

Paper prepared for: **Standing Committee on Agriculture and Water Resources**
Regarding : **Water Use Efficiency in Australian Agriculture**

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Preamble

This paper examines fundamental aspects of water use efficiency (WUE) from the perspective that the water available for consumptive use is a finite volume and will become an increasingly scarce resource in coming decades. The measure of WUE in irrigated agricultural systems is assessed by the mass of plant material produced from a unit of applied water. This measure of WUE e.g. tDM/ML, indicates a large range of efficiencies within production systems. The range is also dependent on the plant systems used, location, climate, seasonability and the attention to the many other factors contributing to plant productivity.

Other measures of efficiency are spoken about in irrigated systems e.g. ML/day, ML/day/labour unit, dollar return per hectare irrigated. These, and similar measures, are peripheral to the fundamental question of how agricultural systems can maximise productivity from applied water.

Present day consequences of government water policies over the past decade

Over the past decade both federal and state governments have adopted policies and programs generally aimed at improving the way water is used. One of the main approaches has been to encourage movement of water to areas and production systems that use the market place to secure the water needed. On the supply side this market has drawn water from those who only made occasional use of their entitlements. Others supplying water for this market may have previously used their entitlement as a drought buffer. A most significant group supplying water to this market are those who have experienced serious challenges to their farm's viability. Low net farm income combined with poor seasons and depressed prices for farm produce can provide a backdrop that reduces capability to innovate and develop sound sustainable farm businesses. An important group who may have this predicament are people who have been farming for many years. The average age of an irrigator is 58 years in the GMID. Over the past decade many on-farm discussions with very predictable outcomes have and continue to happen. "Sell the water and probably continue to live on the place and maybe use the land for some half hearted enterprise" is the normal approach. Usually the neighbour is unprepared to pay the owner's price, so farm amalgamations are thwarted in the short term, but inevitably will happen some day.

Meanwhile the water normally leaves the district with sellers currently receiving \$2,500 to \$3,000 per ML and using the typical \$500,000 to fund a more comfortable lifestyle in their remaining years.

Our farm provides a particular example of these predicaments to the district and most importantly to major public investments in its infrastructure. We sold our 600 cow dairy herd in 2008, and some of the land. The remaining 460 hectare normally supports 100 ha of double cropping (maize and winter crop), 40 ha of lucerne and irrigated annual pastures to assist in contract growing 500 dairy replacement heifers. Between 1.2 and 1.5 Gl of irrigation water delivered by Goulburn Murray Water is used annually. In the past five years public funds have been invested on our farm, including about

\$400,000 in “connection to backbone” and metering works plus about \$300,000 in an on-farm water efficiency project.

This farm is regarded as an unattractive proposition for potential buyers.

Annual fixed charges for “Delivery Share” on this farm of \$54,000 are payable to Goulburn Murray Water (GMW). The farm has excellent dairying improvements, including an unused computerised rotary dairy, but is shunned because of its annual overheads. Cropping operators who surround this farm have taken over the many former dairyfarms in our district. They would be the logical buyers of our operation if it had no water and was unencumbered by the irrigation improvements. All this could be achieved by our payment to GMW of \$500,000 to have Delivery Share removed from the property and spending another \$400,000 to remove channels, drains, fences, lanes and irrigation structures. Perhaps the sale of the farm as a dryland cropping paddock would finance the above \$900,000 expenditure. Finally we would walk away having sold our water almost assuredly to a downstream irrigation business.

Consequences of this sale scenario include

- significant reduction in the water being delivered in GMW’s recently upgraded channels to our farm.
- waste of the public funds in connections work.
- waste of money that funded our on-farm water efficiency project.
- further significant reduction in money generated on this farm and spent locally.
- an increase in fees which GMW would have to charge remaining irrigators.

The above situations only describe some of the consequences in the market associated with water, irrigation supply services and farm land. These are of immediate concern or benefit to people, districts and to government accountability today.

However much greater issues, as a result of the above, that will have effect over coming decades are now being established. These are discussed below and need to be considered in the context of productivity from irrigation water.

Wasting water or productivity

The actual plant production from irrigation water is decreasing significantly as increasingly larger volumes of water are used on new irrigation developments in the semi arid zone. Most of this water is purchased from irrigators in higher rainfall areas. Irrigation policies encourage market forces to shift this water to the semi arid zone. Compared to higher rainfall districts this results in more water being needed to make up for less rainfall and greater evapotranspiration (ET). The amount of extra water varies over the spectrum of rainfall and ET situations.

The diminished productivity of irrigation water is illustrated in the following example. The Shepparton area, with rainfall of 500mm can be compared with the 250mm rainfall of north-western Victoria, south-western New South Wales , and S.A. There is a difference of 2.5 MI per hectare (100 mm provides 1 MI per hectare). ET losses differ by at least 5 mm per week over a 200 day irrigation season, resulting in the need of some 1.5 MI per hectare.

If these two differences are combined a hectare in the Shepparton district will need 4 MI per hectare less water. Extrapolating on this example, 10,000 hectare of arid zone irrigation requires 40 GI more water. The actual irrigated area in the semi arid zone is much greater, and importantly, continues to grow. At the time of preparing this summary water for proposed new irrigation developments are forecast to require an extra 32 GI (Vic.Mallee), 50 GI (NSW side Sunraysia) and 80 GI in S.A.

Table 1 gives some parameters for double cropping in two locations. The magnitude of the difference in dry mater production per megalitre is 66% better in the higher rainfall zone. This large difference can only be interpreted as being indicative because the examples have not necessarily experienced similar agronomic practices.

Table 1 : Double Cropping Example of Water Productivity

Location	Numurkah	Semi Arid Zone
Silage yield (t DM/ha) as cereal and maize crops	35	25
Water use (MI/ha)	7	14
t DM/MI	5	1.7

Clearly fodder production systems in districts with higher rainfall and more temperate climate produce much more high quality (at least 11 MJ of ME per kg of DM) feed.

The economic consideration always seems to be pre-imminent. Clearly, permitting water to move to perennial plant production systems in the semi arid zone does not maximise plant production per megalitre of water. This measure is important if the M.D.B. has scarce and finite water resources.

Lost opportunity

A separate economic consideration concerns the increasing underutilisation of irrigation land that is part of the \$2 billion redevelopment in districts such as Shepparton and Cobram. As water moves from these areas GMW is required to deliver decreasing volumes and consequently charges reflect their predicament. As a result many of the farm production systems become less competitive. The overriding concern is that a large irrigation district prudently located and established by public funds is now under performing. Moreover the current upgrade will no longer service the scale of irrigation envisaged for the district a decade ago. One serious issue is certain. In seasons with lower water allocations the owners of perennial plantings in the semi arid zone will accelerate the move of temporary water and permanent water shares out of the higher rainfall areas. This effect will be much more pronounced than it was in the 2006/07 drought period.

The predicament of plants

Issues associated with plant physiology provide serious limitations in the semi arid zone. These limitations are being amplified significantly by climate change. As day time temperatures rise, many plant species struggle causing a decrease in the diversity of possible production systems. Examples include cell respiration being challenged increasingly beyond 30oC and loss of stomata control at 40oC in most species. Lower photosynthetic activity further reduces production per megalitre of water.

The physiological limits of pasture, crop and fruit trees are very rarely considered in discussions comparing where food is grown, implications to water use and climate change. An extensive bank of scientific knowledge about plant responses is essentially ignored. The effects of temperature and humidity are well documented for issues such as

- decreased fruit set e.g. cherries about 15oC
- increased fruit drop e.g. citrus above 30oC
- decreased brix outside the optimum range (13-27oC) for citrus
- major impacts on pollen viability in most varieties beyond 30oC
- importance of stomatal control in controlling leaf temperature by transpiration. This is functional within specific temperature and humidity ranges for different species.

Certainly irrigation water can be seen as an elixir of the more arid districts. The cheaper land and reduced fixed costs in these areas assist in the water moving from the higher rainfall areas and may make for better investment opportunities for the short term. However policies which assist this approach are leading to a marked decline in production of food per megalitre and in the diversity of plant production systems.

Other water management practices without adequate logic

The Murray estuary is now characterised by managed lakes behind barrages which make them 0.75m above historic sea level. Future changes to sea level clearly indicate significant rises will be experienced within 50 years. The precise future levels can be predicted with guiding probabilities. The strong likelihood of a 0.5m sea level rise will mean storm surges will make the current barrages ineffectual. Yet we maintain a policy of evaporating 1000 Gl of fresh water annually on these lakes in an attempt to transform an estuary to a body of fresh water, although historically it underwent frequent salinity fluctuations. This raises the question of how will our nation regard future expenditure of billions of dollars to upgrade a barrage system that maintains fresh water in a former estuary.

A second matter concerns conveyance losses of water. These are now known in channel systems. For instance an 80% conveyance efficiency over a 200km earthen channel is reasonable. Yet the conveyance losses in river systems remain shrouded in mystery. Certainly there are numerous variables influencing river losses, but they do happen. Meanwhile a megalitre of water at Dartmouth or Eildon is an undiminished megalitre hundreds of kilometres downstream despite governments claiming to have a high priority interest in measuring water.