

Lessons from the Dzud: Community-Based Rangeland Management Increases the Adaptive Capacity of Mongolian Herders to Winter Disasters

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Summary. — We investigated the role of formal community-based natural resource management (CBNRM) in responding and adapting to the 2009–10 winter weather disaster in Mongolia, by comparing herders' adaptation strategies and adaptive capacity in communities with and without formal CBNRM. Livestock mobility and forage and hay storage were the most important strategies for limiting livestock loss, but these depended on resource pooling and exchange strategies. CBNRM herders demonstrated greater adaptive capacity than non-CBNRM herders, due to greater knowledge exchange, information access, linking social capital, and proactive behavior. Social factors mediate and institutional constraints limit the implementation of adaptive strategies in Mongolia.

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Key words — climate change, adaptation, community-based natural resource management, pastoralism, natural disaster, Mongolia

1. INTRODUCTION

Theory and past research suggest that community-level institutions can play a key role in both the management of natural resources (Agrawal & Chhatre, 2006; Bromley, 1992; Chhatre & Agrawal, 2008; Ostrom, 1990), including rangelands (Fernandez-Gimenez, Wang, Batkhishig, Klein, & Reid, 2011; Fabricius & Koch, 2004), and in adaptation to climate change (Agrawal, 2010). However, few studies have assessed community adaptive capacity in the face of catastrophic weather events expected to increase in intensity and frequency with climate change, or evaluated the role of community-level institutions in fostering adaptive capacity. Further, there has been little consensus on the benefits and outcomes of community-based natural resource management (CBNRM) (Brosius, Tsing, & Zerner, 2005; Kellert, Mehta, Ebbin, & Lichtenfeld, 2000). This is especially true for externally-facilitated community-based institutions in rangeland systems, where spatial boundaries around resources are often fuzzy and permeable, and user group membership is negotiable and contingent (Addison, Davies, Friedel, & Brown, 2013; Cleaver, 2000, 2002; Fernandez-Gimenez, 2002; Turner, 2011). This study advances understanding of the role of local institutions, and specifically donor-initiated CBNRM institutions, in adaptation to climate change, through a study of four Mongolian herder communities' responses to a winter weather disaster in 2009–10.

Mean annual temperature in Mongolia has increased 2.1 °C over the past 70 years, among the strongest warming signals on Earth (Dagvadorj, Natsagdorj, Dorjpurev, & Namkhainyam, 2009). Climate change is also expected to increase the frequency and intensity of severe winter weather, or *dzud* (Bayasgalan *et al.*, 2009; Fernandez-Gimenez, Batkhishig, & Batbuyan, 2012). In *dzud*, deep snow, severe cold or other conditions make forage inaccessible or unavailable and lead to high livestock mortality (Begzsuren, Ellis, Ojima,

Coughenour, & Chuluun, 2003; Siurua & Swift, 2002; Tachiiri, Shinoda, Klinkenberg, & Morinaga, 2008). *Dzud* is a recurring natural event that limits the growth of Mongolia's livestock population and causes loss of human life and livelihoods. In the *dzud* events of 1999–2002 and 2009–10 the country lost 30% and 20% of the national herd, respectively. In the 2010 *dzud*, 28% of Mongolia's population was affected (IFRC, 2010), primarily herders, who comprise one third of the country's population. Increasing frequency and severity of *dzud*, together with more gradual warming and drying, will likely create significant challenges for Mongolia's herders and rural communities. Enhancing the adaptive capacity of rural Mongolian communities to climate change is therefore a pressing issue for economic, humanitarian, and environmental reasons. Further, the lessons learned from Mongolia's experience can inform development in other highly variable dryland systems susceptible to extreme weather events.

Rural Mongolian communities experience poverty rates in excess of 30% (Coulombe & Altankhuyag, 2012; Griffin, 2003; Nixson & Walters, 2006), and most rural inhabitants depend directly or indirectly on livestock husbandry for their

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livelihoods, making them vulnerable to extreme weather events. Following Mongolia's abrupt transition to democracy and a free-market economy in 1990, formal pasture management institutions dramatically weakened with the dissolution of herding collectives (Fernandez-Gimenez, 1999; Fernandez-Gimenez & Batbuyan, 2004; Mearns, 1996; Upton, 2009), as did state structures for managing natural disasters such as dzud (Siurua & Swift, 2002; Sternberg, 2010; Templer, Swift, & Payne, 1993). The devastating impacts of a series of severe winters in 1999–2003, coupled with perceived increases in grazing-related environmental degradation, led to the formation of some 2,000 formal community-based rangeland management organizations, established with financial and technical support of various donor and NGO projects (Mau & Chantsalkham, 2006).

In this article, our objectives are threefold. First, we describe the adaptive strategies herders used to prepare for and respond to dzud and constraints to their implementation. Second, we assess the adaptive capacity of herder communities with and without formal CBNRM institutions. Finally, we explore the mechanisms through which formal CBNRM improves adaptive capacity. We hypothesized that Mongolian herders possess traditional knowledge and management strategies to cope with a variable and severe climate, but that recent institutional and socio-economic changes may impose new constraints on their implementation or offer new opportunities for innovation. Further, we hypothesized that herders who participate in formal CBNRM organizations would demonstrate greater adaptive capacity than those who do not. Before introducing our study sites and methods, we briefly review key works on adaptation and adaptive capacity, CBNRM, and Mongolian rangeland institutions.

2. ADAPTATION, ADAPTIVE CAPACITY AND ITS MEASUREMENT

Adaptation is the set of actions, attitudes, activities, and decisions that enable individuals, groups, or systems to persist in the face of current or future change or shocks (Agrawal, 2010; Nelson, Adger, & Brown, 2007). Coping refers to short-term responses that allow survival of a given disaster (Yeh, Nyima, Hopping, & Klein, 2013). Agrawal (2010) argues that livelihood adaptation to climate change among the rural poor requires strong local institutions as well as improved cross-scale interactions among institutions operating at different levels, and identifies 5 key strategies for adaptation employed by the rural poor: mobility, storage, diversification, resource pooling, and exchange. Agrawal further asserts that local institutions shape adaptation in critical ways, and that our current knowledge about the role of institutions in climate change adaptation is very limited. Many pastoralists use a similar set of strategies to deal with the inherent variability in their biophysical and social environments (Fernandez-Gimenez & LeFebvre, 2006; Fernandez-Gimenez & Swift, 2003). In this paper we draw on qualitative and quantitative evidence to describe the adaptive strategies used by herders in the face of dzud. This paper complements and expands on work by Upton (2012) and Yeh *et al.* (2013), who employed similar frameworks to analyze herder adaptive capacity in Mongolia's Gobi region and coping strategies on the Tibetan Plateau, respectively.

Adaptive capacity is the ability to experiment, innovate, and learn, and to act on new information in response to change and disturbance (Armitage, 2005; Engle, 2011; Smit & Wandel, 2006). Whereas coping and adaptation tend to be reactive, and can even lead to maladaptive outcomes (Engle,

2011; Robinson & Berkes, 2011), adaptive capacity is associated with the ability to think ahead and take proactive measures in anticipation of future change, by applying lessons learned from past experiences. Community-level adaptive capacity is also strongly associated with capacity for collective action—a group's ability to overcome incentives for individual maximizing behavior and free-riding to pursue shared goals in the interest of the group (Adger, 2003; Armitage, 2005). High levels of social capital, in turn, are thought to facilitate collective action, which also serves to further build networks and relationships of trust and reciprocity that define social capital (Ostrom, 1997; Wagner & Fernandez-Gimenez, 2008). Effective local leadership may contribute to adaptive capacity by helping to mobilize individuals to prepare for and respond to disasters and resolve conflicts (Armitage, 2005). Access to diverse sources of information and opportunities for knowledge exchange contributes to adaptive capacity by exposing individuals to new ideas and technologies and perpetuating place-based traditional knowledge (Armitage, 2005; Berkes, Colding, & Folke, 2003).

With growing awareness of the need to adapt to as well as mitigate climate change, assessments of climate change vulnerability and adaptive capacity have proliferated at household (Brown *et al.*, 2013; McDowell & Hess, 2012; Notenbaert, Karanja, Herrero, Felisberto, & Moyo, 2013), community (Brockhaus, Djouri, & Locatelli, 2013; Eakin, 2005; Goldman & Riosmena, 2013; Hung & Chen, 2013; Robinson & Berkes, 2011; Yeh *et al.*, 2013), regional (Schneiderbauer, Pedoth, Zhang, & Zebisch, 2013), and national (Mongolian Ministry of Environment and Green Development, 2013) levels. Although frequently acknowledged as critical (Agrawal, 2010; Engle, 2011), relatively few studies have examined the institutional factors associated with greater and lesser adaptive capacity at the community level (Agrawal, 2010; Berkes & Jolly, 2002; Engle & Lemos, 2010; Goldman & Riosmena, 2013; Robinson & Berkes, 2011; Upton, 2012). Assessing adaptive capacity is challenging, in part because the ability to adapt can only truly be measured after an event or process that requires change in order for a system to persist. Engle (2011) proposes that adaptive capacity can be assessed by exploring system responses to past disasters or stresses in relation to attributes or indicators that theory predicts should increase adaptive capacity. Thus, an ideal assessment of community adaptive capacity would measure how key household or community characteristics, such as well-being, alter following a shock or change, coupled with measurement of adaptation behaviors that would help to explain post-shock variation in well-being. Following this logic, we would expect households or communities with high adaptive capacity to take actions in response to change that enable them to maintain well-being to a greater degree than those with lower adaptive capacity. Based on the theoretical linkages outlined above, we expect high levels of social capital, access to diverse information sources and knowledge networks, and strong local leadership to predict higher levels of preparedness for and innovation in response to shocks and changes.

3. COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT

Community-based natural resource management is the management of natural resources by local people and for their benefit, as well as for resource health. Historically, many common pool resources were managed in this fashion, and often

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