

Mongolia's rangelands: is livestock production the key to the future?

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Approximately half of the world's land area is rangeland. This land type is characterized by low, yet highly variable productivity, low-fertility soils unsuited to cultivation, a native flora dominated by herbaceous and/or shrubby species, and, often, a history of degradation. Rangelands include the savannas of southern Africa, shrublands in western Australia, prairies in central North America, and steppe grasslands in northeastern Asia. Not only do these landscapes occur on all continents, but nearly a quarter of the world's human population – over 1.5 billion people – lives on or immediately adjacent to this land type (Grice and Hodgkinson 2002).

Also common on these landscapes are gregarious herds of large grazing animals. The ruminant digestive system common to the dozens of extant and extinct species typical of rangelands evolved about 20–30 million years ago as a remarkable symbiosis of micro- and macro-organisms (Hume and Warner 1980). This mutualistic anaerobic digestive system efficiently breaks the carbon bonds of plant cellulose unavailable to typical aerobic and acidic mammalian digestion and thereby frees masses of renewable energy captured within these rangelands. From these herds emerged the three main ruminant species (all within the family Bovidae) – aurochs (*Bos primigenius*), mouflons (*Ovis orientalis*), and wild goats (*Capra aegagrus*) – which were domesticated between 10 000 and 5000 years ago. Domestication, characteristic of only a very few mammalian species, occurred in a number of locations and under diverse conditions, from sedentary to nomadic cultures, in agrarian and hunter-gatherer societies, both before and after the domestication of plants (Clutton-Brock 1981). However, common to all of these instances of domestication across south-eastern Europe and Asia was the presence of rangelands.

Today, 90% of the world's more than

3.3 billion head of domesticated grazing animals are cattle, sheep, and goats that originated from these three species. And the number of grazing ruminant animals continues to grow disproportionately by continent. Since the middle of the 20th century, populations of cattle, sheep, and goats have increased by more than 1.3 billion head, with large increases on the Asian, African, and South American continents (FAO 2003).

Concurrent with this increase is the continued presence of human populations linked as pastoralists to these lands and their livestock (Figure 1). Over 600 million people, or 50% of the world's poor, living on US\$1 or less per day, are engaged in subsistence animal husbandry. One person in 10 is still directly linked to a grazing livestock-based, agrarian culture within a rangeland setting, a lifestyle that traces its origins to the domestication of animals nearly 10 millennia ago. The environmental, political, social, and economic impacts of this persistent culture are substantial: locally, regionally, and globally (Steinfeld *et al.* 2006).

Although meat protein intake per capita in developed nations exceeds the global average and nutritional requirements, demand on those nations' rangelands has abated. In part, this is because meat production is more reliant on intensive agriculture, and rangeland landscapes are increasingly used for alternative services, such as retirement destinations and recreational activities.



Figure 1. Traditional system of domesticated grazing animals on Mongolian rangeland.

However, in developing areas of the world, where daily per capita meat consumption is rising, meat (and fiber) production continues to rely on native grazing lands.

In the management of our native environments, traditional provisioning services (eg food and fiber production) may not have to be sacrificed to provide a broad array of conservation and protection services (Barbier *et al.* 2008). However, managing these trade-offs requires knowledge of the values of all these ecosystem services and resulting economic opportunities, and this knowledge is often lacking for the less traditional services that may be provided by rangelands (Homewood *et al.* 2001).

So, we are faced with a complex issue. Ecologically diverse services are being demanded by a growing population, from a land type that dominates the world's land surface. Yet, traditional ways of life that link people to land and animals are still valued and are providing livelihoods to a considerable portion of the world's population. These links are being broken, either through generational shifts away from pastoral lifestyles (eg Hoffman and Rhode 2007) or as a result of government policies, such as the array of recent Chinese reforms that include relocation of pastoralists to the fringes of urban environments (Li *et al.* 2007). However, pastoral lifestyles remain ubiquitous around the globe. Many of

these people live at poverty levels, and the continued threat of resource degradation – caused, in part, by this use – has profound environmental impacts (Steinfeld *et al.* 2006). Can these traditional links sustainably co-exist within the broader set of services now being demanded from these landscapes? What does sustaining these traditional links mean in terms of the persistence of poverty and resource degradation within pastoral communities?

A discussion of this issue could occur without reference to a specific landscape, and would still have considerable value. However, tying this discussion to a specific place and people brings in an emotional component that is extremely germane. In the end, this discussion is about people, where they live, how they interact with the land and other people, and the broader impacts of their existence. So, for this conversation, we will direct the debate to the expanse of grasslands that occur in Mongolia, one of the world's great regions of grazing lands, but a country that is increasingly accessed by the outside world because of its beauty, biodiversity, history, and cultural richness (Johnson *et al.* 2006). Here, two individuals with very different backgrounds and perspectives, but with a shared passion and concern for these landscapes and its people, will share their thoughts on this issue.



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Livestock production is not the key to the future of Mongolia's rangelands. The key is developing markets for a suite of ecosystem services that fulfill three criteria: (1) providing steadily growing incomes for Mongolia's rural population, (2) preserving the land on which these services depend, and (3) persisting through short-term and long-term climate variability, including both drought and *dzud* (an episode of extreme winter weather that may include temperatures below -50°C , and deep snow or ice covering available forage). All of these conditions are exacerbated by summer drought, which weakens animals and reduces winter forage availability

Livestock production fulfills none of these three criteria. Mongolia's per capita gross net income (GNI) increased from US\$390 in 2000 (the year of the first democratic elections) to US\$880 in 2006 (World Bank 2008). Increased income is disproportionately concentrated in urban areas, a fact that is reflected quantitatively in the declining contribution of agriculture to gross domestic product (GDP), from 33.8% to 21.1% of GDP during the same period.

One of the few income-enhancing options available to livestock producers is to increase the size of their herds. The current land tenure system tends to promote this strategy,

because land is held in common, while livestock are privately owned. The result is overgrazing, leading to land degradation (Criterion 2). Livestock production is neither economically nor ecologically sustainable during droughts and *dzuds*, both of which are common in Mongolia (Criterion 3). There is increasing evidence that some responses to drought may also negatively impact other ecosystem services, such as wildlife viewing. For example, Retzer *et al.* (2006) argue that, during droughts, herds are moved into mountain pastures from lower elevations. This increases competition with wildlife during periods when forage supplies are already reduced. Declines in wildlife populations reduce potential income from wildlife viewing and trophy hunting.

Wildlife viewing and trophy hunting are just two of many emerging markets for ecosystem services in Mongolia. The Millennium Ecosystem Assessment (MA 2005) identifies four types of ecosystem services: provisioning, regulating, cultural, and supporting. Many of the provisioning services, including livestock production, have the best-developed markets, and ecosystems are therefore often managed to maximize the production of these services. However, there are already a number of markets in Mongolia for ecosystem services that meet, or could meet, the three criteria listed above. Tourism, which creates markets for both cultural and supporting ecosystem services, is increasing. Tourists are drawn by the country's landscapes, and the opportunities for wildlife viewing and trophy hunting. The vast, diverse, and largely unfenced landscapes of Mongolia provide visitors with a wilderness

experience similar to that of the northern Great Plains and Rocky Mountains of the US over a century ago. Taimen, the world's largest salmonid, attract anglers who pay thousands of dollars for catch-and-release fishing. Trophy hunting accounts for a small proportion of visitors, but each tourist spends large amounts of money in the country (Asian Development Bank 2005).

These existing markets have excellent growth potential, as evidenced by glowing reviews in diverse publications including *The Atlantic* (www.theatlantic.com/doc/200102/bodio) and adventure travel websites. In addition, there are a number of potential future markets, including carbon sequestration (Su *et al.* 2003) and direct payments for biodiversity conservation (Ferraro and Kiss 2002). The latter may be particularly viable in Mongolia, which has a population density of fewer than two people per square kilometer.



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I find the three criteria Jeff proposes too superficial to use in the context of livestock production from Mongolian rangeland. Livestock production has been and is the main source of income for Mongolia's rural population, and it does have the potential to provide a steady income for the rural population.

More than one million people residing in rural areas – half of Mongolia's total population – earn up to 70% of their income from the trading of raw and processed livestock products (Figure 2). Among these, 170 000 herder households – about 800 000 people – depend entirely on livestock for their livelihoods. I also believe that there are substantial opportunities for livestock production to become a steady source of income for the Mongolian people. The country has a competitive advantage in that the animals graze on natural pastures all year around.

I work in the Mongolian branch of the Swiss Agency for Development and Cooperation; we have initiated several projects investigating options for high value products made from livestock raw materials. We have found that there are tremendous opportunities for these services to contribute to rural incomes. For example, we tested the feasibility of producing camel milk and the raw materials for beauty products, such as moisturizing cream. Herders, a processing company, and researchers have teamed up and, in a 1-year period, have taken products from these rangelands to the shelves of a supermarket. Herders involved in these projects were able to double their incomes. Now, more and more herders are joining the supply chain. Most herders in Mongolia are literate and extremely adaptable. Working as a team, we have developed a brand called "CameLact", along with quality standards and a certification system. I

would not be surprised if "CameLact" soon appeared in the markets of the Middle East or Europe. There is also a huge export market in neighboring China, where demand for meat and other products of animal origin is increasing.

A switch to production of other ecosystem services could cause environmental damage. For instance, in terms of waste production and other infrastructure-related disturbances, such as road construction and increased use of fossil fuels, tourism's environmental impacts would greatly exceed those of nomadic livestock production. Nomadic herding is a livelihood for Mongolians rooted in the traditional knowledge of the nation, and maintains harmony with the fragile ecology of the country. My grandfather, a respected, elderly herder, was always careful to straighten up the bush where he would tie his horse and to clean the site when we moved to the next camp. It was, and still is, a social norm among herders to take care of the pasture, water, and natural resources on which their livelihoods depend.

I would also question whether many of the alternative sources of income proposed by Jeff, such as tourism, would be viable at times of the year when temperatures reach close to -30°C . In Mongolia, we have inhospitable weather for 6 months of every year. Not many tourists would come during such conditions. Whether tourism could create a steady income and as many jobs as livestock keeping is therefore questionable.

Switching to a new economic system would not be easy for people who have been nomadic herders for generations. This way of life is more than just a source of income; it is a big part of our culture, traditions, and values.

For me, the concept of ecosystem services is still rather theoretical. I don't know of any country where a diverse array of ecological services produced from rangelands supports rural economies and populations. For Mongolia, the priority should be to build upon what we already do well, rather than to look for alternative solutions with which we have no experience. The priority should therefore be to maintain the traditional system of nomadic livestock keeping that is ingrained in the knowledge and experience of the natural resources base upon which it depends. It is more feasible to build upon what we already do well, in harmony with nature. Mongolia should improve livestock keeping for better stewardship of the natural resources base on which it depends, rather than looking for solutions where we have no experience at all.



Jeff Herrick replies

Enkh makes several good points regarding the potential limitations of increasing rural incomes, and the stability of those incomes, through alternative ecosystem services. I agree that there are opportunities to increase rural incomes by developing value-added industries.

I would argue, however, that sustaining Mongolia's land

and its rural people will also require increasing the value of the livestock production system itself, including the land. Markets for additional ecosystem services then become economic buffers, helping the rural population to survive catastrophic climatic events, like the *dzuds* of 2000–2002, during which over 11 million head of livestock were lost. By serving as economic buffers, alternative ecosystem services also help to protect the ecosystem, because there is less incentive to quickly restock following multi-year droughts. Markets for alternative ecosystem services could also help to close the urban–rural income gap, which continues to widen (UNDP 2003).

A recent UN report on urban–rural disparities in Mongolia states that, “Opportunities for human development are unequal, based largely on geographic location. Rural residents have less access to education, health care, information, jobs, and other human development opportunities than their urban counterparts” (UNDP 2003). It is possible that Mongolians will choose to remain on the land with small herds of livestock despite this growing inequity, but experiences in other parts of the world suggest otherwise. For example, in the Bolivian *altiplano*, the introduction of the tractor has allowed individual farmers to cultivate larger areas of land, generating sufficient income to purchase a truck and commute to their fields from urban centers, where there are educational, telecommunications, and health services. Many have subsequently abandoned livestock production, which requires permanent residence in remote areas.

The lack of experience working with alternative ecosystem services is, as Enkh points out, a limitation. By ignoring these potential avenues, however, we risk not only missed opportunities to improve rural livelihoods, but the possibility that they will be unsustainably exploited by others. For example, experience throughout the world indicates that tourism will continue to grow. In many areas, however, the profits are concentrated in large cities, where tour companies are based.

Furthermore, as Enkh also indicates, tourism can cause substantial degradation. The landscapes of Mongolia are extremely attractive to off-road enthusiasts (eg www.gobidesert.mn). Who will benefit from their activities? How will the negative impacts of their visits be minimized? And how will Mongolian herders be paid for the other benefits of sustainable land management, such as global air quality and biodiversity conservation? The collective lack of experience in developing these markets can only be addressed through international cooperative efforts, including research (Herrick and Sarukhan 2007), in concert with local development initiatives. We need to find ways to promote the markets for ecosystem services that



Figure 2. Mongolian herders collect milk and other products from their livestock.

have the potential to benefit the land and the people, while moving quickly to mitigate those activities that could lead to degradation.

Perhaps livestock production is one of the keys to the future of Mongolian rangelands. However, to be ecologically and socially sustainable, this must be refined and combined with other, carefully crafted options that provide diversified sources of income. A strategy of adding value to agricultural products, combined with adding value to the production system itself, may offer the best hope for both Mongolia’s people and its lands.



Enkh-Amgalan Tseelei replies

I very much agree with the points Jeff raises regarding the creation of economic buffers.

The need for alternative income-generation opportunities for herders is especially important during years of natural disasters, such as extended droughts. Unfortunately, Mongolian herders often simply increase the number of livestock to increase their income, given their free access to public pasture land. It is a replay of the classic “tragedy of the commons”. Currently, it is estimated that the carrying capacity of grazing lands in Mongolia is already exceeded by 60% (Green Gold Program 2007).

In Mongolia, over 60% of herders own fewer than 200 animals. This does not generate enough income to support basic needs. I have been working in the field of development cooperation for some years now, dealing mainly with poverty and environmental concerns. Simply put, these conditions are very tough. When people are living in poverty and have no outside job opportunities and little income, their priorities are very different. The capacity of herders in these impoverished rural settings to adopt new concepts, especially complex concepts, is very limited.

Another concern involves the complexity added by cli-

mate change. More than 80% of Mongolia has been identified as sensitive and vulnerable to climate-driven extremes. Sixty years of meteorological records (1940–2000) show that the national average temperature has increased by 1.56°C, with a maximum increase of 3.6°C in the mountainous western region. Drought has increased significantly in Mongolia over the past 60 years (UNEP 2005). During the past 4 years, about 3000 water sources, including 680 rivers and 760 lakes, have dried up.

That is why I think that, to some extent, the international research community and development agencies have a responsibility to communicate basic ecological principles in an understandable manner to ordinary people in rural areas. There is so much information available at research institutions, such as the one where Jeff works, but the people who directly interact with nature – like the herders and other inhabitants of the rural areas in Mongolia – are simply not aware of how critical the situation has become. I do acknowledge that, as people living in these settings, we must care more. Yet, there are problems beyond our capacity, knowledge, and skills; sometimes, the social problems, poverty, and unemployment are just overwhelming. The most important thing now is to raise awareness of these issues. The use of ecologically-based principles of land management remains at the core of the ability of private land owners and public land managers to provide existing and emerging services (Havstad *et al.* 2007).

I agree with Jeff's argument that it has to be a combination of adding value to agricultural products, as well as to the production system itself, and the situation needs rather urgent responses. First, we must build and improve the livestock sector to relieve the social and economic pressures on the Mongolian people. Then we can begin to work toward increasing their capacities to provide additional goods and services.

In Mongolia, land has no assigned economic value. But I believe that the entry point to relieving the social and economic pressures on the Mongolian people lies with improving the livestock sector. We need to sort out this key issue first, and then work to develop more diverse goods and services from these landscapes.



Jeff Herrick replies

As ecologists, we live in a world in which the knowledge we generate is (1) insufficient, (2) inaccessible, or even (3) irrelevant to those who make daily decisions about ecosystem management. Enkh has clearly illustrated that the productive application of ecological knowledge in Mongolia is often limited by all three of these factors. This is generally true throughout the developing world, and even in the US. It is insufficient because we know too little about the impacts of climate change and its interactions with other drivers. It is inaccessible because our knowledge is too infrequently inter-

preted in the context of local conditions, translated into local languages, and communicated at the appropriate time and place or through the appropriate media, where these exist. It is also often irrelevant, because key factors, such as land tenure, often have nothing to do with ecological knowledge (Reynolds *et al.* 2007).

I concur with Enkh that we need to begin by working with the existing local production systems, in Mongolia and throughout the world. Following this discussion, I now agree that livestock production is a key to the future of Mongolia's rangelands, and that livestock production probably has greater potential in Mongolia than in other parts of the world. But I also continue to believe that alternative ecosystem services can and will play an increasingly important role in both ecological and economic sustainability, and that the international community of ecologists has a responsibility to support the development of management systems that can generate these services in ways that respect and build on the knowledge and expertise of local managers and scientists.



Enkh-Amgalan Tseelei replies

Rangeland management and the products it generates, whether livestock production or a broader set of ecosystem services, are parts of a rangeland-based value chain process. In this sense, improvements in sustained livestock production or development of a more diverse set of ecosystem services may result in an increased appreciation of rangeland and its inherent values. With livestock production, pastoralists have the potential to vertically integrate additional values, or engage in provisioning services, as in the example of new products made of camel milk. Development of another set of ecosystem service products may allow horizontal integration of these values. For example, tourist activities, such as camel trekking in the Gobi desert and off-road driving adventure tours in the steppe, may have different values than does the vertical integration of livestock production in these systems. In Mongolia, each and every landscape can have its own specific set of vertical and horizontal values.

However, this calls for a different perspective from the Mongolian people on what we value from our rangeland. At present, in most countries that contain rangelands, it is treated as a fixed asset to production, the value of which is mainly estimated with reference to its pastoral productivity. We would need to treat rangeland as a complex ecosystem, which has far more implications for sustainable production. To do this will require a broad perspective from ecologists, and more thorough evaluations of additional goods and services. Do we yet know the true value of these rangelands?

Our planet is changing very quickly, not only in terms of economics, but also in terms of the natural world. Mongolia is a country with a sensitive environment, and

thus may clearly reflect environmental changes. Even today, we can witness tremendous changes occurring across the country. Could changes in Mongolia be a portent of what is going to happen to the world in the coming years? Diversifying the basis of our subsistence from these lands is very important, but it may be more important to learn how to contend with the changes these landscapes are undergoing now and in the near future, as a result of broader global dynamics.

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