DRYING AND PERCEPTIONS OF CLIMATE CHANGE: INSIGHTS FROM A RIVERINA SITE IN THE SOUTHERN MURRAY-DARLING BASIN

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Abstract

This paper is based on an analysis of interview data about learning to cope with drier times in the southern Murray-Darling Basin in Australia. Its specific focus is about whether the protracted drying might be related to climate change, based on adult interviewee perceptions in one site in the New South Wales Riverina, The data were collected in 2009 as part of a larger, collaborative, four-site *Learning to be drier* project. The Riverina site study, from which the data analysed here derive, examined transcript evidence from Hay and Booligal, on the Murrumbidgee and Lachlan Rivers respectively. It looked at how adults in these river-dependent communities have learned to make sense of and cope with significantly diminished rainfall, lower river flows and less water allocations in the past decade. The aim of this particular paper is to investigate how (and whether) adults think about the causes of drier times, in particular about climate change. The paper raises questions about whether lifelong and lifewide mechanisms and processes post-school, particularly in rural, irrigation-dependent communities, are able to properly prepare, train and educate adults to deal with the complex, insidious and often debilitating risks and consequences of a predicted warmer and drier climate associated with climate change. It concludes that new mechanisms and models of learning are required to help adults in Australia to understand, bear the risks and mitigate the impacts of predicted climate change and further drying of the Basin. It argues that radically new ways of learning are required to reach and properly inform the most climate-sensitive sector, agriculture, to make an informed choice about the risks of 'staying on the land' (or not).

Introduction and context for the research

This paper draws on data from the Riverina, one of the four sites in the *Learning to be drier* research, located in the southern Murray-Darling Basin. The broader research is introduced in Golding and Campbell (2009) and summarized in Golding, Brown, Foley, Smith et al. (2009). Analysis of the Riverina site data, on which this paper is based, is reported in Golding and Angwin (2009). The research was conducted in 2009: a critically important time, environmentally and politically, after over a decade of unprecedented, dry conditions in southeastern Australia. By 2009 the Prime Minister's Science, Engineering and Innovation Council (PMSEIC 2007: 11) had concluded that 'Global greenhouse emission will continue to drive changes in climate across Australia for the foreseeable future'. It recommended (p.3) 'that priority should be given to developing adaptation plans for four foci [including the] Murray-Darling Basin – Australia's food bowl.' Particular priority was recommended for 'Communities with lower capacity to adapt – the Australians most at risk' (p.3). Golding and Angwin (2009) identified the Riverina site as being particularly sensitive to climate change, by virtue of its high dependence on irrigation water from the Murrumbidgee and Lachlan rivers. While our research comprehensively investigated learning associated with drying of the Basin, we deliberately avoided foregrounding or presupposing its causality in the interviews. This paper looks at evidence from

interviewees about whether adults in the Riverina site perceive that the observed drying might be related to climate change.

In 2007 a CSIRO (2007) report identified the definite severity, likely urgency and possible future risks associated with the problem of drying in the southern Basin. The CSIRO attributed these risks to human induced climate change. In summary, the report predicted a future climate that would be drier and warmer, resulting in significantly less stream flows and water for irrigation. By 2009 water reserves and irrigation water allocations were at record lows. National debates were raging about whether human induced climate change was real, and whether to support a national Emissions Trading Scheme (ETS) to control carbon emissions, seen by PMSEIC (2007) to be driving the changes. The ETS presupposed that elevated emissions of carbon dioxide into the atmosphere were altering the global atmospheric balance and changing the climate. Much of the political opposition to the ETS was coming from people labelled as 'climate change sceptics'. Climate change scepticism, despite the conclusive science, had been most prevalent in two of the world's biggest polluting nations, America and China. In both countries in 2006, only around one third of those polled who had heard of the issue agreed that they 'worried a lot' about global warming, compared to around two thirds of Japanese and Indians (Pew Global 2006).

Literature review

One of the difficulties of learning about climate change is, as Weingart, Engels and Pansegrau (2000: 269-270) concluded,

> ... that as long as climate change remains a hypothetical risk and there is no scientific *evidence* of a discernable impact on the global climate, the scientific warning is largely dependent on the assigned credibility of science in general and climate change science in particular – an easy target for skeptics in the absence of ultimate proof.

The concept of 'climate' itself, as Golding Brown, Foley, Smith et al. (2009) argued, is no longer seen in natural or 'uniformitarian' terms. Weingart, Engels and Pansegrau (2000: 272) noted that:

> Whereas earlier [the term climate] had been considered a natural phenomenon to which humankind was more or less passively exposed, now it was perceived as a system with which humankind had actively interfered; further, a system that should be brought back into balance by purposeful human action.

Weingart, Engels and Pansegrau (2000: 280) adopted a constructivist view of learning and understanding in relation to climate change, when they concluded that:

> Whatever the ecological risk climate change may be, … the way the risk of climate change is perceived is socially constructed. …. There is no "one true" or appropriate definition of the issue.

They further demonstrated that communication *about* climate change differs among science, politics and the media, and that by virtue of their disparate forms of communication in modern mass democracies:

> They entail risks of communication hitherto unknown. For science, its credibility as an institution producing reliable information is jeopardized. In the case of politics, legitimacy is at stake. (Weingart. Engels & Pansegrau 2000: 280)

Hulme (2007) put a similar argument in another way, which helps explain why resolution of the very public and continuing battles over beliefs about climate change (and by extension, debates about the cause of protracted drying of the southern Murray-Darling Basin) in Australia are so intractable. The battle occurs;

> … as much in the cultural and individual imagination as in the atmospheric spaces in which physical climates are formed. … [It] reveals more about the struggle for

> ascendancy between institutions of science, government and the civil society than it does about a physical reality. (Hulme 2007: 13)

Fankhauser, Smith and Toll (1999: 74) argued that:

> For autonomous adaptation to [climate change] to be effective, and to avoid maladaptation, certain preconditions have to be met. Individuals have to have the right incentives, resources, knowledge and skills to adapt efficiently. … Perhaps the main role for government will be to provide the right legal, regulatory and socio-economic environment to support autonomous adaptation.

Golding and Angwin (2009) showed that very few of these preconditions were in place in the Riverina site. Government roles (local, state and federal) policies, reactions and responses to these drier times were fragmentary and contradictory.

For most people in the Riverina site, the main, regular source of learning about drying and climate change was the media. The problem with reliance on learning via this form of media communication, apart from the fact that science and politics becomes contested and blurred, is that media discourses tend to be permeated by 'sensationalism, negativity and unequivocal clearness' (Weingart, Engels & Pansegrau: 275). Golding, Brown, Foley, Smith et al. (2009: 557-559) identified evidence of the inherent messiness or 'wickedness' of the problem of drying in the Murray-Darling Basin. They found evidence of the key characteristics of wicked problems identified by Dietz and Stern (1998) to be associated with climate change. These characteristics include multidimensionality, scientific uncertainty, value conflict and uncertainty, mistrust and urgency.

There can therefore be no one, true definition of the wider climate change issue and its risks by virtue of the hyper-wicked nature of the problem. Like Weingart, Engels and Pansegrau (2000), I therefore contest Fankhauser, Smith and Toll's (1999) optimism about the possibility that there is one right, autonomous form of adaptation to climate change in the Murray-Darling Basin. The literature suggests that the best government and communities can do meantime, aside from minimizing global carbon emissions to reduce the risks, as PMSEIC (2007) suggests, is to work on adaptation for a drier Basin at all levels. These include (PMSEIC 2007: 39) information to and engagement of the general public and the business community, 'accurate, pertinent and up-to-date information to policy makers', and generation and conveyance of knowledge of climate change and adaptation options by researchers.

Research method and limitations

The *Learning to be drier* research (Golding & Campbell 2009) interviewed adults in each site in five categories: education and training organisations, water authorities and land managers, farming and other enterprises, community organisations and individuals. The semi-structured individual and small group interviews explored how and what adults learn to respond, formally and informally, in response to changes in water availability. The four selected sites (Alpine, mid-river, lower river and dryland) were identified as being highly dependent on water in the Basin different ways. The *mid-river* site, on which this paper is primarily based, has been highly dependent on irrigation water from the west-flowing Murrumbidgee and Lachlan rivers and aquifers, for broad acre crops including rice and cotton as well as vegetable crops. Most interviews were conducted in Hay, on the Murrumbidgee River. Some interviews were also conducted in Booligal, also in the Shire of Hay, approximately 80 km north of Hay, on the Lachlan River. Potential interviewees were identified by

email and phone call and a reconnaissance visit to the Riverina site. Several weeks later audiotaped, focus group interviews were conducted in the township of Hay (2006 population approximately 3,500) and the small hamlet of Booligal. University research ethics approval was obtained for these interviews, which varied in length between approximately fifteen minutes and one hour each. Interviews were fully transcribed. The interview questions focused o: what informants already knew about water origins, use and availability; how they learned about changes in water use and availability as well as how informants and their organisations were adapting to these changes.

The results are based on narratives from interviews in the mid-river site. Almost every mention of climate change and its possible implication in the drying of the southern Basin in this site came from the interviewer prompting towards the end of an interview. Where arguments about climate change, including scepticism, have been located within the interviews, some attempt is made to locate these arguments within a typology of sceptical[1] arguments on climate change. Grist (2009) proposes a similar continuum between 'types of sceptical arguments' on global warming: uninformed, misinformed, cherry picking, urban myths, FUD (fear, uncertainty, doubt) and non-scientific. Grist creates a separate continuum for 'levels of sophistication' of these arguments, ranging at the lower levels from silly, naïve and specious, to scientific at the higher levels. It would be possible to think of these two continua on two orthogonal axes, creating extremes between 'sophisticated and informed' arguments that are rational, logical and scientific, and arguments that are 'silly and uninformed'.

This research is limited to the perceptions of a the small number of informants in one Riverina site (12) who, in the discussions about the drying of the Basin, spontaneously mentioned climate change or discussed it when prompted. It is further limited to the five categories of informants purposefully selected for the interviews. The small number of spontaneous mentions of climate change amongst the 32 adult, Riverina interviewees may have been affected by the researcher's decision not to presuppose or foreground causality during the interviews or in the information supplied to interviewees. It is inevitable that researcher bias, opinions and knowledge about this contentious issue shaped the choice of this research and of this topic.

Findings

A wide range of interviewees talked about the recent drier times, but very few spontaneously mentioned climate change in the Riverina site. In this section, all Riverina site transcripts have been examined to identify narratives about whether the observed drying might be related to climate change. In cases where climate change was not spontaneously mentioned, the interviewer typically asked the interviewee whether they thought the drying was associated with drought or climate change. One sign of the pressing need to contemplate permanent change to a drier climate in the Riverina site came from a vocational education and training (VET) stakeholder, who spontaneously noted that:

> There is [a] role for educators to help transition to … more efficient, more effective farming systems, not just in agriculture, but right across the board. [This is a] … transition to a drier climate: a permanently drier climate. … You will meet people, even in the education system, who think that this is just a drought. … They no longer have the capacity to really change. [They think] this is going to end and we are all going

[1] In the US literature, the spelling is usually 'skeptical'.

> back to a wet pattern. Some people who lived through the 1940s drought, well they are saying "Well we lived through this as kids", and think: "Why can't we live through this like we did when we were kids?" You also have a number of people who are seeing reality for what it is. I don't think you have got a lot of people really strategically thinking about what needs to go into developing a region to keep it viable. I don't think that thinking is being done on a local front at all …

A second sign came from a state government agricultural adviser in the Riverina site. She spontaneously indicated that the thrust of government information programs was moving from an emphasis on recurrent 'dry periods' [drought], to information about climate change. However the adviser stressed that: "Those programs are still being put together at this stage" and expressed uncertainty about climate change.

> Whether it's climate change or whether it's just a dry period of time we have had in the past. … We have information … that there was originally a dry period of time at the turn of the century and then we had a dry period of time in the l950s. So whether it is a dry period, so whether it is a function of climate change, I think it is something that is going to be debated. … We probably won't have the answers to that.

A stock and station agent, who had specifically referred to 'drought' in her explanations of drying, was asked about her perceptions of climate change.

> My personal opinion is that … there is a huge amount of over reaction to [climate change] at this present stage of time. I am aware of it, but I think there is a lot of scare mongering goes on. I do. I don't believe we are doomed at this point of time, as they will have you believe. I think we have to make serious steps to rectify it.

An irrigator in the Riverina site was happy to admit, in response to a question about causality of drying, that the climate had changed locally. However he was not convinced that human activity was implicated as the cause in the change.

> [The climate] definitely has [changed] in the Hay district. The last 20 years it has just been getting drier and drier. I live on the river … We bought that in about [19]'80 and we had four or five floods up to '89 and we haven't had one since '89, so it's definitely changed. … It's obviously a drought and I would say it's a climate change, but what has caused the climate change? Whether it's man made or whether it's a cycle … I haven't got the education to say that.

Several other interviewees were similarly self-deprecating in relation to their own education and their ability to make informed judgements. Most comments were based on weighing up what they read in the popular press, narratives of others and recollections about what they had personally experienced. For example, a fruit and vegetable grower said:

> [A] lot of old blokes around the area … say we have had droughts like this 80 years ago. So who do you believe? I know myself, being a vegetable and fruit grower, we used to have rock melons ready before Christmas, and now there is no way you can do that it's closer to the second week in February. … It gets cooler earlier in the season but it gets hotter later, that's what I have found … for us to grow stuff like that now, we have to keep changing varieties to keep up with the temperatures.

Farmers in the Riverina site who spontaneously mentioned climate change were uncommon. One farmer in the Hay district who had spontaneously used the words 'drought' and 'climate change' in his narrative, agreed that:

> Climate change [is] there. There's a serious data to say that we are in a decline. …. You see it through the media more than anything. … [The] earth has had climate change before and whether this is human intervention or not or whether it is a 50 year happening, I think it's still unclear. I mean we are generation where we were born in

> the 60s and gone through … 'a 50 year positive', and I am just hoping that I'm in 'a 50 year negative'. … I mean this is only a very young country and it's not that easy to get data out of the original, … traditional owners.

Farmers in dryland areas around Booligal (on the Lachlan River), who had not had access to irrigation water for several years, had somewhat different responses when asked about the prospect of climate change. For example, Dryland Farmer 1 in the Booligal district reverted to the argument that 'climate change is natural'.

> Climate change has being going on since the Ice Age and thank goodness it did, and I think its natural. … I think … the population worldwide … obviously has got some influence on it, and maybe speeds it up the degree that it is changing.

Dryland Farmer 2 in the Booligal district admitted to devouring a wide range of reading about climate change for over 20 years. He came closest of all informants to be cognizant of and accepting of climate change. He recognized his view as uncommon and entertained the possibility that the current cycle of hotter and drier periods might be related, to some extent, to atmospheric carbon dioxide.

> It's probably not particularly common view, but I am a strong believer in climate change. I have no doubt it is happening and I believe there are cycles to our climate, and we are in one of those dry cycles at the moment. [I read] anything I see that is to do with climate change. … Certainly what has happened here since 1989 you would certainly think that climate change is having some affect. But then again, we are going into a drier period. There is no doubt that we have been through drier and hotter periods, before so whether it is coincidental ... in terms of build up of carbon dioxide in the atmosphere, there is no doubt that that is happening and that has an effect on climate.

Dryland Farmer 3 in Booligal observed that entertaining optimism about the future was an essential part of living and staying on the land. He explained why he had doubts about the accuracy of predictions about climate change in these 'dry times'.

> I have this feeling that we are going through a dry time. There's all this 'doom and gloom' that it is never going to rain again in this district … Well it happened the other day … We didn't get as much as we would like, but we will. … I mean if you don't have that attitude that it *is* going to rain you might as well give up now.

A local water manager in Hay agreed that:

> There is definitely some form of climate change happening from what we have been told. [We have gone from] 20 years ago, having a real lot of water, to not very much water. [We] … must be in some form of climate change, there's a drought, it's happening, but I mean that can turn around. It took ten years to get to where we are now; it might ten years to get back the other way. I can't see it is affecting us in the near future.

A retired farmer in Hay, when asked whether he had views about climate change, responded:

> No. It hasn't changed. I don't think, I don't believe it all, that's my opinion. It's cyclical … Look at this year. It's been the hottest year we have had had for quite some time … we had a week of over 46 degrees. [But] … we had fourteen days back in 1978/79 that the temperature never went under 100 [degrees Centigrade], day or night. … I can remember my Dad saying they had heat waves of a similar sort of thing and this would be back in the mid [19]'30s, and they were camped out in tents and they would go out and work on a windmill for half an hour and they would have to come back inside because it was too hot because they couldn't hang on to their tools … They had to kick all the magpies out of their tents because they were invaded.

Finally, some people had developed theories based on their own non-scientific narratives. For example, a representative of a community-based organisation in Hay repeated a long-standing myth about the relation between climate change, and evaporation and transpiration in the Lake Eye Basin.

> I think where climate change is possibly influenced is where a lot of the water that would have gone down the rivers and … and filled up a lot of the lagoons. They have all dried up so you are not getting evaporation from them so you are not getting rain coming back … so Lake Eyre, hopefully, is going to get a bit more water through it. Usually what happens there is that you get the evaporation from Lake Eyre, [it] goes up and then comes back and falls down as rain.

In summary, in the 163 pages (approximately 68,000) words of the mid-river, Riverina transcripts, there were only two spontaneous mentions of climate change amongst 32 interviewees. Only around one third of these interviewees (12) who mentioned climate change, typically in response to its mention by an interviewer, are cited in this paper. For comparison, drought was mentioned 67 times in the Riverina interviewees. Separate examination of the transcripts from the lower-river (Riverland) and Alpine sites revealed a similar pattern of climate change not being mentioned or implicated in drying. In the 138 pages (approximately 57,000) words in the Riverland transcripts, there were only two spontaneous mentions by interviewees of climate change and drought was mentioned 36 times. In the 61 pages of the Alpine transcripts, there were only five spontaneous mentions of climate change, all by the same interviewee, while drought was mentioned seventeen times.

Discussion

The positions adopted on the relation between drying and climate change

The positions on climate change adopted above by the twelve interviewees are and summarised below, from accepting of climate change to being climate sceptical. *Acceptance of climate change* was associated with recognition of widespread denial (VET stakeholder); acceptance of the likelihood that carbon dioxide in the atmosphere is implicated but, entertaining the possibility of coincidence with a natural cycle (Dryland Farmer 2, Booligal); belief and hope that this is part of a longer, natural cycle (Hay farmer); the possibility that human influence was 'speeding it up' (Dryland Farmer 1, Booligal); equivocation about human causality (irrigator); optimism that this is a ten year cycle (water manager) and acceptance of drier times, but deliberate optimism to counter the alternative, 'doom and gloom' view (Dryland Farmer 3, Booligal). *Uncertainty and vacillation* were associated with perceptions of an over-reaction to climate change, but a serious need to address it (agricultural adviser), backed by some contradictory personal observations (fruit and vegetable farmer) and equivocation (stock and station agent). *Total denial of climate change* was based on personal recollection and narratives of similar cycles (retired farmer) and reversion to persistent myths (community organisation representative).

In summary, spontaneous mentions in narratives above about climate change in the Riverina site were almost totally missing. When the interviewers raised the prospect of climate change, there was a wide range of alternative explanations about the cause of drier times. Aside from spontaneous mention and total acceptance of climate change in one VET stakeholder interview, there was very little evidence of acceptance, and mostly denial, vacillation or equivocation about climate change other

than as part of a natural cycle. There was only minor mention or acceptance that human influences might be implicated in the changes.

A similar search of transcript data from the three other sites in the *Learning to be drier* study (Alpine: Foley & Grace 2009; Riverland: Brown & Schulz 2009; Wimmera-Mallee: Smith & Campbell 2009) confirmed a consistent reluctance to consider drying in the Basin as anything other than a natural cycle. With some exceptions, the commonly held view was that this was a drought or natural climatic change. The arguments and evidence used to bolster this view tended to be non-scientific and lack sophistication: several arguments were naïve or specious. The types of arguments tended to be misinformed, uninformed or based on common mythologies about climate change.

Dryland Farmer 4's contribution to the Booligal discussion about climate change neatly summarised many of the elements of the Riverina site narratives, as italicised and enumerated in the text below.

> Climate change has been *happening for how many millions of years* and will continue to happen. I am sure we have increased carbon dioxide production … all the figures are there [1] … It's in *cycles* and I hope we go back into a wet cycle, whether we do, who knows? We don't know. We could be sitting here in five years time and we could be all stuffed. I don't know … but it is *definitely cycles* [2] and climate change has been happening *for a million years* [3] and *we won't stop it* [4]. Whether there are things we can do to slow it down or push it one way or the other, I don't know. The *scientists will probably come up with that* [5]… *but information wise, read, listen, radios* … [6] I listen to ABC radio and there is always something on there once a week about climate change, there's plenty of stuff to read[on the] Internet. There is plenty of stuff out there to read … It's *cycles, well I hope it is cycles* [2], and *we are suffering* [7], *we are in the wrong game* aren't we [8] … but *I think it will rain* [9]. *It has been tough before and it will be tough again* [8].

This narrative includes evidence about long-term climate change [1], a perception of definite cycles [2], change over long periods of time [3], doubts about humans being able to influence change [4], deferral to scientific opinion [5], the need to be informed [6], the suffering being experienced [7], a recognition that they may be in the wrong business if climate change is a reality [8], perpetual and optimistic hope [9] and the inherent difficulty and need for toughness and resilience when living in a cyclically dry, Australian environment [10].

Perceptions of government responsibility to ensure future water allocations

These narrative accounts of drying in this water- dependent site were, with very few exceptions, devoid of spontaneously mentioned considerations about causality. A small number of informants had made an effort to learn about the possible causes of there being less water in the past decade. Only one interviewee was able to accept that there might be permanently less water in a drier climate. The overwhelming concern in the interviews was about short-term water 'allocations' by governments as a percentage of 'entitlements' during 'the drought'. There were 113 mentions of 'allocation' in the Riverina site interviews (and 77 in the lower river, Riverland site). One informant observed that the typical, simplistic view in the site was "If you turn your tap on and water comes out, you're happy."

Mentions of 'government' (70 cases) were typically about government responsibility to ensure the future of the town and the area as a food bowl. For example:

> I don't understand how the Government can just see this area where a huge food bowl is and watch it just steadily decline. … I mean if there is no water here [in five years time], I can see the Hay area becoming part of the Great Sandy Desert … It will become totally non-functional … It will be just dry. There will be nothing.

Consideration of the need for governments to ensure water allocations to other users and uses in the wider Basin or catchment were rare. Spontaneous considerations of 'downstream' (mentioned only twice) and 'upstream' (mentioned only four times) were also notably absent in the Riverina site narratives. Mentions of the 'environment' (24 times) were typically disparaging of government, and as Golding and Angwin (2009) observed, were often linked to the term 'frogs', as part of a cynical perception about the low environmental value of wetlands. For example "I am all for the environment, … but I can't see the advantage of pushing all the water into the river to save frogs."

Conclusion

The data examined confirm that most adults interviewed in this climate-sensitive, Riverina site remain ignorant or dismissive of the 'bigger picture' problems in the Murray Darling Basin. Most remained hopeful and optimistic that this is a drought that would eventually break. Very few interviewees spontaneously mentioned climate change as part of their understanding of drying. Most were dismissive or sceptical of theories about climate change and retreated to the familiar and less confronting idea, that this is simply an extended, cyclical, natural drought. This paper raises serious concerns about the ability or reluctance of adults, in this and other highly water-dependent sites in the southern Murray-Darling Basin, to understand and think seriously about the longer term responsibly of sharing and conserving much reduced allocations of water, in a drying and inter-connected catchment. There is little evidence in the narratives that adults understand or accept the predicted, real risks that climate change will, over the long term, dry the basin even further in future decades. People were clinging to whatever hope, evidence and arguments that they could muster. The first and main argument, when all interviewee responses are considered, is that the drying of the Murray Darling Basin is caused by a cycle of drought that will eventually reverse. The second, less common argument is that drying is part of a natural change in the climate in which humans are not implicated.

The data raise serious concerns about whether and how adults at risk could or should learn about causality in an interconnected basin. In 2009 the New South Wales state government water authority was still calling the ongoing drying of the Basin 'a drought' and farmers were being paid 'Exceptional Circumstances' funding by the federal government, on the assumption that this was an exceptional but natural, one in 25 year event. The paper illustrates the psychological difficultly of reversing denial of the risk climate change in adults, whose livelihoods effectively depend on optimistically gambling with the belief that the risk is not real. Most adults who choose, to 'stay on the land' and maintain Australia's food bowl have lives and businesses that are dependent on water. They have no option but to optimistically accept that the good, wet times will return.

The research is further evidence of a need, identified by PMSEIC (2007: 39), for a 'newer area of adaptation' to climate change beyond scientific and technical reports. that demands 'a communication and education focus'.

> There is [so] little social research on the public perception and understanding of climate change … that public communication intended to enhance adaptive outcomes, or to improve adoption may be ineffective at this stage. (PMSEIC 2007: 39)

It suggests that new mechanisms and models of learning are required to help adults in Australia to understand, bear the risks and mitigate the impacts of climate change. Radically new ways of learning might be required to reach and manage the risk for the most climate-sensitive sector, agriculture. By extrapolation, the paper identifies a desperate need to learn more about upstream and downstream effects, not only in the interconnected water catchments examined, but also in a turbulent, interconnected atmosphere at risk of further warming and drying.

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