted from the diversion of high volume coastal rivers into inland river systems. In a country undergoing rapid development, Australia has historically viewed such engineering projects as challenging, with little regard for the likely biological and social consequences. These include significant decreases in flow and seasonality of the diverted river and increases in the receiving river, affecting the ecosystems of both. Our recent experience shows that more than the diverted water will be exploited from the receiving river and that radically changed groundwater conditions and increased land salinisation will result.

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Urban water pressures

Australia has more than enough water to take us well into the next century, but there is a poor matching of people and water resources. In southern Australia our water is highly developed and highly committed. In the high-rainfall north, little is collected and used.

In the capital cities of Perth, Adelaide, Melbourne and Sydney, water scarcity will increasingly constrain population growth. But urban water efficiency programs in the past five years have contained demand for water, and further improvements are possible.

A recent analysis by Jonathan Thomas, of the Resource Economics Unit, revealed that water availability was unlikely to limit economic development in the next 20 years. But there were some important provisos: there must be improved efficiency in urban areas and an annual efficiency gain of 1.6% in irrigation agriculture during the same period. Significantly, Thomas concluded these gains would provide water to alleviate most problems caused by low environmental flows, and that water quality would not obstruct economic development.

Nevertheless, conflicts in water use may still arise. Within 20 years we will probably see urban and industrial users buy significant amounts of water from rural area users, principally irrigators. Rural social dislocation is likely to occur as affected irrigated areas become less viable. This is already apparent in southern California and Israel. More efficient water use and alternative water sources will delay this, but legislation may be needed to ensure minimum allocations.

Agriculture overflowing

Irrigated agriculture consumes 72% of our available water supplies and it is here that most efficiency gains are needed. The options include improving systems of water delivery and application and shifting to food types that consume less water in their production.

Earthen channel systems that convey water from storages or rivers to farms are a major source of water loss, in some cases up to 90%. Ideally, irrigation water should be conveyed in pipe systems. These are costly, but as water becomes more valuable this option will be increasingly used.

Similarly, long, open inland rivers are inefficient water transport systems. Given the current cost of energy, the low economic returns from agriculture and our understanding of water and salt movement in the landscape, inland irrigation areas are not sustainable in the medium to long term. Future energy costs, food demands and technological knowledge may change this.

Surface irrigation is still the main form of irrigation used in Australia. We are one of the few countries in the world that can still afford, or allow, water to be applied to large areas of pastures in what are often little better than transient floods. Invariably, excessive amounts of water move past the root zone and into the deeper soil layers that are inaccessible to plant roots.

Every effort should be made, both in dryland and irrigated agriculture, to maximise the proportion of water taken up by vegetation. The water that bypasses plant roots is the cause of many of our land and water degradation problems such as salinity and nutrient pollution.

Irrigation is used to optimise plant quality or quantity. But many irrigators and their

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advisers act as though they are irrigating the soil, paying little attention to applying the right quantity of water where it is needed. We must continue to develop and apply controlled irrigation systems, especially for high-value crops of fruit and vegetables.

Perhaps we should also consider the kinds of food we grow. For example, irrigated wheat requires a minimum of 700 litres to produce one kilogram of oven-dry grain, while a kilogram of beef in very high productivity situations requires at least 50 000 litres. So with a few exceptions, producing livestock on irrigated pastures is not making the best use of our water resources.

Suppose we refine our irrigation and other agricultural practices to a point where we have maximised water use efficiency and are at the limit of productive potential. What possibilities exist to progress beyond this?

Professor Gerald Stanhill from the Volcani Institute in Israel suggests that we need to consider manipulating the main chemical processes within plants so that species are able to capture carbon for a lower concomitant loss of water. This is theoretically possible because we already know that many tropical species (called C4 plants) are more efficient at fixing carbon per unit of water loss than are many temperate C4 species.

To make this change will require a huge scientific effort as well as a major social debate. However, such an idea holds the prospect of providing a quantum shift in the amount of food that can be produced from our limited water supplies.

Drawing new boundaries

Big-picture water reforms are also critical for improved water management. Historically, water in Australia has been owned by governments. This hasn't always produced the most efficient use of this precious resource, but it has been difficult to change the system.

It wasn't until the 1990s that the issue of water ownership was seriously addressed. In what may well be a defining moment in water policy, the Council of Australian Governments reached an agreement in February 1994 on the way in which water is to be managed, priced and regulated.

A major consequence of the agreement is that for the first time water access rights and property rights have been disassociated. Water users can now assume greater responsibility for managing their own affairs. This has refocussed many water users, especially irrigators, on the economic value of water and should lead to greater efficiencies.

Another defining moment in water use and management came in 1985 with the formation of the Murray-Darling Basin Ministerial Council. At last it was recognised that water resource management must occur on a catchment basis – in this case in the Murray-Darling Basin, a catchment that transcends state boundaries.

Integrated catchment management recognises the inter-connectedness of water as it moves from the catchment, through run-off and subsurface flow, and enters rivers. It recognises that what happens on the land in catchment areas, and what happens within and close to a river affects the river and water-users downstream.

Given our understanding of these processes, it is surprising that we still have not aligned our local government boundaries to those of the regional catchment. This would enable people to take responsibility for the soil and water resources upon which they depend. Supported by expert guidance, they would then be able to extend their planning horizons from urban to regional areas and from immediate to long-term resource management. Such a change will be essential if we are to achieve sustainable management of arguably our most precious resource.

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