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Managing the grazing landscape: Insights for agricultural adaptation from a mid-drought photo-elicitation study in the Australian sheep-wheat belt

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ABSTRACT

Globally, and under uncertain climate conditions, the agricultural sector will need to feed more people without degrading the ecosystem services on which production depends. Eastern Australia, coming out of a decade of drought, is at the leading edge of this challenge. Measures to adapt agriculture to increasing climate variability are urgently sought. One particularly promising measure is an adaptive grazing decision-making practice called holistic management (HM), typically involving high-intensity, short-duration rotational grazing and the encouragement of pastures with low chemical input needs. Here, we use photo-elicitation to compare the landscape perceptions of HM graziers with those of more conventional graziers, based on their choice of photo targets and the stories those photographs elicited. During that process, HM graziers described their use of adaptive farm management techniques to gain outcomes for production and ecosystems alike, demonstrating a system-based understanding of their farms conducive to farming under increased climate variability. We conclude that HM grazing should be encouraged so as to adapt the industry to climate change. More widespread uptake of HM practices – for public benefit as well as personal – depends on incentives to reduce start-up costs and expand the instruction of HM principles, first targeting those with high adaptive capacity, and removing policies that delay adaptation.

1. Introduction

Globally, livestock grazing covers the largest area of any land use (Asner et al., 2004; Erb et al., 2007), with considerable ecological impacts (Foley et al., 2005; MacLeod and Moller, 2006; Tscharntke et al., 2005). Grazing is anticipated to expand and intensify as global population grows and demands more protein (Foresight, 2011; McAlpine et al., 2009; Tilman et al., 2001, 2002). Grazing expansion and intensification would involve significant environmental costs even under 'normal' climate conditions (Dorrough and Scroggie, 2008; McAlpine et al., 2009). In a context of rising and irreversible global temperatures (Intergovernmental Panel on Climate Change, 2007), increased grazing pressure presents novel challenges to the ecosystem services that sustain agricultural production (Beaumont et al., 2011; Pretty et al., 2010; Zhao and Running, 2010).

Adaptation is commonly suggested as a way to reduce vulnerability to changing climatic conditions (Jones et al., 2007). Most agricultural adaptations include some degree of changed farming practices and modified government policy settings (Howden et al., 2007; Smit and Skinner, 2002). There is increasing research on adaptive capacity in agricultural systems in relation to external conditions, such as resource availability and institutions (Grothmann and Patt, 2005; Hogan et al., 2011; Nelson et al., 2010). However, relationships to the internal conditions of the those involved, such as personal adaptive capacities, values, and perception are poorly understood (Fazey et al., 2007; Marshall, 2010; O'Brien, 2009).

Any given agricultural policy context seeks to influence farmers in a number of ways, but farmers still have enormous freedom to choose their day-to-day management practices. For instance, regulations specify export quality standards but the specific practices by which those expectations are met (or not) are up to the farmer. Farmers' choices will depend, in part, on their landscapes: how they see, understand, and value those landscapes, and how they feel their landscapes reflect upon them (Barr and Cary, 2000; Marshall, 2010; Rogge et al., 2007). We use landscape perceptions as a generic term for this multiplicity of meanings and messages that people derive from their landscapes, and which then drive behaviour (Gobster et al., 2007; Stern, 2000). When making management decisions, farmers will draw upon those landscape perceptions,

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among other things, to balance monetary reward with other valued outcomes like aesthetics, stewardship, identity and lifestyle.

This paper examines how farmers using different management practices perceive their working landscapes, and how those perceptions relate to their responses to – and outcomes under – climate pressures, using a mid-drought case study from the Australian sheep-wheat belt in New South Wales. Climate change and responses to climate change can both have negative impacts on the environment (e.g. biodiversity; Paterson et al., 2008) and humans who depend up on it, such as by causing irreversible damage to valued places and identities such as farm landscapes (Adger et al., 2009). Farming could cease to be viable in certain areas under climate change, resulting in spontaneous farmland abandonment and reforestation through natural succession, formerly suppressed. Similar long-term landscape outcomes, however, could result from intentional adaptation or mitigation activities such as large-scale tree planting (Hunziker and Kienast, 1999; Jackson et al., 2007; Soliva and Hunziker, 2009). Alternatively, pro-active adaptation could maintain consistent landscapes while employing very different practices. Human values will limit these choices (O'Brien, 2009). Farmers manage for meaning, as well as a living, and since much of that meaning is embodied in their farm landscapes, landscape is a useful lens through which to explore the process of agricultural adaptation.

Australian farmers and agricultural policy makers rarely dispute the reality or seriousness of a changing climate. Public dialogue regularly acknowledges the urgent need to adapt to 'increasing climate variability' (Standing Committee on Primary Industries and Resources, 2010). The most dramatic prediction for Australia is that precipitation will become more unpredictable in amount and distribution (Hughes, 2003). The 'Big Dry' drought prevailed over the southeastern sheep-wheat belt for most of the last decade (Cai et al., 2009; Leblanc et al., 2009), breaking only in 2010, and water is projected to become even more scarce in Australia by 2030 (Intergovernmental Panel on Climate Change, 2007). While this most recent drought may not be exclusively the result of climate change (Chiew et al., 2011), the extended episode provides an opportunity to examine how farming will fare under the increasing water scarcity predicted to occur as a result.

Evidence is growing that management practices and climate change are harming the ecosystem services upon which Australian farmers depend, and threatening the long-term viability of their way of life (Hogan et al., 2011; Preston and Jones, 2006). A range of biophysical problems have either persisted or intensified in Australia during the drought, including erosion, weed invasion, tree decline and biodiversity loss (Fischer et al., 2010; Prober and Smith, 2009; State of the Environment Advisory Council, 2006). Scattered tree decline, for instance, is removing the stock shelter that will be increasingly needed to ensure the health of livestock as well as wildlife (Close and Davidson, 2004; Fischer et al., 2010; Gibbons et al., 2008; Manning et al., 2009). More heat-tolerant livestock breeds are typically also less productive (Howden et al., 2007). Such challenges, paired with declining terms of trade, have caused hardship in many rural communities (Edwards et al., 2009; Nelson et al., 2010). Given these challenges, it is important to find ways of responding to changing climate conditions that do not prolong negative social and ecological impacts (Fazey et al., 2010).

A recent study of scattered tree decline in the Australian sheep-wheat belt found that many of its participating graziers had made relatively recent transitions (<10 years) to a grazing system called holistic management (HM) (Fischer et al., 2009; Sherren et al., 2010a). HM typically involves practices like rotational grazing and reducing chemical fertilisers (Savory and Parsons, 1980) that have been suggested as important for adapting grazing to climate change (Howden et al., 2007). A key element of that larger study was to investigate how graziers valued their landscape using photography and follow-up interviews (photo-elicitation) (Sherren et al., 2010b, 2011b). Consistent with Richards and Lawrence (2009), HM graziers revealed a different way of seeing and talking about their production landscapes than those grazing more conventionally. Specifically, HM graziers described different landscape preferences, decision-making practices and experiences of the extended drought, then still in progress. Photo-elicitation data (the photographs graziers took and how they discussed them) permitted us to quantify how the landscape perceptions of holistic managers differed from those grazing more conventionally. We could then explore more qualitatively what those differences might reveal about the kind of thinking required to adapt grazing to climate change and how to foster it.

This paper aims to address three key research questions: (1) What do agricultural managers using different practices perceive to be their most significant farm landscape features? (2) How do agricultural managers using different practices relate to those landscape features? (3) What are the implications of these different landscape perceptions for sustainable agricultural management and adaptation to climate change? The first two questions are addressed through the photo-elicitation results, while the third is addressed in the discussion.

2. Methods

2.1. Case study

We studied an area of one million hectares in the upper Lachlan River catchment of New South Wales (NSW), Australia, in the grassy-box woodland ecosystem type in which grazing is the most viable agricultural activity (Fig. 1). The farming industry in the study area was dominated by sheep, beef cattle and grain, and thus was broadly reflective of the wider temperate grazing zone or 'sheep-wheat belt'. We worked in a relatively wet part of the sheep-wheat belt, according to the Australian Bureau of Meterology, with annual precipitation in our study area between 600 and 866 mm, by comparison with 304 mm at the western (lowest) extent of our catchment. A key aim of the ecological research that preceded this work was to identify the best grazing management practices for supporting tree regeneration. We established sites on 33 farms (31 farmers) to count trees and seedlings and correlate these with farm management practices as well as observed biodiversity (Fischer et al., 2009, 2010). Farms were thus chosen to represent a range of stocking levels (long-term typical stocking rates ranging from 2 to 12 dry sheep equivalent per hectare) and rotation regimes (keeping stock in any given paddock from about 10 to 365 total days per year). Some of our case farmers grew some crops, but they did no irrigated cropping.

Within that range of grazing regimes, many farmers were using a decision-making framework called holistic management (HM). In a livestock grazing context, HM usually involves intense bursts of grazing pressure followed by extended recovery time (Savory and Butterfield, 1999; Savory and Parsons, 1980; Stinner et al., 1997). Terminology is generally a challenge (Briske et al., 2011): HM and 'cell' grazing are similar, and we use HM here, but both are different from rotational grazing. Fundamentally, HM grazing is based on an explicit decision framework combining goal-setting, monitoring practices and adaptive management of the land base (Savory and Butterfield, 1999; Stinner et al., 1997). In practice, the implementation of HM grazing in Australia varies between individual farmers, but often involves: high-intensity short-duration grazing rather than continuous grazing; cessation or reduction in chemical fertiliser use; an emphasis on native pastures; and, monitoring those pastures through the keeping of 'grazing charts' that provide a means of anticipating feed availability and periods of drought