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Spring 2010

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CONSERVING MONGOLIA'S GRASSLANDS, WITH CHALLENGES, OPPORTUNITIES, AND LESSONS FOR NORTH AMERICA'S GREAT PLAINS

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ABSTRACT—Mongolia and North America contain expansive grassland ecosystems that remain sparsely populated, dominated by agriculture, and support relatively isolated human communities dependent on natural resources. Until recently Mongolians raised livestock using extensive pastoralism without seriously threatening most of the region's biodiversity. Yet that changed rapidly following the recent transition from a communist, command-control economy to a democratic, free-market economy. The main challenges to protecting biodiversity on grasslands in Mongolia include overgrazing, poaching, mining, and inadequate management, training, and resources. Mongolia and the Great Plains both retain great opportunities for biodiversity conservation that could also benefit local people. Mongolia has begun embracing nature-based tourism as a means of providing additional jobs and enhanced livelihoods to local communities on its steppe grasslands. Nature-based tourism development in Mongolia may provide a model for conserving biodiversity in the Great Plains. Similar developments are beginning in the Great Plains but have focused primarily on big game hunting and dude ranches. Expanding the model in the Great Plains to include Native American cultures and wildlife viewing may offer alternatives that help restore biodiversity and enhance livelihoods.

Key Words: conservation, Mongolia, nature-based tourism, pastoralism, rangelands, wildlife

INTRODUCTION

Mongolia and the Great Plains of the United States are dominated by expansive grassland ecosystems that remain sparsely populated, dominated by agriculture, and support isolated human communities dependent on natural resources. These grasslands developed under

continental climates, fire, and historic grazing by wild ungulates and contain many landscape and ecosystem similarities, but they also differ in some significant ways. For example, in Mongolia, a country of 156 million ha (slightly larger than Alaska), domestic livestock have grazed the grasslands for millennia compared to about 150 years for most of the Great Plains.

Mongolian pastoralists have used their traditional system of extensive pastoralism without seriously threatening the region's biodiversity during most of region's human history. Extensive pastoralism helped maintain natural grasslands, and as Mongolia supports the lowest human population density in the world (about 1.66 people/ha in 2007; NSOM 2008), the large area of natural grasslands and sparse human population helped maintain natural biodiversity. Following the collapse of the Soviet Union and the transition from a communist, command-control economy to a democratic, free-market economy, overgrazing and loss of biodiversity have become major concerns. The main challenges to protecting biodiversity on grasslands in Mongolia are overgrazing, poaching, mining impacts, and inadequate management and training in natural resource conservation. The extent to which these threats will impact Mongolia's grasslands remains unclear, but poor mining restoration prospects, increased livestock numbers, and a rise in poaching suggest that the challenges to biodiversity conservation will only rise.

Mongolia's capacity and investment in grassland conservation and management have not kept pace with the increased challenges facing the country. We can partially explain this by a lack of financial resources, as the United Nations rated Mongolia as one of the world's poorest nations, with a per capita gross national income ranked 160th in the world in 2007 (NSOM 2008), and to an economy still adjusting to changes following the collapse of the Soviet Union in 1991. Balancing economic development and nature conservation will prove challenging, but it is vital if the country hopes to create a sustainable future based on its three-pronged economy of livestock-based agriculture, mining, and cultural and nature-based tourism. Mongolia has begun embracing nature-based tourism as a means of providing additional jobs and enhanced livelihoods to local communities in its steppe grasslands. Nature-based tourism development in Mongolia may provide a model for conserving biodiversity in the Great Plains. Similar developments are beginning in the Great Plains but have focused primarily on big game hunting and dude ranches. Expanding the model in the Great Plains to include the Native American culture and wildlife viewing may offer alternatives that help restore biodiversity and enhance livelihoods.

We believe that an opportunity exists for Mongolia to develop a sustainable economy in the nation's grasslands based on a combination of extensive livestock production and tourism focused on the unique culture and

ecology of the nation. To be sustainable, both tourism and livestock require vastly improved grassland management to maintain a healthy and productive steppe. Managers must also balance mining, an important and growing economic sector of Mongolia, with the country's animal livestock and tourism sectors to avoid sacrificing long-term values for short-term economic gains. Our collective work has focused on accomplishing this task, namely, improving livestock husbandry, biodiversity conservation, and nature-based tourism to ensure that all remain sustainable and enjoy enduring public support. In this paper, we provide a context for and background on Mongolia's grasslands, then examine the challenges and opportunities for conservation. We conclude with lessons from Mongolia that could be adopted to improve aspects of biodiversity conservation in the U.S. Great Plains.

MONGOLIA'S GRAZING LANDS

Mongolia contains vast expanses of grazing lands with 80% of the country used as extensive grazing and a further 10% of the country in forest that is also often used by pastoralists for grazing (Suttie 2005). Arable lands comprise less than 1% of the total area, with urban, industrialized roads comprising about 5% of the total area (Suttie 2005). Steppe grasslands comprise the majority of grazing lands and in 2007 only about 365,000 people lived as nomadic pastoralists, practicing outside cities on the Mongolian steppe (NSOM 2008). In this paper we use the term nomadic pastoralists to refer to herders who live outside villages and towns and move their livestock, generally several times a year, to meet the needs of their animals. This type of mobile pastoralism stresses extensive grazing and native breeds that require lower inputs as compared to more intensive grazing systems used in other parts of the developed world. Nomadic pastoralists' numbers have remained relatively constant since the early 1990s; however, livestock numbers have increased rapidly with large fluctuations in the national herd size since the end of communism (Figs. 1 and 2) (NSOM 2008). Increased livestock numbers and large fluctuations in livestock numbers have important implications for biodiversity conservation on Mongolian grasslands. In this section, we discuss livestock grazing on the Mongolian steppe, the human population and local livelihoods, and the status of steppe wildlife. For more details on the context of grasslands conservation in Mongolia see Reading et al. (2006).

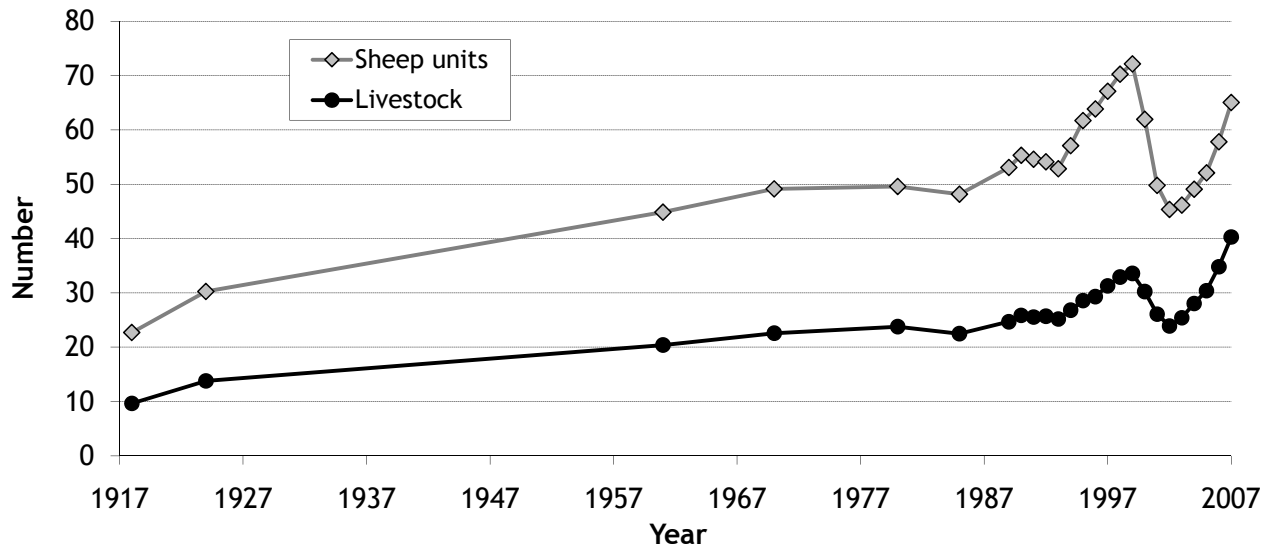


Figure 1. Number of livestock and sheep units in Mongolia, 1918-2007 (NSOM 2004, 2008). Sheep units determined by multiplying the number of sheep by 1, goats by 0.9, cows by 6, horses by 7, and camels by 5, and then summing those totals (Bedunah and Schmidt 2004).

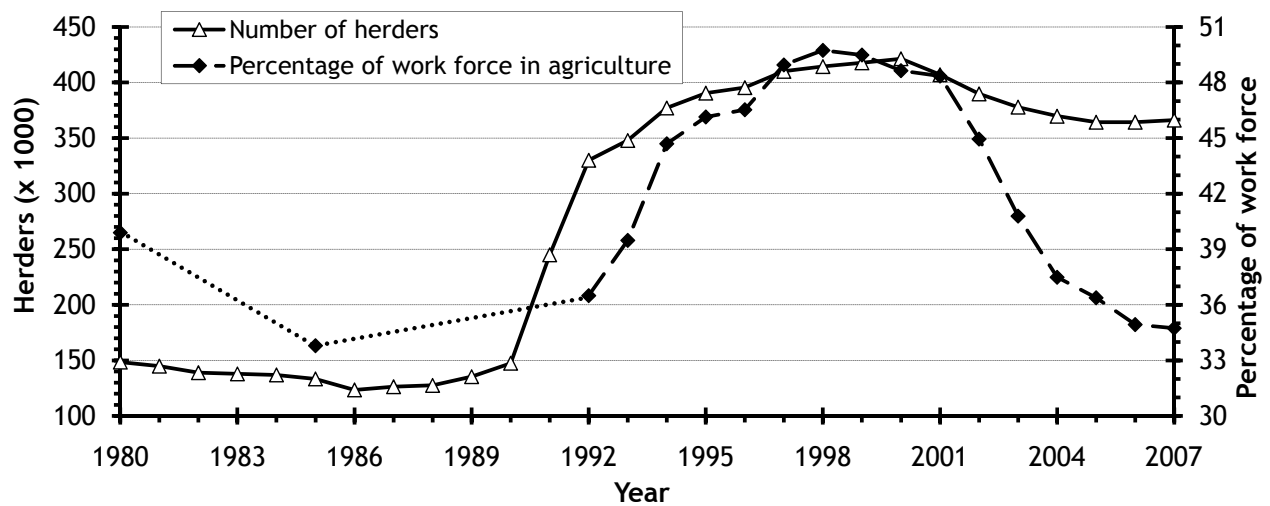


Figure 2. Number of herders and percentage of the workforce in agriculture in Mongolia, 1980-2007 (NSOM 2004, 2008).

Livestock Grazing

The Mongolian steppe extends across the largest contiguous, unaltered grassland in the world (World Bank 2003). Mongolia divides its grasslands into forest-steppe, steppe, and desert-steppe (or semidesert) ecological zones based on rainfall, temperatures, altitude, growing season, and corresponding vegetation (Hilbig 1995; Gunin et al. 1999; Johnson et al. 2006). Although some livestock graze in the taiga forest, mountain tundra, and true deserts

of Mongolia, the steppe ecosystems support the bulk of Mongolia's livestock. Mongolian pastoralists typically used a transhumant grazing system, meaning that they traditionally move their livestock several times each year, depending on range conditions, to use the best available forage. Movement patterns varied but were based on traditional ecological knowledge, customs, and norms to control grazing use by different groups or households. In the past, and today, Mongolian pastoralists raise a wide variety of livestock, including fat-tailed sheep, cashmere

goats, horses, donkeys, cattle, yaks, and Bactrian camels. Most pastoral households maintain multiple-species herds with at least three types of livestock, and often four or five types. Multiple-species grazing has several advantages (i.e., producing a wider variety of products and using different animals for different jobs such as riding or carrying supplies), and each species utilizes different grazing habits so mixed herds can use more available forage.

Some aspects of livestock management changed dramatically during the 20th century, as the country passed through a communist era and then shifted to a democratic government with a free-market economy in early 1990s. This relatively recent change has had major implications for sustainable use of grazing lands. We provide a short discussion on precommunism and communist systems in the next few paragraphs to illustrate how grazing controls changed. For detailed reviews of pastoral social economic units, historical land tenure, pastoral systems, and the history of these changes see Humphrey (1978), Jagchid and Hyer (1979), Bazargur et al. (1993), Germeraad and Enebish (1996), Muller and Bold (1996), Fernandez-Gimenez (1999, 2001, 2006), and Sneath (1999).

Prior to communism land tenure was feudal, with herders employing transhumant grazing management restricted to common lands (*khoshuun*) owned by a feudal lord. Under communism (1921–91) the government abolished the feudal system and established smaller *soum* districts (similar to counties) and livestock collectives. The *soum* district reduced migration distances, and although early attempts at collectivization failed, by the 1960s the government used a mix of incentives and strong laws to force livestock into government-run *negdels*, or collectives. The government permitted herders to own some livestock, but the *negdels* owned most animals and dictated management. Management of the *negdels* altered some management practices but continued to stress livestock movement to take advantage of different pasture types.

Following the collapse of communism, the collectives distributed their livestock and other property to members, with little or no formal regulatory structures to control grazing. As a result, herders attained an almost unlimited and unprecedented freedom of choice with respect to lifestyle, livestock management, and economic activity (Bruun 1996; Fernandez-Gimenez 2006; Schmidt 2006). However, risk also passed from the collective to the herder (Bruun 2006; Fernandez-Gimenez 2006). In most if not all of Mongolia, the lack of strong formal or informal institutions to regulate livestock movement led to declining mobility and increasing out-of-season grazing,

trespassing, and associated conflicts (Swift and Mearns 1993; Agriteam Canada 1997; Fernandez-Gimenez 1999, 2006; Bedunah and Schmidt 2004; Ykhanbai et al. 2004).

From the early 1900s until the transition from communism to a free-market democracy, the number of livestock grew gradually (Fig. 1) (NSOM 2008). Although sheep dominated the Mongolian livestock herd until recently (Fig. 3), horses and cows were as or more important than sheep with respect to sheep units (Fig. 4). Mongolian range scientists developed the concept of sheep units (SUs) in an attempt to standardize grazing pressure with respect to fat-tailed sheep, in which 1 sheep = 1 SU, 1 goat = 0.9 SU, 1 cow = 6 SUs, 1 horse = 7 SUs, and 1 camel = 5 SUs (Bedunah and Schmidt 2004). Since the end of communism, however, pastoralists began to favor cashmere goats because of the high return on cashmere wool compared to other livestock products. As a result, goats increased dramatically, rising 361% from 1990 to 2007, compared to increases of 113% for sheep and declines of 1%, 15%, and 52% for horses, cattle, and camels, respectively (Figs. 3 and 4). In 2008 goats had overtaken sheep as the most numerous species of livestock in Mongolia (Fig. 3).

After the transition to a free market, grazing pressure increased dramatically in terms of both total numbers and SUs before crashing during two harsh winters, known as *dzuds* in Mongolia, in 1999–2001 (Fig. 1). Livestock numbers increased rapidly from about 25.2 million head in 1993 to over 33.5 million head in 1999, before crashing to 23.9 million head in 2002 (Byambatseren 2004; NSOM 2004; Ykhanbai et al. 2004). Since those large winter losses, numbers have again risen rapidly, and although total numbers have never been higher (at 40.3 million head in 2007), SUs remain lower than their 1999 peak (Fig. 1) (NSOM 2008), primarily because goats have largely replaced larger livestock (Fig. 3). A *dzud* during the winter of 2009–2010 has again led to massive die-offs of livestock in Mongolia (World Bank 2010). The accuracy of livestock numbers is difficult to assess, but the communist-era (pre-1992) estimates are likely accurate. By the late 1990s, however, Kennett (2000) suggested that estimates were often 25% too low, as herders underreported herd sizes to reduce livestock taxes, and as such, the rate of livestock increases since the 1990s may be greater than the figures show. No matter how accurate these livestock numbers are, trends show changes in livestock numbers and type of livestock that have important implications for grassland conservation in Mongolia.

Lack of control in livestock populations has resulted in a boom and bust in livestock numbers. Livestock rebound following bad winters and large die-offs to

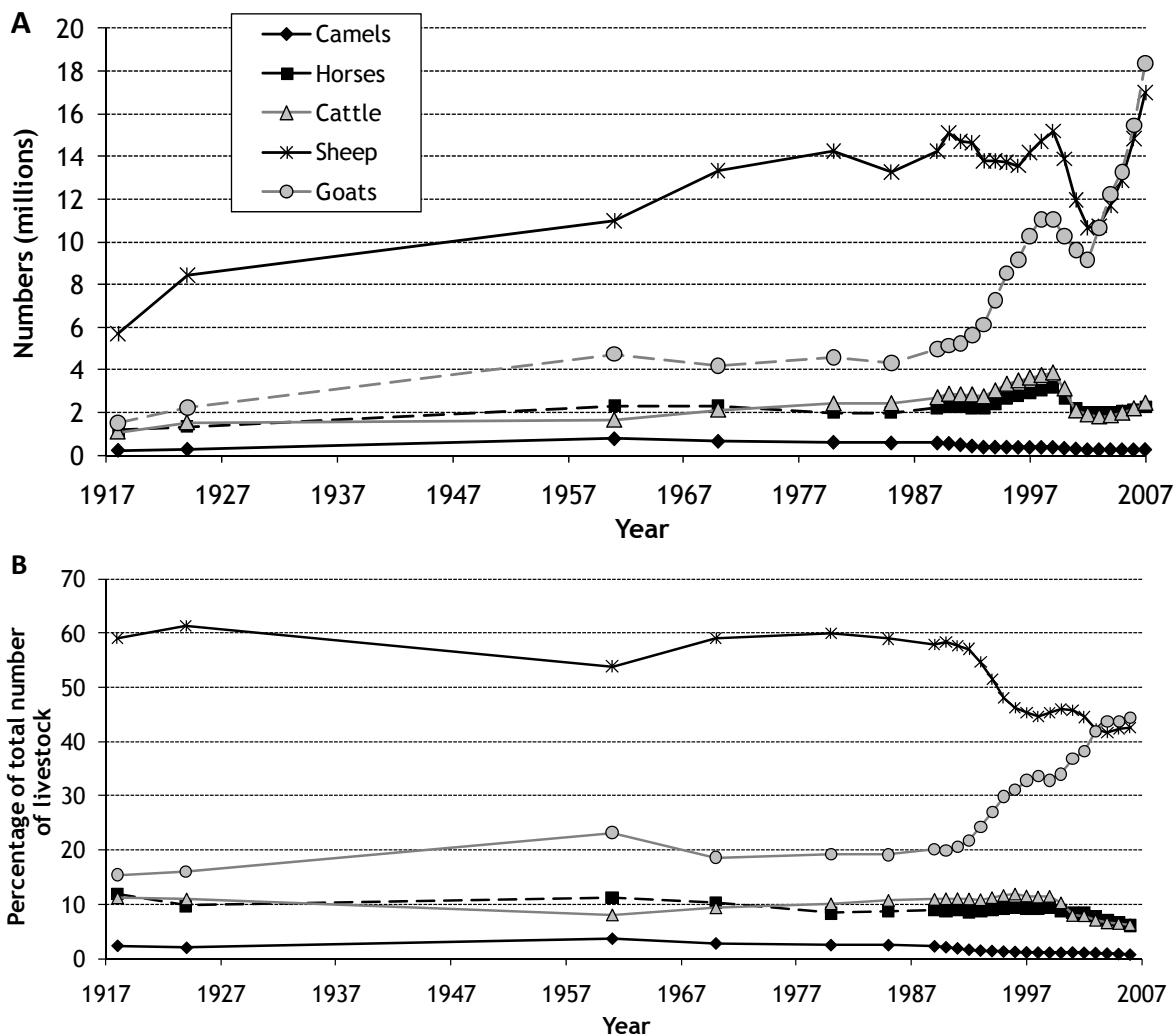


Figure 3. Number (A) and percentage (B) of types of livestock in Mongolia, 1918-2007 (NSOM 2004, 2008).

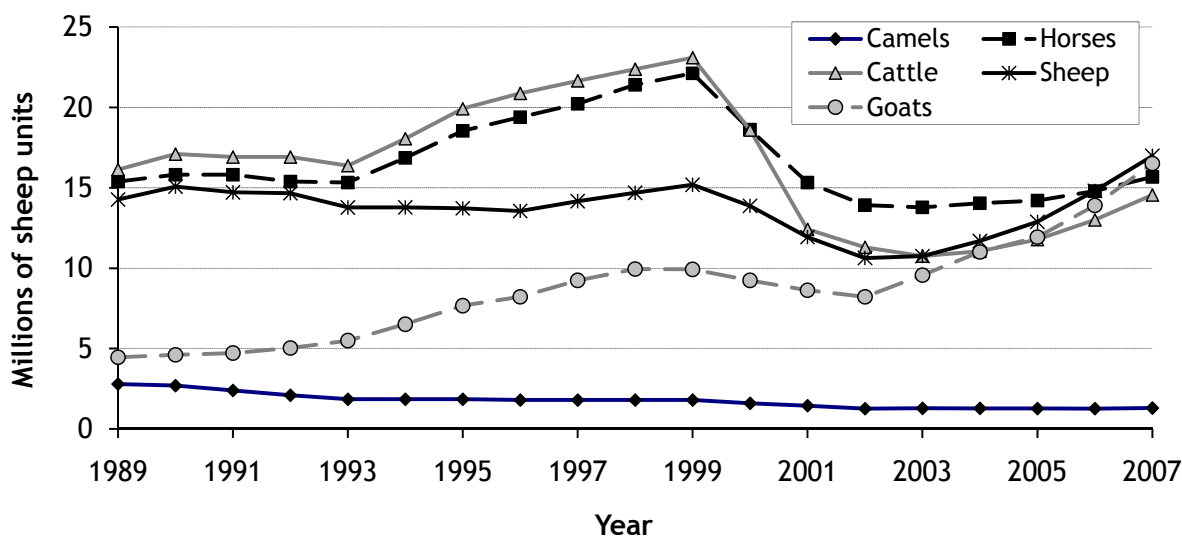


Figure 4. Millions of sheep units in each of five livestock categories in Mongolia, 1989-2007 (NSOM 2004, 2008). Sheep units determined by multiplying the number of sheep by 1, goats by 0.9, cows by 6, horses by 7, and camels by 5, and then summing those totals (Bedunah and Schmidt 2004).

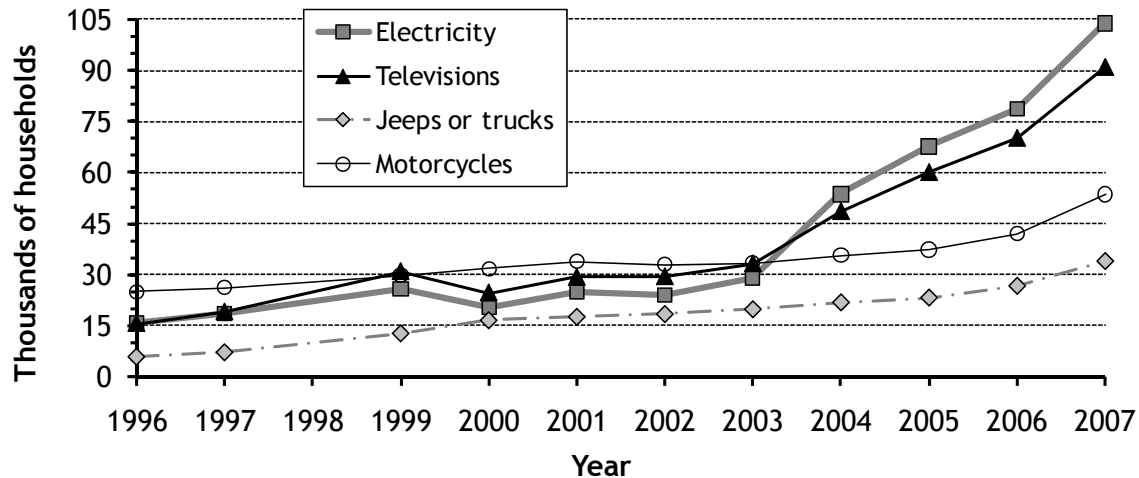


Figure 5. Indices of herder wealth as measured by the number of herder households with electricity, televisions, jeeps or trucks, and motorcycles, 1996-2007 (NSOM 2008).

again overgraze rangelands, reduce forage supplies, and increase the potential for future disasters, such as *dzuds* and drought. Droughts and *dzuds* have commonly occurred historically in Mongolia, often with serious impacts in livestock numbers. The worst *dzud* occurred in 1945 when winter conditions killed about 8 million head of adult livestock (Suttie 2005). Nevertheless, currently the increasing volatility in livestock numbers stems predominately from the lack of controls over grazing areas and/or numbers of livestock (Fernandez-Gimenez 1999, 2001, 2006; Bedunah and Schmidt 2004; Schmidt 2006). Indeed, Mongolia now represents the most extreme example of an open access system (Fernandez-Gimenez 2006; Schmidt 2006), with few or no government or community (i.e., social) limits on herd sizes and movement to reduce overgrazing throughout the vast nation. A new Law on Land, passed in 1994 and revised in 2003, permits greater management of pasturelands by local governments, but it remains little applied (Fernandez-Gimenez and Batbuyan 2004; Fernandez-Gimenez 2006). The resulting volatility in livestock numbers impacts not only livelihoods of pastoral families, but the national economy as well. For example, following the *dzuds* of 1999-2001, the Mongolian economy grew by a mere 1% in 2001 and 3.9% in 2002—far lower than the 8% growth estimated by the government in the absence of large livestock losses (Mearns 2004).

Human Population and Livelihoods

Despite the volatility in livestock numbers, herder numbers have remained relatively stable since just after

the end of communism, when a large number of people emigrated from cities and towns to become pastoralists (Fig. 2) (NSOM 2004, 2008). This stability in pastoralists' numbers belies Mongolia's relatively rapid human population growth (1.56% from 2006 to 2007) (NSOM 2008). Thus, the percentage of people working in agriculture continues to decline (Fig. 2). The ramification of a decreasing agriculture population is hard to predict, but it could signify a decreasing role of pastoralists in national politics as their numbers decline.

Many pastoralists have enjoyed increasing wealth since the mid-1990s, especially over the last five years. Indices of Mongolian herder wealth, such as the number owning jeeps or trucks, motorcycles, or televisions, and with access to electricity (usually through solar panels or windmills), continue to rise (Fig. 5) (NSOM 2004, 2008). Livestock herd sizes also continue to grow (Fig. 6). In 2007, for the first time since privatization of livestock, the percentage of herders with <50 head dropped to under 30% and the percentage with <100 head dropped to under 50%. However, most pastoralists remain poor, but defining poor among herders is difficult. The Mongolian government considers a herd size of about 150 animals as the minimum necessary to maintain a household's livelihood (World Bank n.d.), because these households risk losing self-sufficiency during *dzuds* or other conditions that cause large livestock losses. In 2007 about 71% of herding families retained herds of 200 animals or fewer (the Mongolian government does not report data that would permit us to determine the percentage of herders with 150 animals or fewer; Fig. 6) (NSOM 2008).

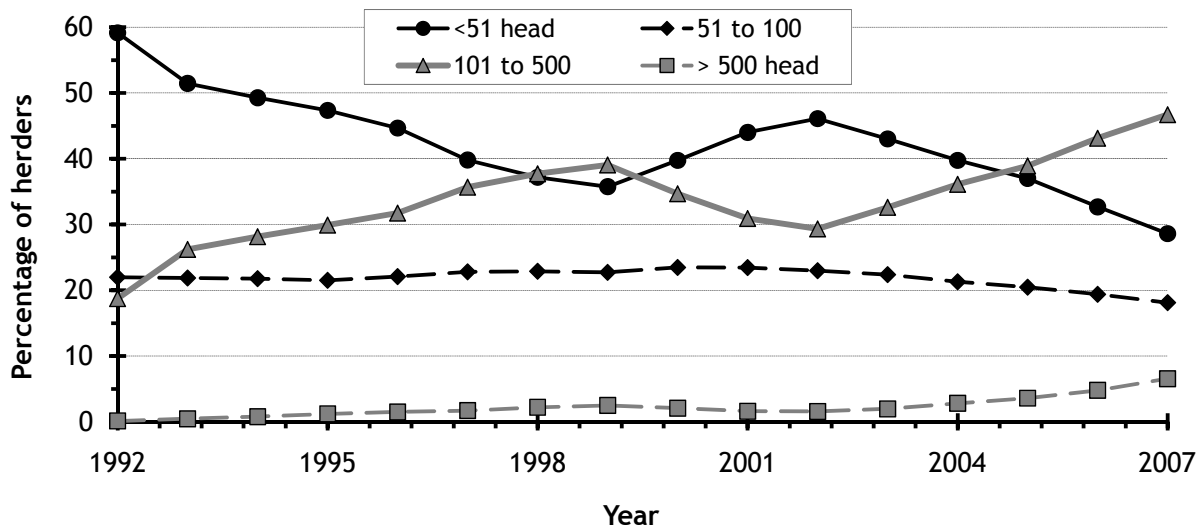


Figure 6. Percentage of herder families in Mongolia owning herds of different sizes, 1992–2007 (NSOM 2004, 2008).

Often both pastoralists and urbanites must supplement their incomes using diverse sources to survive in Mongolia's struggling economy. Some primarily pastoral families obtain additional income from other sources (e.g., working in mines, managing livestock for other people who live in cities or towns). Likewise, many people who work primarily in cities and towns own livestock to supplement their income. In cases where pastoralists work another job in a town or where city dwellers own livestock kept near villages or towns, these domestic animals often move very little, resulting in extreme degradation of pastures near towns and cities (Ferguson 2003; Okayasu et al. 2007). A few pastoralists diversify their family income by engaging in other revenue-generating activities, like producing small crafts from livestock products. Although currently few people likely profit from the production of small crafts, this activity provides potential to help at least some families benefit from increased tourism.

Wildlife of the Mongolian Steppe

Mongolia retains a substantial amount of its original biodiversity, having relatively high diversity for a temperate grassland. Two of the World Wildlife Fund's most important ecoregions worldwide, the Daurian Steppes and the Altai-Sayan Mountains, lie largely within Mongolia (Olson and Dinerstein 1998, 2002). These and other ecoregions in Mongolia support a broad range of plants and wildlife (Finch 1996; Gunin et al. 1998; Reading et al. 2006). Some species persist in impressive numbers, such as the Mongolian gazelle (*Procapra gutturosa*) with over 1 million animals still roaming the eastern steppes,

tens of thousands of goitered gazelle (*Gazella subguttorsa*) inhabiting the desert steppes, and thousands of Asian wild asses (*Equus hemionus*) inhabiting the desert steppes and true desert (Lhagvasuren et al. 1999; Feh et al. 2002; Reading et al. 2001a, 2002; Kaczensky et al. 2006, Lhagvasuren 2007). Other species persist in smaller populations but in large numbers compared with neighboring countries. For example, thousands of argali sheep (*Ovis ammon*) persist in the mountains, foothills, plateaus, and rocky outcrops of western, southern, and especially southeastern Mongolia (Clark et al. 2006; Reading et al. 2001b). Of large mammals, only the dhole (*Cuon alpinus*) was extirpated from Mongolia's rangelands in historic times (the past 1,000 years) (Reading et al. 2006). The Przewalski's horse (*Equus ferus przewalskii*) did go extinct in the wild, but conservationists recently successfully reintroduced the species into three regions (Boyd and Houpt 1994; Bouman 1998; Clark et al. 2006).

Mongolia's flora and fauna represent a mixture of species from the taiga of Siberia, the steppes of Eurasia, and the deserts of Central Asia. Approximately 128 species of mammals, 487 birds, eight amphibians, 22 reptiles, 64 fish, and numerous invertebrates inhabit Mongolia (Reading et al. 1994; Clark et al. 2006; Terbish et al. 2006; Gombobaatar 2009). However, most of central Mongolia supports a depauperate fauna, especially with respect to large mammals. Mongolian conservationists consider several grassland species as threatened or endangered (Clark et al. 2006). Recently, many species of small carnivores and meso-carnivores such as the lynx (*Lynx lynx*), Pallas's cat (*Otocolobus manul*), red fox (*Vulpes vulpes*), and corsac fox (*Vulpes*

corsac) have experienced population crashes and near threatened status as Mongolians harvest these species to supply a growing demand for their pelts and body parts in China and other Asia countries (Clark et al. 2006; Wingard and Zahler 2006). Similarly, millions of Siberian marmots (*Marmota sibirica*) once lived in colonies throughout the steppes of Mongolia, but declines from overharvesting have endangered this keystone species (Clark et al. 2006; Townsend and Zahler 2006; Wingard and Zahler 2006; Murdoch et al. 2009). Although heavily persecuted, populations of wolves (*Canis lupus*) persist across much of Mongolian rangelands.

Mongolia's avifauna is less heavily exploited than its mammal fauna, and most species persist in relatively good numbers. However, some species of birds are declining due primarily to mortality outside Mongolia. Birdlife International designated 70 regions in Mongolia as "important bird areas," of which 32 occur in steppe and desert-steppe regions (Nyambayar and Tseveenmyadag 2009). Nyambayar and Tseveenmyadag (2009) listed six species of grasslands birds from Mongolia as globally "vulnerable": the greater spotted eagle (*Aquila clanga*); imperial eagle (*Aquila heliaca*); lesser kestrel (*Falco naumanni*); great bustard (*Otis tarda*); MacQueen's bustard (*Chlamydotis macqueenii*); and white-throated bushchat (*Saxicola insignis*); and one species as globally endangered, saker falcon (*Falco cherrug*). White-throated bushchats may no longer breed anywhere except in Mongolia. Mongolia's grasslands also support relatively large populations of other species of conservation concern, such as cinereous vultures (*Aegypius monachus*) and Henderson's ground jays (*Podiceps hendersoni*) (Reading et al. 2006). Although people exert little direct pressure on most birds in Mongolia, overharvesting of saker falcon nestlings to supply demand by falconers (especially from the Middle East) has resulted in large population declines and range contractions of this species in Mongolia (Potapov et al. 2001; Zahler et al. 2004b).

A wide range of birds also inhabits the riparian and wetland systems lying within Mongolian grasslands. These wetlands support globally significant populations of waterfowl and wading birds, including several threatened or endangered species such as Dalmatian pelicans (*Pelicanus crispus*), swan geese (*Anser cygnoides*), relict gulls (*Larus relictus*), white-headed ducks (*Oxyura leucocephala*), white-naped cranes (*Grus vipio*), Siberian cranes (*G. leucogeranus*), and vulnerable hooded cranes (*G. monacha*) (Birdlife International 2003; Nyambayar and Tseveenmyadag 2009).

Mongolia's reptiles, amphibians, invertebrates, and small mammals remain poorly understood, but most are probably faring well (Mukhbayar et al. 2001; Terbish et al. 2006). However, Mongolians increasingly overharvest some species of fish, such as taimen (*Hucho taimen*), for internal consumption and export (Ocock et al. 2006a, 2006b).

CONSERVING MONGOLIA'S GRASSLANDS

Countries use a variety of methods to protect wild species and conserve biodiversity, including passing and enforcing laws to control harvest and trade of species, creating and implementing conservation and management programs, and establishing protected areas to protect species and habitat. Mongolia drafted a Red Book (list of threatened and endangered species), joined the World Conservation Union (IUCN) and several international conventions (e.g., Conventions on Migratory Species, Wetlands, International Trade in Endangered Species), passed a number of environmental and conservation laws, and established a protected areas network. These activities accelerated following the end of communism. Mongolia rapidly expanded its protected areas network in the mid-1990s, but over the last decade this growth slowed markedly as have other conservation initiatives (Reading et al. 1999; Johnstad and Reading 2003) (Fig. 7). In this discussion, we primarily focus on the development of protected areas, as arguably little active conservation management occurs outside these areas in Mongolia.

As of June 2008, Mongolia's 72 federal protected areas covered more than 22.4 million hectares (Figs. 7 and 8; BirdLife Asia 2009). The network included Strictly Protected Areas (49.0% of the total area protected in Mongolia), National Parks (41.3%), Nature Reserves (9.2%), and Monuments (0.5%) (BirdLife Asia 2009). As of May 2008, there were also 937 relatively small provincial and *soum* (like county) protected areas scattered throughout the nation, covering 16.5 million ha or over 10% of the country (BirdLife Asia 2009). Some overlap occurs between federal and local protected areas, but still some 38 million ha (>24.3% of Mongolia) falls under some protected status. In relation to countries of Central Asia, Mongolia has placed a much larger percentage of its area under protected status (Table 1) (UNEP-WCMC 2009).

Despite the relatively high percentage of Mongolia under protected status, grasslands have remained poorly represented (Reading et al. 1999, 2006), as is the case globally (Henwood 1998a, 1998b). Over the last decade, Mongolia has expanded the number of protected areas in

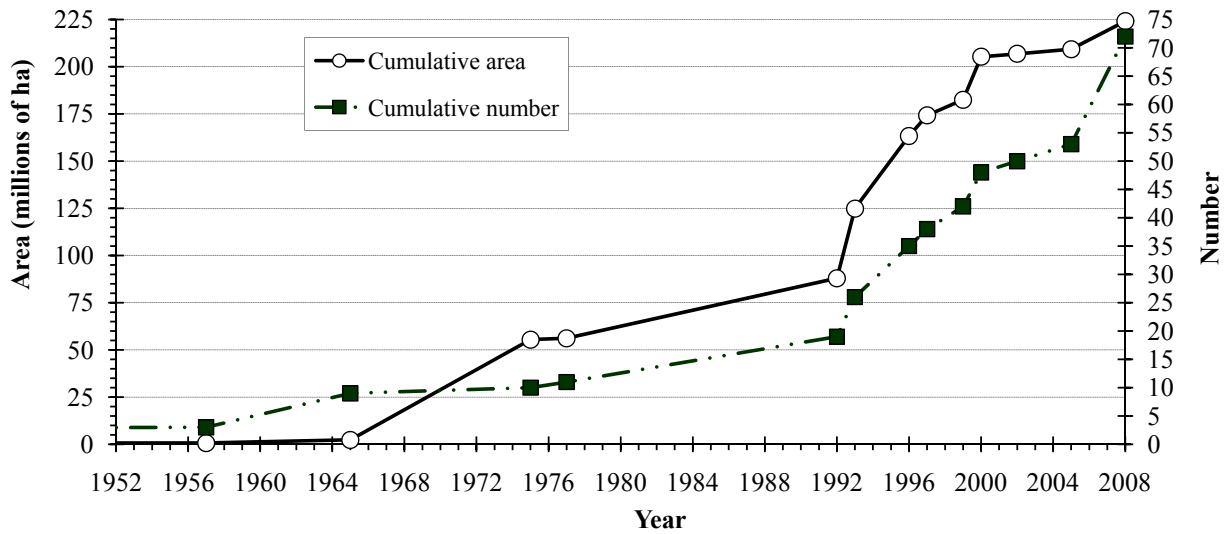


Figure 7. Increase in the cumulative number of, and area covered by, federally designated protected areas in Mongolia (Myagmarsuren 2000; BirdLife Asia 2009).

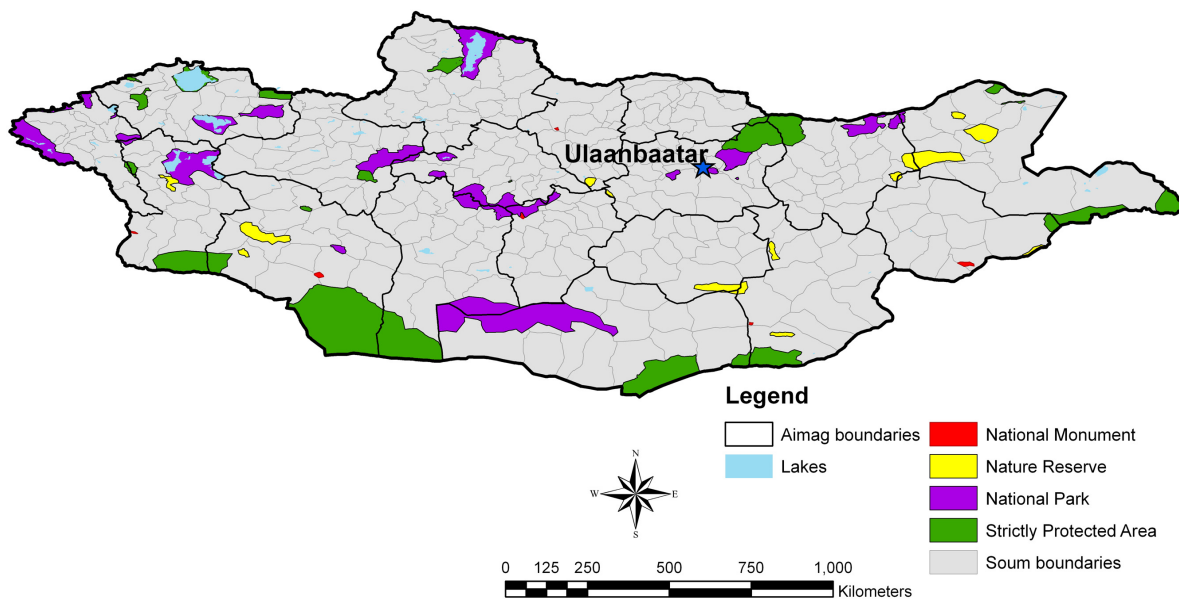


Figure 8. Federally designated protected areas in Mongolia.

steppe ecosystems, yet grasslands remain underrepresented with only 2.0% of steppe, 2.7% of forest-steppe, and 3.4% of desert-steppe ecosystems protected as of 2002 (Reading et al. 1999; Enebish and Myagmarsuren 2000; Johnstad and Reading 2003). Many conservationists advocate rectifying this situation by establishing new protected areas in steppe regions (e.g., see Enebish and Myagmarsuren 2000). Several large nonprofit organizations, such as the World Wide Fund for Nature,

the Wildlife Conservation Society, and the Nature Conservancy, and several smaller nonprofit organizations (e.g., People-Centered Conservation, Denver Zoological Foundation, and several species- or park-specific Mongolian nongovernmental organizations) are working to help others, especially the Mongolian government, realize the importance of protecting greater areas in the steppe.

For all the progress that Mongolia has made with its protected areas system, little biodiversity conservation

TABLE 1
COMPARISON OF PROTECTED AREAS'
COVERAGE IN MONGOLIA AND
CENTRAL ASIAN COUNTRIES

Country	Protected areas		Percentage of country (%)
	Number	Area (ha)	
Afghanistan	16	2,034,296	3.1
Kazakhstan	41	13,996,964	5.2
Kyrgyzstan	31	2,900,012	15.1
Mongolia	72	38,015,439	24.3
Tajikistan	21	2,416,967	16.9
Turkmenistan	31	3,719,303	7.6
Uzbekistan	17	1,971,424	4.4

Sources: BirdLife Asia 2009; UNEP-WCMC 2009.

occurs outside protected areas in the nation (Reading et al. 2006; Wingard and Zahler 2006). There is no federal agency charged with managing the land or wildlife of Mongolia, despite calls for such organizations (Zahler et al. 2004b; Reading et al. 2006; Wingard and Zahler 2006). Thus, outside protected areas, biodiversity conservation is left to the *soum* and *aimag* (province). Generally, each has a nature conservation agency, but usually with a single staff member at the *soum* level and just a couple at the *aimag* level. As a result, little active conservation action occurs on unprotected steppe grasslands. However, again, several environmental and conservation nongovernmental organizations are working to rectify this situation with privately funded conservation programs.

Challenges

A number of challenges face conservation efforts for Mongolia's grasslands and their natural biodiversity. These include overgrazing, mineral extraction, indiscriminate use of rodenticides, uncontrolled wildlife hunting, and the capacity to manage and control natural resource use. Today it is uncommon to see large wild ungulates across much of the country, with notable exceptions in the eastern steppes and southern desert-steppe. The degradation of grasslands and threats to biodiversity have increased during the last decade and require attention.

Livestock overgrazing and rangeland degradation pose a serious challenge to biodiversity conservation on

the steppes of Mongolia and emanate from a number of interrelated factors. Following Mongolia's transition to a free-market democracy, Sheehy (1996) rated most of the grazing land as good or excellent. At the time scientists suggested that only about 11 million ha, or 7% of Mongolia's land area, was degraded. However, following the rapid rise in livestock numbers during the 1990s and the past decade (Fig. 1), land degradation and desertification expanded, especially in the more marginal desert-steppe and desert regions (UNDP 2000; MNE 2001; Amgalanbaatar et al. 2002; Ykhanbai et al. 2004). In 2001 government officials reported that >70% of Mongolia was at least marginally degraded and 7% was seriously degraded (UNDP 2000; MNE 2001), although a World Bank report (2003) disputed these figures. By 2007 the Mongolian government had increased their estimates of seriously degraded land to 9.0% of its land base, or some 14.08 million ha (NSOM 2008). Most of the degraded land occurred on pasturelands, with some 12.31 million ha (9.8%) of steppe pasturelands designated as seriously degraded (NSOM 2008). As livestock numbers increase, they eventually degrade Mongolia's rangelands (as they already have in many parts of the country, especially the more semiarid rangelands), with negative effects for future grazing by livestock and wildlife (Ykhanbai et al. 2004; Reading et al. 2006; Okayasu et al. 2007).

The large increases in livestock, lack of control of grazing lands, and the poor economy of Mongolia have all contributed to a lack of capacity to manage grazing lands in a sustainable way. In addition, the shift in the composition of Mongolia's livestock herd from primarily sheep-dominated to primarily goat-dominated could significantly impact the conditions of the nation's rangelands and wildlife conservation (MNE 2008). Goats often utilize browse that has low value to sheep or cattle (Ensminger 1977); however, wild ungulates often consume these plants, or these species may protect the soil following heavy grazing by sheep or cattle. Goats also prefer foraging on rougher land, eat a wider range of plant species, eat more browse, and travel longer distances in search of preferred forage than do other domestic ruminants (Luginbuhl 2006). These differences suggest that the change from sheep- to goat-dominated rangelands will alter vegetation conditions.

Both sustainable livestock production and improved biodiversity conservation require stabilizing and improving the health of the Mongolia's livestock (Mearns 2004; Ykhanbai et al. 2004; Reading et al. 2006). Productive rangelands and better feed management are critical to improved livestock health, especially during the winter. In

the past, Mongolians created reserve pastures and forage reserves (e.g., hay, forage pellets) for times of shortages (Minjigdorj 1995). Both practices largely disappeared from Mongolia following dissolution of the collectives, although both likely remain important to avoid dramatic livestock losses and ensure food security (Reading et al. 2006). Reserve pastures provided ungrazed areas during the growing season, thus resting forage plants and permitting seed production among forage species. These reserve areas also provide areas for wildlife use and reduce disturbances to wild species from people and livestock.

Associated with livestock grazing, indiscriminate use of rodenticides represents a continued threat to biodiversity conservation on Mongolian grasslands. The Mongolia Agricultural Ministry has conducted massive poisoning programs that broadcast zinc phosphate and bromadiolone across vast expanses of steppe in the face of large populations of Brandt's voles (*Microtus brandtii*) because of the perception that the voles compete with livestock (Natsagdorj and Batbayar 2002; Birdlife International 2003; Zahler et al. 2004a). Although the government has scaled back their programs and no longer widely broadcasts poisons, more geographically restricted poisoning still occurs (authors' pers. observ.). These pesticides kill not only voles and other rodents but several species of birds, small mammal carnivores, and even livestock (Natsagdorj and Batbayar 2002; Birdlife International 2003; Zahler et al. 2004a). Ironically, the reason for the increased vole populations likely relates back to overgrazing and associated shorter vegetation that enables vole populations to expand (Natsagdorj and Batbayar 2002; Birdlife International 2003; Zahler et al. 2004a). Loss of vole predators may exacerbate the problem by facilitating future population irruptions at shorter time intervals (because vole predator populations, which could help stem vole population growth, have declined and recover more slowly than do vole populations).

Beyond livestock grazing and wildlife poisoning, herders threaten biodiversity by harvesting wildlife to supplement their incomes (Wingard and Zahler 2006). Usually these harvests are illegal, in that few people bother to get licenses even for species they can trap or hunt legally (Pratt et al. 2004; Zahler et al. 2004b; Wingard and Zahler 2006). Many people from cities and towns poach systematically to supply a growing demand. Today, poaching poses a significant threat to the biodiversity of the Mongolian steppes (Pratt et al. 2004; Zahler et al. 2004b; Wingard and Zahler 2006). As Mongolia entered the global economy, demands for wildlife, wildlife parts, and plants increased dramatically (Pratt et al. 2004;

Zahler et al. 2004b). The increasing affluence of Asian economies, especially China, exacerbated this problem, as many people in Mongolia, a country with a relatively low standard of living, are searching for ways to improve their livelihoods (Pratt et al. 2004). As a result, populations of many formerly abundant species, such as elk (*Cervus elaphus*) and Siberian marmots, crashed. Both species are now considered endangered in Mongolia (Clark et al. 2006), whereas just a decade ago both were common.

Mining increasingly threatens biodiversity in a number of ways (Brooke 2003; Farrington 2005; Reading et al. 2006; BirdLife Asia 2009). Legal and illegal mining activities, both of which are expanding rapidly, destroy pastures, use and pollute large amounts of water, release chemicals, and often lead to increased poaching (Brooke 2003; Farrington 2005; World Bank 2006; Watts 2007). A strong desire for rapid economic growth resulted in policies directed at facilitating natural resources exploitation (Ferguson 2003; Farrington 2005). As of 2007 the government had issued over 5,800 exploration and mining licenses covering more than 44% of Mongolia's land area (Asia Foundation 2007; MNE 2008). As these mines develop, many of Mongolia's poor migrate from cities and towns to the edge of mines, or even within them, to try to scrape a living together via small-scale mining operations (World Bank 2006). Called "ninja" miners by the Mongolian public and now the media, these miners often cause significant environmental degradation and release dangerous chemicals such as mercury (World Bank 2006; Watts 2007; MNE 2008).

Controlling poaching, mining, and other activities that degrade Mongolia's steppes has proven difficult. Unfortunately, Mongolia lacks the infrastructure, training, and resources to adequately enforce existing environmental laws, many of which remain inadequate themselves (Wingard and Odgerel 2001; Ykhanbai et al. 2004; Farrington 2005; Wingard and Zahler 2006; World Bank 2006). Outside protected areas (and within several protected areas) enforcement often falls to local governments that usually employ just a single officer for an entire *soum* (Zahler et al. 2004b). Even within protected areas, rangers lack the authority to arrest people who break laws, instead being forced to find a police officer from the nearest town to do so (Wingard and Odgerel 2001). And even enforcement and arrest often do little to deter people from breaking laws, as most fines are relatively low and the judiciary is weak (Pratt et al. 2004; Zahler et al. 2004b). Neither laws nor protected areas will likely be sufficient to protect valuable species and/or habitat if land degradation and poverty are rampant and associated with poor policies,

regulations, incentives, and conflicts regarding natural use management.

Finally, even Mongolian culture can present a barrier to more effective grasslands conservation. Despite, or perhaps partly because of, Mongolia's long cultural heritage of supporting conservation (at least in rhetoric—see below; UNDP 2000; Johnstad and Reading 2003) and its low level of development, many politicians, donor organizations, and the Mongolian public at large become complacent about the state of biodiversity and the need for conservation. Prevailing attitudes are colored by romantic views of pastoralism and nature in Mongolia that prevent many people from even seeing environmental problems. Many people from Mongolia and elsewhere appear not to see some of the most pressing conservation issues in the country, or they dismiss the problems as insignificant given the size of the country and the relatively low human population and associated development. Almost any official document on Mongolia's environment includes references to the nation's pristine environment and unspoiled wilderness character. Yet huge portions of the country now sit devoid of large mammals and are increasingly affected by overgrazing, escalating erosion, and expanding deserts. Mines, both legal and illegal, produce growing mounds of toxic waste (World Bank 2006). This reality, however, remains obfuscated by an increasingly urban populace that has largely lost contact with the rural environment that surrounds them.

Opportunities

Despite many significant challenges, several factors bode well for biodiversity conservation on the Mongolian steppe. Mongolia's low human population and very low population density, while often used to discount the severity of the challenges facing conservation, do offer an opportunity to conserve and restore the nation's biodiversity, as demands on the land should remain lower than in most other countries (Reading et al. 2006). Over 1 million people live in Mongolia's capital, Ulaanbaatar, and over half a million live in the country's other cities (NSOM 2008). Thus, only slightly over 1 million people live in rural Mongolia (and most of them in towns), a number that has remained relatively constant for the past 15 years (NSOM 2004, 2008). Despite government programs aimed at increasing the country's human population, Mongolia's population growth rate has begun to decline (NSOM 2008). A stable human population would undoubtedly bode well for improved human living standards and nature conservation.

Mongolia arguably retains the healthiest wildlife populations remaining in Central Asia. Many species extirpated from or barely surviving in other parts of the region persist in relatively large numbers in Mongolia, including argali sheep, Mongolian gazelle, Przewalski's horse, Asian wild ass, wild Bactrian camel (*Camelus bactrianus ferus*), goitered gazelle, cinereous vulture, lesser kestrel, and saker falcon (Lhagvasuren et al. 1999; Reading et al. 2001a, 2002; Feh et al. 2002; Kaczensky et al. 2006). For those species that have declined, a reduction in poaching and overgrazing would likely lead to recovery and recolonization of former habitats throughout the country as those habitat still exist in relatively undamaged states.

Most Mongolians would likely support recovery of the nation's biodiversity. Mongolia boasts a long cultural tradition of nature conservation (UNDP 2000; Johnstad and Reading 2003). Mongolia's strong association with nature finds its roots in a culture that emanates from first animistic beliefs and then Tibetan-style Buddhism that arrived in Mongolia in the 1500s (Finch 1996; Germeraad and Enebish 1996; Gilberg and Svantesson 1996). Both cultural heritages, although repressed during communism, are experiencing a revival since the transition to democracy, and both strongly influence thoughts and practices in Mongolia (Bruun and Odgaard 1996). Buddhist teachings of love and respect for nature generally translate into support for conservation among Mongolians, at least in words if not deeds (Germeraad and Enebish 1996; UNDP 2002; World Bank 2003). Indeed, Mongolia's new constitution guarantees every citizen the right to a healthy environment. The idea of nomadic pastoralists living in harmony with and striving to conserve and protect nature remains the dominant view of most Mongolians (Germeraad and Enebish 1996; Reading et al. 1999, 2006). Yet we believe that conservation requires education programs to counter prevailing notions that nature remains relatively pristine in Mongolia (see above). In addition, pressure to westernize and improve standards of living presents challenges to these traditional values. Elsewhere we argue that effectively conserving Mongolia's steppe would help maintain a sustainable rural economy while protecting the nation's cultural and natural heritage (Reading et al. 1999, 2006).

Most Mongolians support creating protected areas, a tradition that stretches back centuries. Nearly 800 years ago Genghis Khan created Mongolia's first protected area, and the Bogdkhan Mountain Strictly Protected Area, established in 1778, may be the world's oldest continuously protected area (Chimed-Ochir 1997; Enebish

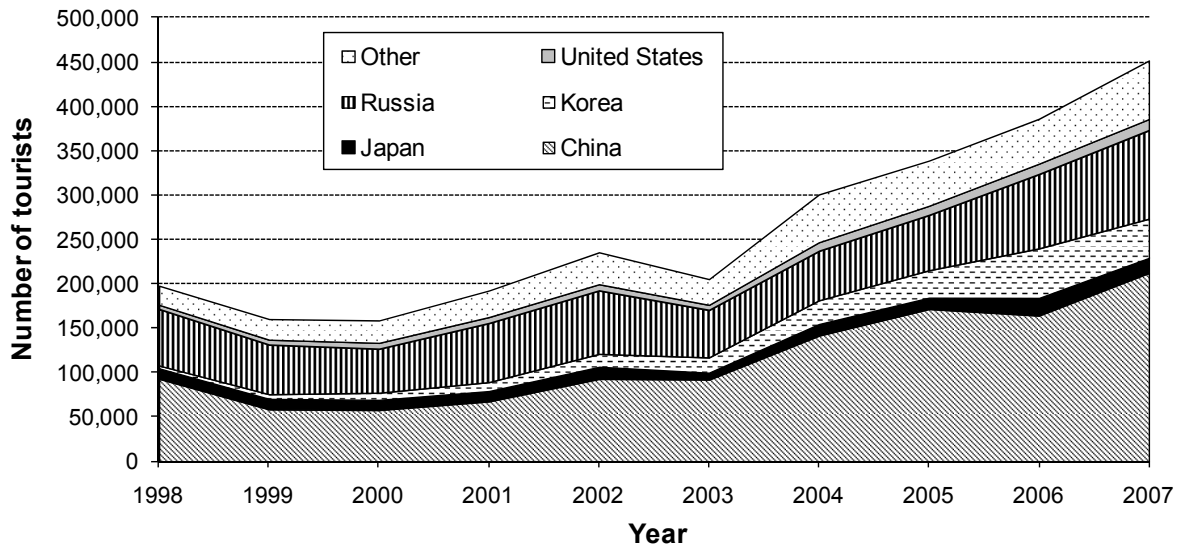


Figure 9. Number of tourists from different countries visiting Mongolia, 1998–2007 (NSOM 2004, 2008). The top five countries of origin are shown separately; other countries are grouped into the “other” category.

and Myagmarsuren 2000). In 1992 the Mongolian Parliament adopted a goal of protecting 30% of the nation's area (Chimed-Ochir 1997). Support for creating new protected areas remains strong among many Mongolians, especially pastoralists (Reading et al. 2006). Yet with over 44% of the country leased for mining or exploration, expanding the protected areas system may require waiting to see which regions of the country show the least promise for mining.

Still, most of Mongolia is undeveloped, and the grasslands remain largely a natural environment with few permanent human structures. These large expanses likely retain sufficient resilience to allow even degraded regions to recover. Cultural and nature-based tourism may provide an incentive to improve these grasslands by creating greater demand for natural grasslands supporting sustainable pastoralists and native biodiversity. Mongolia appears to intrigue a growing number of potential tourists, especially those looking for adventure tourism in a relatively safe country (Yu and Goulden 2006). As a result, tourism is rising rapidly, especially among people from more developed countries and China (Fig. 9), providing an incentive to protect the culture and biodiversity of the country (Yu and Goulden 2006).

The potential for nature-based tourism as an alternative to natural resource exploitation remains largely unknown, but tourism is apparently growing (Yu and Goulden 2006; BirdLife Asia 2009). Officially, 451,788 people visited Mongolia in 2007, an increase of over

285% since 2000 when only 158,205 people visited the country (Fig. 9) (Byambatseren 2004; NSOM 2008). Most visitors, about 85%, arrived via the railroad from Russia or China, suggesting that many came to Mongolia to conduct business rather than for tourism (BirdLife Asia 2009). Nevertheless, we and others believe that the trend in numbers of visitors to Mongolia reflects a growing number of tourists since the start of this century (Byambatseren 2004; Yu and Goulden 2006; NSOM 2008; BirdLife Asia 2009). As stated previously, the reason most visit Mongolia is likely for cultural-based tourism to view the nomadic lifestyle of pastoralists, not nature-based tourism (Yu and Goulden 2006). Cultural tourism in Mongolia requires conserving rangelands to maintain the nomadic culture and wild species that tourists long to observe. Nature-based tourism provides an opportunity to increase the length of tourists' stay in Mongolia, as well as to expand the number of areas in the country that benefit from the industry. Doing so also may increase support for biodiversity conservation by local people who benefit from expanding tourism to include nature-based activities (Walpole and Goodwin 2001; Sekhor 2003).

Protected areas in Mongolia generated about 30% of their budget from tourism (primarily), international aid, and the collection of fines, which could be much higher if officials collected all fines issued (World Bank 2003). Currently, entrance fees to protected areas remain low, and we believe that Mongolia could increase funding for biodiversity conservation by increasing these fees.

In addition, partnerships between nature-based tourism operators and protected-areas-management authorities offer a potentially valuable source of additional funding for protected areas management. In Ikh Nart Nature Reserve, for example, the Dalanjargalan Soum government entered into an agreement with a for-profit tourism operator that has provided some funding for the protected area and also provided economic returns to local pastoralists. In Mongolia, *soum* governments manage federally designated nature reserves, but receive no federal funds for doing so. In this case the Dalanjargalan Soum government provided a tour company exclusive rights for managing international tourism in the *soum*'s portion of the reserve in return for a conservation head tax that supports reserve management. The tourism company also preferentially hired local people and rented horses and camels from local people when available. Other initiatives organize local women into small cooperatives to produce crafts to sell to tourists. Such local benefits generally translate into increased support for conserving reserves and their biodiversity (Walpole and Goodwin 2001; Sekhor 2003; Stem et al. 2003; Gadd 2005). Also, by limiting occupancy in camps (a maximum of 14 guests in Ikh Nart, for example) and using low-impact technologies, such as local *gers* (or yurts), composting toilets, and wind and solar power, the returns to the local people and to conservation efforts far outweigh visitor impacts.

Hustain Nuruu National Park relies on another nature-based ecotourism model to generate income. In this protected area the park administration, in cooperation with the Hustai Trust (which includes board members from local governments and the nonprofit Mongolian Association for the Conservation of Nature), runs their own nature-based tourism operation. This model generates revenue for conservation and management activities, providing a greater return than found in most protected areas of Mongolia.

The above examples help illustrate how nature-based tourism can help conservation efforts in protected areas of Mongolia. Further increasing nature-based tourism and associated revenue requires additional capacity-building in the nature-based tourism sector, including improved infrastructure (accommodations, travel, etc.); better trained, more knowledgeable, and, ideally, certified guides; and more aggressive marketing (Yu and Goulden 2006; BirdLife Asia 2009). Most high-end nature-based tourism to date has focused on fishing and trophy hunting; however, we believe that Mongolia could expand high-end nature-based tourism, especially with more and better wildlife viewing opportunities. In Ikh Nart,

such opportunities arose from strong law enforcement (especially antipoaching activities) coupled with an active research program that helped habituate animals in the reserve to humans. Tourism also creates ecological and socioeconomic impacts that require mitigation to prevent degrading the biodiversity and cultural integrity of the local people that tourists come to see (Johnstad and Reading 2003; BirdLife Asia 2009). These issues remain little addressed in Mongolia and could threaten the sustainability of the nature-based tourism industry (Reading et al. 2006).

SIMILARITIES, CONTRASTS, AND OPPORTUNITIES FOR THE GREAT PLAINS

The climate, topography, soils, wildlife, and vegetation of Mongolia's steppes are similar to North America's Great Plains in many ways (Johnson et al. 2006). Fire, climate, and grazing by communal rodents and large ungulates strongly influenced the formation of ecological communities in both the Great Plains and Mongolian steppes (Bragg and Steuter 1996; Johnson et al. 2006; Steinauer and Collins 1996; Weaver et al. 1996). Several of the same wildlife species (e.g., wolves, red foxes, horned larks [*Eremophila alpestris*], and golden eagles [*Aquila chrysaetos*]) inhabit both ecological regions; and ecological homologs, often from the same genus, render the two regions quite similar ecologically and seemingly familiar to people who visit both (Table 2) (Samson and Knopf 1996). Likewise, many of the same plant species (e.g., fringed sagewort [*Artemisia frigida*] and junegrass [*Koeleria macrantha*]) or the same genera of grasses (e.g., *Stipa*, *Elymus*, *Festuca*, and *Poa*) and shrubs (*Artemisia* and *Krascheninnikovia*) characterize grasslands in both areas. Of course, differences exist between the two regions associated with regional climate, latitude, elevation, soil, and historical use by humans. In general, the Mongolian steppe stretches east to west, while the moisture gradient runs from the wetter north to the more arid south and most precipitation occurs in July and August. The Great Plains, alternatively, stretches north to south with more mesic conditions to the east and more xeric conditions to the west (Samson and Knopf 1996). In contrast to Mongolia, the Great Plains receives more precipitation more evenly distributed throughout the growing season (April through September) and more in spring.

People have long viewed the grasslands of Mongolia and North America as ideal habitats for extensive livestock production operations. Although cultivation transformed

TABLE 2
 EXAMPLES OF BIRD AND MAMMAL ECOLOGICAL HOMOLOGS INHABITING
 THE GREAT PLAINS OF NORTH AMERICA AND THE MONGOLIAN STEPPES

Ecological role	Great Plains homolog	Mongolian steppe homolog
Jumping rodent	Kangaroo rats (several) Several genera	Jerboas (several) Several genera
Colonial rodent	Black-tailed prairie dog <i>Cynomys ludovicianus</i>	Siberian marmot <i>Marmota sibirica</i>
Hare	Jackrabbits <i>Lepus</i> spp.	Tolai hare <i>Lepus tolai</i>
Polecat	Black-footed ferret <i>Mustela nigripes</i>	Siberian polecat <i>Mustela eversmanni</i>
Badger	American badger <i>Taxidea taxus</i>	Asian badger <i>Meles leucurus</i>
Small fox	Swift fox <i>Vulpes velox</i>	Corsac fox <i>Vulpes corsac</i>
Large fox	Red fox <i>Vulpes vulpes</i>	Red fox <i>Vulpes vulpes</i>
Large canid	Grey wolf <i>Canis lupus</i>	Grey wolf <i>Canis lupus</i>
Small felid	Bobcat <i>Lynx rufus</i>	Pallas's cat <i>Otocolobus manul</i>
Large felid	Puma <i>Puma concolor</i>	Eurasian lynx <i>Lynx lynx</i>
Small, fast grazer	Pronghorn <i>Antilocapra americana</i>	Mongolian gazelle <i>Procapra gutturosa</i>
Wild sheep	Audubon's bighorn (extinct) <i>Ovis canadensis auduboni</i>	Argali <i>Ovis ammon</i>
Deer	Mule deer <i>Odocoileus hemionus</i>	Siberian roe deer <i>Capreolus pygargus</i>
Elk	Wapiti <i>Cervus elaphus</i>	Wapiti (red deer) <i>Cervus elaphus</i>
Large eagle	Golden eagle <i>Aquila chrysaetos</i>	Golden eagle <i>Aquila chrysaetos</i>
Large falcon	Prairie falcon <i>Falco mexicanus</i>	Saker falcon <i>Falco cherrug</i>
Kestrel	American kestrel <i>Falco americana</i>	Common/lesser kestrels <i>Falco tinnuculus/naumanni</i>
Large <i>buteo</i>	Ferruginous hawk <i>Buteo regalis</i>	Upland buzzard <i>Buteo hemilasius</i>
Vulture	Turkey vulture <i>Cathartes aura</i>	Cinereous vulture <i>Aegypius monachus</i>
Large owl	Great horned owl <i>Bubo virginianus</i>	Eagle owl <i>Bubo bubo</i>
Medium owl	Long- and short-eared owls <i>Asio otis/flammeus</i>	Long- and short-eared owls <i>Asio otis/flammeus</i>
Small owl	Burrowing owl <i>Athene cunicularia</i>	Little owl <i>Athene noctua</i>
Upland game birds	Prairie chickens and grouse Several genera	Daurian partridge/chukar <i>Perdix dauricus/Alectoris chukar</i>
Sparrowlike birds	Various sparrows Several genera	Various buntings <i>Emberiza</i> spp.
Pipits	American/Sprague's <i>Anthus spinoletta/spargueii</i>	Several species <i>Anthus</i> spp.

the vast majority of the Great Plains' more mesic prairies into croplands, livestock grazing dominates farther west as conditions become drier and more similar to the Mongolian steppes (Licht 1997).

When Europeans first settled the Great Plains, it too was an open access system colonized by livestock producers who ranged their stock across vast portions of the region (Manning 1995; Licht 1997). As the European population increased, however, privatization of pasturelands occurred in North America, and today, private landowners control most of the Great Plains. For example, Licht (1997) reports that only 0.2% of the tallgrass prairie, 1.6% of the mixed-grass prairie, and 7.9% of the shortgrass prairie were publicly owned in the mid-1990s. Similarly, the amount of public land in states lying fully within the Great Plains is a mere 0.9% for Kansas, 1.6% for Nebraska, 2.3% for Oklahoma, 4.9% for North Dakota, 6.0% for Missouri, and 7.5% for South Dakota (NRCM 2000). Actual protected areas, where biodiversity conservation represents the highest priority, comprise an even smaller percentage in each state. In contrast, attempts to privatize the Mongolian steppe have met with stiff resistance by nomadic pastoralists who vociferously protested and effectively halted the national government's privatization efforts. These herders have stressed the need for seminomadic movement of herds to sustain their animals under frequent droughts and snow events.

Coupling Nature-Based and Cultural-Based Tourism

In Mongolia, tourism operators are developing nature-based tourism to complement the cultural-based tourism that already exists there. This approach offers a potential model for the Great Plains that some private landowners could adopt to complement uses and values found on the Great Plains. Interest in dude ranches and Native American Plains cultures appears to remain high in the United States, Europe, Australia, Japan, and other countries and regions of the world. Biodiversity conservation could provide added amenity to tourism operations through nature-based tourism in the Plains as well. Such nature-based tourism operations provide rural jobs that often appeal to young adults and women (BirdLife Asia 2009). Restoring relatively large populations of large mammals and birds would improve nature-based tourism by increasing wildlife viewing opportunities. Although hunting provides some tourism opportunities, hunter numbers in the United States have declined by 2.5 million between 1996 and 2006 while wildlife watching

has increased by 13% in the same period (Crary 2007), suggesting that nonconsumptive uses will continue to increase in importance.

The time for encouraging alternative models for land use in the Great Plains has never been better. With a declining human population and a struggling economy, many residents of the rural Great Plains are looking for new ideas (Flores 1996; Licht 1997). In both the steppes of Mongolia and the prairies of North America, tourism may offer a way to enhance livelihoods enough to help sustain economies and stabilize communities (Flores 1996; Stem et al. 2003; Gadd 2005). And since successful long-term tourism requires a clean and healthy environment, the flora and fauna of both regions would also benefit. Licht (1997) argues that livestock production in much of the Great Plains, especially the more arid portions, appears unviable without government assistance. We and others (e.g., Flores 1996) argue that additional income from tourism could replace the need for government subsidies in many areas and complement livestock production, thus improving livelihoods in these areas.

Rangeland Improvements and Grazing Reform

Grazing reform would arguably offer the greatest benefits to both sustainable livestock production and wildlife conservation in Mongolia and perhaps in the Great Plains. In Mongolia, both local experts and expatriates have suggested several types of grazing reform, from privatization to creating exclusive grazing zones (larger than soums) to a variety of comanagement schemes (Ykhanbai et al. 2004; Fernandez-Gimenez 2006; Schmidt 2006). Privatization of grazing land is unlikely in Mongolia given herders' strong opposition and recognition of the need for flexibility and mobility in the highly variable environment that characterizes the Mongolian steppe (Fernandez-Gimenez 2006). Creating large, exclusive grazing zones would not resolve overstocking and associated degradation within these zones, and so it would still be necessary to control livestock numbers (Fernandez-Gimenez 2006).

Fernandez-Gimenez (2006) and Schmidt (2006) recommend comanagement of grasslands with local or *aimag* government oversight. Such an approach would capitalize on the knowledge and expertise of local pastoralists, while developing a regulatory plan to help ensure greater sustainability. Ykhanbai et al. (2004) see such arrangements as including groups of associated herders, women's groups, local government comanagement teams, joint haymaking and other activities to manage risk, and investments



Plate 8. Mongolian Steppe with Damoiselle Crane (*Anthropodes virgo*; foreground) and Domestic Bactrian Camels (*Camelus bactrianus*; middle) in Gun Galuut Nature Reserve, Tov Aimag, Mongolia. In the background a herd of domestic sheep and goats graze near traditional gers (or yurts) just outside the reserve. Photo by Richard Reading.

in husbandry research. Forming comanagement schemes that link several herders together working with local governments could also facilitate the establishment of reserve pastures (similar to grass banks in the United States), which likely would benefit pastoralists and wildlife. This in turn requires strengthening local institutions and building capacity among pastoralists and local government officials (Bedunah and Schmidt 2004). Schmidt (2006) and others are working to accomplish this very task.

Unfortunately, the type of grazing reform that Mongolia requires seems elusive. Indeed, the Mongolian government recently passed legislation that guarantees pastoralists a certain price for cashmere, providing an incentive that likely will contribute to further increases in the number of goats. Such incentives likely will exacerbate overgrazing problems by subsidizing cashmere goats.

Some people are calling for grazing reform in the Great Plains as well (e.g., Licht 1997; Donahue 1999; McCluskey and Rausser 1999; Wuerthner and Matteson 2002, but see also Heitschmidt et al. 2001), and we and others see a need to transform the ways that livestock producers approach their grazing operations. As in Mongolia, cooperative management of rangelands may offer an opportunity for improved range management, benefits from economies of scale, and greater prospects for biodiversity conservation. Already, ranchers in many parts of the United States form grazing associations, usually for cooperatively grazing livestock on public lands. Combining grazing areas using similar cooperative agreements might provide benefits to groups of ranchers, especially for summer grazing areas that could greatly reduce costs associated with managing livestock and providing fewer fences and fragmented areas that represent poor habitat for many wildlife species. Baydack et al. (2006) outline several ideas for grazing reform in the Great Plains. They identify current agricultural policies, particularly subsidies in the farm bill, as a significant barrier to sustainable agriculture in the Great Plains. Future policies, in their opinion, should integrate conservation, agricultural reform, and community development. More specifically, Baydack et al. (2006) call for improved land stewardship, stronger conservation policies, more grassland restoration efforts, internalization of the full costs of agriculture, increased innovation, a stronger focus on economic viability, and a more complete consideration of the costs and benefits of land use in the Great Plains, including the social costs and benefits.

Some comanagement initiatives for improving grasslands management currently underway in Mongolia may offer prototypes that people in the Great Plains could

adapt to the different context found in North America. Comanagement could offer economies of scale to smaller landowners and, coupled with cooperative cultural- and nature-based tourism operations, might provide more viable, sustainable business alternatives that improve local livelihoods while contributing to biodiversity conservation in the Great Plains. Ranchers in other regions of the United States have come together to coordinate management. For example, in the Blackfoot Valley of Montana a landowner group coordinates management on a 600,000 ha watershed, joining with other groups (private and public) to improve habitat for wildlife and conserve their agricultural lifestyle (www.blackfootchallenge.org).

Improved livestock grazing management promises to benefit wildlife and livestock in both Mongolia and the Great Plains. Reducing overgrazing and improving risk management (through approaches like reserve pastures or so-called grass banks) would increase vegetative cover and reduce erosion and desertification. This in turn should improve the quality and viability of livestock, thereby increasing sustainability. Improved grassland management should also simultaneously benefit wildlife, as residue vegetation and reserve pastures would provide more forage. Of course, greater numbers of wild ungulates could increase competition for forage for livestock, although in both areas we have often heard people express the perception of high levels of competition between wild ungulates and livestock with little data to quantify the degree of competition (authors' pers. observ.). Revenue from nature-based tourism that goes to pastoralists in Mongolia and ranchers in the Great Plains could help mitigate such concerns. We therefore recognize the desirability of developing nature-based tourism (see above) simultaneously with certain grazing reforms and improved grazing management. We believe such an approach would benefit both the human communities and biodiversity in the grasslands of Mongolia and North America.

ACKNOWLEDGMENTS

This manuscript benefited from conversations with, and helpful comments from, a number of people, including A. Bräunlich, Chimgee, C. Finch, T. Galbaatar, Galbadrakh, A. Laurie, B. Lhagvasuren, H. Mix, S. Sevrerlinghaus, T. Tuya, J. Wigsten, G. Wingard, and J. Wingard. Three anonymous referees and editor R. Edwards made comments and suggestions that greatly improved the quality of the manuscript. Support of much of our work in Mongolia has been provided by the Earthwatch Institute, Denver Zoological Foundation, GTZ (German

Technical Cooperation), Mongolian Academy of Sciences, Mongolian Conservation Coalition, Trust for Mutual Understanding, and University of Montana.

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The Center for Great Plains Studies,
University of Nebraska–Lincoln,
and
Great Plains Research
wish to thank the

Denver Zoological Foundation

for its generous support of the publication of this
Special Issue
on

“Saving the World’s Grasslands”



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