Government Drought Support

A Submission to the Productivity Commission Inquiry

Dr Barry White
Consultant

Introduction - My comments are based on my experience as National Coordinator of the Managing Climate Variability R&D Program (MCV) over the period from 1992 to 2005 and on previous experience with QDPI. The MCV program has a key role in maintaining Australia's position of world leadership in climate risk management (pre climate change). Before my MCVP role, I worked for three decades in a state government agricultural department in a wide variety of roles including water resources development, crop modelling, cloud seeding, statistics, economics, drought policy and research management.

The submission is based on selected questions (**in bold italics below**) as in the Issues Paper.

P10 Which are the more important rationales for government intervention during severe drought? Are these the same rationales for intervention in other severe events? There are some aspects such as animal welfare concerns that are likely to be less an issue now than some decades ago when there were limited market opportunities for aged sheep. But in general Government interventions are probably best viewed as administrative attempts to introduce some rationale into a process that is now institutionalised and deeply embedded in the now traditional way farmers, farm organisations, the community, the media and politicians respond to drought, and to some extent to similar events. If one assumes that this is difficult to change in any fundamental way, a new rationale that can divert the response to related policies would appear to be a feasible policy.

My alternative view (grown out of 40 years experience that there was no way to stop a cycle of reviews and ad hoc amendments in pursuit of some concept of equity) is that a renewed framework for drought could be used as the catalyst to drive stronger bottom up regional responses to climate change adaptation. The responses would still be geared to the three NDP objectives relating to self-reliance, maintaining the resource base, and early sustainable recovery. It might be argued that any self reliance engendered by drought assistance to date would help farmers adapt better to climate change. But more likely, unless there is fundamental change in drought assistance, climate change is likely to further erode self reliance.

What is your understanding of the meanings of preparedness and self reliance?
I doubt that these have been very useful terms operationally, but when NDP began would have been seen as convenient indicators in an effort at justification. The main reasons they are seen as not useful include:

- some farmers saw them as patronising,
- they are hard to define and to monitor,
- they are matters of degree, and

- they lend themselves to contradiction when regions have been getting drought assistance for many years.

I also invoked self-reliance in my efforts to raise funding from the Rural RDCs for the MCV Program, without much success. They too in some cases preferred government funding rather than industry funding.

What have been the lessons learned from the last drought and what strategies are farmers now adopting in response to those lessons? Drought experience suffers from some over analysis in terms of lessons to be learned. Drought are hard to compare meteorologically because of differences in timing, and then variations from one drought to another in the farm and the farmer situation (financial, social), and off farm markets determine the responses. The perceptions that farmers have of drought risk are more likely to be based on experience than on analysis. Learning by simply updating experience is likely to underrate drought risk, and even more so for climate change (Weber 2007).

At farm level, decisions are likely to be unique and not readily responsive to research that might be useful or repeatable. In any case the research on decision making in general shows that intuitive approaches dominate although it can sometimes be shown that rational and objective approaches would have been superior. Like most decision-makers, farmers often attribute decisions with a bad outcome to bad luck and decisions with a good outcome to good management. So lessons are hard to come by. When the dust settles after a drought farmers and the community just want to move on. In any case the problems in seeking lessons from farmer experience to plan assistance are as daunting as the problems in obtaining accurate farmer data to base assistance measures on (Ha et al 2007).

A possible exception to the over-analysis claim is the failure (unless remedied in recent years) to analyse the experience over the duration of Exceptional Circumstances declarations. There must have been 100 or more submissions. An analysis may have revealed some important lessons.

P11 What are the impediments to individual farmers, farm businesses, farm dependent rural small businesses and rural communities becoming sufficiently self reliant to withstand severe drought events? A trite and perhaps obvious answer comes from defining self-reliant as not dependent on government assistance measures. But the last decade has been all too exceptional in that respect. However, in general if drought assistance was limited to vital welfare measures and other measures to adjustment, then farmers would perhaps be more self-reliant.

The other three major and linked constraints would still operate (for example as in the AAA Evaluation by DAFF in 2001 and probably still applicable). They are:

- Lack of access to off-farm income,
- Debt levels and fluctuations, and
- Small farms.

P12 In general, do current drought support programs provide an incentive for farmers, farm businesses and farm dependent rural small businesses to become more self reliant and adopt strategies that better prepare them for instances of severe drought? Do they do the opposite? Surveys (for example AAA Evaluation 2001) support the importance of training activities in particular and much of that was

provided by FarmBis. One could argue that climate risk management expertise would be a fundamental component of improved self-reliance. But I do not recall that it was a prominent topic in the FarmBis courses.

I am not aware of evidence supporting achievement of NDP objectives relating to self-reliance, maintaining the resource base, and early sustainable recovery. It is of course very difficult to get conclusive net economic evidence on these objectives, particularly if measured against a no-NDP baseline. (The FMD review to be discussed later could be claimed as providing evidence of improved self reliance but was it essentially collateral from taking an obvious opportunity to minimise tax?)

Thus apart from flow ons from training, it would be hard to find evidence for increased self-reliance or for maintaining the resource base as a result of drought assistance programs. The perverse impacts of the timing of drought declarations and of the provisions of the tax system on the resource base have been well documented and would readily undermine any vague claims of net economic benefits from drought transfer payments.

To what extent do drought support policies prevent the development of market responses to manage drought risk? For example, have drought policies impeded the development of weather insurance or other weather derivative markets?
The obvious first answer is the let-off for the banks.

Crop insurance is unlikely to be an option unless heavily subsidised. The impediments and the operational difficulties with crop insurance schemes have been well documented. Some of the issues with using an SOI-based scheme have been explored (see Climag 6, p8 June 2002) and one bank ran a trial some years ago. Rainfall derivatives are being used in some Australian applications, and some of the impediments have been researched. Schemes based on rainfall are clearly more complex in respect of verification. An MCV project has evaluated correlations between rainfall and wheat yields (Stone 2007).

A very simple scheme as sketched here could be explored. The example is more based on the part or mainly winter rainfall regions of eastern Australia. It would simply be based around the SOI and its recognised value as a predictor during winter into spring for the three month season ahead. A low mid year value doubles the chance of poor spring rain in much of eastern Australia. (Note that virtually all major wheat industry droughts have been El Ninos, but the converse does not apply). The mid year SOI is also a useful indicator of reservoir inflows in southern Australia. The chance of a low mid year SOI value (it happens about 1 year in 4) indicating an El Niño could be insured against in say January given that in January there is no correlation between the January and mid year SOI values.

The scheme as sketched is actuarially sound particularly to be conservative if the trend in SOI is built in. In a particular year the payoff (if SOI is low) to a farmer is likely to exceed the cost if there is a drought on the relevant property or if there is a regional drought where fodder and livestock prices are impacted. The scheme would be cost neutral over time (similar to insurance if the risk reflects the premium). The value of the scheme as sketched in terms of income volatility depends simply on how farmer yields and income correlate with the SOI and on its tax implications. Farmers could easily establish correlations with their annual income stream, and in the process understand more about

their income variability and climate risk. Such a scheme could be an alternative to taxation provisions such as FMD that contain a major subsidy element. A simple example is an annual premium (tax deductible) of $10,000, and a payout of $40,000 in low SOI years (about one year in four on average).

P13 Is the EC declaration process overly complex, long, non-transparent and open to manipulation? By definition almost, yes to all three. And the more criteria and the more tools available together with complications resulting from debates over the current extent of uncertainty from climate change, the more likely events are to fit some criteria of extreme. The presumption for the approach is that events are exceptional regionally and this will indicate exceptional at a farm level. True, meteorological/climate events such as an El Niño do have a degree of regional coherence and that is a primary criteria, but the actual financial and welfare impacts at farm level are highly variable and not readily measurable from an administrative perspective.

Is the current institutional approach the best and most effective way to achieve declarations of instances of severe droughts of low frequency, timing, uncertainty and high consequence? There is a conflict between a regional and historical approach using primarily meteorological criteria to attempt to define how an individual farmer feels impacts on their own situation. Their main context is their experience, their current bank balance and their recent cash flows. There are simply too many factors involved for a regional analytical approach to be meaningful at the property level. Dependence on livestock is an obvious factor including the cash flow and tax implications of forced sales. Recovery prospects are also highly variable depending on whether an enterprise is mainly livestock or grain for example. So equity is hard to achieve.

Does the process need to be refined in the context of a changing climate to remain targeted towards such severe droughts? The answer is clearly yes if the changed climate can be defined and the criteria are unchanged. The evidence that successive droughts were warmer was clear by 2002 (Nicholls, 2004). However rainfall is more variable and attribution more problematic (south west WA is an exception partly because it has low variability, but it may not be an exception in terms of climate change - climate change might have crossed the Nullarbor). For most of this decade farmers have been not well served by some scientists and science based agencies (and politicians for that matter) conservatively affirming that lack of evidence of downward trends in rainfall in SE Australia is evidence of no downward trend in rainfall. Risk managers have different standards to scientists. In the last year some not widely publicised scientific papers have recognised that climate change is likely to be having an impact as reflected in rainfall trends in SE Australia. Scientific leadership on these issues and on climate change generally is often lacking. The media handling of these issues is usually aimed at amplifying confusion.

In the meantime farmers have made up their own minds one way or the other. A majority accept the temperature trend because it has been more apparent, particularly through reduced frosts in more northern regions. On rainfall, the almost universal intolerance for ambiguity and uncertainty results in most farmers having a firm either/or belief - current trends are either ‘natural’ variability or climate change. But effective risk management should be able to accommodate ambiguity and uncertainty by putting more emphasis on adaptive management and on monitoring. Adaptive managers do not need to develop a belief on whether or not rainfall expectations have already changed if the evidence is

confusing. Their strategies should aim to keep monitoring, be robust and cover both possibilities. (They are then operating more as bookmakers than as punters.)

The approach to incorporating uncertainty often flows through into projections of climate change. Uncertainty is usually mentioned but often assumed away. The highly simplified assumption is that risk management is simply a matter of redefining risks. The emphasis in adaptation (for example the preferred AGO approach) has been to attempt to redefine the risks at 2030 and assume away uncertainty and particularly the extent to which the climate is likely to have already changed. Only in the last year there has been some recognition that climate change may have been more rapid than expected and the models may be conservative because they exclude many effects where the evidence is not as strong.

The CSIRO BoM analysis – The analysis has undertaken a very difficult task. The challenge is to show how much uncertainty is involved without undermining the evidence that is available. Increasing uncertainty from temperature to rainfall to soil moisture is noted but not put in a context that would allow some understanding of its significance. The statement is made that the climate models perform 'acceptably well in the Australian region'. (The criteria for this may well be they can simulate climate rather than climate variability.)

Variation between models is used to generate low and high scenarios and is presented as the main uncertainty. The analysis only provides very cursory mention on the all-important aspect of how the declaration thresholds were calculated from the model outputs. Climate models are generally recognised as being poor in terms of representing climate variability. Changes in extremes resulting from climate change to date are accepted as being more rapid than changes in means. There is a view by some measures that actual recent change has been more rapid than models have indicated.

Figure 10 in the report does give some comparison of historical occurrence of extreme rainfall and simulated data for an overlapping period. Clearly apart from Victoria and Tasmania, the output for the mean of the models does very poorly at capturing historic variability over time. But it is difficult to determine the overall significance of that.

Some illustration would have helped show how model output and historical data over the common period to date were used to effectively calibrate the model. The strength of the correlation between actual and model data is the key factor in determining how accurate the models are likely to be for period to 2040. There is also presumably an important assumption that the relationship is invariant with climate change. The soil moisture simulation appears to be based simply on a shift in daily rain using shifts in monthly means per degree of warming for rainfall and evaporation. There is no mention of debates over impact of global warming on evaporation and whether results in some regions would be more sensitive than others to the assumption made.

The SOI (Southern Oscillation Index) – the CSIRO BoM analysis does not mention how important the SOI has been in helping understand the decadal patterns over the last century. The SOI is an atmospheric indicator of ENSO and the El Niño/La Nina episodes. The temperature and rainfall patterns have well established correlations with the SOI over eastern Australia particularly. The 30 year SOI is now at its lowest level coinciding with the drying trend (or alternatively the fewer La Nina events) in recent decades. The

question then needs to be asked on how are the amplitude and frequency of ENSO events is expected to respond to further climate change. But the question remains the subject of active research. The following quote is an example of some of the uncertainty clouding climate change scenarios and the extent of current climate change;

> '*The amplitude of year- to- year rainfall changes driven by ENSO (about a declining 30 year mean) is larger during the 21 st century than it is in the 20 th century in four climate models that simulate ENSO- Australian links well'*
> (from http://www.clw.csiro.au/conferences/GICC/power.pdf)

Changing drought frequency? The key conclusion as shown for the mean levels in Table 8, is that apart from a band across southern Australia, the most likely chance of drought in terms of the extreme rainfall criteria is very similar for the next few decades as for the last century. As Table 8 shows for the Murray Darling Basin (MDB) for 2010 to 2040 the area at 6% is about the same as the historic level of 5.6% for 1900-2007. But the range, based only on model variability is from half to double the area. If the most likely chance was accepted there would be no urgent need to refine the criteria for most of Australian agriculture. However the variation around the mean appears to relate only to the variation between models. As discussed above, there is no discussion of the precision of the approach for estimating thresholds for the simulated data. Nor is there discussion on whether the changes in drought risk are simply related to a shift in the distributions or to more variable distributions.

Given experience of extreme droughts in the MDB over the last decade and recognition that climate has already changed in some respects, the apparent stability of the mean risk of rainfall drought will be questioned by some. Part of the problem is the general Australian perception that climate change equals more droughts, but that is not the case in northern Australia and in many regions around the globe.

For Victoria/Tasmania the analysis shows a big increase in drought frequency for 2010-2040 compared with 1900-2007. The respective figures of percent area of exceptionally low rainfall are 9.7 and 5.4. However the recent decade recorded 8.5%, already close to the mean of 9.7% for 2010-2040. This suggests little further change even though as reported in recent research by Dr Wenju Cai (CSIRO 2008) there are indications that a component of climate change is already active in southern Victoria receiving less rainfall.

My comments on changing drought frequency lead to a conclusion that there may be a much higher degree of uncertainty about the future frequencies than shown by the variability between models. If a trigger is needed, is there advantage in changing the trigger to reflect the changing climate, and how would you do it ?

The report concludes that the current trigger is not appropriate because of changing frequency and severity of drought. But for rainfall, the changes are not large for much of Australia. Temperature changes are much more certain and rapid but there is no discussion of the impacts of temperature increases in terms of drought and agricultural production. There may be offsets, for example reduced frost damage and carbon dioxide fertilisation. The report further concludes that there are problems in revising the trigger and the changes would be contentious.

If statistical precision is warranted, there is some confidence in an estimate based on a century of record. But the high degree of uncertainty would result in a trigger of very low

confidence and wide confidence limits if changes were attempted. Long periods of record are needed to attribute trends. Even longer periods are required in regions of higher rainfall variability, typically the drier regions of Australia. A changed trigger is likely to appear more precise than warranted given the range of uncertainty. EC claimants will be able to argue that there is some considerable uncertainty about the revised estimates. Arguments that recent trends are either historic variability or climate change will intensify without informing improved risk management.

One way to avoid unproductive debates about whether the climate has already changed would be to leave the trigger as it is until better information is available. But uncertainty may increase as models are expanded to include better treatment of new forcings and mitigation becomes more relevant.

It might be worth considering a scenario where the current trigger was maintained for a while. Regions where EC events are more frequent and more severe could well have a case for greater frequency of assistance. Drought impacts and vulnerability cannot be looked at in isolation from the time since the last severe drought. Further, farmers could reasonably argue for some time that their farming system is unlikely to be adapted to a changed climate.

Current and inevitable future debates about drought frequency and whether or not the climate has changed do not seem likely to make any positive contribution to how farmers adapt to climate change. That wont happen without a redesigned package of drought assistance centred on adaptation to climate change.

Do the geographical boundaries used in the EC declaration process unfairly exclude some farmers from relief payments or conversely include some that do not need assistance? Does an EC declaration influence behaviour, for example, does the potential for declaration delay the decision to adopt preparedness strategies? Does the EC declaration process create incentives for states governments to apply for assistance given the Commonwealth is responsible for most of the funding? Have expectations of ongoing assistance being created as a result of many regions been declared as experiencing EC for several years?
In general where the incentives are large enough, perverse outcomes are more likely.

Is a trigger approach, such as an EC declaration, a necessary first step to determine individual eligibility for drought relief? Could assistance be delivered on the basis of individual circumstances without an EC declaration? What administrative efficiency issues does this raise? Re Assistance, it could/should probably be delivered without a declaration in a welfare based scheme. On the other hand, could a trigger for exceptional drought be the trigger for a community developing a regional approach (post drought) to adapting to climate change.

Should governments have structural adjustment policies which are triggered by severe drought? Why is there little use of current exit programs? Do severe droughts lead to an increase in exit from the industry? If not, why not*?* Schemes other than band-aid drought assistance have poor prospects of a good start if launched during a drought. Droughts undoubtedly increase exits but with lags over several years. Factors include:

- not surprisingly farmers take a chance on a good season or good prices coming up,

- experience in the grains industry is a drought is often followed by a bumper crop,
- farmers who have sold livestock in drought may have cash reserves to stay on for a few years in hope of recovery, and
- property sales slow to a trickle during drought.

P16 If governments want to maintain rural communities, what are the most transparent, effective and efficient policies? What are the effects of incorporating these policies in measures directed to the preparedness for, management of, and recovery from, severe drought? Experience in the USA for example has been that it is not generally possible for governments to maintain rural communities. But welfare-based policies to slow the rate and maintain access to health and education services, together with policies with a natural resource management focus should have a role.

I have no doubt that the government and community support in times of severe drought have enormous benefits in terms of morale in regional communities. Some of that support undoubtedly has its origins in the extraordinary self reliance and other qualities that underpinned settlement of rural Australia. So there is a genuine nostalgia and a wish to preserve one of our few defining features as a nation. But there should be more effective ways than drought support to maintain rural communities needing to adapt to climate change.

P17 How can the environmental consequences of severe drought be minimised while providing assistance to farmers? Do current government support measures change these consequences in either a positive or negative way? Comments are restricted to taxation measures. The starting point for an evaluation has been provided by the review by McKerchar and Coleman (2003). Their conclusion was not promising; 'It is clear that policy changes to achieve environmental sustainability are beyond the scope of the Australian income tax system as it has developed'. Perhaps the most productive approaches are those that work at community at catchment level and slowly change community values and capacity to adapt.

What role do FMDs play in helping farmers prepare for severe drought events? Is there evidence that FMDs are substantially drawn down during a drought? If not, what other 'needs' are FMDs fulfilling and is this an intended policy outcome? Do the eligibility criteria of the separate relief payments encourage or discourage the use of FMDs? *T*he review by DAFF(2006) stated the scheme was potentially effective and efficient although no economic analysis of the costs and benefits was available. The evaluation showed low returns to farmers using averaging, the major benefit being the option value from deferring expenditure. The same argument could of course be used for tax averaging. The main benefit from FMD was seen to be through improved risk management. Farmers would be unlikely to attribute their use of FMDs to anything other than minimising tax. In any case they typically make little use of instruments such as futures to manage price risk. It would appear to be difficult to evaluate FMDs in isolation from the other tax measures which have a role in drought policy. Most of these are simply designed to achieve some level of period tax equity. These include averaging, forced sales provisions, livestock valuation, and measures relating to natural resource management.

P18 Should there be a uniform national approach to drought policy?

Whilst it is necessary to be uniform at the level of objectives, it is probably impossible to achieve any kind of equity unless there are State, regional and industry variations. Any variations will then be constantly added to as new droughts throw up new often interacting anomalies.

The period equity in the tax system will be different for grain producers and livestock producers for example. Income from grain is less dependent (statistically) on the previous years income than income from a livestock breeding enterprise. Forced sales provisions and livestock valuation methods will further complicate comparisons.

p20 Other options Other alternatives for drought assistance include expanding research and development funding which is focused on improving resilience to drought and climate variability. The original NDP had a small component of the order of $2m for drought research. As coordinator of the resulting R&D programs on climate variability (CV) from 1992 to 2005 I can make some observations.

Prior to NDP there had been little focus on CV research. Recognition of the potential benefits of statistical forecasts a season ahead from improved understanding of El Niño was the major catalyst. The average annual investment since of the order of $1m annually by the various CV programs has been extraordinarily successful for the following five reasons:

- It could be readily demonstrated that Australian agriculture had always had an extraordinary degree of exposure to ENSO, and there was associated forecast skill,
- There had been till then negligible user involvement to drive science-driven applied climate research,
- The research built on existing capacity to usefully simulated major short term climate risks in organisations close to users,
- The research concentrated on generic tools and these have since underpinned research on adaptation to climate change, and
- The initial and ongoing funding was triggered by droughts, and that created expectations and a market (notwithstanding uncertainty of continuity of funding).

It is an interesting and complex question as to whether the above factors apply to adaptation to climate change. But more importantly is the need now apparent to consider research on CV and climate change adaptation as simply parts of adaptive climate risk management. Farmers don't make the same compartmentalisations that scientists do.

The case for strengthening the funding for CV research on a public good basis is hard to challenge. Proportionality is an issue. The current small size of the program needs to be considered in relation to the challenge of changing fundamental beliefs and attitudes of Australian farmers to managing not just CV but now climate change. Adapting to climate change will be based on managing CV.

The small size of the CV program reflects the following factors:

- Market failure, for example from free rider problems as illustrated by agencies not contributing to CV programs because they saw CV research as public good,
- The timing of contributions driven more by drought than need, and
- Absence of a national climate agenda or avenues for effective user consultation on priorities including for CV research.

In relation to the last point on priority setting, the BoM Review (2007) recommended that the Bureau should; 'establish and promote a clear set of relative priorities for all its activities, following consultation with clients'. Research on weather, CV and climate change all compete for funding and limited research skills without transparent processes to help allocate priorities. The CV perspective includes the apparent dependence of the Bureau on external funding for what are by any criteria national priorities of a public good nature. External funding can be an indicator of likely benefit but when there are many diverse beneficiaries organising collaborative funding is simply slow and inefficient. Free riders are inevitable. Three examples are:

- The IOCI (Indian Ocean Climate Initiative) for SW Western Australia ,
- The SEACI (South East Australian Climate Initiative), and
- POAMA, the BoM coupled ocean atmosphere model being introduced for seasonal forecasts.

The three initiatives were of vital national importance for understanding and managing CV and climate change. But in each case the research effort several years behind urgent needs to get answers. The national climate science agencies with national charters simply did not have processes to initiate research of high national priority. They were wedded to external funding. In more recent years climate change science has dominated and attracted resources away from climate variability research.

How well do farmers manage climate variability? Surveys typically show that about one half of farmers take seasonal forecasts into account in decisions. The proportion is higher where seasonal forecasts have more skill. Experience shows that many farmers simply treat the forecasts as categorical. For example they will respond as if the probability of the most likely outcome is much higher than forecast. Some farmers have gone to a more robust approach that recognises the range of possible outcomes.

Climate change is now impacting the value of seasonal forecasts, or at least that is the perception. Farmers are questioning whether current statistical approaches are being eroded by climate change. But seasonal forecasts that better incorporate climate change will be a key contributor to improved adaptation to climate change. Limited MCV funds have had to be invested in POAMA for example when it could be argued that core funding by BoM was more appropriate.

How to summarise the above? Extra funding for CV research or climate adaptation research should be a high priority and should address some of the systemic issues. The research expenditure needs to be guided by some sense of proportionality with expenditure on drought assistance and the magnitude of the task.

Are their alternatives to the current drought support policy measures that could meet the objectives of the NDP in a more effective and efficient manner, particularly in the face of significant long term climate change? What are the advantages and disadvantages of these alternative approaches?

I have already suggested a strong case for drought assistance to be refocussed on adaptation to climate change. How that might be done is beyond the scope of these comments. However the following points are pertinent.

The review of adaptation in agriculture (CSIRO 2008b) recognised the various uncertainties that colour efforts to determine climate change impacts and responses. The review then included in its summary

> '*Given this inherent uncertainty, the need is to develop enhanced adaptive capacity in agricultural systems (including socio-economic and cultural/institutional structures) to cope with a broad range of possible changes. Synergies with existing Commonwealth policies such as self-reliance in drought and their supporting programs such as Advancing Australian Agriculture as well as with institutions such as Landcare are needed develop this capacity'.*

The capacity to adapt to climate change will also be stimulated by ensuring that expectations on climate impacts are better reflected in markets. For example well-informed water markets can reflect the market assessment of water availability as determined by seasonal forecasts in the short term and by climate change in the longer term.

Reviews of increasing adaptive capacity, for example Smit and Wandel (2006) highlight the importance of broadly based regional and community focussed approaches. They note:

> '*One widely acknowledged lesson is that adaptations are rarely undertaken in response to climate change effects alone, and certainly not to climatic variables that may be of importance to decision-makers. One of the fundamental findings from this work is that it is extremely unlikely for any type of adaptive action to be taken in light of climate change alone'.'*

The lesson appears to be not simply integration with existing policies, or a centralist or science driven approach. The emphasis is on mainstreaming where a local community has determined feasible actions to integrate climate change. The underlying rationale comes from recognition that it is difficult to generalise in advance on the determinants of adaptive capacity in a specific community. Therefore without an understanding of the determinants of adaptive capacity, policies to enhance adaptation to climate change will flounder.

References

Commonwealth of Australia (2007). 'Creating an Australian Bureau of Meteorology for the 21st Century'. Report of a Review Panel, Bureau of Meteorology, Melbourne.

CSIRO (2008a). 'Understanding autumn rain decline in SE Australia. ' Media Release: 08/79, CSIRO.

CSIRO (2008b), 'An overview of climate change adaptation in Australian primary industries – impacts, options and priorities.' Edited by C.J. Stokes & S.M. Howden. Report prepared for the National Climate Change Research Strategy for Primary Industries. CSIRO.

DAFF (2007) Review of the Farm Management Deposit Scheme. Executive Summary, November 2006, DAFF, Canberra.

Ha, A., Stoneham, G., Harris, J., Fisher, B. and Strappazzon, L. (2007), 'Squeaky wheel gets the oil: incentives, information and drought policy', The Australian Economic Review, vol. 40, no. 2, pp. 129-48.

McKerchar, M. and Coleman, C. (2003) 'The Australian Income Tax System: Has It Helped or Hindered Primary Producers Address the Issue of Environmental Sustainability?' Paper presented at the 4th Annual Global Conference on Environmental Tax Issues, Experience and Potential, Sydney, 5-7 June 2003

Nicholls, N., (2004). The changing nature of Australian droughts. Climatic Change, 63, 323-336.

Smit, B. and Wandel, J. (2006). 'Adaptation, adaptive capacity and vulnerability'. Global Environmental Change 16 (2006) 282 –292.

Stone, R., (2007).), http://products.lwa.gov.au/files/PF061103.pdf

Weber E., (2007) http://environment.msu.edu/climatechange/abstracts07.html#weber