LEVERAGING TRADITION AND SCIENCE IN DISASTER RISK REDUCTION IN MONGOLIA -2 (**LTS2**)

ABUNDANT EXPERIENCES OF OVERCOMING DZUD HARDSHIPS

(Best practices of herders overcoming dzud disaster)

Ulaanbaatar
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List of Abbreviations

Aimag – Province

Bagh – township

DWC – disaster warning station

FAO – Food and Agriculture Organization of the United Nations

LEGS – Livestock Emergency Guidelines and Standards

LEWS – Livestock Early Warning System

LTS – Leveraging Tradition and Science project

MNT – Mongolian tugrug

NEMA – National Emergency Management Agency

NGO – non-governmental organization

OIE – World Organization for Animal Health

Soum – County

UB – Ulaanbaatar

UNDP – United Nations Development Program

USAID – United States Agency for International Development

PREFACE

Dzud is a type of natural disaster, a heavy winter snowfall covering grazing land, or sudden and long-lasting time of low temperatures and intensive storms, making it impossible for livestock to graze or reach water, resulting in heavy livestock losses. In the last 70 years Mongolia has experienced 12 large-scale dzuds, with a total livestock loss of 40.1 million; over 60% died in the four dzuds since 1999.

Since 2013 Mercy Corps has run several projects, including the Livestock Early Warning System, LTS1 and LTS2, employing both traditional and scientific technologies for disaster risk reduction, and the Dzud Response Project in 15-20 provinces, with financing from USAID's Office of Foreign Disaster Assistance and the World Bank. These projects aim to lower disaster risks for rural herders by improving local disaster preparedness planning and risk assessment, improving access to weather forecasts and early warnings of drought and dzud through advanced information technology.

Mongolia's traditional nomadic animal husbandry has abundant experience and practice in combatting natural disasters such as drought and dzud, lowering losses by using a thorough knowledge of conditions, intensive animal husbandry, and preventive, preparatory and early detection measures. Herders who have had fewer losses in drought and dzud say they account for this by their experience in weather self-prediction, better assessment of potential threat, *otor* (transhumance) movement to better pasture, culling weaker animals for the market prior to disaster, preparing hay, fodder and warm shelters, keeping animal shelters warm with manure bedding, keeping reserves of fodder and feed during a disaster period, better care for weak animals, handmade feeding, and preparing and ensuring adequate water with underground aquifers. However, such disaster preparedness plans and traditional weather lore are seldom kept in written form, so young inexperienced herders find it difficult to exploit such methods.

Under Mercy Corps' LTS 2 project, financed by USAID's Office of Foreign Disaster Assistance, promoting both traditional and scientific technologies for disaster risk reduction, publications such as the Livestock Emergency Guidelines and Standards (LEGS) and Abundant Experience Overcoming Dzud Hardships have been published and distributed to herders, citizens and policy makers in 69 soums, contributing significantly to building herder capacity to overcome dzud disaster.

The previous handbook compiled 72 best practices of 115 herders in 10 provinces; the updated version offers over 250 traditional ways of predicting natural disasters such as drought, dzud, storm and extreme cold, proven by thousands of years of tradition. Feedback shows that the project's handbook has been in high demand, especially for the local administration and herders. In an official letter, Bayanhongor province Governor D. Jargalsaikhan says, "I have read the book thoroughly and find it useful for herders in overcoming dzud disaster with the least possible loss; I ask you to print another 5000 copies for distribution to all our province herders." Suhbaatar province herder G. Gantulga (Baruun-Urt soum's 8th bagh) says, "I read in the book about putting flags above winter shelters during a snowstorm. So I put 5 jute bran bag flags over my shelter, and found that the yard's snow level was a quarter of the snow level outside the yard; so the experience shared in the book was really noteworthy." The handbook offers proven ways coupled with traditional methods. We hope that the best practice it contains will help teach young herders and those apprenticed to experienced herders and will be incorporated in local dzud disaster response programs.

Let the millennia of wisdom and traditions of Mongolian herders expand and continue to contribute.

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DEFINITION OF DZUD

Dzud is a severe natural disaster when pastures are covered with thick layers of snow which leaves animals unable to graze, or extreme cold temperatures with or without snow stay for a prolonged period of time, or snow storms last over extended periods of time, thus weakening animals and causing them to die in large numbers.

Poor herder management, lack of warm animal shed, fodder and water shortages lead to livestock loss during the dzud. Dzud also affects herders' livelihoods and food safety. There are few types of dzud such as black dzud, white dzud, stormy dzud, cold dzud and combined dzud.

Black dzud happens when animals suffer from extreme cold temperatures without snow, they get thirstry and weak while moving to water sources.

White dzud happens when huge amount of snow covers pastureland and it becomes inaccessible to graze. Snow depth is different in mountaintous, steppe and desert areas. Pasture's accessiblity depends on its forage growth. If forage grows well in summer, animals can access it during winter even with 10-15 cm snowfall. If summer was dry, even small amount of snowfall could easily turn into white dzud. In general, 12-15 cm snowfall in mountainous area, 8-10 cm in steppe and 5-6 cm snowfall in deserts can seriously reduce access to pastures.

Stormy dzud happens when strong snow blizzards take place and make pastures inaccessible for livestock and causes them to starve and freeze to death. When stormy dzud combines with white and cold dzuds, it creates a thick layer of ice and situation deteriorates.

Cold dzud is a situation when temperature drops 10 degrees below the coldest temperature during average winter. This extreme cold causes livestock to freeze to death. If cold lasts 10 days in mountainous area, 7 days in steppe area and 5 days in desert, weakened livestock start to die.

Combined dzud means that white and cold dzud or white and stormy dzuds happen at the same time. For example, during winter of 1952-1953 the temperature stayed below -30 C for 18-25 days which caused the cold dzud. During winter of 1967-1968 snow fell with 50 cm depth in some areas and temperatures at -30 C remained for 20-50 days which caused dzud.

IMPACT OF DZUD AND WAYS TO COMBAT IT

During the last 70 years, Mongolia experienced 12 major dzuds. The number of animals died as a result of all 12 dzuds combined equals number of animals Mongolia has today. The table below shows that dzuds before 1950 and after 1999 killed more animals than other dzuds and respectively affected herder livelihoods. Before 1950, herders suffered from lack of warm animal shelters and animal feed. After 1999, state collectives were disbanded, animal feed was in shortage, and government funding to raise livestock stopped.

Table 1. List of dzuds that happened in last 70 years and its impact

Dzud affected years	# of livestock losses in dzud /million/	Percentage of losses in the total livestock.
1944-1945	8.1	33.2

1954-1955	1.9	8.2
1956-1957	1.5	6.2
1967-1968	2.7	11.9
1976-1977	2.0	8.9
1986-1987	0.8	3.6
1993	1.6	6.4
1996-1997	0.6	2.1
1999-2000	3.5	11.6
2000-2001	4.8	18.5
2001-2002	2.9	12.2
2009-2010	9.7	22.2

Source: Report from NEMA

Livestock is the main source of income for rural citizens. Sudden and substantial decline in herder incomes severely affects herder livelihoods. Herders' health and nutrition deteriorates, they slide into depression and in some instances commit suicide. For instance, Uvurhangai province lost 26% of the total livestock during dzud in 2000, and 44% in 2010. 3500-4000 herder households were affected and 1600-1800 herder households lost all their livestock. In 2010, there were 4-5 instances of suicides committed by herders.

Negative impact from dzud can affect herders long after disaster takes place. For example, after several months since dzud, herders suffer from income drops, experience shortage of food, their health deteriorates, and children drop out of schools. These problems affect local economy, supply of meat and dairy products dwindle, and as a result, it leads to higher prices and currency depreciation on macroeconomic level.

Dzud is a slow developing disaster whose impact is possible to reduce. Main consequencies of dzud include mass starvation of animals due to lack of feed, freezing to death, suffering from thirst. So herders can reduce dzud impact by moving away from dzud

affected area, selling their livestock and buying feed, preparing sufficient quantity of hay and fodder, building warm barns, and diversifying their business by growing crops and producing animal fodder.

Threat of dzud must be assessed and necessary measures must be planned and executed. Necessary measures include relocating herders and their livestock to other places, providing urgent medical and veterinary assistance, distributing food, warm clothing, fuel and animal feed to to dzud affected area.

BEST PRACTICE/EXPERIENCE IN OVERCOMING DZUD DISASTER...

I. Reducing livestock quantity

During long-lasting disaster situations such as drought and dzud, livestock often suffer from lack of feed, forage and water, and do not gain adequate weight; this affects livestock market value. When such disaster is forecast, selling animals at the market offers several advantages: herders will have adequate resources and food to manage the remaining herd. Reducing the quantity of livestock converts livestock that may well die in the dzud into cash and marketable meat. In this way, herders will have more fodder and water for the remaining herd so that they have sufficient resources to sustain their livestock through the hardship.

The overall work of livestock quantity reduction may be considered in three main categories: (a) sale of animals on the market; (b) livestock slaughtering and meat marketing; and (c) culling animals.

Selling animals on a potential market

This measure may cover the times that the livestock marketing season opens and closes, or until sales stop due to oversupply. However, the potential market for livestock may deteriorate or decrease for a number of reasons, such as low demand, low animal weight, supply difficulty, excessive supply and herder reluctance to sell. Selling animals on the potential market has many advantages: ensuring a cash supply to dzud-hit area residents; establishing a long-term relationship between herders and livestock sellers; making a positive impact on herder income; and minimizing potential disaster loss by ensuring efficient and low-cost solutions.

Livestock slaughtering and meat marketing

This is often organized not by individual trades, but through local government and non-government organizations and donors. In most cases, this is appropriate when the potential for local market livestock sales is limited. In this case, government and aid agencies may buy livestock which has not sold well on the local market, and organize for them to be slaughtered them for food reserves and distribution to people in disaster-hit areas.

Fresh meat may be directly distributed to a local community as food relief aid. In some cases, such direct distribution is impossible, so various preservation methods are used, such as salting, drying and heating, so distribution can take place over a longer period. As opposed to direct livestock market sales, slaughtering meat for sale may be cost-prohibitive, as it involves buying livestock, distributing the meat, skin and hide processing and wages for workers. Slaughtering and selling gives a market for affected people to sell their meat, gives access to food aid, offers work at slaughter houses and processing factories for increased income, and develops skills.

Culling animals

During a disaster, some animals fail to meet food supply requirements because of excess weight loss or disease, and they are culled on the advice of public health and veterinary agencies. Culling is sometimes done during an outbreak of infectious livestock disease that may have a significant negative impact on the economy and on public health.

Reducing size of herd and preparing animal feed

As soon as signs of dzud become clearer, experienced herders go on *Otor* and fatten their animals. Then in autumn, they sell animals, choose only strong and healthy females to mate, and buy hay and fodder.

Benefits of camels

Camels are animals perfectly adapted to harsh environment they live in. Camels can use stored fat to survive long periods without external surce of food and water. While dzuds that took place during the last 70 years killed 10-40% of all animals on average, only 4% of camels died.

This is a story about a rich herder from Bulgan soum, Hovd province: One day this man decided to help poor people. He started selling his animals at lower prices or gave away some of his animals for free. In return, he asked the poor people to give him fat of slaughtered animals. This man also swapped his animals for camels. By October, he managed to get rid of his entire herd and kept only camels. Winter of that year was extremely cold with lots of snow. Then rich herder survived that winter feeding his camels tall bushes and branches of aspen trees that were not covered by snow. In spring, mouths of camels eating trees and bushes get hurt and swell. Then the herder applied the fat he received from poor people and cured his camels. He had no losses that winter. In spring, the man swapped his camels for other animals. As a result, he had more animals than before. This story proves that one way to withstand dzud is to raise strong and durable animals in a herd.

How a herder survived dzud with cash and good quality animals

Herder Tavkhaikhuu from Uguumur bag, Khankhongor soum, Umnugobi province, faced a difficult situation. It was clear that his herd (except camels) was unable to survive a cold winter of 2009-2010. There were no pastures in neighborhood to perform *Otor*. The chances of fattening and keeping all his animals alive by doing a long distance *Otor* to other provinces were very low. So Tavkhaikhuu, after a careful calculation of all risks, sold 85% of his herd except camels. He kept 20 female goats and 50 male sheep.

In autumn of 2009, Tavkhaikhuu sold 200 head of sheep and 280

goats for MNT 22 million. He spent MNT 3 million to buy additional hay and fodder. He didn't lose any of his 100 camels. The local herders lost on average up to 50% of their livestock. They also spent a lot of money on fuel, animal feed and rent of winter camps. Compared to them, Tavkhaikhuu suffered no losses and converted his animals into cash. His camels ensured his income didn't decline and few good quality animals he kept served as a foundation of his future herd.

Feeding livestock with soup made from internal organs

During dzud of 2009-2010, Batsaikhan, a governor of Khuren Gol bagh, Tugrug soum, Gobi-Altai province, organized a discussion among local citizens about dzud. It was decided by the citizens to slaughter and sell weak animals. Internal organs would be used to make soup and feed other animals. Animal excreta would be used to make fodder. This way the local herders suffered much lower losses and successfully overcame dzud.

Selling livestock during a dzud disaster

In 2009, most soums in the north of Zavhan province had heavy snowfalls, resulting in dzud conditions in the area. As a result, livestock began to lose weight because of the difficult grazing conditions and livestock sales potential deteriorated. In response to the emergency, the Tesyn Gol LLC organized a small ruminant meat export, with support from the Zavhan Province Governor's Administration. Two hundred thousand small ruminants from the dzud hit area were slaughtered and the meat exported to the neighboring Tuva Republic (Russia). This organized export greatly reduced the herders' potential losses, increasing their cash supply so that they could buy fodder and reduce dzud risks.

II. Supporting veterinary service

The effective delivery of veterinary services to dzud-prone areas helps protect the herds of herders affected by dzud and helps to ensure their recovery from hardships. During an emergency period of drought or dzud, pasture forage degrades and deteriorates, resulting in low animal weight and low resistance to livestock disease. Disasters such as flood and landslide overturn the soil, which in turn increases the risk of outbreaks of infectious diseases such as anthrax, blackleg and botulism. Other communicable diseases may also spread due to livestock and population movement. When livestock is moved to a new area, they often get sick as they have low immunity to common local infections and are unaccustomed to the local pasture conditions. Livestock concentration, water points and transit areas for animals on the move (transhumance) increase the risks of a zoonotic disease outbreak, so veterinary service delivery is a vital prerequisite.

Veterinary services available during an emergency period may be (a) clinical veterinary service or (b) government-run veterinary service.

Clinical veterinary service

An emergency clinical veterinary service offers livestock treatment and vaccination. Clinical veterinary services must be provided either by private practitioners or government-run vet service providers, in some cases with the involvement of a veterinary technician.

Veterinary service for public health

A veterinary service for the public interest has an important role in the recovery stages of long and short disasters. Such veterinary services involve local government support for public health, prevention of zoonotic diseases and monitoring and surveillance of livestock disease. Veterinary public health is defined by OIE (the World Organization of Animal Health) and the FAO (UN Food and

Agriculture Organization) as “The contributions to physical, mental and social well-being of humans through an understanding and application of veterinary science.”

Healthy livestock endures dzud better

Healthy livestock is not only more productive. Healthy livestock has a better capacity to endure hard conditions and withstand natural risks. There are many successful examples of how herders overcame winter without any loss with healthy animals.

During droughts and dzuds, livestock can suffer diseases and infectious parasites and eventually die. So herding healthy animals is important to overcome dzud. In order to explain to herders the importance of healthy animals and expand their business, private veterinary service Khugjil (Development) from Ikh-Uul soum, Zavhan province, selected four herder households from four baghs in 2009-2010 and provided them with all necessary veterinary services and drugs. Some services were offered for free. As a result, these four herder households suffered only 4% of loss. This is 5-6 times less than 18-20% that soum had suffered on average. This example proves that healthy animals sustain much lower losses during cold winters. The number of local herders willing to get veterinary services increased and the vet service expanded their market.

Benefits of healthy livestock

The core of successful practice of Bayar Davjid (in Naranbulag soum, Uvs province) is great use of veterinary services such as de-worming and vaccination. That is why his animals are free from tapeworm; he advises community herders that parasite-free animals gain fat and weight quickly and have resistance to natural disaster and hardship. For instance, small ruminants are de-wormed between 25 May and 10 June, before tapeworm larvae are discharged in feces, and lambs over 6 months old are de-wormed in the fall. Herder Davjid says an adequate salt lick supply is essential to maintain

livestock weight in the cold winter. He feeds to the animals the lick salt in a variety of ways, either directly or mixed with nutrients and all-mash feed, small amounts in grazing muzzles, mixed with bran and bone powders, by pelleting or mixed in water.

Insured animals never freeze

There were 12 dzuds during the last 40 years in Bayanhongor province. Each dzud killed on average 12.8% of entire herd. Since 1993, four times dzud hit the province, and a total of 1.6 million animals died. These losses would cost approximately MNT 40-50 billion at current market rates. This money would be enough to build 30-40 schools with a 320-student capacity.

World Bank-funded "Index-based livestock insurance" pilot project started in Bayanhongor in 2005. As a result, 33% of all herders have been covered by livestock insurance since the end of 2012. During this period, 11,500 herder households covered 1.7 million head of livestock by livestock insurance. MNT 576 million was collected in the insurance fund and 4,070 households received compensation of MNT 1.1 billion.

Delgersaikhan is a herder from Galuut soum, Bayanhongor province. He insured his 800 head of livestock in 2009. The winter of 2009 was harsh. Deep snow layers covered Galuut soum and many herders lost their livestock. By the beginning of 2010, total losses accounted for 13% of all animals. Delgersaikhan worked hard to keep all his animals. He lost 30 head or 4% of his herd. According to the "Index-based livestock insurance" policy, compensation will be paid if total losses of animals of the whole soum go over 6%. Delgersaikhan was able to receive indemnity for 13% loss of his entire herd or 104 animals instead of 4%.

S. Gombo, a herder of Naranbulag soum, Uvs province, covered his 900 livestock with 100% index-based livestock insurance in 2009-

2010, when a devastating dzud hit his area. When the harsh winter arrived, the cold was coupled with heavy snow. Many other soum herder households lost livestock: the 58,300 lost head of livestock was 33.6% of all livestock in the soum. But herder Gombo took responsive action against the dzud using his full potential and had no financial dzud loss. Under index-based livestock insurance, over 6% of livestock loss for the soum triggers compensation equal to a percentage loss of livestock in the whole soum. Under this insurance, Gombo was given MNT 7,778,000 compensation. He received more in insurance compensation than any other herder in Mongolia that year. He also receives full veterinary service, including de-worming and clinical check-ups, so his livestock gain better weight to overcome disasters. He strongly advises young herders to follow his lead.

Burying animal carcasses

Dzud as drought followed by excessive snowfall hit Mongolia in consecutively years (1999-2002 and 2009-2010), each worse than the last. These disasters affected almost the whole country; total livestock deaths reached 9-12 million, which devastated herder livelihoods. To mitigate the dzud, the Government of Mongolia and international relief agencies provided aid in various forms, from supply of livestock feed to veterinary services.

After the 2010 dzud, the UNDP started to run a program to hire local citizens to bury animal carcasses in three provinces, which made up 20% of the dzud-hit area. The program was to prevent the outbreak of disease spread from the animal carcasses and to create paid work for local dzud-hit communities. The UNDP program was duplicated by the Government of Mongolia and development partners such as SDC and Mercy Corps. The burial of livestock carcasses was monitored by local veterinary agencies, and local citizens and disadvantaged groups were hired and paid without deduction or bank service fees. The program made a significant contribution to

improving their livelihoods.

III. Feed and fodder supply

During a disaster emergency period, an adequate livestock feed and fodder supply is crucial to maintain the livestock and property of a local community and to help recovery. A feed and fodder supply can be in various forms: [1] by frequent transhumance (so-called *otor* movement to find better pasture); [2] giving animals additive feed during the disaster. Feed and fodder during an emergency maintains the level of benefits and yields of a certain number of livestock so that citizens have sustainable living resources.

Otor movement

Otor movement is one of the most popular methods for herders to protect livestock from malnutrition and keep them fat and healthy. *Otor* means temporarily moving to another pasture with plenty of grass and water. Herders practice o*tor* to protect their livestock from drought and dzud and fatten up them up.

There are two types of *otor* depending on distance of the pasture where herders want to move to: short distance *otor* and long distance *otor*. Long distance *Otor*s can be organized within their province or soum, or herders might move to another province depending on availability of sufficient grass or risk of dzud and drought. Short distance *Otor*s are usually organized by herders in their neighborhood to fatten up their animals and keep their body weight intact.

Otor brings great benefits in future (proverb)

Mr. Dugerjav, a herder in Bulgan soum, Hovd province, usually travels an average of 600 km of *otor* through desert and mountains in a year. As a result, he suffers no animal loss during winter. Moving

from pasture to pasture not grazed by other livestock, helps herders to keep their herds fat and strong. Animals that stayed in one place for too long get used to this pasture and gain very little weight. So experienced herders change pastures from time to time, thus achieving a greater weight gains in a relatively short time.

Mr.Sodnom-Ish, a herder in Taragt soum, Uvurhangai province: "Mongolians say that dzud is caused by a dry summer. In 2009-2010 we had a very dry and hot summer and less rain than usual with signs of drought. This was the sign that dzud would come in winter. So we discussed it and decided to do *otor*. We started moving early spring and in May we moved to Hangai region. Our herds got fatter and in summer we didn't stay in one place for more than a week. In autumn we camped in Gobi twice which really helped us to keep our animals fat and strong.

Long distance *otor*

Before taking off for *otor*, herders should check if the pasture they will move to has sufficient water and grass resources. Also herders must pay attention to availability of winter barns, risk of animal diseases, and risk of being hit by dzud. If a herder plans to move to other provinces, he or she needs to conclude an agreement with local authorities and negotiate the number of animals to graze on that pasture.

O. Bat-Ochir and O. Otgonbaatar are sons of Oniuz, a renowned herder of Uyench soum, Hovd province. They are pioneering herders who have increased their herd to a thousand. They managed to overcome the 2009-2010 dzud with no livestock loss as a result of frequent *otor* movement to other soums and managing to maintain their livestock weight gain. Moving such distances from areas of heavy snow and low temperatures is a full expression of the old proverb, "Dzud is overcome by running from it."

Choosing the right pasture

This is a story of how herders of Delgerekh soum, Dornogobi province, chose the pasture before the white dzud of 2000. Older herders Tumen and Tsendsuren and young herders Lkhagvasuren and Sakhilga traveled to the neighboring soums Uul-Bayan and Khalzan in Suhbaatar province. They carefully analyzed the pasture, types of plants, wind direction, and how the sun sets and rises. Then the older herders predicted that this area is prone to large snowfalls and proposed to move to Munkhhaan and Bayan-Hutag soums located 150-200 km from this area. But the younger herders refused and camped in Khalzan soum. Then in winter of 2000 Khalzan soum was hit by a series of severe snowfalls which killed most of their animals. Tumen and Tsendsuren managed to overcome the winter with relatively small losses. This story illustrates the importance of experience when choosing the right pasture.

Long distance *otors* bring more benefits

Chuluunbaatar, a herder from 3rd bagh, Erdenedalai soum, Dundgobi Province, suffered few losses during white and cold dzud in 2010. He managed to keep his 700-animal herd almost intact.

Chuluunbaatar divided his herd into two parts. The strongest and fattest animals moved to Erdenesant soum, Tuv province, for the winter. The weakest animals stayed with him in warm barns and he fed them with extra fodder and hay. Also he didn't let sires mate with all females. He instead picked only strongest females and let them mate.

Observing animal behavior

Yaks have been grazing in Gobi Gurvan Saikhan mountain in Umnugobi province for a long time. Before 2009 dzud struck the province, there were 2000 yaks grazing in these mountains. Early autumn of 2009, the yaks left their grazing area and started moving to Delgerkhangai mountain of Dundgobi province, 100 km from their

native land. The owners of these yaks herded them back to Gobi Gurvan Saikhan. However, in winter of 2009-2010, herders lost almost all of their yaks. Only 200 yaks survived. This was a very good lesson to learn. Herders need to pay attention to animal behavior. If herders followed their yaks, they all would be spared.

It snowed heavily in Arhangai province between November 2009 and April 2010. Heavy snowfalls killed many animals. Herder Dorjsuren from Ikhtamir soum, owner of the Best Herder award, was able to save all of his 1000 yaks by watching their behavior closely. Dorjsuren: "it takes a lot of hard work to raise thousand yaks. Yaks have one strength. Yaks are perfectly fit for grazing in forests, and mountains. In other words, if yaks graze in environment they are adapted to, they can survive any dzud. I followed my herd and we survived winter without any loss. Yaks grazing on high mountains look much healthier and stronger. It is because yaks feel comfortable in these pastures. We have to find pastures where yaks would feel comfortable. Also, leaving animal sheds too early, coming back too late would exhaust animals. Forcing animals travel long distances is not good for their health. In order to prevent animal losses, a herder must carefully analyse his herd, pick weaker animals for food or sale. This would be a foundation to raise healthy and strong herd and avoid risks"

Experiences of a Merited Herder who understands goat language

Herder Puntsag (Tugrug soum, Uvurkhhangai province) is a Merited Herder of Mongolia, and has accumulated over 60 years of herding skills and experience in raising goats, and has a proven record of overcoming many dzud disasters with no loss of animals. Goats mainly graze rich forage areas, eat the upper part of plants and pasture flowers. To gain weight, goats need pasture with soft soil, natural salt and nutritious plants for extended periods with little movement. An adult goat discharges 35-40 round dung droplets daily while a two-year old goat drops 25-30, when feed and forage is

suitable. If the pasture suits the herd, goat hair gets curly, their necks look shorter, and they lie on the ground with all four legs spread. Puntsag grazes the goats after watering, especially encouraging 8-14 chews of feed. As goats are not very cold-resistant, they start feeling cold from their legs upwards. Goats without horns scratch their body with their head, which removes and shaves the cashmere. White goats are particularly non-resistant to the cold, while dark colored goats get sunburn quickly in summer. Goats from same female animals tend to graze together. At the end of fall and early winter, keeping the goats in fences and shelters makes them even less able to tolerate cold and they lose weight, so it is better to keep them outside until the end of the first month of winter. When goats feel cold, they tend to run into the fence, so they should be kept in a wide area inside the fence. After snowfall, clear 100-200 m of space inside the fence, so the goats do not get cold legs. It is better if goats are grazed when there is no sun, but in a severe frost, graze in sunlight. When it is windy, graze first towards the wind, then slowly turn against the wind. In winter, first give a good amount of lick salt, then graze. Grazing goats without clearing frost and snow makes them uncomfortable; they look for a warm place rather than eating grass. If the herd is reluctant to graze in the morning, don't rush them, wait for a while. Once they have gained weight and have a good supply of salt, goats don't eat the *ger* covering as some people complain. If goats do this, it means they are complaining to the herder. Unlike sheep, goats are intolerant of cold and require more care, comfortable shelter and fencing.

Pasture negotiations

In order to help local herders escape from drought and dzud in 2000 and 2001, and move to neighbouring Galshar and Bayankhutag soums of Hentii province, and Munkhkhaan soum of Suhbaatar province, the Governor's Office and Citizens Khural of Delgerekh soum, Dornogobi province, implemented the following actions:

i. Organized herder households and their animals into proper

structure fit for moving

ii. Concluded agreements with herders moving on *otor*. Researched availability and capacity of pasture and water resources
iii. Negotiated and agreed on pasture area boundaries, use of winter and spring camps, number of migrating households, duration of stay, and provision of veterinary and human health services
iv. Agreed that coming herders would take care of pasture and water resources, disinfect and eliminate all human and animal waste

The governor's office assisted other herders staying in other provinces for winter. Cases of stealing animals and material property frequently took place at that time.

Engaging local citizens to protect pasture

Every year local governments in Bayanhongor, Hovd and other provinces and soums take winter and spring pastures under protection and don't let any herds graze on them between June and October. Local authorities listen to herders before making any decisions regarding winter and spring pastures. Herders who have little manpower are assisted by other herders to move out. Thus, winter and spring pastures get a long awaited respite and recover from grazing before next winter. Local herders make sure that everyone leaves these pastures and doesn't return before the agreed time.

Fenced pasture protects from dzud

Herders from Bayanhongor, Gobi-Altai, Dundgobi, Uvurhangai, Suhbaatar and other provinces located in steppe zone with scarce pastures identify areas with good grass and water resources and fence them. These fenced areas are later used to prepare hay and livestock stays inside this protected area during snow and sand storms.

For instance, herder Talgat from Tsengel soum, Bayan-Ulgii province, Kebeihan from Altai soum, Bayan-Ulgii province, and Chuluunbaatar from Bayandelger soum, Suhbaatar province, fenced 4-5 hectares of pastureland and planted perennial and other fodder plants. Later they were able to harvest around 40-60 tons of hay each.

Herder Lkhamkhuu from Ulziit soum, Bayanhongor province, has started fencing some pastures along Shargaljuut River since 1971 because he noticed degradation of pasture. At that time, it was difficult to find proper materials for building fences. So the herder collected some metal scrap and waste wires between Shargaljuut resort and the provincial center. He also traveled to Bayan-Ovoo soum and brought back metal wires from the old abandoned haymaking area. By 2000 he managed to fence 24 ha of land and each year harvests over 40 tons of hay. A small river flows through his fenced land and he is able to irrigate his land and water his animals. Besides that a family of marmots dug their hole in there. Lkahmkhuu basically switched to settled farming. He divided his fenced land into grazing and haymaking parts. He also divided animal shelters into sections for pregnant animals, barren animals and newborn babies. As result, Lkhamkhuu was able to survive two dzuds (in 2000-2001 and 2009-2010) with relatively few losses.

Cleaning pasture of snow by horse grazing

During some types of dzud, snow thaws quickly and re-freezes into ice cover, which prevents small ruminants from grazing. It is often not possible to remove the ice with an ice breaking device or by hand. In 2008, when the pasture was covered with 3 cm of ice, J. Batbayar, a herder of Davst soum, Uvs province, first grazed horses and large ruminants on the pasture to break the ice and make pasture available to small ruminants and breeding animals. Other ways included feeding weak animals inside a fence, putting socks on the livestock, providing warm drinking water, applying oil and soothing

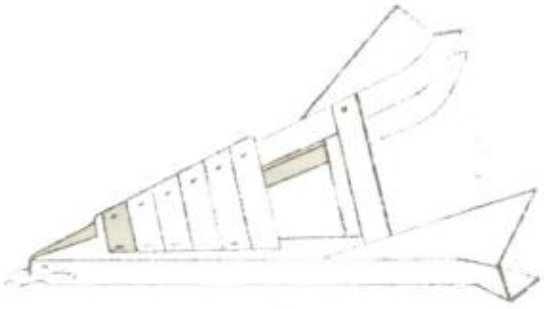
salves to animal legs, feeding mothers and offspring separately, distilling alfalfa for feed, and more frequently cleaning of fence and ice. As a result he overcame the dzud successfully.

Using icebreakers

When snowstorms hit and covered pastures with thick layer of snow, herders Baimedekh, from Zuungobi soum, Uvs province, and herder Talgat, from Tsengel soum, Bayan-Ulgii province, successfully used ice-breakers to clear pastures from snow and help animals get to grass. Herders use camels and horses to drag ice-breakers. Camels are most convenient animals for dragging ice-breakers.

During white dzud, ice-breakers should be used on pastures free of bushes, rocks and stones. If you plan to ride camels to clear a pasture, use ice-breakers made of wooden planks of certain size: 1.5-2 m wide, 40-60 cm high, 5-7 cm thick and 2 m long. Two pieces of 50-60 cm high planks are connected with each other at 45-60 degree angle. Two sides of planks are firmly fastened 150 cm planks. Depending on depth and density of snow, ice-breakers should carry 20-30 kg of weight.

Picture 1. Ice-breaker



Цас хагалагч

Preparing hay

Dzud comes gradually, so herders have to be prepared in advance. Good preparation helps to survive dzud with low losses. During dzud, livestock die in large numbers due to malnutrition, starvation, thirst and extremely cold temperature. Dzud seriously affects herders' livelihood, increases poverty and reduces production of meat and milk.

During good summer and autumn with plenty of grass and water Mongolian livestock are capable of gaining 40-50% of weight. However, during hard winters, animals can lose 15-30% of their body weight. Animals fail to get enough feed during droughts and dzuds and can die in large numbers.

Inability to prepare sufficient quantities of animal feed in advance caused herders to lose 22.2% of the entire herd: 8.1 million animals died in 1944-1945 and 9.7 million in 2009-2010. In 1986-1987 when a similar dzud hit Mongolia, herders lost 0.8 million or 3.6% of entire livestock. The main factor for such low losses was a good preparation, availability of sufficient reserves of animal feed and warm animal shelters.

Using own resources to build ten days fodder reserves

Herder Kebeikhan from Altai soum, Bayan-Ulgii province, faced dzud and other natural calamities nine times between 2000 and 2010. Other herders lost on average 10-20% of their livestock, but Kebeikhan had almost no losses. He attributes his success to good preparation and storage of hay and fodder. Kebeikhan irrigated 35 ha of land and improved the soil by animal manure. He now harvests about 35-48 tons of hayand and makes 25 tons of fodder each year. He built and insulated an animal shelter large enough to fit all five types of animals. Kebeikhan can keep his herd in the shelter with enough feed for 15-20 days during snow and sand storms and other

disasters.

One bale of hay from each citizen with income

Since 2008 the government of Gobi-Sumber province and soums has asked employees from government, non-government and private organizations to donate one bale of hay each to herders. Basically all citizens who earn income had to participate in this action. About 1,000 citizens who had jobs in Gobi-Sumber province donated either a bale or transferred money (4500 MNT per bale). Some organizations mobilized their employees and went out to prepare hay. Money donated by citizens is collected at soum Livestock Protection Fund account. Each soum fund has stock worth about MNT 10 million. And MNT 2.5-3 million is contributed by local citizens.

Gobi-Sumber province used to distribute hay and fodder from the national and provincial reserves in face of dzud. Now the province uses soum funds to help herders if weather conditions slightly deteriorate. The hay and fodder is distributed from the soum fund with discount. In case of serious weather conditions, the soum authorities might distribute it free of charge. This system helped Gobi-Sumber province to get through the past several winters relatively unaffected.

Grow fodder plants in desert

Herder Valya from Bulgan soum, Umnugobi province, placed 200 liter barrel under the ground in Khavtsgait valley of Gurvan Saikhan mountain range and collected water from the small river flowing nearby. Then the water was supplied through plastic pipes to the 10 ha of flat area located 5 km from the barrel. There Valya planted 50 thousand trees to protect from desertification and sand movement. He also planted perennial plants around the trees and allocated four hectares of land to grow alfalfa and other fodder plants. The herder manages to produce about 40-50 tons of grass every year and keeps

them in two hay storage facilities to use later in dzud. Also, Valya uses perennial plants and fallen tree leaves to produce animal fodder. He grows vegetables on one hectare of land to diversify his business. Valya's story shows that if you have a plan and commitment, you can irrigate 15 hectares of land, build a green wall and protect your livestock from natural risks

Use available materials to prepare fodder

Herders Erdenebat from Khotont soum, Arhangai province, Chuluunbaatar from Erdenedalai soum, Dundgobi, Sodnom-Ish from Taragt soum, Uvurhangai, Talgat from Tsengel soum, Bayan-Ulgii and Batsaikhan from Tugrug soum, Gobi-Altai, used available materials to prepare fodder and successfully get through harsh winter: ramson, wild leek, dirty horse dung, horse liver, fat, and oil, livestock excreta, livestock blood, garlic, nettle, and millet.

Picture 2. Fodder ingredients



Silage out of ramson and wild leek

Ramson and wild leek are very rich in protein, vitamins and minerals. These plants are widely used to feed weak animals. Herders usually pick ramson and wild leek in July and August during blooming season and store them in plastic containers, cans, intestines, or leather bags. Then, these containers are piled up in a hole, salted and tightly compressed.

Wild leek silage can have a better quality and taste if you add not only salt but also whey. 200-300 grams of wild leek silage fed to

weak animals once or twice a day would be enough to help them recover.

Horse dung

Horse dung produced in autumn fails to decompose completely and keeps most of its nutrients, so herders collect horse dung to produce fodder. Autumn dung can be used solely for animal feed or it could be mixed with onion plants and salt and fed to animals during winter and spring.

Horse liver and fat

Herders collect healthy horse liver after slaughtering and dry or freeze it. Liver is rich in protein, vitamins and carbohydrates, which makes it excellent fodder for weak or baby animals. Liver can be thinly sliced and partially cooked, or chopped in cubes and fried. Also, liver could be mixed with tea leaves, strong black tea, and meat soup. Horse fat with bran or grass powder can easily help weak animals recover.

Animal excreta

Animal excreta is waste material that hasn't left the body yet. Animal excreta could be one of the best feeds because it still contains semi-processed protein. Nutritious value of one kilogram of dried excreta equals 306 grams of protein. During slaughtering season, animal excreta is collected and stored in 200 liter containers thouroghly mixed with other materials in the following proportion: excreta (70%), bran (10%), salt (10%), and blood (10%). The finished mix must be frozen and stored in piles. During dzud adult animals should be given 500 grams of the mix each day and newborn animals should receive 120 grams each day.

Animal blood

100 grams of salt should be added to 10 kilograms of animal blood collected during slaughtering, then dried. During emergency

situation, sheep and goats should be fed 50 grams of the mix and large animals like cows, camels and horses should receive 100 grams.

Nettle

Nettle has high content of protein and can be used to feed livestock. Nettle can be harvested when it's green, dried and stored away. Animals suffering from malnutrition can use nettle as feed. Taivan, a herder of Tusgalt bagh, Bulgan soum, Arhangai province, harvested nettles from his summer site and prepared ensilage by mixing it with lick salt, salt and onion in a large silo. When the weather worsened and animals started losing weight and energy, he fed his animals with a cup of distilled feed every morning and evening. This increases body temperature; it makes animals more tolerant of cold, and helps small weak ruminants to recover more quickly. He also sliced horse liver thinly and mixed in salt to feed animals in the morning. He managed to protect his livestock during the dzud.

Millet

In some places, herders mix 500 grams of horse fat with the same amount of bone ash, add 50 grams of salt and 450 grams of millet. The resulting mix can be fed to animals. Also, 2 kilograms of millet is added to 10 liters of milk and cooked over a slow fire. Then it is dried and used as a dried milk.

Salt helps to gain and keep weight

Herder Dambajantsan from Khankhongor soum, Umnugobi province, always adds salt in trough when watering animals during winter and spring. Salt helps animals to stay warm and keep their weight. Even during summer and autumn, salt helps animals quickly gain weight. Herders move to Gobi pastures with lots of salty soil to help animals get fat quickly. Salt enters animal body, mixes with water and creates carbon dioxide. Carbon dioxide is proven to improve digestion.

Byambasuren, a herder of Bijir bagh, Bayantes soum, Zavkan province, first ensures that his livestock gain fat and weight, and then grazes his animals separately during winter. He puts young animals in a close warm pasture, older male animals in a more distant pasture and dams nearby by giving additive feed. To maintain weight, he makes sure lick salt and salt are available all the time inside the fence. One old proverb says, "Salt adds weight and limits loss." Byambasuren says, "When there is heavy snowfall, we use the snow breaker a lot, towed by a car, because we get lots of snow and frequent dzud conditions. We sometimes use a horse or a camel to pull the ice breaker, and manually clean the snow from higher elevation areas for the small ruminants and young animals."

Use of garlic reduces risks

In 2009-2010, dzud hit Dundgobi province and many herders lost their livestock. Bayantsgaan Herders' Association NGO, in partnership with local TV station "Cheerful World," organized a campaign to help dzud affected herders. The organizers didn't ask only for warm clothes, animal vest, candles and matches. They also asked local citizens to donate garlic. In a short period of time, the NGO was able to collect 50 kilograms of garlic and distributed it to over 20 households in Adaatsag, Luus, Erdenedalai and Saintsagaan, most severely affected by dzud.

Garlic helps animals recover their strength and increase their weight. Weak animals should be fed one piece of garlic twice a day: in the morning and evening. The Herders'Association and the TV station promoted benefits of using garlic around the province. According to Buuveibaatar, head of the NGO, promotion and donation of garlic contributed to reduction of animal loss in the dzud.

Using Zagasgal or "Salimon" to tend animals

Zagasgal is a local name of Salsola Laricifolia. This is a red and grey

subshrub, 50-60 cm tall. This plant grows widely in Gobi. The plant helps to strengthen immune system of humans and animals and contains biological substances that supposedly make humans younger. This plant is widely used in pharmaceutical industry to produce immune recovery products: Salimon drug, Enkhjin and Munkhjin teas. Salimon is an alcoholic extraction of zagasgal, whereas Enkhjin tea is a powdered zagasgal packaged into small bags.

There are numerous stories of how Gobi herders fed zagasgal to their animals and survived harsh winter. Tserenpil from Khankhongor soum and Luvsandorj from Manlai soum used zagasgal to feed and nurse weak animals. Three kilograms of dried and powdered zagasgal is mixed with 10 liters of water and boiled. After the tea gets black-green, add 20 liters of water and it's ready for feeding to animals. Big animals (cows, horses, camels) receive two liters of tea, small animals receive one liter a day. Weak animals get stronger and are able to survive cold winter. (Basically, 500 grams of zagasgal would be enough to mix with 10 liters of water.)

If a doe doesn't have milk to feed her kid, zagasgal tea mixed with millet and bolied can be fed to does. This mix helps female goats to quickly regain milk in 3-4 days.

Distilling bran to feed animals

Bakhitbek, a herder of Ulaankhus soum, Bayan-Ulgii province, uses distilled bran to feed his weak animals and those with low colostrum. To distill the bran, he puts pellets and bran in a 10-liter bucket, adds a tablespoon of yeast and then pours in warm water. The container is kept in a warm place, about 50 cm - 1 m from the stove, for 2-3 days. To ensure air exchange, the lid has a small hole, and the solution is stirred 2-3 times a day through the lid hole. The distilled feed is ready in three days. After stirring well, add water (0.5 liters) and feed to the animals. This type of feed adds energy quickly and improves

lactation. It can also be an additive feed for offspring. Bran and pelleted feed or beer grain can be fed to small ruminants (one cup every morning) and helps maintain warmth and body weight, some herders say.

Meat soups

Chuluunbaatar, from Erdenedalai soum, Dundgobi province, and other herders practice feeding to weak animals soup made from horse meat or meat of dead animals. Horse meat soup is cooled down and fed to animals: big animals get half a liter of soup, small animals get 300 grams of soup. Or the soup can be mixed with bran and other fodder and given to animals. Meat of animals that died of non-infectious diseases can be thoroughly cooked. The resulting soup is mixed with fodder and fed to animals. The cooked meat is dried and frozen. It is added in small amounts to animal feed and makes it more nutritious and rich in protein. 10 kilograms of overcooked meat is mixed with 4 kilograms of barley, 3 kilograms of millet, 2 kilograms of bran and 1 kilogram of salt and cooked. Then this mix is frozen and cut into small pieces. Feeding 200 grams of this product to animals each day will be a great supplement.

Feeding animals on cardboard boxes

During a cold winter, ruminants often lose weight because of lack of feed and rumination matter. Some herders say that if cattle deteriorate from lack of feed, there is no need to support it because it will likely die, but one citizen in Dalanzadgad soum, Umnugobi province, fed cattle over winter on cardboard boxes and vegetable remains. He removed all staples from the cardboard before feeding, and says that the cardboard gives sufficient nutrition and fills the stomach.

Feeding animals using muzzles

Sanj, a herder of Sevrei soum, Umnugobi province, initiated a method of feeding animals which wore muzzles. This, he said,

ensured equal distribution of feed to all animals and made sure the dosage was stable, as well as reducing feed loss. The feeding muzzle should be about 15 cm wide and 20 cm long, with a strap on each end. Feed for the animal is put into the muzzle, which is then tied to the animal's mouth. For an average herder household, 50-60 muzzles should be enough to feed the herd.

IV. Improving fences, shelters and farmstead conditions

During a drought and dzud emergency situation, one important way to keep animals comfortable is to ensure warm fenced shelters. In a dzud, animals get cold from lying on cold manure, so the manure and lying place must be warm.

Better warm shelters than half a food

"Better warm shelters than half the food" is a phrase that herders have been saying since ancient times. It means warm shelters play a very important role in getting through difficult season with minimal losses. In cold season livestock spends about two third of whole time in warm barns. Warm barns not only protect animals from cold wind and snow; they help them to stay healthy, keep their weight, and ensure safe birthing processes. Animals from warm barns drop 20-25% less weight than animals who spend winter in open pasture. It takes 40% more animal feed for animals without warm shelter. Spending winter in warm and comfortable barns and sheds is as important as having good quality animal feed.

Frost can penetrate even through small holes

Herder Erdenebat from Khotont soum, Arhangai province, started traditional preparation for 2009-2010 winter. First he dried compressed dung inside of his winter camp. Then he collected all manure and stored it away. He covered all spaces and holes in his fence with available materials: cattle droppings, clay, plastic bags.

He also made windows that could be open and closed. Synthetic materials used for insulating fences, walls and windows keep heat, and protect from rain, snow and frost. In 2009-2010 dzud hit hard and many herders with poorly insulated sheds and barns lost their animals. Erdenebat managed to reduce his losses by 80-90%. During extreme cold, animal shelters without insulation and doors freeze and make animals uncomfortable. They refuse to lie down and stay on their feet all the time. Eventually they start to drop their weight and risk dying. Even smallest holes can let the cold in, so it is recommended to check your animal shelters in summer and autumn and patch all holes well in advance. To check if there are holes, one can hold a candle and by wind blows identify spaces and holes.

Drying dung by bio-thermal method

Altai Tavan Bogd mountains in Bayan-Ulgii province are the highest mountains in Mongolia. Local herders who spent a winter there in 2010 experienced extreme difficulties. Large snowfalls and cold temperatures prevented them from grazing their livestock outside of their shelters for a week. These incidents happened regularly. Herder Talgat from Tsengel soum had prepared well for the winter. He stored enough hay and fodder and insulated his animal shelter. He always remembers the phrase “Better warm shelters than half a food.” Talgat is experienced in processing dung by bio-thermal methodology.

Dung is dried using the following method. Animal manure and grass is piled up in several layers on area 2.5 m wide and 8-10 m long. The first layer is 25 cm thick and consists of thick dried grass. The next layer is 2 m thick and consists of animal manure. This pile must be sufficiently moisted. If moisture is not enough, spray water over to reach 40% level of moisture. Then, this pile is covered with 10 cm of thick grass and straws. And finally, wet manure is used to cement this pile. Temperature inside the pile will gradually go up to 50-70° C and kill all bacteria and insects. It will take at least 1.5-2 months

before it dries out completely and gets ready to be used in animal shelters.

Herder Talgat has four fully insulated and protected animal sheds with bio-thermal dung for animals. With sufficient reserves of hay and fodder, and warm, insulated sheds, Talgat was able to get all this animals through 2010 winter unharmed.

Blanket (animal cloth) as a warm and moving shelter

Blankets for offspring and older animals help herders to reduce livestock loss. Blankets reduce body heat loss, save feed and act as wind and frost shield for the animals. To protect small ruminants from unfavorable external factors, warm blankets and abdomen covers are often used. Herders also use blankets with an undercover, which provides a significant increase in warmth for offspring animals. Herders use blankets extensively for offspring and yearling animals. Experiments have shown that blanketing a cashmere goat in winter reduces body weight loss and increases cashmere yield and quality. When a two-year old camel has a blanket in winter, it reduces body weight loss by as much as 80% and increases pasture use potential by 20%. The size and form of blanket may differ for each type of animal, but for a camel should be thin over the back and humps (holes for the humps) and thick on the sides so that it clings to the camel body. A blanket for a foal or calf should be thick on the back and must have a strap to tie it on securely. The front of the animal should be blanketed to stop wind to the neck.

Blanketing (goat cloth) a cashmere goat

Mercy Corps supported a project to assess the impact of blanketing cashmere goats in winter in Umnugobi province's Nomgon soum, Gobi-Altai province's Yesunbulag soum, Uvs province's Zuungobi soum and Suhbaatar province's Bayandelger soum, and to measure the impact on cashmere yield. In these pilot soums, one or two herds of cashmere goats were blanketed through the winter. The results

were compared with other herders to assess cashmere output, live weight loss and cashmere quality change.

The results were that blanketed goats lost about 2% less weight and cashmere yield was 86-92 grams more. That means that blanketing a goat would generate an extra MNT 3870-4140 revenue for a herder. The amount of waste and other particles in cashmere was found to be 5.2 times lower, showing that blanketing could have a significant impact on cashmere quality.

“Zavaal” is warm bedding for cattle

Herders of Dadal soum in Hentii province mainly herd a small number of cross-breed dairy cattle. Cross-breed dairy cows produce 15 liters of milk on average, and many visitors come to Dadal soum to purchase dairy cows. Dairy cows easily get cold and require much attention. Therefore, having warm barns and sheds is very important. Local herders use “Zavaal” to cover floor of barns. Zavaal is dried and compressed animal dung kept in a pen for a long time. Zavaal helps animals stay warm in winter.

Technology for producing zavaal is simple. Wet animal dung is stored in the pen. Each day new layers of dung is piled up. This dung dries up eventually and becomes ready to be used as warm bedding. Buryats consider warm shelters having the same value as animal feed. Each day they collect fresh dung and pile it up on zavaal. Zavaal keeps shelters warm and protects from frost and moist.

Picture 3. ZAVAAL piled in cattle shed

Herder with five gers

People think that a person with five gers must have a big family. In this case, a herder uses five gers to shelter his animals. Even local people are surprised when they hear about it.

Herder S. Mendbayar from Yesunzuil soum, Uvurhangai province: "We were camping in near Ulziit, in 2010. The summer was dry and grass didn't grow. It was clear that winter would be difficult, with dzud. Some smart herders moved away with their herd. That summer I had only one idea in my mind: how to fatten up my livestock. I moved with my herd all the time and they managed to gain some nice weight. In autumn I selected 200 old animals and sold them in UB. I used the money to buy hay and fodder. I also insulated and repaired animal barn. I selected 80 best female animals from 500 and let them mate with sires. The rest 420 females were separated from sires. Then I built five gers with five walls each.

"Starting from 20 September, regular cold snow storms hit our province. It snowed 20 times by the end of November. The snow cover was 30-40 cm deep on pastures and 80-100 cm in trenches and valleys. We haven't experienced this kind of weather for the last 30-

40 years.

“As soon as cold temperatures dropped significantly, I let the animals spend nights in gers. One ger can fit 150 small animals: sheep and goat. 17 cows would fit in one ger. They all had to stand up. Animals would stay warm leaning on each other during the night. In the morning they would go out and find some plants, grass or dung. Herders don’t practice that much. Some people even get surprised. It would be enough to have one layer of canvas cover for the ger. Felt cover would be too warm. The top of ger must be open all night. In the morning open the door for a while before letting your animals out of ger.

“For nomadic Mongols, ger is the best way to protect humans and animals from dzud, cold and snow. When we move from our winter camp to spring camp, we choose pasture with good grass and build five gers. If sudden snow storms hits, I herd all my animals into my gers.”

Picture 4. Mendbayar with 5 gers

Small flags around a shed

G. Narangerel, a herder from Kherlen soum, Hentii province, ties around his animal shed a large number of 25-50 cm size flags, if snowstorm hits his camp. The flags are made of fabric and help to

prevent a shed from freezing and keep it dry from snow. The bigger the size of flags, the better are chances to shield the shed from snow. This simple method keeps the animal shelter dry and clean and protects animals from freezing. Besides surrounding the shed with flags, it's important to tie many flags at the front door. The flags flying in the strong wind, change wind direction and don't let the snow in. This way Narangerel was able to protect his camp from snow and save all his 400 animals from dzud in 2008-2009. This method is simple but very effective.

Picture 5. Animal shed protected by flags

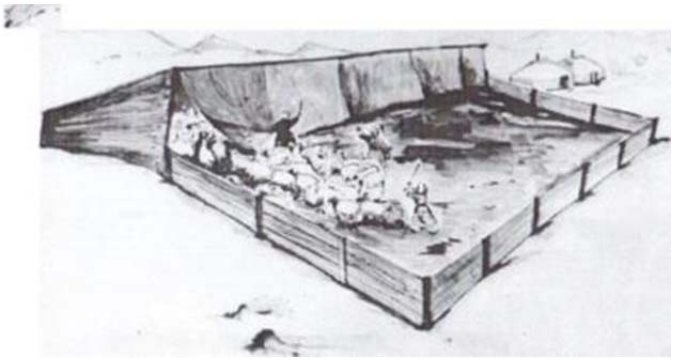
Front side protection from cold snow storm

In April 1980, strong snow storm started blowing from north-west and then suddenly changed direction and blew from south-east. This storm covered eastern and Gobi provinces and affected many herders and animals. Many animals died as well. One herder from Bayan-Adraga soum, Hentii province, hung around animal shed empty fodder bags and managed to save his animals. This story was highly publicized around Mongolia and became one of best pratices that everyone had to know.

Front side of the shed should be covered by blankets made of laminated sacks, canvas or textiles. Laces must be attached to corners of these blankets. In recent years, herders began using cheap synthetic materials with foam sewn inside. Front-side covering is getting very popular among herders. It not only protects sheds from

snow and sand storms, it also helps sheds stay warm.

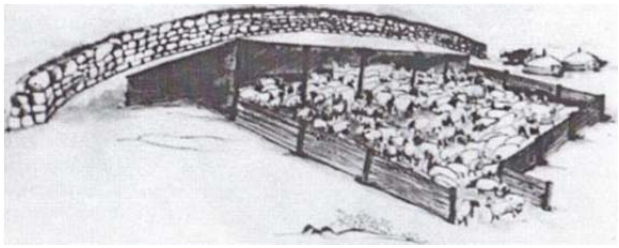
Picture 6. Animal shed with cover



Building a snow fence for livestock

Herders of Tes soum, Uvs province, experienced a devastating dzud in 2009-2010, when most herder households lost their animals. Jagarai, a herder of Tes soum 5th bagh, had the least dzud losses in 2009-2010. Herders living in an area where the temperature falls as low as minus 45 degrees in winter cannot move their herds very far. When dzud hit and the situation deteriorated, Jagarai started moving to better pastures. Each time he moved, he circled the livestock with a fence of snow, and ended the winter with few losses. He would pile up snow to the height of a fence, then used a shovel to level and compact the snow. He burned bushes or wood nearby, so the surface of the snow melted and then turned to a thin layer of ice, creating a strong fence. For fence poles, he burned manure or dung to thaw the soil, and covered the upper part of the fence with bamboo. This way of building a snow fence is cheap and effective and keeps the animals out of the chilling climate.

Picture 7. Snowwalls to protect sheds



Manure melts ice

When dzud hit in 2009, almost each household in Burd soum, Uvurhangai province, lost their animals. It was especially difficult for cows. No matter how good they were fed, cows kept dying.

However, herder Radnaa didn't lose any of his 200 Mongolian cows. Even though his cows were skinny, they looked healthy. We asked him how he managed to keep them all alive. His neighbors lost all of their cows. He responded: "There is no secret. Young herders are becoming lazy." We entered his cow with him shed. Radnaa fully insulated his shed. Baby calves were placed in smaller and warmer stalls. He covered floor of the shed with dry manure deep enough to reach knees of cows. Cows that spent a night in this dry manure would go out next day and gain weight no matter how cold it was. In evenings when cows return from pasture, Radnaa would feed them some hay and herd them into warm sheds. Warm sheds would help cows digest grass they had on pastures. Next morning the cows would be given some hay before they go out to pasture. "Cows in warm sheds covered with dry manure would never die. Most important is to keep the sheds dry and full of manure," said Radnaa. When we visited sheds of other herders, bedding was frozen. Though we advised them to keep beddings dry and warm, herders had no extra sheds and our advice didn't bring results.

Drying manure during extreme cold

Herder Sambuu from Renchinlkhumbe soum, Huvsgul province,

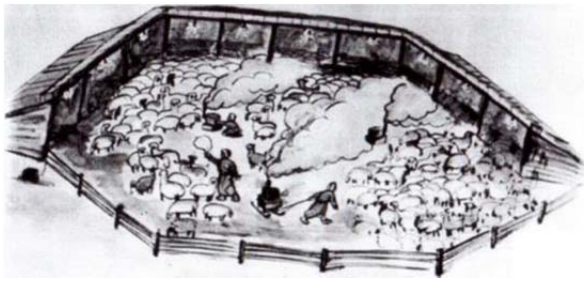
devised a method of drying sheep dung during winter and spring. Place drying dung should be chosen away from sheds on sandy soil. Wood and half a bag of compressed dung are piled up and burnt. After fire flames subside, the pile gets covered by 4-5 cm of thick sand. Then one sack of wet and frozen animal dung is placed on top of the pile. It is covered by 3-5 cm of thick powdered yellow dung. The pile is shielded from wind first two nights and softly compressed each morning. When all moisture evaporates, the surface freezes. Then the next 10-15 cm thick layer of wet and frozen dung is added to this pile. After that 10-15 cm thick layer of powdered yellow dung is added and compressed. After 2-3 days the third layer of dung is added. This layer is 10 cm thick. It takes 8-9 days and three sacks of dry manure to dry three layers of dung.

Floor-heating by famous herder Galindev

Galindev, from Tudevtei soum, Zavhan province, is a two-time state champion sheep herder. He observed that animal bedding piled up in layers doesn't freeze. Thick layers produce more heat. So he used this observation to keep his shed warm. He starts in late November/early December. Galindev digs 70-80 cm deep hole on western and eastern sides of animal barn. The hole is a one meter square. Square holes are located 3-4 m away from each other. Number of holes depends on fenced area. When animals move to pasture in the morning, holes are stuffed by animal beddings that are still warm. The holes are covered with 70-80 cm of yellow dung. This layer will stay for 3-7 days and generate 70-80° C of heat. The yellow dung temperature will heat up to 30° C. Before the herd comes back from pasture, this piled manure needs to be evenly spread on the floor. This exercise should be repeated for a month. After a month, bedding of animals never freezes. Yellow dung in holes heats up and keeps bedding in 1-2 m radius warm. It is very similar to heating floors in apartments. In 15-20 days, the dried manure is taken and replaced by new wet manure. In winter, animal bedding tends to freeze. In this case, a new hole is dug and filled

with new dung. This method helps keep beddings warm and prevents animals from getting cold.

Picture 8. Smoke screen to ease cold



Protecting manure from freezing during dzud

Shalatai, a herder of Ulaankhus soum, Bayan-Ulgii province, ensures his winter shelters remain warm. He blocks the front of the fence with large planking, with 2-3 windows on the roof after sealing for insulation. In the morning after grazing, he piles up the manure so that it keeps the heat inside, and spreads it over the ground in the evening so that animals sleep the night on warm manure.

Some herders of Bayanhongor province's Bumbugur and Bayanbulag soums use old car windshields as windows for winter shelters because of their thickness and resistance to the cold. This keeps the shelter warm and keeps the snow out.

After grazing the animals, they hang a metal bucket in every 50 square meters and inside the buckets they burn fuel to keep the manure and dung from freezing during the day.

V. Livestock water supply

During disasters such as drought and dzud, livestock water supply is important to help livestock survive and ensuring a potential for recovery.

Water points

In emergencies, sustainable water supply can be ensured by a water supply point, which may be in various forms, as hand-dug wells, drilled wells, water reservoirs or traps, ponds, dams and reservoirs. However, establishing such structures and facilities may be difficult. During emergencies, it is advisable to pick one of the following options: improve existing water points; restore deteriorated water points; or establish new water points.

Transporting water

Transporting water is often one way to cope with the initial stages of disaster, as an immediate response to an emergency. However, this incurs high costs and is labor intensive, so is generally considered unviable. In times of disaster, endangering livestock due to lack of water and without an alternative, this method can be employed for short periods while setting up preferred options for quick and effective water supply.

Enlarging water reservoirs at wells

The Umnugobi province administration took action to increase the capacity of wells in the arid Gobi to store more water by enlarging the wells, fencing the area and adding internal wall layers to prevent spillage, important actions to improve the maintenance and use of existing water sources. To increase the width of the well shaft, it must be dug out horizontally and walls broadened. Wells can be added adjacent to the existing wells to increase the space for storing underground water. This was mainly undertaken to increase the gush of a well.

Examining the area for well making

Herders in the arid Gobi region, where both human and livestock water needs are supplied from underground wells, have abundant experiences of well-making by finding the proper point to dig. One such herder, Avirmed of Mandal-Ovoo soum, Umnugobi province, shares his experience in locating a well:

- The signs for an underground water reserve differ from one place to another. For instance, the signs are different between mountain sides and lowlands. In the Gobi or other low areas, water can be found at less than 3 m depth where you find saxaul trees, feather grass, knolls and grasses. Water can be predicted by using the location of the karagana and elm tree.
- If you see a land fracture across and area with feathergrass, it indicates the area has abundant underground water. If forage, grasses and plants are near the fracture, there is little water quite deep. If you dig a well in the junction of cross fractures in winter, you will find a well with abundant water.
- If bushy plants like karagana and feather grass grow in circles, check the area by looking from a distance. If you see a mirage around the area, it indicates there are underground water reserves.
- Water can be found even in rocky areas. Sometimes you may see a rock bed while digging a well. If you see a brown vein going out of the bedrock or the layered rock strata, it indicates that there may be water under the bedrock. In some cases, dig down about 50 cm or a meter, and leave pottery or a metal shovel in the hole. The next day, if the buried items have some dampness, there is water.

Digging a well manually

If you dig a well as soon as the soil has thawed, the water cannot get out of an underground aquifer. You may only find water from the thawing in the soil. Such wells freeze easily, and dry out during the arid season, so herders often say such wells are of bad quality. Instead, a hand well must be dug at the end of December, or in

January- February, when the soil is frozen. When you dig a well in frozen ground, it is always best to burn dung or manure on top, then dig, burn again and dig again. In some cases, it is best to use a long-burning fuel. L. Yol, a herder of Ongon soum, Suhbaatar province, says, "When I dug a well at what is called Budar Rock, I found a large rock which made it impossible to continue. But I burnt about one meter of thick manure in the hole and left it. The next day I saw the rock had broken, so I continued and made a really good well there."

How to correctly find the outlet area for a well

Finding the best spot to dig or drill a well and the proper use of the gush without damage are key to an overall water supply. Zantsaa-Nyambuu, a herder of Bayandelger soum, Suhbaatar province, says, "When we dig a well and see the water gushing out, if the water is buzzing and dirty, this is not the right point, so don't be cheated. You need first to de-water. After some time, if the water level is lower than at first, you did not hit the gush, so keep digging. When you find the real gush, the water level will stay the same or may rise after de-watering. When you dig, the real gush is always from the side, so don't block it. Rather, protect it by making some space for the water outflow."

Preventing a well from freezing

To prevent a well from freezing, it should have a double lid, with sheep or camel wool insulation in between. Manure can be burnt in a metal bucket hung inside the well; or thick layers of soil may be placed around the well. N. Byambasuren, herder of Bayantes soum, Zavhan province, often keeps a well warm to ensure water for his livestock; this is a key way for him to overcome dzud without major loss.

VI. Re-stocking

Post-disaster re-stocking often focuses on recovering the property of people hit by a devastating dzud and ensuring their sustainable livelihoods.

Re-stocking in Ider soum

The Veterinary and Breeding Unit in Ider soum, Zavhan province, has been running re-stocking activities for the last four years. When they began, the unit selected 25 households that were left with no livestock because of dzud and made a re-stocking agreement under a program implemented by the Government of Mongolia.

In selection of beneficiaries of the re-stocking program, the criteria included at least three years' herding experience, household income solely from herding, having run over 100 head of animals (or its equivalent in small ruminants), have private livestock winter shelter, and being interested in continuing in herding.

The Veterinary and Breeding Unit staff organized the purchase of livestock in cooperation with the herder-beneficiaries, ear-tagged all purchased animals and signed a contract with the herders to repay for re-stocked animals by the offspring.

At the soum level, 28 herder households have been re-stocked in the past three years. Providing an average of about 35 head to a household ensures that each household should have built their herd to about 240 animals in three years, the time for repayment, so they have about 200 livestock after passing on the original number of about 35 animals. They can then engage in commercial production with increased household income, with each household raising 2.5 animals for each of the supplied stock.

The local government also developed a local policy entitled Young

Herder Generation to encourage young herders, as the number of young herders was falling year by year. Stocking interventions started targeting young herders based on the experience of the re-stocking program.

Now, the soum government provides livestock to 6-8 young households every year using its own funds without external intervention.

Implementation of a Stocking Program

The Uvs province Labor Department has been running various innovative initiatives under its Herder Employment Support Program, such as providing livestock to households that own only a small number of animals. For instance, T. Vanjil, in the 8th bagh, Ulaangom soum, has been herding since childhood and learned herding skills all his life. He got involved with the Herder Employment Support program in 2014, and was assisted in procuring over 80 head of livestock.

The Stocking Program grants up to MNT 5 million to a young herder to buy animals, and Vanjil bought animals worth MNT 4 million from herders in Turgen and Sagil soums. When a herder buys animals, Labor Department staff are always present to ear-tag the animals. Stocking Program beneficiaries can buy livestock worth up to MNT 5 million, and are indebted for 50% of the total grant in cash. Many local citizens are involved in the program and have grown their herds. E. Tserenbat, a young herder of Undrukhangai soum, Uvs province, was involved with the program in 2013 and bought 80 animals to add to his herd of 79. In the 2014 livestock census, he had 309 head of animals and a much-improved livelihood.

A good herder gives animals to others

S. Gombo, herder of Naranbulag soum, Uvs province, has given animals to over 10 households over the last decade, over 2,000

animals in all. He encourages households interested in herding to live with him as neighbors, gives them animals and teaches them herding skills. When pasture is poor, he takes young herders on *otor* movement as far as Hovd and Bayan-Ulgii provinces, and stays there through the winter. Such a response to dzud teaches young herders about herding. In the 2010 dzud, they divided their livestock into 3-4 parts and herded them separately, using their children and other herders, and they came through the winter with over 4,000 animals. As opposed to herders with over 100 animals that lost 700 to dzud, Gombo lost only 30 animals. He always tells the young herders to learn from his great experience of overcoming dzud disaster.

Re-stocking young herders

The Hovd province government Labor Department is running a young herder re-stocking program to encourage the employment of young herders and increase overall job numbers.

While re-stocking young herders, the program also emphasized skill-building, boosting the benefits and commercial viability of animal husbandry and increasing value-adding opportunities. The program involved 50 young herders of 10 Hovd province soums, supplying 50 animals to each to support livestock production. Young herder households were selected for the program in cooperation with respective soum governors and local Livelihoods Support Councils.

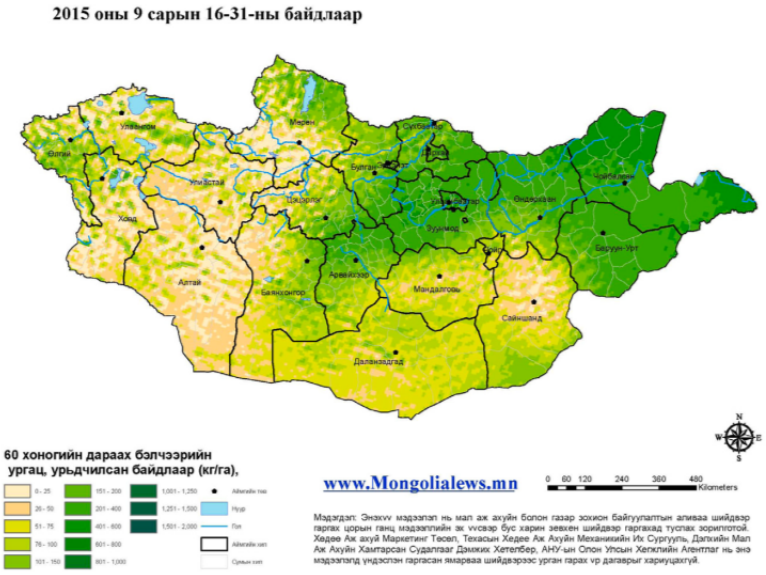
Before the program began, project implementers invited young herders to discuss the topic Creating Wealth - Young Herders and provided training in livestock health, hygiene and herding skills. Under the program, the young herders learned animal herding skills, profitable agricultural production practices and business planning.

Beneficiary herders were sent to Urumqi city and Chingel prefecture of the Altai Region, China, for study trips, meeting herders to hear about experiences in intensive herding, farming and expansion of

animal husbandry businesses, as well as buying equipment for the business. The program also ran a study tour to Khukh Tokhoin Service LLC[1] in Bulgan soum, Hovd province, to see fruit planting practices and explore the potentials to expand their business.

Overall, MNT 250 million has been spent on the program, and more than 100 new jobs have been created. The household income of 50 young herders in the program has doubled.

Picture 9. Forage map produced by the LEWS project



[1] LLC- Limited Liability Company

VII. Dzud Early Warning

Livestock Early Warning System

Two projects, Gobi Forage and Livestock Early Warning System (LEWS), were implemented by Mercy Corps Mongolia between 2005 and 2012. The goal was to create a forecasting system to inform local herders and government about upcoming risks, reduce livestock losses, keep and protect pasture balance, increase livestock productivity and design the proper method to combat natural disasters.

This forecasting system produces 12 types of maps about snow coverage, precipitation, temperature, vegetation index, current forage and 60-day forage forecasting through PHYGROW model that processes satellite data and ground data from 803 monitoring sites all over Mongolia. These maps can help herders make decisions on the right number of livestock for a given pasture. Better pasture management has a positive impact on water resources. During droughts, pasure maps can help find a right balance between livestock and pastures and ensure proper use of water resources. Besides that, herders can identify better pastures to go on *otor*. Herders and government staff make decisions on *otor*, number of herds, and preparation of hay and fodder based on available information.

Weather forecasts via SMS

In 2009-2012 the Meteorology and Environmental Monitoring Agency of Hentii province sent weather forecasts via SMS to 3800 rural G-mobile users from 18 soums of Hentii province. This pilot project funded by the World Vision. Soum meteorology centers collected phone numbers of G-Mobile users of every soum. Then they started sending regular weather forcasts via SMS. Forecasts included timely weather information on each soum, plus forecasts about imminent snow and sand storms. This project was very

successful, but after three years it had to end due to financial constraints. Each user paid MNT 1000 to receive weather forecasts during the project. Currently, the Meteorology and Environmental Monitoring Agency of Hentii is trying to restart this service again. However, due to lack of promotion and financial difficulties, the number of users drastically declined. Old users are still requesting to get this service again.

Natural disaster risk prevention system with active herder participation

All media warned that sand and snow storms with 22-24 m/c of speed are expected in six provinces on 28th May, 2008. This warning came 3-4 days earlier and 80% of herders heard it. But in reality, this dangerous storm swept two provinces and nine soums from north to south. It unexpectedly started on the afternoon of 26 May, and herders were too late to herd their livestock back to their shelters. Fifty-two people and 242 head of livestock died.

In order to warn about sudden natural disasters in Gobi and steppe regions, Disaster Warning Stations (DWC) was established Erdenedalai soum in 2005, Gobi-Ugtaal soum in 2009 and Mandalgobi soum of Dundgobi province in 2012. These units have herders who inform them about weather. The network of 15 informer-herders from eight soums was created. These herders' main task is to inform the stations by phone about coming disasters. There are two types of operations: normal and emergency.

In emergency situations, the station performs following activities:

i. Sends a warning about upcoming disaster. Delivers information on long-term emergency response.
ii. Delivers information about short-term emergency response.
iii. Organizes rescue operations during disaster.
iv. After disaster, conducts damage assessment, conducts search operations, and organizes discussion on recovery plans.

In normal situations, the stations broadcast via FM radio about activities of government organizations, the province Governor's office or province Emergency Agency organizes online meetings with 13 soums.

Picture 10. Herder-informer

Active herders help to collect weather information

The Meteorology and Environmental Monitoring Agency of Hentii province works with 10 active herder-observers in ten locations with cell phone coverage that have no weather monitoring units. The Agency bought precipitation measuring devices for the selected active herders and provided trainings. Every day from 08:00 to 20:00, active herder-observers report by phone about level and duration of precipitation, snow depth, soil surface humidity, and winter and summer conditions. This information helps to add more details to weather forcasts and reduces risk and impact of natural disasters. The active herder-observers receive phone units for MNT 10,000 every day. The Agency is planning to use these observers and water monitoring units to conduct measurements in rivers and lakes and explore impact of global warming on surface water resources.

WEATHER LORE: FOLKLORE RELATED TO WEATHER PREDICTION...

A. Predicting weather by sun, moon, stars and current weather events*:*

At sunrise and sunset...

- Larger than usual morning sun, with reddish color and shining upwards, indicates potential precipitation (snow in winter, rain in summer);
- Fog at sunrise indicates a sunny and suffocatingly hot day;
- If the evening sun looks purple and yellow and turns green as it sets, there will be no next day precipitation though it will be cold, without sudden nighttime weather change;
- An orange sunset, or cirrus clouds stretching in all directions from one point, portend bad weather; a sharp purple sunset means strong wind;
- Vertical wavelengths on both sides at sunrise and sunset indicate possible cold weather;
- If the sky clears during sunset after being overcast, the weather will warm up;
- If sun sets behind clouds and shows dust particles, rain showers and winds are expected in summer, snowstorms in winter;
- If clouds disperse at sunset, there will be rain during the night;
- A ring around the sun and moon (traditionally called three suns), there will be strong wind followed by precipitation and cold weather. If the ring decreases, precipitation is expected soon; if the ring enlarges, precipitation has left the area.

New moon...

- If the new moon on the second day of the lunar calendar is bigger and paler than usual and the ends are blunt, the coming month will have low precipitation and wind; if the two ends are

sharp, the color is brighter and the moon leans backwards, the coming month will have more wind and precipitation;

- A moon that is red and larger than usual portends precipitation soon;
- If the rising full moon on the 15th of the month (by the lunar calendar) is sharply colored, the day's weather will be fair.

Stars...

- If the evening star is close to the moon, the month will offer increased wind and precipitation; if the star is farther from and under the moon, the coming winter will have lower precipitation and wind;
- If weather is bad before the evening star appears in winter's first month (lunar calendar), it presages harsh weather;
- If the Milky Way is not seen on the 9th day of the last lunar calendar autumn month but reappears in the week, it presages a mild winter. If it takes more than a week to be seen, there will be a dzud;
- If the evening star is in front of the moon, drought and dzud are likely;
- Twinkling stars in winter indicate a potential temperature drop.

Clouds...

- If the evening clouds are pale and gray, the next day's weather will turn bad;
- Evening clouds moving northwards indicate a long spell of bad weather;
- If morning fog stays low and disappears, the sky will be clear. If the fog rises and becomes cloud, it is a sign of impending rain;
- Fog at night indicates no precipitation the following day;
- If some of the cloud leans northwards and is dark, it presages rain;
- If clouds move towards each other, there will be bad weather for some time;

- Thin and linear clouds presage rain in summer or a warm winter day;
- Clear sky in the morning with growing cloud (white scattered cloud) which clears in the afternoon, indicates one or two days of good weather;
- If clouds build at all strata from morning, and merge and thicken, bad weather is coming;
- If there are large white clouds at summer sunrise which shift upwards to raincloud, with darkening sky, heavy rain and hail are on the way;
- If white clouds with multiple strata merge and thicken to cover the sky, lowering to rain cloud, there will be rain in summer and snow in winter;
- Quick-moving clouds are a sign of coming wind; clouds descending in summer mean rain; clouds descending in winter mean low temperatures and snowfall; high clouds are a sign of good weather;
- If summer clouds turn red before sunset, the next day will be rainy; clouds turning red at sunset indicate a few days of bad weather;
- Accumulation of lumpy, wave-shaped and cirrus clouds indicate bad weather is coming;
- Swirling clouds presage heavy rainfall or strong wind;
- If the edges of large clouds turn dark quickly, there will be rain; if they turn white at the edges, there will be no rain;
- If the wind reverses, it is a sign of coming rain;
- If lots of small clouds appear in the afternoon and disappear in the evening in the spring, summer and autumn, the next days will be dry and the sky will be crystal clear;
- If cloud shadows are sharp and clear in winter, the season will be mild and warm;
- An overcast sky with holes in the middle of the clouds indicate approaching rain.

Wind...

- A prevailing southerly or easterly wind threatens precipitation;
- Several days of southerly or south-westerly wind in winter and spring mean snow; in summer they mean strong winds and rain;
- In winter, northerly winds and cloudless skies mean a temperature drop;
- If a west wind brings red dust in late autumn and it is not snowing, the winter will be fine;
- If the wind in the day blows from the valley up the mountain and reverses at night, the next day will be fine;
- After some time of dry weather and clear skies, with a steady wind direction, if the wind suddenly changes direction and becomes stronger, the weather will deteriorate;
- If there is thunder when the wind is northerly, it will be a cold spring (east-warm, west-mild and south-warm);
- On the first day of autumn (lunar calendar), thunder means a bad harvest; a southerly wind will bring drought; a westerly wind will bring rain; a northerly wind with cloud from the north-west will bring bad weather. If the wind blows from the south on this day, winter will be gloomy;
- Wind on the 11^{th} and 12^{th} of the last autumn month (lunar calendar) means the wind will persist until the end of the month;
- Excessive autumn wind means mild and favorable weather next spring;
- Gloomy hazy days and windy nights indicate the approach of low temperature.

Wind, snow (precipitation)...

- In summer, hot days and cold nights presage drought;
- Clouds moving northwards after rain means rain will persist, but clouds moving southwards indicate a clearing sky;
- In a warm autumn, excessive cold rain and easterly wind means both winter and spring will be harsh;
- Silent lightning in early spring means a summer of drought;

- If the wind is mild at night, strengthens in the day and stops in the evening, the next day will have clear skies;
- If thunder and lightning lessen, the rain will stop soon, and vice versa;
- When it is raining, if the sky clears from the north west, the rain will stop soon;
- If summer is suddenly hot, it presages heavy rainfall;
- A fall of large snowflakes means a rising temperature;
- If the wind stops in the evening and there is a heavy dew, a clear sky is expected;
- If valley fog clears after the sunrise, the day will be gorgeous;
- In autumn, if wind starts at dawn and strengthens around noon, the weather will worsen;
- If wind strengthens in the evening, the weather will turn bad the next day;
- If it is cold in the lowlands and warm at night in hills and mountains, the next day will have pleasant and stable weather;
- If the day is hot and the sunset is misty, there will be clear skies for the following day;
- If the thunder sounds low, rain will be soft and mild; if sudden and loud, there will be heavy rain.

Rainbow...

- A morning rainbow means rain is coming; an evening rainbow means rain has passed. A rainbow in the east presages a rain shower; a clear low rainbow means bad weather is expected;
- Sharper and clearer blue in a rainbow means bad weather; green means coming rain; red means clear but windy skies;
- A rainbow in the east which shifts westward and disappears means good weather;
- If a rainbow disappears quickly after rain, skies will clear; if a rainbow persists, bad weather is coming;
- A sharp yellow rainbow means the rain will persist;

- A rainbow in the east means the rain will soon stop, while a rainbow in the north means the rain will continue;
- Repetitive winter snowfalls and multiple rainbows presage dzud;
- If an echo sounds low, bad weather may continue for several days;
- Thunder in September means a long warm autumn, but much snow with thunder in October means less snow in winter;
- Excessive snowing at the outset of winter means strong rain in the beginning of summer;
- The more fog on the mountain top, the stronger the wind and the worse the weather;

B. Livestock behavior:

- If yaks stay on the high ground (mountain peaks) in winter, it presages warmer weather; if the yaks stay lower in meadows and valleys, it means cold and windy weather;
- If animals stay in the shelter and refuse to go out to graze, there is bad weather to come;
- If the sheep walk around and dig under the manure, a snowstorm threatens;
- If in the morning sheep and cows lie with heads to windward and keep ruminating, warmer weather is coming;
- When cows lie with legs under the belly and head into the body, snow is likely;
- If cows moo and seem uncomfortable before grazing, snow or low temperatures are coming;
- During summer, if cows moo and will not leave a calf, it will rain;
- When bulls trumpet during rain, it means the rain will soon stop;
- Camels are sensitive to approaching weather changes: they sense impending precipitation, dust and snow 2-3 days prior. Before rain, camels may graze anywhere, often against the wind. Before wind or storm, camels stay near ashes, shrubs and bushes and lie

facing into the wind. If camels continue to graze, the day's weather will be fine;

- When young animals, camels, foals and small ruminants play in the pasture and shelter and chase each other, precipitation or bad weather is coming;
- If a female camel will not leave or keeps returning to her calf, rain, snow or strong wind is coming;
- Horses snorting frequently means heavy wind with rain in summer and low temperatures in winter;
- Sheep and goats snuffling or having nasal problems means precipitation is close;
- Sheep bleating, horses neighing and lactating animals leaving their offspring to graze mean rain will stop soon;
- In early winter, sheep leaving shelter and lying outside means a favorable winter;
- If domestic animals spread out to graze, it will be a warm night; if they graze in the same direction, specifically into the wind, it will be cold;
- If a lactating animal suddenly loses milk, it is a sign of approaching precipitation;
- If ruminants are excessively hairy, there will be heavy snow in winter;
- If pigs are scratching their body, it will become warmer;
- If pigs heap straw for warmth, there will be a storm and low temperatures;
- A loudly braying donkey predicts rain;
- Chickens flapping their wings and sitting on top of the barn indicate wind and precipitation; if they do not take shelter, the rain will not persist;
- If a rooster crows inside the barn, the weather will turn bad; if it crows in summer for no reason, it will rain;
- If a rooster does not crow in winter, the weather will warm up;
- Chickens staying close together and scratching the ground means colder weather;

- When cats and dogs curl up tight it means the wind will strengthen and it will snow/rain;
- When cats sharpen their claws and sneeze, the skies will get overcast and it will rain;
- If a dog sheds hair from the back (in Khangai), the side (in steppe) or the belly (in Gobi), the weather will be good;

C. Wild animals and insects:

- If gazelles, goitered gazelles, wild asses, argali sheep and ibex in the Gobi come more often for water, there will be less snow and extreme cold temperatures in winter;
- If large groups of goitered gazelle, argali sheep, ibex and gazelle move in the autumn from the Gobi area to the Khangai area, less snow is expected in the Gobi;
- If argali sheep and antelopes come down from the mountains, there may be heavy snowfall and low temperatures on the mountain tops;
- When lots of argali sheep and ibex gather in sunny areas and watch the mountain tops, it is a sign of low temperatures and snowstorms;
- If at the first snowfall, antelopes prepare grass nests at the edge of forests/woods or lowlands, the approaching winter will be mild;
- If the deer rutting season is long-lasting, mild weather is expected; if it is late, bad weather is expected;
- Excessive fat in antelopes and hares is a sign of heavy snow and a harsh winter;
- If a deer flips its horns frequently, bad weather is coming;
- If squirrels travel far from their nests, jumping from tree to tree, the weather will be calm and pleasant;
- Squirrels preparing nests high in the trees indicates a warm winter; if nests are on lower limbs and branches, the winter will be cold;
- If no squirrels can be seen in the forest, it is about to snow;

- If chipmunks wash their faces in the sun and squeak loudly, it will soon rain. If the chipmunks squall in the morning, the weather is about to change suddenly;
- In spring, if hares shed slowly, the summer will be cool;
- If hares and rabbits linger under shrubs and trees, heavy wind impends;
- If there are suddenly fewer hares to be seen, the area will be hit by dzud;
- If ant nests are high in autumn, winter will be colder with more snow. If ants hibernate late, the winter will be mild. Ants collecting food urgently means strong wind is likely;
- When snow melting starts from the northern part of ants nests, summer will be warm and long; if it starts thawing from the southern part, the summer will be cool;
- If marmots start storing food and hibernate early, winter will start early. If the hibernation is late, the winter will be mild;
- If mice and rodents pile their stores high, winter will be snowy. If the food store has stones on top, winter will be windy and cold. Low food storage means a warm winter;
- If a marmot's hibernation hole is tightly closed, winter will be harsh. If the closure is loose, winter will be mild;
- If marmots and rodents squeak on cloudy days or after rain, the skies will clear soon;
- If marmots shore up their holes with earth and stones, it will rain heavily;
- If marmots end hibernation before the spring snow thaw, the weather will warm up early;
- If the murine (which only squeaks at dawn) keeps squeaking and whistling through autumn, the weather will be warm; if the murine keeps silent, the winter will be harsh;
- A sudden increase in fox numbers means there may be heavy winter snow;
- If there are plenty of foxes and steppe foxes on the steppe, the area will have good weather and plenty of grass/plants;

- If there is a lot of piled earth from a mole burrow, the year will have plenty of rain and lightning;
- An increase in locusts, grasshoppers and balm-crickets is a sign of potential drought;
- If insects hide in the bark of the trees, it will either be windy or there will be precipitation;
- If spiders spin strong webs, the weather will become dry;
- If crabs are visible on lakesides, rain and bad weather is impending;
- If you see ticks in winter, the season will be warm;
- Soil on a beetle's back means it will soon rain;
- The loud chirping of a balm-cricket means a long autumn is expected;
- If beetles fly noisily, the weather will become mild;
- Flies flying between flowers in the afternoon means skies will clear;
- Flies inside the ger or house mean bad weather is coming;
- If a spider waits for prey for a long time in the day and keeps spinning a web in the evening, it is a sign of good weather;
- With lots of brown butterflies and beetles in summer, it will soon rain;
- Flies and mosquitoes flying close to the water surface means bad weather is coming;
- If flies and mosquitoes fly in the air in fleets, day will be clear;
- Snakes lying still in the sun means the weather will stay fine;
- If snakes leave their holes and can be seen frequently, it is going to rain;
- If there are lots of easily caught leeches (bloodsuckers) in lakes, ponds, streams and swamps in the evening, it presages good weather; if they are hard to catch because they hide in the reeds, it is going to be windy;
- Earthworms in large numbers on the ground means it will rain soon;

- Calmly flying dragonflies indicate improving weather. Agitated dragonflies mean worsening weather. If the dragonflies are in large swarms as if running away, strong wind/storms impend;
- When the sky is clear, but you cannot catch fish, there will soon be steady rain;
- If lots of pike, lennox and herrings jump to catch flies and insects, rain is on the way;
- If frogs leave the swamp in the evening and croak loudly, it will soon be warmer;
- If frogs stick their nose just out of the water to croak, the weather will worsen;
- If frog croaking gets louder and louder, the weather will improve.

D. Birds:

- Cuckoos calling earlier than usual means a short summer and early autumn. Very continuous cuckoo calling is a sign of warm weather; changes in sound indicate an impending rain shower;
- When migrating birds fly high to return to tropical areas, the winter will be warm; if they fly low, dzud and harsh winter are likely;
- If sparrows tweet during rain, the skies will soon clear;
- If the martins fly high, the weather will be fine; if low, touching the earth or water surface with their wings, it will rain. If martins soar and dive, storms are coming;
- If there are lots of urban kites flying and calling, a storm is likely;
- If there are lots of bobwhites in the city in winter, dzud is expected;
- Crows flying far from the nest indicate a warm clear day; crows perched on stones and trees and cawing indicate a likely autumn dust storm and winter snow and cold. Often crows sit on lower branches before wind, and before temperature rises;

- If lots of crows on trees look in the same direction, strong winds are approaching from the direction they are looking;
- If bluecaps eat a lot and keep foraging for food, winds and storms are on the way;
- Urban martins migrating means they are flying from potential wind;
- If snowcocks leave their mountain and come close to animals, heavy snow and cold temperatures are expected on the mountain;
- If sparrows prepare their nest in sunny areas, the summer will be cool;
- If brown pheasants sing through the night, the next day will be hot. If pheasants perch on branches in the evening, the night will be calm and dry. If they hide in bushes, it will rain;
- If geese stand on one leg and hide their head, low temperatures are coming; hitting water with their wings means a warm day; frequent diving means precipitation is likely;
- If cranes come early in spring and are loud, warm weather is coming. If they dance and play, the weather will be warm. If they fly silently and fast, bad weather is likely. If cranes fly high, a hot day is coming, while if they fly north, it will be warm. Flying south means cold weather is coming and if they are loud frequently, it is raining;
- If bustards fail to migrate, a warm winter is coming;
- Herons and hawks squawking loudly while flying means a clear day is coming;
- Just after geese migrate south to the tropics, it will snow;
- If pies perch on the snow, the weather will warm up; if they perch high in the trees on a hot day, the weather will cool; if they stay on the lower branches it will be windy;
- If forest pies come to the steppe for food, dzud is coming;
- If crows fly high, the day will be very hot;
- If jackdaws fly and land in a swirl, it is raining; if they sit on the road, the weather is worsening; if they fly in circles making loud sounds on a winter morning, a storm is coming (rain in summer);

if they fly from the steppe to the mountains at the end of winter, spring is close;

- If migrating birds arrive silently in spring, cold weather threatens; if they stop singing suddenly, a heavy rain shower is coming;
- If a stork stands on both legs, waves wings and hides the beak, it is a sign of either rain or wind. Storks coming early in spring means bad weather;
- Birds foraging for food in the evening means the weather is cooling;
- If a kite flies in big circles, the weather will worsen;
- If an owl hoots during the day, the weather will worsen;
- If ducks and geese gather near a riverbed, storms or wind will come soon;
- If sparrows flock in large numbers and chirp, rain is coming. If they perch on roofs and preen their feathers, it presages warm weather. If they hide under trees, cold temperatures or storms are coming; if they chirp lots in winter, there will be warm weather. If their feathers are ruffled in morning, there will be precipitation. If they fly and chirp in bad weather, it will clear up soon;
- If sparrows stay for a long time drinking, the day will be clear with no precipitation;
- Pigeons cooing means a sunny day; pigeons perched in a windproof place means a cold day;
- Cooing loudly in the morning means bad weather;
- When wood grouse call and the sky is overcast, skies will clear up soon. If wood grouse are silent, the skies will be overcast for some time;
- Seagulls remaining by the water means stable weather; seagulls flying along the shore and moving frequently means bad weather;
- If sparrows stay under trees and bluecaps tweet early in the morning, the temperature will soon fall;

- If wild ducks nest on higher areas like cliffs, the area will have abundant precipitation;
- Ducks flapping or cleaning their wings means it will rain soon;
- When ducks arrive in spring carrying plenty of fat, it will be a long, cold spring;
- If geese and ducks stay on the water and honk a lot, it is going to rain; if they flap their wings repeatedly, wind is on its way;
- If geese fly high, precipitation is likely; if they fly low, there will be less spring precipitation;
- If geese raise their legs frequently or fluff up their feathers, a cold day is likely;
- If there are lots of sand grouse, mild weather is expected; if they hide in bushes, it predicts a sand or dust storm;
- If swans migrate to tropical areas later than usual, it will be a long mild autumn;
- Kites flying steadily, owls hooting frequently and bats flying all night are signs that the weather will become mild and warm;
- If migrating birds arrive in large flocks early, spring is early;
- If rooks arrive early, there will be a warm spring;
- If crows play with water in early spring, it is a predictor of warm weather;
- If bees seek pollen early in summer, the day will be clear; if they do not hum and flap their wings quickly, cold or rainy weather is likely;

E. Trees, grasses and plants:

- Trees getting leaves and grass growing early in spring are signs of potential summer drought;
- Forest noises in winter signal rising temperatures;
- If tree foliage turns yellow starting from the lower branches and leaves and fir needles fall quickly, winter will have low snow levels and temperatures will be warm. If the yellowing starts downwards from the tree-tops and leaves and fir needles fall slowly, winter will be harsh and there may be dzud;

- If the winter forest sniggles and clacks, the day will be cold; if it happens in autumn, there will be little precipitation;
- If fir tree branches hang down, there may be a storm;
- If it is windy and the leaves turn to face upwards, or dry branches fall when there is no wind, rain is likely;
- If you see fir and pine branches bending downward, precipitation is likely;
- If the birches and oaks retain their leaves until late autumn, winter is going to be cold;
- If tree leaves turn yellow earlier than usual, autumn will start early;
- In autumn, birch leaves turning yellow from the top means next spring will be early; if the leaves turn yellow from the lower branches, spring will be late;
- If birch leaves appear earlier than maple leaves, summer will be dry; if birch leaves appear later, summer will be rainy;
- If birch trees still have leaves in early October, snow may start later than usual;
- More cider nuts and less bosks and shrubs in summer means a harsh winter;
- More summer fruit means a cold winter, and vice versa;
- If birch and maple reanimate early in spring, summer will be warm;
- When grasses turn yellow and all die off, it will be a cold winter to come; if the grasses remain despite turning yellow, it will be a warm winter;
- If grasses and plants blossom before their stems/phylum are fully grown, drought impends;
- If pasture plants turn brown and the seeds appear earlier than usual, the coming winter will be harsh;
- Excessive grassy plant growth means heavy winter snow;
- If stipa/feather grasses grow in abundance, winter will have heavy snow;

- If irises blossom early in spring, summer will be arid and drought-hit;
- Abundant white grasses means summer drought and heavy winter snow;
- If bell flowers and arnica flowers shrink their leaves, it is about to rain;
- If new grass grows in sunny places after plants and trees have turned yellow, winter will offer good weather;
- If rhubarb blossoms at night, it is rainy;
- If poplar, maple, wicker and chestnut drop gum, it will soon rain;
- If vetch flowers stand upright and silverweed opens its leaves, precipitation is likely;
- Bees gathering on thistle, black cherry and ash-berry means the approach of clear weather;
- Abundant pissabed means rare rain and an unfavorable summer;
- If there is an abundance of small white flowers in the Khangai region, more rain is likely;
- If pissabed and bell flowers open cup-shaped, the day will be beautiful;
- The higher fat-hen and hogweed grow, the more snow will fall in winter;
- The earlier pissabed blossoms in spring, the shorter summer will be;
- If wood anemone grows in the steppe with longer gripe, it means a lot of snow in the mountain is likely;
- The earlier grasses dry up, the longer and harsher will winter be;

F. Household items …

- Getting exhausted and falling asleep from tiredness means summertime rain;
- Physical disorders such as backache, blurry eyes and neck ache presage bad weather;
- When tar clogs the stovepipe and it gets moist, the sky will be overcast and it will rain;

- If loose tobacco and salt gets moist, rain is on the way;
- If the windows have condensation at low temperatures, the weather is warming up;
- When wood in the stove burns strongly and flames reach into the chimney, windy storms are on the way; when the wood burns noisily and is very smoky, there will be either precipitation or a warm and calm day;
- Excessive moisture in dung and firewood means precipitation is expected;
- If smoke from the stove chimney goes vertically, there is little wind; smoke dropping downwards indicates the likelihood of heavy wind, overcast skies and precipitation;
- Cinder in buckets and stoves burning may indicate wind and extreme cold temperatures;
- Reddish burning in the stove means cold weather is expected; whitish burning indicates the reverse;
- Excessive dampness in clothes and leather products indicates the potential for rain;
- When hide or leather items become soft, it will rain;
- Shrinkage and tightening of cotton and felt, especially canvas covers, wool-woven ties for ger and ropes, means rain is likely;
- When you have no instrument to measure air pressure, half-fill a bottle with river water, seal well and keep indoors, on a table or window ledge. If the upper (empty) part of the bottle shows condensation, the weather will worsen soon. If the condensation disappears, the weather will improve soon.

A herder and experienced weather forecaster advises

Z. Tserenbaljir, a herder of Oigon bagh, Tudevtei soum, Zavhan province: “Herder’s work starts when he gets up and observes the weather for the day and decides which direction or pasture to graze the animals.

“Wild animals, rodents and mice gathering winter feed, fruit and

plant growth, early yellowing of leaves and marmot hibernation: all indicate weather change, so herders must compare the signs to other years and predict the potential upcoming winter and spring. This is a necessary herding skill.

“Detailed planning of moves to fall and winter sites after considering weather conditions also helps protect the herd from frost and cold weather. Herders base herding action on weather observation. Pasture in winter and spring must be rotated as much as possible by classifying pasture as distant, close and windproof, and pasture use depends on the weather.

“In cold winds or heavy frost, animals must be grazed in warmer areas, with mountains at the back blocking the wind. If the weather is fine, use distant pasture. Plant coverage must be thoroughly checked and studied.

“When you graze animals in the morning, first face into the wind, then slowly turn into the wind on the way to designated pasture and maintain calm grazing. In this case, animals eat pasture slowly until they are full. Well-fed animals are often more resistant to cold and hunger from limited pasture.

“Herders must carefully watch wind speed, weather and animal behavior while herding. They should be able to predict the next day’s weather and herd animals accordingly.

“In winter it is best to allocate overall work to all available household members as accurately as possible consistent with seasonal characteristics. Preparation to cope with winter starts in spring, with cleaning and disinfection of winter and spring shelters, removing dried and frozen dung from shelters, piling manure and repairing fences and shelters.”

VIII. Dzud management

Campaigns to help herders

Herders' Association is an NGO from Arhangai province. Its main activities include helping herders add value to their products, expand market for rural producers, and improve animal health. The Herders' Association organized a campaign to help herders during devastating dzud of 2009-2010 in Arhangai that affected almost 80% of the province. During the campaign, the NGO coordinated all assistance coming from the province, Ulaanbaatar and other areas. In addition, they developed and submitted a project proposal to Canada-based Canada Fund NGO and had it approved. Under this project, the Herders' Association collected 60 tons of hay and fodder and distributed it to herders from the worst affected 9 soums. Also, they raised MNT 4.3 million for the Disaster Risk Fund. Ten herder groups from five soums were provided with satellite communication equipment and 800 herders from 200 households were able to communicate to the outside world. This communication helped herders to stay away from snow storms, avoid getting lost, and receive necessary assistance.

Herders' conferences

It's been observed most herders who lost their livestock during dzud are young, inexperienced people. For example, according to the dzud assessment, 70% of herders who lost most of their livestock in dzud in 2000 were young herders under 35 years old.

In order to learn lessons from dzud and share experiences with each other, the Red Cross Society of Uvs province organized a number of meetings and discussions in 2010-2013: a) herders' conference of Uvs province b) meeting of youg herders in Tes soum c) "Female herders in 21st century" conference and conference on Rural Development and Leader Herders in Tarialan and Turgen soums d) "Humanitarian actions of creative herders" event in Malchin soum e)

Conference of Herders of Three Western Regions in 2013.

These events (i) created an opportunity to pass experience and knowledge from older herders to younger herders (ii) linked herders to government people, improved herders' participation in decision making (iii) promoted herders' cooperation, established business links, and convinced herders to unite and work with government

Collaboration of herders for a dzud response

Since ancient times, Mongolians have had proverbs about cooperation, such as "Neighbors' lives are linked, and ideas of neighboring households are linked," and "A single stick is not fuel and a single person does not make a household." These highlight the importance of collaboration and mutual assistance. It has never been shown that dzud hardships are overcome by an individual or by a family alone. All success stories indicate that herders successfully overcome dzud with the help of other herders or non-herder communities in effective collaboration. To strengthen herder capacity to overcome such hardships, herder collaboration mechanisms must be developed and supported. For instance, long distance *otor* movement requires large households to help smaller households; households that have lost animals in the dzud should have family nearby to help sustain livelihoods by helping the animal husbandry. Such joint action should also be reflected in relief aid from the government and international organizations. In other words, aid must focus not on giving to an individual family, but must encourage such collaborative and mutual assistance networks.