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Wicked learning: Reflecting on *Learning to be drier*

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In this final, collaborative paper in the Learning to be drier *edition, we reflect on and draw together some of the key threads from the diverse narratives in our four site papers from across the southern Murray-Darling Basin. Our paper title,* Wicked learning*, draws on a recent body literature (Rittel & Webber 1973) about messy or 'wicked problems' as characterised by Dietz and Stern (1998). It picks up on our identification of the difficulty and enormity of the learning challenges being faced by communities, associated, at best, with a decade of record dry years (drought) and severely over-committed rivers. At worst, drought is occurring in combination with and as a precursor to recent, progressive drying of the Basin associated with climate change. Our research is suggestive of a need for much more learning across all segments of the adult community about '... the big picture, including the interrelationships among the full range of causal factors ...' (Australian Public Service Commission,*

APSC 2007: 1) underlying the presenting problem of drying. We conclude that solutions to the messy or wicked problem of drying in an interconnected Basin will lie in the social domain. This will include building a wider knowledge and acceptance of the problems and likely future risks across the Basin including all parts of communities. The problem of drying as well as its causes and solutions are multidimensional, and will involve comprehensive learning about all five key characteristics of other 'wicked' policy problems identified in previous research in the environmental arena. The narratives that we have heard identify the extreme difficulty in all four sites of rational and learned responses to being drier as the problem has unfolded. All narratives about being drier that we have heard involve a recognition of a combination of the five characteristics common to wicked problems: multidimensionality, scientific uncertainty, value conflict and uncertainty, mistrust as well as urgency. All narratives identify the importance of social learning: to be productive, to be efficient, to survive, to live with uncertainty, to be sustainable and to share. Combating the extent and effects of drying, causality aside, will require new forms of learning through new community, social and learning spaces, apart from and in addition to new technological and scientific learning.

Introduction

Our first paper (Golding & Campbell 2009) set out the parameters and presuppositions of our research including our research questions, method and literature that help inform our method. Our first research question was about how and what adults learn in response to changes in water availability in the southern Murray-Darling Basin. Our second question was about how the learning is experienced by the different stakeholders. Our third question was about how stakeholders are learning to respond. The team papers (Foley & Grace 2009; Golding & Angwin 2009; Brown & Schulz 2009; Smith & Campbell 2009) answer the questions using interview data collected from each of four sites (alpine, mid-river, lower river and dryland

respectively). In this collaborative paper we look back on and draw together some of the key threads from the diverse narratives in the four site papers.

While there has been much recent research into the significantly changed water regime and climate-related parameters associated with change in the Basin, there has been very little previous research of people's learned responses to these changes. We were uncertain at the outset as to which theoretical construct(s) would be most useful in organising and interpreting the data. We decided, after evaluating alternative theoretical perspectives, to structure our final paper and its title around the perceived 'wickedness' of the problems involved in drying, 'not in the sense of evil, but rather as an issue highly resistant to resolution' (APSC 2007: 1). We note very recent research (Lazarus 2009) that identifies global climate change as a 'super-wicked' problem, because time may be running out, there is no central authority and some of those seeking to solve the problem are also causing it. Drying of the southern Murray-Darling Basin, even if it was not related to global climate change, arguably shares some of the same defining characteristics.

The literature on wickedness has its origins in social policy planning, and bears no relation to the way many young people now use the term to mean 'really good'. Wicked problems are seen, by contrast, to be messy, difficult or impossible to solve. They typically involve incomplete, contradictory and changing requirements, that are often hard to recognize. We recognize that the resolution of a drying issue (or climate change) in an interconnected Basin, as Rittel and Webber (1973) would likely argue, cannot be treated with traditional linear, analytical approaches. In a similar way, we identify the necessary adult learning as wicked, in the sense of being highly resistant to resolution, using the limited and fragmented, existing learning opportunities, organisations and systems.

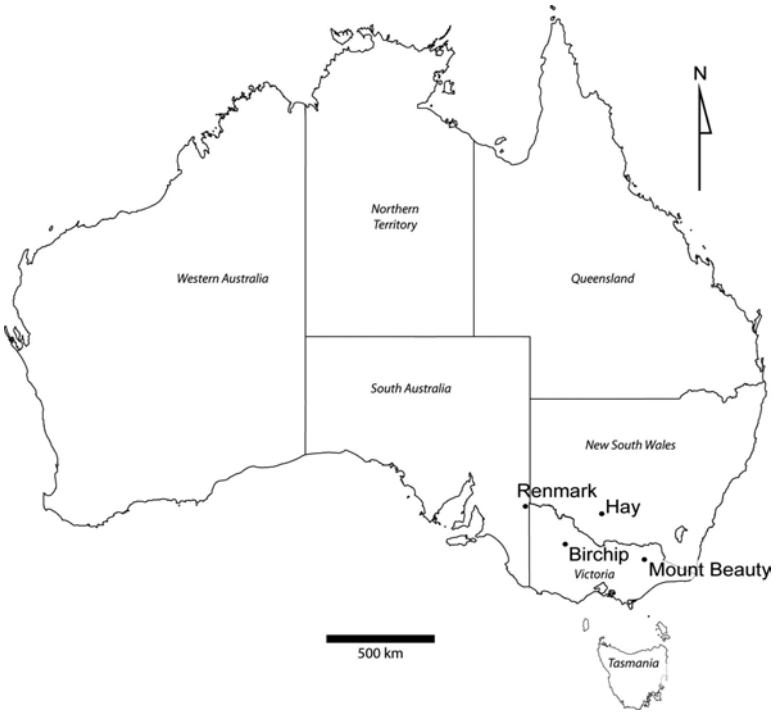
Reflecting on some limitations (and strengths) of the method

Our ability to draw a coherent picture of learning about drying in four sites in the southern Murray-Darling Basin to mid 2009 is limited by a number of factors. These include the small number of sites selected, the limited time each team had on each site and the limited range of interviewee types and individuals selected or available for interview. As with all research, the project and each of our site papers have been shaped by people with different experiences and interests in learning. These include what is valuable to study, how to collect and report data, which literature to consult, which theoretical perspectives best inform and answer the selected research questions and how best to communicate our findings in this academic paper format. In that sense, we do not claim to present an objective or unbiased view. We acknowledge the difficulty, particularly in dryland areas, of separating out the evidence of general rural decline, from the effects of a prolonged drought, and particularly, from the effects of hypothesised climate change.

We have studied learning as a community-based, social constructivist phenomenon, in which learning is situated (Lave & Wenger 1991), and which takes place socio-culturally in context as explored by Vygotsky (see Kozulin 2003). While we regard this approach as appropriate in rural locations and communities where universities and comprehensive technical and further education (TAFE) provision are effectively missing, we have not heard about 'higher' forms of institutional and accredited education and training. The advantage, however, of choosing to hear what a diverse range of people are saying *on site* about drying, is that we have heard a wide range of perspectives and narratives, that tend not to come through some scientific and technical papers.

Reflecting on the evidence across the sites

The location of our four sites in the southern Murray-Darling Basin, including three different states in south–eastern Australia are identified in Figure 1.



The sites ranged from an *alpine* water harvesting area in the headwaters of the Murray River around Mount Beauty in Victoria, to a *dryland* area with little surface water around Birchip in the Victorian Mallee. The *mid-river* site was on the Murrumbidgee River around Hay in the New South Wales Riverina region. A fourth site was on the lower Murray River around Renmark in the South Australian Riverland region. The Riverland and Riverina sites provided perspectives from areas largely dependent on irrigation drawn from major rivers in the Basin.

All areas have been, as the Productivity Commission (2008: xx) *Inquiry into government drought support* put it,

> … experiencing hardship from the latest severe and prolonged drought. … While this is not new to dryland farming, 'irrigation drought' is uncharted territory.

Even in the largely forested, alpine site, a series of unprecedented dry years had increased fire frequency and intensity and led to significant changes to the alpine environment. These changes had placed this site and its tourism-dependent communities in uncharted territory in term of their economies, as well as in terms of public safety and environmental risks.

While the causes of being drier (drought, climate change or both) remain contested and highly politicised, the risks of becoming even drier threaten the viability and sustainability of most water-dependent businesses as well as the environment in all four sites. No time has been more urgent, as a submission (28, p.1) to the Productivity Commission (2008: 187) put it, for:

> … [i]mproved education, research, information provision, and most importantly, public and private extension services … to underpin Australian drought … responses. The human capital on farms and in the advisory sector needs urgent investment as it copes with a torrent of new information and complex issues.

Our research shows that being drier has significant and often debilitating flow-on effects to all families, businesses, arms of government, industry sectors and community organisations in all four sites. This extension should arguably be much broader in its scope than agriculture. If, as Young and McColl (2008: 32) conclude, 'Now is the time to confidently inform those who depend on, and love the Murray Darling Basin what type of future they and the system can expect', all sectors of the community need to be so informed, and urgently. As long as there is widespread distress in drought-affected rural communities (Hennessy, Fawcett, Kirono et al. 2008), there

is a need not only to manage the water, but also to account for the wellbeing and families and communities.

Learning issues by site

The alpine site

The alpine case study (Foley & Grace 2009) found copious evidence of community learning taking place in the region. This was seen through strategies to maintain the tourist economy, strategies and programs to assist with environmental issues related to fire damage to the environment, and community members being aware of and modifying their usage of water. It drew its conclusions using the notion of 'frames of reference' from Berkhout, Hertin and Gann (2006). That is, participants focused their understandings about widespread drying through community beliefs and paradigms within their 'patch' of the Alpine region specifically. There is evidence here of what Berkhout et al. (2006: 151) categorise as 'handling and managing' risks.

The aesthetic beauty of the Alpine region and its related value to tourism was understood by many in the study as the frame of reference from which decisions were being made about drying. More than in other sites, this understanding included more acceptance of climate change. The case study conclusion saw that the frames of reference of the participants were towards the beginning of a stage of learning, understanding and managing change through a local focus, which was seen by Foley and Grace (2009) as a necessary precursor to understanding climate change.

The mid-river site

The mid-river and lower river case studies (Golding & Angwin 2009; Brown & Schulz 2009) identified both regions to be significantly affected by 'irrigation drought', and therefore in difficult and uncharted territory in terms of previously learned or experienced responses. Both regions had previously relied on water security

through 'water banking upstream' and had typically adapted to previous fluctuations in water availability. Never before had irrigators been forced to learn how to cope, as in 2009, with close to zero water allocations, or to allocations of 'critical' water simply to keep vines and trees alive. Water-dependent communities in the mid-river and lower river sites were already seen to be located towards the 'pointiest' and most risky end of what is likely to be the risk of climate change. However adults across the community in both sites were relatively poorly prepared, by their respective local and state governments or their national government, to understand, learn about and bear the risks. Both Golding and Angwin (2009) and Brown and Schulz (2009) identified an urgent need for better and more accessible information and understanding about the likelihood of risks, on which future community, business, family and water management decisions might ideally be based.

Golding and Angwin (2009) found a rapidly changing context in the mid-river, Riverina site. Most adults were struggling to learn about being drier through existing communities of practice. There was no local adult or community learning organization in this region. The learning that took place was restricted amongst water users to what a small number of farmers had learned through the various industry and government organizations. Otherwise, what most people knew had come from personal networks, community-based organizations and the popular media. Confusion about an appropriate, learned response was complicated by parallel, nationally politicized contestation about climate change, global emission and causality, no national Basin plan or agreement, and a state government water agency still in denial about climate change in its communication with water users. In this context, Golding and Angwin (2009) identify an urgent need for new information and dialogue about likely future scenarios and management options for water users across the site. They particularly suggested the need for new *boundary* and *bridging* organizations that are able to bring together different communities

of practice, inclusive of water-dependent stakeholders, to help communicate common understandings of the complex and rapidly changing issues (Hahn et al. 2006; Guston 2001) to people across the site.

The lower river site

Brown and Schulz (2009) identified clustering around six different forms of adult and community learning types in the data from the lower river site. Three of these learning types were oriented towards developing and maintaining sustainable businesses and communities, using and extrapolating from learning principles and experiences from previous fluctuations in irrigation water availability. They included *learning to be productive*, *to be efficient* and *to be sustainable*. Three of the other forms of learning were newer and more acute. One was *learning to survive* on their allocation of 'critical water', the amount of water simply to keep permanent vine and tree plantings alive where no productive capacity was anticipated. Brown and Schulz also identified the community need to *learn about support services* to assist those who are experiencing emotional, relationship, financial and business difficulties.

The lower river site is situated in a difficult point in the catchment. It is located towards the bottom end of a giant Basin, in which almost all of the water used is harvested from and already shared between three other, upstream states. The water needs of its state capital city, Adelaide, had yet to be taken out downstream. The other, new learning needs identified by Brown and Schulz (2009) in the lower river site, further discussed in the current paper in relation to 'wicked' learning, were *learning to live with uncertainty* and *learning to share*.

The dryland site

Smith and Campbell (2009) divided the learning from the transcript data in the dryland site into four categories. *Learning about the*

water supply was important but less directly linked to farming futures than in the two irrigation sites, as the region was progressively moving from open channels with high transmission losses to a piped stock and domestic supply. Dryland farmers without access to irrigation water from rivers and with minimal groundwater resources had always relied on and learned to adapt to a naturally variable and highly seasonal rainfall, and were found to be in a qualitatively different learning space. *Learning to be drier in farming* was found by Smith and Campbell (2009) to be already highly developed in their site, over several lifetimes of dryland cropping and grazing. This recent decade of 'drought years', while unprecedented in scale, was familiar in terms of its effects and involved a learned, coping response by farmers. It had brought further, incremental changes in cropping systems, water retention efficiencies and technologies. It had also hastened further 'farm consolidation', which means an exit from farming for those farming families whose land has been consolidated, although depopulation was not a major issue in the local towns. The drought years and water restrictions in the towns had impacted on gardens in a way not seen before, but as with farming, people seemed to be coping.

As in the two irrigation sites, the most difficult and important learning aside from farming and living in a drier environment was the *learning needed to cope with the economic, social and community changes*. Unlike in the irrigation sites, the dryland site had a range of community-based and local government learning organisations in each small town, already well adapted to lead and facilitate the learning. However, sometimes it seemed that the initiatives may have carried with them some pre-existing attitudes and perceptions that were not always or entirely functional. There was also evidence in this site of *changes to formal learning systems* both in community centres and schools, including changes to course offerings to reflect shifts in the local economy.

Reflecting on the learning choices available across sites

The diversity of local and public adult learning choices available to adults in the four sites diminished, as one might expect, with the decreasing size of the community, but also differed by state. Community-based learning opportunities and organisations were observed in all rural towns large enough to support secondary schools in these and other dryland and alpine towns in Victoria. State government-supported, community-based adult learning organisations provided important, local, 'first steps' to help adults learn to cope with a wide variety of changes. Their approach tended to be more inclusive of community development approaches than to narrow vocational preparation and retraining. In mid-river New South Wales there were no such organisations in larger rural towns. In the lower river site there were some government-sponsored learning organisations available and mentioned by participants. However there did not appear to be a great emphasis on accessing or supporting them.

In all sites and communities, there was a top-down conservatism and inertia associated with formal and sectorally separate approaches to education and training in schools and post-compulsory vocational education and training. In several important senses and with some exceptions, formal adult education institutions and their staff were to some degree insulated from and buffered against the direct effects of change. Most of these institutions benefited from people and businesses needing to change and retrain and some of this was teaching people to be drier. By contrast businesses (including farming businesses) were at the cutting edge of change in that they *had* to learn to be drier or fail as businesses. This included learning new ways to be more water efficient and grow different crops with very little or no water allocations. In addition to this, the most recent learning in both irrigation sites had been about how to trade water.

While we received considerable local support for our research, there was an underlying and learned distrust amongst some people 'on the land' of authorities and experts. Local people had been metaphorically burnt, several times before, by research findings, recommendations and predictions, most recently about fire (in the alpine site) water availability (in the mid-river and lower river sites), salinity (in the dryland site) and environmental flows (in all sites). With an arguable lack of understanding about the complexity and likely wickedness of the causes of change, it had been difficult in all sites to learn to manage the risks. It had been relatively easy to blame others: experts, environmentalists and politicians, and water users upstream or downstream. The hardest learning had been about learning to accept that the changes in water availability may be due to climate change. In some cases, businesses and families had internalised the most difficult learning: that sometimes there was no viable options but to walk away from the land, the community and/or their businesses.

Discussion: reflections on learning

Reflecting on the learning responses observed

There was extensive evidence in all sites that water-related stakeholders with an incentive (financial, environmental or idealistic) to save water, had learnt much about *water savings systems and technologies* in the context of drying. This particularly included water conservation, distribution, metering and recycling technologies in irrigation areas as well as cropping systems in all sites. Most of this learning had been achieved through a combination of learning by trial and error as well as via government and industry advice.

Similarly, there was evidence that significant learning had taken place in learning about new *ways of doing business* in dryer conditions. Learning in farming businesses had typically occurred by individuals actively seeking answers to problems, by trial and error, from the neighbour, by reading the paper or by going on the internet.

Some advice was available from pastoral, agricultural, horticultural and forestry industry extension services in both the private sector and government. Importantly, much of what these government 'experts' knew came in turn from the experience of people 'on the land'. As the period of drying had lengthened, learning about water trading (buying and selling) and substituting water from other sources, particularly from groundwater, has also grown.

The learning options for water-dependent, non-agricultural local businesses (such as irrigation suppliers, laser graders, farm produce processors and cartage contractors) have become very limited in irrigation sites. As the 'long dry' had continued, many such businesses had tried to diversify and extend the location in which they operated to include other areas of the state, and in some cases, to other states. Many other service and retail businesses had been very badly affected in all sites where agriculture was a major industry. This had resulted in businesses either reducing staff, or in some cases, closing up and moving elsewhere.

There was much difficulty learning about *new family and social models* that fit with the changed circumstances. While off-farm income had been an important supplement to farm incomes in Australia for several decades, more recently off-farm income had been the only thing to keep many farm families viable. The hardest learning, again, had been learning about ways of understanding water-related causality and solutions. In many instances, this had also required learning to learn in different and new ways.

Learning to extend knowledge of the risks and possible responses

Agricultural 'extension', as the Productivity Commission (2008: 188) observed, was historically delivered through state government departments but had more recently been 'wound back'. Many extension arrangements were now conducted in partnership with, and partly funded by, the private sector. The Productivity Commission's

separate treatment of agricultural 'extension' from 'education and training programs' in their report is indicative of the implied difference, which we regard as unhelpful and artificial, between 'farmers learning new things' (p.187) and a largely formal 'education and training system that services agriculture' (p.196).

The term 'remote' is often applied from afar to sites and communities (like those studied) that are distant from cities and their comprehensive services. Looking outwards from each of these sites, formal education and training systems were generally missing, and where present were sometimes regarded as remote from or inappropriate to the lifelong and lifewide learning needs of place-bound residents in all four, small rural communities.

Climate change, as Rittel and Webber (1973) noted in IDCC (2009: 72), is part of a family of environmentally related 'wicked problems' with no definite formulation and no clear point at which the problem is solved. As such they pose significant and arguably wicked learning challenges for all four communities.

Learning about the wickedness of the learning problems

Dietz and Stern (1998) identified five key characteristics of 'wicked problems', all of which have come through strongly in the interview data about learning to be drier, whether climate change is causally implicated or not. The first characteristic, *multidimensionality* is demonstrated both within and across all four sites. If 'being drier' is taken as the changed environmental process, it can be seen, as Dietz and Stern (1998: 441) describe it, to have 'many different types of effects, distributed unevenly so that those affected face unequal share of the costs, risks and benefits', within each site and across the Basin.

The second characteristic, *scientific uncertainty* is also present in many 'Learning to be drier' narratives. Decision makers, including government water managers and water-dependent businesses in all sites, want and desperately *need* to understand and know the future

risks in order to make decisions about future fire, environment, river flow, irrigation, business and cropping risks. However the science of climate change and prediction is too uncertain to provide anything other than alternative probable scenarios.

We also identify recurring themes in the narratives associated with the third characteristic of 'wicked problems', *value conflict and uncertainty*. As Dietz and Stern (1998: 444) put it,

> People differ in the importance they attach to the different effects of any action, and these judgements change as people experience how their own and others' actions affect the things they value.

Value conflict and uncertainty of this nature was present in the narratives in all four sites, going well beyond the contested nature of causality. People's different value positions about the relationship between fire, control burning, the environment and woody weeds are good examples from the alpine site. There were conflicting value positions between residents in the Riverina site to maintain 'green lawns and nature strips' and riparian water rights and those outside of the site (including the researchers). Value positions associated with whether to trade water temporarily or permanently away from a site (and particularly interstate) were particularly conflictual in both irrigation sites. There also seemed to be values conflict in the dryland site between those who attended assiduously to the need to adopt practices consistent with reduced water availability, and those who paid less attention to it. While some respondents were tolerant towards people's varying adoptions of 'better' practices, others appeared quite judgemental towards those who were seen to be lagging. Also, conflicting views were expressed about the motives of some of those who provided information. For example, the role of agronomists working in agricultural extension for private companies was strongly endorsed by some respondents, but critiqued by others.

Several forms of *mistrust*, the fourth wicked characteristic, are apparent in narratives developed from all sites. There is a mistrust of the various levels of government to respond in a coordinated, systematic and logical manner to less water. In the mid-river and dryland sites, there is evidence of a mistrust of education opportunities. We were told that the best way to get participants to attend training opportunities was to 'lure them' and 'don't call it training'. In several of the sites there was also a mistrust and wariness of us as researchers, catalysed by their previous experience of those who had taken knowledge away only to see it misused or misinterpreted.

The final characteristic, *urgency*, was evident in participants' voices as they spoke about their experiences with less water. There was pain, emotion and frustration. In the mid-river site, there were those who overcame their *mistrust* of 'not another bloody study' to speak to us, because "We have to do something, anything, about the water and if there is a chance that this will help, let's do it."

Discussion

It is important, before concluding, to acknowledge that consistent with the nature of wicked problems as defined by Conklin (2005), the problems of drying in the southern Murray-Darling Basin, and particularly the problem of climate change, will require large groups of individuals inside *and* outside of the Basin to learn enough about the problem, to change their mindsets and behaviours. Given that people's responses across the Basin will depend to a large extent on their beliefs about causality (over-commitment of water, drought, climate change or a combination of these and other factors), the learning required will be similarly wicked.

While Australian rainfall was recognized more than a decade ago as being 'more variable than could be expected from similar climates elsewhere in the world', Nicholls, Drosdowsky and Lavery

(1997: 66) identified evidence that some of the previous relationships between governing factors had already shifted climate systems in the Australian region. In the decade since, all four sites in our *Learning to be drier* study in the southern Murray-Darling Basin had experienced an unprecedented series of unusually dry years leading to significantly less runoff, consistent with predictions in most climate change models and scenarios.

It is important to observe that as we completed this final, sixth paper in October 2009 some of the southernmost parts of the Basin had experienced encouraging rains. While insufficient in most areas to break the irrigation drought they were enough to give farmers in the dryland area we studied the prospect of one good year in a decade. Whether the lower Murray-Darling Basin will indeed get what CSIRO (2007) predicts by 2030: lower annual average rainfall, runoff and streamflow, more severe droughts and more hot days over 35 degrees C, will only be known 20 years hence.

Conclusion

Conclusions by site

In this, conclusion to this final paper, we return to the initial research questions which formed the focus of our research project and our case studies: 'How and what do adults learn in response to changes in water availability in the southern Murray-Darling Basin?' and 'How is the learning experienced by the different stakeholders and how do the stakeholders learn to respond to the changed circumstances?' In this section we summarise conclusions by site.

All participants had an understanding of where there water came from and that there was less of it. Interestingly Foley and Grace (2009) make the point that the notion of belonging to one of the stakeholder groups becomes problematic as the people of these communities undertake multiple roles displaying multiple identities. Therefore the people living in the alpine site might more usefully

be divided by location, because they appeared to have different perceptions and experiences of dryness depending on which part of the site they lived. Those at the higher altitude location believed that water was more plentiful because of nearby storage facilities for the hydro system. Those at the lower altitude location had a lived reality that water was more scarce, as their river only had winter runoff and became dryer in the other seasons. People in both locations were concerned about changes to the region which would affect the local economy that centred around tourism. Both communities saw the potential changes as being of great concern. Importantly, less water meant higher risk of wildfire. Weeds that had grown as a result of the last bushfire are also seen as a threat to the existing aesthetics and livelihoods being made in the region.

In the mid-river site people around Hay people are asking some very fundamental questions about why they live in the region. With water scarce, some faced the hardship of decisions about staying or moving. What they had done in the past for some was no longer viable or possible. Golding and Angwin captured the way that young people are affected by schools closing and people choosing to leave the district. In government terms, the people in this site must now bear the risk of water availability and water prices. Increasingly the internet is being used as a research tool, as people seek immediate information to make adjustments to their lives. Yet a disjunction remains between the message from the experts and their science, and those who believe they have lived through the same cycles of drying previously.

Brown and Schulz, in the lower river, Riverland site, noted that due to the use of weirs and locks, the superficially 'full' look of the River is deceiving. Whereas water levels look unchanged, flow rates have markedly diminished. Yet just five minutes inland, away from the river, there is little doubt of the impact of the dryness, with trees across the floodplain in dire need of water. Most people in the Riverland are proud of their efficiencies with water, though this is

relative to other users upstream in the basin. Many think there is over-allocation of water, but this is seen as being more about being an upstream problem a problem for the Riverland. Environmentalists and conservative land and water resource managers are seen as being at loggerheads with the growers. The health of the river is desired by all, but prioritised for only by some, as individual interests are maintained.

In the dryland site of the Wimmera-Mallee region of Victoria, the research again found that farmers and community members were trying to work and live using water more efficiently. In some cases new farm practices were being developed. New crops were tried, feedback was sought and informal evaluations were conducted. Information was being obtained through local newspapers and information published by the water authorities. Some information came home via the children's schools, and increasingly via the internet. Informal talks occurred through and over the farm fence between neighbours and acquaintances, where significant observations, information and ideas were conveyed and exchanged. Explicit attempts were made to engage farmers through a farmers' development group. These often employed professionals such as agronomists to provide advice. Some others in the dryland site opted to enrol in short skill-based courses provided through an education or training facility.

Broader conclusions about learning across sites

The relatively recent, extreme drying of the southern Murray-Darling Basin, while more familiar to dryland farmers, has created major water resource availability and allocation problems across the southern Basin, and placed irrigators, water managers and fire authorities in uncharted territory. If we accept that this difficult issue of drying might be a wicked manifestation of climate change, our task, as Conklin (2005: 18) would suggest, '… is not whose fault the mess is—the issue is our collective failure to recognize the recurring

and inevitable dynamics of the mess.' Conklin's analysis of wicked problems would suggest that there are likely to be no easy, technical solutions or value in apportioning blame. Rather, the solutions will lie '… in the social domain, in building capacity to collaborate effectively' (pp.18–19). Conklin (2008: 10) suggests that '… [t]he first step in coping with a wicked problem is to recognize its nature. … There is a psychological dimension here—a shift from denial to acceptance.' If climate change (and perhaps global warming associated with human action) are implicated and are to be more widely accepted, the complex learning associated with their acceptance, and the actions to address them, are ones that we all share and need to learn in an interconnected atmosphere.

Even if this is a 'natural' but extreme aberration from the existing climatic variability, the policy solutions involved with changes in water allocation in an interconnected Basin, particularly in catchments where water entitlements already exceed supply, will still be very difficult. In all cases, including where businesses and environmental values are already lost, damaged, severely compromised or unsustainable, this necessarily involves social and political decisions and values, including consulting and learning with affected communities about what is desirable and appropriate.

The observed differences in learned adaptations to drying between sites are likely to be related to the hetrogeneous nature of the sites and the communities, as anticipated by Adger (2003: 400). Adger postulated the formation of a [climate change] social capital where communities 'find strategies to manage risks through strategic and local networks and interactions … manifesting different forms of social capital in different circumstances'. Adger (2003: 401) suggested that …

> Although insights from social capital and collective action can inform the processes of adaptation, societies that are dependent on climate sensitive resources are themselves heterogenous

> … so when they are faced with significant changes in climate regimes and extremes of weather in the future, different societies will clearly adopt radically different strategies … determined in part by their networks and social capital. Different types of networks will settle on different types of strategies for adaptation.

As well as planned learning, there is evidence of a great deal of unplanned learning (Committee on the Human Dimensions of Global Change—CHDGC 2009) occurring in all four sites. Much of the learning occurring is undertaken by individuals. However as both Senge (1990) and Fiol and Lyles (1985) indicate, organisational (or in this case community) learning is not just an accumulation of individual learning. It is about ensuring that a learning culture is present to nurture all learning, so that the knowledge becomes beneficial in a wider sense. The challenge in all communities across the Basin might be how to create both a community of practice (Wenger 1998), where knowledge and learning is shared amongst all stakeholders. There is also a need to support double loop learning (Argyris & Schön 1974), so that a *coordinated response* to less water might occur at *every level.*

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