

## The effects of enclosures and land-use contracts on rangeland degradation on the Qinghai–Tibetan plateau



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### ABSTRACT

Rangeland degradation on the Qinghai–Tibetan Plateau is a growing concern, often attributed to climate change and overgrazing. A minority of researchers have suggested instead that degradation may be caused by changes in land management, particularly enclosures and the contracting of long-term rangeland use rights to households. However, these claims have been hampered by a lack of empirical evidence. This field experiment is the first to compare rangeland conditions over time in the case of different management regimes on the Qinghai–Tibetan Plateau, specifically single-household versus multi-household management. A survey of vegetation properties in Maqu County, Gansu province in 2009, and repeated in 2011, examined the differences between single- and multi-household management in terms of vegetation biomass, cover, and species richness. In 2009, the biomass of the sedge group under multi-household management was significantly higher than that under single-household management. In 2011, biomass, vegetation cover, and species richness were all significantly higher under multi-household management than single-household management. These data suggest the flaws of the tragedy of the commons assumptions underlying single-household management.

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### 1. Introduction

Rangeland degradation has become an issue of considerable concern for the Chinese government since the economic reforms of 1978 and particularly since the late 1990s, following dust and sandstorms over Beijing, major flooding of the Yangtze River, and the increased incidence of the Yellow River running dry, all of which have been attributed to upstream degradation (Harris, 2010; Ho, 2000a; Yeh, 2009). Claims that 90% of Chinese rangelands are degraded are pervasive and generally accepted in China, despite a lack of credible data and contradictions among and within official reports on degradation (Harris, 2010; YontenNyima, 2012). In addition to technical measures such as aerial sowing, removal of livestock, forage cultivation, and the eradication of small mammals such as pikas, the Chinese government has focused on attempting to halt rangeland degradation through the implementation of policies to privatize use rights to pasture.

These policies have been based on the assumption of the “Tragedy of the Commons” (Hardin, 1968) – the belief that only privatized land-use rights can provide an adequate incentive for households to manage their livestock without causing rangeland degradation, by making herders responsible for matching herd sizes to rangeland resources and for investing in improvements for sustainable management (Harris, 2010; Ho, 2000a; Yan et al., 2005). Rangeland use rights contracts were first implemented in the 1980s with China’s 1985 Grassland Law, which stipulated that grazing land could be contracted out both to collectives and to individual households (Ho, 2000b; YontenNyima, 2012). This possibility was reiterated in the Land Administration Laws of 1986, 1998, and 2004, as well as the amended Grassland Law of 2002. However, the Rural Land Contract Law of 2002 and Property Law of 2007 stated that land, including grazing land, should be contracted to individual households (YontenNyima, 2012). Laws and policies have thus been inconsistent with respect to the basic unit of rangeland use rights allocation as well as whether pasture should be used individually or collectively after implementation of land-use rights contracts.

There has been a strong tendency for local and regional governments to interpret the policies as a mandate to limit land-use rights to the scale of individual households. This began in the

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1980s in Inner Mongolia and gradually spread to Xinjiang and the eastern and then western parts of the Qinghai–Tibetan Plateau (QTP) in the 1990s and into the 2000s. This has led to many documented problems, including household inequality, as rich households that can afford to buy barbed wire fences started enclosing more land than allocated, thus increasing grazing pressure on unfenced land; inequitable access to water and increased labor and economic burdens; and an increase in rangeland conflicts (Cao et al., 2011a; Williams, 1996, 2002; Wu and Richard, 1999; Yan and Wu, 2005; Yan et al., 2005; Yeh, 2003).

Though policy-makers and most scientists assume that overgrazing and climate change are the key drivers of degradation on the QTP, some researchers have pointed out that the Tragedy of the Commons assumption-based rangeland contract system and its enclosures may be more important drivers of rangeland degradation (e.g. Banks, 2001, 2003; Miller, 2000; Sheehy et al., 2006; Taylor, 2006; Yang, 2010; Yan et al., 2005; Yan and Wu, 2005). However, the lack of empirical ecological evidence has limited the acceptance of this argument. This study is the first to test this argument through a field experiment that compares rangeland conditions over time in the case of different management regimes in Maqu. By comparing rangeland vegetation quality between single household and multiple household-managed pastures, the study tests the assumption that privatization and individualization of resources leads to environmentally and socially superior outcomes. In doing so, it contributes to the broad literature on the “tragedy of the commons” and rangeland management (Crépin and Lindahl, 2009; Feeny et al., 1990; McKay and Acheson, 1987; Ostrom, 1990; Peters, 1997; St. Martin, 2001).

## 2. Materials and methods

### 2.1. Study area

Maqu County, Gansu province (101°–102° E, 33°–34°N) is located on the boundary of Sichuan and Qinghai provinces, in the eastern Qinghai–Tibetan plateau (Fig. 1). The altitude ranges from 2900 to 4000 m with an annual rainfall of 450–780 mm. The annual average temperature is 1.8 °C, with a low of –10.7 °C in January and a high of 11.7 °C in July. The maximum air temperature during the growing season can reach 29 °C, and there are on average 270 frost days annually. The rangeland area covers about

$87 \times 10^4$  ha, and 59% is classified as alpine meadow, dominated by sedges such as *Kobresia capillifolia* and *Scirpus pumilus*; grasses such as *Festuca ovina*, *Poa poophagorum* and *Elymus nutans*; poisonous weeds such as *Ligularia virgaurea*, *Stellera chamaejasme*, *Anemone rivularis*, *Trollius farreri* Stapf and *Anemone obtusiloba*; and legumes such as *Astragalus polycladus* and *Gueldenstaedtia Verna*.

Historically, herders of Maqu engaged in transhumant pastoralism of yak and Tibetan sheep based on collective rangeland rights, an apparently environmentally sustainable land use (Cao et al., 2011b; Yan et al., 2005). In 1996, a policy of enclosure and land-use contract grazing was implemented in Maqu County and the local government decided that winter pasture use rights should be contracted to single households (SH), while summer pasture rights could be contracted to units of up to three households (multiple households: MH). Average household size is 4.7 herders in Maqu, and each herder received roughly 15 ha when use rights were contracted. Based on this, we can infer the size of rangeland of the two different household types. In both cases, enclosures were used. For MH grazing, an enclosed area of rangeland proportional to the number of people in the families is jointly managed with no internal boundaries between pastures, while for SH, a smaller rangeland area is fenced off and managed by one household. However, the MH system was in practice implemented on winter pasture in some cases as well, including units larger than 3 households. Local officials were flexible in allowing herders to choose the management regime they preferred.

There are 7406 households in Maqu County, for a total of roughly 35,000 herders. In 2008, a survey of 4752 of those households was conducted to examine management and scope of multi-household units (Cao, 2010). Of those surveyed, 82% managed their winter pastures in multi-household units. Among these households, about 50% did so in units of 3 households, 30% managed in units of around 10 households, and 20% managed in even larger-scale units. On summer pasture, 86% (4103 households) engaged in MH management with around 15 households or more. Generally, those who managed their winter pastures in MH units also did so in summer pasture. On the other hand, some of those who managed their winter pastures in SH units found they needed to organize into MH units on the relatively remote summer pastures due to its limited water sources and for the greater security possible with multiple households, important in the more sparsely populated landscape. Our previous research found that those who managed their

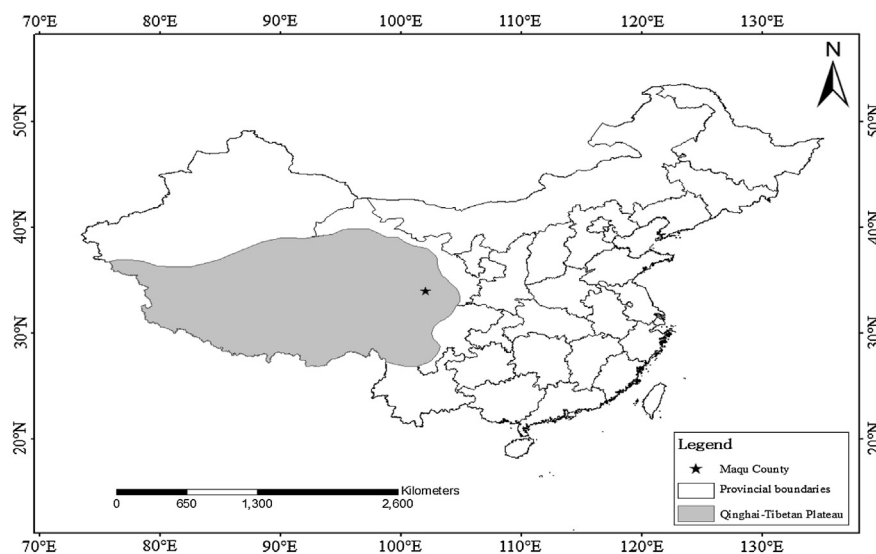


Fig. 1. The location of Maqu on Qinghai–Tibetan plateau.

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