

## Water security: how can extension work with farming worldviews?

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**Abstract.** Water for irrigated agriculture is increasingly contested, and policy approaches are increasingly turning to water markets and new technologies to achieve water resource management goals. Public sector extension services are often in the “front-line” for brokering on-farm change and policy outcomes. This paper outlines the variation in farmer worldviews identified from an action research study involving social researchers and extension based on case study farms in both the Northern Victorian and Macalister Irrigation Districts of Victoria. Seven different water worldviews were distinguished by the research team from qualitative analysis of water management decisions on 12 case study farms. The descriptive titles assigned were: Utilitarian; Pragmatic; Eco-social; Custodian; Agri-centric; Cornucopian; and Autonomous worldviews. These worldviews are influencing decisions concerning water use, the perceptions of policy changes, the perceptions of opportunities available and therefore the options considered possible or feasible for farms. It is concluded that because the public extension role in irrigation management is expected to support improved irrigation practices that reduce environmental impacts, increase water savings and/or enhance profitability, extension and policy need to engage with the water worldviews of irrigators, and this research provides insight to some ways in which this is feasible.

**Keywords:** Water worldviews, irrigated farming systems, reflective practice, extension

### Introduction

Dairying is one of Australia’s top three rural industries with a farm gate production value of AUD\$3.2 billion and it is the fifth most important industry in terms of agricultural exports (AUD\$2.5 billion). There are 7,000 Australian dairy farms with an average herd size of 232 cows run predominantly as owner-operated farms (Dairy Australia 2009). The Australian dairy industry uses 25% of the surface irrigation water in Australia, and has 57% of its farms fully or partly dependent on irrigation to maintain the productivity of their farms (Dairying for Tomorrow 2006). For dairy farm businesses, reliable and affordable irrigation water has been a central platform to farm viability and profitability. However, this is changing. Recent low water allocations, climate change concerns and high water prices have meant a re-think for farmers about the place of water in their business. Farmers are actively looking for alternatives for viable and profitable production and, for the dairy industry, understanding, anticipating and adapting to change in the new operating environment for water is a necessary part of industry strategy. Yet how much emphasis do industry and policy place on understanding the adaptation challenge of changes in irrigation water allocation and pricing at a farm level? What is the role and issues for extension as a professional practice engaged to support on-farm preparedness and adaptation in the face of policy and environmental change?

This paper provides an overview of research into farmer decision making and the role of extension, with particular emphasis on the influence of water worldviews on practice, and the role of extension in challenging worldviews. The research results are described in two parts: The first part describes seven different water worldviews emerging from qualitative analysis of 12 case study farms and the implications for extension. The second part describes and critiques the development and use of an extension tool to aid in the identification of water worldviews by extension and in positioning extension practice.

### *Viewing water security from a farmer’s perspective*

For irrigated dairy farmers, water security includes the allocation policies of governments and water authorities, the types of entitlement or ownership through which they have access to water for irrigation, the efficiency of their individual farming systems in producing pastures and forage, and the irrigation practice they employ. A farmer’s actual water security can extend to include the equity they have in their business and their capacity to purchase additional water rights or water on an annual basis, as well as the annual cost of water right deliveries. Farmers can also suffer a loss of water security through an unmanageable increase in labour demands during periods of reduced water allocations. For the dairy industry as a whole, water security can be threatened through restrictions placed on the discharge of nutrient and salt-rich waters from dairy farms into regional water courses and lakes, or through the redirection of water from agricultural to environmental uses through government policy. Whether or not changes in

Victorian water allocation policies associated with the conversion of sales water into a lower-reliability water share actually gives irrigators greater water security depends to a large extent on the perspective taken to such issues - is an unsecured but regularly bestowed benefit better or worse than a benefit guaranteed but reduced? (Gomez-Limon and Riesgo 2004).

It follows then, that in order to understand "water security" it is necessary to understand how farmers make sense of water in their business. The information being sought, the meaning ascribed and the action taken by farmers concerning water become the entry point for understanding how they cope with interruptions and is something that a physical analysis of a farms technical water use efficiency (Armstrong, 2004) and water situation will not do. Weick's Sensemaking framework (Weick 1995, p. 17) includes seven properties of "making sense":

- grounded in identity construction (the orientation to situations that maintain esteem and consistency of self-conception)
- retrospective (reflective and interpretive of past actions)
- produced through action in context (producing the environments we act in)
- social (contingent on others)
- ongoing (not starting or ending)
- focused on and by extracted cues (simple, familiar structures or points of reference)
- driven by plausibility rather than accuracy (enough certainty to act again).

This framework emphasises the importance of the every-day actions of individuals or groups that underpin competence and how action evolves as successful responses to uncertainties. Decision-making is therefore viewed as a product (rather than a precursor) of actions (Weick 1995) and an evaluative process for actions as responses to uncertainty (Choi 1993; McCown 2002). The focus for intervention then becomes one of facilitating new action, rather than supporting decision-making per se. This shift in perspective is contrary to what may be described as the prevailing "theory-in-use" (after Argyris and Schon 1987) in which information processing is the predominant view of human cognition. Locating information provision becomes the central issue for change-agents (e.g. Fountas et al. 2006) despite contrary evidence suggesting the social and practical dimensions of action are the source of change (McCown 2002).

### **Worldviews**

Worldview is a widely used term with many interpretations. Worldview (derived from the German term *Weltanschauung*), is the overall perspective from which one sees and interprets the world and the collection of beliefs about the world held by an individual or group (Churchman, 1971). It is a high-level concept, one that pervades every aspect of thinking and doing, influencing the way problems are solved, goals are pursued and practice performed. Because people view the world differently, 'reality' is filtered and shaped by past experiences, personal beliefs and values and this makes-up one's 'view of the world'. The need to understand and incorporate different worldviews of people in the definition of a problem situation and the definition of action to improve a situation is a central concept in soft systems thinking and soft systems methodologies (SSM) (Churchman 1971; Ackoff 1979; Checkland 1981;; Checkland and Scholes,1990). An individual's worldview will be unique to them but there will be common elements and ideas that will be evident in what individuals do and the opinion they express. Worldview then becomes something that can be looked for by observers to help understand a social situation (Checkland and Davies 1986). For the purpose of this research we were particularly interested in exploring worldviews that concern the taken-as-given assumptions that farmers use to guide their action in water management and the challenges and problems they face in water security. We argue that an appreciation of worldviews and their influence on practice is essential for understanding the nature of support to change.

### ***Extension and worldview***

In their study of intentional learning of dairy farmers, Kenny (2002) and Paine and Kenny (2002) identified three attributes of extension practice when working with farmers: extension focuses on farmer action; on farmer intentions; and it appreciates the worldviews of both themselves and farmers, when engaged in learning relationships. That is, extension is looking at how the farmer explores options, appraises feasibility and conducts reality checks – all the 'non-reflective' activities making up farming practice. Extension also gains insight into the intentions of farmers (the planning that is anticipating future results from certain actions: the goals, objectives and perception of barriers associated with their farm practices). However intention and action is affected by some form of criteria embodied by individuals that influence how they appropriate action strategies - the criteria or frame through which intention and action is assessed is how extension uses the concept of "worldview". Worldviews can affect the reflective

process by setting the criteria by which actions are examined relative to the intentions of the farmer. Advisers can explore the farmers and their own worldview and its impact on performance and can provide challenging worldviews using stimulating questions based on assessments of current performance relative to the adviser's knowledge of the farmers' intentions. This discussion will ground the role of extension in a learning relationship.

Many farmers may have a worldview that does not include a need to change or improve their performance – particularly according to the 'rules' that extension, policy or research organisations may view as underpinning competent performance. In these situations the learning relationship can become 'tension filled' as different practices seek to influence the others way of making sense of the situation. Regardless of the contrasting worldviews in a relationship, practitioners can still engage in a conversations based on practice – what people are doing and why.

#### ***How might this be applied to the issue of water?***

Can the worldview of farmers in relation to water be impacting on the way opportunities from water markets or environmental flows are perceived? How can extension work with the worldviews of farmers in change? The following research questions emerged from this questioning of the degree to which an understanding of the farm perspective was having in the practice of extension in an irrigation context.

1. How are farmers adapting and making sense of the need for different farming systems with respect to water?
2. What options are being considered and why? What is informing choices concerning farming systems?
3. What forms of support relationships (extension/advisory, policy) for farmers are required to effectively manage through water resource changes?

#### **Research approach**

The research examined the water resource management decisions of 12 case study farms in the Northern Irrigation Region and the Macalister Irrigation Districts of Victoria over the period 2002-2005. The case studies were then used in an action research process with different extension agents in these regions to reflect and theorise about current approaches to water resource intervention and the planning and testing of new approaches, as "reflective practitioners" (after Schon 1983;1987). The research findings were drawn from the experience, decisions and issues faced by the 12 farmers, the extension officers supporting the change and a social researcher (see Nettle et al. 2006). The research reported here focuses specifically on the analysis of differing worldviews of the farmers and implications for extension practice.

The research team (extension and irrigation officers and innovation researchers) chose farms as case studies using specific criteria developed for each region and the extension interest. The aim was to choose cases that would offer variation in: current capacity to improve water resource management and manage through changes in water allocation rules and policy; on-farm roles and responsibilities; beliefs about the need to change; the particular water issue for the farm and the availability and use of information and advisory services in the region.

In the Northern Irrigation area, farmers attending an irrigation course run by the Department of Primary Industry were chosen. The selection criterion for these farms was the perceived different level of preparedness that farmers had for water security changes at entry to the course and different levels of information seeking behaviour. In the Macalister Irrigation District (MID) farmers were selected based on their involvement (or non involvement) in an irrigation course run by the Department of Primary Industries local irrigation officer, their use of whole farm planning (or not) and use of new irrigation technologies.

Semi-structured interviews with the twelve case study farmers were undertaken by rural innovation researchers and, in the MID, an irrigation extension officer. The interviews were conducted in July and August, 2005 and explored:

1. What farmers were doing in relation to water management on their farm and why.
2. How farmers were going about implementing changes on their farm regarding water use.
3. How farmers learnt about and managed water on their farm.
4. How farmers sought and used information and advice regarding water management in their business.

All interviews were audio-taped and transcribed. The transcripts provided the data for the production of case study descriptions and analysis. The case studies were assigned a

pseudonym to protect their privacy. The unit of analysis throughout the research was the farm business.

Identifying worldviews from the case studies involved a form of discourse analysis (Potter and Wetherall 2004) whereby verbal 'cues' from the farmers about their attitudes and beliefs about water and farming were explored. This involved interrogating the text using the questions: "what attitudes, beliefs and/or values seem to underpin their position or action regarding water management?; Is this influencing practices or changes on this farm? How and why? (i.e. what is considered 'in' or 'out' in terms of options?). Then a descriptive title was chosen for the particular worldview to reflect the main underpinning attitudes, beliefs and values impacting on water management. Following this, the extension agents in the research team considered the potential extension strategies that might support changes on the farms based on worldviews. This covered issues such as: what extension options might be aligned or otherwise with particular worldviews, ways to work with the worldview; the conditions under which they might be able to challenge the farmers worldview; reflecting on their own worldview with respect to farming and water-use and whether their own worldviews were consistent or counter to these farms worldviews? The analysis method described is consistent with an action research framework within the realm of research for professional practice (Argyris and Schon 1996). The results below are presented to reflect this process by outlining the water worldviews defined by the research team, providing an illustration of the verbal cues identified by the research team that led to the definition and then outlining the extension officers reflections on the implications of this worldview on their practice. Before the results are presented, the context for water management practices on the case study farms is provided through a summary of the water allocation arrangements in the Northern Victorian irrigation area and the Macalister irrigation district.

*The Victorian Northern Irrigation Region (NIR)* is situated along a 500km stretch of the Murray River basin, between Cobram and the Victorian-South Australian border. The region has extensive areas of irrigated pastures for dairy farming, and irrigated horticulture and cropping. Approximately 20% of Australia's milk production comes from this combined northern Victoria and Riverina dairy region (Dairy Australia, 2009). Irrigators, including dairy farmers, on both sides of the Murray River share a semi-regulated water market that currently allows for trade in annual (temporary) water, and permanent trading of water right (since unbundling in July 2006). The volume of water irrigators can access each annual irrigation season is determined by the amount of water right owned by them, measured in megalitres, and the water right allocations made available by Goulburn Murray Water for that season.

*The Macalister Irrigation District (MID)* Water for the MID is primarily diverted from the local river and stored in Lake Glenmaggie, which receives annual inflows of over 500,000ML, well above its storage capacity of 190,000ML. In the legally gazetted boundary of the MID, the irrigators, including approximately 500 dairy farmers, hold an entitlement to water right (or a 15-year licensed volume) for a certain amount of water, measured in megalitres. The spill-and-fill storages of Lake Glenmaggie enable a policy of water right allocation that is unique. Under this system, water that irrigators take from the start of the irrigation season in August, while the lake is filling, draws down their water right allocations. Once the lake fills and then spills (typically around mid-September) the water that irrigators have already taken becomes 'off-quota' or 'spill entitlements' and is no longer counted against their water right allocation. This off-quota water is charged to farmers on a per megalitre basis at the same price as water right for that year. Unbundling of water right from land occurred in July 2008.

## Results

The results are divided into two parts. The first part describes seven different water worldviews emerging from qualitative analysis of 12 case study farms and the reflections of the extension officers involved in the research team. The second part describes and critiques the development and use of an extension tool developed from the case study analysis to aid in the identification of water worldviews and to position extension practice.

### ***Part 1: Appreciating differences in water worldviews and implications for extension***

Seven of the case study farms have been grouped under a descriptive title chosen to reflect the key aspect of the water worldview emerging from the analysis. For a full description of each of the case study farms, see Nettle et al, (2006). For closer analysis of the actions and practices of two of the case study farms and the implications for advisory practice and policy making, see Nettle and Paine (2009).

### ***A “utilitarian” water worldview***

Adam is 40 years old and is married with young children, he has owned the farm (located on the Goulbourn irrigation system) for about 16 years. Adam’s key water decisions (2002-2005) were: Sell permanent water; buy temporary water; change to a fully flexible dairy production system (adjusting herd size and production on the basis of milk, water and feed prices in a given year).

Verbal cues to a “utilitarian” water worldview: Adam manages water on his farm opportunistically. He views water as a tradeable, functional resource rather than a long-term asset for achieving business goals and recently sold his permanent water right:

“...while I owed money on that water right, I had to make money every year to pay the interests. Now, I’m buying temporary water; if I want to shut up shop and close the production system right down and slow it right back, I can do it.”

Adam views water as a factor of production rather than an asset and this utilitarian view of water affects how he views options for his business:

“It’s a lot more flexible, ...while we had a heap of debt hanging over our head and paying interest, effectively on the water right, we had to answer to someone else all the time”.

Adam values flexibility, control and profit – and decisions regarding water are based on achieving production and profit control.

Extension reflections on the implications of a “utilitarian” water worldview for practice: Adam’s practices lie outside the traditional bounds of dairy farm extension. Extension identifies many risks for Adam from these beliefs including: the casual water use fee as a factored cost in decision making and the uncertain implications (for production and profit) from reliance on purchased, temporary water. Although Adam’s utilitarian worldview may align with market-based water policy, extension officers believe Adam will need highly accurate information on casual use fees and delivery share, and a high degree of management competence to manage more annuals and summer crops. Further, the long-term implications from a financial and investment perspective of Adam’s strategies would need to be thought through.

### ***A “pragmatic” water worldview***

Bruce is 50 with teenage children and farms on the Murray Irrigation system. Bruce’s key water decisions (2002-2005) were: purchased temporary water for the first time; increasing intensity of production on smaller areas of the farm to improve irrigation efficiency; changed calving pattern; changed forage base to more annuals; considered automatic irrigation; considering water purchase (via farm purchase).

Verbal cues to a “pragmatic” water worldview: Bruce tries to match the water he uses to the needs of his current production system on a seasonal basis, but also regards his water “right” as something of value to his farming future. Bruce’s normal water management had been challenged through recent seasons because of the ongoing drought and reduction in allocations and this had prompted new practices concerning purchasing temporary water and increasing irrigation efficiency:

“I grew a lot of grass, and the production I’ve been doing this year (2004–05) has been better than I’ve ever done. I got the returns from it, but I think I can do it more efficiently next year”...“We’ve looked at buying the block next door, because that’s got a little bit of water right with it, that’s still for sale but we haven’t been able to negotiate a price we’ve been happy with. We’ve looked into buying water rights...it’s not a viable option at this stage, we’re better off buying temporary water than we are buying water rights.”

Bruce indicates a reliance on his water right as a long-term asset that he believes will increase in value and provide a level of security to the farm business in the long-term. Water is a “family” asset to be preserved. Other farmers, south of Kyabram on the Goulbourn irrigation system, (Fred and his son-in-law Greg) appeared to hold similar attitudes: Fred and Greg’s key water decisions (2002-2005) were: purchased more land for the water; install automatic irrigation system; laser grading.

More verbal cues to a “pragmatic” water worldview: Fred and Greg view water as an asset for their business with a key priority being to source more water for their business in the short term. They position water policies as a direct threat to their business and the industry.

'Well on 100% [water allocation] we're pretty well right, but ...I sort of feel that if we had another 50–100 megs [ML] of water it would put us in a pretty secure position (Greg) ...It [water right] is money in the bank, really, especially these days (Fred) ... The way it is now, we've got to look after every drop, we are sort of borderline (Greg)...But if they (government) want a dairy industry they've got to allow us to make a profit, otherwise we're wasting our time being there (Greg)

*Extension reflections on implications of a "pragmatic" water worldview for practice:* Bruce and Fred and Greg are all production-focused with beliefs that water is central to the productivity of their farms. Therefore, water is something that 'just has to be sourced profitably'. This pragmatic water worldview aligns well with irrigation extension in terms of aligning water use with the achievement of farm business goals like profit. However, the variation in farms from the perspective of assessing needs, suggesting suitable technologies, identifying opportunities and looking for ways to support the achievement of long-term goals mean a "one-size fits all" approach on the basis of worldview is not appropriate either. However, a learning relationship established with these farms with aligned worldviews mean extension is well placed for conversations about future policy changes that may affect ground-water into the longer term or future climate change policies for instance.

### **An "eco-social" water worldview**

Cliff and Donna are a young farming couple working towards the establishment of a successful, medium-sized farm business, with sustainable land management in the Goulbourn irrigation area. They began lease-purchasing their dairy farm in September 2004. Cliff and Donna's key water decisions (2002-2005) were: change calving pattern; purchase temporary water; change pasture mix; build herd size (as part of farm business development); active participation in environment and irrigation development groups.

*Verbal cues to an "eco-social" water worldview:* Cliff and Donna have one eye on their business and another on their business in society and how it is perceived. Their personal preferences take a back-seat to the farms physical characteristics in defining the farms production system.

'We looked at ... how much water is here, how much land is actually laid out for irrigation, how much is irrigatable properly – as in efficient irrigation – and also we looked at how many cows did we want to milk, from a lifestyle balance. So we ... came up with figures around 300 [cows] in about two-and-a-half seasons, that's what we're ...aiming for...you've got to have goals...to be efficient. (Donna)

'Water is basically our turning point. And we looked at our farm system at the moment and being spring calvers ... this soil type is ...a lot heavier – so we looked at ...split calving, or stay at spring calving, or majority of autumn calving? So now our decisions have changed to go to autumn calving, purely because of the soil type. And the soil type here, you maximise your water usage with sub pastures, so basically your annuals (Donna).

Donna identifies herself as an irrigator rather than a dairy farmer:

'Somehow we have got to put that positive message out about irrigators, and that we are prepared to listen to what consumers are saying. Because they're a very powerful lobbyist, but also we've still got to run our business and so we have to be sustainable. It's an education process for consumers too, and politicians, on what we are doing. ...Possibly down the track to be allocated water you're going to have to meet criteria... we comply with regulation whatever they're going to be...(Donna).

Cliff and Donna reflect a form of eco-centricism where their personal preferences or opportunity to modify the farm characteristics are secondary to what fits the farm. Water is more than a production input or an asset to them – it is a pathway to environmental sustainability of their farming businesses - and other dairy farmers.

*Extension reflections on the implications from an "eco-social" water worldview on practice:* Extension can identify a number of risks to Cliff and Donna's achievement of their goals including the risks from debt from farm development priorities and water prices. However, in working with them on a prioritised action plan for the large number of water-use efficiency issues that make a difference to their profit whilst supporting their non-production goals may offer extension an opportunity to learn about the way eco-social and business goals can intersect – this is triple-bottom-line farming in practice.

### ***A “custodian” water worldview***

Julie and Kev (farm manager) farm on the Murray Irrigation system near Nathalia and milk between 100-130 cows. Julie works off-farm. Julie and Kev’s key water decisions(2002-2005) were: Julie is thinking of selling the farm; feed purchase rather than water purchase through the drought; modified calving pattern; some purchase of temporary water; improved irrigation system, laser grading; introduce oats and lucerne into the forage base, pasture renovation.

Verbal cues to a “custodian” worldview: Julie and Kev believe water is a right for their business – a right that is being taken away:

“The costs are just... when you haven’t got water, the feed costs are up. So whichever way you do it, it’s either because of lack of water allocation, you’re in this cost squeeze. You’ve got to buy too much fodder, or you’ve got to buy the water. (Julie) We’re going to have to sell because we can’t physically keep going much more than twelve months (Julie).

The old politicians set it up [the irrigation system] years ago to try and make the country profitable. Now they’re doing everything they can to break it, to kill it... The main thing behind it is that someone is going to make heaps of money selling water to people who are desperate for it. (Kev).

Julie and Kev believe they have no ability to compete for water resources. The ability to source water to meet production needs is constrained by their cash-flow, business structure and future goals of the business. The changes to water rules reinforce in their mind the sense that there are no options for them. The commitment to try and improve and make the most of their situation despite an apparent “hopelessness” in a viable future conveys a strong sense of resilience on the part of Julie and Kev and also a commitment to the profession and practices of farming.

Extension reflection on the implications of a “custodian” water worldview for practice: This water worldview is confronting to extension and its role. Julie and Kev require a good exit plan and motivation and support. Extension officers perceive a risk from their commitment to farming is that they will continue to spend money on the farm that may not give a return at sale.

### ***An “Agri-centric” water worldview***

Harold bought the farm in 2002 after many years leasing and sharefarming. His farm is on the Murray Irrigation system at Katunga. Harold’s key water decisions (2002-2005) were: shift to annual pastures; building herd size after reduction through drought; change to split calving; purchase temporary water rather than permanent; production system working around a 148% water right in the medium term.

Verbal cues to an “agri-centric” water worldview: Harold perceives water as a production input whose cost and use is to be minimised. He also views previous water allocations as a form of enduring private entitlement in which changes in allocation and pricing represent a threat to the security of farming:

“...we are down in that battler’s class, we’ve been able to get over the hurdle and get our first farm – but I think...we’re going to look at playing in the temporary [water] market at this stage. We’re not in the financial position or established enough to be buying permanent water”.

“They [policy makers] see the price of the temporary water but certainly as a business operation you can’t afford to pay that for the total lot of your water, that’s your marginal water, it’s a bit different to have to pay that for the whole lot of your water, ... you’re starting to certainly hit a ceiling as to what you can feasibly afford to pay”.

Extension reflections on the implications of an “agri-centric” water worldview for practice: This worldview can create a challenge for extension acting in a policy implementation role, particularly if it leads to farms “tuning out” of the policy implications for their business. Extension saw a large role in providing quality and timely information concerning water price and feed-options; building confidence in water trading; discussion of the unbundling implications for the business and assessing the longer term business implications of water changes such as the importance of succession planning in relation to water. The risk of not challenging or working in the constraints of their worldview is one of lost opportunities.

### ***A “Cornucopia” worldview***

Lyn and Geoff farm in the Macalister irrigation district and would like to retire in the next 10 years. Lyn and Geoff’s key water decisions (2002-2005) were: laser grading; re-use system; consider whole farm plan; and high flow flood irrigation.

Verbal cues to a “cornucopia” water worldview: Lyn and Geoff appear to be driven by a “pragmatic” water worldview or even an “agri-centric” worldview:

“...because of the threat that we’re going to lose our ground water...we want to be able to irrigate and maintain our herd size and to do that we need to be looking seriously at water savings...we service a substantial loan, ...I wouldn’t say water specifically but it’s my chore to keep the business profitable...We’ll just milk as many cows as what we’ve got water to grow the grass to feed them (Lyn).”

“...they are not only robbing us of the water, to the environment, they’re going to rob the district of the water that goes to the subsurface that goes into the shallow aquifer, that goes into the drains, ...it’s the fear of compliance...”

Although they struggle with how they might maintain the productivity of their land with less water, their actions are underpinned by the belief in the longer-term benefit to them of their water resource providing wealth and prosperity:

“...we are very excited because we see water as our liquid gold investment in the future...What we’re talking about, moving out of dairy not actually moving off the farm”.

Extension reflections on the implications of a “cornucopia” water worldview for practice: This water worldview can create a challenge for extension in understanding and challenging the water efficiency and wealth possibilities from water management.

### ***An “Autonomous” water worldview***

Paul and Abby farm in the Macalister irrigation district have returned to their “roots” following careers outside farming. Paul and Abby’s key water decision was to install lateral spray irrigation on a section of the farm.

Verbal cues to an “autonomous” water worldview: Paul and Abby are looking to maintain their independence, preferring to have a farm that they could work and manage as a couple/family, rather than a larger farm:

“...we didn’t want 350 cows and employing people – we wanted to kick back - do it yourself.” (Abby)

We ensure we use our water right – we used sales only twice...we get it and we often don’t use it or sell it. We use 150-180ML out of the bore...we don’t sell it – I know that’s not good, but if it gets to the end of the season and if I have water then I can get through – but if I’ve sold it I don’t have that security. (Paul)

They also see water as being part of a wider collective good:

“We’re of the belief that if everyone’s doing tough and for us to use it its \$40/ML and why sell it for a profit when someone else needs it – why should farmers shaft other farmers?” (Abby) “

Extension reflections on the implications of an “autonomous” water worldview for practice: Extension struggles with how to position their engagement to challenge the cost versus profit focus of the farm, the pressure on water entitlement and their self-sufficiency focus as a limitation to opportunities. For instance although water trading may offer possibilities for the achievement of farm goals, this presents a direct challenge to their worldview and must be weighed against other ways to support change.

### ***In summary***

The case studies have reflected a large variation in the “worldviews” farmers hold towards water in their business, their region and more broadly in society. These “worldviews” are influencing decisions concerning water use. This variation influences the perceptions of policy changes, the perceptions of opportunities available (e.g. “hold on to water at all costs” versus “increase farm profitability through opportunistic water sale”) and therefore the options considered possible or feasible for farms. Therefore, to understand a farm’s water issues (and options for addressing them) requires an appreciation of their water “worldview” and not just (for instance) a technical analysis of their farms water use efficiency. Also, an extension or support person needs to recognise their own “water worldview” in supporting change. Ignoring differing “worldviews” or avoiding conflict or tension between worldviews and policy is likely to result in poorly conceived

options for farmers, or “inertia” in industry or policy implementation. Although time-consuming, difficult to achieve and requiring the development of trust and partnerships, advisory relationships may offer a sound platform in which water “worldviews” are negotiated, and foundations for effective change made. A summary of the worldviews defined and cues for extension is provided in Table 1.

**Table 1: Defining water worldviews and the implications for extension\***

Defined worldviews	Main verbal cues used in defining the worldview	Implications noted by extension	Extension strategies for this worldview.
1. Utilitarian	Decisions & practices based on attitudes that water is just another input to farm production that can be replaced, traded or used. Market conditions were the sole arbiter of this use. Decisions appeared business rather than production focussed.	Radical farm practices emerging that challenge ‘standard practice’. Current information services & management capacity may not be high enough to support these level of decisions. Long-term implications are unclear. Margin of error lower.	Increase the level of accuracy & improve timing of market information to farmers (water, livestock & feed markets). Explore risk management options for different systems. Analyse longer-term business implications of utilitarian practice.
2. Pragmatic	Decisions & practices based on beliefs that because water is becoming a more scarce, expensive resource, production decisions involving water needed to be reviewed. Production & exploring ways to ensure profitable production was central.	Highly responsive to productivity extension	Strong alignment with productivity focused extension.
3. Eco-social	Decisions & practices were based on attitudes that water is a societal resource in which farm production & use of water needs to be aligned with the local environment, personal goals & societal expectations (represented in regulation & laws)	Strong alignment with policy worldview Triple-bottom line in reality.	Learning opportunity for extension.
4. Custodian	Decisions & practices are based on attitudes that water is a personal right & farmers use water responsibly as ‘stewards’ . Strong beliefs that adverse market forces (water prices, commodity prices) represent an attack on this responsibility & undermine it.	Potential conflict with policy, extension worldviews	Reliant on connections with other organisations.
5. Agri-centric	Decisions & practices are based on attitudes that water is agricultures right in return for national wealth. Attitudes & beliefs are strongly aligned with a pragmatic worldview, but however	Alignment with productivity extension but potential conflict with policy worldview	Extension as a broker between policy & productivity.
6. Cornucopian	Decisions & practices are based on attitudes that water is such a valuable asset for the future, that it represents a considerable back-up plan for future wealth, irrespective of day to day productive uses.	Worldview is limiting Challenging	Develop ways to analyse implications of reliance on long-term strategy.
7. Autonomous	Decisions & practices are based on attitudes that water is a personal entitlement that is managed individually rather than collectively. Cost minimisation more important than profit maximisation	Worldview is limiting opportunities seen by extension.	Maintain relationship & offer new options.

\* In providing this table, the authors recommend that it is the process used in the development of the classification that is most relevant for providing a feasible way for extension to become more sensitized to the role of worldview in farm practice, why farmers respond or not to extension ‘offers’ and for generating ideas for different extension strategies, rather than the classification of water worldviews per se.

## ***Part 2 – Recognising and working with worldview***

This part introduces the development and use of an extension tool to aid in the identification of water worldviews and positioning irrigation officer extension practice. This tool was developed in the context of the Macalister irrigation district (MID)-.

*The development of WaterMAP (Water Management Action Plan): On-farm change from the right support at the right time:* WaterMAP was developed from the learning's about farmer water resource management and water worldviews outlined previously. It is a social and technical analysis for extension to gain an insight into farmers' water and irrigation related needs. This insight then directs the type of extension effort required, the role of different expertise in achieving change, and can be used to report on outcomes from extension efforts to policy and stakeholders. The WaterMAP process is summarised in Table 2. WaterMAP is a questioning tool an adviser uses with a farmer which is based on:

1. Social and technical analysis of the presenting issue in water at the farm business level (including a short, medium and long term implications of the issue)
2. Technical/physical analysis of irrigation and water use performance (including an assessment of the decision-level involved)
3. Identification of opportunities for change and an analysis of what is required for these opportunities to be realised
4. Adviser "flags" for questioning and documenting the adviser "role" (or other roles) in realising opportunities
5. Documentation of the outcomes from intervention for the farmer and extension programs.

**Table 2: WaterMAP process between adviser and farmer**

1.	Perceptions of water in the farm business (what is/is not a significant water issue for the farm and why does the farmer see it this way).
2.	How the farmer is changing or modifying their water situation (what they are seeing as possible solutions).
3.	A physical assessment of their farm water situation (through to water use/ML/ha/irrigation/bay) Does this reveal impacts on the environment or productivity or both?
4.	Farmers understanding and reaction to the physical assessment.
5.	Presentation of possibilities seen by extension.
6.	Assessment of capacity to capture opportunities (financial, farming horizon, skills, information, services, length of farming career, all decision makers can be engaged?).
7.	A discussion of what needs to happen to improve (business is interested in change or can identify opportunities?).
8.	An adviser assessment of the contribution to policy and program goals of working with this farm (high or low return to extension), whether the farms could be advocates for other farmers for change; is there a learning benefit for extension?
9.	An assessment of the outcomes from working together for the farmer, policy or others (e.g. dairy industry).
10.	Action plan for farmer and extension developed and followed through.

### *Testing the tool*

For the purposes of this research, the tool was trialled with 2 farms in the MID. After each visit, the extent to which the tool helped position the farm and the necessary extension response was tested against evaluation questions. WaterMAP was seen to be able to effectively position the farm and extension response required when:

1. The farm visit and the results are documented. The document is a good record of the farm water issues and of the thinking, intentions and plans of farmers and extension.
2. Other areas of the farm business (other than water) are explored in context.
3. There is a second and/or subsequent visits to the farm that builds on the understanding from the WaterMAP appraisal (i.e. match the intent of the farmer with their records and gather more intelligence on their sources of information and who is trusted).
4. It is actively used as a feedback tool/loop between farmer needs (farm business and water use issues) and extension needs (program goals).
5. It is used to refer to others in the industry once issues outside specific program goals of the extension officer are reached.
6. There is a commitment to accuracy in the water use issue – if early visits indicate a high return from continuing interaction between extension and farming.

Further development of the tool is recommended to improve its useability by a population of service providers.

### Conclusion

Regardless of the contrasting worldviews in a relationship, farmers and extension practitioners can still engage in conversations based on activities. The adjustment of extension practice in coping with the farming position is based on a commitment to reflective practice (Schon, 1983; 1987). Being sensitized to worldview is important for extension in effectively positioning their response. Schon and Rein (1994) call this "*Frame reflection*" where professionals move beyond the safe ground of existing cultural frames and engage with alternative 'views of the world' in concrete acts of 'co-design'. Frame reflection appears critical for achieving societal expectations regarding water use in irrigated agriculture.

### Key learnings

1. Water "worldviews" is an important concept for the improvement of learning processes between farmers and extension regarding irrigation practice.
2. Extension can explore the farmer's worldview, and based on assessments of the drivers of current irrigation performance relative to the adviser's knowledge of the farmers' intentions, use stimulating questions to support change.
3. Effective questioning around farming worldviews may also help in the targeting of extension interactions, particularly with respect to water policy changes

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