



Photo: Herders in the outskirts of Ulaanbaatar, Mongolia; copyright Nozomiqel,

Climate Change Adaptation Strategies for Pastoral Communities of Mongolia's Central Mountainous Region

Chuluun Togtokh



Nomadic pastoral systems are dissipative structure-functions (NICOLIS AND PRIGOGINE, 1977, 1989) immersed in arid ecosystems of great temporal and spatial heterogeneity (CHULUUN, 2000). Historically, traditional pastoral networks emerged in drylands with scarce natural resources, subsequently evolving to increase human adaptive capacity in coping with climate variability and extreme climatic events such as drought and *zud*, a winter condition that can prove devastating for livestock. A large geographical landscape was critical in order to offset climate variability, as traditional pastoral networks used certain landscapes primarily for forage and water. There was thus a strong coupling between traditional pastoral groups and the landscapes they used. Traditional pastoral communities and their cultural landscapes, consisting of four seasonal land types in addition to reserve areas, *otor* pastures and haylands, provides a prime example of a coupled social-ecological system or human-environmental system (GLOBAL LAND PROJECT: SCIENCE PLAN AND IMPLEMENTATION STRATEGY, 2005). These traditional pastoral social-ecological systems were sustainable for centuries.

The Mongolian cultural landscapes, however, were fragmented with the administrative-territorial division reform of the last century (OJIMA & CHULUUN, 2007). Now almost half of all *sums* or sub-provinces lack one or two seasonal pastures. Interestingly, there wasn't much change

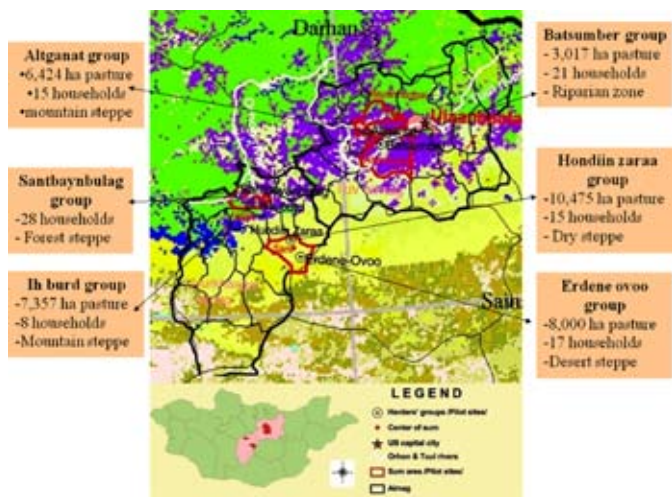


Figure 1: Map of Pilot Study Sites

in terms of cultural landscape use during the socialist period, although there were large changes in pastoral social-ecological systems during the socialist period between late 1950s and 1990. More complex dynamic changes in pastoral social-ecological systems have occurred since 1990 in the transition to a market economy. The number of herders has more than doubled since the early 1990s as a result of the economic migration spurred by livestock privatisation. Traditional pastoral networks at the lowest level (hot ail) re-emerged and re-organised themselves during this period of time, as some younger and more inexperienced herders started to follow their parents or relatives, who had more herding experience. These pastoralists continued to use traditional cultural landscapes under the leadership of experienced herders. Some new herders started to live near the settlements and water sources, causing overgrazing as a result of their low mobility. Due to a rise in the price of cashmere, goat numbers more than tripled from 5.1 million in 1990 to 18.3 million in 2007 since the transition to open market economy (MONGOLIAN STATISTICAL YEARBOOK, 2008).

In addition to economic and social factors, global warming is becoming a slow but critical variable, affecting the reduction of water and food resources. Over the last 60 years, surface air temperature in Mongolia has increased by 1.940C, which, along with its socio-economic vulnerability, makes Mongolia one Earth's hot spots. Spring is also becoming increasingly dry as a result of warmer temperatures and decreased precipitation.

This research aims to investigate change and transformation of open pastoral social-ecological systems (GALLOPIN, 2006) and develop climate change adaptation options for pastoral communities with participation of herders, local and national governmental officers and scientists (VOGEL ET AL., 2007). A social survey among herders on local climate

change observation and its impact on pastoral systems was conducted and participatory workshops with pastoral communities. These workshops aimed to communicate the current and future risks of climate change, land use changes and rangeland assessment techniques, as well as the socio-economic vulnerability of the herders to climate change.

Study Sites for Pastoral Social-Ecological Systems

Two out of six study sites for pastoral social-ecological systems were selected in the buffer zone of the Khustai Nuruu National Park, where wild horses known as tahi were re-introduced. These social-ecological systems in the buffer zone were selected so as to increase knowledge on the interaction between conservation and pastoral land systems, especially those in close proximity to the city of Ulaanbaatar. Four other sites were selected along ecological transects: forest steppe, mountain steppe, dry steppe and desert steppe. Prior to socialism, three of the sums along this gradient used to make up one administrative-territorial unit. One old herder from Sant sum said that this parents used to spend summer in mountains of Khijist sum. This confirms that there was free pastoral movement between mountains and steppe within the old administrative unit and old administrative-territorial divisions were primarily based on cultural landscape principles.

Hondiin Zaraa and Erdene-Ovoo, herders' groups at Sant sum, and Ih Burd at Hijirt sum, were led or guided by the old experienced herders who had lived in these areas for generations. Thus, traditional indigenous knowledge was basis for grazing management in these pastoral communities, and they followed their nomadic cultural legacy better than other herders' groups. Interestingly, the zuds of 1999-2002 prompted an increase in the formation of herders' groups due to several reasons such as legacy of cooperation and social learning, as well as government and donors support. Generally, relatively poor herders tended to form herders' groups, exemplified by Batsumber and Santbayanbulag herders' groups along the Tuul and



Orhon rivers. These groups were not led by an experienced herder, but by a former administrative worker or teacher. These group leaders were intelligent people, quickly learning the advantage of cooperation for relatively poor households.

Migration from the rural areas to the big cities of the central area started to increase in mid-1990s. The migration from the rural areas was a result of environmental change, following summer droughts and intensifying after the 1999–2002 zuds. The herders who had lost their livestock during these disastrous climatic events were forced to leave the area and can be referred to as environmental refugees. The Batumber and Altganat herders are examples of the migration of herders from the rural to the central region of Mongolia. In addition, the Khustai Nuruu National Park probably attracted herders due to its beneficial buffer zone management programmes. Thus both the Batumber and Altganat herders' groups have the shortest local ecological knowledge as only one household in each community was native, with the rest of the herders having migrated from the western Aimags. The Tuul river valley served as a market pathway for the transfer of animals from the western Aimags to Ulaanbaatar city, and it was kept free of grazing by local herders during socialism. State agricultural farms existed in the region north of the Hustai Nuruu National Park between the late 1950s and 1990, but the farmers have since moved out of the area. The fields, abandoned after the transition to a market economy in 1990, have still not recovered from severe soil erosion caused by the farming of these drylands.

Both the central region close to Ulaanbaatar, the capital city, and the Khustai Nuruu National Park were at-

tracting people from remote areas of Mongolia. Thus, the majority of herders living in the buffer zones of the park are migrants, mainly from the western Mongolia. They enjoy double economic benefits from being closer to the market of Ulaanbaatar and the support from the park (SEE TABLE 1 for their income level compared to herders from other regions). Interactions of the herders living in park buffer zone are mutually beneficial. The herders assist in conservation of the park and they benefit from the park's assistance in building fences around springs, or in constructing wells. The herders are allowed to use park pasture during zuds. However, their impact on the ecosystems outside of the park is large, as overgrazing from their herds has led to ecosystem degradation. Herders living along the Tuul river developed a more sedentary lifestyle, moving only twice a year and covering only short, two to three kilometre distances. This has greatly concerned the Altanbulag sum government, which has passed regulations prohibiting grazing alongside river during between late June and late August. The herders, however, do not obey this regulation.

Research findings

Some research findings are summarised in Table 1. Livestock per capita is well correlated with income per capita due to the fact that the herders' main income comes from livestock. The Batumber and Altganat pastoral communities have the highest income. Four other communities, those of the forest steppe, the mountain steppe, the dry steppe and



Photo: Herders in the outskirts of Ulaanbaatar, Mongolia; copyright Nozomiqel
Table 1: Studied pastoral communities

Name	Sum & Aimag	Ecosystem Type	Number of Households	Livestock per capita, sheep unit	Income per capita, USD	Cultural landscape index	Socio-economic vulnerability
Batumber	Altanbulag Tov	Riparian/forest steppe	21	100	1,200	4/7	2.3
Altganat	Argalant Tov	Forest steppe	15	181	1,877	5/7	2
Santbayan bulag	Hujirt Overhangai	Riparian/forest steppe	8	41	547	4/7	3.3
Ihburd	Hujirt Overhangai	Mountain steppe	8	49	618	5/7	3.2
Hondlin Zaraa	Sant Overhangai	Dry steppe	15	83	827	6/7	3.4
Erdene-Ovoo	Sant Overhangai	Desert steppe	17	79	972	6/7	3.5

the desert steppe, live along transect. In the herders' group, the livestock per household as well as the income per capita and overall richness of the cultural landscape has increased along this transect. In terms of cultural landscape, Batumber and Santbayanbulag herders living in the riparian zones during the summer and fall lack three pasture types out of seven (4/7). Thus most ecosystem degradation was observed in the riparian zones where herders have become more sedentary. Cultural landscape is better conserved in Sant (6/7) as compared to Hujirt. As a consequence, the ecological condition in Hujirt is worse than in Sant, and it seems that this is already affecting the incomes of the herders (SEE TABLE 1). There are signs that this trend may continue unless the proper measures are taken. The environment and poverty is interlinked. The socio-economic vulnerability of each community was calculated based on its proximity to the market,

its income, the loss of animals during the 1999-2002 zud and the level of economic diversification. The pastoral communities of Tov aimag showed less socio-economic vulnerability due to higher income and shorter distance to the markets of Ulaanbaatar city.

The herders were very sensitive to water availability during both the warm and cold seasons and there was also ecosystem degradation as a result of overgrazing around the wells and the few remaining springs that had not already shrunk due to climate change impact. The herders were very sensitive to snow cover change as well. For instance, Nogoos Suuri, a herder of Hujurt sum, indicated that 6 springs had disappeared and that only a single watering point remained for 14 households with 3,000 livestock. This only remaining spring was prone to freezing, leaving these households without water in early December 2006 (SEE PHOTO AT LEFT). As there is usually snow on the ground during this time of year, the herders dispersed, moving away from their winter camps so that they could use the snow as winter water source.

Photo right:
Copyright M.
Altanbagana, 2007

Photo Below: Herders in the outskirts of Ulaanbaatar, Mongolia; copyright Nozomiiqel.



Discussion

Livestock density exceeds carrying capacity in central Mongolia. The herders' economic well-being has generally improved with increased livestock numbers. Due to a rise in the price of cashmere, goat numbers have tripled since 1990. Water and foraging sources are becoming depleted due to climate change in central Mongolia and the depletion has been amplified due to increasing land use intensity. Herders complain that goats further ecosystem degradation because they dig out the roots of young plants in the spring. Plant species composition is shifting with a decreasing number of edible plant species. Plant biomass may have already been reduced in non-linear fashion due to the interaction between climate change and overgrazing in central Mongolia. Spring drying trends have delayed the onset of plant growth in Gobidry steppe boundary area (ELLIS ET AL. 2002) and plant biomass decreased in central Mongolia during the 1990s, primarily due to climate change (OJIMA ET AL. 2004). Livestock numbers

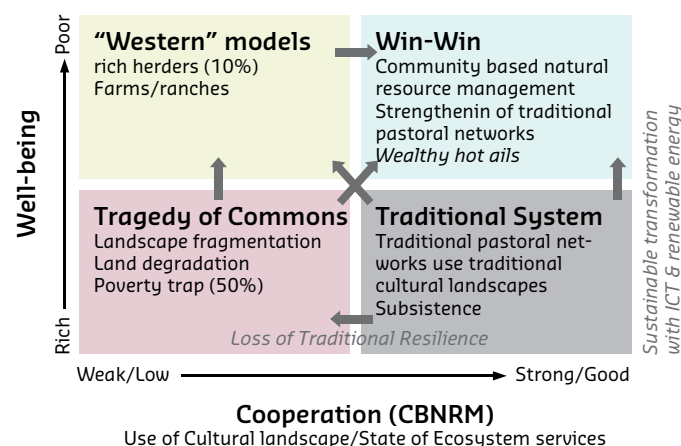
have increased since the early 1990s causing increased overgrazing effects with a reduction of dominant plant species known by the herders as Mongolian grasses. Observations of grassland ecosystem conditions in inner Mongolia, China and in Ovorhangai Aimag taken in 2002 and 2007 indicate that central Mongolia may be headed towards ecosystem degradation and desertification problems of the type already experienced in inner Mongolia.

In the central Mongolia study sites, small stream, lake and spring disappearance was also observed. Decreases in snowfall, increased tree cutting, the melting of permafrost, intensifying drying trends, destruction of riparian zone shrubs and swamps, and overgrazing all interacted in a non-linear way, resulting in the disappearance of water sources. Regional climate may be affected due to the albedo change that comes with land and snow cover changes. Last summer, large floods in Hujirt sum territory due to both heavy rainstorms and drought conditions were observed. Riparian ecosystems appear to have keystone value in coupled pastoral social-ecological systems. The collapse of these critical ecosystems' ability to provide water would greatly impact the pastoral community, as water is the most valuable resource for both people and animals in drylands.

The complexities of coupled social-ecological systems increased with Mongolia's transition to a market economy and there are three general categories of herders and communities that are affected to different degrees. A wealthy class of herders with more than 500 livestock per household is emerging, making up only about 5% of herder households. A middle class with 200-500 livestock per household now makes up almost 20% of all herder households, and this group of herders has more choices to increase their resilience and adaptive capacity. Herders with less than 200 animals per household will have the advantage if they join formal herders' groups such as NGOs or informal traditional networks, as well-organised cooperation will give opportunities for economic, social, ecological, technological and cultural benefits. More than half of herders are considered poor with less than 100 animals per household. These poorer herders typically live near the cities and along the rivers and the link between environmental degradation and poverty is notable among this group. Some would benefit from re-training and the institution of sustainable farming systems with the introduction of productive livestock breeds and the diversification of their economy to include pigs, chickens and vegetables as sources of income.

Climate change adaptation options for cultural landscape restoration suggested in participatory community workshops included the introduction of community based

Figure 2. Models for pastoral social-ecological systems



conservation and sustainable use of natural resources, the addition and protection of water points for additional pastureland, the agreement between neighbouring sums for communal use of otor and reserve pastures, and the enlargement of administrative-territorial units, for instance, by combining several sums into one unit in order to restore cultural landscapes. For pastoral communities living in the riparian zones, diversification of the economy and intensification of the livestock industry through ecotourism and farming, the prevention of riparian ecosystems from degradation and desertification and taking animals to otor pastureland during the summer period were suggested options. Protection of springs from degradation by livestock was critical for communities living in the mountain and forest steppe.

Research findings and thoughts for future adaptation strategies for pastoral social-ecological systems can be summarised in the scenarios diagram in figure 2.

Traditional system. Cooperation within traditional pastoral networks serves as a mechanism enhancing resilience to climatic disasters. Communal disaster relief mechanisms, assisting the most affected herders in many different ways, were in place. Traditional pastoral communities used cultural landscapes to cope with climate variability and climatic extremes. Due to proper management, rangeland ecosystems used for traditional grazing and ecosystem services were in good condition.

Tragedy of the commons. The rangelands are still State owned in Mongolia although livestock has been privatised. This has been the main reason for the increased overgrazing and ecosystem degradation near both settlements and water sources under capitalism. Poor herders especially have tended to become less mobile, living near towns, infrastructures and water sources as a result causing dryland fragmentation. Generally, herders have not cooperated and have competed

more for resources in this scenario. Many herders in this model have lost their traditional resilience mechanisms to cope with climate variability and extremes, and potentially 50% of herders live in poverty. Deterioration of the social-ecological system with ecosystem degradation and increasing poverty happens in this model.

“Western models”. Only 5-10% of herders became wealthier through the transition to a market economy. Generally, these rich herders don't cooperate with a larger pastoral community. They often take advantage of the current State ownership of pasture, often causing more damage to ecosystem services. Some of herders have small communities and use traditional cultural landscapes. Thus, some of the traditional networks that use cultural landscapes in sustainable ways can be included in the win-win model, with social and ecological benefits. This group of herders needs to be encouraged through proper pasture and culture landscape ownership mechanisms.

Win-win model. In the win-win scenario, the majority of herders must be transformed. The most desirable pathway for pastoral systems would be direct transformation from a traditional system to a win-win state, strengthening traditional pastoral communities with modern technologies such as renewable energy and communication information technology. High levels of literacy among the Mongolian herders (98%) and the suitability of the nomadic culture in concert with wireless communication make such a sustainable transformation very attractive. There is a great opportunity to conserve natural, cultural and social capital in order to maintain the adaptive capacity and resilience of Mongolian pastoral social-ecological systems to climate change and globalization. Teaching sustainable farming techniques to herders living near settlements and water points would be another pathway to reach a win-win situation and escape the tragedy of the commons state. A reform of administrative-territorial divisions that restores cultural landscapes appears to be the best, most cost effective adaptation option in order to promote the sustainability of coupled social-ecological systems with increased adaptive capacity and resilience to climate change at supra-pastoral community scales..

Conclusion

Pastoral land systems central Mongolia are becoming very vulnerable to climate change. Water and forage availability is changing due to global warming. Land use change, especially since Mongolia's transition to a market economy in 1990, have become a critical factor in the vulnerability of

pastoral social-ecological systems. The traditional coping mechanisms enhancing the resilience of pastoral communities in the face of climate variability will be lost in Mongolia as in the surrounding countries of Central Asia, China and Russia unless alternative development agendas are taken. The opportunity of using the existing cultural landscape at community and cross-administrative boundary scales in Mongolia appears to be the most cost-effective resilience option for climate change adaptation in pastoral communities. Many international projects on pastoral development, poverty reduction or nature conservation in the Mongolia only consider parts of the problem. More holistic approaches are needed to achieve win-win scenarios. Strengthening traditional pastoral networks with modern technologies to enhance social wellbeing as well as legal framework development for cultural landscapes at community and administrative unit scales for ecosystem service conservation are required to promote sustainability in pastoral social-ecological systems.

Chuluun Togtokh, Ph.D. Professor, Environmental RS/GIS Laboratory, National University of Mongolia, President, “Global Citizen” NGO, Ulaanbaatar, Mongolia. chuluun@nrel.colostate.edu

ACKNOWLEDGEMENTS

The project “Policy Framework for Adaptation Strategies of the Mongolian Rangelands to Climate Change at Multiple Scales (PARCC)” is supported by a grant from Advancing Capacity in Support of Climate Change Adaptation (ACCCA), managed by the UNITAR and the START and funded by the European Commission EuropeAid Cooperation Office, the UK Department of Environment and Rural Affairs and the Netherlands Climate Change Support Programme. The PARCC project is endorsed by the Global Land Project.



LITERATURE

- Chuluun, T. 2000. Climate variability, nomadic society and turbulent history: A Mongolian case study. Update-IHDP, Newsletter of the International Human Dimensions Program on Global Environmental Change 1: 10-12
- Ojima, D. and T. Chuluun. 2007. Policy Changes in Mongolia: Implications for Land Use and Landscapes. Pages 179-193 In: Galvin, K.A., Reid, R.S., Behnke, R.H. and Hobbs, N.T. (eds), Fragmentation in Semi-arid and Arid Landscapes: Consequences for Human and Natural Systems. Springer, Dordrecht, The Netherlands.
- Coleen Vogel, Susanne C. Moser, Roger E. Kasperson, Geoffrey D. Dabelko, 2007, Linking vulnerability, adaptation, and resilience to practice: Pathways, players, and partnerships, Global Environmental Change (17, 2007, 349-364)
- Gilbert C. Gallopin, Linkages between vulnerability, resilience, and adaptive capacity, 2006, Global Environmental Change magazine (16, 2006, 293-303)
- Turner B.L., Eric F. Lambin, and Anette Reenberg, 2007, The emergence of Land change science for global environmental change and sustainability, Proceedings of the National Academy of Sciences of the United States of America, 2007, vol.104