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Adaptive capacity on the rangelands

Nadine A. Marshall and Matthew Curnock

CSIRO Land and Water, ATSIP Building, #145, James Cook University, Townsville Q 4811. E: nadine.marshall@csiro.au, matt.curnock@csiro.au, Ph: 07 4750 8500

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Abstract

We present an overview of a range of social science projects that have recently been conducted on the northern Australian rangelands. These projects have focused on understanding the current capacity of beef producers to adopt new strategies so as to better adapt to the impacts of climate change. We assess the capacity to adapt as comprising four essential elements: i) managing risk and uncertainty, ii) possessing strategic skill sets such as planning, experimenting, refining and learning, iii) psychological and financial buffers, and iv) an interest in change. These elements represent the ability to convert current resources into a successful adaptation strategy and trajectory. Our results show that there is an apparent lack of suitable capacity currently existing within the industry to meet the challenges of the future. For example, our results found that only 16% of producers are likely to have sufficient adaptive or transformational capacity. Results also highlight several factors that are associated with producers that are more successful through time. For example, we have learned that producers with strong networks and levels of trust with informal and formal connections, a strong locus of control, larger properties, a focus on profitability, and use technology, are more likely to remain within the industry through time. These factors could be used as a basis for enhancing adaptive capacity. We suggest that an efficient strategy for ensuring viability on the Australian rangelands would be to invest in developing the capacity of producers to better cope and adapt to change.

Introduction

Managing the climate and its impacts on natural resources is not a new challenge. Ever since the inception of agriculture some 4-10,000 years ago, human civilisations have had to contend with 'good' years and 'bad' years. However, the 21st century is shaping up to be a period of rapid change and with it comes great challenges to the relationship between nature and humanity. Past emissions of greenhouse gases have already committed the planet to climate change. Current estimates suggest a significant increase in global temperature in the coming decades that are likely to significantly affect our precious natural resources. Changes in variables such as temperature and rainfall will act to push natural resource systems towards their thresholds of tolerance, threatening the future of those industries and communities dependent on them. Even the most drastic mitigation efforts are unlikely to limit climatic changes over the next few decades.

The specific challenge faced by cattle producers living in northern Australia will be to build the productivity and profitability of their enterprises without degrading the natural grazing resources on which they depend. Success not only depends on maximising productivity during any one season, but also on minimising impact on the future ability of the land to produce. Of particular concern is that degradation processes on the grazing lands are especially accelerated during periods of drought. Under forecast climate scenarios, the monsoonal north of Australia will experience increasingly variable rainfall, warming and increased evaporation. In some areas drought conditions are likely to occur with increasing frequency (Moise et al 2015)., If stocking rates are too high at the onset of drought, soil sustainability will be diminished and the productivity of future years will be impacted. Under such conditions it will be particularly challenging for cattle producers to adapt and maintain operations.

Ensuring that cattle producers have sufficient capacity to adapt to climate change and adopt new practices is paramount if the northern beef industry is to be sustained. People with the capacity to adopt sustainable resource management practices are better prepared to meet plausible future climate scenarios and be "climate ready". People with the capacity to adopt sustainable practices and contribute towards environmental stewardship can support the resilience of the ecosystem and in turn address their own wellbeing.

We present an overview of a range of social science projects that have recently been conducted on the northern Australian rangelands. These projects have focused on understanding the current capacity of beef producers to adopt new strategies so as to better adapt to the impacts of climate change. Our main message is that through a focus on increasing the adaptive capacity of people, it may be possible to sustain the land.

We draw on the most up-to-date thinking on; (i) social resilience, (ii) adaptive capacity, (iii) the extent which adaptive capacity exists in the northern rangelands, and (iv) the extent to which the northern beef industry is vulnerable to climate change. Insights into the sorts of strategies that could be invested in to increase the capacity of the northern beef industry to better prepare to change are also discussed.

Social resilience

For practical purposes, resilience of linked social and ecological systems is regarded as the antonym of vulnerability. The approach that we use to assess social resilience or vulnerability to climate change is based on that of the IPCC and measures three essential components; exposure, sensitivity and adaptive capacity (Figure 1). This approach to assessing vulnerability can identify (i) where a system might be most vulnerable, (ii) describing the magnitude of vulnerability, and (iii) the nature of vulnerability.

Because of the interdependency between social and ecological systems, social vulnerability is a function of the ecosystem's vulnerability (Figure 1). Importantly, feedback mechanisms exist between the systems such that ecological vulnerability is also a function of the social system's vulnerability (figure 1). Resource managers and other climate stakeholders can assess system vulnerability in part by assessing ecological vulnerability and social vulnerability (Marshall et al. 2013).

We assess the sensitivity of the northern beef industry to climate change as a function of their dependency on climate-sensitive resources (the grazing resource). Resource dependency can be financial or social (such as through concepts such as place attachment, occupational identity, investment in local knowledge *etc.*) (Marshall et al. 2007, Marshall 2011).

We assess the capacity to adapt (within social systems) as comprising four essential elements: i) managing risk and uncertainty, ii) possessing strategic skill sets such as planning, experimenting, refining and learning, iii) psychological and financial buffers, and iv) an interest in change. These elements represent the ability to convert current resources into a successful adaptation strategy and trajectory (Marshall 2010).

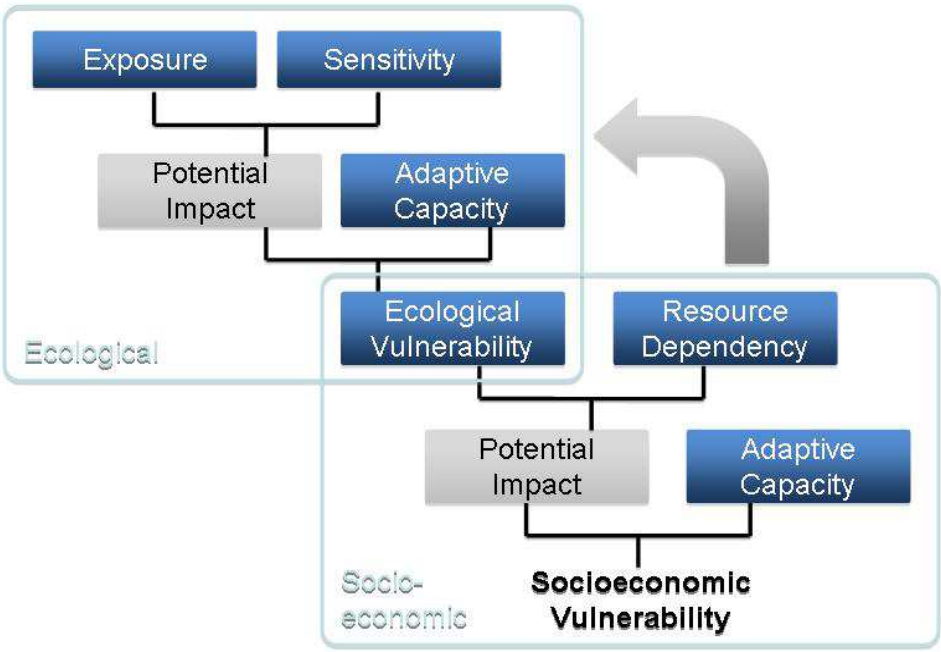

Figure 1. A conceptual diagram of system vulnerability (social and ecological). Adapted from the IPCC 2007 and presented in Marshall et al. (2013).

Resilience of northern beef producers across northern Australia

Recent research across the Monsoonal North area identified four types of cattle producers according to their vulnerability to climate change, which was based on measures of resource-dependency and adaptive capacity (Marshall et al. 2014). The two most vulnerable types were the most prevalent within the sample. The main type of cattle producer represented 43% of the sample (Type I). This type was vulnerable due to lower skills for planning, experimenting, reorganising and learning, and had a lower level of interest in adapting to the future. They were 59 years old on average and were only weakly networked within the industry. Their businesses were generally small (mean size was 72,728 ha, 1.9 employees, 4,600 head of cattle and a business turnover between A$1 to $5 million).

The second type of cattle producer represented 41% of the sample (Type II). They managed risk and uncertainty poorly and lacked strategic direction in their businesses, thus leaving them vulnerable. These producers were 51 years on average. Their businesses were medium-sized (mean size was 111,634 ha, 3.4 employees, 7,000 head of cattle and a business turnover between A$1 to $5 million).

Type I and II producers combined represented about 84% of the sample. Only 16% of producers appeared to have higher levels of resilience to change. The next category of cattle producer, represented 13.4% of producers (Type III), and had a stronger psychological and financial buffer than Type I and II producers. They were well networked and tended to operate large businesses (mean size was 364,639 ha, 8.9 employees and a business turnover between A$1 to $5 million).

The last type of producer, representing only 2.6% of the sample (Type IV), managed risk well, liked to experiment with options and was interested in change. Their mean age was 41 years old. They were well networked and used technology such as seasonal climate forecasts. They also operated larger businesses (>A$5 million) and perceived themselves as responsible for the future productivity of their land.

Strategies to enhance adaptive capacity

We have learned that producers with strong networks and levels of trust with informal and formal connections, a strong locus of control, larger properties, a focus on profitability, climate change awareness and the use of technology are more likely to adapt and thus remain within the industry through time. These factors could be used as a basis for enhancing adaptive capacity within the northern beef industry. We suggest that an efficient strategy for ensuring viability on the Australian rangelands would be to invest in developing the capacity of producers to better cope and adapt to change (Marshall et al. 2012).

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