Capacity for broadacre mixed farmers to adapt to climate change in Queensland

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Keywords: adaptive capacity, climate change, livelihoods

Introduction

The ability of farmers to effectively adapt to climate change depends not only on the degree of exposure to climatic change but more importantly the amount of knowledge, support and opportunities available to them in order to respond to that change. Adaptation options operate at the farm scale in addition to industry level approaches (Rodriguez *et al*. 2011). Changes to enterprise mix (e.g. proportion of crops to pastures) are an example of one farm-level adaptation option. Frameworks to assess the adaptive capacity of farmers have been developed to provide information on the potential of farm enterprises to adjust their whole farming enterprise under future climate scenarios across regions and industries. The rural livelihoods framework (Ellis 2000) provides one such method of assessing major influences on farmers' vulnerability based on the assessment of five capitals: human, social, natural, physical, and financial capitals. This holistic approach is well suited to allow farmers to identify and prioritise adaptation options and barriers for any given change scenario (Brown *et al.* 2010). While climate change adaptation options for mixed farmers are well documented (Howden *et al.* 2010 and Stokes *et al.* 2010), the willingness and ability of farmers to adopt these options of farmers varies regionally.

Research to understand and measure the adaptive capacity of Australian farmers has been undertaken as part of a national study to deliver projections of the impacts of climate change on the productivity of crops and pastures across Australia. The objective of this research is to identify indicators that describe constraining and enabling factors affecting farmers' capacity to adapt under projected climate change and combine this information with biophysical impact data to determine the vulnerability of Australian farming systems to climate change. A total of 12 adaptive capacity workshops were held across the country from July 2010 to July 2011. Farmers were asked to identify and self-assess their adaptive capacity. The results from these farmer self-assessments will be compared to indices developed from ABS and ABARE data at a national level. This paper focuses on the results from two workshops from mixed-farming regions in south-east Queensland i.e. Goondiwindi and Roma, Queensland Australia.

Methods

At all 12 locations participants were chosen by local co-ordinators to reflect the range of farming enterprises within the region. Each workshop ran for 3-4 hours, with 5-16 participants in attendance. Most attendees had a farming background, though rural financial planners, agribusiness and regional Natural Resource Management (NRM) extension staff also participated. The local catchment co-ordinator selected participants (five in Goondiwindi, and nine in Roma). These two regions are characterised by medium to large broad acre mixed grain and grazing farms operating in one of the most variable climatic regions in Australia, and where farming is considered to be under threat from expanding coal and coal-seam gas mining developments.

A brief introduction was given on projected climate impacts for the region to set the context for the workshop. Participants were then given an overview of the workshop process including definitions of the five capitals. They were then invited to identify key indicators for each of Human, Social, Natural, Physical and Financial capitals that enabled or constrained their ability to manage their mixed farming enterprises under climate change for their local area. Participants rated each indicator on a scale of 0 to 5 according to the degree to which the indicator was likely to be supporting climate change adaptation in the future (Brown *et al*. 2010). If indicators were severely constraining (<2) then participants were asked to think of actions that would help to address these.

Results and Discussion

Overall, the endowment of capitals for mixed farmers around Goondiwindi was variable, with relatively high levels of Natural and Physical capitals, moderate levels of Social capital and low levels of Human and Financial capitals (Figure 1). By comparison, the endowment of capitals for mixed farmers around Roma was low to moderate, with a relatively high level of social capital. Human, Natural and Financial capitals were moderate, neither enabling nor constraining adaptation to climate change. Physical capital was low, potentially constraining adaptation in the future. Significant commonality existed between the two regions in terms of the identification of common Natural, Physical and Financial issues that would either enable or constrain future adaptation (Table 1)

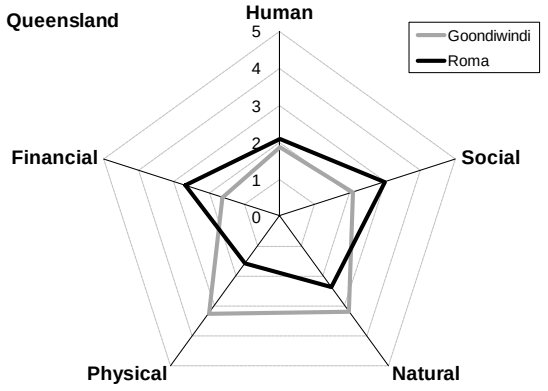

Figure 1. Mean scores of indicators within each capital for workshops conducted with mixed farmers in Goondiwindi and Roma. Queensland.

Scores for indicators were based on existing opportunities within regions. Common human and social capital themes included the age of farmers, off-farm labour availability, the skill base of farmers including formal and informal education, access to extension staff, and activity in community groups such as sporting clubs and Landcare. A vibrant, attractive regional centre was seen to be central to the long-term viability of the region providing health and education services and opportunities for off-farm income.

- Human capital was perceived to be particularly constraining in both regions: age and access to labour were a concern in Goondiwindi while access to extension was constraining in Roma. These indicators were seen to limit farmers' abilities to adopt and or trial new management options.
- Natural capital scored relatively highly and included indicators that valued natural resources, particularly land capability and water access. Landscape amenity was important for both regions as participants were aware of the need to have an attractive physical environment, including access to goods and services, to attract and retain people within the region.
- The availability and condition of infrastructure including communications, roads and rail, and processing and storage facilities were common indicators between the regions. External pressures in the form of land values and commodity prices/input costs were highlighted as being important indicators of financial capital.
- The development of mining activities around Roma provided many opportunities in the form of off-farm income and access to regional services but also affected access to farm specific services, particularly relating to ready access to mechanics and skilled labour. In Goondiwindi farming is still the primary occupation but use of off-farm income was estimated to contribute to household incomes for more than 60% of farms in the region.

Priority actions to alleviate constraining indicators in both regions included: attracting people to and retaining people within the region; training and mentoring extension staff; provision of finance and business training to young farmers to allow them to establish in the region, and train and retain

skilled labour. Increasing farm business management skills was seen as a priority for all farmers, including diversifying income streams both on and off farm. Addressing value chains was seen as a way to increase the value of produce, while upkeep of road/rail/storage and processing facilities is necessary to access markets. The need to attract health specialists to rural areas and to increase the use of technology, particularly video conferencing was seen to increase the quality of life, and time available in the community for those who were travelling extended distances to seek medical assistance.

Table 1. List of indicators that mixed farmers used to self-assess their capacity to adapt to climate change from Goondiwindi and Roma, Queensland. Each indicator was scored from 0-5, with 0 being constraining and 5 being enabling adaptation for climate change.

Capital	Indicator	Goondiwindi	Roma
Human	Mentoring for extension staff		0
	Age	1	3
	Access to labour	1	
	Access to management advice		1
	Attitude		2
	Family priorities/stage of life	2	
	Formal education		3
	Employment opportunities		3.5
	Confidence in farming	3.5	
Social	Access to health services		1
	Corporate farms	1.5	
	Extension and support services	2	
	Transient workforce	2	
	Isolation	2.5	
	Family structure/stage of life	2.5	
	Club/association membership		2.5
	Changes to community structure		3.5
	Regional climate forecasting		4
	Landcare		4
Natural	Weed and pest control		1.5
	State of natural resources	2.5	
	Land capability	3	2.5
	Water availability and quality	3	2.5
	Landscape amenity	3.5	3
	Ecosystem services	4	
Physical	Waste management	0.5	
	Marketing/processing/storage infrastructure	2	1
	Energy infrastructure		2
	Demonstration sites		2.5
	Road/rail infrastructure	2.5	1
	Communication infrastructure	3	2
	Genetic resources	4	
	Service infrastructure in rural centres	4	
	Water infrastructure	4	2
Financial	Value of product	0.5	
	Willingness to invest in farm	0.5	
	Input costs	1	
	Return on investment	1	
	Land prices/value	1	1
	Cash reserves		1.5
	Financial instruments		1.5
	Managing risk	2	
	Equipment and technology costs	2	
	Cost of livestock feeding during drought	3	
	Diversify income sources		3.5
	Off-farm income	3.5	4.5
	Demand for land		4

Biophysical modelling of changes to enterprise mix under climate change will inform farmers of the potential to alter the proportion and varieties of crops and pastures grown on farm (Rodriguez *et al*. 2011). However, farmers will be reluctant or unable to take up future opportunities if regional centres are in decline, if processing facilities are not accessible and if up-skilling of farmers and support staff, including extension personnel, is not undertaken.

Responses at the workshops were framed by the experiences of recent floods, affecting the condition of road networks, drought, affecting on-farm viability and reliance on off-farm income, and the price received for produce compared to the cost of inputs. The rural livelihoods approach complements the biophysical modelling undertaken in each region and has highlighted potential gaps in policy that may combine to constrain the production of food and fibre under climate change.

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