

Environmental challenges in Mongolia's dryland pastoral landscape

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Abstract

Changing environmental, economic, and political conditions since 1990 have impacted Mongolian pastoralism. Privatization of livestock, reduced government support, and immediate livelihood needs have affected traditional herding practices and human-environment dynamics. This study examined herder perceptions of major challenges facing pastoralism today. Mongolian herders identified ongoing ecological processes as dominating daily life and actions. Results established that environmental conditions, particularly water resources and pasture quality, were paramount concerns. Transformation to a market economy coupled with limited state assistance over the last 15 years has decreased rural water supplies, reduced mobility, and increased overgrazing, leading to land degradation. Herders specified water availability, variable precipitation, insect invasion, adequate pasture, and extreme winters as the primary pastoral challenges.

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1. Introduction

Water, grazing land, and mobility are central to most pastoral livelihoods in arid landscapes. Today the subject of dryland pastoralism includes concerns about land degradation, desertification, and human impact on the environment. Much of the debate concentrates on Africa, where extensive research has taken place across dryland regions of the Sahel, East and southern Africa (Hiernaux, 1996; Eriksen, 2001; Sporton and Thomas, 2002). Investigations in the Middle East (Al-Eisa., 1998; Gardner, 2005) and more recently on degraded arid lands in China (Li et al., 2006; Liu et al., 2005) continue efforts to understand dryland processes. Under-researched, however, are the cold drylands of Inner Asia (Li et al., 2006; Sugita et al., 2007). In an effort to make arid lands dialogue more inclusive and relevant to diverse regions, this exploratory paper considers rangeland issues in a Mongolian context.

Mongolia represents an evolving pastoral landscape facing the challenges of adapting a traditional nomadic lifestyle to modern realities. With 50% of the population dependent on livestock production for its livelihood (Johnson et al., 2006) developing enduring herding practices is a national concern. Historically, pastoralism

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was organized by nobles and monastic representatives in a feudal system that provided regulation of herding practices and allowed for adaptation to environmental conditions (Mearns, 1993). This gave way to seven decades of Soviet communism and collectivization. The communist era shifted livestock and land possession to a powerful central government that gave financial and logistical support and salaried herders (Fernandez-Gimenez, 2000). Removed from economic and social pressures, collectivization provided water infrastructure, transport that ensured mobility, veterinary care, emergency fodder, and controlled livestock numbers and movement (Fernandez-Gimenez, 1999). This era transformed pastoralism from its traditional subsistence basis to a production-oriented system. By maintaining highly mobile, low impact grazing patterns the environmental consequences during collectivization were limited. Since 1990, Mongolia has shifted to private ownership in a democratic market economy (Bilskie and Arnold, 2002). Dramatic change over the last 15 years has seen Mongolia fall into the more universal pastoral norms of maximizing livestock production, reduced mobility, increased sedentarization, and concentration on income-producing animals as herder motivation and options changed from meeting quotas to generating income as in other pastoral regions of the world (Bedunah and Harris, 2002; Sorbo, 2003; Lesorogol, 2006). Concurrently government levels of support and control have been slashed, land tenure has evolved towards private possession, and poverty is widespread (Sneath, 2003). The predictable results are the deterioration of the rural water infrastructure, intensified grazing patterns, increased land degradation, and an end to cooperative herding decision-making and implementation (Batjargal, 1997; Janzen and Bazargur, 2003).

In Mongolia's low precipitation, often highly variable conditions (Batima and Dagvadorj, 2000, Begzuren et al., 2004, Retzer and Reudenbach, 2005) mobility and opportunistic grazing patterns make efficient use of the ecological system and allow adaptation to Mongolia's periodic extreme winter and drought conditions (Sneath, 2003). Mongolian rangeland has customarily been open and communal with varying degrees of control exercised by local authorities in the pre-Soviet era, the state during communism, and now by a weak government (Fernandez-Gimenez, 2000). These authorities traditionally defined seasonal grazing areas and coordinated migration and herd composition. The dismantling of collectivization and tight control of herding patterns has challenged the traditional pastoralist land use paradigm. A shift to private livestock ownership, changes in land tenure, a lack of government regulation, and new economic pressures now alter land use. This is seen in the desire to secure control of winter camps, to establish water access, such as private hand wells, reduced migration, and increased settlement. As the structural realities behind herding evolve state attempts to address land possession, contracts, and privatization in the Land Laws of 1994 and 2002 have been inconclusive (Janzen and Bazargur, 2003).

Herders' ability to migrate with seasonal or ecological conditions has decreased over the last 15 years. Mobility is essential for sustainable rangeland use by dryland herders (Fratkin and Mearns, 2003; Ykhanbai et al., 2004), yet several contributory factors now reduce movement. Transport costs and access, no longer provided by the government, become a limiting factor, particularly for poor herders. Decreased water points restrict movement to known sources, often (over)used by others. Between 1990 and 2000 the number of engineered wells fell 80% as functioning hand wells dropped from approximately 35,000 to 20,000 (Tanaka et al., 2005). Water becomes the keystone ingredient, motivating both migration when practical or increasing sedentarization near existing water points among herders with reduced mobility. Settlement for economic (access to markets, jobs) and social (health and education) reasons further inhibits movement. Fewer moves result in increased grazing pressure and lead to speculation of long-term pasture damage. The UNEP (2002) claimed 70% of Mongolia as degraded and using remote sensing Javzandulam et al. (2005) identified 31% of the land as severely degraded. This shows that changes to the ecological system are occurring though whether the result of variable rainfall (Stumpp et al., 2005), human action (Lee and Zhang, 2005), or a combination is not clear. What is evident is that Mongolia now shares similar environmental concerns as other arid lands.

The effects of governance and land tenure change on pastoralists' welfare and environmental degradation have been explored in numerous studies from other regions (Thebaud, 1995; Dougill et al., 1999; Christensen et al., 2003). In Mongolia, however, information on transitions in pastoralism prior to 1990 was published mainly in Russian, and since 1990 has received limited documentation. This paper aims to contribute to the broader literature on social and ecological issues in pastoralist areas by documenting Mongolian herder perceptions of current environmental conditions and challenges. It was expected that herders would find both

ecological issues (water availability, pasture resources) and social changes (economics, reduced government role) to be major concerns.

2. Methods

2.1. Area description

Mongolia is located in Inner Asia, bordered by Russia to the north and China to the south. Grasslands comprise 80% of the country's 1.56 million km² area that is home 30 million livestock (camels, cattle, yaks, horses, sheep, and goat). Bio-climatic zones include montane (8%), forest steppe (15%), steppe (34%), desert steppe (23%), and desert (19%) (Geographical Atlas of Mongolia, 2004). An upland country, 85% of the land is above 1000 m with most grassland between 1000 and 2500 m. Annual precipitation ranges from <50 mm in the southern Gobi region to >400 mm in mountain areas with a national average of 224 mm (Batjargal, 1997). The continental climate, extreme temperature variation (40 to –50 °C annually, diurnal ranges of up to 30 °C), short growing season and poor soils limit crop agriculture to <1% of the surface area (Batima and Dagvadorj, 2000). Out of a population of 2.5 million, approximately half are dependent on pastoralism for their livelihood (Mongolian Statistical Yearbook, 2005). Three research areas were selected (Fig. 1) for geographical breadth to represent a range of potential water and land use scenarios across Mongolia.

2.2. Survey

From March to August 2005 I conducted surveys of herders in the three study areas. The western region was represented by Hovd province, located in a low precipitation (127 mm/yr) steppe and desert-steppe zone with some surface water availability. The north-central forest and grassland steppe of Selenge province and the bordering region is comparatively water-abundant with an annual precipitation average of 289 mm and several surface water sources. Dundgovi and Omnogovi provinces occupy the south-central desert-steppe and desert areas with low precipitation levels (156 and 127 mm per year, respectively) and minimal surface water (Geographical Atlas of Mongolia, 2004; Mongolian Statistical Yearbook, 2005).

From the province capital I followed dirt tracks towards a selected district town, and along the way gers (tent homes) were visually located for field interviews. This led to a stepping-stone process where abodes were spotted and visited along a general trajectory towards the town. Once reached, an alternate route was taken to return to the province capital. In this way herders from different districts were selected by proximity to the travel route, irrespective of social or economic attributes such as family size or wealth. The surveys conducted were designed to examine pastoralist perceptions of impacts and challenges in the herding environment, with particular focus on their daily interactions with water and land. The survey assessed herder knowledge and



Fig. 1. Insert map.

opinions through field-site interviews and participant observation to ascertain how and in what ways the environment may have altered and how the pastoral–nature interaction has evolved (Lee and Zhang, 2005). This can provide a perspective on claims of degradation and desertification stressed in published reports and limited relevant articles (Middleton and Thomas, 1997; Ministry of Nature and Environment, 2002; ADB, 2004).

Assessments ($n = 53$, not all answered all questions) were made to determine herder concepts of water and land issues in their respective area. Topics addressed included water resources, pasture issues, mobility and land use, environmental challenges, changes to pastoral systems, and herder insights. Pastoralists were asked standardized questions that were not conditional on prior answers. Interviews were conducted through a translator in the pastoralist's habitation after cultural formalities were observed with handwritten notes taken at the time of the interview. Analysis synthesized statements with results reflecting herder responses and estimates. When possible herder reports were verified by personal observation of water sources, pasture quality, and number of livestock.

Answering a set of semi-structured questions regarding water and grazing practices allowed respondents to express personal ideas and behavior. From this common themes emerged relevant to daily pastoral life in the Mongolian countryside. A drawback to this form was that herders spoke about basic themes in different manners, often not responding directly to uniform questions, limiting the scope of comparison. Further study with increased interview numbers in each region would strengthen survey validity and range.

3. Results

Surveyed pastoralists expressed clear positions on factors affecting their livelihoods. When asked issues affecting their lives the top eight problems identified were nature/environment related (Table 1). Water problems were access and supply, precipitation, and drought. Pasture issues included vegetation quality and availability, insect competition for grass, and extreme winter conditions limiting forage. Weather indicated variability as well as hot and cold temperatures; dust interfered with herding operations. Potential anthropogenic impacts were rarely mentioned. Government policies and actions, efforts to develop water supplies, increased numbers of livestock, mobility patterns, competition for resources, and mining illustrate points where humans interact with the environment. Connections between human agency and ecological conditions were infrequently stressed.

Water issues: “*Can't have many animals without water*”—water issues were the most frequently cited problems, and included both livestock needs and precipitation impacts on pasture conditions (Table 2). Responses regarding lack of water, broken wells, and drying of surface water sources identify absence as a problem; salinity addresses suitable quality. Low well level relates to changes in existing sources while mining can impact access to water and quality. More than half of the respondents felt there was insufficient water availability. Forty of the 53 respondents (75%) obtained water from wells, and even those who had river or spring access at the time depended on wells at other seasonal campsites. The particular concerns expressed regarding wells were as follows: engineered wells are broken, the government should fix or replace them;

Table 1
Pastoral problems identified by herders in rural Mongolia

Pastoral problem	Times cited
Water supply	25
Precipitation	24
Insects	21
Pasture	19
Extreme winter	14
Weather	10
Dust	6
Drought	3

Note: Total is greater than respondents ($n = 53$) as several listed more than one issue.

Table 2
Most important water issues by % of citations

Water issue problem	%
Lack of water	33
Broken well	21
Saline	16
Low level	12
River/spring dry	10
Mining	8

Table 3
Most important rangeland issues by % of citations

Rangeland issue problem	%
Rainfall	26
Insects	23
Pasture quality	20
Extreme winter	15
Increase in livestock/herders	10
Dust	6

more hand wells are needed in grazing areas and in unused pasture to expand rangeland; it is not possible for herders to build deep wells, hand wells are costly and difficult to construct, thus government financial and technical assistance is needed; water levels are decreasing; water is saline. One western site exemplified several issues—the herder used a broken engineered well, the hole was too small for a standard bucket, the water was considered polluted and unsuitable for humans, and because of the low water level it took six hours to water 276 animals by hand. In a country with limited surface water supplies (ADB, 2004) pastoralists identified the disappearance of streams and springs as a problem. Herders in the southern region, where mining is undertaken with little environmental oversight (Farrington, 2005), thought severely decreased water flow in the Ong River was due to mining activity diverting water sources.

Rangeland issues: “*I want more animals but the pasture is not good*”—Herders cited the condition of the physical landscape and natural elements in several different forms. Range concerns were discussed generally as pasture quality and specifically as a lack of rainfall for vegetation growth. After precipitation the greatest perceived threat to grazing land was from insects, translated as locusts, eating available grasses, followed by pasture quality (Table 3). The winter *dzud*, a condition of extreme cold and ice-crusting snow that prevent animals from grazing, was considered a much greater threat than droughts. Secondary factors included the pressure of increased livestock numbers and families moving into a herder’s traditional pasture, dust storms resulting from a lack of plant cover, and periods of drought and prolonged heat.

Livestock numbers varied greatly, ranging from less than 100 to more than 800 animals per household (Fig. 2). Herders with moderate (200–399) and high (≥ 400) animal numbers averaged 5.8 moves and cited water as their main concern whereas those with fewer animals (< 200) moved 4 times and cited precipitation as their main concern. Livestock were typically categorized by size with sheep and goats identified as small stock and large stock including horses, camels, and cows/yaks. Similar to a previous study (Stumpp et al., 2005), small stock represented approximately 85% of herd composition, horses 10%, and camels, cows, and yaks comprised 5%. Bedunah and Schmidt (2004) suggest 100 animals are a viable herd size and Janzen and Bazargur (2003) identify those with 200–300 livestock as mid-level herders. Results imply study participants were reasonably successful in Mongolian pastoral terms.

The annual number of moves varied from 0 to 20, with 30% moving twice or less, over half migrating 3–6 times, 15% moving 8–10 times. Herders moving twice or less had half as many livestock as those moving 3–6

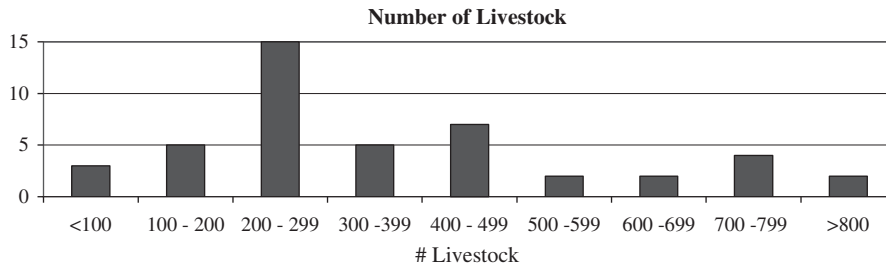


Fig. 2. Number of livestock owned by each herder.

Table 4

Number of interviewees, average herd size, average number of moves per year and main environmental concern (%) by distance to water

	Distance to water (km)		
	0–1	1–3	3+
<i>Number of</i>			
Interviewees	20	15	12
Livestock	346	242	304
Moves	4.6	5.8	4.4
<i>Main environmental concern (% cited)</i>			
Water	21	20	23
Pasture	15	16	15
Precipitation	21	18	15
Locust	21	18	12

times and 30% less than herders who migrated 8 or more times though there was not a significant correlation between moves and number of livestock. Claimed annual migration distances ranged from 100 m to 100+ km with long distances perhaps conflated with the common theme of how far one would go in search of water, rather than actual distance of a recent move. Twenty-two percent made annual moves of ≤ 5 km, 31% moved 7–15 km, with 47% moving > 20 km. While herders with more livestock moved more frequently, they tended to move shorter distances.

Stated distance from herder's dwellings to a water point ranged from 100 m to 8 km. Those using surface water, located predominantly in the north, were a mean of 1.8 km from a water source whereas well users distance from water averaged 1.3 km. Herders within a kilometer of a water source averaged 20% more livestock than those farther away. Those located 1–3 km from water moved 1.2 times more per year than those nearest and furthest from water points. Herder environmental concerns were similar regardless of distances from water points (Table 4).

4. Discussion

Water (indicated by responses of water, precipitation, and drought) and pasture quality (noted by responses of pasture, locusts, and extreme winter) were pastoralist's main concerns. Economics were considered a derivative of water and range issues: if these were adequate income would follow. Other agents, such as the government, were seen as peripheral to environmental concerns and of little relevance to livelihood issues except as they impinge on the ability to herd, such as limiting migration or imposing taxes. Concerns such as poor pasture quality, high livestock concentration, and a lack of water were defined as herding problems but become environmental issues. Water and pasture elements were broken down individually; combined they define the pastoralist's physical space. Actions and behavior, often motivated by livelihood issues, also impacted the pastoralist's interaction with nature.

Primary rangeland issues—rainfall and locusts—reflect the inter-annual variability of pasture factors. Locust infestation at the time of the survey was severe (Southern province infested by locust plague, 2004) but is cyclical and was not identified in a previous ecological study (Fernandez-Gimenez, 2000) or subsequently noted. Herders believed rainfall had decreased in their area though provincial records showed fluctuating precipitation patterns from 2001 to 2004 (Mongolian Statistical Yearbook, 2005). The most recent *dzud* in 1999–2001 (Nandintsetseg et al., 2007), exacerbated by drought, killed approximately 10 million animals, a third of the national herd, leaving 5% of herders with no animals (Ykhanbai et al., 2004). Differing intensity and pasture levels, rainfall patterns, localized conditions, and herder/government response affect *dzud* distribution in the country, reflecting how the interplay of several factors defines the pastoral environment. Relevant to pasture quality was a shift in herd composition from sheep to goats as the dominant animal over the last four years (Mongolian Statistical Yearbook, 2006). Herders considered goats good economically for the cashmere produced though prior study suggests goats have a detrimental impact on grasslands (Tumurjav, 2003). Drought was seldom cited as a major factor, perhaps due to perceived mobility and grazing strategies adapted to low precipitation.

Pastoral challenges were largely expressed in environmental and natural terms. Less evident in this survey were how the changing human–nature interaction impacts the environment. In the last century pastoralism shifted from a pre-Soviet subsistence orientation, through a centrally planned collectivized system that made an effort to mitigate natural effects, to a capitalist approach in which herders define and determine their interaction with the environment. Market economics now plays a key role—driving livestock numbers, type of animal raised, and affecting the number and distances of moves. What is identified as poor pasture quality may in fact be an outgrowth of a lack of movement, often cited as a key feature in maintaining a viable, low-input pastoral structure (Sayre and Fernandez-Gimenez, 2003). Declining mobility intensifies grazing pressure and has a detrimental effect on rangeland that, when paired with reduced water sources, serves to create a positive feedback loop as human action exacerbates natural forces in affecting the environment (Fig. 3).

Pastoralists’ perceptions did not reflect how externalities such as herder decisions, government policy, or social factors impacted the environment. If ecological concerns are to be addressed, an awareness of these relations and the de facto responsibility of different participants is needed (Walker et al., 2004; Reynolds et al., 2007). Attitudes towards water resources portray this interconnectedness as respondents focused on a desire for more wells, particularly in places with adequate pasture, and the rehabilitation of broken wells. This continues to be viewed as the role of the government, a holdover of Soviet patterns (Ykhanbai et al., 2004), despite years of evidence showing that the state has limited ability to build or fix wells. Thus beyond natural factors the improvement of water supply depends on herder action—repairing wells, investing in new wells, or motivating the state to re-engage in water development. Water access can differentiate herders with the

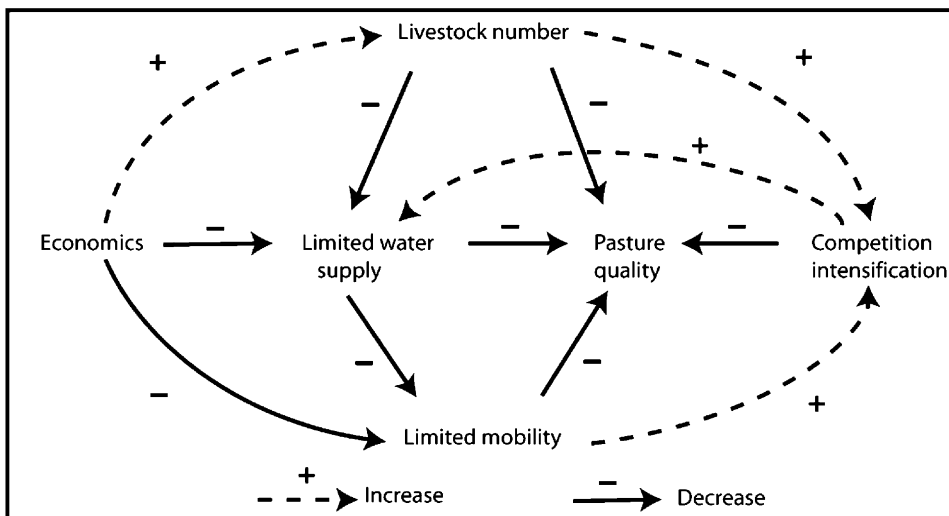


Fig. 3. Herding impact on the Mongolian environment.

inclination and means to improve water points or move to less-used sources from poorer families with reduced pastoral options. Yet possessing a well, like a campsite, is a disincentive to migrate. Today limited water supply concentrates livestock around functioning water points (Bedunah and Schmidt, 2004), increasing competition exemplified by one site in western Mongolia where herders reported several thousand livestock watering at one well. A situation is created where present needs for water and the behavior it entails may decrease future rangeland utility, thus impacting long term pastoral viability (Lambin, 2005).

Local dynamics are also part of global processes. Mongolia, with its dry climate, low soil fertility, and sparse vegetation is susceptible to land degradation and desertification processes (Yang et al., 2004) documented in neighboring China (Sneath, 2003; Lee and Zhang, 2005) and other arid lands more commonly studied. As one herder summarized, “with little good land, too many herders leads to pasture degradation.” These terms are used by international development agencies and government officials yet definition is elusive. When viewed as irreversible and negative change desertification entails crossing thresholds, the identification of which depends on how terms are defined and by whom (Batterbury et al., 2002). Natural processes and biophysical vulnerability work in tandem with human personal and socio-economic motivators to impact the environment, a process that can be influenced by government policy. Overgrazing and questionable land use patterns in rural Mongolia reflect intertwined human and environmental roles. To identify degradation necessitates differentiating natural fluctuations from anthropogenic factors over a sufficient timeframe in the country’s variable dryland setting (Lambin, 2005).

A clear understanding of degradation processes and terminology is important in pastoral issues because future Mongolian government initiatives and laws may reshape the herder paradigm. Foremost will be increasingly complex tenure issues as traditional and more formal rights of possession evolve. User contracts now exist to winter and spring camps while pasture remains under public stewardship. Land privatization is discussed by members of the government with encouragement from the Asian Development Bank and international consultants (Sneath, 2003), a possibility that remains an anathema to herders (Sayre and Fernandez-Gimenez, 2003). In this survey only one herder considered privatization a feasible alternative, explaining that new approaches might be tried to address poor current conditions. The conventional global argument continues in Mongolia where privatization is presented as a remedy for poor land use and as a way to promote pastoral investment. An alternative approach would address local practices that lead to inappropriate land use and evaluate if the causes (economic) or the remedy (privatization) is likely to be effective in light of Mongolia’s history and environment. Parallels can be drawn from research in other arid lands that individualized property rights had little impact on land productivity or investment in improvements in Africa and China (Lane and Moorehead, 1994; Sporton and Thomas, 2002; Williams, 2002). Lund (2000) states there is not a link between privatizing property and investment. Thebaud (1995) points out that privatization may be contrary to the essential nature of pastoralism—the ability to deal with variegated environmental conditions through mobility—that can be equally applicable to what Mongolia encounters today. Also relevant are the drivers of the degradation–desertification debate—politics, economics, development aid and projects, and individual, business, government and international agendas that can use

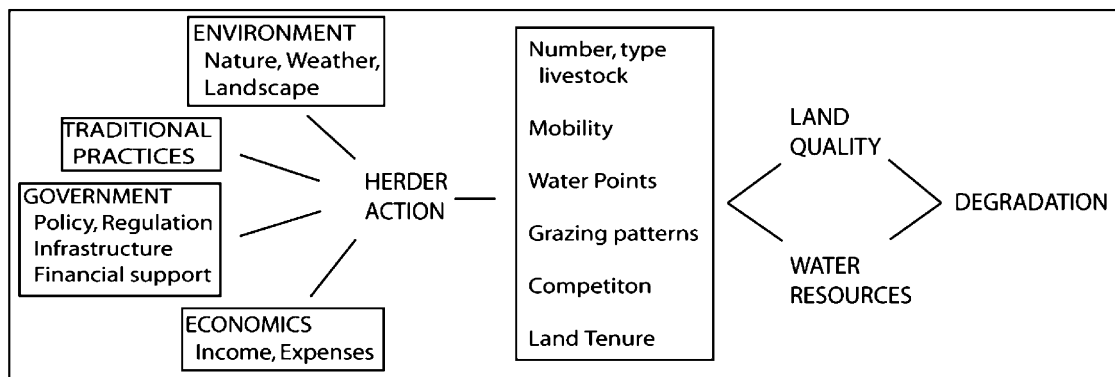


Fig. 4. Process of herder interactions affecting rangeland in rural Mongolia.

the topic towards their own ends. What looks clearly physical—land and water—are also social issues because their roles are influenced by human forces (Fig. 4).

5. Conclusion

Mongolia, isolated from western, non-Soviet systems until 1990 (Swift and Mearns, 1993), has emerged into a world that challenges its longstanding approaches to pastoralism as the state retreats from active participation and market economics becomes a driving force. From a broad perspective environmental changes are affected by mobility, water supply, variable rangeland quality, land tenure, livestock preferences, and herder motivations. At the local level pastoralists remain in need of water and adequate grazing land for livestock, and the skills to cope with natural variables—precipitation, *dzuds*, drought, and heat; naturally occurring events—insect invasions, wind, dust storms, saline water; and human agency—movement patterns, intensified grazing, constructed water sources, motorized transport, emergency fodder, mining, and financial decisions. The sustainability of pastoralism remains uncertain with new government regulations, climate change, economic forces, and natural conditions impacting herding.

Embedded in a natural system, this survey highlights the challenges herders face, many beyond their control. Encountering predominant contemporary forces relatively later than other pastoral groups, Mongolia can sift through several perspectives when considering potential future development decisions and directions. Pastoralism has continued through previous transformations; the task will be to evolve a modern hybrid pastoral system where neither pre-Soviet nor communist era approaches are feasible. This can best be done by incorporating the concerns and needs of the large percentage of society that continues to engage in mobile livestock production for their livelihood into the broader societal debate. It will be the herder who is able to adjust to current realities while maintaining the essential adaptive features, such as mobility, that will meet today's physical and economic complexities and lead herding into its evolving future form.

Larger scale issues like degradation are alluded to by the nature of the problems faced. Today's physical conditions, herder behavior, natural cyclical events, and socio-economic needs and choices form land use patterns. Rather than accepting determinations at face value further scientific research addressing the degradation/desertification debate can establish a basis for environmental claims in this little-studied region. Future efforts can untangle current trends and perceptions from pre-existing physical conditions in Mongolia's arid countryside. Without a factual basis, ecological terms can be co-opted to serve the arguments and desires of groups with the power to shape the rural landscape. Local conditions need to be evaluated and environmental challenges addressed for the continued sustainability Mongolian pastoralism.

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