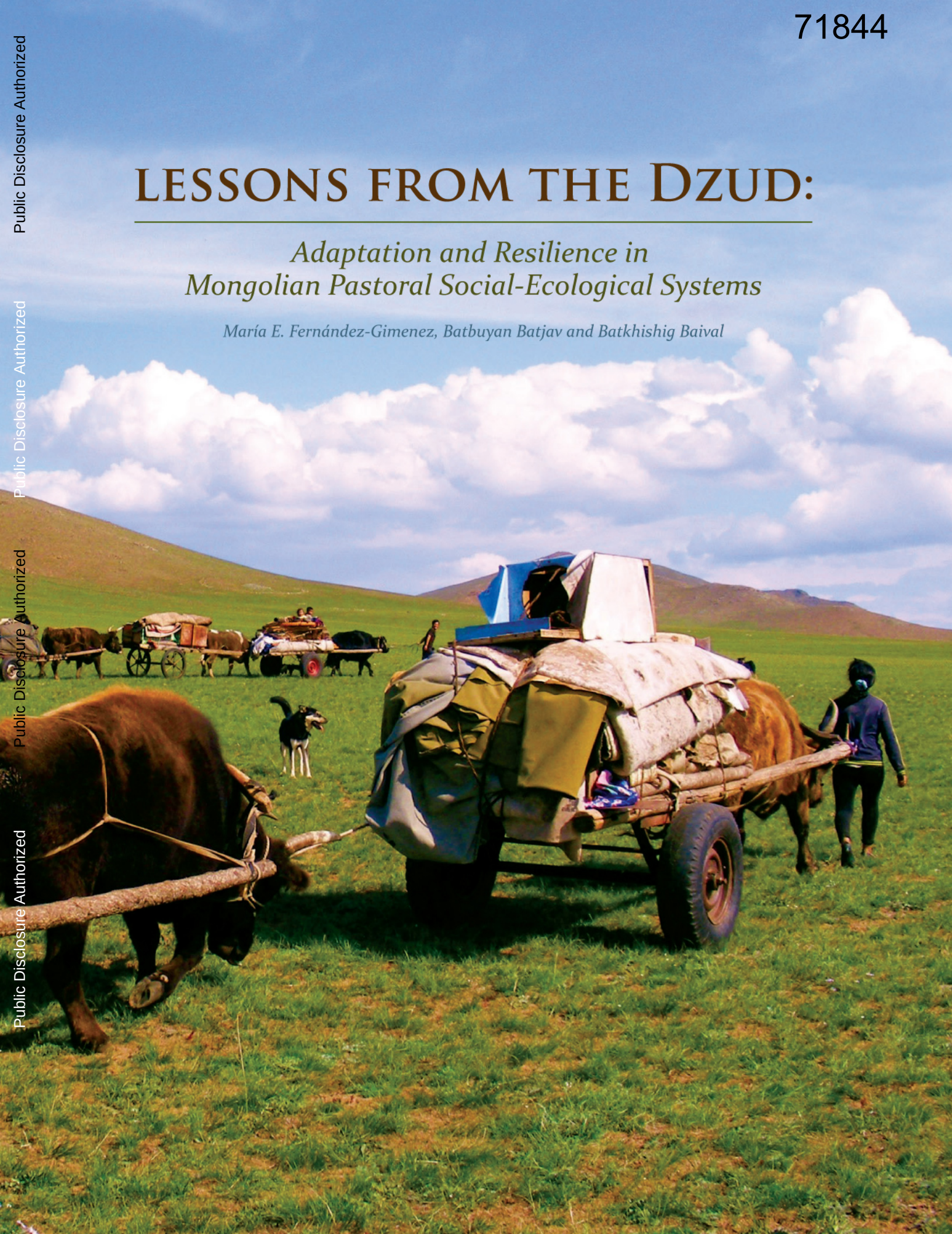
LESSONS FROM THE DZUD:

Adaptation and Resilience in Mongolian Pastoral Social-Ecological Systems

María E. Fernández-Gimenez, Batbuyan Batjav and Batkhishig Baival



COLORADO STATE UNIVERSITY & THE CENTER FOR NOMADIC PASTORALISM STUDIES

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June 2012

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Acknowledgements

This work was commissioned and overseen by Robin Mearns (World Bank Social Development Department) and Andrew Goodland (World Bank East Asia Sustainable Development Department). It was financed under grants TF093061 and TF096133 by the Trust Fund for Environmentally and Socially Sustainable Development (TFESSD), a multi-donor trust fund supported by Finland and Norway that provides grant resources for World Bank activities aimed at mainstreaming the environmental, social and poverty reducing dimensions of sustainable development into Bank work.

We thank Ms. Khishigdorj, Mr. Tsogtbaatar, and Ms. Erdenechimeg for their assistance with the fieldwork and Ms. Gantsetseg (Jinst Soum), Ms. Tserenduren (Bayantsagaan Soum) and Mr. Buyankhishig (Ikhtamir Soum) for their help in organizing the focus group meetings in their respective soums. We gratefully acknowledge the participation of over 200 herders and community members who took part in focus groups, interviews, the photovoice project and household surveys in 2010 and 2011.

A summary article based on the findings of this study has been accepted for publication in the journal *Global Environmental Change* (forthcoming).

Executive Summary

Rationale, Methods, and Objectives

Dzud is the Mongolian term for a winter weather disaster in which deep snow, severe cold, or other conditions render forage unavailable or inaccessible and lead to high livestock mortality. Dzud is a regular occurrence in Mongolia, and plays an important role in regulating livestock populations. However, dzud, especially when combined with other environmental or socio-economic stresses and changes, can have a significant impact on household well-being as well as local and national economies. Mongolia has experienced documented changes in climate in the past 60 years, and extreme events such as dzud may potentially increase in frequency and magnitude with future atmospheric changes. Therefore, understanding the effects of dzud on herder households and communities, and identifying the strengths and limitations of existing household, community and government coping and adaptive responses to dzud is critical to developing effective strategies to adapt to climate change and manage pastoral risk related to weather disasters.

In the winter of 2009-2010 Mongolia experienced the most severe dzud since the consecutive dzud winters of 1999-2002. The 1999-2002 dzud was an important catalyst for a number of donor-led efforts to improve pasture and livestock management and risk preparedness using community-based approaches. In the 2009-2010 dzud, about 8.5 million livestock had died, approximately 20% of the country's livestock population, affecting 769,000 people or 28% of Mongolia's human population. According to the Red Cross, 220,000 herding households were affected of which 44,000 households lost all of their livestock and 164,000 lost more than half their herd. This study aims to learn from this disaster to help inform and improve current and future response measures, including community-based rangeland management.

Much of the scant existing research on dzud focuses on its meteorological characteristics and its impacts on livestock populations. Relatively few studies have investigated, in depth, how dzud affects herder households and communities, how herders individually and collectively understand and respond to dzud, and the role that local governments play in dzud preparation and response. This study aims to fill this gap in knowledge by conducting in-depth case studies of four communities´ responses to the 2009-2010 dzud to document both household- and community-level impacts and responses. The case studies use a mixed-methods approach employing qualitative and quantitative data collection and analysis techniques including interviews, focus groups, household questionnaires, photovoice and document review, and were carried out in two soums (districts) located in the forest-steppe zone of Arkhangai Aimag (province), Ikhtamir and Undur Ulaan, and two soums in the Gobi desert-steppe zone of Bayankhongor Aimag, Jinst and Bayantsagaan. Each pair of cases included one soum in which formal community-based rangeland management (CBRM) organizations had been formed and one without formal CBRM organizations, allowing us to investigate the role of such organizations in disaster preparation and response. The specific objectives of this study are to assess herder household and community vulnerability, adaptive capacity, and medium-term recovery and resilience from the dzud of 2010. We aim to identify factors associated with household and community vulnerability, adaptive

capacity and resilience to dzud, and to make recommendations for rangeland management and pastoral development policy and practice based on these insights.

Factors Affecting Vulnerability

Vulnerability is related to exposure and sensitivity to disaster as well as the capacities to cope and adapt in the face of disaster. In the case study sites, exposure at each site was a function of pre-existing forage conditions, weather conditions during the dzud, and changes in forage availability during the dzud, especially those caused by incoming otor herders from other soum, resulting in a "hoofed dzud." (Otor refers to long-distance moves outside of regular seasonal migrations usually undertaken to avoid weather disasters, or to fatten animals in the fall.) Sites that have natural features that provide cover or de facto forage reserves were also less exposed. Factors that led to increased household sensitivity to dzud were 1) poor animal condition going into the dzud, 2) insufficient winter and spring forage reserves, 3) and smaller initial herd size (in general, poorer households lost a larger percentage of their livestock). Community-level sensitivity was related to local government disaster preparation and response and the presence or absence of formal herder collective action institutions, with pro-active local governments and formal organizations associated with lower sensitivity. Similarly, coping and adaptive capacities were positively influenced by effective formal and informal collective action among herders, pro-active and responsive local government, and herder knowledge about and experience with dzud.

Adaptive Strategies and Constraints to Adaptation

Herders used a range of coping and adaptive strategies in advance of and in response to the dzud, which fall into 6 major categories: storage, mobility, diversity, reciprocity, flexibility and communal pooling. Storage in the forms of animal fat/weight gain, hay, hand-made and purchased fodder, and grazing reserves, was a critical strategy. In the forest-steppe herders who did fall otor had significantly lower losses than those that did not, and in the desert-steppe, households that fed stored hay or grazed reserved spring pasture had lower losses. In light of the negative impact of incoming otor herders during the dzud, more effective designation and use of soum-level otor reserves is a critical strategy for the future.

Mobility of different types is an important strategy before, during and after dzud. Fall otor enables animals to gain weight and store fat. Although many herders did winter otor, the outcomes of this strategy are more variable and the benefits less clear. After dzud, as many as 22% of herders surveyed in the more severely affected sites planned to move to settlements, at least temporarily, to seek alternative livelihoods.

Diversity is expressed in a variety of adaptive strategies used by herders, all of which were shown to be important through qualitative or quantitative assessments. Diversity strategies include hedging risk by keeping a multispecies herd, generating income from multiple sources rather than a single livelihood, possessing access to diverse natural resources, and having a diverse social network.

Reciprocity and exchange are central to Mongolian herding culture and underlie key strategies such as otor movements during dzud. Norms of reciprocity that promote pasture sharing with herders on otor

from other locations can be essential to the survival of those herders who are on otor, but our case studies illustrate that they can also increase exposure and vulnerability of the communities that host the incoming otor herds. These findings raise important questions about the custom of reciprocal access to pastures during disasters and how otor movements can be managed to maximize the benefits and minimize negative impacts to the host communities. Another form of reciprocity, mutual assistance among herder households, or between herders and kin living in cities or settlements, plays a potentially important role in surviving dzud, but was relatively weak in our study sites. Exchange of knowledge is critical, including both traditional knowledge and technical information on best practices in dzud preparation and response. Knowledge exchange was also relatively weak and should be strengthened.

Flexibility is a general strategy that refers to the invention of new practices and the ability to change how particular strategies are implemented in order to make them feasible or increase their effectiveness in a disaster situation. In the case studies we observed flexibility in social organization (splitting households or khot ail), in movement patterns, and other practices such as not breeding or selling more livestock in the fall.

Communal pooling involves sharing resources, labor or wealth, distributes risk across households, and improves the efficiency of many production activities. Pooling was a common strategy in the study sites with labor sharing and joint management of pastures and otor reserves being the most common pooling strategies. Labor sharing focused primarily on haying and other winter preparations, and herding during the dzud. Following the dzud some herders began engaging in more joint marketing activities. Pooling strategies were definitely enhanced by formal CBRM organizations, which helped to organize many labor sharing and joint resource management activities among their membership.

Our analysis of vulnerability and adaptive strategies identified 24 constraints to adaptation across our study sites, which fall into 5 major categories: human capital, social capital, economic, institutional and environmental. Awareness and understanding these constraints can help focus future efforts by herder organizations, government and donors on eliminating these barriers to adaptation in the face of natural disasters.

1) Human capital constraints:
   - Lack of knowledge and access to information
   - Lack of labor, aging herder population
2) Social capital constraints:
   - Weak mutual assistance (bonding ties)
   - Little experience with collective action
   - Limited social networks (especially bridging ties) and information exchange
3) Economic constraints:
   - High debt and no savings
   - Lack of access to insurance
   - Lack of technology and machinery (e.g. tractors for haying)
   - Limited opportunities for income diversification
   - Poor access to markets
   - No market differentiation for product quality

- Aid dependence stifles innovation and creates dissent

4) Institutional constraints:
- Inherent challenges of collective action
- Conflicting incentives for small- and large-scale producers
- Insufficient support for scaling out formal collective action (e.g. herder groups, PUGs)
- Lack of communication and coordination among aid organizations, different levels of government and herders
- Lack of supporting legal environment for formal collective action (i.e. legal status for herder groups, PUGs)
- Insufficient regulations and enforcement to manage cross-boundary otor movements
- Legal constraints to access resources (e.g. forests)
- Unenforced mining regulations and lack of legitimate process for local involvement in mining decisions
- Increasing permanent resettlement of herders from other soum

5) Environmental constraints:
- Lack of water
- Lack of areas suitable for reserve otor and dzud pastures
- Lack of diversity of habitats and grazing resources

Reflections on Resilience

Resilience is a system's ability to maintain its basic structure, function and identity in the face of shocks and changes—to recover and reorganize following a major perturbation such as dzud. A fundamental characteristic of resilient systems is their capacity to learn, adapt and "live with change." Dzud is a recurrent natural disaster in Mongolia, one that herders are accustomed to and have learned to live with over the long term, employing many customary adaptive strategies. In the current situation, dzud interacts with other sources of stress and change including economic shocks, institutional transformations, and the emerging effects of climate change, all of which place additional stress on the system and may limit the effectiveness of traditional coping and adaptive strategies. It is too soon to assess resilience of our study sites to the 2009-2010 dzud. However, we offer some brief reflections on potential resilience indicators observed at the study sites, and ways to capitalize on this shock to the system as an opportunity for learning and positive system transformation.

1) Resilience to Past Dzud

A positive indicator of resilience is the recovery and reorganization of pastoralists in Jinst Soum following the last major dzud series in 1999-2002. Of our four case study sites, Jinst was most severely affected by the 1999-2002 dzud, losing 75% of the local herd. Between 2003 and 2009, Jinst's livestock population rebounded dramatically, and with financial support and technical assistance from the UNDP Sustainable Grasslands Management Program, six herder groups were organized and implemented grazing management improvements and small enterprise development in the soum. In the 2009-2010 dzud, Jinst herders and local government were among the best-prepared, most pro-active, and demonstrated the strongest informal and formal collective action. Jinst experienced the smallest losses in the 2010 dzud. Jinst's experience demonstrates that herders can learn from dzud experiences and

with appropriate support, can use this opportunity to make adaptive changes that increase sustainability and resilience to future shocks.

2) A "Teachable Moment" for Transformation

As Jinst's experience demonstrates, dzud can serve as a leverage point for positive system transformation. Our focus group, photovoice and survey data all illustrate that many herders in our other study sites are aware of the need for change and are ready to learn. Many participants emphasized the need to reduce livestock numbers, improve animal quality and health care, and enhance collective action to harvest and store hay, protect reserve pastures more effectively, and allow overused summer pastures to rest and regrow. The next 2 years, while memory of the dzud is still fresh, are a critical window of opportunity to initiate and further strengthen support for community-based rangeland management initiatives and other investments that encourage collective and individual action for improved pasture and herd management.

3) The Roles of Pasture User Groups, Herder Groups and the Sustainable Livelihoods Program

In our study, communities with formal community-based rangeland management (CBRM) and herders that were members of CBRM organizations had significantly more indicators of adaptive capacity, including better winter preparations; more innovative management and sustainable pasture and herd management practices; wider social networks; greater trust, reciprocity and leadership; greater access to information from more diverse sources; and more proactive behavior. The question remains, what kinds of community-based organizations best support collective action by herders, especially for improved pasture management? Our study sites included initiatives that take three distinct approaches to supporting community-based herder initiatives: 1) territorially-based Pasture User Groups (PUGs) focused primarily on pasture management and involving up to 50 households (Green Gold Pasture Ecosystem Management Program (GG)), 2) smaller kin- or neighborhood-based herder groups focused on pasture management and livelihood improvement involving 5-20 households (UNDP Sustainable Grasslands Management Program (SGM)), and 3) project-specific support for herder-proposed initiatives (Sustainable Livelihoods Program). The World Bank-supported Sustainable Livelihoods Program (SLP-II) was active in all of our study sites, although only recently in the Arkhangai sites, GG PUGs were located in Ikhtamir and UNDP-organized herder groups in Jinst. Thus the SLP overlapped with the other two types of organizations, but PUGs and herder groups did not coexist in either Ikhtamir or Jinst.

Although some practitioners view PUGs and herder groups as competing models, we think that they are potentially complementary, as are initiatives sponsored under the SLP. To date at our study sites the UNDP SGM appears most effective at catalyzing collective action by herders, strengthening government-herder cooperation and communication, and leading to measurable changes in resilience. However, this approach only reaches a limited number of participants, and thus the majority of rangelands and herders in the soum do not benefit from improved management and coordination. PUGs seek to involve all the herders within a defined territorial unit in cooperative management of pastures, in order to overcome free-rider problems. PUGs were effective in helping herders prepare for dzud, especially with hay making, and in facilitating collective learning after the dzud. However, this approach has been less effective, thus far, in fostering other types of cooperation, communication and mutual assistance. The

SLP provides an additional source of resources that can help existing herder groups or PUGs to implement their cooperative initiatives, and it was being used in this fashion in Ikhtamir. In sites such as Undur Ulaan, with no formal community-based herder organizations, SLP funds may catalyze collective action by providing the incentive for groups to cooperate in order to access these resources. However, it is not certain that these opportunistic groupings driven by the availability of funds will lead to any type of enduring collective action in the absence of technical and capacity-building support of the kind provided to PUGs by GG and herder groups by UNDP-SGM.

The complementarity of these efforts, in theory, is the following. PUGs provide an overarching institutional and organizational framework for pasture use at the territorial level, which is essential given the spatial and temporal variability of pasture resources in Mongolia and the importance of storage, mobility, diversity and reciprocity as adaptive strategies. PUG functions would include pasture management planning, monitoring and enforcement, including the designation of seasonal pasture areas, PUG-level forage reserves and hay harvest and storage, setting dates for movements and facilitating adaptive pasture management across all households within the territory. Nested within PUGs, herder groups composed of subsets of PUG members collaborate on more specific initiatives related to haying, neighborhood reserve pastures, restoration and care of water sources, cooperative marketing, small enterprise development, otor, and herd care and management. These activities, especially those that involve direct financial investment and risk, require a higher level of trust, communication, and accountability, which is difficult to achieve among 50 households, but is feasible in smaller groups. The SLP provides a source of capital to both types of organizations, though perhaps more oriented to larger-scale projects at the level of PUGs or multiple cooperating herder groups. This helps to insure that SLP resources are used to advance projects that take place within the context of existing pasture management plans developed with high levels of herder participation and legitimacy, and in an organizational setting with a strong record of past cooperation, capacity and accountability, so that the funds are well-used to serve genuine community needs rather than the interests of a few clever and opportunistic individuals.

In sum, our results show that several different organizational models for grass-roots herder instutions can be successful in the Mongolian context, but significant initial technical assistance and support is needed to help such groups organize and develop their capacity—an economic incentive alone is not sufficient. Thus, scaling out this institutional innovation beyond the existing limited donor-funded projects remains a challenge. Finally, it is important to note that even in apparently successful community-based organizations, benefits may not be equally distributed among participants, and not all community members may have equal opportunities to participate. Recognition and further investigation of these power dynamics and their consequences is vital if these grass-roots institutions are to reach their potential for social-ecological resilience building on Mongolian grasslands.

4) Local Government Coordination with Local NGOs, Donors, and Grass-roots Herder Initiatives

Another lesson from our case studies, especially Jinst and Bayantsagaan, is the importance of local government cooperation and coordination with herder organizations, local NGOs, and donor agencies and staff. Neither herder-led organizations nor local governments with their current limited resources,

staff, and capacity, can alone effectively manage pastures or respond to disaster such as dzud. It is imperative that local governments learn the value of communicating with and supporting herder-led initiatives, and that herder groups are pro-active in sharing information with and making proposals to local governments. Similarly, when local governments and aid organizations do not effectively communicate and coordinate with each other in disaster response, aid may be mis-allocated or may not be distributed at all. Resilience requires cross-sectoral cooperation of different types of organizations.

5) Cross-boundary and Cross-level Institutions are Essential

Just as cross-sectoral cooperation is important, cross-level and cross-boundary institutions are essential. Our case studies specifically point to the perils of unregulated otor movements during dzud and the way that this can increase the vulnerability of receiving communities if they are not prepared with designated otor reserves and cross-boundary agreements cannot be effectively monitored and enforced. Mobility and reciprocity are critical strategies to reduce vulnerability to dzud. In order for these strategies to work without significant collateral damage to host soum pastures and livelihoods, strong cross-level institutions are needed that designate aimag, soum and national otor reserves, specify conditions for their use, and ensure that the terms of agreements between soum are respected.

Implications for Mongolia and Beyond

Like many disasters, dzud is a complex social-ecological phenomenon and vulnerability to dzud is a function of interacting physical, biological, social, economic and institutional factors. Vulnerability is affected by local, cross-boundary, and cross-level factors. Actions that are adaptive and reduce vulnerability for one group at one spatial or temporal level may be mal-adaptive and increase vulnerability for another group or at a different level. Communities that are well prepared for dzud at the household level may suffer disproportionate losses if exposure is increased by in-migrating otor livestock from other soum. Relief aid that helps prevent loss of life, suffering and impoverishment in the short-term may contribute to long-term dependence syndromes, social disparities, and lack of initiative on the part of both local government and herders. The lessons of the dzud for actors at all levels of social organization point to the need for increased responsibility and leadership by individual actors, be they households, herder groups, or local governments, as well as the critical importance to all actors (including donor and aid organizations) of reaching out, communicating and cooperating with others within and across sectors.

The challenges of resilience-building in our case study sites are not unique to our sites or to Mongolia. Rather, they echo the struggles of other variable and low productivity pastoral and ranching systems around the world, in both developing and developed nations. Thus, the lessons learned from our cases may also have implications for pastoral development policies and climate change adaptation in livestock systems in other regions. Mongolia, like many other dryland extensive livestock production systems, is subject to high variability in resource availability over space and time, arising from both inherent geographical variation and temporal and spatial variability in weather conditions, which drive forage growth in all locations, as well as dzud occurrence in Mongolia. This variability, in turn, leads to similar challenges and potential options for addressing them. This study highlights two common cross-level challenges and five key implications for building resilience that apply to Mongolia and other similar dryland systems. The first challenge is the apparently conflicting needs for secure rights to key resources

(e.g. winter pasture and dzud reserves) and flexible access in times of need (e.g. otor movements), which create cross-boundary and cross-level governance dilemmas in pastoral systems worldwide. The second challenge is the perverse incentives provided by drought or dzud disaster aid and drought policy in many countries, which penalize the most proactive managers by withholding assistance and reward those who fail to act (e.g. destock) early in a climate disaster.

The discourse on drought and dzud relief, perverse incentives, and the moral hazards of relief aid raise the broader policy question of who bears the risk for climate disasters and who is responsible for disaster preparation and recovery. How can actors at each level of social organization be encouraged to behave proactively and assume appropriate responsibility for preparedness, while ensuring that there is a broad humanitarian safety net in place to prevent permanent loss of livelihoods and food security? What functions of disaster preparation and response should be the responsibility of individual producers, local or national government, civil society, and donor organizations? And which mechanisms—market-, community- or state-led—will most efficiently and effectively promote preparedness and facilitate timely and effective response?

Our results, considered together with experiences from other systems, suggest that individual livestock producers ultimately bear the risk and responsibility for dzud preparedness. But in order to act they need access to timely and accurate information, technology, and labor, as well as appropriate incentives (and absence of "perverse incentives"). Information, technology, labor and incentives, in turn, can be provided as functions of informal and formal community institutions (information, technology and labor), local and sometimes national government (information and incentives), and civil society and donor organizations (information, technology, and capacity building for community institutions). Pasture management, otor arrangements, monitoring local pasture conditions, and determining the criteria and identification of households for aid distribution are appropriate responsibilities for local government in tandem with community groups and civil society organizations, while national government provides the legal framework and mandates for pasture management, trans-boundary otor movements, and pasture monitoring, and the social safety net for the most severely affected households.

Market mechanisms can also play a role, but many of these are as yet poorly developed in Mongolia. Index-based livestock insurance is one mechanism for pooling risk, and was piloted in 4 aimag in 2006-2009 and expanded to 17 others in 2010. However, observers in other regions of the globe have expressed skepticism about the viability of this approach and it is too early to evaluate its effectiveness in Mongolia. In the longer-term, market incentives will be crucial to supporting shifts in herd composition and increasing livestock quality over quantity. The mechanisms here may involve a combination of market incentives and state policies such as sustainability certification, niche marketing, and payment for ecosystem services. Although such methods hold promise, there are also many challenges. As in many remote arid and semi-arid regions, a major impediment in Mongolia remains the limited potential to diversify rural economies, which limits herders' alternatives.

To build more resilient pastoral social-ecological systems in Mongolia and beyond, our vision must move beyond improving disaster preparation and response to enhancing the adaptive capacity of herder

households and communities. Adaptive capacity consists of the ability to learn, and the ability and willingness to act on that learning. Overall, we foresee three possible response pathways in our study sites following the dzud, each with different implications for future system function. 1) *Migrate out.* Herders who lost their livelihoods may leave the sector and potentially the region. This decline in the number of households and livestock may act as a stabilizing feedback at the local level, though outmigration of large numbers of herders who relocate to other regions or the capital city may be a source of cross-scale vulnerability at the national scale. 2) *Rebuild herds.* Herders and local governments may passively wait for herds to rebuild, repeating the boom-bust cycle when the next dzud arrives. We hypothesize that this pathway could result in an amplifying feedback, as in recent history herds have recovered to numbers exceeding the previous peak, with significant impacts on pastures, before the livestock population is once again decimated by a subsequent dzud. Unchecked, this boom-bust cycle may eventually lead to an undesirable regime shift if an ecological degradation threshold is crossed before the next dzud. 3) *Actively adapt.* Finally, either on their own or as the result of targeted program interventions, herders and local governments have the opportunity to learn from this dzud, and to put their learning into action by implementing the ideas they expressed in focus groups and surveys by improving livestock quality and reducing quantity and improving collective action for pasture management. However, the success of such social learning at the local level will depend upon cross-level learning and the development of stronger cross-level institutions to manage pastoral mobility, as well as continued investments in developing livestock market and market incentives to improve quality over quantity and diversify livelihood portfolios.

What can be done to strengthen the adaptive capacity of Mongolian pastoral social-ecological systems---that is, the individual and collective abilities to learn and adapt? The key lessons from our cases resonate with the emerging research on resilience-building in other pastoral systems. The overall lesson is that learning and action must take place within and across different social units (e.g. households, herder organizations, soums) at the same level of organization as well as across different levels of organization. Our case studies highlight the following five key lessons and implications:

1) **Social networks** are critical for mutual assistance, knowledge and information exchange (including access to and integration of different types of knowledge), resource access and pastoral mobility (e.g. otor arrangements). Additional research is needed to understand the structure and function of social networks among pastoralists and between pastoralists and other actors, but interventions that support the development of expanded and strengthened bridging ties between herders, local government and extra-local organizations and experts enhanced resilience in our cases.
2) **Formal collective action** among herders (e.g. PUGs, herder groups, etc.) contributes to stronger networks, learning, and action based on lessons learned. Community-based management is not a panacea, nor is it sufficient to address some of the cross-level challenges facing Mongolia; however, our data and other recent studies demonstrate that these approaches hold promise, in part because they illustrate that local people are not helpless in the face of change.
3) **Cross-boundary and cross-level governance institutions** are essential, and are urgently needed in Mongolia to address the cross-level and cross-boundary dilemmas that increased vulnerability during the recent dzud.

4) **Forums and venues that encourage social learning** are fundamental to strengthening adaptive capacity. In our cases, formal collective action organizations, and sometimes local government, played important roles in opening such dialogs. Moving forward, communities will need to cultivate their skills in **multiple-loop learning** that questions assumptions and seeks root causes.
5) **Environmental and socio-economic monitoring** are crucial because change must be detected in order for learning, action and adaptation in response to change to take place. Thus, it is especially important to develop formal and informal ways to track changes in slow variables within and across levels of governance and spatial organization—requiring further cross-level coordination.

Recommendations

We close this summary with a series of recommendations for actors at different levels of social organization. These recommendations are specific actions that should be taken in order to strengthen adaptive capacity to future disasters.

Recommendations for Herder Households

1) Herders are responsible for their own survival and must prepare accordingly. The most important investments households can make is feeding animals well in summer and fall, so they have sufficient fat reserves to endure the winter, and ensuring an adequate supply of standing grass reserves, hay and fodder for winter and spring. These two measures, in turn, require proper pasture management practices and institutions (see 2 below). Selling old and unproductive animals in the fall, and restricting breeding before a bad winter can also keep forage demand in balance with supply.
2) Herders must work with each other and their local government to implement sustainable grazing practices and the institutions (rules, policies and norms) to support them (also see 1 below).
3) Herders are encouraged to participate actively in developing their soum's dzud response plan and to consider buying livestock insurance to protect themselves against high losses.

Recommendations for Khot Ail and Herder Groups

The case studies illustrate clear benefits of both informal cooperation among herder households and khot ail (herder camps consisting of several to many households), and collective action by formally organized herder groups and PUGs. Our recommendations focus on key arenas where cooperation is essential or where it leads to the greatest observable benefits.

1) Under Mongolia's current legal framework for pastureland tenure and management, cooperation and coordination among herders using the same grazing territory are essential for sustainable use of pastures. Therefore, we strongly recommend that herders work closely with others who share the same seasonal pasture areas to plan for and manage pasture use and seasonal movements, especially designation and protection of winter, spring and dzud reserve pastures. We also recommend that such user groups actively seek support and cooperation from local governments in developing, monitoring and enforcing their grazing plans.

2) Khot ail and herder groups are encouraged to work together to rehabilitate wells, springs, and other water sources; to protect strategic pasture communities and plants that are useful during dzud such as shrubs for browse, tall grasses (ders, *Achnatherum splendens*), forest understory, and riparian

pastures; and to combine efforts to collect and store hay (sharing machinery, fuel and labor). All of these resources contribute to reduced vulnerability during dzud.

3) Knowledge and resource exchanges and the social networks that support them are critical to adaptation. An important function of organized and informal herder groups can be to mobilize expertise, training, and financial resources within and outside the local community. Herder groups are encouraged to draw on and combine all available information sources: local and traditional knowledge, professional knowledge, and scientific and technical knowledge and to share their knowledge, experiences and lessons with others. One aspect of this is building the capacity to cooperate and to function as an organization. Thus, we encourage herder group members to learn and practice the principles of good communication, planning, transparency, and accountability with others in the group.

Recommendations for Local Government

Soum government and bag governors can play important roles in ensuring adequate individual and community preparedness for winter and dzud. (The bag is the smallest administrative-territorial unit in Mongolia, comprising 100-300 households.)

1) Although individual preparedness is ultimately a household responsibility, local government can promote responsible individual behavior through public education and incentives that encourage fall livestock culling and sales, fall otor, hay and fodder harvest and storage, and identification and protection of winter, spring and dzud reserve pastures.
2) One of the most critical roles for local government is pasture management planning, monitoring and enforcement. In the context of dzud, this includes designating in advance specific otor areas for local herders and for herders from other soum, making arrangements in advance for incoming and outgoing otor herders, and strengthening capacity to monitor and enforce policies related to reserve pastures and otor herders.
3) Effective local governments are pro-active, participatory and adaptive in developing and implementing disaster management plans. This includes planning for disaster in advance by developing a disaster management plan with broad stakeholder input (including herders), and updating the plan based on lessons learned in each dzud. Local government response during the dzud is also critical, including coordination and communication with herder groups, donor agencies, and regional and national government in order to target and distribute aid appropriately, efficiently and fairly.

Recommendations for Regional and National Government

1) Dzud preparation and response at all levels depends critically on clear policies to guide and capacity to implement pastureland governance across multiple scales. As national policies for pastureland tenure and management are revised and strengthened it is especially important to consider provisions for designation of dzud (otor) reserves at the local, aimag and national levels, and mechanisms to coordinate and regulate otor movements between different soum and aimag.
2) In order to improve coordination and communication among multiple agencies (National Emergency Management Agency (NEMA) and others) and relief organizations and different levels of

government, it is important to identify the distinct roles of local, regional and national government, donor and aid organizations and community organizations and develop effective communication and coordination mechanisms between them.

3) Due to the different ecological and management characteristics of different geographical regions in Mongolia, regionally-specific recommendations for dzud preparation and response may be required.

Recommendations for Donors and Relief Aid Organizations

1) Distribution of hay, fodder and food prevents impoverishment during emergency periods, but short-term aid should be linked to longer-term development support. Increasing dependence on relief aid may increase vulnerability to future disasters both at the household and community levels.
2) With respect to short-term relief aid, we recommend that donor and relief organizations increase coordination with local governments and other aid organizations within each soum, and with the national government and other aid organizations at the national level. At the local level, we recommend working with local government and herder organizations to develop appropriate criteria for aid distribution (which households), specific types of support needed (food, fodder, clothing, cash), and most effective physical distribution mechanisms (how to items to households in need).
3) With respect to longer-term development support, key areas of investment that strengthen local adaptive capacity in disasters include:
    a) Support for formation and capacity building for community-based herder organizations (herder groups and PUGS) and programs aimed at improved livestock and pasture management. To succeed, these organizations require initial structured support and ongoing technical assistance and capacity building, as well as capital to implement projects available through programs like SLP. It is also critical that donors with similar interests coordinate their capacity building efforts.
    b) Support for improved hay production, harvest and storage technology, using technology appropriate for local environments.
    c) Support initiatives that enhance food security through training in home gardening and small-scale market gardening at local levels so that human food sources are diversified, nutrition improved, and winter-hardy produce can be stored for consumption over the winter (e.g. potatoes, carrots, cabbage, etc.)
    d) Support for livestock insurance, community-based revolving loan programs, and grassroots initiatives to diversify local economies that build on local environmental and community assets in a sustainable way.
    e) To help herders meet their goals of improving livestock quality rather than quantity, invest in mechanisms that improve herders' information about and access to markets, and their ability to increase the value of livestock products through domain of origin marketing, fair trade, sustainability certification, and value-added processing.

1. Introduction and Objectives

1.1 Purpose and Objectives

Dzud is the Mongolian term for a winter weather disaster in which deep snow, severe cold, or other conditions render forage unavailable or inaccessible and lead to high livestock mortality. Dzud is a regular occurrence in Mongolia, and plays an important role in regulating livestock populations. However, dzud, especially when combined with other environmental or socio-economic stresses and changes, can have a significant impact on household well-being as well as local and national economies. Mongolia has experienced documented changes in climate in the past 60 years, and extreme events such as dzud may potentially increase in frequency and magnitude with future atmospheric changes. Therefore, understanding the effects of dzud on herder households and communities, and identifying the strengths and limitations of existing household, community and government coping and adaptive responses to dzud is critical to developing effective strategies to adapt to climate change and manage pastoral risk related to weather disasters. Much of the scant existing research on dzud focuses on its meteorological characteristics and its impacts on livestock populations. Relatively few studies have investigated, in depth, how dzud affects herder households and communities, how herders individually and collectively understand and respond to dzud, and the role that local governments play in dzud preparation and response. This study aims to fill this gap in knowledge by conducting in-depth case studies of four communities´ responses to the 2009-2010 dzud to document both household- and community-level impacts and responses. The case studies use a mixed-methods approach employing qualitative and quantitative data collection and analysis techniques including interviews, focus groups, household questionnaires, photovoice and document review, and were carried out in two soums located in the forest-steppe zone of Arkhangai Aimag and two soums in the Gobi desert-steppe zone of Bayankhongor Aimag. Each pair of cases included one soum in which formal community-based rangeland management (CBRM) organizations had been formed and one without formal CBRM organizations, allowing us to investigate the role of such organizations in disaster preparation and response.

The specific objectives of this study are to assess herder household and community vulnerability, adaptive capacity, and medium-term recovery and resilience from the dzud of 2010. We aim to identify factors associated with household and community vulnerability, adaptive capacity and resilience to dzud, and to make recommendations for rangeland management and pastoral development policy and practice based on these insights. A secondary objective of the project is to further strengthen the capacity of the participating Mongolian researchers in quantitative and qualitative data collection and analysis methods, and to increase their familiarity with concepts, theory and measurements related to vulnerability, adaptation and resilience. In this document, we report the results and recommendations from the first year of the study. In the second year of the study, we will continue to follow the recovery of the four case study sites from the dzud, and focus more specifically on identifying current and recommended roles of individual households, local government and the private sector in mitigating pastoral risk from dzud.

The remainder of this introductory chapter defines key concepts applied in this study, such as vulnerability, resilience, adaptation, and dzud, and provides a brief overview of past research on these themes in order to provide a theoretical and empirical context for this study. The chapter concludes with a synthesis of information about the characteristics of the 2009-2010 dzud that is the focus of this study. Chapter 2 describes the research strategy including data collection and analysis methods. Chapters 3 through 6 are detailed case study narratives of each of the four case study sites, in turn. In Chapter 7 we summarize the highlights of each case study and provide a cross-case analysis of vulnerability, adaptive capacity and resilience from the cases, and in Chapter 8 we offer management and policy recommendations based on our analysis.

1.2 Vulnerability, Resilience, and Adaptation[1]

Vulnerability is defined as susceptibility to damage or harm (Adger 2006; Agrawal 2008; Eakin and Luers 2006; Turner et al. 2003), and consists of three components: exposure to harm, sensitivity to harm, and adaptive capacity—the ability to respond constructively to harm—either in advance or after the fact. Poverty, vulnerability and climate change are thought to be closely related, because poor populations often are most sensitive to harm, have less capacity to adapt, and in some cases may be differentially exposed to stressors. Pastoralists make up a large proportion of the rural population in the temperate, arid, and semi-arid grasslands of Mongolia, which are expected to be significantly affected by changing climate (Angerer et al. 2008). Thus, pastoralists' exposure to the potential impacts of climate change is high. Further, people who depend directly on forage and water for their livelihoods are more vulnerable to the impacts of climate change than those whose livelihoods are only indirectly linked to grasslands. Therefore, pastoral populations are also likely to be sensitive to climate change impacts. Pastoralists that experience high levels of poverty, including those in Mongolia, also have greater sensitivity, and potentially less capacity to adapt to these changes. Other factors affecting these populations may also influence their vulnerability, including land tenure and environmental management policies (de Haan et al. 2001). These assertions are better conceptualized as hypotheses, to be tested through the case studies we present. Important questions about the vulnerability of Mongolian pastoralists remain: In what ways are pastoralists vulnerable? How does their vulnerability compare to other poor populations? How does socio-economic change affect these systems and how do these effects interact with climate change to influence vulnerability?(de Haan et al. 2001).

Resilience is defined as the amount of change a system can absorb without altering its essential structure and function (Walker and Salt 2006). Resilience is not an inherently good or bad property. Undesirable system states such as totalitarian governments or highly degraded ecosystems are sometimes very resilient. A central tenant of resilience thinking is that change is constant and pervasive, and that learning to live with change is a more successful strategy than trying to control or limit it. Understanding resilience in the context of natural resource management requires that we consider

[1] The text of this introductory section is adapted from Fernandez-Gimenez, M.E. 2008. Resilience and adaptation in pastoral social-ecological systems. Paper presented at the workshop, "Poverty, Vulnerability and Resilience in North Asian Rangelands: Case Studies of Community-based Rangeland Management in China and Mongolia," April 14-17, 2009, Beijing, China.

ecosystems and the human societies that are part of and depend upon these systems as linked or coupled social-ecological (or human-natural) systems.

Natural disturbances and stresses such as fire, grazing, snowstorms, floods, wind storms, and droughts are important to the function of many ecosystems, and are part of the natural variability of these systems. Attempting to limit these natural disturbances through management may sometimes be successful in the short-term, but may have long-term unintended and undesirable consequences (Holling and Meffe 1996). For example, suppressing wildfires in fire-adapted ecosystems may lead to an unnatural accumulation of fuel, creating the risk of catastrophic fires in the future, and reducing the biological diversity of the ecosystem. Killing predators in order to increase the population of herbivores in a system can result in an herbivore population explosion, subsequent destruction of vegetation biomass and population crash.

If change is a constant feature of system behavior, what enables a system to evolve and adapt, yet to remain recognizable as the same system, with the same essential parts and processes? In other words, what characteristics make a system resilient? How do we know when a system has changed irreversibly (crossed a threshold), or more important, when it is on the verge of an irreversible change?

Resilience thinking moves us away from a mindset of controlling complex natural or coupled human-natural systems towards an attitude of understanding, embracing, and adapting to change as an integral aspect of system behavior. Gunderson and Holling (Gunderson and Holling 2002) proposed that ecosystems and by extension, social-ecological systems, undergo an ongoing **adaptive cycle** of change, whereby a system grows, conserves, collapses and reorganizes time and again. The ability to reorganize, adapt and learn as a system moves through this cycle repeatedly over time is the key to resilience. Pastoral systems in Mongolia have undergone several dramatic political economic and environmental shocks over the past century, yet despite these significant changes, basic features of this social-ecological system have remained constant over time—the system has thus far remained resilient.

Resilience thinking also requires attention to the dynamics of **cross-scale interactions—**that is, the ways that processes and structures at one spatial or temporal scale affect those at levels above and below that focal scale (Peters et al. 2004). Often we cannot understand the consequences of specific events or changes by focusing at a single scale. Processes that occur as broad spatial and long temporal scales often dominate those that occur at finer and faster scales. For example, broad patterns in geomorphology and climate determine the distribution of plant and animal species at more local spatial scales and shorter time periods. However, sometimes fine-scale dynamics may cascade upwards to alter broad-scale patterns. The conversion of grasslands to shrublands and subsequent desertification provides one example of this type of upward cascade, whereby patch-scale dynamics may eventually spread over broad areas, and create feedbacks to atmospheric conditions through the increased albedo associated with large areas of bare ground (Peters et al. 2004). In this report, we adopt the terminology proposed by Cash et al. (Cash et al. 2006) who distinguish between cross-scale and cross-level dynamics with “scale” referring to “the spatial, temporal, quantitative and analytical dimensions used to measre and study any phenomenon, and “levels” as the units of analysis that are located at different positions

on a scale." For example, in Mongolia, the bag, soum, aimag and nation are different levels of territorial administrative units along the same scale.

In the context of Mongolian pastoral social-ecological systems, national-level political and economic changes in the early 1990s resulted in local-scale changes in herder communities across the country, however different communities responded and adapted differently to these changes. Similarly, national-level law relating to the management of pastures has been interpreted and implemented in different ways in different communities. These are examples of the effects of broad-scale changes on fine-scale dynamics. We have also observed examples of fine-scale processes influencing broad-scale events. One example of this in Mongolia may be the influence of many local-scale experiments in community-based rangeland management affecting the direction of national-level policies for pastureland tenure (Fernandez-Gimenez, Kamimura, and Batbuyan 2008).

The sustainability and resilience of complex coupled systems such as Mongolian pastoral social-ecological systems depends upon their ability to adapt and to maintain the self-regulating feedbacks within the system. Maintaining these feedbacks, in turn, requires attention to the "slow variables" that underlie key processes. In social-ecological systems, the human ability to learn and act on the basis of new information can play a key role in adaptation and self-regulation within the system. This is one reason why various forms of ecological knowledge—local, traditional, and scientific—as well as environmental monitoring are critical to the resilience of these systems. Social institutions (rules, norms, policies and laws) that are adaptive, flexible, locally responsive, multi-scale and diverse also promote resilience (Folke et al. 2005). Successful adaptive governance institutions help maintain the resilience of desirable systems in the face of change, but also recognize the opportunity and need to transform systems in the face of crisis—to create new, more desirable systems.

Walker and Salt (2006) proposed 9 characteristics of a resilient world: diversity, ecological variability, modularity, attention to "slow variables," tight feedbacks, social capital, innovation, overlap in governance, and ecosystem services. Berkes et al (Berkes, Colding, and Folke 2003) focus on 4 interconnected attributes of systems that promote adaptive capacity: disturbance as a source of social and ecological change, social and ecological diversity that provide resources for adaptation, ecological knowledge that influences management practices and institutions, and capacity for self-organization. These sources both highlight the importance of social and ecological diversity, variability and innovation; ecological knowledge and the ability to observe and respond to key slow variables that produce changes in ecosystems and the services they provide; and strong social relationships and institutions that foster learning and adaptation.

Measuring resilience remains a challenge. How do we know if a system is resilient or not until after a shock or surprise? What can we measure to prospectively evaluate the resilience of a system in order to manage to maintain desired resilience? One approach to assessing resilience that we are exploring in Mongolia is to evaluate the degree to which a social-ecological system exhibits presumed indicators of resilient systems, particularly as they relate to the capacity of the system to learn and adapt.

Adaptation is the set of actions, attitudes, activities and decisions that maintain the capacity to deal with current or future change or shocks to a social-ecological system (Agrawal 2008; Nelson, Adger, and Brown 2007; Agrawal 2010). Agrawal (2008) argues that livelihood adaptation to climate change among the rural poor requires strong local institutions as well as improved cross-scale interactions among institutions operating at different levels, and identifies 5 key strategies for adaptation employed by the rural poor: mobility, storage, diversification, resource pooling, and exchange. Agrawal asserts that, "adaptation to climate change is inevitably local," (p. 3), that institutions shape adaptation in critical ways, and that "the gap in current knowledge about the role of institutions in adapting to climate change is remarkably large," (p.1).

Many pastoral systems have adopted a number of strategies over centuries and millennia that have enabled them to deal with the inherent variability in their biophysical and social environments. These include: 1) making use of diverse species, habitats and livelihood strategies; 2) mobility of herds and households in space and time; 3) flexibility in mobility patterns, social organization and livelihood strategies employed; 4) de facto or intentional grazing reserves; 5) institutions of reciprocity and exchange (Fernandez-Gimenez and LeFebre 2006; Fernandez-Gimenez and Swift 2003). Many traditional pastoral systems thus already have incorporated many of the principles of resilience, and this in turn has enhanced their ongoing ability to adapt to and cope with an environment of constant change. However, the magnitude of changes and stresses that now face many pastoral societies is perhaps greater than ever before, calling into question the continued resilience and adaptive capacity of such systems.

Resilience thinking is an emerging field of study and practice. In this project we explore what resilience means in Mongolian pastoral social-ecological systems, particularly as it relates to vulnerability to and recovery from the 2010 dzud.

1.3 Dzud

Dzud (sometimes spelled zud) is a winter disaster in which deep snow, severe cold, or other conditions that render forage unavailable or inaccessible lead to high livestock mortality. Mongolians identify at least six types of dzud (Begzsuren et al. 2003; Siurua and Swift 2002; Tachiiri et al. 2008). White dzud happens when deep snow covers grass. Black dzud refers to freezing temperatures and lack of snow (essential for livestock and human water in the winter) and forage. A combined dzud occurs when there are both deep snow and cold temperatures. A storm dzud is indicated by high wind and blizzard conditions. Iron dzud happens when a layer of ice makes forage inaccessible. Finally, a hoofed dzud occurs when many livestock converge in a location, and the combination of trampling and heavy grazing eliminates forage. Many herders believe that "dzud follows drought" and severe winters are likely to occur following a poor summer.

Dzud occurs every 5-10 years in Mongolia (Table 1), although not all locations are equally affected in any given dzud and some regions have greater cumulative risk of dzud than others. For example, in the series of dzud years from 2000-2002, Bayankhongor aimag (province) had the highest average livestock loss rate over the 3 years (Tachiiri et al. 2008). A GIS analysis by the Center for Nomadic Pastoralism

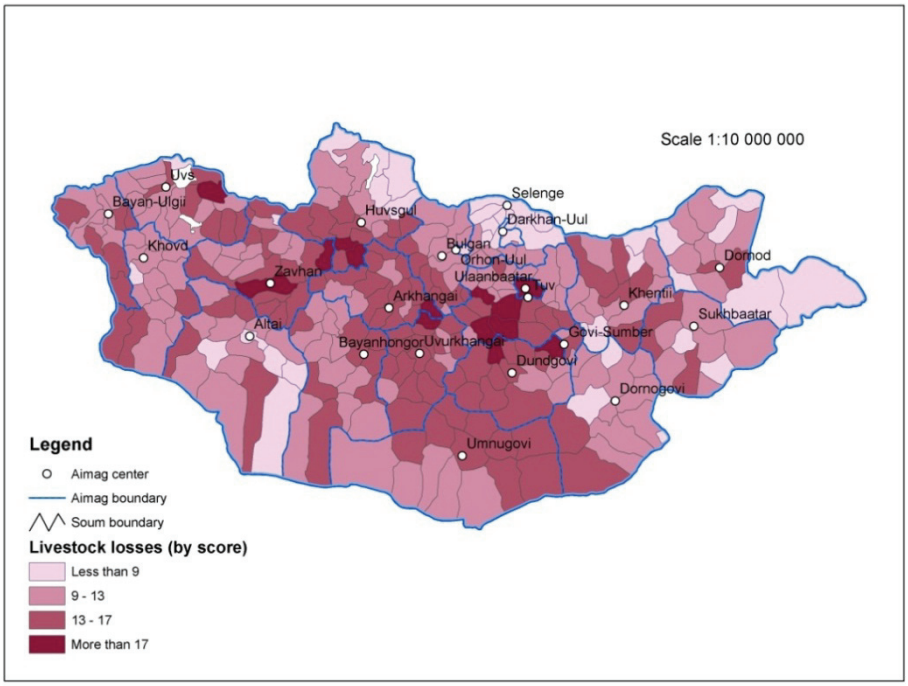
Studies (Figure 1.1) illustrates cumulative dzud losses since in 5 dzud since 1994, suggesting that some areas of Mongolia are more vulnerable to dzud than others, probably due to a combination of exposure and sensitivity.

Dzud is considered a disaster because of its effects on livestock populations that support the livelihoods of a third of the Mongolia's human population. Although there is relatively little research on dzud, a few recent papers have begun to examine the mechanisms through which dzud affects livestock mortality, and means of predicting dzud impacts and severity. Begzsuren et al. (2004) analyzed weather and livestock mortality data and found that dzud (snow depth) and combined dzud and drought had biggest effect on livestock mortality in the Gobi, but cold temperature alone was not a good predictor of mortality in their study area. They concluded that dzud and combined dzud and drought limit livestock populations, although they rebound quickly. Tachiiri et al (2008) used vegetation and weather (Snow Water Equivalent or SWE) indices derived from remotely sensed data together with livestock mortality data to explain the mechanism of dzud mortality in the 1999-2003 dzud years. They found significant

Table 1.1 Dzud incidence in Mongolia during the last 70 years (updated from (Reading, Bedunah, and Amgalanbaatar 2006)).

Year	Type of Disaster
1944-45	dzud + drought
1954-55	dzud
1956-57	dzud
1967-68	dzud + drought
1976-77	dzud
1986-87	dzud
1993-94	dzud
1996-97	dzud
1999-00	dzud + drought
2000-01	dzud + drought
2001-02	dzud + drought
2009-10	dzud + drought

Figure 1.1 Map of cumulative dzud livestock losses for 5 dzud since 1994. Darker colors indicate higher cumulative losses. For each dzud, losses in each soum (district) were classified on a scale of 1-4 where 1=less than 5,000 animals died, 2=5-10,000 animals died, 3=10-15,000 animals died, and 4=more than 15,000 animals died. Scores are summed over all 5 dzud years for each soum, with the resulting cumulative scores divided into 4 classes. (Data source: Mongolian National Statistics Office. Map created by the Center for Nomadic Pastoralism Studies)



correlations of animal mortality with low NDVI in the August preceding the dzud and high Snow Water Equivalent (an indicator of snow accumulation), suggesting that poor summer and fall forage conditions followed by a winter of deep snow explained much of the dzud mortality. This study did not examine temperature influences, however. Although Tachiiri et al. focused on the 3 consecutive dzud years from 1999-2003, their results suggest that certain areas of the country are more vulnerable than others to the impacts of dzud. In their analysis the most consistently affected regions were in the center of the country with the lowest average cumulative impacts in the far east and far west. Bayankhongor was the most severely affected aimag over the 3 year period. Moringa et al. 2003 (Morinaga, Tian, and Shinoda 2003) found that low temperatures and deep snow were negatively correlated (they do not usually occur simultaneously), so that when they are combined, it is likely that a severe dzud results.

Sternberg et al. (Sternberg, Middleton, and Thomas 2009) examined the relationship between drought and dzud in South Gobi Aimag using the Standardized Precipitation Index (SPI). They found no association between drought and dzud at their study sites for dzud episodes since 1987 through 1999-2001, in contrast to many popular definitions of dzud (ReliefWeb 2010; Weather 2010). However, their analysis of livestock and human population trends showed a sharp decline in both animal and human populations during the 1999-2001 dzud, which they interpreted as a reflection of migration out of the soum (district) to avoid dzud impacts. They found that over the long term, human populations were correlated with drought, but livestock populations were not, and concluded that, “Drought is a common place event and only one of several environmental challenges affecting this arid region. Its frequency and intensity here showed a moderate link with natural factors with little influence on livestock numbers. Pastoralists have adapted and evolved mechanisms to reduce drought impacts on their livelihoods,” (p. 375). This conclusion leads them to the recommendation that drought and dzud aid be de-coupled.

Less research is available on the social and economic impacts of dzud, although popular reporting and calls for aid assistance highlight these effects (UN 2010, 2010). The World Bank (The World Bank 2010) estimated that the 1999-2002 series of dzud years resulted in the loss of 413.8 billion MNT to the economy (US$369 million). Past dzud have demonstrated the negative correlation between livestock losses and agricultural GDP (The World Bank 2010), and have resulted in significant movement of herder populations from rural to urban areas in search of alternative livelihoods (UN 2010). More difficult to document are the impacts of dzud on individual livelihoods and the social and emotional well-being of herders, although the toll can be severe. During the most recent dzud, there were reports of increased suicide, and past dzud have been associated with increases in alcohol abuse and other social problems (Siurua and Swift 2002). Beginning in the early 1990s, immediately following privatization, several studies have documented the impacts of dzud on household well-being and identified important coping and adaptive strategies.

Templer et al. (Templer, Swift, and Payne 1993) analyzed the impacts of the 1993-1994 dzud on 60 herder households in Govi Altai Aimag, which occurred just after decollectivization, when herders were especially vulnerable due to their inexperience in coping with dzud without significant government support through the collective structure. They found that poorer households suffered significantly greater livestock losses as a percentage of their herd and suggested that this may make these households vulnerable to falling into entrenched poverty, where the number of livestock is insufficient to support their basic needs, they are no longer viable as an economic unit and are forced to exit the pastoral economy. Templer et al. argued that because dzud is a covariate risk affecting all households in a given geographic area, mutual support systems among households are not sufficient to buffer the effects and government must play a role in risk mitigation and response to prevent unacceptable inequities and overall loss of productivity. The recommended government roles included the reform and revitalization of the State Emergency Fodder Fund (SEFF) and development of a livestock insurance scheme compatible with the then new market economy and private ownership of livestock.

In 2000, the World Bank supported a Participatory Living Standards Assessment (PLSA), conducted by Mongolia's National Statistical Office (Mearns 2004; NSO and Bank 2001) to better understand the meanings and experiences of poverty and well-being from the perspective of both herders, town and city residents. The study revealed emerging sources of household vulnerability following privatization, including changes in traditional kin-based and other social networks "towards semi-commercial forms [that] often excluded the most vulnerable." (p. 128). Dzud was recognized as a major source of risk to rural households, and the study identified coping and adaptive strategies used by herders and others during dzud and other shocks or disasters. Despite the changes in traditional social networks, such interhousehold transfers remained important as coping and adaptive strategies, together with livelihood switching or diversification, migration, borrowing and saving. The recommendations from the PLSA were instrumental in influencing the subsequent wave of donor investments in community-based pasture management and sustainable livelihoods.

Ethnographic research during the last major dzud in 2002 identified key coping strategies used by herders in the Gobi and mountain-steppe regions of Bayankhongor aimag (Siurua and Swift 2002), namely use of reserves (food and fodder purchased or prepared in advance of winter); livelihood diversification with small cash income from pensions, wages, and small-scale businesses; informal mutual assistance, primarily from urban kin or Homeland Associations; and relief aid. These factors prevented widespread famine following the series of dzud and drought years, despite documented declines in health and nutritional status of herders (Siurua and Swift 2002). Many herders exited the herding economy, at least temporarily, following these dzud events.

In a study related more broadly to herder vulnerability to climate change, Janes (Janes 2010), found that poverty was significantly associated with poor physical and emotional health among herders, but points out that this does not necessarily mean that poverty causes lower health status, as the reverse is also possible (poverty results from the "impaired emotional and physical health of [poor household] members") (p. 241S). The same study found significant positive relationships between the existence of strong social networks between rural herders and urban households and the health of herding household members, providing evidence for the importance of these informal support systems to reducing household vulnerability. Janes surmises that herder vulnerability stems from the interaction of national and global economic and political processes with the characteristics of individual herding households, such that poorer herders are increasingly vulnerable and insecure. Further, he concludes that, "Pastoralism has been touted as optimally suited to dealing with climate change, but it can only function efficiently when government provides appropriate supports to mitigate risk and control resource access at a community level that ensures some level of equity and fairness." (p. 243S) Specifically, he argues that it is essential to provide "rural herders the capacity to effectively and flexibly regulate access to and use of essential common resources." (p. 244S). Janes' analysis is echoed by a more recent assessment of the 2010 dzud by Sternberg (Sternberg 2010), who identifies a complex of factors, including changes in pastoral land tenure changes and land use that translate to a reduction in pastoral capacity to mitigate and manage climate disasters.

In sum, dzud is a major disturbance that affects Mongolian pastoral systems frequently, but its occurrence in any given year is difficult to predict. Dzud has significant impacts on livestock populations, and consequently on herders' livelihoods and well-being, as well as the national economy. Indirect effects of dzud include large-scale migrations of people to urban and peri-urban areas, creating a cascade of additional social and resource management challenges. In the period since livestock population and weather data have been regularly documented in Mongolia (roughly the past 40-50 years), dzud has played a critical role in limiting livestock populations before density-dependent competition for forage results in severe overgrazing, starvation, and livestock populations crashes. Thus, despite its devastating consequences for herders, dzud serves an important ecological function in this social-ecological system, by reducing animals and hence grazing pressure, to a more sustainable level, albeit temporarily, and allowing pastures to rest and regenerate. Further, Mongolian herders have well-developed traditional coping mechanisms for dealing with dzud. However, the political-economic transitions of the 1990s and resulting transfer of the risk burden to individual herders combined with weak state regulation of pasture use, calls into question the continued effectiveness of these

traditionally adaptive strategies. The dzud of 1999-2002 was a "wake-up call" for herders and policy-makers, and resulted in significant investments by donors to promote risk and disaster management through a variety of community-based pasture management initiatives, in part to address the weak institutional environment governing pastoral resource access and use (Mau and Chantsalkham 2006). The effectiveness of these initiatives is still uncertain, but there are some preliminary indications of positive impacts (Morton, Amgaa, and Enkhbat 2002; Schmidt 2004; Upton 2008; Usukh et al. 2010). Dzud, despite the devastation and human suffering they cause, can also serve as an opportunity for learning and creative transformation, leading to more sustainable and resilient pastoral systems in the future. In this report, we take a close look at preparations for and responses to the 2009-2010 dzud in four case study sites to assess the factors influencing household and community vulnerability to the dzud, as well as the capacity for learning, adaptation and transformation as a result of this shock to the system.

1.4 The 2009-2010 Dzud

The dzud of 2009-2010 was characterized by prolonged freezing temperatures and deeper than normal snow cover in much of the country. Temperatures reached below -40^{o}C in 19 of 21 aimag and snow depths ranged from 20-200cm (Sternberg 2010). According to the UN ReliefWeb fact sheet, as of May 2010, 8.5 million livestock had died, approximately 20% of the country's livestock population, affecting 769,000 people or 28% of Mongolia's human population. Fifteen of the 21 aimag were declared disaster zones (ReliefWeb 2010). A September 2010 Red Cross report stated that 220,000 herding households were affected of which 44,000 households lost all of their livestock and 164,000 lost more than half their herd. A UB Post article from December 2010 reported that 9.7 million head of livestock died (about 22% of the 2009 year end herd). Authorities were concerned that this dzud, like those of 1999-2002, would lead to massive rural to urban migration (Sternberg 2010).

The Government of Mongolia was quick to recognize its lack of capacity to provide adequate relief, and by early 2010, appeals for international assistance were mounted. Sternberg (2010) identified a number of weaknesses in the Government of Mongolia's capacity to respond to slow onset disasters such as dzud, which take place over a wide spatial extent in remote areas, including the lack of communication and coordination among government ministries and relevant scientific institutes with responsibilities for planning and support, differences in knowledge and capacity between rural and urban areas, and the challenges of communication and data sharing from remote rural sites. A complementary study to this one, also supported by the World Bank, focused on dzud disaster financing and response in Mongolia (Benson 2010), taking a macro-level perspective on the dzud whereas this report examines dzud impacts and response from the household and community perspectives. Benson reaches similar conclusions to this report, including the need for greater clarity in the roles and responsibilities of government and private sector, improved and more transparent mechanisms for targeting aid to affected households, enhanced communication between sectors, and means to strengthening herders' capacity to cope with and adapt to dzud risk.

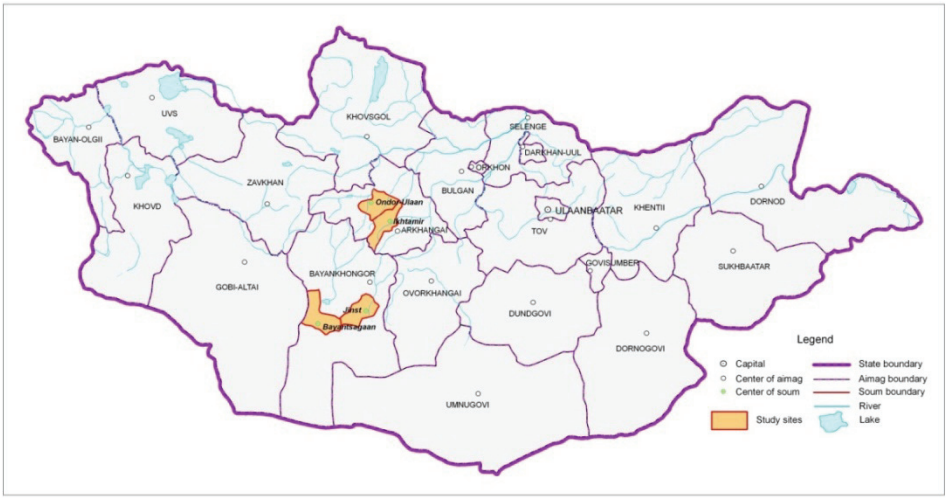
2. Study Sites and Methods

We used the following specific methods to explore the impacts of and responses to dzud in the proposed study soum: 1) key informant interviews with local government, NGO and donor officials, 2) focus groups with herders, 3) a photovoice documentary of herders' dzud coping and recovery experiences, 4) a short household survey to document dzud losses, coping responses, and assistance received, and 5) collection and review of local documents related to dzud impacts and responses. In the sections below, we identify the study sites and briefly review the data collection and analysis methods. More detailed descriptions of the analysis approaches may be found in the appendices to this report.

2.1 Selection of Study Sites

We conducted case studies of dzud impacts and responses in four soum, two in the mountain-steppe zone of Arkhangai Aimag (Ikhtamir and Undur Ulaan) and two in the desert-steppe region of Bayankhongor Aimag (Jinst and Bayantsagaan) (Figure 2.1). These sites were selected because of our prior research experience and data collection in these areas, which provided us with a rich understanding of the pre-dzud ecological and social conditions at each of the sites. Each pair of soum includes one site that has been a site of donor project investment to organize formal community-based rangeland management (CBRM) organizations (the Swiss Agency for Development and Cooperation (SDC)'s Green Gold Ecosystem Management Program in Ikhtamir, and the UNDP Sustainable Grasslands Management Program in Jinst). This paired design also enabled us to compare the preparation for, impact of and response to dzud in communities within each ecological zone with and without these CBRM organizations. According to our analysis of cumulative dzud impacts, all sites except Jinst fall into the second highest impact category, while Jinst is the third highest. A January 2010 UNICEF map of soum affected by the dzud identified Ikhtamir and Jinst as "affected" and Undur Ulaan and Bayantsgagaan as "extremely affected."

Figure 2.1 Location of the study sites. (Map by Center for Nomadic Pastoralism Studies)



2.2 Interviews and Focus Groups

In each study site, we conducted interviews with representatives of the soum government, local staff of donor organizations and NGOs, and other key informants such as leaders of organized herder groups or PUGs. We used semi-structured interviews to obtain basic information about soum socio-economic characteristics, and dzud preparedness, impacts and responses. The interview guide is included in Appendix A. Table 2.1 provides a list of interviewees in each study site.

Focus groups with herders were organized in each of the study sites. In year 1 we conducted 2 focus groups each in Jinst and Ikhtamir and one each in Undur Ulaan and Bayantsagaan to document herders' dzud experiences, coping and adaptive responses, and their perceptions of the lessons learned and possible benefits of the dzud. In year 2 we conducted additional focus groups in the original sites in Undur Ulaan and Bayanstagaan and additional focus groups with herder groups in Jinst and traditional herder neighborhoods in Bayantsagaan, in coordination with sampling for another project. In year 2 focus group discussions centered on dzud recovery, learning and adaptation rather than impacts and responses, which were the focus of the year 1 discussion.

Both interviews and focus group discussions were audiorecorded and transcribed. Transcripts (in Mongolian) were coded for major themes related to our research objectives, as well as emergent themes. Appendix B provides a list of the codes. Coded passages were then consolidated into tables by themes to facilitate synthesis of findings within sites and comparisons across sites. In writing the case studies, we reviewed all of the qualitative evidence related to each theme and summarized the findings, being alert for variations within and between study sites that would contradict the emergent conclusions. In year 1, for the Arkhangai study sites the consolidated tables were translated into English prior to write-up while the Bayankhongor tables were left in Mongolian and only the quotations used as supporting evidence in the case studies were translated into English. In year 2 only the final synthesis tables were translated, and all coding and summarizing took place in Mongolian.

Table 2.1 Interview and focus group participation at each study site. Superscripts indicate the year the individual was interviewed (a= Year 1 only, b= Year 2 only, c = both years).

	Ikhtamir	**Undur Ulaan**	**Jinst**	**Bayantsagaan**
Soum Officials	Soum Governor [a] Deputy Governor [a] Agriculture & Livestock Officer [a] Soum Parliament Head [b]	Soum Governor [a] Soum Parliament Head [a] Land Officer [a] Deputy Governor [b]	Head of Soum Governor's Office [b] Agriculture & Livestock Officer [a]	Soum Governor [a] Head of Soum Governor's Office [a] Deputy Governor [b]
Donor Staff	SLP [a] World Vision [a]	SLP [c] World Vision [a]	Vets without Borders [a] Head of Zegst NGO [b]	SLP [a] World Vision [a]
Other Key Informants	APUG leader [c] Ishgent PUG leader [b]	Bag Parliament member [b]	"Orgil" Herder group leader [b]	Tsetsen Uul leader [b] Bayanstagaanii Uvur

	Khukh Davaa PUG [b]		"Devshil" Herder group leader [b] "Bodi" Herder group leader [b] "Sar-Uul" Herder group leader [b] "Shar Khad" Herder group leader [b]	leader [b] Ar Shandiin Gol leader [b] Khutsiin Uul leader [b]
Focus Groups	Bogat Bag 2010 (18) Bogat Bag 2011 (7) Khan Undur Bag 2010 (17) Khan Undur Bag 2011 (5)	Dongoi Bag 2010 (12) Dongoi Bag 2011 (7)	Soum Center 2010 (6) Khunug Bag 2010 (7) Soum Center 2011 (6) Bodi Group 2011 (9) Devshilt Group 2011 (3) Orgil Group 2011 (6) Sar-Uul Group 2011(6) Shar Khad Group 2011 (5)	4th Bag 2010 (13) Soum Center 2011 (5) Tsetsen Uul 2011 (7) Bayantsaganii Uvur 2011 (5) Ar Shandiin Gol 2011 (6) Khutsiin Uul 2011 (4)
Total Participants	56	26	57	49

2.3 Photovoice

Photovoice is a participatory research method that empowers community members to describe and analyze their world with images and words they create. This method was first used in the field of public health to identify community problems and assets, prioritize issues, and catalyze community action to improve conditions (Wang and Burris 1997). We used photovoice in this project to learn more about herders' experiences of and responses to the dzud of 2009-2010. We hoped this method would inspire herders to discuss among themselves the reasons that the dzud resulted in disaster for many families, and what they could do as individuals and communities to prepare for future hard winters. Finally, we believed that herders' photographs and words could be a powerful way for rural people to communicate with decision-makers who can help affect change.

We used photovoice together with our other methods to document the impact of the dzud on herder families and communities, and investigate how herders responded during and after this crisis. After the Jinst and Ikhtamir focus groups, we asked for volunteers to take part in the photovoice project as photographers. The volunteer photographers participated in an additional training workshop immediately following the focus group. In the training session, each photographer was given a simple

digital camera and instructed in how to use and care for it. We discussed the overall aim of the photovoice project—to take pictures related to the dzud.

Photographers were provided with a paper form on which to record notes about the pictures they took, including the location, date and time, subject and why they took the photograph. We also discussed ethical considerations, such as asking people for permission before taking their photograph, and not photographing people in compromising or embarrassing situations. The photographers spent some time practicing taking pictures with their cameras and received individual coaching in basic photography techniques from the research team. At the end of the training workshop, the research team and photographers agreed on a meeting time and place where we would reconvene in 5-7 days to print out and discuss their photographs.

A total of 8 people participated as photovoice photographers, 5 men and 3 women. The youngest photographer was a high-school student and the oldest a grandmother. Most of the photographers were ordinary herders, but one herder was the elected leader of a formally organized Pasture User Group in Ikhtamir Soum, and one of the Jinst Soum participants was the soum Environmental Inspector, who was formerly part of the staff for the UNDP Sustainable Grassland Management project, which organized herder groups in the soum.

In Ikhtamir soum 5 of the 6 volunteer photographers attended the photovoice follow-up discussion, which was held in the soum center at the Green Gold Ecosystem Management Program project office. One photographer who was not able to attend asked another herder to return his camera with the photographs. After all the photographers arrived, they were instructed to select their five favorite or most important images from the photos they took to print and discuss. We downloaded onto a laptop computer all of the images taken by each photographer, and then printed out on a portable battery-operated color photo printer, 4 x 6 inch copies of each photographer's five selected images.

After receiving her printed photos, each photographer was asked to spend some time writing a caption for each photo. After the captions were completed, the photographers took turns sharing their images with the whole group and explaining the significance of each photograph. The sharing was done in "round robin" fashion, with each photographer explaining one picture, then the next photographer sharing one of theirs, until each person had shared and explained all five of their images. After all the photographs had been displayed and explained, a more general discussion ensued about what the photographers liked or found interesting in each other's work, and what they thought were the emergent themes from all of the images collectively.

Following the discussion, we suggested to the Ikhtamir photographers that they select a subset of the 35 printed photos and arrange them to create a poster about the dzud. The photographers picked 12 of the 35 images and organized them in a sequence to tell the story of the dzud. They chose the title "Lessons from the Dzud" for their poster, and we have used the same title for the photovoice book that is an appendix to this report. The research team documented the arrangement of the photos for the poster and later created a poster in Power Point using the digital photographs and the captions the

herders had written. The posters were printed out in Ulaanbaatar and 3 copies returned to the community, one for each of the participating bags (administrative sub-units), and one to display in the soum center.

In Jinst Soum, 3 volunteers participated in the photovoice project, two men and one woman. Due to the timing of the fieldwork in October, community members were very busy preparing for the oncoming winter and did not have time to meet as a group after taking their pictures. In Jinst, the research team met with each of the photographers individually to print out their photographs and document their captions.

In the photovoice book we present each photographer's five selected images and their captions in the original Mongolian and in English translation. We present them without further interpretation from the research team, in order to emphasize the herders' perspectives through their images and words.

2.4 Household Survey

In year 1, we attempted to resample households that were surveyed in summer 2009 as part of a pilot-test of our methodology for collecting linked ecological, social and livestock productivity data. Households in each of the 3 study bags in the two study soum were selected using a stratified random sampling approach with wealth group as the strata. Based on wealth ranking with 3-4 informants in each study bag, average wealth rank was calculated for each household on the official list of bag households. The population was then divided into 4 wealth groups and a random sample was drawn with equal numbers of households from each wealth group. Because there were fewer poor and very poor households in the sampling frame, and we were unable to locate all of the selected households or sufficient substitutes in these categories, the number of households sampled in each strata is not equal. The actual proportion of households surveyed in each wealth group better represents the distribution of wealth groups in the population prior to the dzud. To administer this survey, we first attempted to contact households that we surveyed in 2009, in order to make use of data on household socio-economic conditions prior to the dzud. When we were unable to find sufficient households that had been previously surveyed, we drew replacement households with similar wealth characteristics from our sampling frame. In all we surveyed 32 Ikhtamir households (18 and 14 from Bogat and Undur Ulaan bags, respectively), 18 Undur Ulaan households, 28 Jinst households, and 16 Bayanstagaan households, for a total of 94 households across the 4 study areas.

Data were collected by 4 trained enumerators using a face-to-face closed-end survey instrument. The survey (see Appendix C) consisted in 6 sections as follows: 1) household demographics, 2) livestock inventory (pre- and post-dzud), 3) pre-dzud conditions and winter preparations in 2009, 4) dzud impacts and responses, 5) aid received and given, and 6) future plans.

Data were entered into Excel and then imported into SPSS 17 for analysis. Descriptive and inferential statistics were calculated separately for the Mountain-Steppe and Desert-Steppe study areas and the results compared qualitatively between sites. For all nominal and ordinal variables, frequencies were

calculated using the Cross-tabs function in SPSS. For continuous (scale) variables means and standard errors were calculated for each study site.

To assess factors that influenced vulnerability to dzud losses, we used the percent of the 2009 herd lost in the dzud calculated in Sheep Forage Units (SFU), as our vulnerability indicator and dependent variable. One sheep is equal to 1 SFU, a cow 5 SFU, camel 6 SFU, horse 7 SFU and goat 0.9 SFU. For binary explanatory variables, for which survey respondents answered "yes" they did or "no" they did not undertake specific winter preparation or dzud response measures, we conducted Student's t-tests comparing the percent of herd lost for households that did and did not undertake each method. We used multiple regression to assess the relationship between percent of herd lost and continuous explanatory variables, such as mobility metrics (total and average distance moved in the 12 months prior to the dzud, number of moves, number of different campsites). We used ANOVA to assess whether percent herd losses varied among the 4 wealth groups in each of the study areas, as determined by the participatory wealth ranking used to stratify our sample. We also evaluated the direct and indirect effects of membership in a herder group (Jinst) or PUG (Ikhtamir) by assessing whether there were differences in losses or in dzud preparation or response measures between members and non-members. Due to the small sample size, we considered differences significant at a p-value of 0.10.

In year 2 a more detailed household survey was conducted on a slightly different sample in each study site. The year 2 survey was designed to compare the behavior and outcomes of households belonging to formal CBRM organizations with those who participate in traditional herder neighborhoods without any formal organizational structure. In Ikhtamir and Jinst, where formal organizations exist, we surveyed 5 members each of 5 such organizations in each soum. In Undur Ulaan and Bayantsagaan, we surveyed 5 members each of 4 neighborhoods in each soum. Analysis in year 2 focused on the differences among the 4 study soum in herd and pasture management practices and other indicators of adaptive behavior, livelihoods, information sources and social capital. In this analysis we sought to deepen our understanding of the relationship between community characteristics, including presence of formal CBRM organizations, local government pro-activeness and capacity, remoteness from markets, and environmental context, and household and community resilience and adaptive capacity, as indicated by the characteristics and behaviors of individual households within each study community.

2.5 Case Study Composition and Cross-Case Analysis

Case studies were composed using a descriptive, chronological, inductive approach (Yin 1994). We used the same outline to structure each case study, beginning with basic background information about the site, and then a chronological description of dzud preparedness, impacts, coping and adaptation strategies, followed by an analysis of the factors influencing vulnerability and indicators of resilience for that site. In each of these sections, we summarize the relevant quantitative and qualitative evidence from the surveys, interviews and focus groups. We conclude each case study with a summary of the key conclusions and implications of the case.

The cross-case analysis focuses on the factors influencing dzud vulnerability, coping and adaptation strategies, and resilience and adaptive capacity. To facilitate analysis we summarized factors influencing vulnerability, the frequency and effectiveness of coping and adaptation strategies, and constraints to adaptation in a series of comparative tables to help identify patterns across the study sites, focusing on commonalities and differences in vulnerability and the factors that help to explain them.

3. Ikhtamir Case Study

3.1 Soum Ecological and Socio-Economic Context

Ikhtamir Soum lies in the forest-steppe ecological zone and covers 4850 square kilometers. The western part of the soum is dominated by remote high-mountain terrain characterized by alpine and subalpine vegetation while the eastern half is more accessible and steppe and mountain-steppe vegetation dominates.

The average summer temperature is 14.1°C, while winter temperatures average -13.5°C. Annual average precipitation from 1961-2008 was 342mm (Jamiyansharav 2010; Dorligsuren et al. 2011). The effects of climate change are strongly felt in Ikhtamir. Climate change data from the nearest long-term stations, in Erdenemandal and Tsetserleg, show increases in average annual, maximum and minimum temperatures of 5.38°C, 4.12°C and 7.25°C for Erdenemandal and 4.38°C, 4.38°C, and 4.17°C for Tsetserleg (Jamiyansharav 2010, and Fassnacht, unpublished data). In Erdenemandal, annual precipitation has fallen by 186 mm over the past 100 years, while the number of rainy or snowy days has declined by 24.6. In Tsetserleg, annual precipitation has decreased by 89mm (Jamiyansharav 2010).

River flow in Ikhtamir has also decreased from 1976 to 2005 on the Khanuu and Khoyt Tamir Rivers. Peak stream flow declined by 166m3/s for the Khanuu River and 314m3/s for the Khoyt Tamir River over the past 100 years, while average annual stream flow fell by 24.7 m3/s and 40.7 m3/s over the past 100 years for Khanuu and Khoyt Tamir, respectively (Dorligsuren et al. 2011).

The current human population of Ikhtamir is 5,247 people comprising 1415 households of which 1073 are herding households. The number of herding households more than tripled following livestock privatization in the early 1990s, but since then has remained relatively stable. In 2009 (prior to the dzud) about 100 of these households had more than 500 head of livestock, 300 households had between 200-500 head and the rest had fewer than 200 head. About 400 households live in the soum center, half of which are below the poverty line. Among herder households, prior to the dzud, about 60% of herder households earned less than 2.5 million MNT per year.

Table 3.1 Ikhtamir Soum population trends. (Source: 1990-2011 soum statistics and (Dorligsuren et al. 2011))

	1990	1995	2000	2005	2008	2009	2010	2011
Total Population	5,213	6,432	6,568	6,714	5,157	5,247	5,230	5,232
Total households	1,524	1,574	1,457	1,382	1,339	1,415	1,480	1,461
Herder households	316	1,118	1,192	1,031	1,027	1,073	1,093	1,045

Poor households	876	No data	No data	No data	No data	No data	420	380

Livestock husbandry is the primary economic activity in the soum. Herd sizes have grown steadily over the past two decades since privatization, with the number of livestock doubling from 92,015 head in 1990 to 259,803 in 2009. Fifteen percent of livestock were lost in the dzud period from 2000-2003, but herds rebounded relatively quickly and by 2009, had again reached record sizes, surpassing their previous high point by more than 100,000 head. Herd compositions have also shifted over time, with greater emphasis on goats rather than sheep.

Figure 3.1 Livestock population over 41 years in Ikhtamir, Arkhangai. (source: Soum statistics)

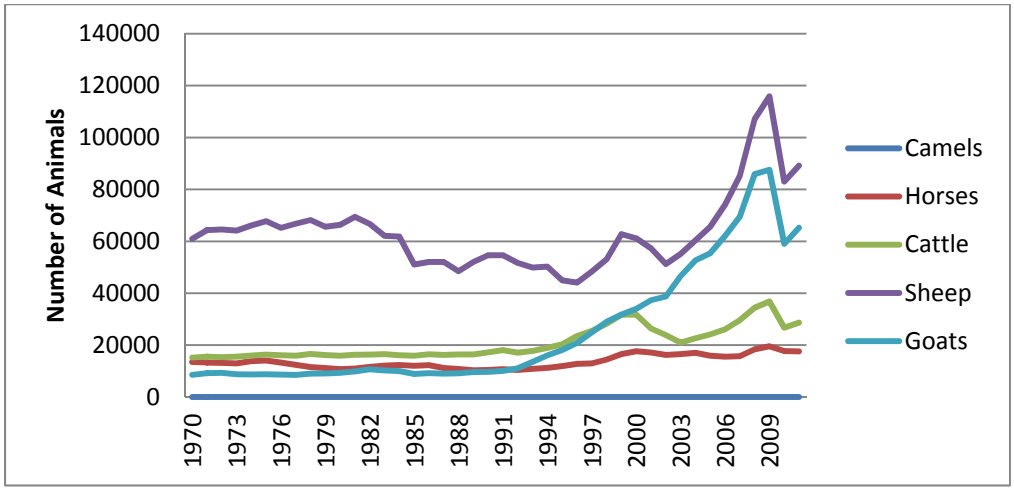


Figure 3.2 Total livestock population in sheep forage units (SFU) over 41 years in Ikhtamir, Arkhangai . (source: Soum statistics)

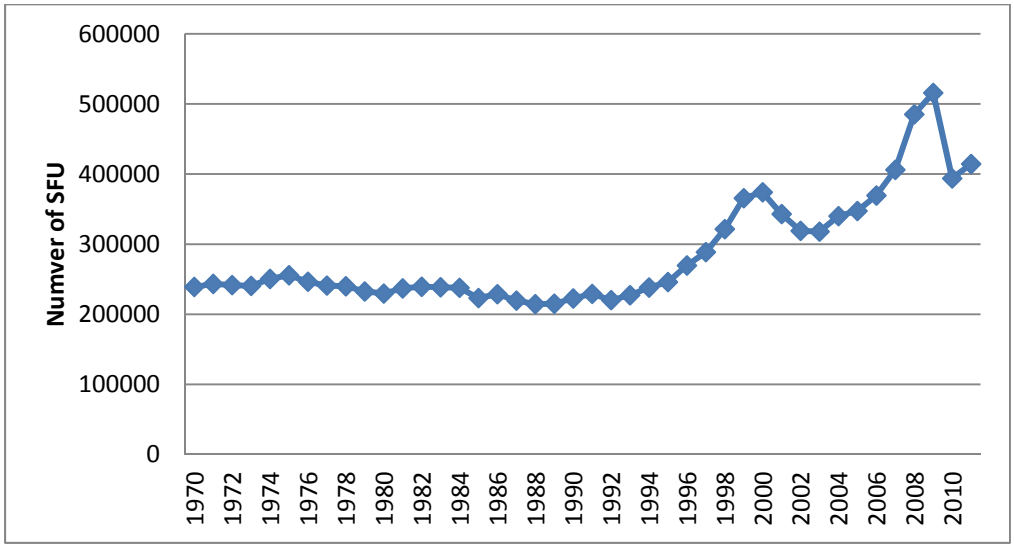
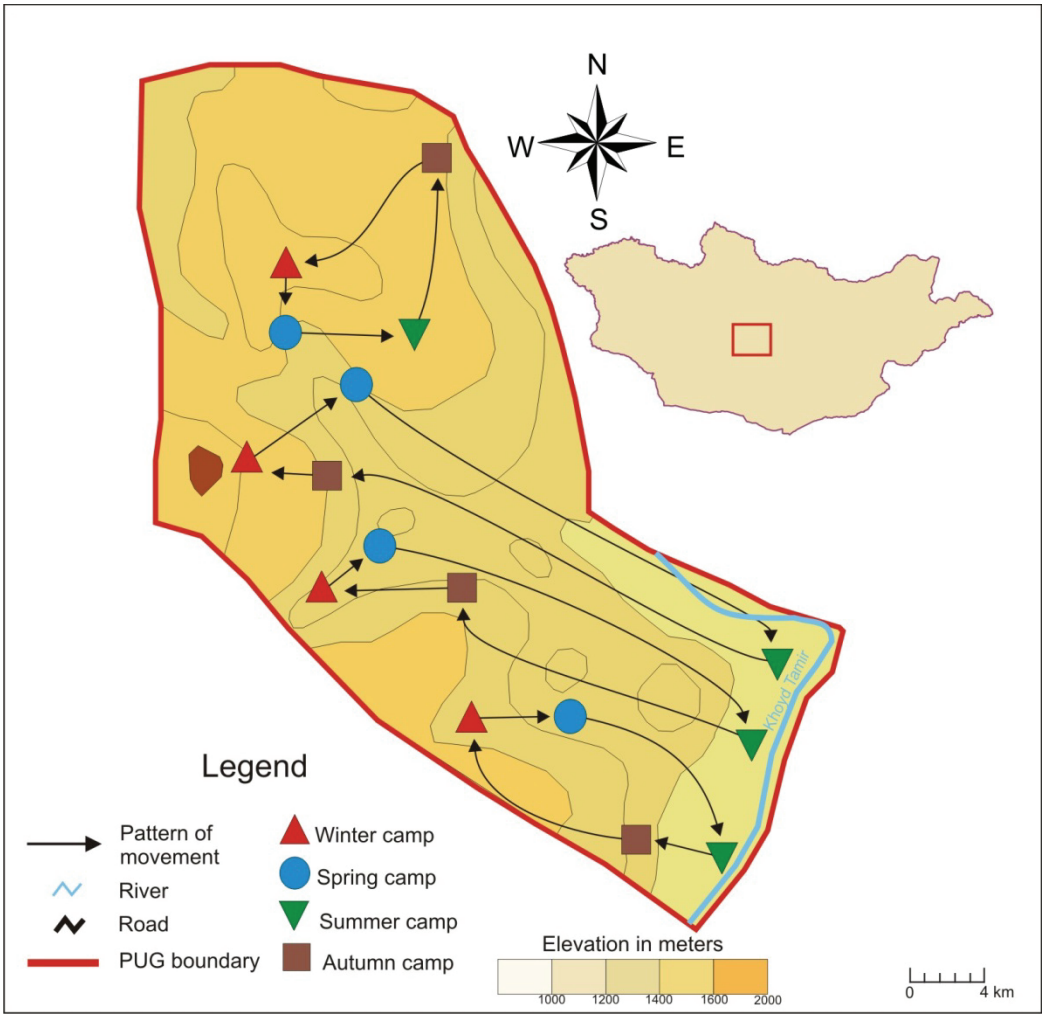
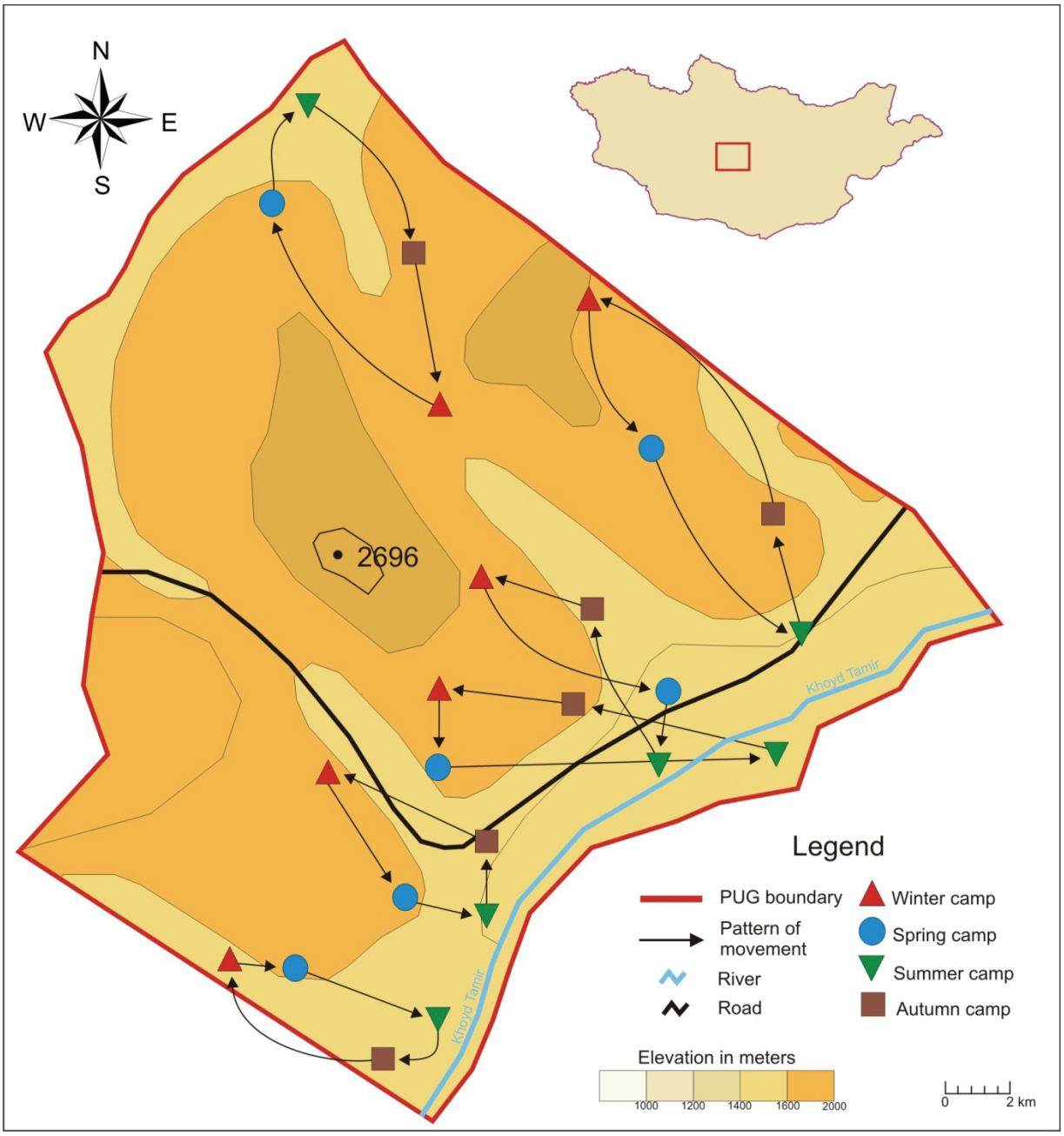


Figure 3.3 Movement patterns in Ishgent PUG, Bogat bag, Ikhtamir Soum.



Pastoral movement patterns in both Ikhtamir study sites follow the typical Khangai pattern of spending the summer along large river plains, where water and forage are abundant for lactating animals, and moving to sheltered valleys for the winter and spring. In both bags a subset of herders traditionally spent summer along smaller tributary rivers fed by springs, but this has not always been possible in recent years with the drying of natural water sources. In Khan Under PUG, many herders historically spent the summers at the Khanuu River on the northern border of the bag and the soum, but in recent years with the low flows in the Khanuu, they have remained along the Khoyt Tamir River. As this case study reports, one response of these herders to the dzud was to pass a bag resolution requiring all bag herders to move to the Khanuu River in summer of 2010, to allow the Khoyt Tamir pastures to recover.

Figure 3.4 Pastoral movement patterns in Khukh Davaa PUG, Khan Undur Bag, Ikhtamir Soum.



3.2 2010 Dzud Narrative

3.2.1 Exposure and Sensitivity

3.2.1.1 Weather Conditions, Pasture and Animal Growth and Winter Preparations

The summer of 2009 was drier than normal and most herders perceived that the growth and production of plants in pasture and hay-cutting areas was less than normal as a result (78.6% of Khan Undur herders surveyed and 88.9% of Bogat herders). Most also perceived that livestock conditions were worse than

usual (Khan Undur 78.6% and Bogat 55.6%), and many mentioned in interviews or focus group discussions that livestock did not gain enough weight or "meat fat" (*makhan tarag*) during the summer, as well as failing to put on fat (*okhon tarag*) in the fall to withstand a cold winter. Local officials confirmed this view. For example, the Ikh Tamir Agricultural officer stated, "Animal condition was poor due to the dry summer. [Many herders] didn't do *otor*[2] in the fall due to the lack of grass. Animals accumulated 70% of their normal fat (i.e. 30% less than normal)." Similarly, a focus group participant from Khan Undur bag commented, "Grass that [usually] remains green during the fall started to disappear from August 20. Usually the grass remains green until October and helps animals to gain fat in September."

As a result of the dry summer, and the overall drying trend, pasture use patterns in summer have changed in the past decade with more livestock and animals concentrating around the Ikh Tamir River during the summer, and formerly used summer pastures along some of the tributary streams and the Khanuu River unused due to lack of water. This has led to overuse of these pastures, conflict among herders from adjacent bags and PUGs, and likely contributes to insufficient weight gain of animals over the summer.

Due to the low productivity in the summer of 2009, many herders reported that they were unable to cut sufficient hay to store for winter and some did not cut any at all. Herders from Ishgent PUG in Bogat Bag cut significantly more hay (2.3 tons per household on average) than those from Kukh Davaa PUG in Khan Undur Bag (0.5 tons per household). This may have been due in part to better conditions further north (most Bogat herders perceived rainfall to be same as or higher than usual in 2009, whereas 100% of Khan Under herders felt it was below normal). Ishgent PUG has also worked specifically on developing their hay-making capacity with the help of new mechanized hay-making equipment provided through the Green Gold project. In focus groups Ishgent PUG herders referred both to hay they harvested individually (one person reported storing 15 tons) and hay that the group prepared for their collective use, 1000 hay bales.

Perhaps to compensate for the lack of hay, 71% of Khan Undur households made hand fodder, while only 44% of those from Bogat did. Herders in this area make hand fodder from dried nettles as well as various wild onion species. However, participants in the Kukh Dava PUG focus group (Khan Undur bag) reported that nettles and onions did not grow as much or dried up early in 2009, so they were not able to make as much hand fodder as usual.

All Ikh Tamir herders, in theory, participate in Pasture User Groups (PUGs) and PUGs have developed and implemented pasture management plans that enforce rest of winter pastures. We found that 40-50% of surveyed households reserved spring pastures. Over a third of the surveyed Khan Undur households reserved dzud pastures for use by their khot ail, while only 6.7% of those in Bogat Bag had dzud reserves. A high percentage of surveyed Ikhtamir households made fall otor movements to fatten

[2] Otor refers to movements herders make other than regular seasonal movements, usually for the specific purpose of fattening animals in the fall, or escaping a weather disaster such as dzud or drought. Otor movements are usually made with only part of the herd and household, and herders often camp in a tent or small ger.

their animals (92% of Khan Undur households and 72% of those in Bogat), although one local official reported that, in general, herders did less fall *otor* in 2009 due to the lack of grass.

In addition to harvesting and storing hay, preparing hand fodder, and going on *otor*, herders made other typical winter preparations, especially preparing their winter shelters. Winter shelter preparation includes repairing or expanding structures, cleaning the inside of shelters, corrals, and bedding grounds (*buuts*) and, importantly, removing and drying the previous winter's accumulated dung. The dried dung is later replaced and used as insulation for the shelter and bedding grounds, and for household fuel. This concentrated dried sheep and goat dung from corrals is informally referred to as *Mongol nurs* or "Mongolian coal," referring to its ability to burn slowly and intensely. The head of Ikhtamir's PUG Association commented the importance of this practice, repeating a Mongolian saying, "If you prepare yourself very well for winter with your shelter and *buuts*, even if you only have half the necessary fodder, you can pass winter smoothly."

In 2009, however, many Ikhtamir herders, lulled by the previous warm winters, failed to prepare their shelters and *buuts* adequately. As the same informant reported, "Last summer was very dry and therefore herders couldn't collect enough hay. The hay was used up in December. Herders didn't prepare well. We have had no bad winters since 2000. That's why a lot of herders didn't prepare well—like fixing winter shelters. They also didn't prepare their bedding ground (*buuts*)." The Ikhtamir Deputy Governor reported similar apathy among herders, and faulted them for failing to slaughter or sell their animals early in the winter: "We received information that the weather in winter would be very harsh and cold, which is common news for us and we did not take it seriously. The previous summer was very dry and herders could have done mass slaughtering, but herders have a mentality to increase their livestock number and retain rather than sell animals."

No surveyed herders in Ikhtamir were insured. In the Kukh Davaa PUG focus group, herders mentioned that they were interested in insurance, but it was not yet available in their area: "There are no households who have animal insurance in our bag. We are discussing about it." One Ishgent focus group participant commented, "No households in our place have animal insurance. When I visit the soum center I always ask about this and get the same answer that such service is not provided in our soum."

According to the Ikhtamir Agricultural Officer, Ikhamir soum had no fodder reserves apart from 1000 bales of hay that were harvested by one of the Green Gold-sponsored PUGs. In 2009, the soum government arranged to access and distribute the PUG's hay to those in need. Due to continued issues about rights to the hayfield, this agreement was discontinued in 2010.

3.2.1.2 Dzud Awareness and Early Warnings

In response to an open-ended question about factors that influenced their winter preparations in 2009, many survey respondents indicated that they did not expect a difficult winter and had received no warnings from the government or through other media. In the Khukh Davaa PUG focus group, participants reported that they were warned by the soum administration and held a bag meeting to discuss how they would respond. As part of the regular seasonal bag meetings, herders were instructed

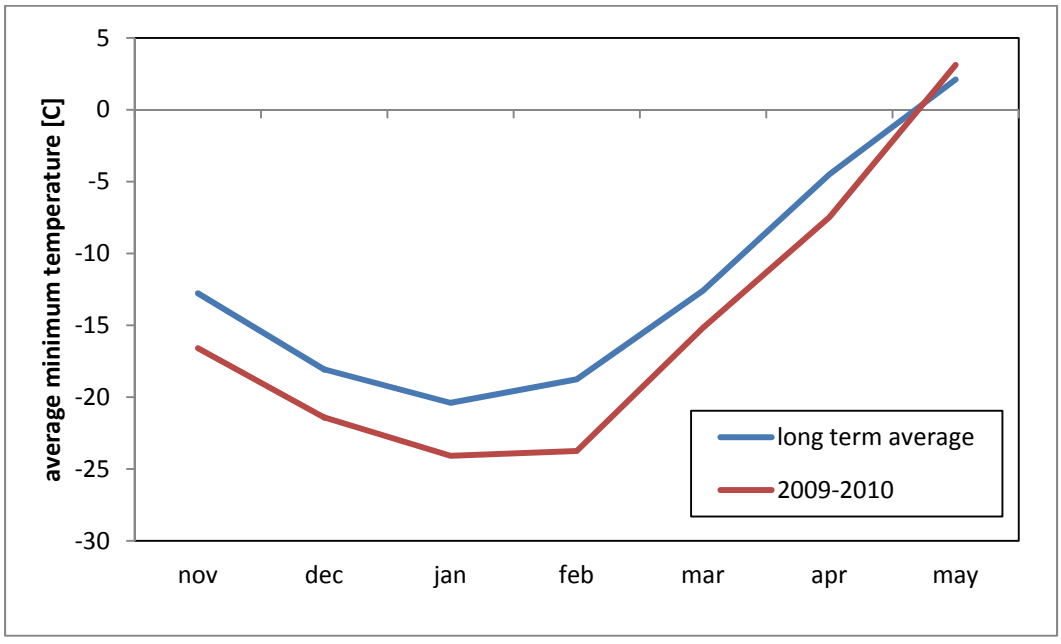
to prepare hay and buy feed in advance of the winter. Herders in this focus group also reported that herders expected a difficult winter due to the poor pasture conditions the preceding summer.

3.2.1.3 Dzud Characteristics

Local government officials reported 28 snowfalls between November 2009 and June 2010 with an average winter temperature of -25°C. Officials reported that snow covered 70% of the soum with the average snow depth of 15 cm in the flat areas and 80 cm in the forests. The Ikhtamir Agricultural Officer described that the first snow melted and then froze, creating a crust that lasted until the end of April. She perceived that this dzud was more severe for Ikhtamir than the 2000 dzud. The Deputy Governor reported, "It was very cold and the cold days lasted for an extended period. The snow cover was not that thick, 15-20cm. In the old days we used to have this amount of snowfall, but the grass grew taller. But now even a thin snow cover means livestock have nothing to graze on. Weak animals feel cold even at 2 degrees."

According to focus group participants, the prolonged freezing cold weather was the main and most serious aspect of the *dzud* that affected livestock mortality. One Kukh Dava PUG participant reported, "This winter we had many cold days and spring season continued longer than usual. The last 3 months were most difficult. In the end of April and May we had heavy snow. But at the same time this provided moisture to grass to grow, and the grass was eaten right away." Others in the same focus group also commented on the late onset of spring, which worsened the situation.

Figure 3.5 Average monthly minimum temperatures for Tsetserleg in 2009 compared with long-term average. (Source: Soum meteorological records)



An analysis of climate data from Tsetserleg and Erdenmandal stations (the nearest reliable long-term weather stations to Ihtamir and Undur Ulaan) confirms these perceptions. The 5-month average

November through March temperature for 2009-2010 at Tsetserleg was the coldest on record. At Erdenemandal, it was colder than all previous years on record except 1976-1977, 1967-1968, and 1968-1969. The Tsetserleg station also had the most monthly precipitation on record for November and December 2009[3].

3.2.1.4 Incoming Otor Herders Increased Sensitivity to Dzud

Herders from Bogat Bag reported that a large number of herders came to Ikhtamir from other soum during the dzud. They began to arrive in November and did not leave until March. According to some focus group participants, the impact of the increased number of livestock due to the influx of outsiders exacerbated the impacts of the dzud, particularly the scarcity of forage, and contributed to mortality of local herds. One Ishgent PUG herder explained why many outsiders went to his bag: "Compared to our area, other places started snowing earlier and the snow covered their pasture completely. Snow covered only 50% of our territory, therefore herders from other bags and soum came into our territory as *otor* movement." This influx of outsiders in the middle of the dzud increased the effects of the dzud on the local resident herders. An Ishgent PUG focus group participant described the situation: "Around 20,000 animals came and grazed on 26,000 hectares of pasture. The impact of that we experienced in spring. When the herders who came in *otor* left, we had "black dzud" in spring, where we had a shortage of pasture." Many others echoed this perception in their comments: "When the snow started to melt, herders who came in *otor* from other places left our territory with poor pasture." "The animals who came in *otor* and then left ate nearly everything." "Our soum faced a black[4] dzud when the herders from outside left."

3.2.2 Coping Responses

3.2.2.1 Herders' Coping Responses

Winter Otor. About half of the surveyed herders in both bags went on winter *otor* in search of better pastures and warmer conditions. However, the head of the Ikhtamir PUG Association reported that these households did not always fare well, because the families they went to camp with were ill prepared and did not have warm and dry bedding grounds for their animals. In focus groups, several herders also remarked on the problem of insufficiently warm bedding places.

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[3] Following the methods of Nandintsetseg et al. (Nandintsetseg, Greene, and Goulden 2007), who reference Nicholls and Murray (Nicholls and Murray 1999), we examined the following two temperature based extremes: 1) cold nights which are defined as the frequency of days with the minimum temperature below the long-term (1961-2009 where available) mean first percentile, and 2) cold days which are defined as the frequency of days with the maximum temperature below the long-term mean first percentile. Since we were looking at extremes, the number of frost days (frequency of days with minimum temperature below 0 °C) were deemed to not be relevant here. For Tsetserleg, there were 18 cold nights in 2009-2010 that is the most since the winter of 1968-1969 that had 29. In terms of cold days, 2009-2010 also had 18 that is only fewer than 1968-1969 that had 24. Erdenemandal had 11 cold nights and 12 cold days in 2009-2010. This is the fifth and fourth fewest, respectively, after 1976-1977 (19 nights and 24 days), 1968-1969 (27 and 23), 2004-2005 (16 and 15), and 1966-1967 (15 nights). (Analysis provided by Steven R. Fassnacht and S. Tumenjargal, Associate Professor and Graduate Student, Dept. of Forest, Rangeland and Watershed Stewardship, Colorado State University. We gratefully acknowledge their contribution.)

[4] This herder said "black dzud" but what was probably meant was "hoofed dzud".

Feeding Strategies. Over 80% of Bogat Bag herders grazed their winter and spring reserve pastures, but only about half of those in Khan Under grazed these seasonal reserve pastures. About a third of surveyed herders in both bags grazed khot ail dzud reserve pastures. Bogat herders were also more likely to graze soum designated dzud reserves (18% compared to none of the Khan Under households surveyed). Fifty-three percent of Bogat households and 78.6% of Khan Undur households reported clearing snow from pastures to make forage more accessible for their animals.

Many households purchased additional hay (300-400 tons on average), as well as feed (600-800 kg of bran on average), and fed their stored hay (94% in Bogat, 78.6% in Khan Under) and hand fodder (41.2% in Bogat,78.6% in Khan Under). Several local officials mentioned that herders have lost knowledge of how to feed purchased fodder properly. The Ikhtamir PUG Association leader explained that before feeding bran (the most commonly purchased feed), it must be soaked in warm water for 24 hours. Herders mixed the feed with hot water, but did not allow it to soak for the necessary time.

In the focus groups and open ended survey questions, herders reported many additional measures they used to feed or strengthen their animals during the cold weather (See Survey Appendix) These measures included various rice and porridge mixtures, tea and milk preparations, and soups made from various concoctions, the most memorable being a broth made from boiled mice and voles that herders trapped and cooked. Herders also mixed horse dung with bran, aspen leaves and other substances, and used the dried rumen contents of slaughtered animals as supplemental feed. Herders also reported giving IV glucose and vitamin complexes to their animals in an attempt to strengthen them.

Protection from Cold. Most herders in Bogat (82%) and Khan Undur (79%) brought their animals into gers during the dzud to keep them warm. Almost all herders put blankets on their animals (94% and 100% in Bogat and Khan Undur). Other measures that herders mentioned in In focus groups included massaging the frozen legs of animals and burning dung fires in winter shelters and corrals to warm animals.

3.2.2.2 Government Responses

The Ikhtamir Soum government appears to have been poorly prepared for the dzud. They had little in the way of dzud reserve pastures or hay reserves, and what hay they did have was provided by Green Gold PUGs. They responded by using their local funds to purchase additional hay from the national government (see Aid Provided below). In addition, the soum and bag governors played key roles in identifying which households should receive targeted aid from various external donors.

In the Ishgent PUG focus group one herder commented, “Soum officials and doctor worked badly during the dzud. We heard that because of low losses some bag governors received a motorcycle. Soum officials and the bag governor did not visit herders. A bag meeting was not organized and no advice was provided.” In Khan Undur bag, in contrast, a bag meeting was organized to discuss dzud response.

3.2.2.3 Aid Provided

According to the Soum Agricultural Officer, Ikhtamir received dzud assistance from 8 different donors or aid organizations as well as the Mongolian government (see Table 3.2). In addition, the soum government used three million MNT of its local budget to purchase additional hay from the state fodder

reserve, which were sold to herders at the subsidized price of 3500 Tg per bale. Surveyed herder in Ikhtamir identified a total of 8 external aid sources, but they did not overlap completely with those reported by the soum official.

Table 3.2 Sources of aid listed by soum official and household survey respondents.

Sources of Aid	**Aid Listed by Soum Official**	**No. (Percent) of Survey Respondents**
Soum Government	Free hay (1000 bales); subsidized hay (January)	11 (32.3)
National Government	Free hay, 10 tons fodder (January), food and clothing (spring)	5 (15.6)
Red Cross	25 families received 300,000 MNT each including food and clothing (February)	0
Erdenet Factory/Homeland Association	Every household received 25kg flour and 5,000 MNT of medicine, delivered to each khot ail (February)	29 (90.6)
ADRA	90 families received 50,000 MNT each food and clothing (March)	0
World Vision	Not certain (April)	0
Green Gold	16,000 MNT per family to all herder households (total 3.8 million MNT) (May)	10 (31)
SLP	50 families received 50,000 MNT of food each, 5 million MNT of IVOMEC (vet medicine) distributed to all households (May)	5 (15.6)
French	80 families received 100,000 MNT of food each (June)	0
ADB	30 families who lost most livestock received 300,000 MNT each (Not yet distributed at end of June)	0
Vet Net	Not listed	2 (6.2)
Soum School	Not listed	2 (6.2)

Opinions about How Aid is Distributed. As Table 3.2 illustrates, most food and clothing aid was targeted to specific households that were designated as most needy. In most instances, the soum or bag governor provided a list of households that were determined to be in greatest need of assistance. In some cases aid was transferred directly to the soum or bag to distribute. In others, such as World Vision, staff of the donor organization used the list as a starting point, and then evaluated the households themselves. World Vision targeted households who had lost more than 30% of their herds and openly displayed the list of recipients. According to the WV representative in Ikhtamir, "We didn't receive any complaints about aid distribution, because the selection was done in accordance with objective criteria and many people checked the list. It was a collective decision, not made by one person."

Ikhtamir SLP program staff focused on assisting families with many children, female-headed households, and those who lost many livestock, and used the soum governor's list as a basis for making their

decisions. The SLP staff discussed how they met with GG and the Poverty Alleviation Program as well as soum officials, in order to coordinate assistance and avoid duplicating aid to the same families.

Despite these efforts, some soum officials reported that they received many complaints about how aid was distributed. According to the soum Agricultural Officer, "There are a lot of complaints from those who did not benefit and felt they should have had some assistance. Bag governors were burdened by complaints. Bag governors said it was a waste of money. Donor organizations hand selected receipients. The soum administration suggested that [future] aid be in cash to establish a fund that can be used appropriately."

In focus groups, herders differed in their views about how aid should be distributed. Some felt it was important that aid be distributed across all households, so that everyone receives the same amount. Others felt that this diluted the aid so that the amount received by each is not enough to make a difference. The negative feelings about targeting aid to the most needy households were sometimes expressed in terms of perceptions of increasing dependence and "strategic poverty" as discussed in the next section.

Concerns about Aid Appropriateness and Dependence. Some officials and some herders expressed concern about what they perceived as increasing dependence of some households on external assistance, strategic behavior and perverse incentives. One Khukh Davaa focus group participant summed up these concerns from a herder's perspective:

"Nowadays herders have become less active and this is wrong. If we will continue to have a policy that 'since he is poor we need to help him,' then we will never reduce poverty. For some herders assistance has caused them to be lazy. So, this is the negative side of help/assistance. When help comes it has always been distributed among the poor herders. This makes them less active. Animals [herds] do not grow by themselves, they need care and hard work. And nobody admits that. We work very hard. And when you see that the government gives help to those people who say that they lost animals and have nothing, it makes herders more and more lazy."

Others echoed these views:

"The help makes herders less active and in the end, on top of laziness, leads to poverty."

"Most help goes to poor households. But nobody understands that those herders who have many animals worked harder in order to increase their numbers."

A project staff person from the SLP program in Ikhtamir expressed similar concerns:

"Too much aid has the opposite effect. People become dependent on aid. People are not pro-active. They may even become poor on purpose in order to qualify for aid. We should talk directly to herders, not just rely on some other data. We should visit them and see their conditions first hand."

As did the soum's Deputy Governor:

"I want to change the dependency mentality of herders. People have an understanding of aid to benefit them and complain if they are left out of such assistance. They have got the idea to live on aid."

Social Capital and Informal Assistance. Few Ikhtamir survey respondents reported receiving assistance from family members. However, in some of the focus groups, herders mentioned the importance of assistance from relatives in the city, who sent food and flour. Others discussed how khot ail members cooperated in the dzud to care for each other's animals when one household went on otor, leaving their small stock behind in care of the other khot ail households.

3.2.3 Dzud Impacts

3.2.3.1 Herd Impacts

In Ikhtamir soum overall, 69,085 head of livestock perished in the 2009-2010 dzud (129,724 sheep forage units or SFU). This is more than twice as many as those lost in 2001 (29,724 head or 60,010 SFU). Nearly a third (26.7%) of the livestock in the soum as of the 2008 year-end census died. In Ikhtamir overall, the Deputy Governor reported that 55 households lost all their animals and 204 households lost more than 50% of their herd.

Among the households surveyed in Bogat and Khan Undur bags, Bogat households lost 35% of their herd on average and Khan Undur families 26%. Cattle fared the worst. The average family in both bags lost 41% of their cattle. In Bogat bag, percentage losses per household for other species were also relatively high (about 25% of horses, 40% of sheep and 38% of goats), while in Khan Undur they were considerably lower for other types of animals (8% of horses, 12% of sheep and 19% of goats). Herders in the focus groups also reported that fewer horses died, and that cattle, and young sheep and goats were most vulnerable.

In focus group discussions, herders described in graphic detail how their animals froze to death. Many described how animals froze in the fields, especially young stock. One spoke of how his animals' feet froze and ears "broke off." In the words of another herder, "We had animal losses not because of a shortage of hay, but due to freezing cold weather condition. Some animals were not able to walk back to the winter camp and died in the fields." Some attributed the freezing to lack of warm bedding grounds: "Due to lack of warm [dried] manure, many animals lost weight and quickly started to get weak. We gave fodder to all animals, weak and healthy, but it did not help."

3.2.3.2 Human Well-Being and Livelihood Impacts

In surveys and focus groups, Ikhtamir herders reported relatively few direct negative impacts on human health and well-being from the dzud, although it was clearly a difficult and stressful time. Local officials in interviews mentioned an increase in health and emotional problems related to the dzud.

In focus groups, herders were more concerned about the economic and livelihood impacts of the dzud, especially the loss of many cows, which are essential for dairy production for both subsistence and sale in the mountain-steppe zone. The following quotations from herders in the Kukh Davaa focus group describe the situation.

"The amount of milk from cows has declined. Therefore milk products are rare now. We used to sell our milk to the kindergarden in the aimag center. From the profit we bought flour, rice and other items. None of our family members has a pension or social assistance. Therefore we have very limited sources of income. Our well-being is declining. Our household income is declining, too. It is difficult to have a normal standard of living."

"We have 10 cows and milk them. The product was sold in the aimag center. Income from that was 670,000 MNT per year in the past. But this year we will not have this income. We lost 5 cows in the dzud. We made a calculation and are hoping to have 200,000 MNT income this year. Which means we lost around 400,000 MNT"

"We had 5 milking cows with calves and now we are left with only one, which we will do our best to raise. But it is not enough for living. We need to do something for living."

3.2.3.3 Poverty and Dzud Impacts

Over all the mountain-steppe sites, there was an apparent trend (not statistically significant) between household wealth level and the percent of herd lost. The poorest herders lost the largest percentage of their herds, on average, while the wealthiest sustained the lowest losses, in terms of the percent losses. In absolute terms (head of livestock or SFU lost), households with more livestock generally lost more animals, but they also had more animals, as well as a larger percentage of their herd, remaining after the dzud.

3.2.3.4 Beneficial Impacts of the Dzud?

In the Ishgent PUG focus group, herders discussed that many unproductive animals died in the dzud and referred to this as "natural selection," implying that the dzud ensures that only the genes of the hardiest, best adapted animals are passed on. Herders in Khukh Davaa PUG mentioned the spring soil moisture from the late snows, which contributed to good grass growth in the summer of 2010 following the dzud. Finally, dzud was seen by some as a necessary lesson for herders: "This dzud trained herders. It reminded us about 'half feed and warm bunk' and taught us about proper preparation for winter. Without such experiences, herders will not learn necessary lessons."

3.2.4 Adaptive Responses Immediately Following the Dzud

3.2.4.1 Plans for the Future—Household Level

Most surveyed herders planned to continue living in the same location in the countryside in the coming year, but one respondent in each bag planned to move to Ulaanbaatar or another city. One Kukh Davaa focus group participant shared a poignant story of sending his children away to work in the mines: "Last winter we sent our two children to Dornogobi Har-Airag mining. One is working is a borer and other one as a teacher. Before Dzud we had more livestock and were able to support the children's livelihood. Now we have 4-5 cattle and raise them on our own, no need to call them to help us in herding. We told them to take care of themselves only, please don't give us and don't ask anything from us."

Most respondents also planned to continue herding as their main livelihood activity. Some expressed that, "There is no other way for living but herding." However, 15-20% of those surveyed planned to do

another job instead of or in addition to herding. Ishgent and Khukh Dava focus group participants discussed that they would try to diversify their incomes while maintaining their herds, as the following quotations illustrate:

"I will try to increase my livestock and in parallel will try to work in case opportunities arise."

"It is necessary to look for alternative livelihoods, because herding along can't meet all our livelihood needs. Therefore, something else than herding is important to contribute to the household."

"First it is good to utilize natural resources, for example collecting pine nuts. In parallel, it is helpful to learn to work for others who are about to start some entrepreneurship [small business]."

However, they also highlighted the challenges herders face in trying to pursue a different occupation, "Livestock is not a secure asset, but herders do not have education and specialization and they will face hardships if they abandon herding."

Most herders planned to let their herds regrow at a natural rate, although 15% of surveyed Bogat households and 11% of Khan Undur households planned to look for animals to buy. About 30% of Bogat households reported they would focus on animal quality over quantity in the future, as did 11% of Khan Undur households. In focus groups, herders also expressed similar sentiments, as participants from the Ishgent PUG focus group stated: "We ought to keep livestock numbers under certain limits," and "It is important to pay attention to the quality, not numbers."

3.2.4.2 Plans for the Future and Evidence of Learning—Community Level

At the community level, there were several hopeful signs that the 2009-2010 dzud experience has led to important lessons and learning at both individual and collective levels. In Ikhtamir, the Association of PUGs facilitated a formal process of collective learning and self-reflection by organizing a soum-wide meeting of herders attended by about 200 herders. The participants discussed the mistakes that were made, what they learned from the dzud, and concluded by outlining 12 "lessons learned," which were documented and printed on laminated cards for distribution. According to the soum governor, the 2 main conclusions of the meeting were: "1) Be prepared for winter. Each household should have 30 days of hay reserved, the local government 3 days for the entire soum, and national government 3 days for the whole country. 2) Rotational grazing of pasture management. We agreed that herders need to graze distant pasture, not pastures near their winter shelters. During winter start grazing far away and reserve pastures near the shelter for the emergency." In Khan Undur bag, herders passed a resolution to move to the Khanuu River during the summer, allowing their winter pastures to rest and regrow.

The dzud experience to some degree influenced herders' resolve to work together, as well as emphasizing to local officials the importance of fostering and supporting collective action and cooperation among herders, especially cooperation in pasture management. The largest institutional challenge to effective collective action for pasture management remains the issue of cross-border use, especially during the *dzud*. Table 3 illustrates some of the qualitative evidence of changes in individual attitudes and behavior and collective action, and Table 4 identifies some of the constraints to collective action.

3.2.5 Recovery, Learning, Adaptation a Year after the Dzud

3.2.5.1 Winter Conditions in 2010-2011

The weather conditions in 2010-2011 were less cold than in 2009-2010 and the snow cover was not that thick. All focus group participants indicated that the weather in 2010-2011 was relatively warm, where compared to the dzud winter, when, "the cheeks of people who came back from day herding was so red in dzud year."

3.2.5.2 Summer Conditions and Winter Preparations in 2010-2011 and 2011-2012

The pasture conditions in summer 2010 were different than in 2009. Herders reported that pasture recovered, and the yield was higher. However, the herders from the Khokh Davaa PUG reported that high pasture yield was uniform across all parts of their territory. There were areas where grass was not sufficient to cut hay. Although pasture conditions had improved somewhat, herders reported that animal condition in summer and fall 2010 was poorer than that in fall 2009. According to some focus group participants animals had not fully recovered from the dzud: "Animals that lost weight in the dzud did not have sufficient weight in the fall, lacked "meat fat.""

As part of 2010-2011 winter preparations most households prepared at least one mound of hay. All but one of the Ikhtamir households surveyed in 2011 reported cutting hay in fall 2010. In focus groups, several herders also remarked that some herders even cut hay from the forest. The average family prepared a large amount of hay and did not use it all during the winter of 2010-2011. Herders from Khokh Davaa PUG reported making hand fodder based on knowledge received from a training that the PUG leader organized. However not all herders were able to participate in the training, and therefore only a few households were able to prepare and store hand fodder. One third of surveyed Ikhtamir households prepared hand fodder in 2010.

Preparation for the winter of 2011-2012 at the household level was the same as the previous year, according to informants. However, in focus groups several herders remarked that the winter preparation started earlier than usual and efforts focused on animal gain of "meat fat." Herders from Khokh Davaa PUG reported that they moved to an area with mineral salt (*khujir*) which was located 20 km distant. Herders from Ishgent PUG reported that "several herders went for otor, but not very far away since the pasture was recovered due to intensive rain of this year." Forty-six percent of household survey respondents in Ikhtamir reported going on fall or summer otor to fatten their animals before the winter of 2010-2011.

At the community level in 2011, herders prepared supplementary fodder as a part of winter preparations. All the available technology of the PUG was involved in this activity. There were cases when one PUG with a tractor helped another PUG at harvest. This activity was done with financial assistance from the Green Gold Ecosystem Management Project, which provided seeds and tractors.

Herders from Ishgent PUG reported that they stored hay in a barn that was built a year earlier under the risk management component of SLP-II. Most PUG herders were involved in cutting hay. "Some herder worked one day, and others a few days, and those who worked more days had free meals and per diem." In the Khokh Davaa PUG focus group one herder reported on a shortage of labor to help with haying: "Now adays due out migration especially of younger people, there is a shortage of labor and therefore cooperation becomes essential, even in such work as collecting firewood."

In Ishgent PUG as part of winter preparation herders moved the location of their reserve pasture fence to new place close to a water source and *bag* center. The PUG leader explained that this decision was related to repeated entry of non-PUG member animals from the neighboring bag. "Control over the access to this reserve and close location to newly built deep well was the main reason [for moving the reserve]."

3.2.5.3. Recovery from the Dzud

According to focus group participants, herd sizes had not recovered one year following the dzud. Herders indicated that one a half and two years is too a short time for recovery and that more than two years are required to regain the same herd size as before the dzud. Soum level statistics (Figures 3.1 and 3.2) illustrate that while herds have begun to recover in Ikhtamir, they are still far from pre-dzud levels.

There were different comments on household income recovery. Many herders lost the means for production when their cattle died: "I lost 5 cows in the dzud, which means no dairy production for sale." However herders agreed that while household income did not reach the level it was before the dzud, income was not severely reduced. Much of the lost income was made up by a social subsidy in the amount of 21000 MNT per person per month that the government is providing as part of an election promise. In the words of one participant, "The 21000 MNT makes a significant contribution to cover the cost of essential items and food."

Another important source of household income in 2011 was from nature. According to herders, "This year pignolias (*samar*) and berries grew very well." One herder mentioned that, "Even people from Ulaanbaatar and the aimag center came to collect *samar.*" Herders collected the pine nuts (*samar*) and sold them in the aimag center.

In focus groups, herders reported that the poverty level has not declined and may have increased. Soum officials concurred, saying that there are few wealthy and many poor households in the soum. Herders explained that herd size has not recovered, the price for livestock product s is still low, and alternative sources of income are limited. However, herders from both PUGs reported that there was no case when households left the community to live in the soum or aimag center or move to another location.

Although both herders and local officials perceive pasture to be improving following the dzud, due to the combination of reduced stocking pressure and increased summer rainfall in 2010 and 2011, pasture conditions still have not regained their previous productivity. As one herder indicated, "I remember that

without looking far, within close range we were able to cut as much hay as we wanted. I used to be able to cut 8 oxcarts of hay close to my winter camp site." Even with the current recovery, this level of productivity has not been achieved.

3.2.5.4. Learning, Adaptation and Resilience

In the second year of our study, there were many qualitative indications that herders, individually and collectively, had begun to act on the ideas and intentions they expressed during the year 1 focus groups. In general, the attitude toward winter preparation has changed and herders are preparing for winter early and thoroughly.

At an individual level, the main lesson that herders were acting upon was to focus on herd quality rather than size. All herders who participated in the year 2 focus groups indicated that they were seeking to "improve breeding" and "trying to bring high productivity breeds from other places." Some of the male breeding stock were obtained from herders who recently in-migrated or from *tuuvarchin* (stock drover) herdsman. One herder spoke of how he travelled to Dundgobi aimag to look for high quality breeding stock and brought them back to Arkhangai. Male breeding stock were also brought from western provinces such as Uvs, Gobi Altai and Bayankhongor aimags and even from Sukhbaatar aimag of eastern province. In addition to increasing quality by improving breeding stock, there was evidence that some herders were reducing herd size or more actively culling unproductive animals from the herd before winter. One Khukh Davaa PUG participant reported, "One young herdsman who had many animals, sold part of them and bought high production cows and shifted to farming management." This quotation illustrates that in some instances there may be spontaneous shifts towards greater intensification in production.

Herders also understood that improvement of animal quality and productivity also depends on the condition of pastures, as one herdsman indicated in a focus group discussion, "Herders these days understand improvement of herd quality as not only bringing in high productivity breeds but also making winter shelters warm, protecting pasture, and rotating and resting pastures." Herders from Khukh Davaa PUG reported that "There are a few households who have more than one spring camp site and rotate them in case one of them worsens."

Implementation of the lessons from the dzud at the community level was more complex. In Ikhtamir, at a collective level (usually within a PUG), herders cooperated to harvest and store hay and obtained external support to construct a hay storage barn. They also began to work together to protect water and pastures more effectively. For example, the leader of Ishgent PUG described that, "Before, herders complained about the lack of water sources, and the need of rehabilitate or build a new wells, but now herders are protecting springs and putting up fences around them. Such activities are coordinated and herders are helping each other to put up fences and look after them." In Ishgent PUG as part of winter preparation, herders moved the location of their reserve pasture fence to a new place close to a water source and the bag center.

3.2.5.4. Roles of Different Actors in Dzud Preparation and Recovery

In year 2 we asked herders about their ideas for the roles that different actors should play in dzud preparation and recovery, including local government, civil society organizations, donors and private individuals.

In focus group discussions, herders indicated that **local government** should establish a local emergency fodder fund, including coordinating the purchase, storage and distribution of hay. The following focus group quotations illustrate these views:
"We learned last time that the soum government poorly prepared for the dzud. The hay distributed hay was not enough and not all households receive aid."
"Last time they bought one lorry of hay for 800 households. Who will get it?"
"There is a need to prepare a large amount of hay that will be enough for long period."
Herders also thought the local government should play an important role in regulating prices for fodder and if possible provide a low price during the disasters.

Many herders suggested that local government should mobilize labor forces during the dzud. One herdsman recommended, "There are many young people in the soum center that jobless. They could help with delivery salt to herders or help to old herders." Herders from Ishgent PUG indicated, "There is no coordination of programs or projects. The resources that been provided are not sufficient to accomplish the tasks… On top of that there is no information of how was spent the government resources."

In discussing the role of **civil society organizations**, herders from Ishgent PUG commented that the strong connections between rural and urban populations that existed during the collective period have weakened. "In that time we had one or two urban organizations with whom we had close relations, where urban people helped in difficult periods of the year by providing labor or sending essential items (blankets, candles, batteries etc). In return we provided livestock food products (milk, yogurt, meat)." "These days it could be any organization or government institution, NGO or even school and kindergarten". Herders indicated, "Through such relations herders are not only who are protecting pasture, but others are part of this process." "Such relations are a very important part of education. There are many children growing in city that have not seen a live animal." They see a role for civil society organizations in strengthening these bonds, not only during disasters, but throughout the year in such as way that Mongolia's growing urban population continues to identify with and be invested in the health of the nation's natural resources and rural population.

In focus group discussions, herders commented on the important role of **donor organizations** in developing adaptation strategies. The SCD Green Gold project, and SLP-II are the main donor organizations operating in Ikhtamir soum. According to soum officials, donor organizations should continue provide technical and financial assistance. Herders from Khokh Davaa PUG reported that SLP-II provided assistance to repair the road over the pass that allows access to salt. Herders from Ishgent PUG reported that SLP=II provided assistance to build a barn for hay storage. The Green Gold project helped in organizing in production of supplementary fodder.

With respect to the responsibility of **individual households**, herders agreed that one of the important lessons from dzud was to have good individual preparation. “Each household is required to pay attention to individual preparation. Nobody will come to you and start to help.” “Herders need to plan in advance and start winter preparation as early as possible, when the price is low.”

3.3 Discussion

3.3.1 Factors Affecting Vulnerability

In Ikhtamir, household vulnerability was influenced primarily by the pre-existing level of household wealth and well-being and individual preparations for winter. Poor households lost a greater proportion of their herds and were more likely to be left with nothing. Herders who worked hard during the preceding summer and fall to make sure their animals gained weight and put on sufficient fat fared better than those who did not. In particular, herders who undertook fall *otor* lost fewer animals than those that did not. Hay storage, advance purchases of fodder, and, in particular cleaning and repairing winter shelters, were also important to survival. Qualitative data suggests that in 2009, many herders did not adequately prepare their winter shelters to ensure animals had a dry, warm bedding ground, and this significantly contributed to mortality, even when fodder was available. Many herders lacked knowledge of how to use purchased fodder, and so this investment was probably less helpful that it could have been. Both some herders and local officials suggested that many young or new herders lack experience and knowledge to prepare for winter and cope with dzud. As one Ishgent PUG herder expressed, “Climate and earth have changed and herders have become younger. On average they have herded for 15-20 years. Therefore they have little experience and this causes some conflicts between traditional and new practices.”

At the household level, it is less clear what role formal aid and informal mutual assistance played in the outcomes of individual herds and households. While many surveyed households received some form of assistance, it was not clear whether this assistance ultimately affected herd survival. As most of the assistance was directed towards human food and clothing, it no doubt helped families during a difficult time, but probably did not affect livestock losses.

At the community level, lack of preparedness on the part of the soum adminstration likely affected vulnerability due to lack of hay reserves and designated dzud reserve pastures. In addition, the soum administration was apparently ineffective in negotiating with neighboring soum or the aimag government to minimize the impact of incoming *otor* herders on Ikhtamir herders. In Bogat bag, the thousands of *otor* animals from other soums had a devastating impact, leading to some of the highest losses in the soum, despite the fact that these herders were generally well-prepared in terms of hay reserves. Although preparations for winter are ultimately the responsibility of individual herders, the local administration probably could have done more to advise and encourage herders to be well-prepared.

3.3.2 Recovery and Resilience

In 2010, herders in focus groups demonstrated understanding of the need to change some of their individual and collective practices in order to be better prepared for dzud in the future, and generally to manage their livestock and rangelands more sustainably. In 2011, herders had begun to implement some of these changes, putting their learning into action. Most notably at the individual level, a number of households discussed a change in overall strategy to focus more on animal quality rather than herd size. In 2011, it appears that the focus on animal quality was being implemented, with many herders seeking to improve the quality of their breeding stock by purchasing new breeding stock from outside the region. In Ikhtamir few herders planned to leave the area and there were limited opportunities for income diversification outside of the livestock sector, limiting these adaptation options.

At the community level, herders began to make a more concerted effort to pool their labor to harvest and stockpile hay, successfully seeking outside support to fund construction of a storage facility. Herders also took more collective actions to improve grazing patterns, restore water sources and protect reserve pastures more effectively. Some of these actions were initiated immediately following the dzud in 2010 (such as the implementation of a decree in Khukh Davaa enforcing summer movements to rest overused pastures), while others were implemented in 2011. These included rehabilitation and protection of water sources to improve water availability and disperse grazing pressing, and taking action to protect reserve pastures by changing the location of a fenced reserve to an area where it could be more effectively protected from out of season grazing by livestock from outside of the soum or bag. Also at the community level, the APUG has played a role in fostering collective learning from the dzud experience, which may have contributed to changes in both individual behavior and collective action.

3.3.3 Role of Adaptive Strategies

Table 3.4 attempts to categorize and summarize some of the main adaptive and coping strategies used by herders in the dzud, applying the 5 categories of strategies previously identified in the literature (Agrawal 2008; Fernandez-Gimenez and LeFebre 2006): storage, mobility, diversity, reciprocity and exchange, flexibility, and pooling of resources. The most frequently employed strategies were storage (hay), mobility, and reciprocity or exchange. According to our quantitative analysis, the most effective strategy was fall *otor*, as this enabled animals to gain sufficient fat to withstand the freezing conditions. Winter *otor*, on the other hand, did not appear to provide much benefit, and qualitative evidence suggested that in some cases it may have led to greater losses.

Strong norms and traditions of reciprocal pasture use between soum resulted in increased vulnerability for Ikhtamir herders, especially those in Bogat bag. Although these herders had more hay stored, the effects of the influx thousands of additional animals from other soum severely affected pasture conditions and the survival of animals in this part of the soum. Thus, storage was not sufficient to counteract the negative impacts of reciprocity in this case.

Table 3.3 Evidence of adaptive responses at individual and community levels in Bogat and Khan Undur bags, Ikhtamir Soum (2010 data).

Adaptive Response	**Example**	**Illustrative Quotation**	**Source**
Individual Attitudes, Knowledge and Behavior	Focus on livestock quality, reduce numbers	"We ought to keep livestock numbers under certain limits" "It is important to pay attention to the quality, not numbers" "It is important to improve herd quality. It will take several years 5-7. We need to have new blood…It won't help to use local livestock."	Ishgent FG Ishgent FG Ishgent FG
	Improve winter preparations	"Dzud-related livestock mortality brings a lot of changes in the mentality of herders. They see the importance of keeping livestock healthy, having savings in the bank. The dzud kept the most healthy animals, which creates and opportunity to raise a healthy herd in a short period of time." "I will warm my shelter and will collect a good amount of hay." "This summer we have good forage production and plan to harvest a sufficient amount of hay. We will reserve about 10,000 bales of hay in the barn." "If we prepare sufficient hay and herd animals to fatten them during otor, we will overcome smoothly harsh winter months."	Deputy Governor Ishgent FG Ishgent FG Khukh Davaa FG
	Expect the unexpected	"We can't deny the fact that dzud might happen again next year, because we can't control nature." "Being relaxed by warm winters happened in the past years and we were not prepared to expect the bad effects of dzud. We don't assume the dzud is over, it might happen again this winter, so we will not be careless like last year."	Khukh Davaa FG Khukh Davaa FG
Collective Action	Cooperation in general	"According to my observation, collective strength and action is necessary. It is not efficient to be on our own, scattered around. We can survive longer if we stay together."	Ishgent FG
	Coordinated pasture use	"A key for animal husbandry is pasture. Pasture is protected only on the basis of cooperation, but not on an individual basis. Otherwise herders will overgraze each other's pasture. So it is important to conserve pasture communally." "This year we learned a lot of lessons from the past dzud. Our PUG had a meeting and agreed to go for *otor* right after Naadam in July." "For example, when we all camp in our summer pasture, we talk about the time to move away. This year I think people will move out without warning." "The PUG advises them where to move, helps to fence reserve pasture and natural springs, and talks about rotational grazing."	Deputy Governor Khukh Davaa FG Khukh Davaa FG Khukh Davaa FG
Changes in Formal Institutions	Khan Undur bag resolution	"Our bag governor is planning to send herders for *otor*, improve animal shelters, ensure proper vaccination, and establish a hay reserve."	Khukh Davaa FG

Evidence of pooling of resources, particularly labor and more effective management of common grazing lands, emerged during the fall and second year following the dzud, when herders worked together effectively harvest and store large volumes of hay, develop and enforce more sustainable grazing patterns, and cooperated to rehabilitate water sources.

Many herders demonstrated innovation born of desperation in their attempts to concoct created feeds for their animals to maintain their strength, but it is not clear that these measures had much benefit.

Table 3.4 Summary of adaptive strategies used in Ikhtamir Soum.

Strategy	**Examples**	**Frequency of Strategy**	**Benefit**
Storage	Stored hay Made hand fodder	High Moderate	Medium Low-Medium
Mobility	Fall otor Winter otor Post-dzud migration	Moderate Moderate Low	High Low Too soon to tell
Diversity	Alternative livelihood or income generation	Low-Moderate	Low-Medium
Reciprocity/ Exchange	Purchased fodder Received *otor* herders from other soum Informal mutual assistance	High High Low	Medium? Negative Low
Flexibility	Fed creative alternative home-made feeds	High	Low
Communal Pooling	Cooperation to harvest and store hay (post-dzud) Implement/enforce new grazing rules on common Pastures Collective rehabilitation of water sources	High Moderate Moderate	High (expected) High (expected) High (expected)

3.3.4 Role of PUGs and the SLP

The Green Gold sponsored PUGs play a potentially critical role in reducing vulnerability and building resilience by helping herders organize to collectively prepare for winter and manage their pastures more cooperatively and effectively. PUG herders were generally well prepared in terms of hay stores, and in some areas are rotating their pastures effectively among seasons. The Association of PUGs also played a role in helping herders to reflect collectively on their dzud experience and discuss needed changes in individual and collective actions. The PUGs were not necessarily effective in responding during the dzud, however. We did not document any instances where the PUGs played a role in helping herders organize to limit their losses during the disaster. Rather, their role was more in preparation and post-dzud learning and transformation.

The efforts of the SLP project in Ikhtamir were largely complementary to the GG-sponsored PUGs. The SLP project was described by the program officer as being “bottom-up” and herder-driven, with herders

proposing projects, which are then discussed and prioritized at the bag level, then forwarded to the soum where a similar discussion occurs and the final projects are selected. In Ikhtamir, many of the funded projects were proposed by and benefit PUGs (e.g. a hay storage barn in Ishgent PUG, have making equipment for a PUG in Khan Undur bag, and fodder production for Ard Zuu PUG. SLP and GG also coordinated on the distribution of emergency aid during the dzud to avoid duplication.

3.3.5 Constraints to Adaptation

Constraints to adaptation include both the physical limitations of the environment, which may preclude the use of some strategies in some places and times, labor shortages, and cultural and institutional constraints.

In focus group discussions, herders reported a shortage of labor as one of the main constraints to adaptation at the household level. The age composition of herders has shifted towards middle-aged and older herders while younger people seek a higher education outside of the district. Without the labor contribution of these young people, according to one focus group participant, "Some families can't prepare firewood, bring drinking water, make otor moves, send animals to salt areas etc. or even participate in PUG work." Lack of labor also hinders herders in winter preparations such as preparing shelters and harvesting hay, although the increase in cooperative hay harvesting has helped somewhat. The labor shortage affects basic production activities such as milking. As one herder reported, "Now I can't milk as many cows as I used to before."

Livelihood diversification at an individual level may be limited by institutional barriers. A herder from Khokh Davaa PUG reported, "Many herders who have woodworking skills to build products such as oxcarts, saddles, furniture, ger frames etc. have limitation on implementation. Permits are limited, and herders have to pay a high fee for use of wood from forest." To overcome this constraint, some herders are forming "*nukhorlel*" or formal herder communities that may legally gain access to the wood and products from the forest.

Herders in Ikhtamir identified lack of information and access to technology as a constraint to adaptation at the individual and community levels. For example, herders as yet have no information about or access to livestock insurance. Herders indicated interest in livestock insurance but due to lack of information they are not able to purchase insurance. Herders were interested to learn more about livestock insurance products, including the level and conditions for compensation for livestock losses.

In the Ikhtamir case, most of the constraints at the community level related to challenges to implementing collective action. Heterogeneous interests of small-scale and large-scale herders created a challenge for effective organization of PUGs. Lack of institutions to coordinate inter-soum movements and otor were another major constraint, which turned a potentially adaptive strategy (reciprocity) into a maladaptive one for herders on the receiving end. If perceptions of aid dependency and, especially strategic poverty to "make a living" from donor assistance are accurate, these attitudes may stifle herder innovation and adaptive capacity.

Table 3.4 Evidence of constraints to adaptation from interviews and focus group discussions (2010 data).

Constraints to Adaptation	**Illustrative Quotation**	**Source**
Challenges to collective action, general	"During the collective period were forced to collaborate. Now it is not the same. Within the GG project there is there is the start of these efforts on rangeland management."	Soum Governor
Challenges to collective action, cooperation is small scale, among kin	"Informal collaboration among kin groups. Not much expanded cooperation, mostly among relatives. In summer camps are many people camping together."	Soum Governor
Challenges to collective action, PUGs	"Herders join PUGs on a voluntary basis, but wealthy families aren't interested to join."	Khukh Davaa
	"A herder becomes a PUG member when he provides his contribution to the revolving fund. Wealthier herders do not need to get loans from the fund and therefore don't need the PUG."	Khukh Davaa
	"The results show herders with few livestock are more interested to get involved in the PUGs, but those who have large herds are not."	Deputy Governor
Conflicts among large- and small-scale herders	"Those herders who have many livestock stress ones with few livestock. Large numbers with poor quality of animals trample pasture and affect the earth. It is necessary to raise the tax for the herders with a thousand livestock. People are fearful of herders who have a thousand livestock."	Khukh Davaa
Incoming cross-border *otor* movements	"We can't do anything when otor herders come. It is not allowed to banish otor herders. When they claim our pasture is better and has less snow and try to save their remaining few livestock, it is very hard to say 'no'."	Ishgent
Lack of formal institutions to address cross-border *otor*	"Usually we do otor within the soum. Both other soums' herders came to our soum for otor. If we plan well with our rangelands we can do otor within the soum. When outsiders come, it makes the situation difficult. Every year we make plans to allocate an otor place for those that come from other soums."	Agricultural Officer
Aid dependency	"Too much aid has the opposite effect. People become dependent on aid. People are not pro-active. They may even become poor on purpose in order to qualify for aid. We should talk directly to herders, not just rely on some other data. We should visit them and see their conditions first hand."	SLP Staff

3.4 Implications for Policy and Practice

- It is essential to set aside dzud reserves at the household, soum and aimag levels, and to have designated areas where herders from other soums can be directed so that their presence does not have a negative impact on local pastures and herds.
- Setting aside these reserves may require revisiting overall stocking rates, or stocking in particular areas of the soum or during specific times of year.
- Mobility within and between seasons should be encouraged and, if necessary, enforced. Fall otor was a critical factor in ensuring animal fitness to survive the winter.
- In addition to dzud reserves, households/khot ails should have distinct seasonal pasture areas for winter and spring and local regulations should be devised to be sure that winter and spring pastures are protected from out-of-season grazing from both soum herders and outsiders.
- PUGs hold promise for fostering collective action to manage pastures and prepare for winter with communal hay harvest and storage. However, they are voluntary associations and there are few incentives for herders with large numbers of livestock to participate, which undermines effective collective action. PUGs and local officials will have to consider how to regulate the behavior of herders who do not participate in these territorially-based management institutions, or whether, eventually, membership must be mandatory.
- Cross-boundary, multi-scale institutions are essential to manage otor movements. Otor is a critical strategy for both fattening animals and surviving harsh winters, but the current unregulated and uncoordinated movements are causing significant damage to receiving areas.
- The targeting of aid to the poorest families was somewhat controversial in Ikhtamir, among some herders and officials. Some perceive this approach is unfair to herders who work hard to care for their herds, and that too much aid promotes “laziness” and strategic poverty among herders. Dependency on and expectations of aid in future disasters may limit herder innovation and adaption.
- The most useful aid in terms of reducing livestock loss was the hay and feed that arrived early in the dzud. The food aid from Ganzorig (Erdenet Company) was most appreciated by herders because it arrived just before Tsagaan Sar. Some complained that inappropriate or poorly timed aid was wasted money and felt that cash assistance in a fund that could be locally administered would be best.
- Dzud impacts are not all bad. Dzud mostly affects the least fit animals, leaving the strongest behind to improve the local stock. Spring snows provide much-needed moisture for plant growth. Dzud crises lead to learning that can catalyze constructive collective action and inspire individuals to change their beliefs and practices.

4. Undur Ulaan Case Study

4.1 Soum Ecological and Socio-Economic Context

Undur Ulaan Soum lies in the forest-steppe ecological zone and covers approximately 44,000 ha. This case study focuses on Dongoi bag in Undur Ulaan, which borders Ikhtamir and lies just north of our Ikhtamir study sites.

We were unable to obtain long-term climate records for Undur Ulaan, but expect the climate and trends to be similar to neighboring Ikhtamir. The Khanuu River originates in and flows through Undur Ulaan soum, and forms the border between Undur Ulaan and Ikhtamir to the south along one reach. Peak stream flow in the Khanuu River declined by 166 m^3/s and average annual stream flow fell by 24.7 m^3/s over the past 100 years for Khanuu (Dorligsuren et al. 2011). According to a 2004 census of springs in the soum, 55% of the natural springs had dried out (interview with Deputy Governor). Although donor projects have rehabilitated many wells in the soum, the water levels are dropping (interview with Deputy Governor). In response to the alarming decline in springs, soum residents began to build small fences around the springheads to protect them. When they discovered that the small fences were not enough, they fenced larger areas (100 m^2) and observed some beneficial effects.

The 2009 human population of Undur Ulaan was 5,798 people comprising 1570 households of which 1,220 were herding households in 2008.

Table 4.1. Undur Ulaan Soum population trends. (Source: 1990-2011 soum statistics)

	1990	1995	2000	2006	2007	2008	2009	2010	2011
Total Population	4431	5629	6068	5767	5454	5729	5798	5711	5737
Total households	No data	No data	1584	1576	1532	1501	1570	1582	No data
Herder households	No data	No data	1413	1288	1220	1328	1173	1195	No data

Like Ikhtamir, livestock husbandry is the primary economic activity in Undur Ulaan soum. And like Ikhtamir, Undur Ulaan livestock populations have more than doubled from 90,107 head in 1990 to 240,351 in 2009. As in Ikhtamir, about 15% of livestock were lost in the dzud of 2000-2003, but in Undur Ulaan, most of the losses occurred in the first winter, and herds began to regrow by 2001. By 2009, the herd size had more than doubled from its size in 2001. As is common throughout Mongolia, herd compositions have also shifted over time, with greater emphasis on goats rather than sheep.

Figure 4.1 Livestock populations over 41 years in Undur Ulaan (source: Soum statistics)

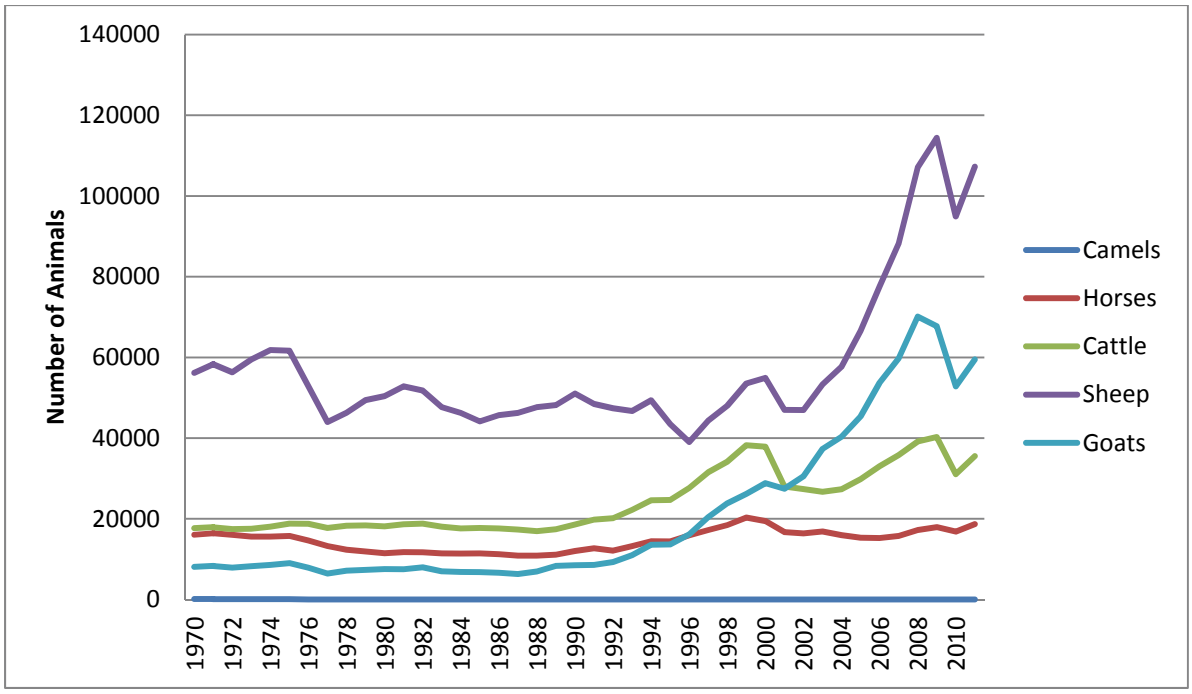
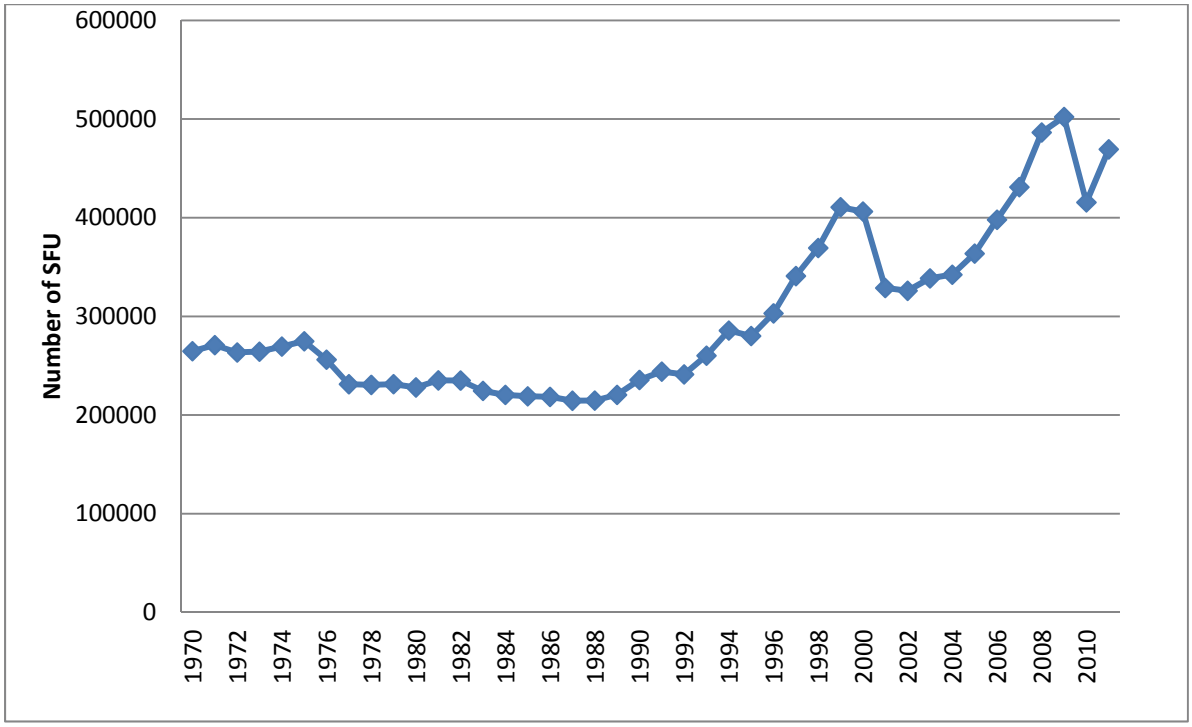


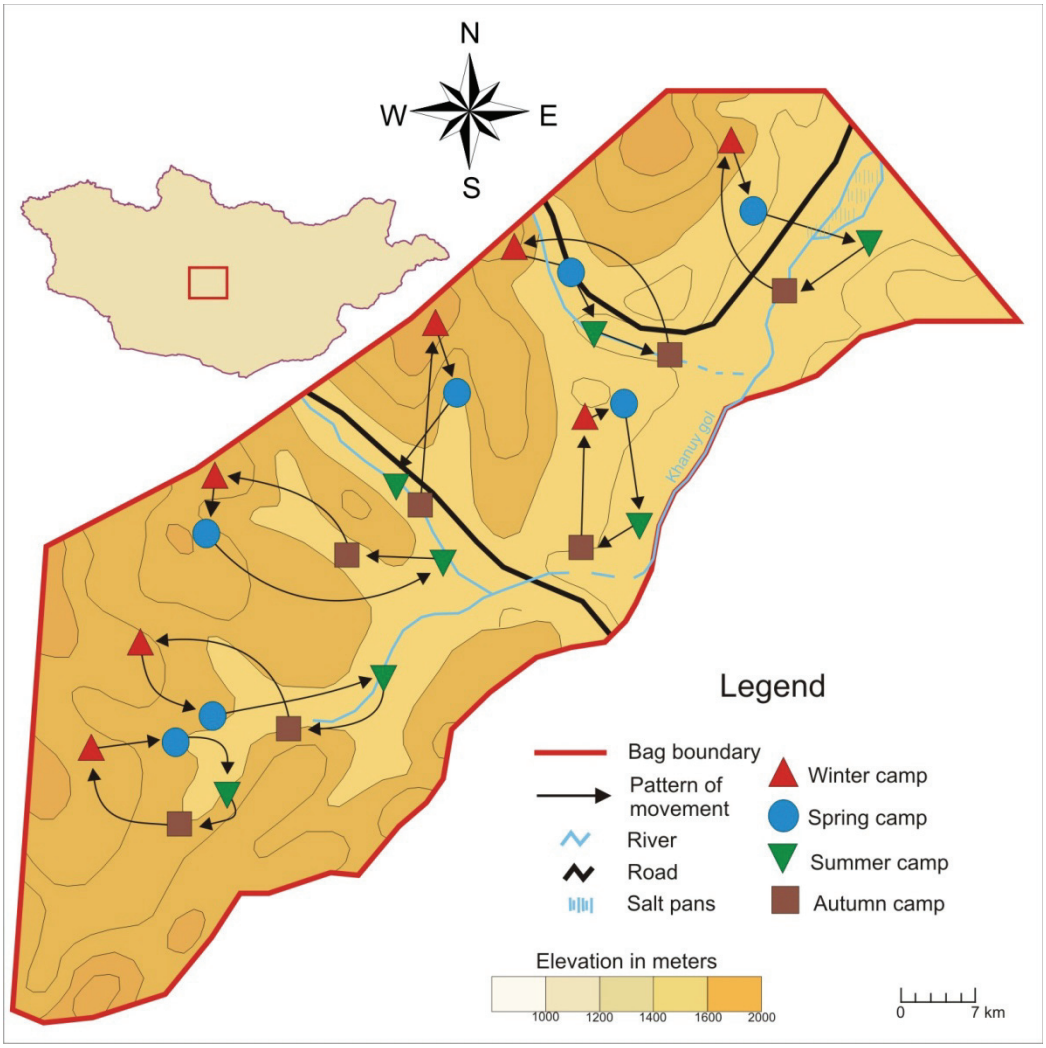
Figure 4.2 Livestock population in sheep forage units (SFU) over 41 years in Undur Ulaan (souce: soum statistics)



Pastoral movement patterns in Undur Ulaan are generally shorter than those in Ikhtamir, often with only 2-3 km between winter/spring and summer pastures (Figure 3). This is in part due to the shortage of water sources due to the drying of rivers and springs, and contributes to year-round grazing of areas

formerly grazed during only one or two seasons. As is typical in the Khangai Region, herders in Dongoi bag summer in the area along the Khanuu River and move to protected valleys for the winter and spring. Fall is spent on the river plain, at an intermediate location between the river shores and the mountain valleys, or in more distant *otor* pastures.

Figure 4.3. Seasonal movement patterns of herders in Dongoi Bag, Undur Ulaan Soum, Arkhangai



Donor organizations and projects currently or recently active in Undur Ulaan include World Vision, Sustainable Livelihoods Program, DANIDA, IFAD (restocking project, which ended in 2007), and Veterinarians Without Borders (2006-2008). SLP is new to this soum, which has been chosen as a "model" demonstration site for the project.

4.2 2010 Dzud Narrative

4.2.1 Exposure and Sensitivity

4.2.1.1 Weather Conditions, Pasture and Animal Growth and Winter Preparations

As in Ikhtamir, the majority of Dongoi herders believed that the rainfall, pasture growth and resulting animal conditions were worse in 2009 than usual. Seventy-eight percent of the surveyed Dongoi bag herders perceived the summer of 2009 to be drier than usual, 83% though pasture conditions were worse, and 61% thought animal conditions were poorer than usual. In the words of one Dongoi focus group participant, "It is obvious that animals will not gain weight or fat where there is no water and not enough pasture." Many Dongoi focus group participants also commented on the poor health status of animals going into the winter with respect to overall health, parasites, etc. One mentioned that their bag lacks any kind of community facility for dipping animals against parasites, so that this type of care falls to individual herders to organize.

On average Dongoi herders prepared less hay and significantly fewer went on fall otor (33%) than in Ikhtamir. The Undur Ulaan Soum Governor explained that "People try to do otor in summer and fall but due to the limitation of water resources they do a short time (1-2 weeks). Mainly otor is done by wealthy people who can move a longer distance. People with fewer animals can't move." The head of the Soum Khural noted that, "Livestock of herders who went on [fall] otor survived better."

Dongoi herders also purchased less bran than Ikhtamir herders, but they bought more "*khorgoljin*" concentrate, so the overall grain purchases were similar between soum. Fewer Dongoi herders (12.5%) reported setting aside reserve winter or dzud pastures (6.3%) than in Ikhtamir.

Soum officials reported directing herders to prepare 1000 tons of hay in each bag, but due to the dry year only 60% was collected.

4.2.1.2 Dzud Awareness and Early Warnings

Together with several donors in the community, Undur Ulaan soum organized a herder meeting prior to the dzud in 2009 to discuss generally the state of livestock husbandry, need to improve animal quality, culling, hay preparations, otor movement, and conflicts over pasture with herders from neighboring soum. The soum Land Officer mentioned that herders did receive early warnings of the dzud, but ignored them, thinking that the winter would not be so bad. According to the Land Officer, "The last 10 years was a very nice period and herders thought this winter would be the same. If herders knew the climate would be harsh this winter, they would cull and sell and this would help them overcome the winter with less losses. From our soum we provided a report about winter preparedness for the aimag and the aimag sends it to the state."

4.2.1.3. Dzud Characteristics

Local government officials reported 33 snowfalls between November 2009 and June 2010. From January 3-6 the temperature was -40^{o}C. Undur Ulaan experienced heavy snows in three of its bags, though not in Dongoi. Most of the key informants felt that the snows were not unusually deep, but the cold temperatures were severe. As the Land Officer described, "The strength of the low temperature was the

most unusual feature that influenced livestock death. They would go for grazing and yearlings would freeze to death in the pasture."

4.2.1.4 Incoming Otor Herders

As in Ikhtamir, Undur Ulaan received many herders for *otor* during the winter. Estimates of the number of otor livestock varied among different officials, but two different officials stated that at least 67,000 animals from other soums wintered in Undur Ulaan. These herders primarily came from Tariat soum to the northwest, although also from Chuluut and other soums. Some of thse families have been coming to Undur Ulaan for winter for a number of years, and their movements were not specifically dzud-driven, but others were.

Several officials alluded to institutional constraints to limiting the numbers of incoming herders. According to the head of the Soum Khural, "On paper we made an agreement to allow only 20 families, but those families were not willing to camp in the assigned areas and to follow the decision of local authorities. They are happy to pay fees [fined] in accordance with the law, because it is reasonably low." The Soum Governor stated, "This year people from other soum came on otor, about 67,000 head on otor, starting in October. They left dead animals that local people had to clean up. There is no legal mechanism to force people to leave or clean up."

Although there were apparently many outside herders in Undur Ulaan during the winter of 2010, there were not many in Dongoi bag, according to focus group participants.

4.2.2 Coping Responses

4.2.2.1 Herders' Coping Responses

Winter Otor. About half of the surveyed Dongoi households went on winter otor. Among the herders that participated in the Dongoi focus group we learned of several instances of cooperation in the face of the disaster. One group of families who had not previously been close [double check] worked together to move their animals to a sheltered forest area where, although the snow was deep, the forage was good and the area was somewhat protected from the fierce cold. They sent the older people and children to the aimag center and the younger people went on otor, with 10 people living in a small otor ger.

"For 5-6 years this area was not used. Because of the cold winter we went there. Due to that we were able to save half of our herd. We moved in otor to that area, leaving our main ger behind, locked. Around 10 people lived in a small otor her there."

In another case, a group of households in one khot ail, took turns using their reserved winter pasture. As one described, "Beside our main winter pasture, we have a reserve winter pasture in an area called Guu. We discussed among the herders of our khot ail and decided to use that pastuer in turn. In that way 2-3 households will use it one month and then others will use it the next month."

The Undur Ulaan Land Officer also discusses similar strategies, but warned that they should not be used every year or there is a risk of degradation: "During the dzud we saw how herders joined efforts together. They collected yaks and cows as one herd and took them to the forest where there was more

forage and shelter. Each took a turn for 1 day. 4-5 families' herds with 400-500 cattle. They were left there for 2 months and they did not bring them back to the main gers. They had 2 otor gers and 4 people rotated to take care of the animals on a rotating basis. During normal years families are not interested to join in one herd because there is less forage per animal. During dzud years it's because of desperation they form a big herd. If it continues on an ongoing basis it will trample pasture and cause problems."

Feeding Strategies. In Dongoi bag, similar percentages of surveyed households grazed their winter, spring and dzud reserve pastures as those from Ikhtamir (78%, 72% and 33%, respectively), although no Dongoi households used government designated reserves. Most households fed stored hay and purchased fodder, but only 28% fed hand fodder. However, some Dongoi focus group participants mentioned that they had no money to purchase additional fodder, and so their losses were high. Others were only able to feed free fodder they received from the government. As in Ikhtamir, Dongoi herders described many desperate feeding measures, such as the following, "We gave soup made from bone, Mongolian and Russian vodka, onion, and garlic to all the animals who were near to freezing." Many herders focused on feeding the weakest animals, but others felt it might have been better to let the weak die and focus on keeping the strongest animals alive, as the following quotations illustrate: "It could have been a better idea to stop feeding very weak ones, as feeding didn't strengthen them. Livestock nowadays has no ability to withstand cold temperatures." "During the dzud the weak animals should be left. They have little chance to survive." "We provided fodder to the weak ones, but they all died."

Protection from Cold. All of the surveyed Dongoi herders put blankets on their animals and about three quarters brought animals into their gers. Herders who went to new locations for otor described spreading fresh dung on the corral and shelter walls to try to insulate them.

4.2.2.2 Government Responses

The Undur Ulaan Soum Governor reported that the soum administration, together with hospital personnel, visited families twice, and in some places three or four times, during the dzud. The government also obtained hay from the national emergency fodder fund and sold it to herders at a reduced price (3700 MNT per bale). The local government provided 100,000 MNT to clean up the carcasses, either burying them or moving them to peripheral areas and burning them to prevent the spread of disease.

4.2.2.3 Aid Provided

Local government and donor officials listed 8 sources of aid in aggregate, and surveyed herders also identified 8 sources, but none mentioned World Vision, which provided assistance to 401 families, according to local staff. Many herders listed the bag governor as the aid source, as he was important in distributing some of the aid received from other sources, suggesting that many herders that received assistance did not really know where the aid came from.

Concerns about Aid Distribution and Appropriateness. According to the Soum Governor, some herders complained that assistance came too late or wasn't what was needed. They felt it was, "Better to spend

the money to make rain in the spring and make the grass grow." Dongoi focus group participants reported that the bag governor distributed feed to all households, but as a result the amount per family was too small to make much of a difference. In one herder's words, "One sack of fodder will not feed 500 sheep." In general, Dongoi participants felt that the fodder was not very helpful, because the amount was small, and that direct food assistance to people would have been better. Interestingly, this is the opposite of what Ikhtamir herders said.

Table 4.2. Sources of aid listed by soum official and household survey respondents.

Sources of Aid	**Aid Listed by Soum Official and Donor Staff**	**No. (Percent) of Survey Respondents**
Bag Governor	(Distributed aid from other organizations)	10 (58.8)
Soum Government	Subsidized hay (3700 MNT per bale), purchased from state emergency fodder fund	0
National Government	Bran and fodder distributed for free, but herders paid for transportation 65 khot ail received 1.5 million MNT animal medicine among them	4 (23.5)
UB Homeland Association	10 tons of feed	1 (5.9)
Erdenet Factory	All families received 25kg flour and 5,000 MNT of human medicine.	17 (100)
Parliament Member	3 tons of bran	1 (5.9)
World Vision	401 families with children registered in the WV program received 25kg flour, 5 kg rice. Some received medical assistance. (May)	0
SLP	5 tons of kasha distributed among all households (May)	1 (5.9)
Japanese Government	176 sacks of khorgoljin concentrate feed 160 125kg bags of flour	1 (5.9)
Family Members		2 (11.8)

World Vision staff in Undur Ulaan said they received no complaints about their aid distribution, and displayed the list of selected households openly. According to this staff person, local government took part in the distribution decisions.

Although the comments were not as prevalent in Undur Ulaan as in Ikhtamir, some Undur Ulaan herders expressed similar to concerns about aid depencency, as this focus group participant expressed: "There is a common perception that herders did not do anything to save animals from losses and always demand government help or assistance from outside."

Social Capital and Informal Assistance. A slightly higher percentage of Undur Ulaan survey respondents mentioned receiving assistance from family members. As discussed above under feeding strategies, we documented several instances of mutual assistance and cooperation among khot ail members or neighbors within the same valley who cooperated during the dzud to take their animals on otor.

4.2.3 Dzud Impacts

4.2.3.1 Herd Impacts

In Undur Ulaan soum overall, 39,662 head of livestock died in the 2009-2010 dzud (107,662 sheep forage units or SFU). This is nearly twice as many as those lost in 2000-2002 (19,832 head or 80,331 SFU). Slightly over 20% (21.4%) of the livestock in the soum as of the 2009 year-end census died. The Deputy Governor reported that 33 households who owned fewer than 10 animals lost all of their stock.

Among the households surveyed in Dongoi bag, the average household lost nearly 43% of their herd (calculated in SFU), including 61% of their cattle, 45% of sheep, 41% of goats and 23.5% of horses. These percentage losses are higher than for either of the surveyed bags in Ikhtamir soum, although in absolute numbers (SFU lost), Undur Ulaan households had rever losses overall (165 SFU on average compared to 190 in Bogat bag and 167 in Khan Undur).

4.2.3.3 Human Well-Being and Livelihood Impacts

Undur Ulaan herders reported similar direct negative impacts on human health and well-being from the dzud as those in Ikhtamir, including exhaustion, frostbite and emotional stress. In focus groups, herders focused on the economic and livelihood impacts of the dzud. Here, too, the dzud had a disproportionate impact on cows, which are the mainstay of subsistence in the mountain-steppe, and are also an important income source from marketing surplus milk.

4.2.3.4 Poverty and Dzud Impacts

Over all the mountain-steppe sites, there was an apparent trend (not statistically significant) between household wealth level and the percent of herd lost. The poorest herders lost the largest percentage of their herds, on average, while the wealthiest sustained the lowest losses, in terms of the percent losses. In absolute terms (head of livestock or SFU lost), households with more livestock generally lost more animals, but they also had more animals, as well as a larger percentage of their herd, remaining after the dzud.

4.2.3.5 Beneficial Impacts of the Dzud?

Many Dongoi herders discussed positive aspects of the dzud in the focus group. Like Ikhtamir herders, they also saw dzud as a selective pressure that ultimately leads to stronger, better adapted herds, as one herder commented, “The animals that survived passed natural selection. Therefore they are healthy animals.” Herders in Dongoi also understood the role of dzud in limiting livestock populations: “The dzud helped to reduce the number of animals. Herders will keep the number of animals at the current level and will not increase.”

These comments were also related to the strong perception by Dongoi herders that pasture conditions had declined and overstocking is a contributing cause, as illustrated by the following quotations:

“1000-2000 animals depletes the pasture, leaving nothing to graze on, which destroys roots of the plants and soil cannot stabilize. All this means that the pasture is overstocked and the intactness of the pasture is lost.”

“When the total number of livestock [national herd] reaches 40 million, pasture gets destroyed.”

"To compare present days' forage production with the year of 2000, it has decreased 50%. Litter was there to protect soil moisture, but it has disappears and therefore hooves of the animals trample the soil and make it dry."

"Pasture is getting eroded by animals' hooves, wind and dry temperatures."

4.2.4 Adaptive Responses

4.2.4.1 Plans for the Future—Household Level

In Dongoi bag, more surveyed herders (22.3%) planned to move away from their current location in the countryside in the coming year than in Ikhtamir. Three of the four who planned to move intended to go to the aimag center (2) or Ulaanbaatar (1), and one planned to go to the soum center. All considered the move temporary and those who still had livestock planned to leave them with relatives or friends in the soum. Focus group participants observed that some herders in the area had already departed, "Those herders who lost all their animals move to the city and aimag center and seek other opportunities to make a living. … Some people locked their ger and the whole family has gone somewhere."

Eighty-eight percent of surveyed Dongoi households planned to continue herding livestock for a living, but nearly a quarter (23.5%) also planned to do a different job, instead of or in addition to herding. One focus group participant mentioned vegetable growing as a potential supplemental income source. Dongoi focus group participants also discussed the challenges of seeking other kinds of work in other places, "When we come to UB or the aimag center to get some employment, it is very hard to find any kind of job. It requires you to be in a certain age range and to possess qualifications. In addition, they like to hire local residents, and not temporary migrants. We are herders since childhood and therefore we cannot do any other job."

In addition to discussing alternative income sources and employment opportunities, Dongoi herders repeatedly returned to the theme of the need to obtain better prices for their livestock products, and to develop foreign markets. "It is important for the state to pay attention to develop foreign markets for meat. Herders have less possibilities to bring their meat to consumers in UB. When herders arrive in UB to sell their livestock, middlemen complain about their products and therefore herders have to accept the price that is offered."

A third of surveyed households in Dongoi bag planned to look for livestock to buy to rebuild their herds, while half said they would wait for herds to regrow at their natural rate and 16.7% planned to maintain current numbers and focus on quality rather than quantity of animals. Slightly less than two thirds of surveyed households (64.7%) planned to insure their livestock in the future.

As noted in the previous section on Benefits of the Dzud, many Dongoi herders perceived negative ecological changes and viewed overstocking and inappropriate grazing as among the causes for these changes. At least among those herders we met, the level of awareness of the need to change grazing and husbandry practices was high. In this respect we observed strong evidence for learning at the individual level. Some examples of supporting qualitative evidence are found in Table 3.

4.2.4.2 Plans for the Future and Evidence of Learning—Community Level

The Undur Ulaan soum government discussed plans for a fall 2010 meeting to focus on female herders, whose voices are not often heard in regular soum gatherings where men dominate. In contrast to Ikhtamir, the government here did not attempt to sieze the opportunity for collective reflection, learning and change that the dzud could inspire. However, local officials were excited that their soum had been selected as a model demonstration site for the SLP and seemed to hope that this might help catalyze more endogenous collective action among herders.

In the context of discussing the planned fall meeting for women herders, both the Soum Governor and the Khural Leader, made statements about intensification of livestock husbandry as a potential strategy. Neither of them felt that intensification was viable in Undur Ulaan. In the words of the Soum Governor, "Everyone talks about intensification, but it requires specialist knowledge. Better to talk about how to improve extensive pasture management. Everyone cannot intensify because there is no market nearby." The Soum Khural Leader expressed similar views, "It is said that it is important to develop intensive livestock production. I personally think it is necessary to strengthen extensive livestock production. Certainly I am not against intensification, but there is no market in Mongolia to absorb all the products of intensive production and herders lack the relevant mentality."

Local officials observed indications of cooperative pasture management among small groups of herders (see Table 3). Among focus group participants, we heard a number of proposals for how grazing management could be reorganized or improved to address what they perceived as the vulnerabilities born of poor grazing practices (overstocking and year-round grazing of winter pastures). A main focus of this discussion was the need to protect haying areas and reserve pastures with fencing, and how several khot ails could work together to fence reserves (see Table 3 for supporting quotations).

4.2.5 Recovery, Learning, Adaptation a Year after the Dzud

4.2.5.1. Winter Conditions in 2010-2011

All focus group participants indicated that the winter of 2010-2011 was relatively warm. "In comparison to weather conditions of 2009-2010, the 2010-2011 winter was relatively less cold. The temperature was not that cold as year of *dzud.*"

4.2.5.2. 2010-2011 Summer Conditions and Winter Preparations

The pasture condition in summer 2010 was different than in 2009. Herders reported that pasture had recovered and the grass was higher. Herders also reported that the strength and fatness of animal in 2010 was greater than in 2009. In the words of one focus group participant, "It was a good summer; we had good rain and the pasture recovered, and animals gained weight and fat."

Herders were much more diligent in preparing for the winter of 2010-2011 than they had been the previous fall. They repaired winter shelters and cut far more hay than in the previous year. Focus group participants reported, "Herders cut a lot of hay," "Hay was cut even in forest areas," "Those herders who used to have 1 lorry of hay for winter preparation, last year prepared 5-6 lorries of hay," and "Even those who did not used to prepare hay had 1 lorry of hay." Enough hay was collected that there was a

surplus remaining at the end of the spring 2011. Results of the household survey indicated that 100% of surveyed households in Undur Ulaan cut hay in preparation for the winter of 2010-2011, more than any of the other study sites.

In addition to repairing winter shelters and cutting hay, a Bag Parliament member reported that more herders went on otor in 2010-2011. However, household survey data indicated that only 13% of surveyed households did summer or fall otor before the winter of 2010-2011.

4.2.5.3. 2011-2012 Winter Preparations

Herders also prepared well for the winter of 2011, in part in response to television news and information from other herders warning of another severe winter. However, focus group participants reported that they did not collect as much hay in 2011 as in the summer of 2010. In 2011, herders reported taking their animals to mineral salt licks to assist with conditioning for winter, and some herders planted fodder crops.

As part of winter preparations in October 2011 (when the research team was present) herders in Dongoi bag collectively butchered sheep and goats to sell and reduce herd sizes before winter. As they explained, "We decided to collectively butcher mainly sheep and to sell them jointly, because it reduces the cost of selling. This year we had discussed and decided to do this within our *saakhalt* neighborhood. Most herders will spend this money to buy fodder, because this time of the year it's cheaper."

4.2.5.4. Recovery from the Dzud

According focus group participants, herd sizes had not yet recovered due to the short amount of time since the dzud. In addition herders reported that the number of wolves and animal thieves had increased, affecting the rate of herd growth. Pasture conditions have improved, however, aided by good rainfall years in 2010 and 2011. According to herders' observations, "Compared to previous years the pasture is recovered," "Bare ground was covered by vegetation, and in some cases new plants have grown," "The dried lake recovered."

Most herders indicated that household incomes also had not recovered. "Many families lost a large proportion of their animals, therefore it is difficult to expect a quick recovery [of herds and associated income from livestock products]." However, new infrastructure development in Undur Ulaan created the opportunity for income diversification. The construction of an asphalt road through the soum was completed and the road runs through the Dongoi bag center. Some households gained extra income by working on the road construction and others set up small "fast food" enterprises along the road as an additional income source. Herders perceived that poverty levels remained unchanged, niether improving or declining one year after the dzud.

4.2.5.5. Learning, Adaptation and Resilience

Similar to Ikhtamir, herders in Undur Ulaan felt that the main lesson they have learned from the dzud was to focus on herd quality rather than the size of the herd. Herders raised this issue in the year 1 focus groups and continued to talk about it in additional detail in year 2, demonstrating that some households are acting on these changed attitudes towards production goals. Herders indicated importance of

improving breeding by bringing high productivity breeding stock from other places. However, their dialog also indicated that they realize that animal quality is related to more than genetics, and also reflects other pasture and herd management practices. As a herder in the Dongoi focus group stated, "The herd quality means not only improving the breeding but also following traditional herding practices (herding animals to allow better grazing, reducing the length of the milking season.) A bag parliament member reported, "Nowadays some herders vaccinate their own animals and sell unproductive animals."

In Undur Ulaan, herders are beginning to demonstrate some indications of taking a more pro-active approach to managing and protecting their natural resources, individually and collectively. For example, One herder reported that he and his children built a new well and received a certificate of appreciation and 50000 MNT from the government in recognition of this action. Another herdsman indicated in a focus group, that some herders are fencing off whole valleys to protect spring campsites and pasture. In year 1 focus groups, herders discussed the potential benefits of collectively reserving and protecting pastures. These discussions have continued and expanded, though there is limited evidence of implementation. In the year 2 focus group, herders reiterated their interest to have designated reserve pastures. "Hay is not always available. Therefore, for example, 5-6 families could put together a fence to have reserve pasture of a decent size." According the bag parliament member, such discussions are more and more frequent among herders. There is talk of creating their own bag fodder fund in the bag center, where hay can be provided to herders most in need. "Herders themselves will prepare hay. It will reduce dependency from outside."

In addition to reserve pastures at the neighborhood or khot ail level, and the bag-level fodder fund, herders expressed interest in designating a community reserve pasture, where herders can move on *otor*. All herders have agreed to create such a reserve pasture and not use or send animal there. However, they indicated that they have had difficulties determining where this reserve will be located.

4.2.5.6. Roles of Different Actors in Dzud Preparation and Recovery

In focus group discussions, herders indicated the importance of **local government** in regulating pasture management, especially in-migrants from neighboring soum. "Soum boundaries should be clearly fixed. In-migrants from other soum should be sent out, especially those herders with a thousand animals." Also herders in the focus group reported that "There are cases where *tuuvarchin* [stock drovers] from western provinces cut hay without permission from local herders' hay fields, when they were not there." Thus, herders see this regulatory role as one that local government should play, but currently is not, reinforcing the findings from year 1 regarding the lack of institutional mechanisms to regulate incoming otor herders during the dzud.

As second important role for local government, according to focus group participants, is coordination among different programs and projects within the soum. Such coordination is currently lacking, and there is an apparent lack of accountability in the administration of funds. Focus group participants complained, "There is no coordination of programs or projects at the soum administration level. The funding sources provided are not be used properly." Similarly, herders commented that, "Funds are

distributed among relatives and friends of those people who have the power to decide," and "There is limited verification of government programs and funding." As a result, in Undur Ulaan, there is strong distrust in the local administration because, "There is no information of how the government resources were spent."

In focus group discussions, herders commented on the potentially important role of **donor organizations** in the improvement of pasture management. In Undur Ulaan, the SLP-II program was recently established and is the only program that currently supports herder collective action in the soum (unlike Ikhtamir, where the Green Gold project is active). Herders reported that SLP -II assists with funding to put fences around hay fields, rehabilitate wells, repair winter shelters and other activities. To receive such support herders must form a herder group with more than 3-4 families. According the local officer of SLP-II, 94 herder groups ranging from 3 to 9 families in size have been established recently involving a total of 330 households—about 27.5% percent of herders in the soum. Despite this apparent success, most herders in the Dongoi focus group complained that herder groups that received assistance were not in their bag and that "The funds are distributed among the close people or relatives of people who are in power." Here "close people" refers both to households that are physically located near to the soum center and those who are "close" in the sense of being friends or relatives of people in power.

In Undur Ulaan, herders seem to be recognizing that ultimately winter preparations are the responsibility of individual households. As herders noted in the focus group, "Nowadays herders do everything without notification from someone. We learned that since the soum administration is not able to provide hay and fodder when we need it, the only way is to rely on ourselves."

4.3 Discussion

4.3.1 Factors Affecting Vulnerability

According to our household survey, Undur Ulaan households in Dongoi bag experienced higher percentage losses than those surveyed in Ikhtamir's Bogat and Khan Undur bags. However, soum level data suggest that overall, Undur Ulaan losses were similar to or less than those of Ikhtamir. Several household level factors likely contributed to the vulnerability of the surveyed households in Dongoi bag, especially the lack of hay reserves and poor animal condition entering winter. The low animal conditions, in turn, were a function of poor nutrition in the previous summer and fall, due to lack of fall otor movements. The short distances between summer and winter pastures in Dongoi bag probably contribute to overuse of winter pastures and insufficient reserves for winter and spring. As in Ikhtamir, pre-existing herd sizes and levels of household wealth/well-being were related to the percentage of herds lost, with large herders experiencing proportionally smaller losses. Although aid appears to have been equitably distributed in Undur Ulaan, many households did not receive enough livestock feed to make a difference in animal survival. Although other areas of Undur Ulaan soum experienced an influx of otor herders from other soum, Dongoi bag was not severely affected.

Table 4.3 Evidence of adaptive responses at individual and community levels in Dongoi bag, Undur Ulaan Soum (2010 data).

Adaptive Response	Example	Illustrative Quotation	Source
Individual Attitudes, Knowledge and Behavior	Focus on livestock quality, reduce numbers	"It is necessary to pay attention to improve the quality of the remaining livestock." "It is important to raise livestock in accordance with carrying capacity, which will help to conserve the pasture." "The most important policy is not to increase numbers because it leads to degradation. [We need to] 1) increase breeding, 2) increase pasture within SLP project. Fence, rotate pastures, and establish a fodder fund (hay storage)." "Now herders are thinking of having fewer, higher quality livestock. …Herders got a lesson from this dzud—it is very hard to survive and they could lose all their animals."	Dongoi FG Dongoi FG Soum Governor Land Officer
	Improve winter preparations	"It is important that herders work better on a daily basis and keep livestock healthy, and prepare sufficient hay and fodder." "The most effective measures? To make good otor and rotational grazing. [What good are] a few bales of hay for hundreds of livestock? Most important is to find the right spot with forage and cover from wind."	Dongoi FG Land Officer
	Expect the unexpected	"A herder needs to adapt to these conditions and organize his livelihood accordingly. There are many factors, including climate and human. It is an issue of adapting to these things. We cannot expect things happening this year to happen next year. It was warm for a long time and suddenly cold weather hit all of us. None of us, nor our livestock, have seen these conditions [before]."	Dongoi FG
Knowledge Integration and Information Exchange	Traditional herding knowledge	"Every morning herders should observe the sky and mountains and think where to herd and graze their livestock. Herders don't learn good practices from books and manuals." "When I was 17, there was a dzud in the year of the horse. During that dzud my father followed the principle of 'half feed but warm shelter or bunk' and he sealed the animal shelter and burned dung to warm the corral up. He also collected frozen animal droppings and overcame the dzud without any loss. That year the snow reached up to the thigh of a horse."	Dongoi FG Dongoi FG
	Experiential	"Herders learn more from their own mistakes and successes than from traditional	Dongoi Fg

	knowledge	herding knowledge."	
Collective Action	Cooperation in pasture management.	"The severity of the dzud and snow amount varied from place to place. Herders didn't rest their winter pasture and preferred to stay there year round. But this year in summer all herders moved away from their winter pasture to the river banks." "Some people are traditionally living together in a small valley. [Among them] there are some trends of cooperation like pooling animals and taking them on otor or dividing them by species."	Dongoi FG Soum Governor
	Cooperation in protecting reserve pastures and hay fields	"We will discuss and agree which area to fence for reserve pasture. Two khot ails who get along will need to fence such an areas, so this reserve will be enough to keep livestock of two khot ail. For herders it is challenging to buy barbed wire, and we need some financial assistance." "The idea of a fenced reserve pasture is correct, because an open pasture cannot be protected and reserved. Herders will not herd their livestock if the area is enclosed." "We can fence a hay field in collaboration with each other and share the harvested hay." "We need to protect hay areas. Maybe form herder groups. It's inevitable that herders do pasture and herd management together. For example, planting fodder plants must be done on a collaborative basis."	Dongoi FG Dongoi FG Dongoi FG Land Officer
	Cooperative marketing	"I observed that in the past few years herders started to cooperate in some small activities like collecting wool from each other and assigning two people to sell it at a centralized place. Each family will weigh their wool and the sellers pay them." "People are trying to jointly sell their products. Some community members find the price is higher, they collect and sell for the community."	Land Officer SLP Staff
Changes in Formal Institutions	None documented		

Table 4.4 Evidence of constraints to adaptation in Undur Ulaan soum (2010 data).

Constraints to Adaptation	Illustrative Quotation	Source
Climate change, insufficient forage & water	"People try to do otor in summer and fall but due to the limit of water resources, they do a short time." "The climate during the summer has changed. It is very hot and livestock didn't graze much and didn't get fat. I don't know how climate will affect the sustainability of future livestock." "Many small rivers and springs have dried out and the water level in wells has dropped. Because of this herders are grazing areas around big rivers and this causes a shortage of pastures."	Soum Governor Land Officer SLP Staff
Insufficient knowledge and experience	"Young people have no knowledge of how to pass a dzud, and there are few old people to pass on their knowledge."	Soum Governor
Lack of nearby markets, poor terms of trade for herders, little market differentiation of quality	"It is important for the state to pay attention to develop foreign markets for meat. Herders have less possibilities to bring their meat to consumers in UB. When herders arrive in UB to sell their livestock, middlemen complain about their products and therefore herders have to accept the price that is offered." "Someone is gaining from the price difference. Herders sell for 2K Tg when market price is 5K Tg. Due to this situation, herders didn't care any more about quality, because there is no price differential for quality."	Dongoi Focus Group SLP Staff
Collective action is small scale, among kin	Most descriptions of cooperation were within khot ails or among closely related families. Few examples of larger-scale cooperation	
Collective pasture management is an emergency measure, not regular practice	"During a normal year, families are not interested to join in one herd because there is less forage per animal. During dzud years it's because of desperation."	Land Officer
Differing incentives among large- and small-scale herders	"Those who have few livestock are not as concerned as those with 1000 livestock. They herd with binoculars. Those with more livestock need to feed them all, so go further and leave them grazing for many hours." "Small sheep and goats are kept on an individual basis by each household. If we collect sheep and goats in one herd the numbers are too many and it is difficult to herd them in a strong wind and blizzard. Those with small numbers of sheep and goats could herd them together, but not those with large herds."	Land Officer
Incoming cross-border *otor*	"This year people from other soums came on otor. 67,000 head starting in October. They	Soum

movements	left dead animals that local people had to clean up."	Governor
Lack of formal institutions to address cross-border *otor*	"We use the traditional principle of moving to any open space. People are willing to pay the penalty in the law and stay—it is a small amount. The national government passed a resolution that doesn't allow to charge for pastures." "There was no legal mechanism to force people to leave or to clean up."	Soum Governor Soum Governor

4.3.2 Indicators of Resilience

Focus groups and responses to open-ended survey questions suggested that herders in Dongoi have learned from the last dzud experience, and, like many in Ikhtamir, are interested in focusing more on animal quality than quantity in the future, and improving pasture management, especially the protection of reserve pastures and hay areas. They connect the dzud impacts with declining pasture conditions due to overstocking. This evidence suggests that learning and some level of self-reflection is occurring, which may lead to changes in behavior. Year 2 data suggest that some herders are acting upon these realizations by seeking to improve their herd genetics by bringing in breeding stock, and culling animals in the fall.

At the community level, herders in Dongoi bag demonstrated collective action and mutual assistance in coping with the dzud, and discussed aspirations to further develop cooperation among households and khot ail in the future, especially to protect reserves and hay fields. These discussions continued in year 2, though there has been limited actual implementation in Dongoi bag. In other parts of the soum there has apparently been more action, supported by funds from SLP-II. There was less discussion in Dongoi of collective management of mobility (resting pastures), although the need to move away from winter pastures and rest them in the summer was mentioned as a lesson learned from the dzud.

The soum government and donor plans to facilitate a meeting for women herders in fall of 2010 was another hopeful sign, indicating the government reaching out to hear voices of an important segment of the local population and listen to their ideas specifically about economic and social development and the state of livestock husbandry.

4.3.3 Role of Adaptive Strategies

Table 4.5 Summary of adaptive strategies used in Undur Ulaan Soum.

Strategy	**Examples**	**Frequency of Strategy**	**Benefit**
Storage	Stored hay Made hand fodder	High Low	Medium Low-Medium
Mobility	Fall otor Winter otor Post-dzud migration	Low Moderate Moderate	High Moderate Too soon to tell
Diversity	Alternative livelihood or income generation (road construction, and associated small businesses)	Low-Moderate	Moderate
Reciprocity and Exchange	Purchased fodder Received *otor* herders from other soum Informal otor cooperation	High High in soum Low in Dongoi Moderate-High	Medium Negative Moderate-High
Flexibility	Fed creative alternative home-made feeds	High	Low?
Communal	Collective action during dzud	Moderate	High

Pooling	Increased efforts to protect pastures jointly	Low in Dongoi	Potential high

4.3.4 SLP and Informal Herder Cooperation

Unlike Ikhtamir, Undur Ulaan herders have not received donor or other technical assistance to organize formal herder groups or PUGs to manager pasture resources. Herder collective action in Undur Ulaan is more informal and takes the form of ad hoc cooperative marketing of livestock products, and, during the dzud, cooperation with and among khot ails to facilitate otor movements to sheltered, forested locations. However, many herders in the focus group expressed interest in further cooperative action to protect reserve pastures and hayfields.

The SLP-II in Undur Ulaan was just beginning to get underway at the time of our initial fieldwork in June 2010. SLP-II supported two types of projects, community initiatives and pasture risk management projects. At the time of the fieldwork five community initiatives totaling 25.76 million MNT had been identified and funded: hot showers, repairs to student dorms, equipment for cultural center, new hospital beds, and the repair of roads over two mountain passes. Four pasture risk management projects totaling 11.5 million MNT had been selected. Two projects involved fencing areas for fodder cultivation, reserve pasture or hay fields. Another was for a bag-level animal dip and the last was to convert a hand well into a deep well with a motorized pump and pump-house. The funded pasture risk management projects appear to be in line with the priorities herders mentioned in the Dongoi bag focus group discussion.

SLP staff described a process of bag-level discussions to identify priorities which are later approved by a soum-level committee. At this point SLP in Undur Ulaan has not directly addresses pasture management issues or assisted herders in forming groups or strengthening existing informal cooperation among herders. When the initial pasture risk management projects were proposed at the bag meeting, staff subsequently met with other herders in the area to enlist their support for the projects.

At the time of our second visit in 2011, SLP-II was well underway the project staff reported that 94 herder groups had been established involving some 330 households and nearly a third of the soum's herder population. However, herders in Dongoi expressed extreme dissatisfaction in how the program was being implemented, due to their perception that their bag was not favored, perhaps because it was distant from the soum center, and that funding decisions were not fair or transparent, with preference given to relatives and people in positions of power.

4.3.5 Constraints to Adaptation

Constraints to adaptation in Undur Ulaan are outlined in Table 4.4 and included the impacts of climate change on water resources and pasture, which make it difficult to use strategies such as fall otor. Poor access to technical knowledge and lack of herding experience was another constraint, especially among the younger generation of herders. In the year 2 focus group, herders also mentioned lack of access to technology and machinery to cut and transport hay as a limitation on their ability to harvest and store forage. As in Ikhtamir, herders indicated an interest in livestock insurance but lacked information and understanding of how it works.

Although endogenous collective action was observed in Dongoi bag in response to the dzud, it was mostly at a very small scale. There was little evidence of cooperation during the dzud beyond herders within one khot ail or a few neighboring ("saakhalt") khot-ails working together. As in Ikhtamir, the differing interests and incentives of small- and large-scale herders may influence the potential for cooperative action. Unlike Ikhtamir herders, those in Undur Ulaan have not had the benefit of extensive technical assistance in how to organize as a herder community. In year 2 focus groups herders indicated that a major constraint to collective action was their lack of knowledge about how to organize formally as a herder group or a cooperative.

At the soum government level, perceived lack of institutional support to regulate incoming otor herders is a constraint to adaptation. Otor is widely recognized as a valid and necessary strategy, but if not carried out in a coordinated fashion that respects the needs of the receiving soum as well as the arriving herders, it can have negative consequences. Although herders are "talking the talk" of reducing livestock numbers and improving animal quality, a major constraint to pursuing this strategy is lack of market differentiation of higher quality products, and in general, lack of access to distant markets and generally poor terms of trade for herders. The completion of the paved road to Undur Ulaan in 2011 may improve market access somewhat, which could reduce this constraint.

4.4 Implications for Policy and Practice

- The dzud may have created a "teachable moment" for herders in Undur Ulaan soum, especially with regard to the value of collective action for pasture management and disaster preparedness. This is a strategic time for well-placed interventions to build on the endogenous cooperation that occurred during the dzud and assist herders in organizing more formally to manage their pastures and self-regulate mobility and stocking rates.
- The presence of SLP and identification of Undur Ulaan as a demonstration soum under this program further create the opportunity to test whether and how SLP's "grass-roots" approach can create incentives for herders to form more enduring and formal community-based organizations. Are the groups that form to apply for project funds simply opportunistically organizing to gain access to short-term financial resources and benefits, or can these opportunities stimulate endogenous development of more enduring community-based resource management organizations?
- As in Ikhtamir, the unregulated influx of otor herders created serious problems in some parts of Undur Ulaan and local government felt that the existing legal provisions (mild fines) were insufficient to address this issue. This situation points again to a serious institutional shortcoming that must be addressed to achieve sustainable pasture management and avert further disasters brought on by "hoofed dzud."
- Overall, winter preparations in Undur Ulaan were lax on the part of both government and herders. Hay harvesting, hand fodder preparation and fall *otor* were all insufficient to cope with the cold winter.
- Herders now recognize the value of dedicated dzud reserve pastures and of adequately protected hay cutting areas. Some perceive the solution as collectively managed and used fenced reserves and hay fields. This may be a valid area for investment on an experimental basis, but requires monitoring to evaluate the ecological and social impacts.

- In Undur Ulaan, substantial numbers of herders planned to move away (22.3%) or seek additional or alternative livelihoods (23.5%). This dzud crisis may create an opportunity to train a more diverse workforce and develop alternative and additional income streams, develop value-added production, and assess, overall, the potential to create a more diverse local economy that could result in fewer herding households, and more sustainable livestock numbers, while providing viable livelihood alternatives that would enhance community resilience to future climate or economic shocks.
- As in Ikhtamir, Undur Ulaan herders and officials perceived benefits to the dzud. Policy-makers and donors should also recognize that dzud plays valuable ecological regulation and social learning functions, and use the disaster as an opportunity to launch policies that not only help avoid future human devastation, but encourage long-term sustainability of extensive pastoral livestock husbandry.

5. Jinst Case Study

5.1. Soum Ecological and Socio-economic Context

Jinst soum is located in Bayankhongor aimag, Mongolia. The territory of Jinst is 531,264 ha, from which 516,907 ha is considered as a rangeland. Jinst is located 100 km south to the aimag center. Jinst belongs to semi-arid desert steppe ecological region and it lies on a broad plain between the Khangai and the Gobi Altai Mountain ranges in the west central Mongolia. Ikh Bogd Mountain is located in the south-western part of the soum with the highest peak elevated in 3,957m above the sea level. The Tuin River, the largest river, flows from the north to south and is considered the main source water for livestock as well as for human consumption.

Last 20 years average annual precipitation in Jinst Soum is 105 mm with mean January temperature of -16^{0}C, and mean July temperature of 18^{0}C and with about 120-130 frost-free days. April brings the highest average wind speeds (5 m/second). According to the observations from a meteorological station located in Bayankhongor, which is considered the closest to Jinst (100 km north from Jinst), there has been an overall increase of mean temperature of 5.0^{o}C per century in comparison with a national mean temperature increase of 3.61^{o}C (Batima et al. 2005).

According to 2009 statistics, the total population of Jinst is about 2,023 people and 548 households, and about 40 percent of the population is below 18 years old. The total number of herder households is 410, which is about 85% of the total population. Overall the population of the soum has declined since the mid-1990s, with a major drop following the 2000-2002 dzud.

Table 5.1 Human population of Jinst Soum. (Source; Soum statistics)

	1990	1995	2000	2005	2008	2009	2010	2011
Total population	2313	2537	2352	2044	1958	2023	2024	2052
Total households	No data	No data	567	477	537	548	587	584
Herder households	No data	No data	No data	337 (2004)	404	410	No data	487

Pastoral livestock production is the primary economy of the soum. As of December 2009 the total number of livestock was 136,262, including camels (1,187), horses (2,266), cattle (1,152), sheep (21,486) and goats (110,171). Goats comprise approximately 81% of herd, sheep 16% and the remaining 3% camel, horses and cattle. Following privatization in the early 1990s, gerd sizes grew steadily until 2000 and then sharply declined from 125,185 in 2000 to 22,100 in December 2002. By 2009, the herd size recovered to 132,262 (Figure 5.1).

Figure 5.1 Livestock populations by species 1972-2010 in Jinst Soum, Bayankhongor. (Source: soum statistics)

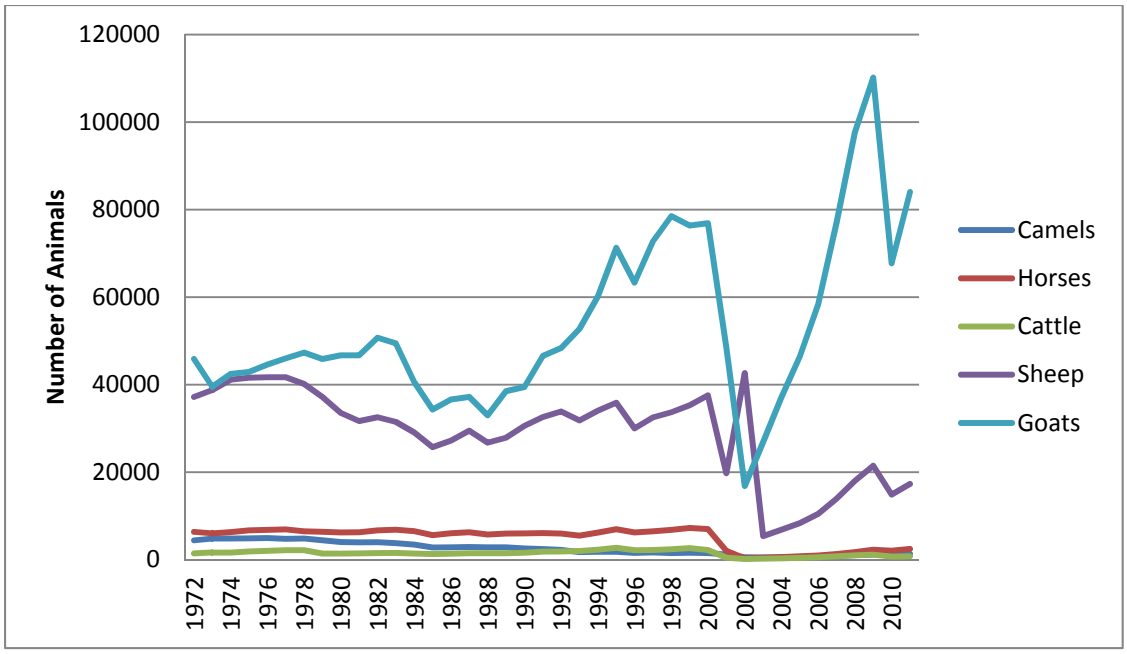
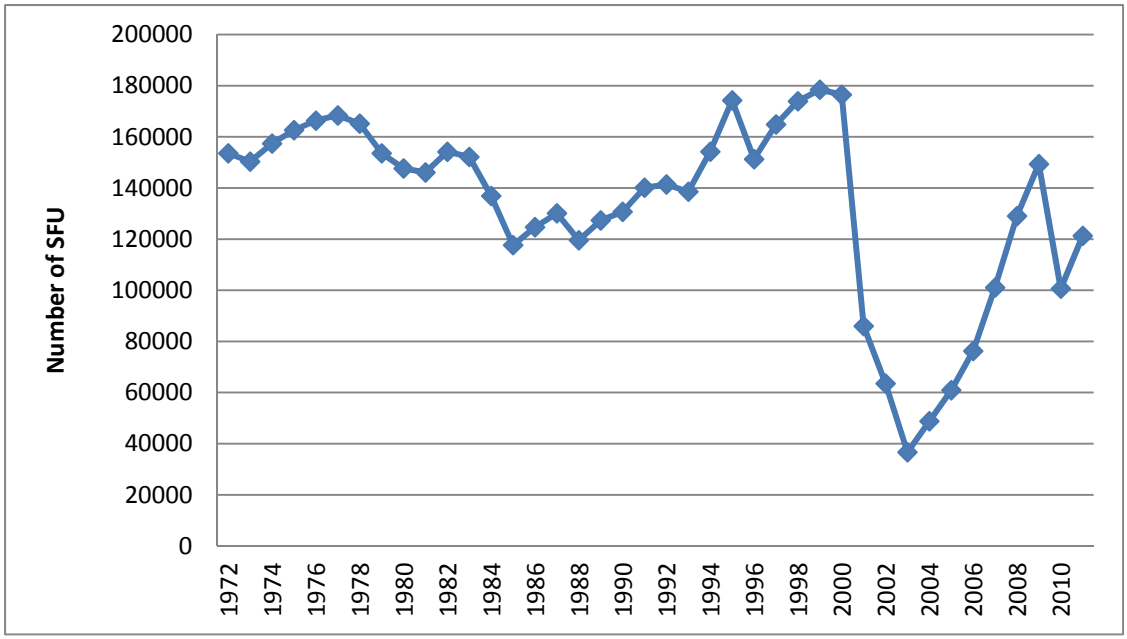


Figure 5.2 Livestock population in Sheep Forage Units (SFU) 1972-2010 in Jinst, Bayankhongor. (Source: soum statistics)



Pastoral movement patterns in Jinst soum depend on the location of water sources in the range of 10-15 km. Different neighborhood groups center on several different desert marshlands with natural springs and wells, as well as the Tuin River. Most herders spend the winter in sheltered valleys of the Narin Khar Mountain Range, spring and summer at the riparian areas, and fall in intermediate steppes. The winter camps of some interviewed herders were located along the Tuin River in pasture dominated by *Achnatherum splendens*, which protects them from wind and provides good forage for winter and

spring. In spring they move to hills and then in summer to the north to flat steppe area with wind. Fall is spent along the river in the riparian area.

Figure 5.3 Movements patterns of herders in Jinst Soum, Bayankhongor.

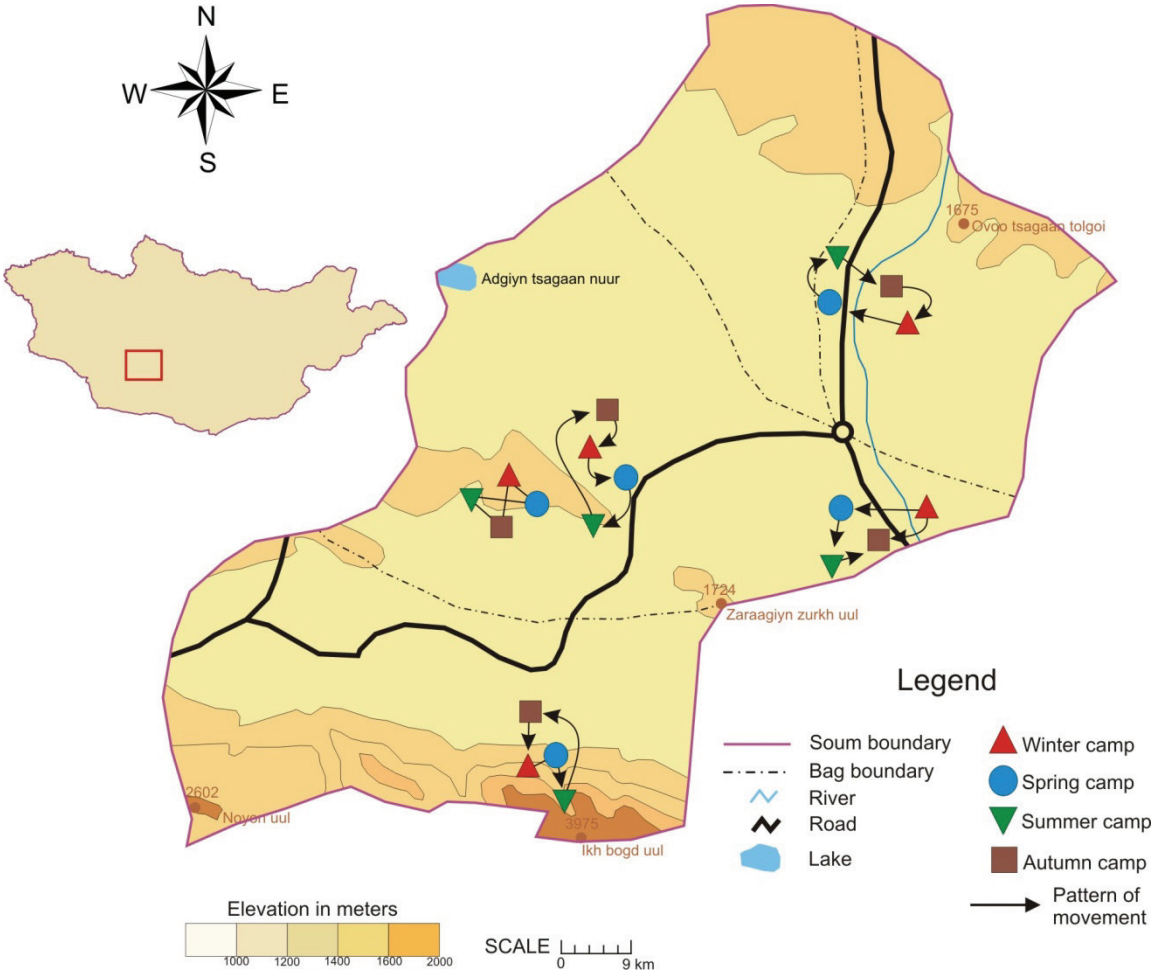
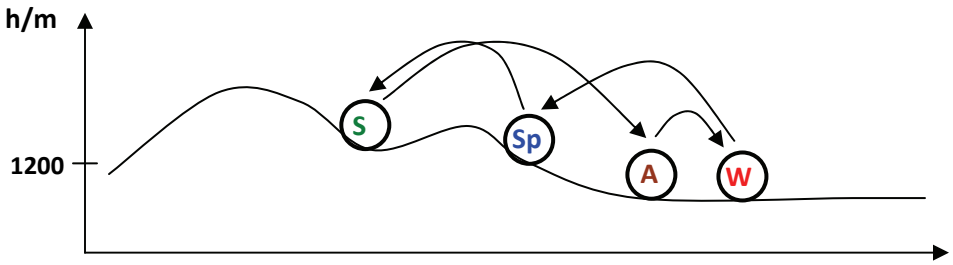


Figure 5.4 Movement pattern for one neighborhood of herders in Jinst Soum, Bayankhongor.



Donor organizations and project currently or recer t includ the Sustainable Livelihood Program (SLP), the UNDP Sustainable Grasslands M gram (UNDP-SGM) (2003-2008) and Veterinarians Without Borders (2007-2009).

5.2 Dzud Narrative

5.2.1 Exposure and Sensitivity

5.2.1.1 Weather Conditions, Pasture and Animal Growth and Winter Preparation

According to our survey 78.6% of herders perceived pasture conditions in summer were worse than usual. However, some felt there were better pasture conditions in summer of 2009, especially compared with the last few years when it was hot and dry condition. The dry summer was due to late and less rain than before. Eighty-two percent of surveyed herders perceived rainfall in summer to be lower than usual, and the late rains did not allow plants to in time for animals to gain meat fat. According the survey, 42.9% of herders thought that animal condition in summer-fall 2009 was worse than usual.

Most herders in Jinst reported that they could not to prepare hay in large quantities due to short grasses. Mainly herders harvested *Scirpus*. Herders who are member of herders groups harvested hay collectively. The leader of one of the herder groups reported, "because of that herders were able to save 50-70 % of stock. Otherwise they would have high losses as they did in the dzud of 2001." However, the main fodder of this region traditionally was hand-made fodder. Each household every year makes them as part of their winter preparations. But due to drought of last few years, herders did not prepare hand fodder in sufficient quantity. The surveyed households indicated that 39.3 household prepared hand fodder. In addition to purchasing fodder and *khorgoljin* and preparing hand fodder, herders made fall otor movements (75% of surveyed households) as preparation measure for winter. About 60% of surveyed households reported that they reserved winter pasture, and herder group members described how they set aside and managed their reserves to prevent grazing at other times of year.

Before winter, herders living nearby to each other discussed among themselves about how preparations were going, and where good pasture was available for winter grazing to coordinate otor movements. One herder group indicated that they organized meetings twice in September and November where they discussed collecting hay, making hand fodder, repairing winter shelters, etc. "Not all members always participated in the meetings. Usually half gather. However, all participated in collecting hay."

In the last few years a project from Veterinarians without Borders has been implemented through 13 herder groups in Jinst, providing medicine, and organizing training for the volunteers from each herder groups. The soum governor described this activity as successful and helping to improve animal health.

5.2.1.2 Dzud Awareness

Leaders of herder groups mentioned that experienced herders were aware of the coming dzud based on traditional knowledge of weather prediction. For example "In fall when a period of strong wind started, animals did not move against the wind to water points, but stayed behind bushes."

5.2.1.3 Dzud Characteristics

The cold weather started in end of December and continued until beginning of March. However the situation has been described as not "white dzud." The leader of one herder group said "Used to be in

November, pasture was covered by snow, but these days there is no snow." Following the snowless early winter, herders were surprised by sudden snow in the spring starting from April 20th. The heavy snows that fell 2-3 times and the drop in temperature were the main some herders lost animals. However, officials commented that such losses can be avoided.

The soum governor reported that "All herders with whom we watched TV news about dzud during the tour agreed that weather condition here was not comparable to the situation in severely affected areas." Within Jinst, different parts of the soum were affected in different ways. In areas where there was less snow herders from neighboring soum came for wintering, and some of them even came in summer. When they moved back they left no pasture behind and herders described this as "hoofed dzud." In areas where the weather was cold, female animals suffer from miscarriage.

An analysis of meteorological data from the Bayankhongor station (100 km north of Jinst) and Huriult in Bodg Soum 30 km to the south indicate that the cold was not as severe in Jinst as in the Arkhangai sites. In Bayanhongor, 2009-2010 was the fifth coldest winter on record in the past 48 years based on the average November through March, and maximum and minimum temperatures, and Horiult was the fifth and eight coldest in 37 years based on the maximum and minimum temperatures, respectively. However, November 2009 had the coldest average and minimum temperatures on record in Horiult. The number of cold nights and days was low at Bayanhongor at four and six with 11 and 10 winters having more extreme nights and days. There was only one cold night with 18 winters having more and five cold days with 8 winters having more. Figure 5.5 illustrates the higher than average monthly precipitation in April due to the heavy spring snowfall and Figure 5.6 shows that average winter temperatures were not significantly different from the long-term mean in Horiult.

Figure 5.5. Total monthly precipitation in 2009-2010 compared to long-term average in Horiult, Bogd Soum, adjacent to Jinst.

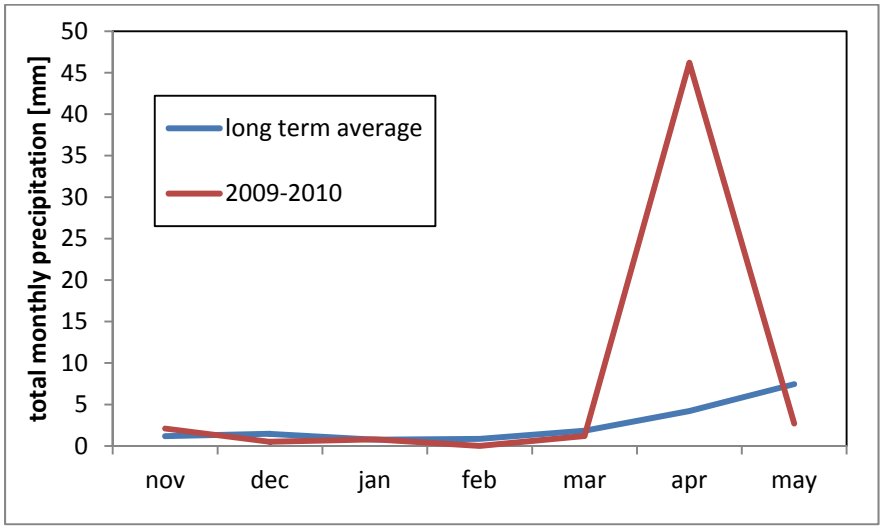
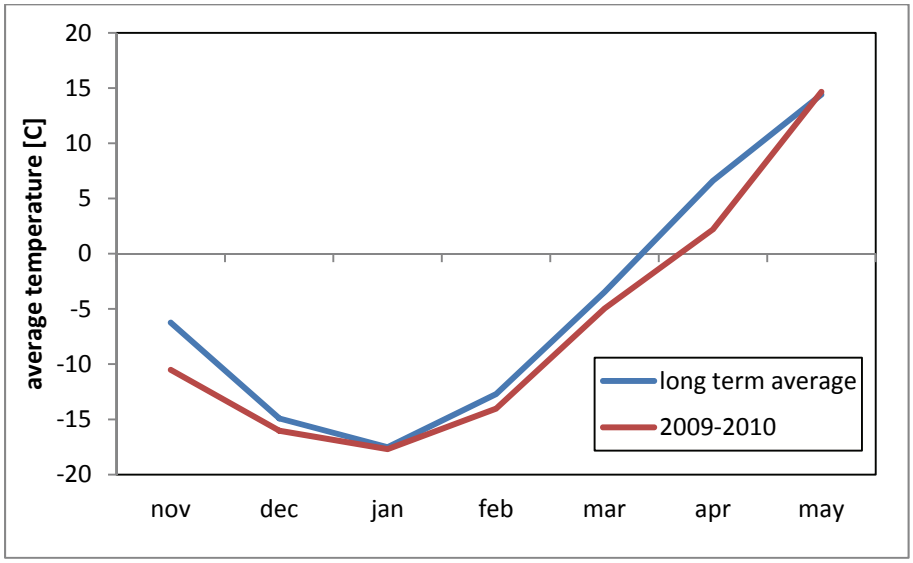


Figure 5.6 Average monthly temperature in 2009-2010 in Horiult, Bogd Soum, compared to the long-term average.



5.2.1.4 Incoming Otor Herders

Jinst received many herders for otor during the winter, because it had better pasture this year and also local government desingated otor reserve pasture, which attracted them to come. According to local officials, herders came from neighboring soums such as Bayantsagaan (28 households with 35000 animals), Bayan Undor (6 households with 4000 animals), Shine Jinst (7 households with more than 3000 animals), Ulziit (3 households with 2000 horses and 800 small stock) and from Baastagaan (2000 horses). In total, more than 10,000 horses arrived on otor from Baatsagaan and Ulziit to graze Jinst's reserves at Baruun and Zuun Khongorin tal.

5.2.2 Coping Responses

5.2.2.1 Herders' Coping Responses

Protection from Cold. During several months of the 2009-2010 dzud, herders tried some innovative practices to save their livestock. The temperature was extremely cold and the duration of these cold days was extended longer than the previous years. Herders dug a 5-10 meter-long trench in the buuts (bedding or accumulated dung) with the height of a goat and kept their goats, lined single file, in this tunnel, covering them with some canvas. A herder mentioned, "Some herders build tunnels to keep their goats for nights and this prevented goats from piling up on each other, to keep them warm for the night." This practice was implemented during collective period and the herders recalled this practice in times of emergency.

Movement. According to our qualitative data, herders who did otor in the fall and winter survived with fewer losses. One experienced herder mentioned that "my son took the fittest livestock and went to otor to the hills, 20 km from here, and he built a temporary shelter by installing poles and using some plastic materials for cover." Some herders in Jinst went further, to other soum, for distant otor during dzud: "We went for otor to Tsagaan Gol in Baatsagaan soum (65 km). Thanks to otor we saved the

majority of the herd. Other herders in our neighborhood did very badly." One herder shared his herding practice of paying serious attention to the duration of grazing time in pasture: "I followed my herd constantly from morning until sunset. When you follow your herd it brings a lot difference, because livestock graze steadily, I let my herd to go to pasture at 10 in the morning and bring it late in the evening."

*Feeding Strategies.*Herders used a lot of different feeding techniques. One experienced herder described that he used to give ration to each of his one year old sheep and goats, otherwise older animals would not let them eat. He also fed adult animals with hand-fodder made from taana and humuul (wild onions), and that was very helpful.

5.2.2.2 Aid Provided

According to survey respondents and local officials, Jinst received dzud assistance from 13 different donors, aid organizations and government sources (Table 5.2). Surveyed herders perceived assistance from the parliament members and Veterinarians Without Borders as the most valuable assistance during the dzud.

Aid Distribution. The head of the governor's office in Jinst was in charge of the dzud emergency aid and he reported that the main criterion for distribution was the number of livestock. However, he mentioned that the soum government had a policy to involve every herding household in the aid program. The hay and fodder were distributed at a subsidized price or for free depending on the donor's requirements. For example, two out of three members of parliament provided assistance of hay and fodder to sell to herders at a below- market price. But one MP just distributed it for free.

International NGOs such as ADRA, World Vision and Vets without Borders had their own beneficiary selection requirements and specific relief items for distribution. The local project officer for the Vets without Borders described that they targeted herder group members whom they work with and distributed one sack of khorgoljin and one sack of bran to each of the 164 households. In addition, they also distributed one sack of khorgoljin to an additional 380 non-group herders. ADRA supported 50 families by providing relief food items and seeds and tools for vegetable gardening. World Vision also targeted the families of the sponsored children they work with.

When hay and fodder were distributed for free as well as at the subsidized, price herders came to the soum center to retrieve them. In the case of subsidized hay and fodder, herders had to come with cash and buy the feed, as it was not distributed on credit. For direct aid distributed by the Vets without Borders, herder group leaders were responsible for distribution to the group members. Group leaders picked up feed from the soum center with a vehicle and distributed it to other herders.

Table 5.2 Sources of aid listed by soum official and household survey respondents.

	Aid Listed by Soum Officials	**No. (Percent) of Survey Respondents**
Erdenet (Ganzorig)	1 sack of pellet feed, food (Jan)	2 (7.1)
SLP	5 kg race, 5 kg flour per household (March, May)	7 (25)
Soum Government	Bran, rice, dry milk, flour (Feb) 20 tons hay, 10 tons bran, 5 tons khorgoljin from Aimag reserves	6 (21.4)
Veterinarians without Borders	100 households received 5 kg flour, 1 bran, 1 sack of pellet feed and 1kg dry milk per household (March)	20 (71.4)
National Government	1 dry milk,2 kg rice (March) 5 tons khorgoljin, 10 tons bran for sale at subsidized prices	8 (30.8)
UB Homeland Association	Candle, matches, medicine (3.1 million MNT) (Jan)	2 (7.1)
Bag	1 sack of pellet feed (March)	1 (3.6)
Aimag Khural Member	1 bale hay, 1 sack of pellet feed (March)	1 (3.6)
World Vision	Food (flour, dry milk-1kg, rice-5 kg), 100 families received warm clothes	3 (10.7)
Aimag Homeland Association	Animal blankets, fodder, candle, dry milk (March)	3 (10.7)
Three Parliament Members	2 bales hay, 1sack of pellet feed, bran, food (flour, rice, meat in can) per family (Dec Jan, April)	10 (35.7)
Red Cross	Medicine, boots, canned meat (March)	3 (10.7)
ADRA	50 households received food (flour, rice, vegetable oil)	0
Family members	Cash	1 (3.6)

5.2.3 Dzud Impacts

5.2.3.1 Herd Impacts

In Jinst soum overall, 38,790 head (39,280 SFU) of livestock perished in the 2009-2010 dzud. In the 2001 dzud, about 53,300 livestock died and 49,000 were lost in 2002. According to the 2009 livestock count, there were 136,262 animals in Jinst and as of semi-annual count in June 2010, nearly a third (28.5%) of the livestock in the soum had died.

The households surveyed in Jinst lost 58.8 head on average. Average percentage losses (in SFU) per household for five species were about 0.5% of camels, 47.2% of cattle, 5.9% of horses, 13.53% of sheep

and 14.8% of goats (Table 5.3). Herders in the focus groups reported that young sheep and goats were the most vulnerable.

Table 5.3 Mean loss per surveyed Jinst household as a percent of the 2009 herd in SFU.

	Mean (Standard Error)
Camels	0.5 (0.5)
Cattle	47.2 (15.5)
Horses	5.9 (2.6)
Sheep	13.5 (3.2)
Goats	14.8 (2.7)
Total	13.7 (2.2)

In focus group discussions and interviews, herders described that their animals became too weak when extremely cold days continued for about two months, especially young goats. One experienced herder spoke of how she kept her young sheep and goats in an extra warm ger and fed them well with fodder, but these measures didn't help her much and she lost most of her young animals, "We had about 100 yearling goats and now we are left with 18." Another women herder described, "Female goats started to miscarry around December 10th and these weak females suffered from fever."

5.2.3.2 Human Well-Being and Livelihood Impacts

Both focus groups and the survey revealed some negative impacts on human health from the dzud, including frostbite, exhaustion, high blood pressure, stress, and concerns about the health of other family members. Focus group informants shared that the dzud caused a lot of stress among herders, and that from March through May they were extremely exhausted and emotionally devastated. They kept their children and elders who are vulnerable in the soum center to be close to school and health care.

According to the chair of the governor's office in Jinst, 21 households lost more than 70% of their livestock and 40 families lost more than 50%. Focus group discussions clarified details of how a herder household's economic and livelihood condition is affected by dzud. They were especially concerned about repayment of their bank loans and some herders were not able to pay on time and had to ask for an extension. "When a herder is unable to pay back their loan, loan officers visited herders and took some of their livestock."

Food security and summer income were affected, as this focus group comment illustrates: "We have a scarcity of dairy products. When visitors come we are embarrassed by having a shortage of food, and summer income was very low." The head of the governor's office mentioned, "In the spring when livestock was thin and weak, Khaan Bank in cooperation with a Chinese company purchased a whole goat with a low price, Chinese people eat fat-free meat and they purchased the weakest ones for about 22,000-25,000 tug."

In the summer of 2009, 70 families were enrolled in the livestock insurance program and in June 2010 they all received insurance payment. Herders who benefited from the insurance, mentioned that it provided them a lot of encouragement and cash to cover banks loans and other households needs.

5.2.3.3 Poverty and Dzud Impacts

The dzud in 2000-2002 tremendously affected herders' livelihood situations. Focus group informants recalled that most families' income was significantly reduced and many households fell below the poverty line. According to the soum statistics about 35% of total households were considered poor in 2004, whereas this percentage was reduced to 12.8% in 2009.

Herders told that after the 2000-2002 dzud, herders' livelihoods eventually recovered well and herders' living standard improved across all households. According to herders' responses, the 2010 dzud negatively affected to food security and summer income, but has not necessarily increased the poverty rate. Some herders who insured their livestock before July 2009 received insurance paymenst, "We paid minimal amount of 25,000 MNT and this summer we received 425,000 MNT as insurance payment." Thus insurance may have helped affected households avoid falling into poverty as a result of dzud.

5.2.3.4 Beneficial Impacts of the Dzud?

Herders said that dzud doesn't have any beneficial impacts on their economic conditions because it negatively affects food security and income. However, it resulted in fewer livestock grazing on the same pasture, which improved livestock body weight and fitness in the summer of 2010. Summer and fall of 2010 was productive in terms of forage. Herders mentioned that dzud was, "lessons learned for young herders and they had some lessons on how to manage their herd in the future and what needs to be done as a preparation for winter." Similarly, others said, "Herders understood the importance of having fit livestock at the end of fall and preparing sufficient hay and fodder to feed them during an emergency period. Fat animals have multiple good benefits. It was very important to keep winter shelter warm and have good dry manure as bedding."

One woman herder described, "First, this year our animals gained good weigh and fat. Second, the forage production was sufficient, and finally after last year's dzud herders were left with some livestock to raise. These three factors are important and create possibilities to collect hay and fodder enough for the winter. Next year when I will have many offspring, I will take good care of them to keep alive during the winter. I thought we can consume yearling goats not waiting until they become big."

5.2.4 Adaptive Responses

5.2.4.1 Plans for the Future—Household Level

Few Jinst survey respondents planned to move away from the countryside, and most also planned to continue herding as their main livelihood activity. However, 22% of those surveyed planned to another job instead of or in addition to herding. One will work as fireman in the secondary school, three respondents will plant vegetables, and one will work in fuel station. Most herders planned to let their herds regrow at a natural rate, although 15% of surveyed households planned to look for animals to buy.

Herders in focus groups mentioned, “in the fall, it is necessary to sort the animals and slaughter when they are fat and this will keep livestock number in balance.”

Donors and international NGOs collaborate with the local government to support affected herders’ livelihoods. The chair of the governor’s office said, “Those 21 families who lost more than 70% of their livestock will continue herding and will benefit from the restocking project supported by UNDP. Each will get 10 animals worth of 300,000 MNT. In addition to their few (20-30) remaining livestock this will help a lot to increase their herd.” NGOs like Veterinarians without Borders, World Vision, and ADRA, support herders to do small-scale gardening by providing seeds, tools and irrigation facilities.

5.2.4.2 Plans for the Future and Evidence of Learning—Community Level

Based on their lessons learned from the 2000-2002 dzud, herder group members were able to anticipate effects of the 2009-2010 dzud and make some preparations to save their livestock. Despite their preparations, they suffered from unexpected livestock losses during the 2010 dzud. Based on their lessons, the Bayankhongor aimag governor, Jinst soum governor and all bag governors issued decrees about winter preparation for 2010. The decree called all the herders, government and non-government organizations and private sectors to join and assist in establishing reserves of hay and fodder. It says that by October 15th each family will contribute 3 kg of hand-made fodder, zoodoi, to the soum reserves. The decree formally reminds everyone to be proactive and mobilize all efforts to ensure sufficient winter reserves at all levels by making silage, hand fodder and collecting hay.

Jinst authorities reported that in 2010, herders prepared about 20 tons of hand fodder and about 100 tons of hay. In Jinst, there is a reserve of *Phragmites communis* in Tsagaan Gol, which is commonly used for hay. *Allium mongolicum* and *Allium polyrrhizium* are used to produce highly nutritional hand fodder. Reserves of hay and hand fodder were produced at two levels: the government level and the household level. Group herders thought about establishing a group hay reserve, but they need to build a big barn to keep the hay.

Major learning was observed in herd management practices. Herders all agreed to keep the number of livestock under certain limit and to sell them in the fall when they are fat and fit. “We need to learn and be serious about reducing the livestock number. Being a herder it is very hard to do mass livestock slaughtering, because we have a mentality to increase livestock numbers not to sell in the market.” After each disaster, herders learn about the importance of keeping the number of livestock under certain limit, but during good years they tend to increase their herd size without clear plans on effective herd management. One herder mentioned, “There is a common practice, a herder with 1000 livestock had 300 lambs this spring and would normally slaughter 300 sheep and goats, but not more than that. This actually doesn’t reduce the herd size. We need to learn to sell more livestock, which is an almost impossible decision for a herder.” According to traditional pastoral practices, herders normally don’t consume and slaughter young goats and sheep. Herders discussed among themselves to use and sell young animals without waiting the additional 2-3 years until they mature.

5.2.5 Recovery, Learning, Adaptation a Year after the Dzud

5.2.5.1 2010-2011 Winter Conditions

Herders described that the winter of 2010-2011 was milder than the previous *dzud* winter and that livestock condition and body weight was good even in the spring.

5.2.5.3 Summer Conditions and Winter 2010-2011 Preparations

There was a heavy snow fall late in April 2010 that badly affected herds, but herders mentioned that the wet snow layer gave a good amount of moisture allowing good growth of green shoots early in the spring. The summer of 2010 was productive, allowing herders to cut hay and collect hand-harvested fodder. Herders described complex of measures undertaken as part of preparation for the winter of 2010-2011. In Jinst, many of these activities were also carried out prior to the dzud of 2009, but in some instances preparation practices changed in 2010.

- Rotational grazing, pasture resting:
  Many herders in Jinst that belong to herder groups have implemented rotational grazing and resting of pastures since 2004. As a result, when they faced the *dzud* in 2009-2010, they were experienced and better prepared: "We have learned to protect pasture early in the spring". A herder group leader described that "rotational use of seasonal pastures help us in many different situations, as it preserves not only particular pasture for seasonal use, but it helps the herd to get necessary fat and energy, which in turn improves our livelihood." Following the 2009-2010 dzud herders have continued to implement the grazing rotations and reserves they initiated earlier.

- Setting aside reserve pastures:
  Herders enthusiastically shared about the importance of small reserve areas that every household in the group established. "Every household fenced a small area of pasture of about 0.3 – 0.8 ha as a reserve pasture to graze our yearlings and weak animals in the spring." Apart from fencing a small pasture for reserve, another herder group leader (Orgil group) described setting aside a larger reserve pasture (2-3 ha) not by fencing, but just protecting it from grazing. They informed that they use this reserve pasture only in the spring and having such reserve helped during the recent *dzud*: "After when the Grassland project implemented in our *soum*, our group initiated this practice of setting aside close-distance reserves and this practice continue till now even after the project is over. Every household in the group has set such pasture and for example our livestock got trained to run to the protected pasture." In general, it was observed that the rangeland management practices herders learned after the first *dzud*, played a significant role in overcoming the 2009-2010 dzud. During the focus group discussion in the third herder group (Shar Khad), herders also shared their opinions about the benefits and skills they have gained as a result of creating reserves.

- Otor movement:
  The ability to make otor movements depends on the availability of reserve pastures at multiple scales where herders can bring their herd for a temporary period of 2-4 weeks and sometimes longer (up to 6-9 months). The summer and fall before the 2009-2010 dzud some good herders

used all possible avenues to go for otor: “Before the dzud of 2009 we were mobile doing otor and thus our herd gained good weight and fat and therefore we were not badly affected by this dzud. The following summer of 2010 we also did a lot of otor to fatten our livestock.” Some mentioned that they have split their herd in two herds and brought one for distant otor and other one they kept close to the campsites to graze in close-distant pastures. Another herder shared: “This winter my family went well (2010-2011), as we managed to do otor in the previous summer (2010) and our livestock gained good weight and fat, we did sufficient preparation for the winter.”

- Hay harvesting, hand fodder production and feed purchase

  Herders across the *soum* harvested a good amount of hay from Tsagaan Gol in the fall of 2010. Herders organized themselves to collect the hay and in addition the local government encouraged herders to stockpile sufficient hay before the winter. Local government officials reported that in the summer and fall of 2010 Jinst herders collected a sufficient amount of hay for their own use and the local government didn’t distribute any hay at subsidized prices. In the summer of 2010 herders also prepared a lot of hand fodder at the household level, namely *zoodoi*, *darsh* and dry herbs to feed weak animals in the spring, as they have seen benefits of such supplements during the emergency months. According to the herders, they preferred to produce hand fodder than buy feed from the market.

- Livestock winter shelter

  During the summer and fall of 2010, herders were determined to reconstruct and improve their winter shelters. At the individual household level this practice was not prioritized before the *dzud* of 2009-2010. Focus group informants and local officials expressed that in 2010 some herders enlarged the size of their shelters and covered the walls and roofs to keep warm the livestock in the winter. Due to high costs associated with this work, herders were less able to make sufficient investments in the renovation and reconstruction work. The local agriculture officer described that 22 new animal shelters were contructed in the summer of 2010 in Jinst.

5.2.5.3 Recovery from the Dzud

During our second visit in May 2011 herders as well as local officials reported that the livestock herds are slowly recovering due to good birthing rates and recovery positively affects the household economic situation. Local government officials also reported that some herders from neighboring *soum* including Bayan-Undur, Bayantsagaan and Shinejist migrated to Jinst to become its residents. In 2009-2010 over 130 people officially registered as newcomers. The local government informed that in the past two years the number of people who moved in was greater than the number of people who moved out. According to the respondents there are several reasons of why people migrate to this soum. Government officials explained that electricity was installed in 2007 and migration to other areas decreased in general. Better ecological conditions and rangeland production were another factor that attracted herders from neighboring soum.

5.2.5.4 Learning, Adaptation and Resilience

Experienced herders have much better sense of predicting the situation about upcoming winter, as one elder described about his assessment of the situation: “Signs of upcoming winter condition were noticable, I could see that there will be dzud and hardship in the winter. The reserve pasture that we kept was utilized before the winter and there was not forage on the pasture already in the fall, so we bought supplements and fodder in sufficient amount.”

The main lesson of the dzud was to keep reserve pasture near to uvuljuu camp, as experienced herders’ practices teach during dzud years one-year old and weak animals should graze nearby pasture. There are different feeding practices for different types and ages of livestock and therefore the feed and hay preparation should be done accordingly considering diet and requirements of each livestock.

The second lesson: Livestock shelter for winter was a practice that was neglected among young herders. This practice was mandatory for all herders during the collective period and the collective administration allocated necessary human and financial resources on annual basis. Due to maintenance costs associated with livestock shelters, many herders were unable to keep shelters in good repair.

The third lesson: Hay preparation and hand fodder production. “Our family did good work to improve condition of our livestock shelter. We cleaned and removed the bedding (accumulated layers of dung) and restored and covered the walls and roofs of the shelter.” Herders collected natural hay from the Tsagaan Gol and prepared hand fodder and natural salt licks: “Last fall we harvested about 15 tons of hay, prepared over one ton of hand fodder and 500 kg of salt licks.” The second year visit to Jinst soum provided a lot of similar evidence that demonstrated the increased capacity of the local soum government to organize collective efforts to harvest hay at the appropriate time by increasing awareness among herders soum-wide.

Internal factors that affect herders’ resilience are related to low capacity to handle household income and expenses. Herders tend to use cash to cover their household needs, but neglect resources to cover costs for production. Production costs include maintenance of shelters, *otor* movements, hay harvesting, hand fodder production, supplement purchase, vet services, and herd quality improvements. Herders shared the difficulties they face in reducing the number of livestock due to their need to cover these expenses and given that there are few alternative means of generating income other than raising livestock. In Jinst, herders lack a market to sell fresh milk and meat on a regular basis.

A new external factor affecting herders’ adaptive capacity and resilience in Jinst soum is mineral exploration. There is a mining company that is doing some exploration in Sarin Gezeg in Uubulan in the first *bag*. Herders described that there are 25 herders’ winter shelters and customary pastures locates in that area. We met with these families affected by the exploration work who shared their concerns as: “In first *bag nutag* an exploration brigade is looking for reserves of molybdenum, copper and other minerals, and the herders don’t like this. We have there only one deep well and that company uses the well as well. As local people we raised these issues many times at the local *bag* assembly meetings asking for protection of our pasture. We feel that there is a pressure from the top officials.” Herders gave a lot of examples how their pasture and thus livelihoods are affected, as this exploration covers

significant land: “All winter and spring pastures of the herders are getting degraded and eroded, because of heavy truck movements that created multiple roads in the area. We didn’t know what they explore and what kind of minerals and precious stones they found, we don’t know…” During the focus group discussion herders described the area where exploration is occuring as rich with wildlife, hay land and springs. They provided some estimates of territory they affect: “The area that is affected by this exploration is about 3 by 3 km.”

5.2.5.5 Roles of Different Actors in Dzud Preparation and Recovery

The role of civil society organizations and donors in dzud preparation and recovery are well documented by information and interviews provided by local government officials as well as herder representatives. For example, they mentioned several donor intiatives such as index-based insurance, a community-based veterinary-trainer project, a small grant-project to improve rangeland practices, and restocking projects that were helpful to herders to recover from dzud losses. A local government official reported that the UNDP implemented a restocking project as the dzud rehabilitation program, where 21 herder households from Jinst benefited by receiving a small herd of livestock worth 300,000 MNT. ADRA, an international NGO, supplied vegetable and potato seeds and greenhouse materials to dzud-affected herders who have access to land and irrigation. Soum officials described how the UMDP Sustainable Grassland Management project implemented in Jinst a few years ago initiated management practices among group herders such as rotational grazing and establishing reserve pasture that increased their preparedness to dzud. An agricultural officer informed that there several waterpoints were rehabilitated with grants from the Sustainable Livelihood II project.

5.3 Discussion

5.3.1 Factors Affecting Vulnerability

Focus group informants described that 2009 summer forage production was not as good as the summer of 2010 and they were not able to make hand-fodder. However, in general many Jinst herders were well prepared with adequate stocks of hay and reasonable animal conditions. In Jinst, household vulnerability was most influenced by otor movements and trespassing from other soum. Qualitative data suggest that in the summer and fall of 2009 a mass of otor herders arrived from neighboring soum. The local government official described that 50,000 livestock belonging to more than 40 families spent fall, winter and spring in Jinst. Most of them, 28 families with 35,000 livestock, were from the Bayantsagaan soum, 6 families with 4000 livestock were from Bayan-Undur, and 7 families with 3000 livestock from Shinejinst. In addition, a large herd of horses, more than 10,000, from Baatsagaan and Ulziit did otor in Jinst. The soum agriculture officer described this dzud as “hoofed dzud”, when livestock from other areas come and overstock the available pasture resulting in shortage of forage and massive livestock mortality: “If we didn’t have huge herds of livestock from other soum that caused a lot of difficulties and shortage of forage, we couldn’t have had a better winter with less livestock loss.” From an interview with a herder, “One day an elderly herder from Bayan-Undur came to us and asked to stay together with us this winter. They had more than 400 sheep and goats. I couldn’t say ‘no’ and shared my winter campsite and let them use our animal shelter. As a result, I lost twice more livestock than him.”

The soum agriculture officer observed that in general there are two contrasting types of herders with different livestock mortality rates. The first are those who had less livestock loss, are responsible and hardworking and completed all the necessary measures such as hand fodder, hay collection, and preparing animal shelters. The second type of herders are those who were not serious enough and paid less attention and hoped that the winter will be mild, and consequently suffered more.

5.3.2 Indicators of Resilience

The 2009-2010 dzud revealed several indicators of resilience among the herders on individual and collective levels. In Jinst several herder groups were formed in 2003 with support of the UNDP Sustainable Grassland Management project that ended in 2008. This project collaborated with herder groups in many activities such as pasture management, creation of reserve pasture, well rehabilitation, skill development and risk management. Focus group informants as well as local government officials referred to the importance of collective action that group members undertake together. The leader of "Devshil" group told that, "Each member of our group established by fencing a small area for reserve pasture and kept it from summer and fall grazing for several years. Llast December the forage in the reserve pasture was very thick and almost one meter high and we used it in the spring." This experienced herder told that each of the group members was able to prepare sufficiently for winter by vaccinating livestock, harvesting some hay and fodder, slaughtering more than the normal number of livestock, and intentionally not breeding livestock in the fall. Another group leader mentioned that they didn't have many livestock losses, as they were able to reserve their pasture, collected hand fodder, warmed up winter shelters for livestock, etc., "The Sustainable Grassland Management project trained us to have a pasture management plan and now we use our pasture on a rotational basis, protecting our reserve pasture from off-season grazing, which is about a 5 km x 2 km area. Two families protect it from two sides and don't herd their livestock in this pasture. This helped a lot to overcome dzud."

Focus group discussions with herder groups revealed that they knew about the upcoming hardship and were prepared for its anticipated effects. When herder group members were asked if the preparations that they made for winter were helpful, they responded, "Absolutely, this helped some of us to save 50% and some 70% of our herd, otherwise, we could have suffered like in the 2000-2002 dzud when we were left with only 10-20 animals." With assistance from the Sustainable Grassland Management project a herder group established 2 ha of reserve pasture.

Local government officials observed that organized group of herders have had less risk, because they combined their efforts and had collectively rehabilitated water points, winter and spring shelters, harvested hay and prepared hand fodder. He mentioned, "I think it is very helpful for herders to move into a joint form of cooperation, as there are numerous things they can accomplish together. For example, one individual family cannot harvest much, but if they come together and prepare each others' hay in turn or shear sheep and goats, will have much better results." At least three herders groups formed in 2003 with support of the UNDP-SGM project participated in the project implemented by Veterniarians without Borders, which trained herder group leaders in basic veterinary services and vaccinated all livestock in the herder group.

Another important resilience indicator was observed at the government level. The local government was responsible for raising awareness among herders about the upcoming emergency situation in 2009-2010. "We advised herders to reduce the number of livestock, sell them in the market, not breed the livestock, prepare hay and fodder, rehabilitate and utilize reserve winter and spring campsites. As a result our soum herders in comparison with other soums had less livestock mortality. But there are a lot of families who suffered a lot." Lessons from consecutive dzud of 2000-2002 provided good warning to the herders as well as local government. A herder recollected that "I am experiencing my second largest dzud after I became a herder. I had a big lesson learned from 2001 and 2002. I used to have about 700-800 head of livestock, but was left with only 54. With this in mind, last year I did all my best to save all my livestock, but it was still very hard to keep them all alive. Young goats and sheep are vulnerable towards such disaster, I fed them well with hay and fodder and kept them warm inside, but the weather was extremely cold."

Herders as well as local officials referred to their experience and lessons obtained from devastating dzud in 2000-2002. Based on their lessons local government's strategy was to secure adequate level of preparedness at community as well as individual herder levels. However, warning and awareness raising activities were not organized in the summer of 2009, but mainly in November 2009, when dzud signs were more obvious.

5.3.3 Role of Adaptive Strategies

5.3.3.1 Storage

Reserves significantly contributed towards the adaptive capacity of herders as well as government officials. It was evident that many types of reserves could be established at multiple. At the individual household level, it was crucial to have reserves of small fenced and larger open pasture, harvested hay reserves, hand fodder, and purchased sacks of wheat bran, savings of cash, and extra winter and spring shelters. At the community level, ability to harvest naturally growing hay and availability of communal reserve pasture set aside for an emergency use were important. Herders' awareness of the importance of such variety of reserves improved their ability to cope with disaster situation at individual herder and community levels.

5.3.3.2 Mobility, Reciprocity and Exchange

Mobility was another important adaptive response of herders. Otor herders that arrived from other soums to Jinst were able to benefit by reducing their risk of massive livestock loss. According to both qualitative and quantitative evidence, availability of near and distant pasture provides the best solution for herders to withstand the effects of dzud. Government policy encouraged cross-border movements during the emergency period, which was in line with pastoral norms and practices of mutual support and hospitality among herders.

Reciprocity and exchange practices determined not only individual herder's decisions, but also soum government action and policies. When a herder comes with his herd moving more than 100 km and asks a local herder for a refuge for winter, it is unthinkable not to accept his request due to cultural norms and expectations. Similarly, when a governor from a high-risk soum comes with an agreement

proposal to accept certain number of livestock for winterization, the recipient soum governor should agree with his proposal if the situation is better in his area.

Though mobility brings some benefits to the moving households, in Jinst it also contributed to negative effects and harm to the receiving sites. Herders as well as local officials claimed that, "The effects of dzud could have been less harmful, if we haven't received numerous otor livestock from other soum."

5.3.3.3 Flexibility

Flexibility in decision-making is essential during the dzud. As one experienced official commented, "Dzud treats everyone equally." Herders appear to weigh their behavior against anticipated risks, and must be able to make decisions quickly. This flexibility and risk-weighing is illustrated in the balancing of considerations related to otor reciprocity, discussed above. It is too risky for herders to lose face in front of their peers, which might cost their future ability to move and access others' pasture and shelter in the future. Therefore, they chose to share their winter pasture and campsites with external otor herders. On an individual basis in the short term, flexibility in sharing critical resources in times of dzud is not helpful, but on a broader scale and over a longer timeframe this strategy may increase herder's adaptive capacity in the face of dzud.

5.3.3.4 Diversity

In Jinst, diversity was mainly important in the diversity of pasture and natural resources available that created options for preparing for and responding to dzud. These included the riparian areas around desert springs and rivers, mountain pastures that provide shelter in the winter, and the vast steppes on either side of the Tuin River that create de facto reserves.

5.3.3.5 Communal Pooling

Jinst herders shared labor for winter preparations, especially in the fall following the dzud (2010), although herder group members also helped each other with childcare during the disaster. Jinst herder groups also set aside group-level reserve pastures.

Table 5.5 Evidence of adaptive strategies in Jinst Soum.

Adaptive strategies	**Supporting Quotations**
Flexibility	"Nature is very flexible… there are too many of livestock and if dzud didn't happen last year, the grassland production will not good like this year, this only happens due to loss of huge number of livestock."
Storage	"Our soum is rich land, we have river and also we have good places to cut hay." "We experienced benefits of fencing small areas for reserve. It is really nice, especially for baby and young livestock, to use the reserve in spring. Each family in our herder group established such small reserves with support from the project." "Last year, we went to Tsagaan Gol that is 45 km from here to harvest hay. This was only place where we could harvest hay, otherwise the pasture production was very bad last year…" "In our soum we have an open steppe called "Khongorin tal" which spreads upto 80 km in length and width. This area is set aside as soum reserve otor pasture. "

Reciprocity	"Part of the winter preparedness is helping each other and using each others assistance before winter in rehabilitating winter shelter, cleaning coral from old manure, etc." "Herders let their far relatives to come from drought affected soum to spend winter and spring as a distant otor and they share their pasture and winter campsites with them."
Mobility	"We could overcome the dzud thanks to otor movements that we did during the fall." "Last year, our family did otor movements several times during summer and fall, which helped us to save our livestock. Most of the other families in our neighborhood suffered a lot."
Diversity	"Last year we harvested about 10 tons of hay from Tsagaan gol." "We have better forage in the mountains … our livestock can get good weight and fat in the ravines of the mountain, because this mountain has very good production of forage and plants."
Communal Pooling	"Ability to overcome risks with fewer losses is partially due organized forms of cooperation among herders. They organized as groups and used collective efforts to renovate shelters, rehabilitate wells, harvest hay, etc."

5.3.4 Role of Herder Groups

The UNDP-SGM project helped organize several herders groups, each comprised of about 8 herder families. The field study was conducted in the fall of 2010, three years after the project's completion and there are many instances documented where the herder groups played a significant role in helping herders to successfully cope with disaster situation (Table 5.6).

Table 5.6 Examples of practices that herder group members undertook individually and collectively to withstand effects of Dzud 2009-2010.

Practice	**Supporting Quotations**
Rotational use of pastureland	"There was UNDP project implemented in our soum. The project trained herders to have pasture management plans by clarifying customary borders of the herder group and helping them to draw a sketch of herder group territory. They trained herders to use the pasture on rotational basis, setting aside reserve." "Group herders obtained a very good understanding and experience to collectively manage their pasture, to reduce risks." "Since 2008 a project is implemented by "vets without border" and this project supported establishing 13 herder groups in our soum and vocationally trains a group leader to be a vet assistant." "from Sustainable Grassland management project I obtained understanding about rotational use of pasture and now Vets without border project provide us good information about animal health, vaccination, etc "
Collective hay and hand-fodder harvesting	"Ability to overcome risks with fewer losses are partially due organized forms of cooperation among herders. They organized as groups and used collective efforts to renovate shelters, rehabilitate wells, harvest hay, etc." "Last summer and fall, our household prepared good amount of hand-fodder and also purchased brans from aiamg center and fed our livestock." ("Orgil"

	herder group leader)
Pastureland management	"The pastureland management is better now, we make plans for rotational grazing reducing continuous grazing on the same pasture. We have plans for utilization of our short-distance pasture, and there Bazar and our family protect our common reserve from the north and Byamba and Haltar from the south, therefore it is getting protected and reserved for spring use. Now it is not like before, during the time of the dzud in 2000-2002, when any one can come and graze their livestock." ("Orgil" herder group leader) "Some herders collaborate to utilize their pasture appropriately by jointly protecting it without dominating. Our soum herders got organized in some groups and had good efforts to protect winter and spring pasture fro grazing during the summer that was supported by the local government decree. In 2006-2008 we had Sustainable Grassland Management project implemented that was a big project making herder groups to have pasture utilization schedule and rotations." (head of soum government office)
Established reserve pasture by fencing	"We established about 2 ha of reserve pasture with 20m x 40m dimensions, and fenced with barbed wires. Without strict control and protection, the fence is easily broken, so we consistently take good care of the fence and protect it from others. During the SGM project all families in our group established this kind of small reserve pastures. In December 2009, project officer from Vets without border visited us and when he saw inside of fence a lot of forage, but nothing outside he got so surprised how come it can grow like this in the desert." "I have seen benefits of fencing; even a small reserve pasture is useful." "During spring we grazed our livestock in our reserve pasture, because our reserve pasture had a good forage as protected it during summer and fall"
Winter shelter rehabilitation	"There are 10 families in our group and these families are part of three different kinships/relatives and these herders help each other in cleaning coral, renovating winter shelter, etc." "The winter shelter become far better that it was during the dzud 2000-2002, it is now much warmer and well insulated. Before we used some big rocks to build it, but now we daub stone walls with mud very and well covering from wind."
Warning and discussion among themselves about dzud situation	We discuss among ourselves about the weather and pasture condition in the winter and spring. Last year we met 2 times in September and October to discuss issues related to winterization. Herders talked about their preparation for winter, who is moving when and where. Last year we mainly talked about scarcity of hay, etc.
Herd management	Last fall we knew about upcoming hardship and slaughtered more livestock than normal years. As of fall 2009 our group herders had many livestock, three households had more than 1,000 and the rest had about 500-600 livestock.

5.3.5 Constraints to Adaptation

In Jinst, constraints to adaptation included herders' incomplete knowledge of fundamental reasons for pasture degradation. Herders as well as government officials perceive that external ecological factors such as lack of rain and the increase in livestock numbers are the main reasons for degradation.

However, most herders and officials fail to understand that social factors such as pasture management practices and institutions affect pasture degradation. Thus, the importance and urgency of implementing sustainable pasture use practices and planning is not well recognized across all herders and government officials. As a result, policies to encourage collective action to protect and properly use pastureland are weak. The Jinst case demonstrated benefits of formally organized herder groups in pastureland use, however these institutions were mainly supported by donor projects. Upon completion of these projects, there is a lack of local government policy, resources and capacity to support and scale out the good practices.

At an individual household level, herders lack alternative livelihood options, which limits their ability to take adaptive actions such as reducing their herd sizes to focus on improving animal quality. A new constraint to adaptation in year 2 was the initiation of mineral exploration in Jinst's first bag. Exploration occupied and damaged valuable pasture resources including critical spring pastures, drew down water essential for livestock and domestic use, and led to a sense of disempowerment among local herders, who repeatedly raised concerns about the impacts of exploration to an apparently unresponsive government.

5.4 Implications for Policy and Practice

- Awareness raising and warning actions taken by provincial and soum governments encouraged herders to be proactive and plan and prepare for winter.
- Disseminate lessons from the past dzud to herders using public meetings and other means of information sharing.
- Encourage protection of reserve pastures. Small pastures could be fenced if they are located along the river bank with sufficient level of ground moisture. But in the desert steppe, it is more beneficial set aside communal pasture areas as reserve, protect it during all seasons and use it only in times of emergency.
- Formal and informal discussions with organized groups of herders bring up important ideas and suggestions to include in local planning and policy development.
- Aid and relief assistance from international and national organizations provided encouragement and supported household food security and livelihoods on a temporary basis.
- Organized groups of herders could be used for distribution of relief items (as was done by Veterinarians without Borders).
- Selection of beneficiaries could be more appropriate if it were conducted through herder groups. This will avoid exclusion of herders who are in greatest need. Transparency in selection of households is critical.
- Seasonal pasture rotation to protect reserve pastures and allow regrowth is the most essential strategy for risk management. Pasture management plans should be developed and enforced at all levels, including household, group, bag, soum and aimag. There are some examples of group range management practices that demonstrate successes, but for long-term sustainability spontaneous operation of herder groups is not sufficient. Therefore, it is crucial to scale out this strategy through policy support and planning.
- Local soum government officials understood the benefits of organized herder groups, but could take a stronger role in encouraging and supporting this form of cooperation across all herding households.

- Limited alternative livehood options and access to markets limit herders' adaptive capacity at the household level.
- Mineral exploration that damages critical pastoral resources affects community resilience both by removing or limiting key adaptation options (e.g. storage of forage in reserve pastures), and by eroding the effectiveness of local governance institutions when herders' protests and concerns are ignored in community meetings.

6. Bayantsagaan Case Study

6.1 Soum Ecological and Socio-Economic Context

Bayantsagaan soum belongs to Bayankhongor aimag of Mongolia. There are six bags in the soum. The territory is 539,513 ha, of which 538,223 ha is considered rangelands. Bayantsagaan soum is located at the beginning of the Gobi Altai mountain range in desert-steppe ecological zone. The highest point of the soum (3085 m) is Dund Khamar Mountain, located in the center of the soum.

The current population of Bayantsagaan is about 3401 people comprising 975 households of which 71 percent are herding households. There is a 12-year school operates in the soum, where 830 children enrolled as of fall 2010. The preschool has the capacity to enroll 160 children.

Table 6. 1 Human population of Bayantsagaan Soum (source: Soum statistics)

	1990	1995	2000	2005	2008	2009	2010	2011
Total population	3025	3660	3946	3623	3420	3401	3346	3356
Total households	No data	No data	927	889	971	975	976	961
Herder households	No data	No data	No data	682	664	672	833	817

Livestock husbandry is the primary economic activity in Bayantsagaan soum, although artisanal ("Ninja") gold mining has become important in recent years. The livestock population reached 180,000 head in 2009 and goats make up 75% of the herd. About 70 % of livestock were lost in the dzud of 2000-2002.

Figure 6.1 Livestock populations from 1972-2011 in Bayantsagaan, Bayankhongor.

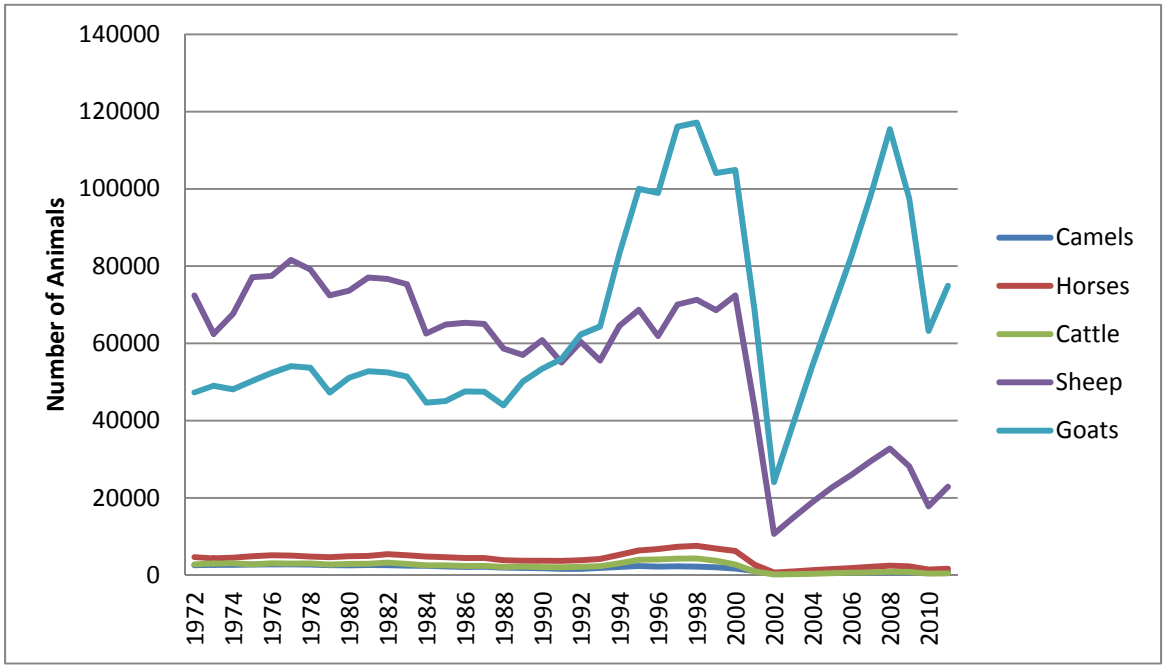
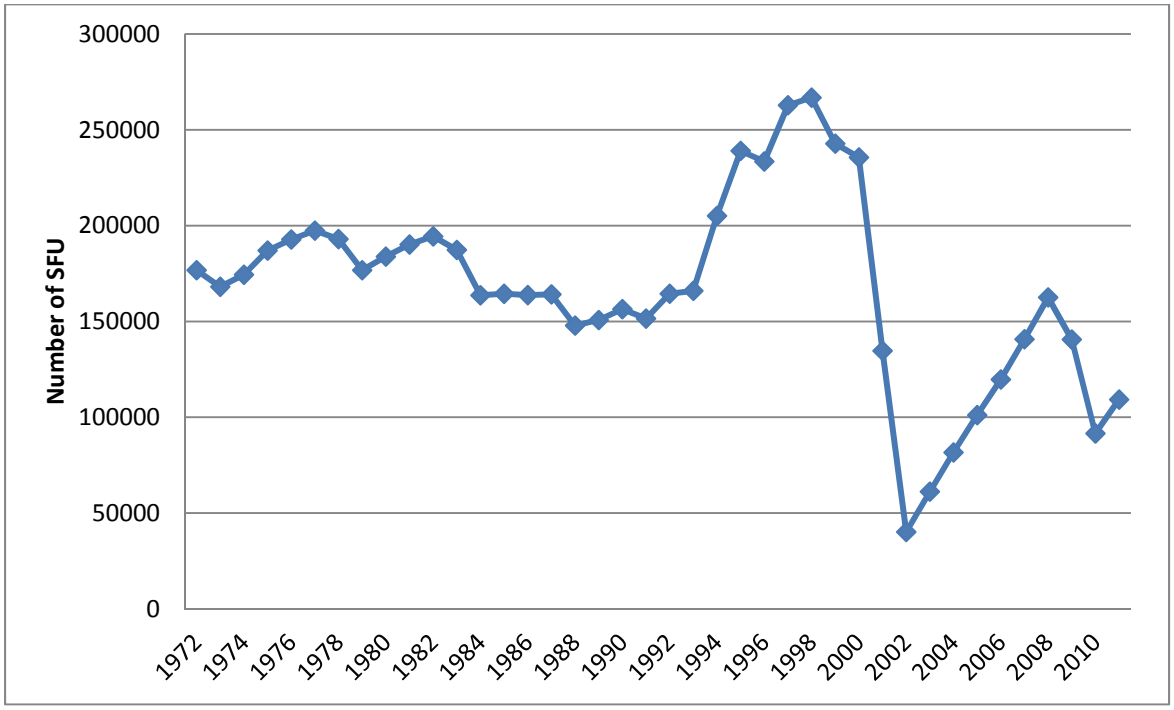
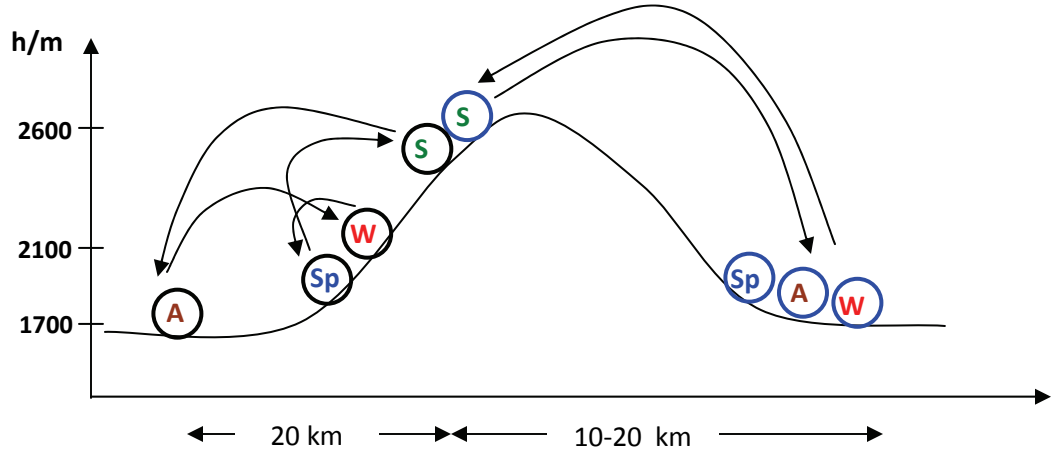


Figure 6.2 Livestock in Sheep Forage Units from 1972-2011 in Bayantsagaan, Bayankhongor
(Source for both graphs: soum statistics)



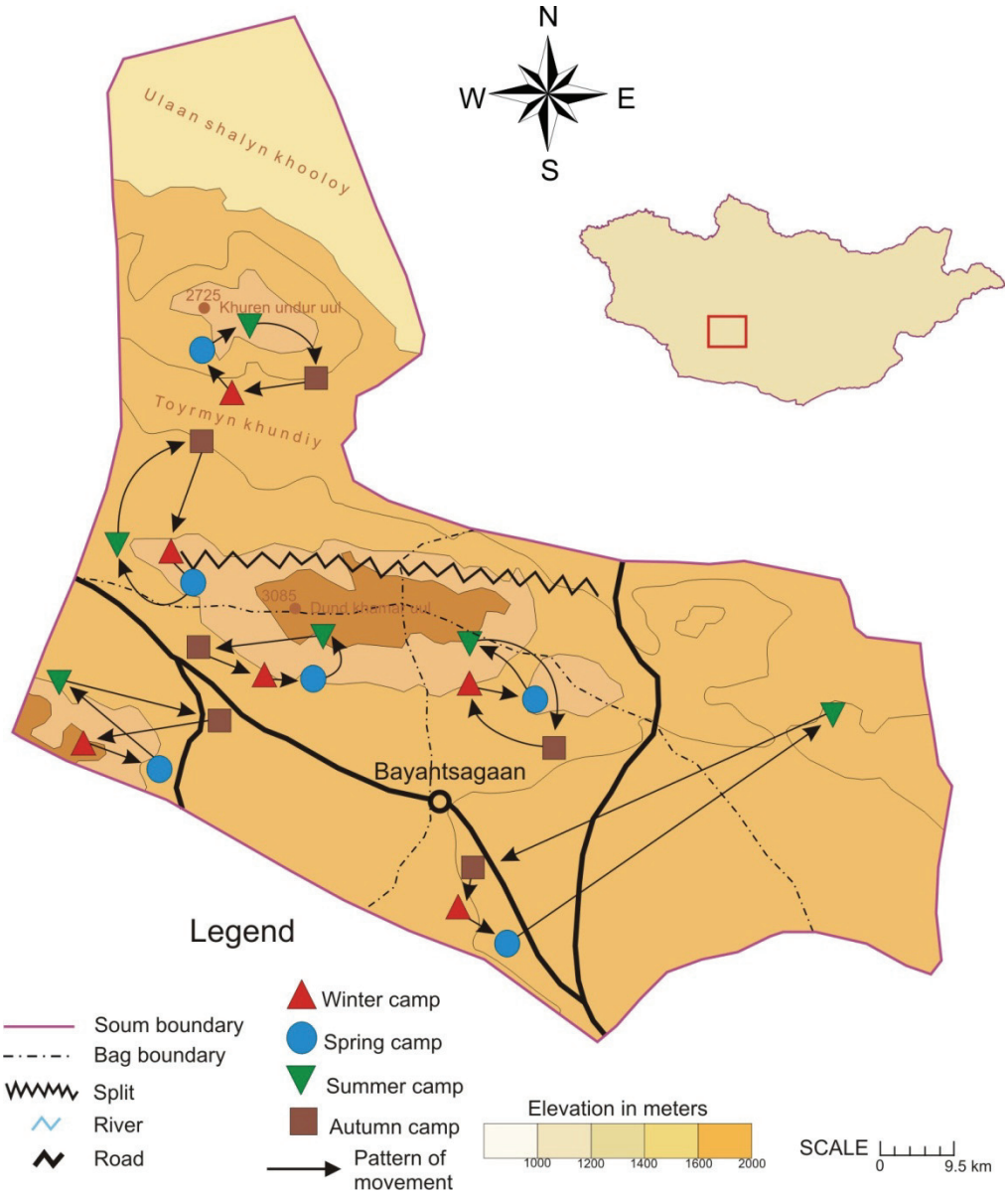
Pastoral movement patterns in Bayantsagaan soum are generally between summer and autumn pastures over a distance of about 20 km. A peculiarity of this patterns lies in the fact that summer pasture is located in a mountainous area where it is cool during the hot summer and autumn pasture is in the valley to extend period of grazing until snowfall. The winter and spring pastures are located on the lower slopes of the mountain. Due to the shortage of water sources herders graze the same pasture areas two or three seasons.

Figure 6.3. Pattern of movement in Bayantsagaan soum, Bayankhongor aimag



There are several projects implemented by international donor and non-government organizations in Bayanstagaan, such as World Vision and World Bank's Sustainable Livelihood Program.

Figure 6.4 Pastoral movement patterns in Bayantsagaan, Bayankhongor.



6.2 2010 Dzud Narrative

6.2.1 Exposure and Sensitivity

6.2.1.1 Weather Conditions, Pasture and Animal Growth and Winter Preparations

The herders perceived the summer of 2009 was dry as were the last 2-3 years. Eighty-seven percent of surveyed herders perceived rainfall in summer lower than usual and 93.8% of herders thought that pasture condition in summer-fall 2009 was worse than usual. Therefore, animals did not gain enough weight and 75% of herders considered animal condition worse than usual.

According to the bag governor, changes in climate are becoming evident, as warm weather continues until the end of September. The climate changes significantly affect the use of traditional knowledge to predict the weather. Participants of the focus group explained, "Experienced elderly herders used signs of stars and moon to predict weather, but nowadays they have difficulties to use these signs."

The soum governor described that approximately 20% of the pasture available in the soum is not utilized due to the shortage of water resources. "If a new well were built there it would reduce grazing pressure." He mentioned that the soum herders could have prepared better for winter last year, saying "Herders haven't made substantial efforts for winter preparation." Those who were able to afford it bought hay and fodder in the fall. Focus group participants described that due to low productivity it was impossible to collect fodder. According to the survey data, 56.3% of surveyed households prepared hand fodder using traditional methods by collecting perennial forbs such as *Allium polyrrhizum* and *Allium mongolicum*. Herders in Bayanstagaan harvested only a tiny amount of hay, due to the absence of good hay-cutting areas in the soum and the poor productivity of steppe pastures in the summer and fall of 2009. In 2009, the SLP funded a project where a few herders established a 3 ha reserve pasture by fencing and seeding the fenced area with perennials.

6.2.1.2 Dzud Awareness

Through media, herders were able to get weather forecasts and early warnings about the upcoming winter conditions. In the focus groups, participants reported that they constantly followed weather forecasts from radio and TV and realized that they would have to survive through a hard winter and spring. The Bayanstagaan soum government organized activities and meetings to raise awareness among herders. The soum governor reported that in June 2009 they called a soum civil representative meeting to present and get approval for the soum risk management plan for winter of 2009-2010. The risk management plan was comprised of the following 5 measures, which were implemented before the winter of 2009-2010.

1. Make a situation analysis and assessment of possible areas and soum to send herders for distant otor. Sign agreements with the recipient soum governments.
2. Since the number of livestock had increased in the soum, the government organized activities to find markets to sell livestock and called all interested herders to look for such opportunities on an individual basis.
3. Estimate how many livestock can spend winter and spring in the soum pasture given its poor production in the summer and fall. On the basis of this analysis, local government estimated how

many livestock needed to be sent away to other soum for distant otor and how many livestock could survive in the soum given the poor rangeland condition.

4. Establish contacts with appropriate sources that supply hay and fodder and make preliminary contractual agreements with them. Mobilize financial resources from external partners to prepare reserves of hay and fodder to be available in the emergency.
5. Ensure full operation of the local emergency management brigade.

As a result of implementing the above plan of action, before fall of 2009 local governor reported they were able to negotiate sending 77 households with about 40,000 livestock for distant otor to 10 soums from three provinces of Gobi-Altai, Tuv and Bayankhongor.

6.2.1.3 Dzud 2010 Characteristics

Focus group and interview informants described the dzud of 2009-2010 as a "black dzud." In contrast to the dzud in 2000-2002, it had less snow fall and very thin snow cover. The reasons for large livestock mortality were related to consecutive droughts in the past few years and extreme cold temperature. According to key informants, the weather was freezing cold, after the first snow fall it got frozen and animals had nothing to graze on, "because of freezing temperatures animals couldn't move themselves to pasture and were deeply frozen from inside".

6.2.1.4 Incoming Otor Herders

Bayantsagaan received many herders for *otor* during the winter. Herders from Bayan Ondor and from Chandmani soum of Gobi Altai moved into the territory of Bayantsagaan in summer and stayed until winter. They moved to the periphery territory which not much used by local herders. According to the head of the soum administration, nearly 20 percent of Bayantsagaan soum is seldom used due to its remote location and lack of water.

6.2.2 Coping Responses

6.2.2.1 Herders' Coping Responses

Movement. More of the surveyed Bayanstagaan herders went on winter otor (44%) than Jinst herders 29%). On otor, herders moved to other places where conditions were better, sometimes 100km or more from their home territory. The head of the soum administration mentioned that "During the dzud 56 families moved in otor to other soum such as Baatsagaan, Bayan Ovoo, Jinst, Bogd, Buutsagaan, Khureemaral, and even to territory of Chandmani of Gobi Altai aimag." Some movements were made without coordination with local officials. According to one herder, only after arriving at their destination, "Our soum administration contacted the local officials and arranged conditions to support us." However, soum officials also reported making otor arrangements in advance of the winter for many families, and one surveyed herder reported moving 800 km to Tuv aimag under an arrangement facilitated by the Bayanstagaan soum government.

Feeding Strategies. The herders who stayed in their homeland are used different approaches to save animal from losses. As few Bayanstagaan households were able to harvest hay, a larger proportion fed hand fodder (56%) than in neighboring Jinst (36%). Some of them fed their animals soups made from garlic, several days each week**.** Horse dung and nettles were also used as fodder. Bayanstagaan focus

group participants reported feeding a mix of fodder and hay cut into small (2 cm) pieces. They said this was the most effective feeding strategy because animals like it and digested it easily.

Protection from Cold. Bayanstagaan herders made efforts to keep their animals warm by putting blankets on them (75%) and bringing animals into their gers (88%). According to one herder "there was period when our ger was full of animals." Some herders also reported hanging a curtain at the opening to their winter shelter, but this was not very effective.

Mutual Assistance. In the disaster, each family had to focus all its efforts on the survival of its own herd, so mutual assistance was scarce and mostly limited to assistance within close family networks, such as sharing purchased feed and camping together to share labor.

6.2.2.2 Aid Provided

According to soum officials, Bayantsagaan received dzud assistance from 8 different donors or aid organizations as well as the Mongolian government (see Table 6.2). The largest proportion of survey respondents reported receiving assistance from World Vision (43.8%) and herders were generally happy with the level of support although some felt it arrived too late.

Aid Appropriateness and Distribution. The Bayanstagaan soum government ,with assistance from different organizations and individuals, was able to mobilize food aid and animal hay and fodder during the dzud. According to herders who received the aid, "Every assistance no matter how big was greatly helpful, because we went through a very tough time until late June and the assistance raised our mood and was great emotional support."

Herders perceived aid distribution was satisfactory, and they were all aware that every family in the soum benefited from the assistance. Herders highlighted that when someone from local government and other donor organization visited during the dzud, it provided them a lot of encouragement and motivation to do their best until summer. "It was so nice when representatives from an aid organization visited us with doctors and checked on us and gave us some useful medicines."

The soum government established a working group to manage the relief aid distribution process and this working group was led by the soum governor, and bag governors, herder representatives, and NGOs were members of the working group. As there were several sources of aid, the soum government maintained certain household selection and aid distribution policies. For example, World Vision, which is implementing a long-term area development program in Bayantsagaan, selected 120 herding households that were left with at least 50 heads of livestock. World Vision relief assistance was aimed at herders who will remain herding livestock after the dzud. World Vision distributed coupons to those families and invited them to come on a fixed date (May 4th 2010) to receive aid commodities in the soum center, ensuring transparency of the distribution process. The World Vision project officer stated that "We had a policy to distribute only to a member of the selected household, not other people, and during the distribution we had World Vision leaders and aimag government representatives to monitor the whole process."

Table 6.2 Sources of aid listed by soum official and household survey respondents.

	Aid Listed by Soum Official	**No. (Percent) of Survey Respondents**
SLP	1 sack of pellet feed	2 (12.5)
Soum Government	1 sack of pellet feed, flour-25kg, rice-25kg	0 (0)
VetNet	Medicine	1(6.3)
National Government	1 sack of pellet feed	1 (7.1)
UB Homeland Association	1 sack of pellet feed	1 (6.3)
Bag	2 bale hay, 1sack of pellet feed	3 (18.8)
World Vision	Fodder-5 sacks, flour, sugar-2kg, rice-25kg salt-1kg , medicine	7 (43.8)
Parliament Member	1 sack of pellet feed	2 (12.5)
Red Cross	Food (tea, flour, rice, sugar,) boots	1 (6.3)
UNDP	Food and fodder	0
ADB	Cash	0

Table 6.3 Details of aid distribution in Bayanstagaan Soum.

	Number of Households	Type of Aid	Per Household (MNT)	Total Aid (thousand's MNT)
World Vision	120	Food, clothes	120 000	14.4
UNDP	99	fodder, food,	242 000	24.5
Red Cross	16	Medicine, food, clothes	100 000	1.6
ADB	48	Cash	300 000	14.4
National Government (Ministry of Food, Agriculture and Light Industry)	8	Livestock (restocking)	1 700 000 (50 Goat, 5 sheep)	3.6
National Emergency management agency of Mongolia	170	fodder		7.8
SLP-II	456	fodder, food	11000	5.0
Aimag emergency management agency	All households	fodder		3.1
National Parliament members	All households	280 tons fodder, (bran, feed), hay		*No data available*

6.2.3 Dzud Impacts

6.2.3.1 Herd Impacts

In Bayantsagaan soum overall 27,707 head livestock perished in the 2009-2010 dzud (30,014 sheep forage units or SFU), which includes 14 camels, 563 horses, 220 cattle, 4,696 sheep and 22,215 goats. In the dzud of 2001, about 72,000 livestock perished and 80,000 died in 2002. According to end of year 2009 livestock count, there were 140,000 animals in Bayantsagaan and as of the semi-annual count in June 2010, 20% of the livestock in the soum had died.

A critical indicator that expresses herd composition and growth is the number of offspring and the soum governor reported only about 400 offspring in the spring of 2010, which is a tiny number at the soum level. The main reason for the low reproduction rate is that herders intentionally did not breed their livestock before winter 2009-2010, as they expected an unfavorable winter. However, the governor was optimistic that "this summer and fall our soum livestock has got good weigh and fat, and we expect in the spring 2011 almost 100% of survival of all newborn animals."

According to the Bayantsagaan soum governor, herders early in the summer of 2009 made the decision to do distant otor to other soum and sell their livestock. Approximately 77 herder households with total 40,000 livestock did movements to other soum and an additional 50,000 livestock were sold in the market in the fall. The Governor told that before winter 2009-2010, there only about 90,000 livestock out of 180,000 remained in the soum.

6.2.3.2 Human Well-Being and Livelihood Impacts

The 2010 dzud affected almost every family's livelihood in Bayantsagaan soum. Herders' income totally depends on marketing of livestock products, such as livestock, wool, cashmere and hides. "Herders' household income is very flexible due to instability of market prices for livestock products as well as increase in prices of consumer goods." In addition to this factor, consecutive drought for the past few years and the harsh winter of 2009-2010 directly influenced food security and household income, especially for small-scale herders who lost most of their livestock. Affected herders are not able to store up dairy products or meat for the winter, and face the prospect of slaughtering their few remaining livestock. "Annually we consumed about 10 goats and sheep during summer and fall, but this year we consumed only 5. All families reduced the amount of food they consume." Herders faced a shortage of dairy and meat products, the main staples in the countryside, "During summer we normally eat a lot of fresh dairy products, but this summer we drank black tea and don't eat *urum* and *aaruul*."

After the dzud, herders' purchasing power dropped significantly, which resulted in low intake of food and nutrients, especially affecting children, elders and nursing and pregnant women. During 2009-2010, herders had to buy several 50 kg-bags of wheat bran as a fodder with a unit price of 10,000 MNT. In addition, human food items such as garlic, millet, and semolina were procured from local markets to feed their livestock, which increased household expenses tremendously.

"During 2009-2010 we have several households who lost the majority of their herd and some young people moved to other soum to seek earning possibilities, such as to do herding for some cash." Cashmere is the main source of income and one herder during the focus group mentioned that "Before the dzud our family used to harvest about 50 kg of cashmere and last spring (2010) we harvested only 15 kg, which shows how much we have economically affected."

The 2009-2010 dzud caused many herders to fail to pay back bank loans on time. Government officials reported that "it is almost impossible to find someone in our soum who doesn't have a bank loan. Every household owes some money to the bank."

6.2.3.3 Poverty and Dzud Impacts

According to the head of the soum governor's office, living standards for about 30% of households fell following the dzud. Officially at the end of 2010 there are 253 households (550 people) who are below the poverty line. Of these, 88 households are very poor (140 people).

6.2.3.4 Beneficial Impacts of the Dzud?

Herders refer to lessons learned as beneficial impacts of dzud. Herders mentioned a lot of management practices necessary to prepare beforehand, such as dry bedding, because animals who stay dry have a better chance of making it through extreme cold than those who can't get dry due to wet bedding. In terms of ecological benefits, herders expect that following dzud, pasture conditions will improve in the spring and summer with reduced stocking rates and increased production of forage. This favorable ecological condition enables the remaining livestock to get well-nourished and fit.

6.2.4 Adaptive Responses

6.2.4.1 Plans for the Future—Household Level

Almost 19% of surveyed Bayanstagaan herders planned to move away from the countryside in the coming year, although all planned to leave their remaining livestock behind with relatives or friends. A quarter of Bayanstagaan herders surveyed said they would not continue herding livestock in the coming year, over 40% said they would seek a different job in the coming year, and 50% said someone in their household would be involved in artisanal gold mining.

For some families with few animals and unemployed youth, mining is a main source of their livelihood. As a soum official said "Herders are partially becoming Ninja miners." There is no formal mining in Bayantsagaan, but there are two exploration companies. "Since we have some areas with reserves of gold, herders frequently go to do artisanal mining." Local government officials informed that they don't have any official number of people from the soum who is involved in the artisanal mining, but they estimate that approximately 20% of soum households are permanently occupied by artisanal mining, which has become their main source of livelihood. They reported that almost everyone in the soum does artisanal mining once a while. "This year after the dzud people found some places in our soum with gold reserves, where everyone goes to try their luck and get some income."

While half of Bayanstagaan herders said they would wait for there herds to regrow naturally, 33% planned to look for livestock to buy and 27% planned on a different strategy, such as focusing on quality rather than quantity of livestock.

Based on quantitative and qualitative findings, herders expressed the following lessons learned and plans for the future:
1. Livestock is not a secure source of livelihood due unpredictable weather and ecological conditions.
2. Therefore, it is important to have skills and expertise for some non-livestock income generation possibilities.
3. Vocational training may be needed to specialize herders.
4. Raise a small, but highly productive herd for meat.
5. Harvest a sufficient amount of hay during summer when forage production is good.
6. Prepare a sufficient amount of hand fodder using locally available plants.

Herders shared several specific strategies that they plan to implement in the interim phase until their herd is replenished. One young couple plans to process wool and make felt products, such as mittens, vests and socks, to sell to cover household needs. An elderly woman said that "I will take orders to make del (traditional dress), and I have some pension as well. I will do fine if my remaining 60 livestock will have a good reproduction rate next year, I will have 100 livestock by next summer."

One informant mentioned that they have a well and will do gardening for some income to supplement herding. World Vision is implementing a project that supports those who want to do some gardening and planting trees. This project offers alternatives for some households to start an alternative livelihood. Herders mentioned that water and soil conditions are not that favorable for vegetable production, but with availability of the water and good care they can produce some to sell in the local market.

Herders shared that production of forage plants or having reserves set for hay cutting is important to implement in the future. They talked about fencing small pasture areas, protecting them from summer grazing and using them during emergencies.

Finally, Bayanstagaan herders experienced benefits of livestock insurance and plan to insure their livestock in the future. In the fall of 2010 one reported, "I have insured goats this year, because it was very helpful for some herders who got involved in the insurance."

6.2.4.2 Plans for the Future and Evidence of Learning—Community Level

At the community level, herders seek possibilities to get organized as groups. They consider that more formal organization will help them to pursue common goals by jointly addressing shared concerns. Herders expressed their needs for obtaining relevant training and knowledge-building programs specially organized for herders. There are few formal organizations operating in Bayantsagaan that provide extension and other vocational training to herders. Herders face shortage of relevant information about household economies, markets, pasture management, livestock management and animal health.

The soum government learned that with proper management and early measures livestock should survive the winter months without problems. Prevention and attentiveness at household, community and soum levels are key elements to a successful winter for livestock and herder households. Some herders who worked very hard were able to save most of the livestock and some informants suggested that, “It is necessary to acknowledge those herders who were more successful through the dzud.”

Herders as well as local officials are more interested to support formation of organized groups of herders or cooperatives, as the following quotations illustrate. “About 6 households with same perspectives and ideas could get together to form a group or a kind of cooperative. More than 10 families will not be appropriate, because it will bring more disagreements and confusion.” “I think herder group is good strategy and I am interested to get together as group.”

6.2.5 Recovery, Learning, Adaptation a Year after the Dzud

6.2.5.1 Winter Conditions 2010-2011

According to herders in Bayantsagaan, the winter of 2010-2011 was relatively mild and warmer than the previous winter. Informants from interviews and focus groups reported that the condition and weather of 2010-2011 was favorable and with the reserves of hay herders had a good wintering season.

6.2.5.2 Summer Conditions and Winter Preparations 2010-2011

In Bayantsagaan soum, it was dry during the summer of 2010, but it rained well late in the summer and fall causing regrowth of rangeland plants, especially *Allium polyrizum* and *Allium mongolicum*. Herders enjoyed warm autumn days with occasional rain and productive rangeland. As a result herders described that they had a long and productive fall in 2010. As the soum livestock officer described: “There was rain in August last year and in the Gobi region rain is never late. We estimated carrying capacity in June and August together with the meteorological station people, and it was calculated that August carrying capacity was much higher than June estimates. In June there was 30 kg/ha, and August production was 70 kg/ha.”

In the summer and fall of 2010 all soum herders were encouraged to prepare reserves of hay and feeds and the local government estimated that over 55 tons of hay and feed was prepared before winter in 2010. In the late summer and fall the good precipitation allowed herders to produce hand fodder and have some reserves of hand-harvested hay. As a local official mentioned, “We had a good rain in the summer and we also recovered the practice of reserving hand-harvested hay by raising awareness among herders, and as a result the wintering situation of 2010-2011 was much better than the previous year.”

6.2.5.3 Recovery from Dzud

A good birth rate of the herd in the spring of 2011 was the most visible evidence of recovery for herders, as in the previous spring of 2010 herders did not obtain any offspring and had no herd growth, only losses. As a result of losing female livestock and offspring in 2010, the herd composition changed greatly. For example, during the focus group discussion herders mentioned than in 2010 spring they had

almost no kids and lambs and even male breeding animals died, causing changes in herd composition that in turn affected household income and food security. However the spring of 2011 was much more productive and herders hoped for improved food intake and growth in household livestock numbers. Herders as well as local officials described that herders will keep raising more goats than sheep. During the collective period Bayantsagaan soum mainly produced sheep, but since privatization herders raise more goats for their cashmere value.

The main source of income is livestock production but after the dzud 2009-2010 herders started to go for the "yellow thing," which means artisanal gold mining. Informants described that two informal mining areas were discovered in the soum that immediately attracted several hundreds of 'ninja' miners from all over the country. The soum residents, especially young people, started to mine the gold and this positively influenced to their household income. But some herders shared that: "If herders had possibilities to sell their livestock products for a better price and they had a stable price for their products, herders would not be willing to go for the yellow thing."

In addition, the human development fund is paying 21,000 MNT per month per person and herders explained that this money is helpful for them to cover their household needs for staple food items and ensure food security. Especially for the younger generation that doesn't have any cash income, but only livestock, the human development fund is providing a lot of support. According to a local official, "In our soum an average herder household must have at least 200 livestock to keep its livelihood on average level, but after the last dzud more than half of population has less than 100 livestock, which is just survival level for them."

6.2.5.4 Learning, Adaptation and Resilience

One main indication of adaptation at the household level is livelihood diversification and introduction of wage labor. As discussed above a large proportion of Bayanstagaan herders are involved in artisanal mining to supplement their incomes. In addition, herders left with few livestock after the 2009-2010 dzud started to herd other soum herders' livestock on a wage basis. After the dzud, they were paid on average about 500-600 MNT per head of livestock per month. Local officials informed that: "Herders in Bayan-Undur, generally, are well-off and they negotiate with the herders from our soum to herd their animals for them for a pay." During the focus group and interviews with herders, they mentioned that herders would not tell the officials about the additional number of livestock they herd to avoid conflicts. It was observed that neighboring soum herders who got involved in the artisanal mining business asked Bayantsagaan herders to look after their livestock, while they are busy with the mining. In addition to supplementing incomes with mining and wage labor, there is a trend for herders to migrate out of the soum to more productive rangeland areas such as Jinst, and even to Ulaanbaatar.

A year after the dzud there is little evidence of increased formal collective action or initiatives to improve pasture management in Bayantsagaan. Focus group participants mentioned that a few herders were able to obtain grants from the Sustainable Livelihood project to establish small reserves by fencing about 0.5-1 ha pasture: "There are a few experienced herders who fenced a small area with ders (*Achnatherum spp*) as a reserve and they haven't utilized it during the whole summer, but they use it in

winter and spring for the youngsters and weak animals." As the local government official mentioned, before the dzud of 2009-2010 herders hadn't tried such management, but in the past couple of years it is becoming more popular. However, he mentioned that most herders don't have or can't obtain resources to do this work. From focus group discussions and interviews it was evident that herders are willing to organize to form a formal group to improve their livelihood and protect their pastureland. However Bayantsagaan herders are not as organized on rangeland use and reservation as Jinst herders due to lack of leadership, facilitation and technical assistance.

Herders in Bayantsagaan mentioned that they do cooperate with each other on customary forms of activities, such as assisting in movements, looking after each other's livestock and do other routine activities. A herder from Byantsagaan soum described that: "The herders in our neighborhood sometimes get together to harvest cashmere in the spring, shear the sheep and in general we often visit and check on each other." When other soum herders come for otor, they normally have informal talk and negotiate between themselves about duration and the area. A herder interviewed shared: "In the spring of 2010, 4-5 herder families with at least 400 livestock each moved from Shinejinst. Local herders normally negotiate with them and tell them not to graze close to our winter pasture. We certainly can't afford having them every year, and these otor people move to our place only during the time of emergency. In here our winter pasture is just sufficient for us. Bag governors also tell these people not to graze in the winter camp."

Herders in Bayantsagaan experience several major constraints to adaptation at the household and community levels. According to the end-of-year census, the total population of the soum in 2011 was 3346 people and the government officials reported that more 50% live below the poverty line. Herders are well aware of the benefits of improving herd composition and quality rather increasing the number, but they can't do much about it. Herders explained during the interviews and focus group discussions that, "It is impossible to reduce the livestock number because it is the main source of our livelihood." An official told that herders don't have cash income, and therefore they need to get bank loans and to repay the loans they need to keep growing the herd: "Goat cashmere season starts in May, and as soon as herders get their cashmere combed, they go to settle their debts."

At the household level, herders shared that it is hard for them reserve some pasture, because winter campsites are located close to each other and therefore it is impossible to set aside pasture for reserve. At the community level, soum officials also stated that there is no area to designate as a soum reserve pasture: "We don't have a formally designated otor pasture in our soum. There is a place called Argalant that could become soum otor reserve pasture, but there is no water there. If we drill a well, it could become our otor pasture." This area was an official multi-soum reserve during the collective era. The most important reserve Bayantsagaan herders currently have access to is the mountain, and during summer and fall herders bring their livestock to the mountain tops. According to the local environmental inspector, habitat for some wildlife is affected by this movement.

Due to continuing drought conditions in previous years, herders mentioned that it is impossible for them to stay on their customary campsites and they tend to move to higher mountain areas in Edrengiin

nuruu and Bayankhairkhan mountains. Across all focus group discussions and interviews, informants described limited water supplies as the main constraint that affects their movement and pastureland utilization practices: “Water points are very scarce in our area and many springs disappeared and the level of water in the hand-wells is very shallow and not enough for all the livestock. Herders from the neighboring soum moved to our place for otor and we need to share the well with these people as well.”

6.2.5.5 Roles of Different Actors in Dzud Preparation and Recovery

Herders mentioned that the support of local government, parliament members and the homeland association during the dzud period was very helpful. In constrast to Jinst herders, respondent didn’t mention any type of donor projects implemented in the soum in response to dzud preparation and recovery. The soum government started to act early in the fall of 2009 before the disasterous winter by making rapid assessment of potential soums where they can send their herders for distant winter otor. In addition, local governor listed several other measures that they undertook before the dzud. For example, the soum government officials took strategies to encourage herders in the fall of 2009 to slaughter livestock and sell in the market, prepare reserves of hay or to mobilize funds to purchase the hay in the fall before the price went up and estimate how many livestock the Bayantsagaan rangeland can carry in the winter and how many they have to send away in order to keep the remaining livestock safe. Local soum government conducted awareness raising meetings among herders in the fall of 2009 and provided some predictive messages about the upcoming emergency events in the winter of 2009-2010. As result, almost all herders in Bayantsagaan didn’t breed their livestock to reduce risks of losing mother and weak animals during the hardship. It was noticeable that the most important actor in dzud preparation was the local soum government. In the fall of 2010, local World Vision staff shared that as part of dzud rehabilitation efforts, this organization has a plan to support herder groups or organized forms of households who collectively started doing some livelihood development initiatives.

6.3 Discussion

6.3.1 Factors Affecting Vulnerability

One of the biggest challenges for herders as well as local authorities in Bayanstagaan is availability of water for livestock, which in turn affects pasture use and mobility. Some 20% of available pastureland is not utilized due to remoteness and shortage of water. In Bayantsagaan, there is a trend that herders utilize the same pasture all year around without resting. “Herders stopped making frequent movements like in old days. They camp in summer in one side of the hill and in winter in other side. Herders move out from their soum only during dzud.”

The main factor that increased vulnerability of livestock towards dzud was poor livestock condition, specifically body weight, fitness and health. For several years there was drought in Bayantsagaan that had a gradual negative effect on the overall condition of livestock and reduced the herd quality in general, “livestock is getting weaker and thinner year after year due to scarcity of forage, and with the first signs of dzud they get easily affected and frozen.” Focus group informants stated, “last year livestock was in a very poor condition, no accumulated fat, thus livestock easily were chilled, perished and frozen to death.” Animals have a higher requirement for energy in the colder winter months so with poor body weight and poor forage they are easily affected.

Awareness raising and early warning was available to herders via public media, local government and experienced herders. However, authorities said, “the majority of herders in our soum could not make sufficient preparations for dzud by preparing hand-fodder, purchasing hay and bran, etc.” Lack of cash and poor purchasing power limits herders ability to get sufficiently prepared for harsh conditions. During the socialist period, each collective had an emergency storage house to store reserves of hay. But nowadays the lack of these facilities prevents the local government from establishing emergency hay funds. Additionally, poor rangeland production didn’t allow herders to clip plants to make hand-fodders.

It appeared that herders were looking for some organized campaign or instructions from authorities, like bag and soum government. Though they knew very well about upcoming difficulties, some herders failed to take appropriate measures, such as distant movements, destocking, buying fodder, and preparing their winter shelters. The lack of a sense of urgency as well as insufficient cash, influenced their preparedness for dzud.

Another factor that increases vulnerability of herders is related to the lack of skills for alternative income generation. There are very few people with the level of skill required to process locally available raw materials such as wool, cashmere, hides, meat, and dairy for sale in competitive markets such as Ulaanbaatar. In addition, the isolated location and poor infrastructure development make herders less interested in developing those skills and they prefer keeping even a small herd of livestock. “I am prepared to go today if there is a possibility for an employment. It will be great.”

It was evident from interviews that local traders increase the price for fodder and hay during dzud and winter and also raise the prices of staple food items causing extra burden to the household economy.

Bank loans bring a lot of hardship for herders, “I don’t know yet how to pay back the loan, I have 600,000 loan and with interest fee it is 700,000. Probably will go for gold and try to pay it.” Another herder shared that “I will pay back my loan next spring after harvesting cashmere, and immediately I will get another loan again. I would say this is the main survival strategy at the moment.”

6.3.2 Role of Adaptive Strategies

6.3.2.1 Storage

Storing of hay and fodder in the fall is a critical as part of winter preparedness. Those who could afford had purchased some hay and fodder before the winter and started to feed their livestock. Besides storing feed on an individual basis, it was important to have hay and fodder stored in the soum center beforehand. However, due to lack of storage facilities and resources, the Bayanstagaan government was not able to prepare reserves of hay and fodder. Emergency aid items arrived late after when majority of the herd had become too weak to recover. In the words of one informant, “If we had had reserves of hay and fodder in the soum center, we could have saved a lot livestock.” The forage production in the summer and fall before the dzud was very bad and herders were not able to prepare sufficient hand-

fodder. However, some herders mentioned that they collected horse dung to use for feeding during the dzud. Hay-cutting is limited in the soum, due to the lack of natural riparian areas that produce the types of plants harvested for hay in the desert-steppe, and this limits the ability of herders and local government to rely on hay storage as a main strategy.

6.3.2.2 Mobility

Bayantsagaan herders' main strategy to avoid mass losses of livestock was distant otor movements to other soum and aimag. More than 10% of soum herders did movements for otor that allowed them to prevent massive death and reduced vulnerability. "It was beneficial for those who went for otor and they came back almost with their entire herd."

6.3.2.3 Diversity

Diversity of practices that herders implemented during the dzud helped to take care of the weak livestock. Herders came up with various feeding ideas and blends of feed, using available materials, such as horse dung, dried nettle, wheat brans, horse fat, etc. They also used human food items such as garlic, green tea and milk fat as a supplement feeding strategies. Bayanstagaan lacks diversity of forage resources (e.g. natural riparian areas), which limits the use of diverse habitats to fatten, maintain and shelter animals in the winter. The presence of gold in the area means that many households seek to diversify their income by sending at least one family member to do artisanal mining to supplement earnings from livestock husbandry.

6.3.2.4 Reciprocity/Exchange

During dzud every herder was badly hit and it was impossible to heavily rely on each other's assistance and care. However, close family members helped each other, as one herder recounted, "When my brother ran out of his fodder, I gave him a sack of wheat bran." Some herders mentioned that in the face of the hard winter, they camped together with their elder family members and helped to herd their livestock. Families camp together to cooperate to make movements and share herding labor. During the dzud it was very common for herders to exchange their ideas and practices about the best ways to feed livestock. One women herder described that, "I shared my methods to prepare garlic extracts and make blends of oat feeds, and it was really economical and efficient."

6.3.2.4 Flexibility

Flexibility of household structure was very important during the dzud. Herder households had to split temporarily to go to distant otor as well as to keep children in the school and elders in a safe place.

6.3.2.5 Communal Pooling

Scattered across an expansive and low productivity landscape, Bayantsagaan herders have fewer opportunities to work together on pasture management and herding tasks, but they share labor for traditional activities such as felt making.

6.3.3 Indicators of Resilience

Experience and lessons obtained from the 2000-2002 dzud reminded herders about helpful ideas and practices, "I obtained a big lesson from the dzud in 2000-2002." Herders as well as local government officials mentioned that before last winter herders were able to sell some of their livestock in

Ulaanbaatar. In the previous dzud herders could not sell any and regretted it. Last winter herders mentioned that they used income from selling livestock to buy hay and fodder for the remaining livestock from Ulaanbaatar market.

After the dzud in 2000-2002 herders learned to feed their livestock with supplementary feeds and they learned methods how to use fodder more economically. “During the dzud in 2000-2002, I just simply distributed one bale of hay to livestock, but last winter I chopped hay and blended it with other things. It was very economical and efficient and worked great.”

Another sign of resilience was related to the ability of local government to raise awareness among herders early in the summer and develop and pursue emergency preparedness action plan. The local government utilized their networks with key government and political leaders in the aimag center and Ulaanbaatar, and were able to negotiate assistance in supplying hay and fodder with subsidized rates. Another important result was that local government actively encouraged herders to sell more livestock before winter. As of June 2009 there were more than 180,000 livestock in Bayantsagaan soum and the local government organized a special measure in September and drove 22,000 sheep and goats on foot to Ulaanbaatar for sale in the UB market. The distance was more than 800 km and although the livestock sold in the Ulaanbaatar market at a low price, the local governor considered this a kind of success, because otherwise they could have perished. All herders were preoccupied with the idea to sell livestock and get some cash before winter to prepare some hay and fodder. In addition to the above mentioned 22,000 livestock sold in Ulaanbaatar, herders sold and also used approximately 30,000 livestock on an individual basis. These measures helped to reduce significantly the total livestock population from 180,000 to 130,000 before winter. Another measure that was very helpful to overcome the dzud with less loss was distant otor movements for extended period. “I did distant otor to Tuv aimag (800 km) and spend winter, spring and summer, and came back one month ago. The forage and diet was not suitable for the livestock, because our animals got used to different forage and we came back. I sold 11 cattle before dzud. I brought quality breeding males for meat from Tuv province, would like to improve herd quality.”

Herders were optimistic that their herds will recover within about two years if pasture production is good. They expect a better winter, after which they will have new offspring to replenish their herd in the spring and have abundant of milk and dairy products next summer and fall. They are hopeful that market prices for consumer goods will be stable. Despite their optimism, herders were mentally prepared for the coming winter of 2010-2011 to be another difficult one and with this mentality individual households as well as local government prepared for the upcoming winter.

6.4 Implications for Policy and Practice

- The disaster preparedness plan that was developed in June 2009 by the local government was helpful to implement necessary measures beforehand. Therefore, based on the lessons learned and experienced, it is important to improve the disaster preparedness plan at all levels of operation, such as soum, bag, khot ail and household.

- Relief aid distribution policy and planning should be developed as part of the disaster preparedness plan.

7. Cross-case Analysis and Synthesis

In this section we compare our case studies to understand the sources of variation in dzud vulnerability and adaptive capacity at the household and community levels, in order to identify potential management and policy responses to reduce vulnerability and strengthen adaptive capacity and resilience to future dzud disasters. We begin by presenting short summaries of each of the four case studies to highlight the key points and lessons from each, followed by a comparative analysis of vulnerability across the sites, focusing on factors that explain differences in vulnerability among cases. We then discuss the major adaptive strategies observed and their relative effectiveness, identify major constraints to adaptation, and conclude with some initial reflections on resilience in Mongolia pastoral social-ecological systems. Although the focus of our analysis is the four case study sites in Mongolia, our knowledge of the conditions in other regions of Mongolia suggests that the lessons learned from these cases have broad applicability to similar sites within Mongolia, and to other pastoral systems that exhibit similarly high spatial and temporal variability.

7.1 Case Summaries

7.1.1 Ikhtamir

The two Ikhtamir bags varied in their preparedness for winter due to variation in resource distribution and pasture conditions within the soum, but overall Ikhtamir herders had adequate stored hay and standing reserve pasture. Preparations for winter were enhanced by the presence of the PUGs, which helped organize herders to make hay and encouraged them to go on fall otor. Exposure to extreme cold was high and to snow variable, and vulnerability was significantly increased by thousands of otor livestock that migrated to the soum, bringing on a "hoofed dzud," and leading to high livestock losses in areas where otor herds concentrated. During the disaster sensitivity to dzud was increased by herders' lack of knowledge about how to use supplemental feed, and by poorly prepared winter shelters and bedding grounds that failed to protect animals against the cold. There was little evidence of informal mutual assistance during the dzud and the PUGs did not play a strong role in helping herders cope during the disaster, although all herders received relief aid from Green Gold (as well as other agencies). After the dzud, however, PUGs and the APUG were important in helping herders reflect on the lessons learned from the dzud, facilitating collective decision-making to improve pasture management (e.g. passing a resolution in Khan Undur bag that all herders move to Khanuu River in summer 2010 to allow Ikhtamir River pastures to rest), and organizing herders to further improve hay harvesting and storage. The improved hay storage capacity provides added adaptive capacity to future dzud, and also may stimulate spontaneous intensification of dairy production among some local herders. The local government in Ikh Tamir did not show much initiative before or during the dzud, officials complained that they had no legal means to address the disaster created by incoming otor herders, and herders remarked that soum officials did not visit them during the dzud. Some herders and local donor staff expressed concern about relief aid and how it was distributed, feeling that targeting poor households was unfair to herders who worked hard to prepare for winter and save their animals, and created a perverse incentive for households to become strategically poor in order to live off of aid. **A main lesson from Ikhtamir is that even communities and households that are relatively well prepared in terms of**

animal condition, stored hay and grazing reserves, can be extremely vulnerable if institutional arrangements are not in place to effectively manage cross-boundary mobility of otor herders. Ikhtamir also demonstrates the benefits of formal CBRM organizations, in facilitating learning and enhancing adaptive capacity by organizing herders to act on lessons learned, individually and collectively.

7.1.2 Undur Ulaan

In Undur Ulaan the combined effects of drought and insufficient water sources made it difficult for herders to fatten animals or store adequate hay. Few herders did fall otor. The cold was extreme and snow deep in places, but the area of Undur Ulaan where our case study was done did not experience a hoofed dzud. Overall, herders were apathetic in their winter preparations and local government did little to guide or encourage them. In addition to lacking hay stores, few households prepared hand fodder or set aside reserved winter or, especially, spring pastures. Due to poor preparations, Undur Ulaan herders were vulnerable to the impacts of the dzud and experienced significant herd losses. Herders in Dongoi Bag in Undur Ulaan engaged in new forms (to them) of cooperation in order to overcome the dzud and prevent worse losses. Neighboring khot ail pooled their animals and cooperated in taking them on otor to sheltered areas in the forest. Herders from different households shared limited reserve pastures on a rotating basis. In focus groups, herders indicated interest in continuing these neighborhood-level cooperative activities, especially to protect and fence reserve pastures, and restore springs. Undur Ulaan received similar amounts of relief aid as Ikhtamir but relied on the bag leader for distribution and most herders did not know the source of the assistance. Unlike Ikhtamir, the Undur Ulaan soum government did not take advantage of the dzud as an opportunity for collective reflection and action planning with herders, although they planned a meeting of women herders for September 2010. However, many herders expressed a new awareness of the need to limit livestock numbers, improve animal quality and collaborate to protect reserve pastures. In the year following the dzud, herders continued to discuss these themes, some had taken actions to improve herd quality at an individual level, and one group was working cooperatively to slaughter and sell their animals in the fall. Although the SLP-II project was active in Undur Ulaan, the herders in Dongoi bag saw few benefits of the program and those who participated in focus groups perceived a lack of transparency and fairness in distribution of the funds. Interest in greater cooperation in managing pastures, water and hay lands continues, but Dongoi herders lack the capacity to organize themselves and are discouraged by their lack of success in obtaining SLP-II support. Herd and income recovery following the dzud has been slow, but the negative impacts of the dzud on household income were mitigated somewhat by new opportunities for wage labor in road construction and the small business opportunities that the new paved road respresented. **Undur Ulaan illustrates how high sensitivity to dzud due to lack of preparation, organized collective action and government intervention, as well as the more chronic effects of a drying climate and disappearing water sources, led to increased vulnerability to winter disaster. The case also shows how a crisis can motivate informal cooperation, raise awareness and influence herder attitudes about future herd management, and create a "teachable moment" that could be a lever for change with appropriate interventions and support.**

7.1.3 Jinst

Jinst was severely affected by the 1999-2002 dzud, when three quarters of the soum's herd perished. Following this disaster, Jinst was selected as a site for the UNDP's Sustainable Grasslands Management Program and 6 herder groups were established in the soum with the program's support. Although the program ended in 2008, most of the groups have continued to function. Herders who are part of these groups have established grazing plans and set aside collective reserve areas, some of them fenced. Both local government and the herder groups encourage and assist herders in preparing for winter, especially in harvesting hay from riparian areas. The soum is also endowed with a diversity of natural habitats including a river and several natural desert springs/marshes and their associated riparian areas, a small and a large mountain range that provide cover and forage diversity, and several large but poorly-watered expanses of steppe that serve as de-facto forage reserves. The forage and animal conditions in Jinst in the summer and fall preceding the dzud, though below average, were not severely deficient. In sum, Jinst's sensitivity to dzud was low due to ample storage on the hoof, in hay reserves, and in reserve pastures, as well as other preparations. Jinst's exposure to the weather-induced dzud was also low, as the temperatures were not as extreme as in other locations. However, Jinst was exposed to a "hoofed dzud" due to thousands of incoming otor livestock from other soum. During the dzud both local government and herders were proactive. The government directed otor herders to use the de facto reserves and organized the spring sale of thin animals to China. Herder groups responded in a variety of ways to support their members and herders also demonstrated higher levels informal mutual assistance given and received (both within and outside the soum) than any of the other sites. Many herders in Jinst had livestock insurance and received payment for their losses. In the year following the dzud local government and herder groups in Jinst continued to organize herders for winter preparations, focusing on taking advantage of the productive 2010 summer to organize a large hay- and fodder-preparation campaign that involved most herders and many government officials in the soum. The pre-dzud preparations and especially herders' experience of the benefits of having designated otor and dzud reserves at the household, herder group and soum levels, reinforced for them the importance of these management practices and benefits of organized collective action for pasture management. Following the dzud, new mineral exploration activities threaten the adaptive capacity of herders in one bag by damaging their reserve spring pastures, drawing down a critical water source for livestock and humans, and leaving herders angry and disempowered when local government apparently ignored their concerns. In sum, **Jinst is an example of a resilient system, where herders and local government learned from past dzud experiences and put their learning into action to reduce vulnerability to subsequent disasters. Jinst illustrates the potential benefits of formal collective action among herders and of the resulting increased communication and cooperation between herder organizations and local government. However, new threats to Jinst's adaptive capacity emerged following the dzud when mineral exploration damaged spring reserves and water sources, and undermined herders' confidence democratic processes, and an influx of new permanent residents in the soum threaten to strain available resources and potentially, existing collaborative institutions.**

7.1.4 Bayantsagaan

Bayanstagaan is the most arid and least diverse of the study sites, lacking natural water sources and riparian areas that produce harvestable hay or serve as natural reserves. Bayanstagaan's mountain

pastures, which once could have served as a reserve, have been depleted by continuous use in recent years. Due to the poor forage conditions and limited water supplies, herders are dispersed over a large area, the distances and limited forage makes it difficult for them to cooperate, and there are no donor projects in the soum to help organize or train herders in collective pasture management. In addition, herds from even more remote and dry soum to the west and south make otor movements to Bayantsagaan putting further pressure on the limited pastures. Due to the inherently unproductive pasture conditions coupled with the dry summer preceding the dzud, Bayantsagaan herds were in poor condition going into the winter and herders had stored almost no hay. Winter conditions were more extreme than in Jinst and livestock losses were correspondingly higher. Bayanstagaan's local government, however, was proactive before, during and after the dzud, and the actions of local leaders likely helped prevent a worse outcome from this natural disaster. Prior to winter the local government developed a disaster plan and issued guidelines for winter preparations to all herders. As part of this edict, local government strongly encouraged herders to sell off livestock in the fall before the weather worsened. Anticipating the potential for dzud, the government also negotiated in advance otor agreements for Bayanstagaan herders with soum as far away as Tuv aimag, and made arrangements with suppliers for supplemental feed and fodder. During the dzud, the government coordinated effectively with relief aid organizations in the distribution of assistance to herders, who expressed satisfaction with the government's attention. Bayanstagaan herders had a high rate of insurance coverage, which helped mitigate losses somewhat. Many herders who were significantly affected by dzud losses planned to migrate to other soum or cities, at least temporarily, and a large proportion of households expected that someone from their family would engage in mining to earn extra income. Following the dzud, many herders did resort to mining to supplement their income, as well as wage labor herding absentee livestock. Although herders clearly understand the benefits of reducing herd size, improving quality and having a more diverse herd, they are constrained by high debt loads and lack of alternative income sources to emphasizing increased cashmere goat production. **The Bayanstagaan case illustrates vulnerability due to the combination of inherently limited natural assets and absence of informal or formal collective action to manage pastures. Bayantsagaan's local government set an example of leadership, pro-active planning, and effective coordination and communication during a disaster that other soum can learn from.**

7.2 Vulnerability Analysis

Exposure to dzud is a function of local and regional variations in temperature (black and iron dzud), snow depth (white dzud), pre-existing forage conditions, and changes in forage availability during dzud due to high livestock numbers (hoofed dzud), often caused by an influx of otor herders from other areas. In addition, local geography influences both exposure and sensitivity to the dzud, because some sites offer more cover and protection from storms, are endowed with natural forage reserves (in forested or riparian areas or pastures far from water), or are less remote from markets and easier to reach for the distribution of aid.

Three of the four study sites experienced extremely cold temperatures (all but Jinst) and some locations within the Khangai sites also had significant snow cover (Table 7.1). Forage conditions preceding the dzud were perceived as poor in all sites except Jinst (where they were moderately poor to average).

Incoming otor herders from other soums critically increased the exposure of several of the sites to "hoofed dzud," and significantly increased vulnerability, especially in Ikhtamir and Jinst. Overall, Jinst was least exposed and Undur Ulaan and Ikhtamir were most exposed in this dzud.

Table 7.1. Dzud characteristics in the 4 study sites.

	Ikhtamir	**Undur Ulaan**	**Jinst**	**Bayantsagaan**
Dzud Weather	28 snowfalls Ave winter temp. in 2009-2010 significantly lower than long-term ave.	33 snowfalls Jan 3-6 -40^{o}C	5th coldest winter in last 48 years Heavy late spring snow (April)	Freezing weather, little snow
Dzud Type	White dzud Hoofed dzud	White dzud	Hoofed dzud White dzud	Black dzud
Incoming Otor Herds	Est. 20,000 otor animals in Bogat bag alone	Est. 67,000 otor animals from other soum	Est. 56,800 otor animals, including 10,800 horses	Received some otor herds (no specific numbers)
Outgoing Otor Herds				77 households with 40,000 head sent to 10 other soum in 3 aimag

At the household level, **sensitivity to dzud** was driven by 1) animal condition going into the winter (weight gain and fat storage), which in turn was a function of pasture conditions and herd management during the preceding summer and fall, and 2) the availability and use of forage reserves, especially during the spring. In general, poor herders lost a larger percentage of their herds. Sensitivity was highest in Undur Ulaan and Bayanstagaan, where forage and animal conditions were worse going into the dzud, and where herders had less stored hay and limited access to reserve pastures. Sensitivity was also influenced by other winter preparations, like repairing winter shelters and preparing warm, dry bedding grounds. Herders in Undur Ulaan and Bayanstagaan were generally less well prepared, while those in Jinst were better prepared (Table 7.2).

Table 7.2. Summary of pre-dzud conditions, preparation and responses by study site. Data are from the household survey.

		Ikhtamir	**Undur Ulaan**	**Jinst**	**Bayantsagaan**
Pre-Dzud Conditions (Herders' perceptions)	% of herders who perceived pasture as worse than usual	84.4	83.3	78.6	93.8
	% herders who perceived animal conditions as worse than usual	65.6	61.1	42.9	75.0
Winter Preparations 2009	Hay cut (tons)[a]	1.5 (.3)	1.4 (.2)	1.7 (.6)	.1 (.1)
	Hand fodder (%)	56.3	27.8	39.3	56.3
	Fall otor (%)	81.3	33.3	75.0	62.5

	Reserved spring pastures (%)	48.4	11.1	30.4	36.4
	Reserve dzud pastures (%)	33.3	19.4	25.0	25.0
Responses to Dzud	Winter otor (%)	48.4	50	28.6	43.8
	Fed stored hay (%)	87.1	94.4	71.4	31.3
	Fed hand fodder (%)	58.1	27.8	35.7	56.3
	Fed purchased fodder(%)	100	94.4	100	100
Impact of Dzud	% of herd lost (SFU)[a]	30.7 (3.3)	42.9 (6.7)	13.7 (2.2)	38.9 (5.9)
	Species most affected (total losses in SFU)[a]	Cattle 102.3 (23.3)	Cattle 74.1 (15.6)	Goats 41.2 (10.7)	Goats 66.3 (14.7)
	Species most affected (percentage loss in SFU)[a]	Cattle 41.3 (3.1)	Cattle 61.6 (12.5)	Cattle 47.2 (15.5)	Sheep 43.0 (7.3)

[a] Data are mean (standard error)

At a community level, sensitivity was a function of local government and herder leadership in helping to prepare the community for winter. In some sites, such as Bayantsagan, the soum government actively encouraged herders to prepare well for winter, facilitating fall sale of livestock and negotiating otor agreements in advance of winter. In others, such as Ikhtamir and Jinst, herder organizations played an important role in organizing herders to cut and store hay and prepare for winter. Undur Ulaan had the weakest government and community leadership in preparing for and responding to the dzud.

Table 7.3 Effect of wealth and winter preparation methods on percent of herd lost in the dzud (calculated in sheep forage units). For the comparison among wealth groups, soum was treated as a blocking factor. For all other variables, comparisons were across all soums.

	Percent of Household Herd Lost Mean (Standard Error)					
	Wealthy	**Middle**	**Poor**	**df**	**F**	**P**
Wealth Group	25.5 (4.4)	29.7 (3.3)	39.2 (3.7)	2	3.296	0.043
	Yes		**No**	**df**	**t**	**P**
Fall Otor	26.1 (2.8)		35.4 (4.2)	89	1.884	0.063
Reserved Spring Pasture	21.6 (3.8)		34.2 (3.3)	78	2.364	0.021
Reserved Dzud Pasture	24.2 (5.7)		30.2 (2.6)	88	.944	0.348

Coping and adaptive capacities were influenced by herder knowledge and experience with dzud, effective collective action and government leadership in response to the dzud, and informal local and extra-local social networks. Jinst was severely affected by the 1999-2002 dzud, Jinst herders have not forgotten the lessons learned from this experience, and these appear to have influenced their preparations for and their ability to respond during the disaster. Jinst also demonstrated strong collective action both before and during the dzud, facilitated by the herders groups established under the UNDP Sustainable Grasslands Management project, which continue to function effectively. In Ikhtamir the PUGs helped organize winter preparations, and were also important in helping herders to

distill lessons learned from the dzud and inspire collective action to improve pasture use. However, the PUGs did not play a large role in helping herders to cope during the dzud, and herders' lack of knowledge about preparation for and feeding during a dzud may have contributed to losses. Although Undur Ulaan herders had less experience with formal collective action, they demonstrated small-scale spontaneous collective action during the dzud which focus groups indicated might carry over into future pasture management activities. In Bayantsagaan, formal and informal collective action among herders was weak, but the local government demonstrated initiative and innovation in encouraging herders to sell off livestock early in the winter and negotiating otor agreements with other soums. In Jinst, local government also took action to facilitate sale of thin livestock during the spring to Chinese buyers, so that herders could obtain some financial return (albeit low) for animals that might otherwise die.

Mutual assistance among neighbors and kin within the soum seems to have been highest in Jinst and weaker in the other soum. In focus groups, Undur Ulaan herders described examples of cooperation among neighbors but the year 2 survey documented the lowest levels of mutual assistance from friends and kin in Undur Ulaan. In Jinst families from one of the herder groups collaborated in forming a small sewing business in the soum center. During the dzud they split their households, sending women and children to the soum center, where the women could work in the business while caring for the school children, and the men remained in the countryside with the herds. In Bayanstagaan scarcity of forage makes cooperation among households and khot ail difficult. Overall, however, assistance between households was not common (which supports previous findings about mutual assistance during dzud by (Siurua and Swift 2002)). Assistance from kin and friends outside of the soum was more common, especially formally organized support from soum "Homeland Associations" in UB and the aimage centers. Past research has shown the importance of social networks for reducing vulnerability in Mongolia (Janes 2010; Siurua and Swift 2002).

In sum, Undur Ulaan appears to be the most vulnerable site in this dzud. Despite some examples of endogenous collective action during the dzud, the lack of preparedness before and effective government response during the dzud led to high losses. In Bayanstagaan, although exposure and sensitivity were high, local government leadership before and during the dzud helped to mitigate what could have been even worse losses. Ikhtamir was moderately well-prepared for the dzud, but the incoming otor herders had a devastating impact on local pastures and herds, and significantly increased vulnerability. Jinst was least vulnerable, in part because weather conditions were less severe both in the preceding summer and during the dzud, and in part because of good preparation and strong coping and adaptive mechanisms, due to a more effective local government and strong formal institutions for collective action among herders. Table 7.4 illustrates different sources of vulnerability at the household and community scales, as well as cross-scale influences.

Table 7.4 Sources of dzud vulnerability at different levels.

	Level		
	Household	**Community**	**Cross-Level**
Physical	• Inadequate livestock shelter	• Snow depth • Coldness • Drought • Limited water availability	• Climate change affecting water availability, drought frequency and possibly dzud frequency
Biological	• Poor animal condition	• Poor summer/fall forage • Limited habitat diversity (lack of sufficient haying areas, natural refuges, de facto grazing reserves) • "Hoofed dzud"	
Socio-economic	• Lack of knowledge/experience • Poverty level • Lack of alternative or supplemental income opportunities	• Poverty rate • Limited alternative employment opportunities	• Increasing aid dependence may reinforce poverty and stifle initiative
Institutional	• Weak bonding social capital (ties to relatives & close friends) • Weak bridging and linking social capital (ties to local or regional government, NGOs, donor projects)	• Little mutual assistance and informal cooperation • No formal collective action or community-based organizations • Weak and/or reactive local government • Weak coordination between local government, NGOs, donor projects, and herder communities	• Weak or non-existent cross-level and cross-boundary pasture management institutions • Weak disaster management and coordination

7.3 Adaptive Strategies

In addition to assessing vulnerability at each site, we sought to understand what suites of strategies herders used to cope with and adapt to the dzud, which strategies were chosen under different circumstances, and which were effective in different situations. We organized strategies into six broad classes, following the classification of Agrawal (2008, 2010) and Fernandez and LeFebre (2006): storage, mobility, diversity, reciprocity and exchange, flexibility, and communal pooling of resources (Table 7.3).

7.3.1 Storage

Storage was a widely used and critically important strategy for surviving the dzud. Storage takes the form of stored hay, home-made hand fodder, fodder bought in advance of the winter, and reserved winter, spring and dzud pastures. "In vivo" storage in the form of animal weight gain and fat reserves is also critical. Finally, storage may also be in the form of cash savings and stockpiled food supplies.

Herders whose wealth is in the form of large herds have an advantage over those who have fewer animals, but they would likely be even better off if they had converted more of their animals to cash by selling them in the fall and banking the proceeds.

In Arkhangai, households that did fall otor had significantly lower losses than those that did not. In Bayankhongor, households that fed stored hay and those that grazed reserved spring pastures had significantly lower losses. These findings clearly point to the direct relationship of storage strategies to dzud outcomes at the household level.

At the soum level, Jinst had a designated otor dzud reserve area, but the incoming livestock exceeded its capacity and it lacked adequate water. Following the dzud the local government determined that it would designate further reserves in the future. Ikhtamir also designated a particular area for use by otor herders (though it is unclear if it was an officially set aside reserve), but the incoming herders refused to stay there. Given the impact of otor herders in increasing local exposure to dzud, more effective storage (and subsequent use) of standing forage in soum otor reserves is a critical strategy for all soums in the future.

7.3.2 Mobility

Mobility of different types is also a critical strategy before, during and after dzud. As described above, fall otor movements enable animals to gain weight and store fat. Ikhtamir and Jinst had the highest rates of fall otor. Many herders also did otor during the winter, however the benefits of this strategy were more variable. In some instances winter otor helped herds survive (as in Undur Ulaan where herders sought shelter and forage in little-used forested areas), and in others, winter otor may have led to increased exposure due to lack of sufficiently warm and dry shelter at the otor destination. It appears that in sites with adequate reserves, such as Jinst, herders are less likely to undertake winter otor. We also found that there were no differences among wealth groups in the frequency of fall otor, but the wealthiest households were significantly more likely to go on winter otor than the other three wealth groups. Long-distance otor movements thus seem to be determined by wealth, which influences both the need for otor to feed large herds, and the resources available to make otor movements. Our qualitative findings suggest that use of short-distance otor is related in part to the availability and accessibility of appropriate otor destinations within the soum, which may be limited by lack of water or poor production in drought years.

In addition to otor movements, regular movements among seasonal pastures and, where possible, alternating between different seasonal pastures in different years, are important to allow plants opportunity for regrowth. Regrowth of winter and spring pastures during summer is essential to allow for a winter forage reserve to accumulate (thus providing for storage of forage). Allowing pastures to rest for a growing season (for example, by alternating between different summer pasture areas in different years) also allows individual plants and the plant community to recover and accumulate stored carbohydrates which helps ensure resilience to future grazing.

Table 7.5 Adaptive strategies used in the four study sites.

Adaptive Strategies	**Ikhtamir**	**Undur Ulaan**	**Jinst**	**Bayantsagaan**
Storage/ Reserves	Hay storage facility Reserve pastures Planting fodder crops Otor (stored animal fat)	Increased hay harvest in 2010	Reserve household, herder group and soum pastures Planting fodder crops Hay harvest Hand fodder Otor (stored animal fat)	Very limited opportunities for storage due to lack of reserve and otor pastures and haying areas
Mobility	Increased seasonal pasture rotations Use of alternate summer and spring pastures Summer & fall otor for salt and to fatten animals	Increased understanding of the relationship between herd quality and pasture condition, but limited implementation Out-migration following dzud Winter otor to escape dzud	Well organized seasonal pasture rotations among herder group members	Soum organized otor before and during dzud High levels of out-migration following dzud
Diversity	**Resource and animal diversity:** Increased genetic diversity of breeding stock (following dzud) Planting fodder (*Urtica cannabiana*) **Income diversity:** Vegetable growing Potential intensified dairy production Harvesting pine nuts and berried Forest product industry **Institutional diversity:** PUGs, APUG Multiple donor projects	**Resource and animal diversity:** Increased genetic diversity of breeding stock Planting fodder **Income diversity:** Road construction "Fast food" enterprises along paved road **Institutional diversity:** SLP-II	**Resource and animal diversity:** Diverse resources including mountains, river, riparian areas Planting fodder **Income diversity:** Vegetable growing **Institutional diversity:** Herder groups Multiple donor projects	**Resource and animal diversity:** Limited species diversity Limited resource diversity **Income diversity:** Artisanal mining Wage labor (herding absentee-owned stock) **Institutional diversity:** No civil society organizations in soum Few donor projects
Reciprocity/ Exchange	Purchase hay and fodder Received incoming otor herders	Purchase hay and fodder Post-dzud fall culling Incoming otor herders	Purchase hay and fodder Insurance Sale of thin livestock Incoming otor herders	Purchase hay and fodder Insurance Outgoing otor herders
Communal Pooling	Labor sharing (e.g. hay cutting) Joint pasture management Joint water point rehabilitation	Labor sharing (e.g. herding during dzud, joint slaughtering and marketing)	Labor sharing (e.g. winter preparations, shared childcare during dzud) Joint pasture management and dzud reserves	Labor sharing (e.g. traditional activities such as felt making)

A final type of mobility is migration to the soum or aimag center or Ulaanbaatar during of following dzud. In our household survey, the sites with higher vulnerability and more severe losses (Undur Ulaan and Bayantsagaan) experienced higher rates of planned outmigration (22% and 19%) of surveyed households, respectively. Most herders expected these moves to be temporary, however, which suggests that they are more of a coping strategy than an adaptation.

7.3.3 Diversity

Diversity can take can be expressed in a variety of adaptive strategies, including keeping the traditional diverse herd of multispecies livestock herd, possessing access to a diversity of natural resources used by pastoralists (different pasture types, varied topography, riparian and forested areas, salt licks, etc.), generating income from multiple sources rather than relying on a single livelihood, and having a diverse social network. In both study regions we witnessed that the dzud disproportionally affected particular types of livestock (cattle in Akhangai and goats in Bayankhongor), suggesting that a diverse and balanced herd composition is a wise hedge against the risk of dzud.

Our qualitative findings suggest that access to a diversity of natural resources is important to coping and adaptation. Soum endowed with natural topographical and habitat diversity confer an advantage on their herders. This was seen in the contrast between Jinst, where herders were able to harvest hay from and create reserve pastures in their several natural riparian areas, make use of mountain pastures on Ikh Bogd Mountain and steppe pastures on East side of Tuin River, and Bayanstagaan, which lacked these natural assets (riparian areas), or had exhausted them due to continuous grazing on Bayan Tsagaan Mountain. Similarly, the sheltered forest slopes in Undur Ulaan provided a refuge for herders within the soum whose herds might not otherwise have survived.

An important aspect of dzud adaptation is the ability to earn income from non-livestock sources. In our pre-dzud survey in 2009, Ikhtamir households had significantly more income sources on average than those from the other soum, and Bayanstagaan households received more of their income from non-livestock sources. In our survey after the dzud, it appears that non-livestock income, especially from Ninja mining, will continue to be an important strategy for Bayantsagaan households.

Finally, this study shows that herders in soum with formally organized CBRM groups (Ikhtamir and Jinst) have more diverse social networks and more sources of information than those from non-CBRM soum (Undur Ulaan and Bayantsagaan). For example, herders in CBRM soum were significantly more likely to have obtained information from a professional expert (X^2=15.17, p=0.002), formal training or seminar inside the soum (X^2=23.231, p<0.000), or training outside the soum (X^2=8.156, p=0.043). Herders in these soums also reported knowing more people whom they could turn to for advice on livestock health, reproduction and nutrition (X^2=26.684, p<0.000), livestock marketing (X^2=27.137, p<0.000), pasture rotation and resting (X^2=28.706, p<0.000), and disaster preparedness and risk management (X^2=24.918, p<0.000). Other recent research (Batkhishig 2012) supports this finding. Since information and technology were identified as key constraints to adaptive capacity, access to a more diverse social network and set of information sources should enhance household and community adaptive capacity.

7.3.4 Reciprocity and Exchange

Norms of reciprocity are central to Mongolian herding culture and underlie fundamental strategies such as otor movements during dzud and drought. But the culture of reciprocity can also have a dark side, and corruption in Mongolia has been interpreted as having a basis in this strong cultural norm (Sneath 2006). In the context of dzud responses, norms of reciprocity, especially regarding sharing pasture with herders on otor from other areas, can be essential to survival of those who are moving, but, as our case studies show, they can also increase exposure and overall vulnerability of communities who are hosting incoming otor herds. Thus, at a local spatial scale and short (one winter) time scale, otor is adaptive and beneficial for the herders making the move, and can be harmful (and potentially maladaptive) for those receiving otor herders. Over a larger spatial scale, it is possible that otor enables survival of a larger regional herd, even if it leads to more losses locally. Similarly, while it may have detrimental impacts on receiving herders in the short term, if they benefit from reciprocity by being welcomed by their neighbors when they flee a future disaster, it may help them in the long run to be generous now. To fully assess the implications of reciprocal pasture use during disasters, we need to know more about the longer-term social impacts of otor. Does otor strengthen ties between herders from different soum, expanding their networks, and presumably building social capital and reducing vulnerability? Or does it increase conflict and weaken incentives for local collective action, potentially increasing vulnerability? If pastures that local herders collectively reserve through intentional cooperative action are consumed by otor herders, does this reduce or eliminate the incentive for these herders to participate in collective pasture management?

Mutual assistance among local herders and between herders and more distant kin and friends are potentially very important to coping and adaptive capacity. Substantial past research has demonstrated the importance of social networks and other dimensions of social capital for collective action, economic development and conservation (Pretty and Ward 2001; Walker and Salt 2006). In our case studies, we found relatively few examples of informal mutual assistance among herders, apart from the sharing of pastures and campsites with otor herders, as discussed above. The strongest evidence for the importance of mutual assistance came from Jinst, where we documented multiple examples of herders supporting each other through local networks (facilitated by herder groups) as well as instances of giving aid to distant relatives in more severely dzud-affected locations and of receiving assistance from city kin. To deepen understanding of the role of local and extra-local social networks to herders' vulnerability and resilience further investigation is needed focused on these questions.

Market exchange is potentially important in allowing herders to purchase and sell risk, substituting for other adaptive strategies. In our case studies market exchange enabled herders to purchase supplemental feed, and, in Jinst, to sell thin livestock in the spring for cash. Remoteness from markets and poor terms of trade may limit herders' use of this strategy. However, if markets for hay develop, we may see more local exchange and buying and selling of locally-produced feed. Insurance is a product that herders can purchase and which provides them with a market-based means of distributing risk. In our study, only herders in Jinst and Bayantsagaan had access to livestock insurance, although most herders surveyed expressed interest in purchasing it. Access to credit enables herders to use market exchange, potentially reducing vulnerability in the short term. Over the longer term, high debt may

ultimately increase vulnerability or force herders into alternative livelihood strategies. Many herders reported that they were unable to pay back debts due the dzud losses, and high debt levels constrain herders to continue to increase their herd sizes and goat numbers in order to pay back loans with cashmere income.

Information and knowledge exchange before, during and after the dzud is a key strategy that reduces vulnerability and increase resilience. This strategy can occur at various levels of social organization from exchanges between individual herders and households, to information dissemination within herder groups, bags and PUGs, to information provided by and to local, regional and national governments. It is important for herders to have adequate information both about the local situation (e.g. predicted and current weather and pasture conditions, aid distribution) as well as the situation in the surrounding region and across the country. Technical information about how to prepare for and respond to dzud is critical (e.g. building techniques for shelters, hay harvesting and storage, proper use of supplemental feed, preventive care for animals), as is exchange about dzud experiences and lessons learned, which can influence individual and collective behavior and reduce vulnerability to future disasters. Local, regional and national governments are important both as conduits for information going out to herders and to other levels of government, but also as receivers and transmitters of information about the local situation. Local government, in particular, plays a crucial function in documenting the local conditions, severity and emerging impacts of dzud to higher levels of government and relief organizations. Complete, accurate and timely information on the local situation is critical to ensure that government and donor assistance is targeted to the areas most in need. In our cases, we observed both successes (Bayanstagaan) and failures (Ikhtamir) in local government efforts and effectiveness in information exchange before and during the dzud.

7.3.5 Flexibility

Flexibility is a general strategy that refers to the invention of new practices and the ability to change how particular strategies are implemented in order to make them feasible or increase their effectiveness in a disaster situation. In our case study sites we observed flexibility in social organization in response to the dzud, with herders splitting households or khot ail, or joining with other families or khot ail in new configurations. Some herders altered customary movement patterns, applying flexibility to the strategy of mobility, by using different winter camp areas, for example. Herders also altered other management practices, such as not breeding their livestock in the fall in anticipation of a hard winter. Finally, flexibility was expressed in herders' innovativeness in using different feed substances, injecting animals with glucose and vitamins, and, in Jinst and Bayantsagaan, digging narrow trenches in the accumulated dung of bedding grounds to prevent goats from piling up on each other, suffocating and freezing to death.

7.3.6 Communal Pooling

Communal pooling involves sharing resources, labor or wealth, distributes risk across households, and improves the efficiency of many production activities. Pooling was a common strategy in the study sites with labor sharing and joint management of pastures and otor reserves being the most common pooling strategies. Labor sharing focused primarily on haying and other winter preparations, and herding during the dzud. Following the dzud some herders began engaging in more joint marketing activities. In 2011

Table 7.6 Constraints to adaptation. Upper case "X" indicates major constraint, lower case "x" indicates minor constraint.

Category	Constraint	Ikhtamir	Undur Ulaan	Jinst	Bayantsagaan
Human Capital	Lack of labor/aging herder population	X	X		X
	Lack of knowledge and information	x	X	x	X
Social Capital	Weak mutual assistance	x	X		X
	Little experience with collective action		X		X
	Limited social networks and information exchange	x	X	x	X
Economic	Lack of technology and machinery (e.g. tractors for haying)	X	X		X
	Lack of access to insurance	X	X		
	Limited opportunities for income diversification	X	x	X	x
	Poor access to markets	X	X	X	X
	No market differentiation for product quality	X	X	X	X
	High debt and no savings	X	X	X	X
	Aid dependence stifles innovation and creates dissent	x			
Institutional	Inherent challenges of collective action	x	x		x
	Conflicting incentives for small- and large-scale producers	x	x		
	Lack of support for scaling out formal collective action		x	x	x
	Lack of communication and coordination among aid organizations, different levels of government and herders	x	x	x	
	Lack of legal environment for formal collective action	x	X	x	x
	Lack of otor regulations and/or effective enforcement	X	X	X	x
	Legal constraints to access resources (e.g. forests)	x			
	Unenforced mining regulations			X	
	Increasing permanent resettlement of herders from other soum			X	
Environmental	Lack of water		X		X
	Lack of areas suitable for reserve otor/dzud pastures		X		X
	Lack of diversity of habitats				X

the Mongolian Government passed a resolution to encourage further collective marketing, as well as improvement of livestock quality, by committing to provide a premium price for high-quality sheep and camel wool to herders belonging to a marketing cooperative. Pooling strategies were definitely enhanced by formal CBRM organizations, which helped to organize many labor sharing and joint resource management activities among their membership.

7.4 Constraints to Adaptation

Our analysis of vulnerability and adaptive strategies identified 24 constraints to adaptation across our study sites, which fall into 5 major categories: human capital, social capital, economic, institutional and environmental (Tab le 7.6). Each of these constraints is discussed in detail within the case study chapters referenced in the table. Awareness and understanding these constraints can help focus future efforts by herder organizations, government and donors on eliminating these barriers to adaptation in the face of natural disasters.

7.5 Quantitative Analysis of Adaptive Capacity Indicators

Using data from the year 2 survey we sought to validate our vulnerability analysis developed with qualitative and quantitative data from the first year. Based on our conclusions (above) we hypothesized that Jinst has the greatest adaptive capacity and Undur Ulaan the lowest. Similarly, we hypothesized that members of formally organized herder groups would also possess more indicators of adaptive capacity.

The indicators of adaptive capacity used in this analysis included a number of scales derived from the year 2 survey data. These scales and their constituent variables are described in Table 7.7. For each scale we compared the mean scores among the 4 study soum using 1-way ANOVA, and between members and non-members of formal CBRM organizations using a student's t-test. Our results strongly support most of our conclusions from the qualitative data, showing that Jinst scores the highest on almost every indicator of adaptive capacity, followed by Bayantsagaan and Ikhtamir, with Undur Ulaan scoring lowest on most indicators (Table 7.8). Similarly, herders belonging to formal CBRM organizations scored significantly higher on almost all indicators than those that were not CBRM members (Table 7.9).

One somewhat surprising result was that Bayantsagaan scored relatively high on many of the indicators, especially those related to bonding and cognitive social capital, despite its remoteness, lack of civil society organizations and formal CBRM groups, and vulnerability. In general, the two Gobi soums scored significantly higher on most social capital indicators, regardless of CBRM membership. This finding aligns with qualitative observations and perceptions of other researchers that Gobi communities and households are more open, friendly and hospitable than those from other regions (U.Tungalag, personal communication, January 2012). It also corresponds to recent findings from economic experiments in Australia that found that arid and variable environments have distinctly different social network structures (McAllister, Holcombe, et al. 2011), and that trust and reciprocity increased with increasing variability in resource availability (McAllister et al. 2006; McAllister, Tisdell, et al. 2011). To determine if regional differences in social capital in Mongolia exist more generally, a much larger sample is needed from sites throughout each region.

Table 7.7 Description of quantitative indicators of adaptive capacity measured in the household survey in year 2.

Adaptive Capacity Indicator Scale	Concept and Rationale	Constituent Variables
Winter Preparation	Winter preparations are key to surviving dzud. This variable is the sum of 13 practices herders undertake to prepare for winter. Many of these variables relate to the adaptive strategy of *storage*.	Reserve winter pasture, Reserve spring pasture, Reserve separate dzud pasture, Fall (or summer) otor, Cull unproductive livestock, Cut hay, Prepare hand fodder, Purchase and store grain, Purchase and store concentrate, Purchase and store other feed, Vaccinate livestock, Deworm livestock, Treat for external parasites
Innovation	Herders who actively manage, monitor or restore natural resources, improve their herd quality or composition, or experiment with alternative production systems (e.g. farming) are more adaptive. This variable is the sum of 20 variables related to the above concepts	Purchases improved breeding stock (separate variable for each species), Changed species composition, Reduced herd size, Intentionally did not breed, Fence pasture,hay area or water source (3 separate variables), Dig new well or repair well (2 variables), Plant fodder, Use fertilizer, Use irrigation, Plant garden, Protect key natural resources, Take action to prevent soil erosion, Take action to restore damaged land, Monitor environmental conditions
Information Diversity	Herders tho have access to diverse sources of information are more likely to receive information about impending shocks or changes and how to cope with or adapt to them. Lack of information was identified as a constraint to adaptive capacity. This variable is the sum of 16 information sources.	Radio, Television, Newspapers, Computer (internet), Brochures, Experts, Soum government, Local veterinarians, Herders in khot ail, Herders in neighborhood, Herders outside neighborhood, Bag khural, CBRM organization meeting, Formal training within the soum, Formal training outside the soum, Other source
Knowledge Exchange	Herders who are knowledgeable about livestock and rangeland management will be better prepared for dzud and more careful stewards of their resources. This variable is the sum of scores on a 3 point scale (none, 1-3, > 3) that asked herders how many people they know who can help them with specific topics.	Livestock health, reproduction and nutrition, Livestock marketing, Pasture rotation and resting, Disaster preparedness and risk management
Structural	Social networks are a “structural” form of social	Neighbors, Family in the soum, Family elsewhere, Distant

Social Capital Total	capital that can be crucial for obtaining support during a disaster and also to "getting ahead" in other times. This variable is the sum of all sources from which the respondent received help during a recent hardship.	relatives, Friends, Government, Politicians, Religious leaders, CBRM organization, Development/Aid organization, NGO, Bank, Insurance company
Structural Bonding SC	Bonding social capital are ties to people of similar background and social position.	Neighbors, Family in the soum, Family elsewhere, Distant relatives, Friends,
Structural Bridging SC	Bridging social capital are ties to people or organizations different from oneself and/or who occupy a different social position.	Government, Politicians, Religious leaders, CBRM organization, Development/Aid organization, NGO, Bank, Insurance company
Total Cognitive SC	Cognitive social capital refers to a sense of trust, norms of reciprocity and shared values within a group. Sum of 7 items each coded on a 3 point scale (disagree, neutral, agree). Items 5-7 are reverse coded.	1. My community has good informal leaders whom we trust 2. People in my community always try to help each other 3. People in my community help each other in times of need 4. Most people in my community are trustworthy 5. People in my community mainly look out for themselves 6. If given the chance, people in my community will take advantage of others 7. I am concerned that our community is getting less friendly, people are less contected to each other and not looking out for each other as they used to do
Trust SC	Trust is an important component of social capital that is thought to reduce the transaction costs of initiating and sustaining collective action. Sum of 3 items.	Items 1, 4, 6 above
Reciprocity SC	Reciprocity is an important component of social capital that helps to sustain collective action. Sum of 4 items.	Items 2, 3, 5, 7 above
Leadership	The quality of formal and informal leadership is important for organizing collective action to prepare for and respond to disasters.	1. My community has good informal leaders whom we trust 2. My community has some knowledgeable and respected people we can turn to for advice 3. I know helpful organizations in my soum who support and collaborate with us 4. In my community, the local government pays attention to and listens to us

Proactiveness	Proactiveness is an indicator of the respondent's participation in formal and informal collective action and their capacity and propensity to communicate with government officials and technical experts. Sum of 6 items.	Member of a soum organization, Member of a national organization, Talked with local authorities about problems in your community, Talked with experts about rangeland issues, Joined in collective rangeland improvement or management initiatives, Joined with other community members to address any other type of problem or issue.
Income Diversity	Diversity of income sources should make a household more resilient to loss or reduction in one of the sources. This variable is simply the sum of all types of income sources reported by the respondent.	Livestock (all products), Government payment, Herd others' livestock, Pension, Vegetable farming, Salary, Remittances, Wage labor, Rents, Mining, Hunting, Interest from loans, Handicrafts, Investments, Develompent aid, Small business, Cash gift from family or friends, Other income

Table 7.8 Comparison of adaptive capacity indicators among the study soum. See Table 7.7 for an explanation of the indicators.

Adaptive Capacity Indicator	Soum	N	Mean	Std. Error	df	F	*P*
Winter Preparation	Ikh-Tamir	22	7.91	.360	3	6.633	.000
	Undur-Ulaan	22	5.59	.440			
	Bayantsagaan	17	7.24	.566			
	Jinst	21	8.52	.639			
Innovation	Ikh-Tamir	23	4.04	.501	3	12.653	.000
	Undur-Ulaan	20	2.05	.407			
	Bayantsagaan	15	5.73	.765			
	Jinst	21	7.19	.755			
Information Diversity	Ikh-Tamir	21	8.52	.501	3	8.660	.000
	Undur-Ulaan	20	6.30	.405			
	Bayantsagaan	16	7.88	.539			
	Jinst	23	9.78	.552			
Knowledge Exchange	Ikh-Tamir	24	2.63	.345	3	17.877	.000
	Undur-Ulaan	23	.78	.208			
	Bayantsagaan	17	3.59	.374			
	Jinst	24	4.08	.425			
Structural Bonding Social Capital	Ikh-Tamir	20	2.30	.398	3	3.850	.013
	Undur-Ulaan	10	1.30	.367			
	Bayantsagaan	17	3.00	.343			
	Jinst	23	3.17	.348			
Structural Bridging Social Capital	Ikh-Tamir	19	3.21	.436	3	9.713	.000
	Undur-Ulaan	10	1.00	.211			
	Bayantsagaan	17	2.71	.329			
	Jinst	22	4.23	.378			
Total Structural Social Capital	Ikh-Tamir	15	5.00	.498	3	8.775	.000
	Undur-Ulaan	10	2.40	.542			
	Bayantsagaan	17	5.71	.513			
	Jinst	20	7.05	.682			
Total Cognitive Social Capital	Ikh-Tamir	24	9.63	.807	3	3.901	.012
	Undur-Ulaan	23	8.13	.742			
	Bayantsagaan	17	10.47	.654			
	Jinst	24	11.38	.586			
Trust	Ikh-Tamir	24	4.17	.333	3	3.991	.010
	Undur-Ulaan	23	3.87	.262			
	Bayantsagaan	17	4.53	.259			
	Jinst	24	5.13	.236			
Reciprocity	Ikh-Tamir	24	5.46	.507	3	3.250	.026
	Undur-Ulaan	23	4.26	.563			
	Bayantsagaan	17	5.94	.489			
	Jinst	24	6.25	.382			
Leadership	Ikh-Tamir	24	4.96	.476	3	17.051	.000
	Undur-Ulaan	23	2.78	.407			
	Bayantsagaan	17	5.41	.333			
	Jinst	24	6.79	.376			
Proactiveness	Ikh-Tamir	24	2.42	.306	3	22.422	.000
	Undur-Ulaan	23	.61	.206			
	Bayantsagaan	17	2.06	.264			
	Jinst	24	3.79	.324			
Income Diversity	Ikh-Tamir	24	2.83	.214	3	3.573	.017
	Undur-Ulaan	23	2.35	.119			
	Bayantsagaan	17	3.18	.196			
	Jinst	25	3.08	.215			

Table 7.9 Comparison of adaptive capacity indicators between CBRM members and non-members. Equal variances assumed unless indicated with *.

Adaptive Capacity Indicator	CBRM member	N	Mean	Std. Error	t	df	*P*
Winter Preparation	No	39	6.41	.344	-3.246	80	.002
	Yes	43	8.12	.391			
Innovation	No	36	3.64	.490	-2.653	77	.010
	Yes	43	5.58	.530			
Information Diversity	No	36	6.97	.348	-4.250	78	.000
	Yes	44	9.20	.380			
Knowledge Exchange	No	40	1.93	.292	-3.549	86	.001
	Yes	48	3.40	.290			
Structural Bonding Social Capital	No	27	2.33	.302	-1.111	68	.270
	Yes	43	2.79	.265			
Structural Bridging Social Capital	No	27	2.15	.260	-3.892*	65.802	.000
	Yes	41	3.71	.305			
Total Structural Social Capital	No	27	4.52	.481	-2.355	60	.022
	Yes	35	6.14	.478			
Total Cognitive Social Capital	No	40	8.98	.564	-2.242	86	.028
	Yes	48	10.63	.480			
Trust	No	40	4.10	.199	-2.025	86	.046
	Yes	48	4.69	.207			
Reciprocity	No	40	4.88	.421	-2.063*	72.553	.043
	Yes	48	5.94	.297			
Leadership	No	40	3.80	.340	-4.627	86	.000
	Yes	48	5.96	.318			
Proactiveness	No	40	1.23	.198	-6.009*	85.005	.000
	Yes	48	3.10	.242			
Income Diversity	No	40	2.68	.126	-1.512	87	.134
	Yes	49	2.98	.150			

We found no significant differences between CBRM members and non-members in the assistance they received from family and friends (Structural Bonding Social Capital), or in their income diversity. These findings are not greatly surprising as most Mongolian herders rely on their ties to close and distant family and friends in times of need, as these relationships are the safety net of first resort. Lack of differences in income diversity between members and non-members suggest that formal CBRM organizations at these study sites have not yet had a major impact on expanding herders' livelihood options. The most significant differences in income diversity were between regions, and were largely accounted for by mining and wage labor opportunities in Bayantsagaan and more households engaged in vegetable and handicraft production in Jinst.

7.6 Lessons from the Dzud: Reflections on Resilience

Resilience is a system's ability to maintain its basic structure, function and identity in the face of shocks and changes—to recover and reorganize following a major perturbation such as dzud. A fundamental characteristic of resilient systems is their capacity to learn, adapt and "live with change." Dzud is a recurrent natural disaster in Mongolia, one that herders are accustomed to and have learned to live with over the long term, employing many customary adaptive strategies. In the current situation, dzud interacts with other sources of stress and change including economic shocks, institutional transformations, and the emerging effects of climate change, all of which place additional stress on the system and may limit the effectiveness of traditional coping and adaptive strategies. It is too soon for a

comlete assessment of resilience of our study sites to the 2009-2010 dzud. However, none of the sites show signs of a permanent transformation to a fundamentally different system. Based on our findings, we offer some reflections on indicators of resilience observed at the study sites, and ways to capitalize on this shock to the system as an opportunity for learning and positive system transformation. We conclude by placing our findings in the context of their broader implications for climate change adaptation and resilience-building throughout and beyond Mongolia.

7.6.1 Resilience to Past Dzud

A positive indicator of resilience is the recovery and reorganization of pastoralists in Jinst Soum following the last major dzud series in 1999-2002. Of our four case study sites, Jinst was most severely affected by the 1999-2002 dzud, losing 75% of the local herd. Between 2003 and 2009, Jinst's livestock population rebounded dramatically, and with financial support and technical assistance from the UNDP Sustainable Grasslands Management Program, six herder groups were organized and implemented grazing management improvements and small enterprise development in the soum. In the 2009-2010 dzud, Jinst herders and local government were among the best-prepared, most pro-active, and demonstrated the strongest informal and formal collective action. Jinst experienced the smallest losses in the 2010 dzud, but it was also less exposed to extreme weather conditions than the other three sites. Quantitative and qualitative findings in the second year following the dzud further demonstrate Jinst's high levels of adaptive capacity and determined these to be associated in part with the presence for formally organized herder groups. Jinst's experience demonstrates that herders can learn from dzud experiences and with appropriate support, can use this opportunity to make adaptive changes that increase sustainability and resilience to future shocks.

7.6.2 A "Teachable Moment" for Transformation

As Jinst's experience demonstrates, dzud can serve as a leverage point for positive system transformation. Our focus group, photovoice and survey data all illustrate that many herders in our other study sites are aware of the need for change and are ready to learn. Many participants emphasized the need to reduce livestock numbers, improve animal quality and health care, and enhance collective action to harvest and store hay, protect reserve pastures more effectively, and allow overused summer pastures to rest and regrow. In the second year following the dzud at least some of the herders in each of the study sites are acting on these changing attitudes, individually and collectively. For example, in the year 2 survey, 40% of respondents reported that they had intentionally changed the species composition of their herds, 34.5% had sold animals to reduce herd size, 30% intentionally did not breed animals when a hard winter was forecast, 31% fenced or improved a natural water source, and 23% fenced a reserve pasture area. However, relatively few respondents actively worked to prevent soil erosion (4.5%), repair or restore damaged land (4.5%), protect other key resources (14.6%) or participated in any type of environmental monitoring (11.5%). The 2 years following a dzud, while memory of the dzud is still fresh, are a critical window of opportunity to initiate and further strengthen support for community-based rangeland management initiatives and other investments that encourage collective and individual action for improved pasture and herd management. Herders now appear willing to pursue alternative production goals (i.e. quality over quantity) if the knowledge and means are available and the market rewards increased quality. At the same time herders would benefit from

increased technical support and capacity building to engage in improved pasture management, but especially active protection, restoration and monitoring of pastures and other key natural resources. The increasing impacts of mining and climate change as well as livestock grazing make these activities ever more critical to maintaining system resilience.

7.6.3 The Roles of PUGs, Herder Groups and the SLP

Our results clearly show that in our 4 study sites, formally organized community-based herder organizations are strongly associated with a suite of desirable herd and pasture management behaviors and indicators of enhanced adaptive capacity. The question remains, what kinds of community-based organizations best support collective action by herders, especially for improved pasture management. Our study sites included initiatives that take three distinct approaches to supporting community-based herder initiatives: 1) territorially-based PUGs focused primarily on pasture management and involving up to 50 households (Green Gold PEM Program), 2) smaller kin- or neighborhood-based herder groups focused on pasture management and livelihood improvement involving 5-20 households (UNDP Sustainable Grasslands Management Program), and 3) project-specific support for herder-proposed initiatives (Sustainable Livelihoods Program). The SLP was active in all of our study sites, although only recently in the Arkhangai sites, GG PUGs were located in Ikhtamir and UNDP-organized herder groups in Jinst. Thus the SLP overlapped with the other two types of organizations, but PUGs and herder groups did not coexist in either Ikhtamir or Jinst.

Although some practitioners view PUGs and herder groups as competing models, we think that they are potentially complementary, as are initiatives sponsored under the SLP. To date at our study sites the UNDP SGM appears most effective at catalyzing collective action by herders, strengthening government-herder cooperation and communication, and leading to measurable changes in resilience. However, this approach only reaches a limited number of participants, and thus the majority of rangelands and herders in the soum do not benefit from improved management and coordination. PUGs seek to involve all the herders within a defined territorial unit in cooperative management of pastures, in order to overcome free-rider problems. PUGs were effective in helping herders prepare for dzud, especially with hay making, and in facilitating collective learning after the dzud. However, this approach has been less effective, thus far, in fostering other types of cooperation, communication and mutual assistance. The SLP provides an additional source of resources that can help existing herder groups or PUGs to implement their cooperative initiatives, and it was being used in this fashion in Ikhtamir. In sites such as Undur Ulaan, with no formal community-based herder organizations, SLP funds have apparently catalyzed collective action by providing the incentive for groups to cooperate in order to access these resources. However, this approach also created mistrust on the part of herders who did not receive funds and perceived the process as lacking transparency and fairness. Even when the process is transparent and legitimate, it is not certain that these opportunistic groupings driven by the availability of funds will lead to any type of enduring collective action in the absence of technical and capacity-building support of the kind provided to PUGs by GG and herder groups by UNDP-SGM.

The complementarity of these efforts, in theory, is the following. PUGs provide an overarching institutional and organizational framework for pasture use at the territorial level, which is essential given the spatial and temporal variability of pasture resources in Mongolia and the importance of

storage, mobility, diversity and reciprocity as adaptive strategies. PUG functions would include pasture management planning, monitoring and enforcement, including the designation of seasonal pasture areas, PUG-level forage reserves and hay harvest and storage, setting dates for movements and facilitating adaptive pasture management across all households within the territory. Nested within PUGs, herder groups composed of subsets of PUG members collaborate on more specific initiatives related to haying, neighborhood reserve pastures, restoration and care of water sources, cooperative marketing, small enterprise development, otor, and herd care and management. These activities, especially those that involve direct financial investment and risk, require a higher level of trust, communication, and accountability, which is difficult to achieve among 50 households, but is feasible in smaller groups. The SLP provides a source of capital to both types of organizations, though perhaps more oriented to larger-scale projects at the level of PUGs or multiple cooperating herder groups. This helps to insure that SLP resources are used to advance projects that take place within the context of existing pasture management plans developed with high levels of herder participation and legitimacy, and in an organizational setting with a strong record of past cooperation, capacity and accountability, so that the funds are well-used to serve genuine community needs rather than the interests of a few clever and opportunistic individuals.

In sum, our results show that several different organizational models for grass-roots herder instutitons can be successful in the Mongolian context (also see (Leisher et al. 2012; Upton 2008, 2012; Ykhanbai et al. 2004)), but significant initial technical assistance and support is needed to help such groups organize and develop their capacity—an economic incentive alone is not sufficient (Batkhishig et al. 2011). Thus, scaling out this institutional innovation beyond the existing limited donor-funded projects remains a challenge. Finally, it is important to note that even in apparently successful community-based organizations, benefits may not be equally distributed among participants, and not all community members may have equal opportunities to participate (Upton 2008; Murphy 2011). Recognition and further investigation of these power dynamics and their consequences is vital if these grass-roots institutions are to reach their potential for social-ecological resilience building on Mongolian grasslands.

7.6.4 Local Government Coordination with Local NGOs, Donors, and Grass-roots Herder Initiatives

Another lesson from our case studies, especially Jinst and Bayantsagaan, is the importance of local government cooperation and coordination with herder organizations, local NGOs, and donor agencies and staff. Neither herder-led organizations nor local governments with their current limited resources, staff, and capacity, can alone effectively manage pastures or respond to disaster such as dzud. It is imperative that local governments learn the value of communicating with and supporting herder-led initiatives, and that herder groups are pro-active in sharing information with and making proposals to local governments. Similarly, when local governments and aid organizations do not effectively communicate and coordinate with each other in disaster response, aid may be mis-allocated or may not be distributed at all. Resilience requires cross-sectoral cooperation of different types of organizations.

7.6.5 Cross-boundary and Cross-level Institutions are Essential

Just as cross-sectoral cooperation is important, cross-level and cross-boundary institutions are essential. Our case studies specifically point to the perils of unregulated otor movements during dzud and the way

that this can increase the vulnerability of receiving communities if they are not prepared with designated otor reserves and cross-boundary agreements cannot be effectively monitored and enforced. Mobility and reciprocity are critical strategies to reduce vulnerability to dzud. In order for these strategies to work without significant collateral damage to host soum pastures and livelihoods, strong cross-level institutions are needed that designate aimag, soum and national otor reserves, specify conditions for their use, and ensure that the terms of agreements between soum are respected.

7.7 Implications for Mongolia and Beyond

Like many disasters, dzud is a complex social-ecological phenomenon and vulnerability to dzud is a function of interacting physical, biological, social, economic and institutional factors. Vulnerability is affected by local, cross-boundary, and cross-level factors. Actions that are adaptive and reduce vulnerability for one group at one spatial or temporal level may be mal-adaptive and increase vulnerability for another group or at a different level. Communities that are well prepared for dzud at the household level may suffer disproportionate losses if exposure is increased by in-migrating otor livestock from other soum. Relief aid that helps prevent loss of life, suffering and impoverishment in the short-term may contribute to long-term dependence syndromes, social disparities, and lack of initiative on the part of both local government and herders. The lessons of the dzud for actors at all levels of social organization point to the need for increased responsibility and leadership by individual actors, be they households, herder groups, or local governments, as well as the critical importance to all actors (including donor and aid organizations) of reaching out, communicating and cooperating with others within and across sectors.

The challenges of resilience-building in our case study sites are not unique to our sites or to Mongolia. Rather, they echo the struggles of other variable and low productivity pastoral and ranching systems around the world, in both developing and developed nations. Thus, the lessons learned from our cases may also have implications for pastoral development policies and climate change adaptation in livestock systems in other regions. One of the fundamental similarities between Mongolian pastoral social-ecological systems and dryland extensive livestock production systems in much of Africa, central Asia, Australia and western North America is the sometimes extreme variability in resource availability over space and time, arising from both inherent geographical variation and temporal and spatial variability in weather conditions, which drive forage growth in all locations, as well as dzud occurrence in Mongolia. This variability, in turn, leads to similar challenges and potential options for addressing them. Two of the major cross-level challenges encountered in our cases were 1) the need for and consequences of mobility and reciprocity in the face of dzud, and 2) the potential perverse incentives associated with dzud relief assistance. We also observed the potential for learning, behavior change and increased adaptive capacity at individual and community levels, as well as significant constraints to acting on lessons learned and strengthening adaptive capacity and resilience to future disasters.

Pastoralists in many spatially and temporally variable systems have employed mobility, reciprocity and flexibility to address the challenge of patchy and unpredictable resource availability (Fernandez-Gimenez and LeFebre 2006; Turner 2011; Galvin 2008), just as Mongolian herders rely on otor as one response to dzud. As in Mongolia, the apparently conflicting needs for secure rights to key resources and flexibile access in times of need, create potential cross-boundary and cross-level governance

dilemmas in these regions as well (Nkedianye et al. 2011; Turner 2011). Though many pastoralists have managed these conflicting demands successfully in a variety of ways, increasing land fragmentation (Nkedianye et al. 2011), land privatization (Li and Huntsinger 2011), nationalization, and even well-intentioned common pool resource management policies that fail to grasp the nuances of pastoral mobility and reciprocity arrangements (Turner 2011) threaten the viability of pastoral mobility institutions and increase vulnerability to climate disasters. Although common property regimes are often thought most appropriate for facilitating pastoral mobility, recent studies of agistment arrangements in Australia demonstrate that mobility and reciprocity can serve as successful strategies for dealing with spatial and temporal variability even in private property systems (McAllister et al. 2006; McAllister, Holcombe, et al. 2011; McAllister, Tisdell, et al. 2011). Similarly Alimaev and Behnke (Alimaev and Behnke 2008) show that herders in Kazakstan have persisted in maintaining their mobility through a series of property regime transformations. Our Mongolia cases illustrate that community-based pasture management alone is insufficient, and support the contention that carefully crafted, context-specific, nested, multi-level cross-boundary institutions are essential to maintaining mobility, reciprocity, flexibility and the social ties that both facilitate and are strengthened by pastoral mobility patterns (Turner 2011; Galvin 2008). Our findings also suggest that more research is needed to understand the dynamic relationships between pastoralists' local and extra-local social networks, livestock mobility, and access to pastoral resources, especially the consequences of power asymmetries within and between networks at different levels of social organization, and the implications for development of robust, equitable and just community-based and co-management regimes.

The criteria and strategies for dzud disaster relief aid distribution in Mongolia are feared by some to create perverse incentives by rewarding herders with assistance who do not adequately prepare for winter, and withholding assistance from those who are proactive and conscientious in their winter preparations. To avoid this dynamic, in some areas aid is distributed equally among all herders, resulting in too little assistance to make a meaningful impact. Similar concerns about perverse incentives are articulated in the literature on drought relief and drought policy in other semi-arid and arid pastoral regions including the Western US (Coppock 2011; Dunn, Smart, and Gates 2005), Australia (Botterill 2003; Ha et al. 2007), and Southern Africa (Vogel, Koch, and Van Zyl 2010). In these contexts drought relief is seen to encourage livestock producers to hold their livestock rather than destocking, leading to overuse and further degradation of already stressed rangelands (Botterill 2003; Dunn, Smart, and Gates 2005; Ha et al. 2007). Further, the financial "bailout" approach of government drought policies, such as those in South Africa, is thought to undermine efforts to promote more proactive drought planning and management (Vogel, Koch, and Van Zyl 2010). These discourses on drought and dzud relief, perverse incentives, "lazy herders," and the moral hazards of relief aid raise the broader policy question of who bears the risk for climate disasters and who is responsible for disaster preparation and recovery. How can actors at each level of social organization be encouraged to behave proactively and assume appropriate responsibility for preparedness, while ensuring that there is a broad humanitarian safety net in place to prevent permanent loss of livelihoods and food security? What functions of disaster preparation and response should be the responsibility of individual producers, local or national government, civil society, and donor organizations? And which mechanisms—market-, community- or

state-led—will most efficiently and effectively promote preparedness and facilitate timely and effective response?

A comprehensive analysis of dzud and disaster policy in Mongolia is beyond the scope of this report, and has been carried out in other venues (Benson 2010; Sternberg 2010), but our results, considered together with experiences from other systems, suggest some key considerations. First, individual livestock producers ultimately bear the risk and responsibility for dzud preparedness. But in order to act they need access to timely and accurate information, technology, and labor, as well as appropriate incentives (and absence of "perverse incentives"). Information, technology, labor and incentives, in turn, can be provided as functions of informal and formal community institutions (information, technology and labor), local and sometimes national government (information and incentives), and civil society and donor organizations (information, technology, and capacity building for community institutions). Pasture management, otor arrangements, monitoring local pasture conditions, and determining the criteria and identification of households for aid distribution are appropriate responsibilities for local government in tandem with community groups and civil society organizations, while national government provides the legal framework and mandates for pasture management, trans-boundary otor movements, and pasture monitoring, and the social safety net for the most severely affected households. Some have suggested that such aid should be focused directly on human needs rather than on livestock production (e.g. emergency fodder supplies) (Benson 2010). This would further shift the burden to individuals and local communities to prepare and purchase adequate fodder in advance, and could stimulate local fodder markets where there is enough production to harvest and sell as surplus.

Other market mechanisms can also play a role, but many of these are as yet poorly developed in Mongolia. Index-based livestock insurance is one mechanism for pooling risk, and was piloted in 4 aimag in 2006-2009 and expanded to 17 others in 2010. However, observers in other regions of the globe have expressed skepticism about the viability of this approach (Binswanger-Mkhize 2012) and it is too early to evaluate its effectiveness in Mongolia. In the longer-term, market incentives will be crucial to supporting shifts in herd composition and increasing livestock quality over quantity. The mechanisms here may involve a combination of market incentives and state policies, such as the recent Cooperative Regulations that provide a price premium for high-quality collectively marketed camel and sheep wool. Several donor organizations are exploring mechanisms such as sustainable cashmere certification to connect herders with markets that will pay a premium for sustainably produced products (Cédric Bussac, Vétérinaires et Agronomes Sans Frontières, personal communication, 2011). Certification, niche marketing and payment for ecosystem services are all relatively recent market-based mechanisms to promote sustainable livestock production, and although such methods hold promise (Bohlen et al. 2009; Goldstein et al. 2006; Nardone, Zervas, and Ronchi 2004; Greiner, Gordon, and Cocklin 2009), there are also many challenges (Bullock et al. 2011; Bulte et al. 2008; Lipper, Dutilly-Diane, and McCarthy 2010). As in many remote arid and semi-arid regions, a major impediment in Mongolia remains the limited potential to diversify rural economies, which limits herders' alternatives.

To build more resilient pastoral social-ecological systems in Mongolia and beyond, our vision must move beyond improving disaster preparation and response to enhancing the adaptive capacity of herder households and communities. Adaptive capacity consists of the ability to learn, and the ability and

willingness to act on that learning (Inderberg and Eikeland 2009). Overall, we foresee three possible response pathways in our study sites following the dzud, each with different implications for future system function. 1) *Migrate out.* Herders who lost their livelihoods may leave the sector and potentially the region. This decline in the number of households and livestock may act as a stabilizing feedback at the local level, though outmigration of large numbers of herders who relocate to other regions or the capital city may be a source of cross-scale vulnerability at the national scale. 2) *Rebuild herds.* Herders and local governments may passively wait for herds to rebuild, repeating the boom-bust cycle when the next dzud arrives. We hypothesize that this pathway could result in an amplifying feedback, as in recent history herds have recovered to numbers exceeding the previous peak, with significant impacts on pastures, before the livestock population is once again decimated by a subsequent dzud. Unchecked, this boom-bust cycle may eventually lead to an undesirable regime shift if an ecological degradation threshold is crossed before the next dzud. 3) *Actively adapt.* Finally, either on their own or as the result of targeted program interventions, herders and local governments have the opportunity to learn from this dzud, and to put their learning into action by implementing the ideas they expressed in focus groups and surveys by improving livestock quality and reducing quantity and improving collective action for pasture management. However, the success of such social learning at the local level will depend upon cross-level learning and the development of stronger cross-level institutions to manage pastoral mobility, as well as continued investments in developing livestock market and market incentives to improve quality over quantity and diversify livelihood portfolios.

At the individual household level, our results show evidence of learning and limited changes in behavior. Assessments from the US (Coppock 2011) and Australia (Stafford-Smith et al. 2007) illustrate that ranchers and pastoralists can and do learn and change as the result of past experiences with drought, but that the periodicity of disasters affects whether learning takes place in Australia. In the US, Coppock contends, the only ranchers remaining in Utah are those who are good managers—the rest having exited the sector due to a failure to learn and adapt. In Australia, failure to learn due to the scale mis-match between the generation time of ranchers and the occurrence of severe droughts, has led to system transformation in some instances. In Mongolia, the occurrence of dzud (and drought-dzud combined events) is sufficiently frequent that learning is possible at the level of individuals and communities.

What can be done to strengthen the adaptive capacity of Mongolian pastoral social-ecological systems---that is, the individual and collective abilities to learn and adapt? The key lessons from our cases resonate with the emerging research on resilience-building in other pastoral systems. The overall lesson is that learning and action must take place within and across different social units (e.g. households, herder organizations, soums) at the same level of organization as well as across different levels of organization. Our case studies highlight the following key lessons and implications:

1) **Social networks** are critical for mutual assistance, knowledge and information exchange (including access to and integration of different types of knowledge), resource access and pastoral mobility (e.g. otor arrangements). Additional research is needed to understand the structure and function of social networks among pastoralists and between pastoralists and other actors, but interventions

that support the development of expanded and strengthened bridging ties between herders, local government and extra-local organizations and experts enhanced resilience in our cases.

2) **Formal collective action** among herders (e.g. PUGs, herder groups, etc.) contributes to stronger networks, learning, and action based on lessons learned. Community-based management is not a panacea, nor is it sufficient to address some of the cross-level challenges facing Mongolia; however, our data and other recent studies demonstrate that these approaches hold promise, in part because they illustrate that local people are not helpless in the face of change.
3) **Cross-boundary and cross-level governance institutions** are essential, and are urgently needed in Mongolia to address the cross-level and cross-boundary dilemmas that increased vulnerability during the recent dzud.
4) **Forums and venues that encourage social learning** are fundamental to strengthening adaptive capacity. In our cases, formal collective action organizations, and sometimes local government, played important roles in opening such dialogs. Moving forward, communities will need to cultivate their skills in **multiple-loop learning** that questions assumptions and seeks root causes.
5) **Environmental and socio-economic monitoring** are crucial because change must be detected in order for learning, action and adaptation in response to change to take place. Thus, it is especially important to develop formal and informal ways to track changes in slow variables within and across levels of governance and spatial organization—requiring further cross-level coordination.

8. Recommendations

We close with a series of recommendations for actors at different levels of social organization. These recommendations are specific actions that should be taken in order to strengthen adaptive capacity to future disasters.

8.1 Recommendations for Herder Households

1) Herders are responsible for their own survival and must prepare accordingly. The most important investments households can make is feeding animals well in summer and fall, so they have sufficient fat reserves to endure the winter, and ensuring an adequate supply of standing grass reserves, hay and fodder for winter and spring. These two measures, in turn, require proper pasture management practices and institutions (see 2 below). Selling old and unproductive animals in the fall, and restricting breeding before a bad winter can also keep forage demand in balance with supply.
2) Herders must work with each other and their local government to implement sustainable grazing practices and the institutions (rules, policies and norms) to support them (also see 1 below).
3) Herders are encouraged to participate actively in developing their soum's dzud response plan and to consider buying livestock insurance to protect themselves against high losses.

8.2 Recommendations for Khot Ail and Herder Groups

The case studies illustrate clear benefits of both informal cooperation among herder households and khot ail, and collective action by formally organized herder groups and PUGs. Our recommendations focus on key arenas where cooperation is essential or where it leads to the greatest observable benefits.

1) Under Mongolia's current legal framework for pastureland tenure and management, cooperation and coordination among herders using the same grazing territory are essential for sustainable use of pastures. Therefore, we strongly recommend that herders work closely with others who share the same seasonal pasture areas to plan for and manage pasture use and seasonal movements, especially designation and protection of winter, spring and dzud reserve pastures. We also recommend that such user groups actively seek support and cooperation from local governments in developing, monitoring and enforcing their grazing plans.

2) Khot ail and herder groups are encouraged to work together to rehabilitate wells, springs, and other water sources; to protect strategic pasture communities and plants that are useful during dzud such as shrubs for browse, tall grasses (ders, *Achnatherum splendens*), forest understory, and riparian pastures; and to combine efforts to collect and store hay (sharing machinery, fuel and labor). All of these resources contribute to reduced vulnerability during dzud.

3) Knowledge and resource exchanges and the social networks that support them are critical to adaptation. An important function of organized and informal herder groups can be to mobilize expertise, training, and financial resources within and outside the local community. Herder groups are encouraged to draw on and combine all available information sources: local and traditional knowledge, professional knowledge, and scientific and technical knowledge and to share their knowledge, experiences and lessons with others. One aspect of this is building the capacity to

cooperate and to function as an organization. Thus, we encourage herder group members to learn and practice the principles of good communication, planning, transparency, and accountability with others in the group.

8.3 Recommendations for Local Government

Soum government and bag governors can play important roles in ensuring adequate individual and community preparedness for winter and dzud.

1) Although individual preparedness is ultimately a household responsibility, local government can promote responsible individual behavior through public education and incentives that encourage fall livestock culling and sales, fall otor, hay and fodder harvest and storage, and identification and protection of winter, spring and dzud reserve pastures.
2) One of the most critical roles for local government is pasture management planning, monitoring and enforcement. In the context of dzud, this includes designating in advance specific otor areas for local herders and for herders from other soum, making arrangements in advance for incoming and outgoing otor herders, and strengthening capacity to monitor and enforce policies related to reserve pastures and otor herders. Monitoring pasture carrying capacity season to season, as well as pasture conditions year to year, can help in making wise planning decision for otor and seasonal movements, regulating incoming otor herders and stocking rates, and identifying areas in need of rest or restoration.
3) Effective local governments are pro-active, participatory and adaptive in developing and implementing disaster management plans. This includes planning for disaster in advance by developing a disaster management plan with broad stakeholder input (including herders), and updating the plan based on lessons learned in each dzud. Local government response during the dzud is also critical, including coordination and communication with herder groups, donor agencies, and regional and national government in order to target and distribute aid appropriately, efficiently and fairly.

8.4 Recommendations for Regional and National Government

1) Dzud preparation and response at all levels depends critically on clear policies to guide and capacity to implement pastureland governance across multiple scales. As national policies for pastureland tenure and management are revised and strengthened it is especially important to consider provisions for designation of dzud (otor) reserves at the local, aimag and national levels, and mechanisms to coordinate and regulate otor movements between different soum and aimag.
2) In order to improve coordination and communication among multiple agencies (NEMA and others) and relief organizations and different levels of government, it is important to identify the distinct roles of local, regional and national government, donor and aid organizations and community organizations and develop effective communication and coordination mechanisms between them.
3) Due to the different ecological and management characteristics of different geographical regions in Mongolia, regionally-specific recommendations for dzud preparation and response may be required.

8.5 Recommendations for Donors and Relief Aid Organizations

1) Distribution of hay, fodder and food prevents impoverishment during emergency periods, but short-term aid should be linked to longer-term development support. Increasing dependence on relief aid may increase vulnerability to future disasters both at the household and community levels.
2) With respect to short-term relief aid, we recommend that donor and relief organizations increase coordination with local governments and other aid organizations within each soum, and with the national government and other aid organizations at the national level. At the local level, we recommend working with local government and herder organizations to develop appropriate criteria for aid distribution (which households), specific types of support needed (food, fodder, clothing, cash), and most effective physical distribution mechanisms (how to items to households in need).
3) With respect to longer-term development support, key areas of investment that strengthen local adaptive capacity in disasters include:
    a) Support for formation and capacity building for community-based herder organizations (herder groups and PUGS) and programs aimed at improved livestock and pasture management. To succeed, these organizations require initial structured support and ongoing technical assistance and capacity building, as well as capital to implement projects available through programs like SLP. It is also critical that donors with similar interests coordinate their capacity building efforts.
    b) Support for improved hay production, harvest and storage technology, using technology appropriate for local environments.
    c) Support initiatives that enhance food security through training in home gardening and small-scale market gardening at local levels so that human food sources are diversified, nutrition improved, and winter-hardy produce can be stored for consumption over the winter (e.g. potatoes, carrots, cabbage, etc.)
    d) Support for livestock insurance, community-based revolving loan programs, and grassroots initiatives to diversify local economies that build on local environmental and community assets in a sustainable way.
    e) To help herders meet their goals of improving livestock quality rather than quantity, invest in mechanisms that improve herders' information about and access to markets, and their ability to increase the value of livestock products through domain of origin marketing, fair trade, and value-added processing.

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