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Provision of Technical Assistance for Enhancing Climate Resilience and Economic Sustainability of Livestock Farming in a Rural Community of Mongolia

Deliverable 2.3: Climate Change Vulnerability Assessment in Bayantümen Soum

Submitted to: The United Nations

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About the Project

The "Enhancing Climate Resilience and Economic Sustainability of Livestock Farming in a Rural Community of Mongolia" project (November 2021 -November 2022) is a United Nations Climate Technology Center and Network (UN-CTCN) technical assistance project. The project is in line with Mongolian national climate change strategies and plans, including the Nationally Determined Contribution (NDC) adaptation targets for livestock, pastureland and livelihood and social safeguards and the Mongolia Sustainable Development Vision 2030 for the resilience of pastoral livestock, manufacture of meat products and the business and economics of herders and herder groups. The project works with the Climate Change Department of the Ministry of Environment and Tourism (MET) and the local project proponent, the Northeast-Asian Environmental and Agricultural Research Center (NEARC) in Dornod aimag. Alinea International implements the project in partnership with the Alberta Biodiversity Monitoring Network (ABMI) and the R&D Center for Climate Change and Sustainable Development (CCSD).

The project strengthens climate-resilient livestock farming while deriving economic sustainability for vulnerable herding communities in Bayantümen soum and contributing to the Nationally Determined Contributions (NDC) and national climate change adaptation and mitigation priorities for Mongolia. The expected outputs of the project are:

- Completion of a participatory, gender-responsive and socially inclusive climate change vulnerability assessment on livestock farming.
- Identification of pastureland management measures for climate-resilient livestock farming.
- Development of business models for a community-scale meat-processing system for climate-resilient livestock farming.
- Enhanced capacity of government bodies for climate-resilient livestock farming.

The gender and vulnerable groups' analysis supports collecting locally specific information on risks, vulnerabilities and capacities in relation to climate change. It facilitates analysis of the information in ways that can surface differences based on gender, age, and other relevant dimensions. The analysis considers the potential negative impacts of climate change on gender equality and vulnerability and pastoral/rangeland/livestock use and governance and the influence of these on different people's resilience. The adaptation strategies address women's access to and control of natural resources and their leadership in resource management, business, and local planning.

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Acronyms and abbreviations

ABMI	Alberta Biodiversity Monitoring Network
CCSD	Center for Climate Change and Sustainable Development
CCV	Climate Change Vulnerability
FGD	Focus Group Discussion
IPCC	Intergovernmental Panel on Climate Change
MET	Ministry of Environment and Tourism
NDC	Nationally Determined Contribution
NEARC	Northeast-Asian Environmental and Agricultural Research Center
NSO	National Statistics Office
UN-CTCN	United Nations Climate Technology Center and Network

Summary of Findings

A participatory gender-responsive climate change vulnerability (CCV) assessment was conducted in Bayantumen soum (eastern Mongolia) to advance knowledge of local herders about the potential risks of climate change to their livestock herding systems and their specific needs and constraints to strengthen resilience to climate change. Through direct interviews of herder families during a field visit in June 2022, a total of 109 survey questionnaires were completed, and the perception and practices of nomadic herders, who have lived and observed changes in local grazing landscapes for generations, were obtained.

Herders described climate change and extreme weather events as one of the main challenges they have been facing in raising livestock. Herders' observations of changes in location, timing, amount, intensity, and form of precipitation, followed by changes in seasonal temperature patterns, were more remarkable. Herders were most concerned about delays in spring and early summer rain or relatively drier growing season, as well as more intense heat stress and severe water supply shortage for plant growth and productivity during the optimal vegetation growing period. In addition, Local herders indicated a high sensitivity to climate change risks associated with the supply of livestock feed and fodder, pasture forage productivity, and livestock access to water during harsh summers and winters. Herders thought several emerging environmental issues in their area had been rooted or intensified due to the recent changes in local and regional climates. These issues included: an increase in livestock herd size; change in livestock herd mixture; reduction in livestock movements or herders' immobility across the landscape; migration of unregistered livestock into their area; and consequently, increase in grazing pressure, particularly around the few usable water bodies. Despite the relatively high exposure and sensitivity, herders believed in potentially having the ability and capacity to adapt their livestock farming to risks from local climate changes. However, they identified lack of practical knowledge and adaptation technology, labor shortage, and limited financial capacity or incapacity as major barriers limiting their capacity to implement adaptation measures. Lastly, surveyed herders were overall characterized with a relatively low and close vulnerability to climate changes, but with a tendency towards a slightly higher but still low vulnerability for more experienced herders with larger household sizes and a higher dependency on income from livestock.

While acknowledging herders' long history of adapting to environmental change, this assessment sets the stage for communicating the expected impacts and considering pasture management strategies and technologies that help herders maintain climate-resilience pastoral livelihood systems. Local herders must play a fundamental role in finding appropriate adaptation pathways to cope with the joint effects of increasing grazing pressure and climate changes. Together with emerging community-based pasture management institutions, they must coordinate and contribute to empirical and systematic monitoring of their grazing landscapes. In addition, local governments and financial institutions must implement payment tools and mechanisms that support local herders and pasture user groups to improve pasture health and productivity and promote the delivery of undervalued environmental services related to soil, water and biodiversity resources in grazing landscapes. Finally, yet importantly, women as frontline decision makers and an essential part of traditional herding practices must play a leadership role in coordinating and implementing new pasture monitoring and potential adaptive solutions for pastoral livelihood systems in the Soum area.

1 Background and Objectives

Climate change is considered one of the most significant challenges of the twenty-first century. Its impacts are happening faster than expected worldwide, particularly in arid and semi-arid regions that play a vital role in global food supply and security. Variability in rainfall patterns and extreme weather events such as recurrent droughts and harsh summers and winters are among the most apparent and disruptive impacts of climate change on local communities and the natural resources and landscapes they rely on for their livelihood.

Climate change is projected to severely impact traditional pastoralism and livestock herding practices. Herder communities and pastoral systems rely highly on accessibility to good quality grazing lands and ecosystem goods and services they provide. Arid and semi-arid grazing lands are generally more sensitive to climate change impacts. It is predicted that the aridity and harshness of the arid and semi-arid grazing lands will be more severe in the future, potentially putting the sustainability of the pastoral and herding livelihood systems in these fragile landscapes at risk. Grazing lands are generally thought to be naturally resilient to climate variability. However, their adaptive capacities have deteriorated over time due to harmful internal and external pressures from both climate change and environmental degradation. Increasing vulnerability to climate change and the scarcity of resources for livestock production could potentially result in severe resource competition and violent conflicts among livestock herding communities in arid and semi-arid grazing lands.

Traditional pastoralism has long been a highly valued livelihood style and socio-cultural nomadic heritage among herding communities in Mongolian arid and semi-arid landscapes. The more recent dynamics of the country's pastoral and herding livelihood systems have mainly been driven by increasing livestock populations and changes in animal husbandry, degradation of forage, soil and water resources, and negative impacts from global warming and climate change. Representing about one-third of Mongolians, herders are at arguably increasing risk of losing their livelihoods to continuous environmental degradation and recurring extreme climate events.

Natural grazing lands that cover around 80 percent of Mongolia provide critical ecosystem goods and services, including forage for livestock, habitat for biodiversity and well-functioning watersheds for protecting soil and water. However, overgrazing had become a growing challenge across Mongolia since 1990, when the management of grazing lands was changed from a communal socio-economic system into poorly regulated private ownerships or household grazing practices. This widespread overgrazing has caused severe land degradation in more than two-thirds of Mongolia's grazing lands and raised alarming concerns about the sustainability of current livestock herding production systems.

Mongolia is already experiencing significant changes in its typical climate patterns. Recent changes in annual and seasonal patterns of air temperature and precipitation have doubled the frequency and extent of extreme and chronic climate events such as heat waves and droughts. Future climate projections also indicate that the intensity and risks of extreme climate hazards are likely to increase further by the middle of the century. These emerging, unusual climate patterns and increasing grazing pressure due to the rapidly

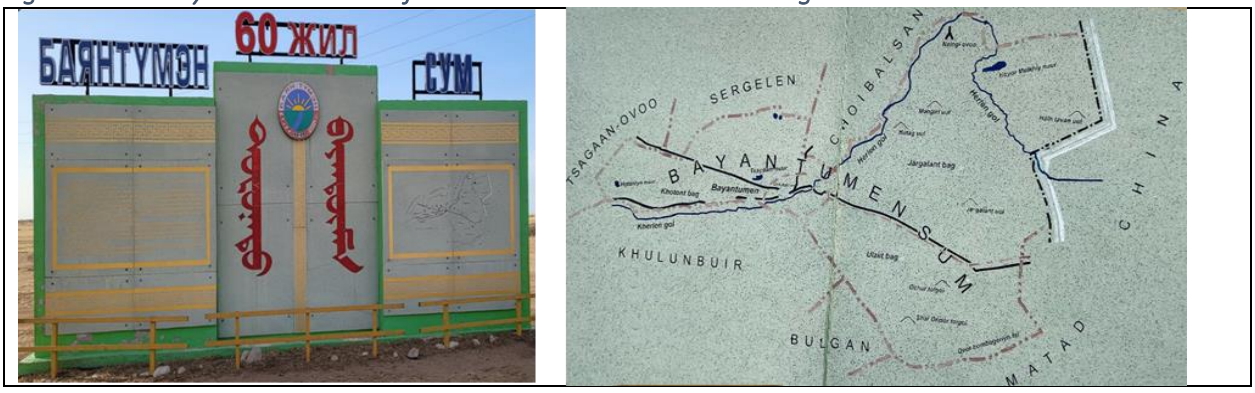
growing livestock population have already stressed the country's fragile grazing lands and diminished their productivity and grazing capacity. Consequently, the overall household well-being is reducing, and herding communities are becoming more vulnerable to climatic changes.

Individual household members play essential but different roles in herding practices. Women and underrepresented members tend to have fewer resources and significantly lower capacity to cope with and adapt to stresses caused by climate change and the degradation of grazing lands. Therefore, a gender-responsive and socially inclusive assessment of climate change vulnerability and risks is required to determine potential adaptive solutions for impacted herder communities and pastoral systems.

Understanding herders' perception of climate change and local impacts on pastoral livelihood systems is an essential first step to enhancing the resilience of herders and herding households to climate change risks. Typically, station-based meteorological data are analyzed to estimate the rate of change in climate patterns. However, in sparsely populated regions of Mongolia, significant data gaps exist in station-derived climate patterns across space and over time. In addition, predictions of climate change and its impacts based on downscaled climate models are highly uncertain at regional and local levels. Herders' observations of local climate change have the potential to provide more robust, finer resolution information on recent impacts of climate change in such data-spare regions. It holds the potential to provide a more complete picture of the vulnerability of local pastoral livelihood systems to climate change. Herders' observations also allow for a better understanding of the anticipated adaptation measures by the local herding communities to cope with climate change risks.

A participatory gender-responsive and socially inclusive CCV assessment was conducted in Bayantumen soum (district) of Dornod Province in eastern Mongolia. The CCV assessment aimed at increasing the knowledge of local herders about the potential risks of climate change to their livestock production systems and their specific needs and constraints to strengthen resilience to climate change. This report includes a summary of herders' perception of climate change risks to their livestock production systems and their capacity for adapting climate-resilient livestock farming practices and pasture management technologies. The CCV assessment also included the potential risks of climate change for underrepresented and vulnerable gender and age groups and their adaptive capacity to climate change risks, which is explained in a separate report.

Figure 1: The Bayantumen Soum of Dornod Province in eastern Mongolia



2 Assessment Approach

2.1 Study Area

The Bayantumen Soum (from now on, 'the Soum') is located in the eastern corner of Mongolia, about 650 km from Ulaanbaatar and 10 km from Choibalsan, the center of Dornod province (Figure 1 and 2). The Soum is further divided into three subdivisions called 'Bagh'. With an average altitude of about 750 meters above sea level, it is positioned on the gently rolling steppe hills of the Mongolian Plateau (Figure 1 and 2).

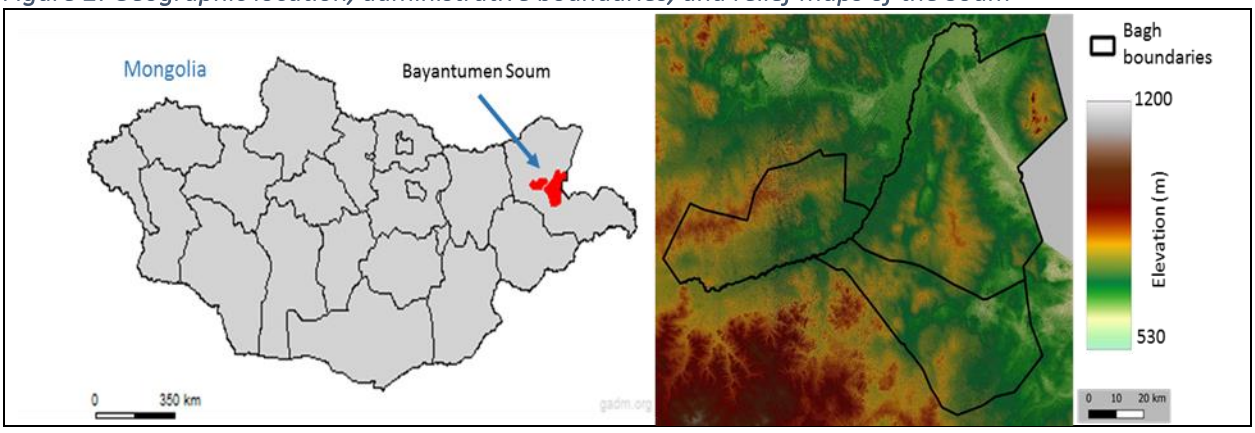
Only one meteorological station is located in the Soum. The annual precipitation in the Soum ranges from about 250-300 mm. The four months of May, June, July and August provide about double the precipitation amount compared to the other eight months. The mean annual temperature is about 2 °C, with January and July as the coldest and warmest months, respectively.

The Soum is mainly covered with dry-steppe pastures of turfy grasses or rhizomatous grasses growing on fragile and erodible sandy soils. Fertile riparian and meadow soil suitable for halophyte grasses, subshrubs and shrubs distributed along riverbanks and other lowland areas.

The Kherulen River is the primary source of water, which originates on the eastern slopes of the Khentii Mountains (Figure 2). Due to extremely high evapotranspiration losses (around 90.1% of precipitation), Soum has limited and unevenly distributed water supplies

The animal husbandry sector comprises about 24 active herder groups and 250,000 head of livestock, mostly raised traditionally. Recently, there has been a constant increase in livestock numbers and a decrease in the available pasture. Many herders with their livestock have migrated into the Soum due to severe pasture degradation and climate change impacts in other regions of the country. As a result, river areas and pastures near water resources have been heavily overgrazed and eroded.

Figure 2: Geographic location, administrative boundaries, and relief maps of the Soum



2.2 Herder Survey

The Intergovernmental Panel on Climate Change (IPCC) defines CCV as "relative risk or the degree to which a system is susceptible to or unable to cope with adverse effects of climate change and climate extremes". The CCV is, therefore, a function of three main components:

1- Exposure or the magnitude and rate of climate change to which a system is exposed.
2- Sensitivity or innate tolerances of the system to climate change impacts.
3- Adaptive capacity or the system's ability to implement adaptation measures that potentially avert the negative impacts of climate change.

A gender-responsive and socially inclusive CCV assessment of local pastoral and livestock farming systems to potential impacts of climate change was conducted in the Soum. The CCV assessment was based on the perception and practices of nomadic herders, who have lived and observed changes in local grazing landscapes for generations.

The concept of the CCV defined by the IPCC was considered to develop a comprehensive survey questionnaire that included both open- and close-ended questions (Annex A). First, a complete list of the recently observed trends in climate variables and predicted near-future climate change impacts on livestock farming systems was compiled from relevant studies and reports in Mongolia and similar pastoral systems. In consultation with local experts, the survey questions were then structured as follows:

1- Specific characteristics of livestock farming systems in the Soum, including information on demographics, livelihood, pasture resources and livestock production management (sections A and B in Annex A).
2- The perception of climate change and the rate and magnitude of exposure to climate change impacts (Section C1 in Annex A).
3- The level of concern and sensitivity of local livestock farming operations to observed and anticipated climate change impacts and how they are linked to other emerging environmental issues in local grazing landscapes (Section C2 in Annex A).
4- The ability and existing capacity of livestock farming systems and herding communities to undertake or continue adaptation actions to address the risks of climate change (Section C3 in Annex A).
5- Major barriers and challenges limiting the adaptive capacity of local livestock farming operations and herding communities to observed and anticipated impacts of climate change (Section C3 in Annex A).
6- Gender-specific characteristics of local livestock farming systems and herding communities, including information on ownership, responsibilities, decision-making process and income (Section D in Annex A).

Across the Soum, a total of 109 herder surveys were completed through direct interviews of herder families during a field visit in June 2022 and with support from local experts and the herders' stakeholder group.

The survey interviews included a range of herder household members with diverse demographics, education, pasture, livestock and livelihood characteristics, as detailed in Table 1.

Table 1: Characteristics of herder household members surveyed in the Soum

Characteristic	Detail: Category, Frequency and Percentage (%)
Gender	*Female*: 56 (51.4%); *Male*: 53 (48.6%)
Age (year)	*15-25*: 6 (5.5%); *26-35*: 25 (22.9%); *36-45*: 25 (22.9%); *46-60*: 29 (26.7%); *>60*: 24 (22%)
Marital status	*Unmarried*: 19 (17%); *Married*: 90 (83%)
Education	*Primary*: 54(50%); *Secondary*: 33 (30%); *Post-secondary* 22 (20%)
Household size	*1-3*: 41 (38%); *3-5*: 44 (40%); *>5*: 24 (22%)
Herding history (year)	*<10*: 34 (31.2%); *10-20*: 24 (22%); *> 20*: 51 (46.8%)
Total livestock herded	*<300*: 43 (40%); *300-500*: 22 (20%); *>500*: 44 (40%)
Income from livestock	*<50%*: 26 (24%); *50-75%*: 22 (20%); *>75%*: 61 (56%)

2.3 Data Processing and Analysis

Information obtained through the herder survey was analyzed based on the specific characteristics of surveyed herders and their livestock farming systems (number 1 in section 2.2) to obtain information on questions listed in section 2.2 (number 2 to 6). The results were then employed to assess the vulnerability or relative risk from CCV to local herding communities and their livestock farming systems.

A simple numerical rating approach was used to assign CCV scores to surveyed herders. First, the qualitative scores assigned to sub-questions related to exposure, sensitivity, and adaptive capacity to climate change (questions 3 to 8 in Annex A) were standardized from 0 ('No or Not' categories) to 1 ('Big', 'Very Much', 'Most', 'High' or 'Major' categories) scale ('NA/Don't Know' records were not considered).

These quantitative scores were then averaged with equal weight and separately across sub-questions and questions associated with exposure (questions 3), sensitivity (questions 4, 5 and 6), and adaptive capacity to climate change impacts (questions 7 and 8 in Annex A).

The final CCV scores for surveyed herders were calculated as the difference between the standardized, average scores (0-1) of potential exposure and sensitivity and the standardized average scores (0-1) of adaptive capacity. Therefore, the final CCV scores lie between '0' and '1', with '0' indicating no vulnerability and '1' indicating the maximum vulnerability of surveyed herders to climate change impacts.

Figure 3: Survey of herder communities in the Soum

3 Exposure to Climate Change

A total of 109 herder household members were surveyed for their observations of recent climate changes in the Soum. Herders identified climate change as one of the main challenges they have faced in recent years and expect to face more in the future in raising livestock and being a herder. Most of the surveyed herders (about 80%) agreed that climate change is occurring in their area, and extreme weather events are happening more frequently recently due to climate change. They also expected (about 72%) that these unprecedented changes in climate patterns would be more severe in future (e.g., following 20 years).

Herders' perception of exposure to climate change was assessed based on nine climate change indicators identified from the previous climate change studies relevant to the region (Table 2). Overall, about 80% of the surveyed herders indicated some (46%) or big (34%) magnitude of exposure to climate change. However, herder's observations of changes in location, timing, amount, intensity, and form of precipitation (85%), followed by changes in seasonal temperature patterns (78%), were more remarkable. During the interviews, herders highlighted their major observations of recent climate changes in the area as less snowfall and snow cover during winter; cooler, windier, drier and slower spring season; and relatively drier summer months and more intense droughts. A significant number of surveyed herders already had experience dealing with natural hazards and extreme climate events. However, changes in the intensity and duration of winter storms (dzud) and extreme events such as floods seem to have not been among the primary observations of the herders about the recent climate changes in their area (Table 2).

Assessment of recent climate changes in eastern Mongolia indicates a shorter cold season (October-March) but a longer warm season (April-September). It shows increases in both mean annual maximum (0.6-2.0°C) and minimum daily temperatures (1.0-2.0°C), indicating more intense extreme hot days but less frequent extreme cold periods and generally a milder cold season. It also shows a slight increase in warm season rainfall but more intensified droughts and dryness. Future projections also demonstrate increases in temperature across all four seasons (on average, 1.3°C) but a minimum change in precipitation except for the summer season (June-August) with an expected decrease of 10-20%.

Table 2. Herders' perception of local climate changes over the last 20 years. Values in this and tables 3–7 indicate the percentage of surveyed herders out of 109 surveys completed.

Table 2: Herders' perception of local climate changes over the last 20 years

Type of Change	Magnitude of Change			NA/DK
	No (1)	Some (2)	Big (3)	
Location and timing of rainfall	5.9	45.1	44.1	4.9
Amounts of seasonal and annual rainfall	4	56	29	11
Amount and intensity (power) of rain in a single rainfall event	9.2	49	32.7	9.2
Amount and intensity of snowfall and duration of snow cover	8	39	45	8

3 Exposure to climate change

Type of Change	Magnitude of Change			NA/DK
	No (1)	Some (2)	Big (3)	
Seasonal and annual temperature	9.1	36.4	41.4	13.1
Number of hot days during summer months	13.1	40.4	34.3	12.1
Number, intensity and duration of winter storms and dzud	18	59	14	9
Number, intensity and duration of droughts, floods and hail events	8	44	33	15
Onset and length of the growing season	23.6	47.2	27	2.2

4 Sensitivity to Climate Change

Herders' perception of sensitivity to climate change was assessed using 25 indicators associated with impacts (Table 3) and risks (Table 4) from local climate changes and how they are linked to the emerging environmental issues in the Soum (Table 5).

4.1 Herders' Perception of Impacts

Overall, about 74% of surveyed herders (*Somewhat*: 29%; *Very much*: 45%) raised concern about the six types of climate change impacts that were asked for their perception (Table 3). Among these impacts, herders were most concerned about climate change impacts related to the growing season and summer period. The majority of herders raised concern about the reduced amount of rainfall or relatively drier growing season (81%) and increased frequency of harsher summer periods (80%). This was followed by impacts on onset and length of growing season (74%) which is closely tied to the previous two impacts (Table 3).

Although changes in the absolute volume of rainfall were a primary concern for the herders, they were also worried about the delay in spring and early summer rain in recent years. They are well aware that climate change-induced increases in growing season temperature can potentially improve heat supply for vegetation growth in their area. However, they are highly concerned about the more intense heat stress and severe water supply shortage for vegetation growth and productivity during the optimal growing period (June-July) in their semi-arid grazing lands. In recent years, the frequency of spring drought events showed an increasing trend in eastern Mongolia.

Table 3: Herders' level of concern about local impacts of recent climate changes

Type of Impact	Concern level			NA/DK
	Not (1)	Somewhat (2)	Very much(3)	
Reduced amounts of rainfall during the growing season	3	26	55	16
Increased number of flood and hailstorm events	13.3	35.7	26.5	24.5
Increased number and duration of harsh (very hot) summers	4	29	51	16
Increased number and duration of harsh (very cold) winters	5	21	50	24
Reduced amount of snowfall and snow cover on the ground	10	31	36	23
Altered onset and length of growing seasons	7	28	46	19

4.2 Herders' Perception of Risks

Herders were also asked about the sensitivity of their herding and livestock farming systems to eight major types of risks from local climate changes (Table 4). On average, around 74% of the surveyed herders assigned a moderate to a most level of sensitivity (46%) to the listed risks. As also highlighted during group discussions and interviews, local herders indicated a high sensitivity to risks associated with the productivity (79%) and profitability (72%) of their livestock herds. Based on the survey results, this mainly came from risks to the supply of livestock feed and fodder (81%), pasture forage productivity (75%), and livestock

access to water (77%) during harsh summer and winter months, which altogether can potentially increase the rates of livestock health issues (73%).

Table 4: Herders' perception of their sensitivity level to risks from local climate changes

Type of Risk	Sensitivity: 1 or 'Not Sensitive' to 5 or 'Most Sensitive'					NA/ DK
	1	2	3	4	5	
Increase in the frequency and severity of steppe fires	9.9	4	12.9	5.9	50.4	16.9
Uncertainty in grass available from the pasture	6	7	21	9	45	12
Limited supplemental feed and fodder availability in harsh summers and winters	5	6	16	15	50	8
Uncertainty in access of livestock to water	9.9	4	15.8	10.9	50.5	8.9
Increase in the rates of livestock health issues	14.1	7.1	20.2	10.1	42.4	6.1

Reduction in forage and hay production and a decrease in forage quality and nutrient availability for livestock are expected under a changing precipitation and temperature regime during the growing season. Around 70% of the surveyed herders indicated that they currently have access to enough pasture forage for their livestock. However, a significant percentage of them also indicated a need to buy additional hay and fodder for their livestock, including grass hay (67%), oats (35%), concentrated feed (13%), and wheat barn (91%).

Currently, most herders (90%) either do not own private or shared hayland and cropland or the area of their cultivated land is not sufficient. In addition, more than 70% of their additional hay and fodder requirements are bought from local animal feed markets in and around the Soum area. Therefore, as climate change impacts intensify in the Soum and surrounding areas, any declines in pasture forage quality and quantity need to be offset by supplementary feed and fodder from other regions. However, this might not be possible anymore for herders with low income and livelihood sustainability levels.

Like similar regions around the world, climate change is projected to reduce surface and groundwater, and thus, livestock access to water in arid and semi-arid grazing lands in Mongolia. Surveyed herders indicated river (38%) and specifically well or groundwater year-round (45%) and during the winter season (74%) as primary water sources for their livestock. However, they were concerned about the risk of a higher rate of variability in river flows and water quality, as well as a decline in groundwater levels in recent years. In herders' opinion, if livestock has no access to water, it does not matter how green pastures are. Herders also indicated that livestock was used to obtain enough water by licking the snow while grazing on pastures in winter. However, with the reducing trend of snowfall and snow cover in recent years, they believe this is no longer an option for their livestock. A few herders were also anxious about the upstream water harvesting and management in the Kherulen river basin and if it can result in water scarcity and conflicts as climate change progresses in their area.

Lastly, most of the herders (90%) thought their livestock shelters were sufficient during harsh winters. Damage to the critical local infrastructures for livestock seems to have not been a major risk to their livestock herding operations in recent years.

4.3 Herders' Perception of Environmental Issues

A thorough CCV assessment of herding communities and their livestock farming practices requires a clear understanding of the interactions between impacts from local climate changes and other emerging environmental issues. Therefore, herders were also asked about their perception of the linkage between local climate changes and 11 environmental issues relevant to the Soum (Table 5).

Overall, 74% of surveyed herders thought that the questioned environmental issues had been rooted or intensified due to the recent climate changes in their area (Table 5). Although around 60% of the herders indicated that the number of livestock they herd had increased slightly (47%) or a lot (17%) in the past five years, they were uncertain that local climate changes primarily caused this recent increase in their livestock number. However, herders emphasized the increase in herd size as a coping strategy they had previously taken to avoid a total loss of their livestock during a drought or dzud. Further implementation of such adaptation strategies could contribute significantly to the growing number of livestock in the Soum as climate change impacts worsen and livestock market opportunities expand in the future.

A relatively large percentage of herders (71%) thought that recent climate changes intensified steppe fires in the region. High water deficits and drier and hotter climates generally satisfy fuel flammability during the fire season. However, due to high grazing pressure and frequent spring droughts in recent years, fuel load is minimal, except for small patches of halophyte grasses and subshrubs along the lakes and rivers, as well as rarely grazed pastures with little or no water resources. Therefore, herders seem to have been less worried about the risks of steppe fires in their area in recent years.

Table 5: Herders' perception of the link between environmental issues and local climate changes

Type of Environmental Issue	Link to climate change			NA/DK
	Not(1)	Somewhat(2)	Very much(3)	
Shift in agricultural lands and increase in land cultivation	12.4	26.8	19.6	40.2
Livestock number increases	29	31	28	12
Increasing pressure of trampling and grazing intensity	21	34	38	7
Increasing out of season grazing and livestock movement events	9.2	35.7	49	6.1
Shift in steppe vegetation (e.g., native to invasive plants)	9.1	32.3	50.5	8.1
Increasing frequency and severity of steppe fires	22	28	43	7
Expanded size of bare ground and barren patches	6.9	34.7	50.5	7.9
Increasing runoff and water-related soil erosion events	14	29	43	14
More frequent dust storms and wind-related soil erosion	5	33	53	9
Reductions in crop and forage yield and quality	3	31.5	42.4	23.2
Dropping water level in water resources (e.g., rivers, wells)	7.9	30.7	51.5	9.9

Mongolian herders have migrated across the grazing lands with their livestock for thousands of years. However, their mobility patterns around their seasonal campsites have recently changed, and the distance travelled during the seasonal movements has generally decreased. About 85% of the surveyed herders indicated a linkage between climate change-related increases in drought periods and herders' mobility or livestock movements (Table 5). Traditionally, nomadic herders were used to moving at least four times a

year. However, survey results revealed that 23% of herders do not move at all, 30% move once or twice a year, 19% move three times a year, and only 28% move at least four times a year. In addition, the survey results revealed that the seasonal movement of about 77% of the herders is recently limited to a maximum of 10 km, of which 41% move less than 5 km to reach their furthest pastures.

Herders thought this reduced livestock mobility was primarily driven by climate change-induced drop in water resources level (82%) and pasture forage quality and quantity (74%) in their area (Table 5). They highlighted the need to find unconventional water sources. They emphasized that if water is available and the pasture condition is good, they migrate to 3–4 fixed sites, preferably near their winter and spring shelters. However, 87% of them indicated that they do not usually use any sort of *otor* movement. They also highlighted that their control over access to traditional livestock movement routes and pasture and water resources had been recently diminished by establishing new pasture management boundaries, as well as by pressure from outside herders and livestock moving into or through their area.

Grazing pressure is frequently mentioned as a driver of land degradation in the region. Overall, 72% of the surveyed herders believed that local climate changes had recently intensified grazing pressure in their area, particularly around and close to the remaining water resources (Table 5). They firmly believed that recent climate changes in other parts of the country have also contributed to grazing pressure in their area. Herders stated the recent relocation of a large number of unregistered livestock into the Soum due to severe land degradation and frequent droughts in other regions of the country. They thought this had significantly contributed and will continue to contribute to grazing pressure and pasture degradation in their area. However, a few herders also stated lack of livestock mobility and, therefore, lack of vegetation recovery period in continuously grazed areas as another reason for high grazing pressure.

Climate change-induced shift in steppe vegetation was one of the most quoted (83%) environmental issues by surveyed herders (Table 5). In general, herders were aware of the disappearance or declines in the abundance of specific desirable plant species and increases in the abundance of undesirable and poor-quality plant species in their pastures. They knew how grazing pressure and herd composition or livestock mixture impacts steppe plant species and vegetation cover. They considered horses to damage evidently their pastures compared to other livestock. However, they were uncertain about the extent to which grazing pressure, herd mixture and climate change have contributed to vegetation change and pasture degradation in their area. Basically, they did not say pasture vegetation has degraded only because of climate change.

The expanded size of bare ground and barren patches was another mostly quoted (85%) environmental issue linked to local climate changes (Table 5). Most herders described vegetation cover degradation in the context of increasing soil (86%) and water erosion event (72%) in recent years. Herders indicated more intense wind and sandstorms, possibly driven by the impacts of recent climatic changes in their area. Climate change and overgrazing have been considered the main drivers of pasture degradation in Mongolia. Consistent with this public view, the drivers of degradation most commonly mentioned in recent studies were grazing, followed by changes in precipitation and temperature regimes. A key issue is the concentration of livestock around the few usable wells and water bodies. Overgrazing reduces or eliminates vegetation cover, leading to increased loss of soil moisture and worsens soil erosion by wind and rain. The

shallow topsoil in the sandy steppe brown soils of the Soum will be at a high risk as impacts from grazing pressure and climate changes will intensify.

5 Adaptive Capacity to Climate Change

Herders' perception of adaptive capacity to climate change was determined using 12 indicators related to different aspects of their livestock farming operations. Specifically, herders were asked to rate their ability (Table 6) and the major barriers (Table 7) to undertaking adaptation actions and addressing the risks of climate changes in their area.

Despite the relatively high exposure and sensitivity to risks from climate changes (Table 4) and in contrast to the expectations and ground observations, 78% of the surveyed herders believed in having a moderate (27%) to high ability (51%) to adapt the questioned aspects of their livestock farming to risks from local climate changes (Table 6). Among these aspects, herders perceived to be slightly less capable of dealing with livestock feed shortage (73%), livestock immobility or limited seasonal movement (77%), and risks from steppe fires (74%). Herders also stated a much higher than expected ability to deal with the risks associated with access to water resources and health control services for their livestock under a changing climate in their area (Table 6). However, several herders stated the flexibility in livestock movement and distribution across the landscape as the key determinant of their vulnerability and also ability to cope with risks from climate change impacts. In addition, as expected, most of the herders (84%) indicated a relatively high ability to deal with climate change risks to their basic livestock shelter and other critical infrastructures.

Table 6: Herders' perception of their ability and capacity to adapt to risks from local climate changes

Type of Risk	Ability: 1 or 'No Ability' to 5 or 'High Ability'					NA/ DK
	1	2	3	4	5	
Livestock access to feed/ fodder and feed supplements	20	5	12	14	47	2
Livestock access to water	12.9	6.9	17.8	8.9	53.5	0
Livestock diseases and health control	13	3	19	13	51	1
Livestock protection from steppe fires	13	10	23	10	41	3
Livestock shelters and other critical infrastructures	12.1	3	16.2	8.1	59.6	1
Livestock movements, transportation and retailing	17.2	5.1	11.1	10.1	55.6	1

A total of six indicators (Table 7) related to knowledge, awareness, and technology; the physical environment and biological resources; economic and financial structure; human resources and operational capacity; and governance and institutional capacity were used to assess herders' perception of barriers to adapting to local climate changes.

Unlike the previous indicators, a mixed range of herders' perceptions was obtained for the questioned barriers. Overall, 55% of herders identified these barriers as moderate (3) to major barriers (5), while the remaining 45% characterized them as no or minor barriers to coping with local climate changes (Table 7). The herders' lack of practical knowledge and adaptation technology was the most rated barrier (68%). This was followed by the labor shortage (63%) and lack of financial resources (63%) or herders' limited financial capacity or inability to implement adaptation measures. Lastly, a relatively higher percentage of herders (52%) thought the existing capacity within government institutions and the physical and biological

capability of their land and water was no barrier to supporting climate change adaptation measures.

Table 7: Herders' perception of major barriers limiting their capacity to adapt to local climate changes

Type of Barrier	Barrier: 1 or 'No Barrier' to 5 or 'Major Barrier'					NA/DK
	1	2	3	4	5	
Lack of financial means and capacity to cover costs of implementing adaptation strategies	20.2	15.2	27.3	9.1	26.3	2
Lack of practical and technological knowledge of effective adaptation strategies	15.2	13.1	28.3	13.1	26.3	4
Lack of operational capacity to undertake adaptation strategies (e.g., machinery)	28.4	14.7	27.4	12.6	10.5	6.3
Labor shortage	25.5	11.2	17.3	19.4	26.5	0
Lack of or incapacity of government institutions to support the implementation of adaptation strategies	43.3	9.3	15.5	10.3	18.6	3.1
Lack of or incapacity of the land and/or water to support the suggested adaption changes	38.5	13.5	15.6	7.3	20.8	4.2

Improvements in knowledge and information distribution, advancements in technology and infrastructure, and the development of appropriate policy and financial incentives were stated by herders as necessary steps to adapting their management to a changing climate. Herders debated that access to pasture and livestock information at relevant spatial and temporal scales promotes their ability to detect and respond appropriately to the risk of negative feedback from climate changes. Herders also discussed the need to create financial incentive programs and policies (e.g., payment for environmental services) that promote implementing adaptive solutions. Government interventions and programs, such as managing increased livestock numbers by initiating tax penalties for owning over a certain number of livestock, were also highlighted. Herders emphasized that they require higher-level policies and coordination for pasture monitoring and effective seasonal movements of their livestock across the landscape. From group discussions with herders, it sounded that locals are currently undergoing a competition for increasing the number of livestock and altering herd composition without thinking thoroughly about its outcomes for their pastures and other essential resources.

Figure 4: Livestock herding in the Soum

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6 Vulnerability and Risks from Climate Change

A simple numerical rating approach based on the standardized (0-1) average scores of the 46 questioned indicators (Table 2 to 7) was used to calculate final scores of exposure, sensitivity, adaptive capacity, and CCV for the surveyed herders. Variation in these scores (Figure 5) was then compared amongst herder groups with different herding history (year), the total number of livestock herded, the percentage of income obtained from livestock herding, and the number of household members (Table 1).

Overall, surveyed herders were characterized with a relatively high exposure to climate changes (Figure 5). The scores showed a tendency towards a higher exposure of herders with a more extended history of livestock herding and a higher dependency on income from livestock (Figures. 5A and 5C). While a tendency toward a lower exposure to climate changes was observed for herders with a larger household size (Figure 5D). Surveyed herders were also characterized with a relatively high sensitivity to climate changes (Figure 5). There was only a small association between herder's scores of exposure and sensitivity to climate changes. However, in contrast to the exposure scores, the results also showed a tendency toward a higher sensitivity of herders with a larger household size to climate changes (Figure 5D). Surprisingly and in contrast to the expectations, surveyed herders were also characterized with a relatively high adaptive capacity to cope with climate changes (Figure 5). Similar to the exposure scores, the results showed a tendency towards a higher adaptive capacity of herders with a longer history of livestock herding and a higher dependency on income from livestock (Figures 5A and 5C). However, no association between herder's scores of exposure or sensitivity to climate changes and their adaptive capacity was observed.

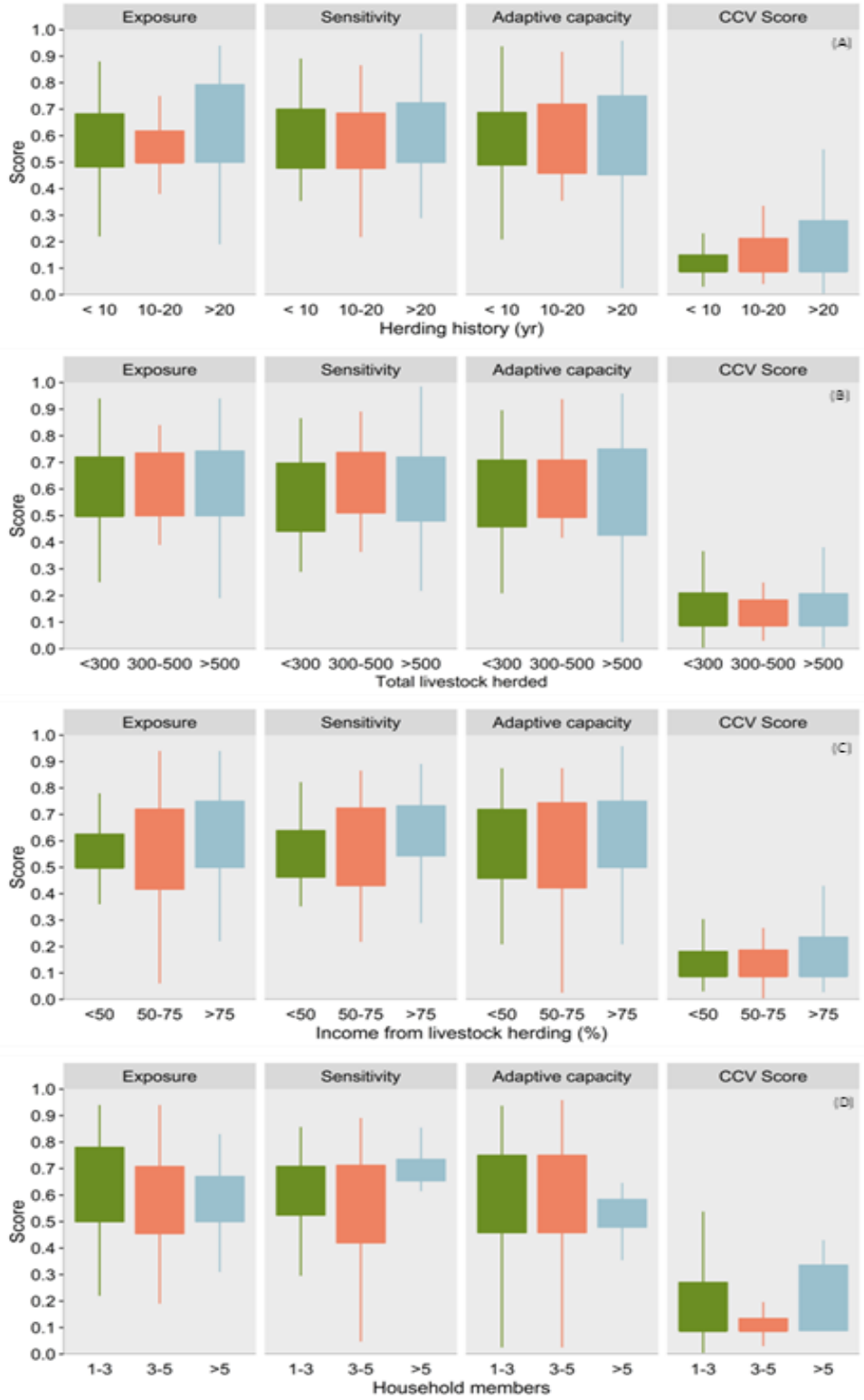
The final CCV scores for surveyed herders were calculated based on the difference in their impacts and risks from climate changes (exposure and sensitivity) and their adaptive capacity. Overall, surveyed herders were characterized with a relatively low and close vulnerability to climate changes (Figure 5). However, the scores showed a more apparent tendency towards a relatively higher but still low vulnerability of herders with a longer history of herding, a larger herd and household size, and a higher dependency on income from livestock (Figure 5). The results explained here could be well influenced by indicators selected and survey design and sample size. However, from the field observations, it was evident that experienced herders have a deeper understanding of long-term climate changes and how and to what extent these changes can put their herding practices and livelihood at risk. t was evident from herders' feedback that it would be more challenging to feed, move and raise a larger livestock herd as climate change impacts intensify in the region. A higher risk and vulnerability of larger households mainly relying on herding and raising livestock was also observed from discussions with local herders.

Herder's perception of climate changes and risks presented here could likely be mainly related to their perceptions of the changes in pasture condition, which is not only affected by changes in climate but also by changes in pasture management, including livestock grazing pressure. In addition, the divergence observed between herders' perception of their adaptive capacity and the expectations or reality could likely be related to sets of beliefs and concepts through which they live and understand the environment around them and use to solve the problems they face. Mongols' optimistic views and their specific attitude and culture of positivity support a belief that talking about bad things will cause them to happen. Therefore,

this assessment might not have captured an accurate picture of herders' adaptive capacity for risk management under a changing climate.

Figure 5 shows the variation in potential exposure, sensitivity, adaptive capacity and CCV of surveyed herders to climate change impacts. Boxplots illustrate the range of variation in standardized, average scores calculated for different groups of surveyed herders (A: herding history; B: total number of livestock herded; C: percentage of income from livestock herding; D: number of herders' household members).

Figure 5: Variation in potential exposure, sensitivity, adaptive capacity and CCV of surveyed herders to climate change impacts



7 Gender, Vulnerability Assessment

7.1 Gender division of labour and gender gap in authority

The study used 10 variables for measuring the gender division of labour in livestock production, domestic chores and participation in the community activities. Even though the majority of respondents answered that this is joint work, the results reveal that male members of households are more active in six (6) out of seven (7) livestock herding activities while female members are more active in dairy production and home chores including childcare, cleaning, washing and cooking. Most participants responded that men are more active in the community activities such as meeting with officials and participating in meetings, activities and trainings for herders' groups and cooperatives. The results reveal that male herders are more active in the production and social-community activities while female herders' participation is dominant in the unpaid work or reproductive works and home chores (Table 8). It is important to highlight that there long and repetitive activities under the women's "home chores" even the table shows that male herders are active in many activities, comparing number of activities is not a measure of total time spent on activities. On the other hand, it is interesting to see that female members' participation in income generation activities is lower than male members.

A Time Use Survey conducted by the National Statistics Office (NSO) in 2019 reveals that a rural man over 12 years old spends 554 minutes per day for a week for production activities while a rural woman spends 374 minutes, a man sends 68 minutes, but a woman 264 minutes for unpaid home chores and a man spends 818 minutes and a woman spends 802 minutes for self-development and private times (NSO, 2019). A rural male spends more than 1.5 times than a woman in production activities, but they spend 3.9 times less in home chores. This allows men more time than women for self-development and private time.

This difference was revealed quite uniquely in the difference between men and women living in the capital, in the provinces and soum centers. Specifically, rural women spend the most time on production activities compared to other women, but they spend 71 percent of production activities on household final products for consumption. By comparison, women in the capital spend only about 5% of their time in production on making household products. Therefore, the rural women participants of our study confirm that "men are involved in agricultural production activities, and women are dominantly involved in milk and milk products processing and housework". In addition, it shows that rural women's' unpaid care duties limit the time available to earn income.

The relatively low participation of female herders in agricultural production activities is related to the fact that the herder families are live separately in the soum center and countryside during school. During the Focus Group Discussion (FGD) with female herders, it was explained that living separately has become common among people under 40 years of age and relates to the reduction of the school age to six years. The consequences of this separate living for women include reducing women's participation in livestock production as well as their income and power (or authority) in the family. In addition, in terms of economic impact for the household, when only one member is producing the household products, it limits overall

production and income, increases the lack of human resources, and tends to increase household expenses as well, since those products no longer produced in the home must be purchased.

Table 8: Gendered division in livestock farming and house chores (% completed by each)

Task	Man\ Husband (%)	Woman\ Wife (%)	Boy (%)	Girl (%)	No Answer (%)
1. Herding, watching and caring animals	83.3	10.8	5.9		
2. Search for animals	91.0	3.0	6.0		
3. Milking and preparing dairy products	6.1	88.9			4.0
4. Haymaking and harvesting	74.0	3.0	4.0		19.0
5. Fencing pasture	44.9	3.4	1.1	1.1	49.4
6. Plant hay land or cropland	40.4	2.2	1.1		56.2
7. Housework (take care of child, clean houses, wash, cook and etc.)	7.1	84.7	2.0	6.1	
8. Meet with officials for business	70.7	24.2	2.0		3.0
9. Participating in herders' group's activities such as meetings, trainings and etc.,	68.7	26.3	1.0		4.0
10. Treating animals, preventing diseases, washing and tec.	74.2	19.6	5.2	1.0	

Source: Herders' survey in Bayantumen soum, Dornod, June, 2022

The survey identified the gender disparities in eight (8) livestock production activities. Men's participation dominates in livestock production activities (except for cleaning the guts of slaughtered animals), sales, income distribution, and training in animal meat preparation which relates to the traditional division of labour. More than 10 percent of the participants of the study use a commercial slaughterhouse, so they do not perform some detailed activities of meat preparation at household level.

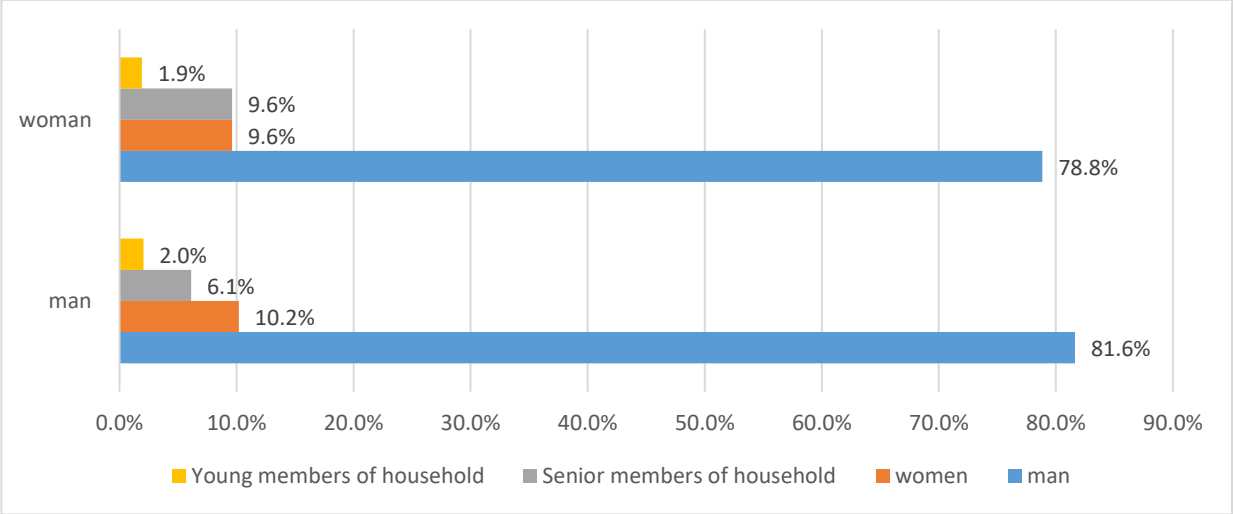
It was observed that training activities for feeding and meat preparation out of mentioned activities in the study are rare in the local area. On the course of the interview, it was observed that male participation might be higher in these trainings if the training were organized.

Table 9: Gender division in meat producing

	Male	Female	No Necessary
1. Feeding animals	46.5	18.2	35.4
2. Driving and transporting	90.7	3.1	6.2
3. Slaughtering	88.9	2.0	9.1
2. Breaking, dividing, and classifying	87.9	2.0	10.1
3. Skinning and cleaning the carcass	79.3	7.6	13.0
4. Cleaning intestines	11.1	78.8	10.1
5. Selling animals or meats	79.8	14.1	6.1
6. Communicating with partners and negotiate prices	82.0	13.0	5.0
7. Distribute income from selling livestock or meats	66.0	29.0	5.0
8. Attending at training on feeding and meat preparation and meetings	48.0	12.2	39.8

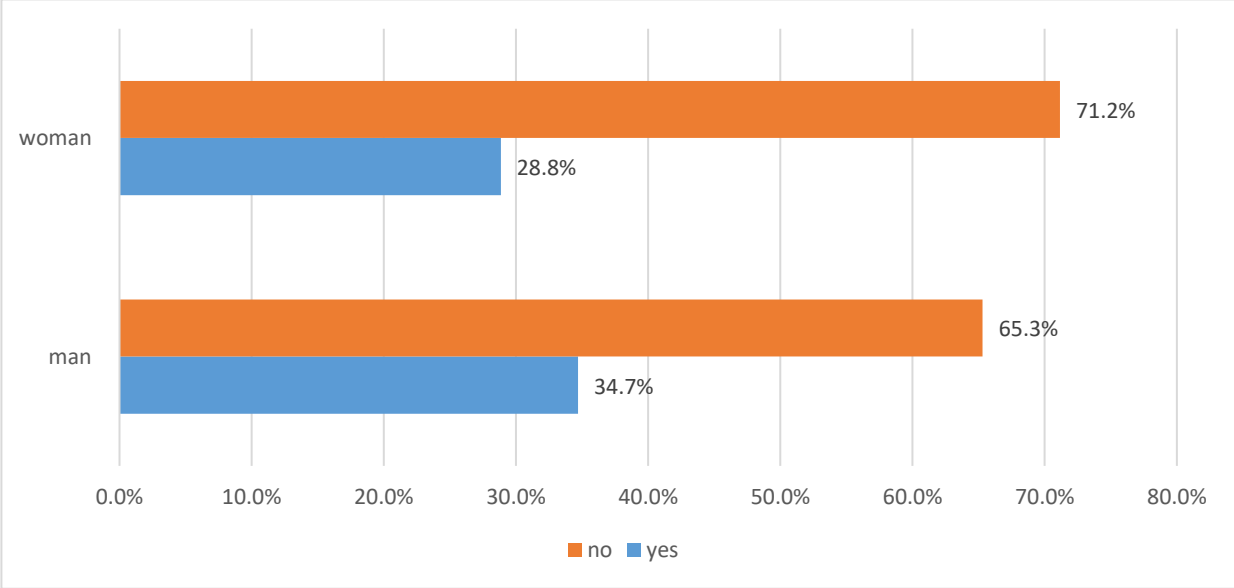
Table 9 reveals that the participation of men in meat production is dominant across all but one activity. To this extent, 80% of the respondents (78.8% of women and 81.6% of men) say that the power to distribute income from meat production and make decisions related to meat production is in the hands of men (Figure 6). In particular, male members of households with 1,000 or more animals make 100% of the decisions related to meat production. This low participation by women in production activities leads to low decision-making power.

Figure 6: Who usually makes meat production decisions? (by sexes)



Survey responses showed that 34.7% of men but only 28.8% of women are able to save money in their own savings account with the income from meat processing activities, a difference of 6 percent. Thus, there is a difference in participation and power between men and women in meat production that leads to different opportunity to share in the income. Low participation leads to disparities in power and income (Figure 7).

Figure 7: Do you save money from meat processing activities (by sexes)



When herders are asked to name the sources of income that can be sold or used without asking for anyone in the family, they named selling livestock or meat, cashmere, and skins and hides, milk and dairy products, and pension and allowances. There is no significant sex difference, but 23% of women and 19% of men answered that they do not have a source of income that they have authority to manage on their own. Although there are women who have the authority to use of the income from the sale of livestock without asking anyone, there is another category of women who have no source of income to use without asking anyone. Therefore, instead of analyzing by the single category of sex as "women and men", the survey evidence shows that it is better to identify the vulnerability by intersectional analysis including economic position and marital status.

7.2 Gender gap in property ownership

Official government livestock census registration information is recorded in Form A approved by NSO. In our survey, we determined owner of the livestock and 84% of the respondents answered that their herds are registered in the name of the husband as the head of the household, 5.2% registered as their co-owners, and 5.2 registered under the name of the female head of the household (Table 10). There was no significant different by gender or marriage status.

Table 10: Ownership of household livestock according to the official registration Form A

Head of household - husband	Head of household - wife	Co-owned	Children	Parents and relatives	Other people
83.5%	5.2%	5.2%	4.1%	1.0%	1.0%

The number of livestock remains significantly important in determining the livelihood of the herders, while the size of family members plays an important role in nomadic livestock production. The average number of livestock of all herders participating in the survey is 541 while the average number of livestock owned (145) was lowest for 15-25-year-olds. Therefore, vulnerability in terms of livelihood is more evident among the group aged 15-35 (Table 11).

Table 11: Mean of livestock by age group and sex

Age-Interval	Mean	N	Std. Deviation
15-25	145.0	6.0	127.1
26-35	455.0	25.0	369.9
36-45	690.3	25.0	444.7
46-60	575.1	29.0	476.1
over 60s	528.6	17.0	552.4
Total	540.8	102.0	456.6

In terms of marital status, the average number of livestock for people living as couples is 570, while for people living alone or as a single headed household, the average number is 400 (Table 12). Rather than sex, being the head of a household alone results the differences in the livelihood of the herders. Men and women who are single or single heads of households may be more vulnerable to climate change.

Table 12: Mean of livestock by marital status

Marital Status	Mean	N	Std. Deviation
Married	570.0	82.0	435.7
Single or single headed	400.4	26.0	474.7
Total	529.2	108.0	449.0

82% of men who are single heads of households have less than 300 livestock. The small sample size limits detailed statistical analysis. This shows that there may be correlations in both ways, on one hand, being a single household head is key factor to have small number of livestock, and on the other hand, having small number of livestock results to live or head the household alone. The small sample size limits detailed statistical analysis that could be done further.

Although the average number of livestock of female participants was higher according to the result of our survey, it is also revealed that livestock as well as most of the property, assets and tools of families are registered in the name of men, heads of the households. This means that men have a better chance of getting loans from banks and financial institutions.

The study also identified the ownership of the profit, facilities and equipment used in household consumption and production in the official registration. Profit and equipment such as winter and spring camp, wells, trucks, carriages and motorcycles, which are common in pastoral families, are mostly owned by a man. In addition, more than 40 percent of the herders who participated in the study own fences, houses, apartments, and vegetable fields in central settlements, and almost all of them are owned in the name of men (Table 13). Thus, men are dominant in property ownership in local areas covered by our study.

Table 13: Ownership of properties or facilities

Properties and facilities	Man\husband (%)	Woman\Wife (%)	Father (%)	Mother (%)	No (%)
1. Winter camp	71.4	3.1	2.0		23.5
2. Spring camp	58.1	3.2	3.2		35.5
3. Well	60.0	4.2	3.2		32.6
4. House	44.2	3.2			52.6
5. Apartment in town	36.4	4.5			59.1
6. House with yard in town	33.7	6.0	1.2		59.0
7. Land for crop, vegetable etc.	19.8	3.7			76.5
8. Business premises and facilities	15.8				84.2
9. Truck	64.4	2.2			33.3
10. Sedan car	49.4	6.0	1.2	1.2	42.2
11. Tractor	33.8	5.0	1.3		60.0
12. Motorbike	80.0	2.1			17.9

Winter and spring camp and associated land have significant role in the livestock herding because it allows for the use of pastures. 76.5% of the respondents have winter house, 56.5% spring camp, 59.5% summer camp, and 52.6% fall camp and 66.6% have certificate for winter camp, 60% have certificate for spring camp, 3.1% have certificate for summer house and 1.8 have certificate for fall camp only. In general, an ownership certificate is given for winter camp and spring camp according to the law, the summer and fall camp are used within the public ownership purposes.

Based on the gender analysis, the number of women who have winter, spring, summer and fall camp is 4-7% less than men, while 3-13% less women have ownership certificate (Table 14). So, it is observed that male herders have a relative advantage in terms of land use compared to women. There are no differences by marital status.

Table 14: Ownership of camps by sex (%)

Camps	Ownership of Camps				It's Certificate			
	Male		Female		Male		Female	
	Yes	No	Yes	No	Yes	No	Yes	No
a. Winter camp	83.0%	17.0%	70.6%	29.4%	73.3%	26.7%	60.4%	29.6%
b. Spring camp	59.1%	40.9%	54.2%	45.8%	63.2%	36.8%	60.0%	40.0%
c. Summer camp	61.5%	38.5%	57.8%	42.1%	3.3%	96.7%	2.9%	97.1%
d. Fall camp	55.3%	44.7%	50.0%	50.0%	3.7%	96.3%	0.0%	100.0%

Analyzing the ownership and possession of winter and summer camps by age group, 40% of young people aged 15-25 have winter camp and 25% have ownership certificate, and 20% have spring camp, but none of them have ownership or possession certificate (Table 15). Obtaining ownership and possession certificates is less of a problem for youth whose parents have winter and spring camps with certificates and demise it to their children, but it is a challenge for youth from herder's family whose two or more children became herders. Furthermore, in an in-depth interview, young people expressed that the most difficult problem they face is obtaining their own winter and spring camps, especially for young herders who recently migrated. The NCGE/ADB gender analysis of young herders showed that a main problem for young herders

is to have their own winter and spring camp, and although the percentage of young herders is decreasing, local administrative offices do not pay attention to implement measures to help them get their own land (NCGE, ADB, 2021).

Table 15: Ownership of camps by age groups (%)

Camps\age groups	15-25	26-35	36-45	46-60	Over 61
Winter camp	40.0%	77.3%	73.9%	77.8%	80.0%
Spring camp	20.0%	45.0%	63.6%	61.5%	58.3%
Summer camp	20.0%	60.0%	66.7%	59.1%	63.6%
Fall camp	0.0%	52.6%	60.0%	50.0%	70.0%

... Before I went to South Korea as a worker under the contract, I was a cattle farmer with my grandparents, and after coming to the province center, I couldn't find a job. I stopped having people take care of our herds and became a herder my-self. However, I could not get my own winter and spring camp, and all the wells in my around are owned by other families. I worry about how to herd animals in case of with no land and water? I would like to pay the costs of drilling a well and settle down, but it is difficult to get a permission, because it is a protected area. *From the interview with young herder, 4th bagh*

... We have few herds, but we herd the other family's herds. So far, we have applied for a land for winter camp to the bagh and soum administrative unit, but we don't have an official certificate. Even we do not have a certificate for winter and spring camp, our neighbors do not mistreat. Some get the land certificate of the land we set for winter camp, thus we do not have our own land. *From the interview with the herder with few herds.*

The survey analyzed whether the number of animals owned, or the possession of a winter or spring camp influenced receiving the certificate. The results showed that 58% of herders with less than 300 herds have winter camp but only 54.5% of those have received their certificate (Table 16) and only 28.6% of them have fall camp. Thus, we can see that it is difficult for herders with a few number herds to have their own winter camp and certificate. Hence, they may face a shortage of pasture due to the increase of movement from other provinces and the trend for herders with huge herds to buy a land. We can see the relevance of the herd size and pasture shortage from the answers of the study; herders with large herds tend to say that there is not enough pasture. It is obvious that rate of pasture usage as a public resource, is directly related to the number of animals. We believe that mutually agreed rules for the pasture management in relation to the number of animals and establishing the appropriate number of animals per household in relation to pasture, will be more suitable to meet the interests of herders with few animals.

Table 16: Ownership of camps by number of livestock herding (%)

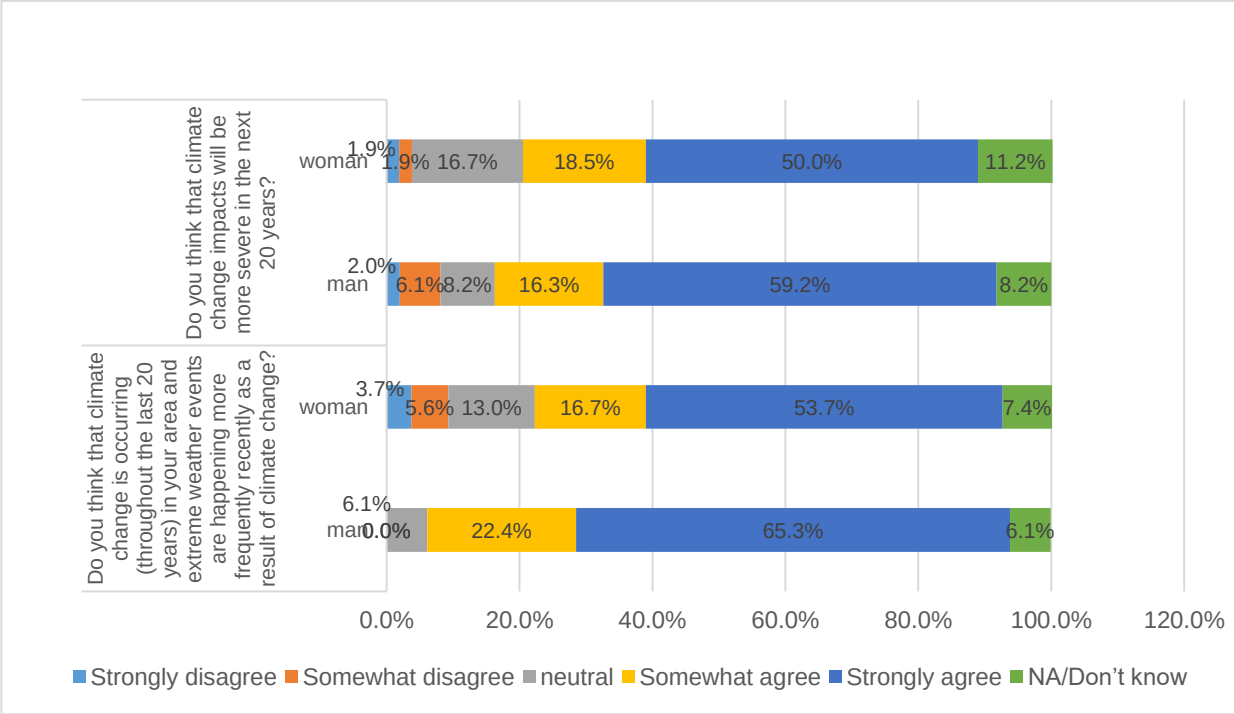
Camps\number of livestock	0-300	301-500	501-999	1,000 and over 1,000
Winter camp	58.3%	80.0%	86.4%	95.0%
Spring camp	28.6%	50.0%	76.2%	94.4%
Summer camp	34.5%	60.0%	70.8%	87.5%
Fall camp	27.6%	61.5%	47.6%	100.0%

7.3 Perception on climate change

7 Gender, vulnerability assessment

Nine (9) out of 10 men, and seven (7) out of 10 women said that they agree that climate change is observed in their area compared to 20 years ago. Only a few "disagree" responses were received and these were from female herders. In terms of sensitivity to climate change and its impact, there are more male respondents than female say that they agree that climate change impacts will be stronger, and they are sensitive to the changes being faced. However, looking at the responses by age groups, respondents agree that climate change is observed (not at the level of statistical significance). The more senior the respondent (at the level of statistical significance), the stronger they agree that climate change will increase in the next 20 years.

Figure 8: Individual perception and evaluation on climate change (by sexes)



Regardless of category of sex, the majority of male and female herders (more than 7 out of 10) agree that the following changes of climate have occurred in their area over the past 20 years as a result of climate change. However, the percentage of women who answered "no change" is higher than that of men, except for seasonal and annual rainfall, but this difference is not statistically significant. Also, the data was analyzed by age and number of livestock, but no significant differences were found.

Table 17: Respondents' assessment on climate change in their area over the last 20 years

	No change		Changed		NA/ Don't know	
	Man	Woman	Man	Woman	Man	Woman
1. Location and timing of rainfall	6.0%	5.8%	90.0%	88.5%	4.0%	5.8%
2. Amounts of seasonal and annual rainfall	6.3%	1.9%	83.4%	86.5%	10.4%	11.5%
3. Amount and intensity (power) of rain on single rainfall event	8.5%	9.8%	83.0%	80.4%	8.5%	9.8%
4. Number, intensity and duration of droughts, floods and/or hail events	6.3%	9.6%	75.0%	78.9%	18.8%	11.5%

7 Gender, vulnerability assessment

	No change		Changed		NA/ Don't know	
	Man	Woman	Man	Woman	Man	Woman
5. Seasonal and annual temperature	6.3%	11.8%	79.2%	76.5%	14.6%	11.8%
6. Number of hot days during summer months	10.4%	15.7%	77.1%	72.5%	12.5%	11.8%
7. Number, intensity and duration of winter storms and cold weather (dzud)	16.3%	19.6%	75.5%	70.6%	8.2%	9.8%
8. Amount and intensity of snowfall and duration of snow cover on the ground	6.1%	9.8%	85.7%	82.4%	8.2%	7.8%
9. Onset and length of growing season	23.8%	23.4%	76.2%	72.3%	0.0%	4.3%

The majority of male and female respondents (more than six out of ten) are concerned about the following aspects of climate change. However, 4 out of 6 questions were answered as "Do not know or no answer" by only women, and the percentage of the women, who are not concerned about the "increased number of droughts, floods, hailstorms" and " reduced amount of snowfall and snow cover on the ground", is immediately two times greater than the men. But this difference had no statistical significance. In terms of analysis by age and number of animals, no differences were indicated as well.

The question "Increased number of drought, flood and hailstorm events" has the characteristic of asking the opposite phenomena at the same time in the same question. Thus, it is to note that some female respondents perceived and answered this question as if it asks "Increased number of hailstorm and heavy rains" only. On the other hand, the questions "Reduced amounts of rainfall during the growing season" and "Increased number and duration of harsh summers" were perceived and implicated as "droughts" for Mongolians. Herders believe that there has been increase in heavy and hailstorms, but especially the female herders mentioned during the group interview that "It's good as long as it rains" which they meant it does not matter if it is heavy or hailstorm.

During the group interview with female herders, they said that men are more at risk by the climatic changes as they usually are responsible for daily livestock farming activities taking examples of herding and looking for animals when there is heavy rain, large amount of snow, and wind and storm. Whereas "we (women) stay at home as we are responsible for house chores and dairy products processing, we feel the challenges of the climatic changes less". Although the herders did not give the exact reason as if it is due to labor shortage, increase in the number of animals, greater efforts on fattening animals, or a change in nature, there is increase in animal husbandry activities per family which result the families stop milking their sheep and goats and milking their cows only once in the morning rather than two times a day. However, elder herders highlighted that it could be true that they stopped milking and producing dairy products because they avoid work and are being lazy. In general, except one woman from the group interview, all of them has doubt that milk and dairy products could be a source of income. Only three (3) of the women interviewed answered that they earn money from milk and dairy products. Herders tend to implicate that less processing and producing of dairy products is caused by firstly, increased number of livestock, secondly, dairy products production itself is physical labor demanding work, third, it negatively effects for fattening of animals.

Table 18: Herders' assessment of concern about the climatic changes for their livestock farming operations

Question	Unconcerned		Neutral		Concerned		NA/Don't know	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
1. Reduced amounts of rainfall during the growing season	2	4	18.4	11.8	79.6	82.4	0	2
2. Increased number of drought, flood and hail storm events	8.5	17.7	27.7	19.6	63.8	60.8	0	2
3. Increased number and duration of harsh summers	4.1	3.9	16.3	13.7	79.6	80.4	0	2
4. Increased number and duration of harsh winters	4.1	5.9	16.3	17.6	79.5	74.5	0	2
5. Reduced amount of snowfall and snow cover on the ground	6.1	13.7	24.5	17.6	67.3	66.7	2	2
6. Altered onset and length of growing seasons	6.1	7.9	20.4	13.7	71.4	76.4	2	2

The majority of male and female herders participated in the survey believe that the followings are associated with climate change. Particularly, the percentage of male herders who believe that the increase in the number of livestock, increase of out of season grazing events and migrations/ seasonal movements of livestock, increase of frequency and severity of steppe fires are associated with climate change was found to be 4 percent higher than that of women. Whereas the percentage of female herders who believe that shift in steppe vegetation (native, palatable plants to invasive, weedy unpalatable plants), increase of runoff and water-related soil erosion events, reductions in crop and forage yield and quality, and drop of water level of lakes, wetlands, rivers, wells, springs and other water resources was found to be 4 percent higher than that of men. Percentage of female herders believe that increase of out of season grazing events and migrations/ seasonal movements of livestock, and frequency and severity of steppe fires are not related to climate change was found to be 6 percent higher than that of male herders. And, percentage of male herders who believe that increase of runoff and water-related soil erosion events, and drop of water level of lakes, wetlands, rivers, wells, springs and other water resources are not associated with climate change is 6 percent higher than that of female. However, these are the difference shown in sex disaggregated results, the difference did not observe at statistically significance when Chi-square analysis was conducted for verification. It is observed that the more senior the respondent, the higher the tendency that they believe there is association between following issues and climate change (Table 19). For herders with between 300 and 800 animals, it is observed that they believe those issues are associated with climate changes, but no differences were observed at the statistical significance.

Table 19: Perception on the environmental issues resulted from recent climate changes in their location

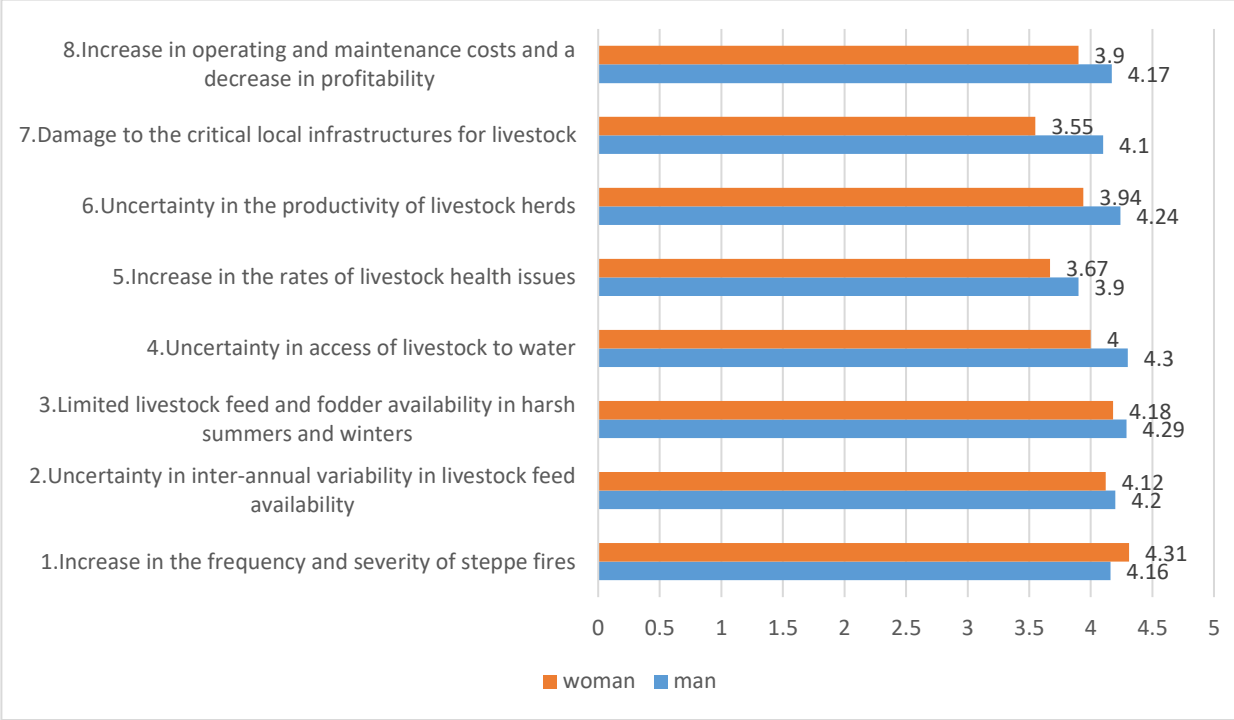
Question	Not at all from CC		Somewhat from CC		NA/don't know	
	Man	Woman	Man	Woman	Man	Woman
1. Shift in agricultural lands and increase in land cultivation	13.0%	11.8%	47.9%	45.1%	39.1%	41.2%

7 Gender, vulnerability assessment

Question	Not at all from CC		Somewhat from CC		NA/don't know	
	Man	Woman	Man	Woman	Man	Woman
2. Livestock number increases	28.6%	29.4%	61.2%	56.9%	10.2%	13.7%
3. Increasing pressure of trampling and grazing intensity	20.4%	21.6%	73.5%	70.6%	6.1%	7.8%
4. Increasing out of season grazing events and migrations/ seasonal movements of livestock	6.3%	12.0%	89.6%	80.0%	4.2%	8.0%
5. Shift in steppe vegetation (native, palatable plants to invasive, weedy unpalatable plants)	14.6%	3.9%	77.1%	88.2%	8.3%	7.8%
6. Increasing frequency and severity of steppe fires	16.3%	27.5%	75.5%	66.7%	8.2%	5.9%
7. Expanded size of bare ground and barren patches	8.0%	5.9%	86.0%	84.3%	6.0%	9.8%
8. Increasing runoff and water-related soil erosion events	18.0%	10.0%	66.0%	78.0%	16.0%	12.0%
9. More frequent dust storms and wind-related soil erosion	4.1%	5.9%	87.8%	84.3%	8.2%	9.8%
10. Reductions in crop and forage yield and quality	2.1%	3.9%	70.9%	76.5%	27.1%	19.6%
11. Dropping water level of lakes, wetlands, rivers, wells, springs and other water resources	10.0%	5.9%	80.0%	84.3%	10.0%	9.8%

Male and female herders evaluated the sensitivity of the livestock farming operations to climate change by the Likert scale of 1 (not sensitive at all) to 5 (most sensitive). When the mean is compared by gender, the response of "higher than average sensitivity" was found in all parameters, and except for the "increase in the frequency and severity of steppe fires", men were more sensitive than women. In particular, the biggest difference shown in terms of view of men and women was on the indicator "Damage to the critical local infrastructures for livestock" (the average of women is 3.55, while that of men is 4.1, the difference is 0.55). In general, perceptions of climate change are similar among male and female herders, but male herders have a slightly negative (realistic) perception of climate change-related phenomena and effects than women. This could be related to their higher volume of participation in livestock farming production operations. And this trend is not significant, but there is a potential to increase in parallel with the aging which is related to their life experience. Among the male and female herders with 300-800 animals, it is observed that they were more sensitive and concerned about climate change and its effects, but it was not detected at the level of statistical significance.

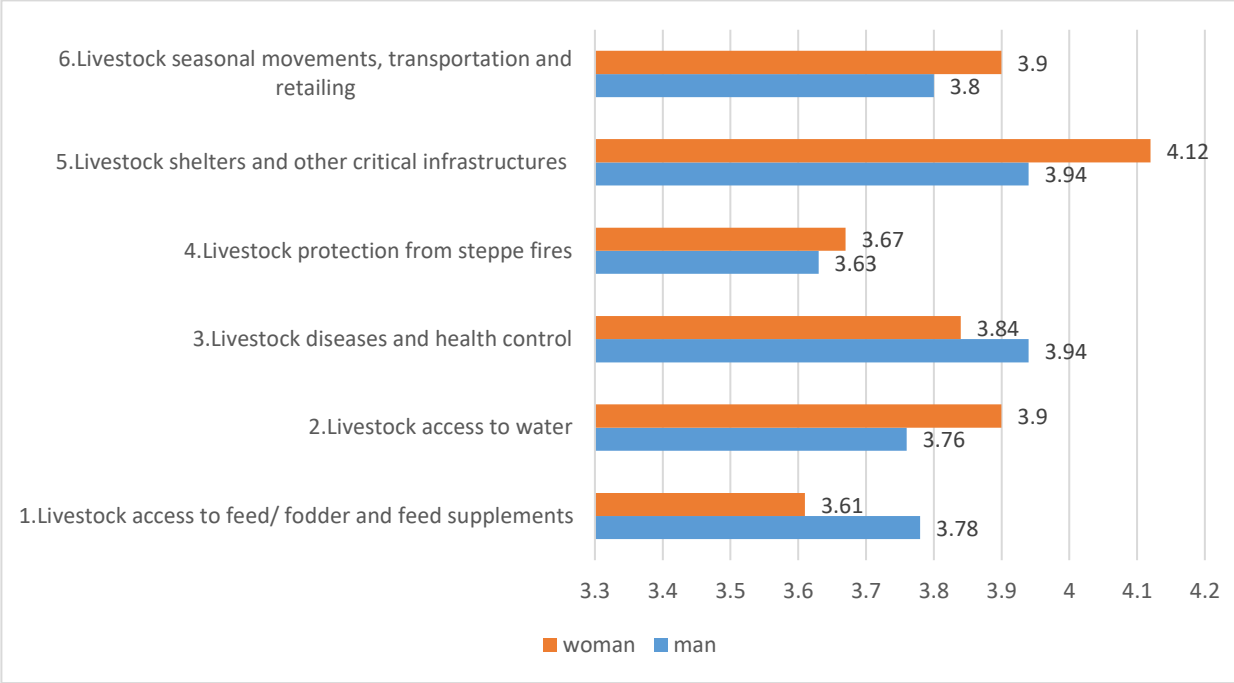
Figure 9: How sensitive do you think your livestock farming operations are to the following climate change effects



Herders participating in the survey evaluated their ability to undertake adaptation actions and capacity to address the risks of climate change associated with the following aspects listed in the table. A very small difference of 0.1-0.18 was found when comparing the answers of men and women. Male and female herders rated their abilities above average. From the aspect, 'livestock protection from steppe fires' and 'livestock access to feed/ fodder and feed supplements' were rated at the lowest level. The female herders rated their ability to provide enough grass and fodder for their livestock at the lowest level. When comparing the rating of this ability with the number of livestock, it is highly rated the ability to obtain enough feed/fodder as the number of livestock increases.

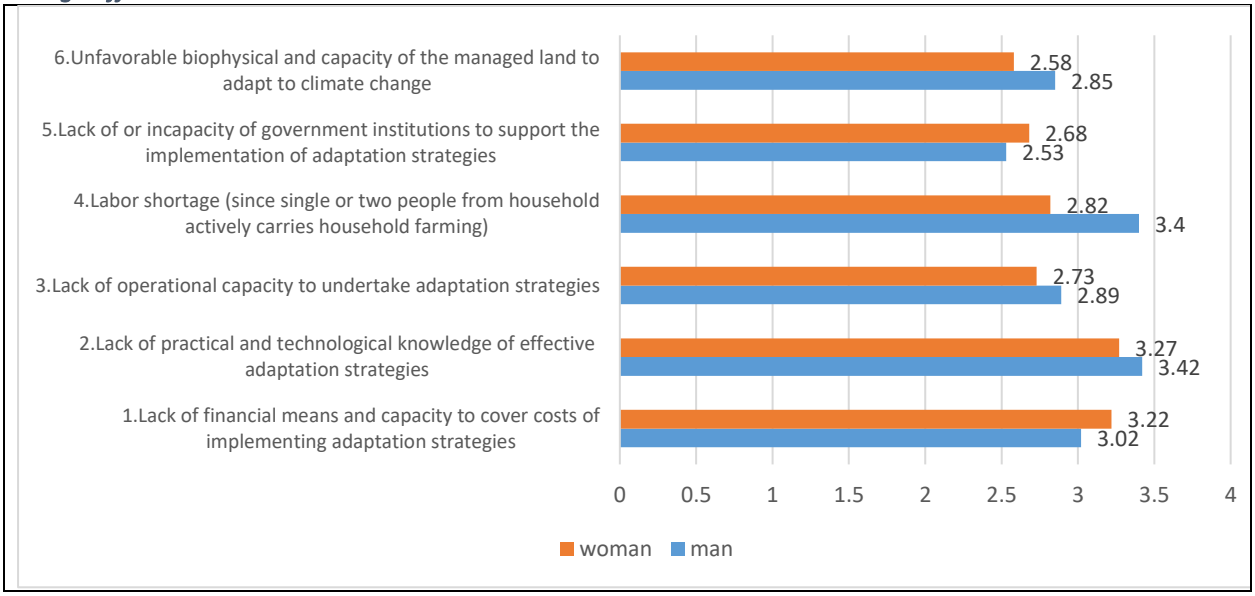
This survey shows that climate change may expose greater risks to women those who financially disadvantaged. To note again that, women and young herders with fewer number of livestock are more vulnerable in terms of their ability to prepare enough fodder for their livestock.

Figure 10: How do you rate your ability and existing capacity to undertake/ continue adaptation actions to address the risks of climate change associated with the following aspects of your livestock farming operation during harsh and extreme seasons



The herders rated major barriers limiting their adaptive capacity to climate change effects. It is observed that lack of financial means for women, lack of practical and technological knowledge as well as labor shortage for men, lack of or incapacity of government institutions for women tend to limit their ability to adapt to the climate change. Differences in socio-economic backgrounds between men and women will create different challenges for men and women in their ability to cope with the impacts of climate change. The findings of this survey show that men and women see problems differently.

Figure 11: Major barriers limiting the adaptive capacity of your livestock farming operation to climate change effects



The study clarified the following impacts of climate change: who is more at risk; whose workload is increasing; and whose income is being reduced. Survey participants answered that both men and women are negatively affected by the climate change in the first questions but tried to clarify and prioritize effects and risk. According to the answers, more than 62% of the respondents believe that men are more at risk and more affected than women by 6 types of natural phenomena caused by climate change (Table 20).

This is related to the high participation of men in the agricultural production activities and the fact that women live in soum centers during school. But women tend to answer that they are more at risk than men based on the gender division of labour. It can be concluded that climate change has gender impacts by increasing the workload of male herders, while reducing women's or household income (even for household consumption) or increasing costs.

As mentioned in the gender analysis on the livelihoods of young herders, the impact of climate change and the increase of the frequency and distance of migration (*otor*) in areas with high pasture degradation has led to men living away from their families for a long time (NCGE, ADB, 2021). Family members living apart for long periods of time can have negative effects on their health and family life.

7 Gender, vulnerability assessment

Table 20: Who is more at risk from the following phenomes of climate changes?

Question	Man (%)	Woman (%)	Boy (%)	Girl (%)	NA/ Don't know (%)	Justification that women affected negatively than men
1.Reduced amounts of rainfall during the growing season	70.7	23.2	2		4	• Difficult to dry dung fuel • Difficult to milk a cow • Difficult to dry curds and dairy products etc.,
2.Increased number of droughts, flood and hailstorm events	61.9	32	2.1		4.1	Low rate of milk
3.Increased number and duration of harsh summers	77	15	3		5	Low rate of milk
4.Increased number and duration of harsh winters	82	11	2	1	4	
5.Reduced amount of snowfall and snow cover on the ground	85	9	2		4	
6.Altered onset and length of growing seasons	73.7	18.2	2	1	5	Low rate of milk

8 Next Steps

A participatory gender-responsive and socially inclusive CCV assessment of local livestock herding systems was conducted in the Bayantumen soum. Overall, herders identified climate change as one of the main challenges they have faced in recent years and expect to face more in future in raising livestock and being a herder. However, they believed in being able to adapt their herding practices to climate change risks if major barriers currently limiting their adaptive capacity are appropriately removed. Thus, as climate change progresses, herder communities and local organizations must work together to make decisions encouraging adaptation and promoting resiliency to their new climate and environmental conditions.

Local herders must play a fundamental role in finding appropriate adaptation pathways to cope with the joint effects of increasing grazing pressure and climate changes. Herders deeply understand their surrounding landscapes and the environmental good and services essential to their herding livelihood systems. Effective adaptation of grazing pressure management, including practical livestock movements across the landscapes, requires the ability to accurately monitor environmental changes and properly distribute robust information on the health of essential natural resources for climate-resilient herding practices. High-quality, long-term monitoring data is essential to develop and measure pasture health indicators and provide an early warning system to detect climate change impacts on pasture resources and adapt new pasture management solutions. Thus, herders and emerging community-based pasture management institutions must coordinate and contribute to an empirical and systematic monitoring of the components and functions of their grazing lands under a changing climate and resource depletion.

Financial incentives, in particular programs and high-level policies that actively limit livestock number and promote climate-resilient livestock herding productions based on the proper use of pasture resources, should be a high priority. Local governments and financial institutions must implement payment tools and mechanisms that support local herders and pasture user groups to improve pasture health and productivity and promote the delivery of undervalued regulating and supporting environmental services such as water reserve and purification; soil carbon and nutrient cycling, and storage; and habitat for native species across grazing landscapes.

As frontline decision makers, women play an important role as stewards of natural resources in traditional livestock herding practices. However, they often do not have equal access to the extension services, training, technical support or financing necessary to deploy new, climate-resilient practices. Given women's and men's important but different roles in herding, the new pasture monitoring and restoration programs must set potential adaptive solutions to climate change through a gender lens. Such programs and policies must bring socio-economical and environmental welfare to women and vulnerable groups and leverage women's roles and leadership to mitigate and adapt to risks from climate changes and protect environmental resources and services.

This assessment summarizes existing and possible future impacts and risks from climate change on local herding communities and their livestock herding operations. While acknowledging herders' long history of adapting to environmental change, this assessment sets the stage for communicating the expected impacts and considering strategies and pasture management technologies that help herders maintain climate-resilience pastoral livelihood systems.

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Annex A. Herder Survey

Herders' Survey Questionnaire

A. DEMOGRAPHIC INFORMATION

All respondents complete this section

I. Guideline for focus group discussions (FGD) /survey with the herders

To be completed by the interviewer

Interviewer: _____

Location: Bagh # _____; detailed location: _____

Date and time: _____

End time: _____ (target 45 max total)

Preparation and introduction:

- Introduce the purpose of the study and code of ethics;
- Get permission for recording;
- Self-introduction first. Ask participants to introduce themselves. When you get acquainted, ask and fill in the following table.
- (Has been added to the Mongolian version)

II. Demographic Information

Name and surname: _____

Location of household: _____

Age: _____Sex: _____

Marital Status? _____

Highest level of education completed:

Primary _____ Middle school _____ High school _____

Tech School/college _____ University _____ Other _____

Number of children: _____

Total members of household: _____

B. Pasture, Livestock and Livelihoods

Livelihoods Information

1) How long have you been raising livestock? (# years):

___ < 10 years ___ 10 – 20 years ___ > 20 years

2) What proportion of your annual income is from livestock?

___ < 25% ___ 26 to 50% ___ 51 – 75% ___ > 75% ___ 100%

3) Livestock Herded This Year (Owned Livestock and Others):

Type of Livestock	Total # Owned by Your Family	Total # Owned by Someone Else	Total # herded by you	Offspring Born in 2022
Camel				
Horse				
Cattle				
Sheep				
Goats				

4) How has the number of livestock you herd changed in the past five years?

Decreased a lot	Decreased a little	No change	Increased a little	Increased a lot

5) Livestock Slaughtered for Home Use, 2021:

Type of Livestock	Total Slaughtered
Camel	
Horse	
Cattle	
Sheep	
Goats	

6) Livestock Marketed in 2021:

Type of Livestock	Total # sold	Price (indicate /head or /kg)	Place Marketed (v)			
			Farmgate	Choibalsan	Other	If other, describe
Camel						
Horse						
Cattle						
Sheep						
Goats						

7) Other Livestock Income, 2021:

Type of Livestock	Please rank in order of money earned (1 = highest)	Amount sold	Price
Livestock for meat		Done in Q7	Done in Q7
Livestock for breeding			
Cashmere			
Wool			
Dairy products			
Hides & skins			
Other			

Pasture, Water & Livestock Feeds

8) What is the approximate size of the land that you manage?
   a. Pasture ____ (ha)
   b. Hay land ____ (ha)
   c. Cropland ____ (ha)
9) Is the pasture you use sufficient to provide for your livestock?
   - Yes
   - No

10) If NO:

    What are the limitations of your pasture (size, quality, other): _____

11) What do you think needs to be done to improve the condition of the pasture?
12) How many seasonal camps do you have? _____ total number

	Yes	No	Certificate Yes	Certificate No
Winter camp	1	2	1	2
Spring camp	1	2	1	2
Summer camp	1	2	1	2
Fall camp	1	2	1	2

13) How many households share your camps?

none	1	2	3	4	More than 4	If >4, how many?

14) How many migrations (seasonal movements) do you make for livestock in one year?

none	1	2	3	4	More than 4	If >4, how many?

15) How many km is it to your furthest pasture? _____
16) Do you use any *otor* pasture:
   - Yes
   - No
17) If YES, how far away is the pasture? _____ km
18) How much native grass hay did you make last year? _____ kg or _____ mt
19) How much traditional handmade fodder did you make last year? _____ kg or _____ mt
20) Do you have planted hay land or cropland of your own or as a group?
   - Yes
   - No
21) If YES:

    a. Is it your own ____ or as a group ___? (*check the right category*)

b. How many hectares? ____
c. How much livestock feed (hay, fodder crops) did you harvest last year? ___ mt
d. When and what stage of growth is the hay harvested at? (e.g., before or after heading or full bloom)?
e. When _____ stage _____
f. To the best of your knowledge, in what year was the land modified? _____

22) Do you ever buy the following?

Type	Yes	No	If yes, how much (kg)
Native Grass Hay, baled			
Oats for hay (green fodder)			
Concentrate feed (pellets)			
Wheat bran			
Other (describe			

If YES:

a. Where do you buy it?
__ local farmer
__ feed market in soum or aimag
__ other
b. How much did you buy last year? _____ kg or _____ mt
c. If needed, from where the additional hay/ animal feed is imported?
____ other soums within the aimag _____ from other regions

What is the primary source of water for your livestock?

___ stream ____ river ____ lake ___wetland ____ well (groundwater)
___ other (if other, please describe)

a. What is your water source in winter? _____

Livestock Production Management

23) What diseases do you vaccinate your livestock for?

List: _____

24) Are your livestock shelters sufficient?

- Yes
- No

Memberships and Information

25) Where do you get technical information on livestock and pasture? (check all that apply)

a. MOFALI and/or Dornod Department of Agriculture
b. NEAC

c. University or Research Institutes
d. Projects
e. Industry (feed companies, livestock companies, meat plants, etc)
f. Internet
g. Groups that I am a member of (PUG, coop, association, etc)
h. Other (please describe): _____

26) Are you a member of any a pasture users group (PUG)?
- Yes
- No

27) If YES:

a. What group? _____
b. When was it formed? _____
c. How many members? _____
d. Are the members related (same family group)? Y/N
e. What type of activities does the group do together?

i. Pasture Management ___
ii. Water/well management ___
iii. Marketing ___
iv. Input purchases ___
v. Common fund with other members ___
vi. Other: _____

28) Are you a member of any other groups:

a. Producers' cooperative
b. Industry association
c. Finance coop or similar group
d. Other (Please describe): _____

<u>Challenges and Opportunities</u>

29) What do you think needs to be done to make more money from raising livestock?

30) What are the greatest challenges (problems) you face in raising livestock and being a herder?

C. Climate Change Vulnerability Assessment

Section C1: Exposure to climate change

1) Do you think that climate change is occurring (throughout the last 20 years) in your area and extreme weather events are happening more frequently recently as a result of climate change?

1	2	3	4	NA/Don't know
Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	

2) Do you think that climate change impacts will be more severe in the next 20 years?

1	2	3	4	NA/Don't know
Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	

3) How do you rate the magnitude of the following changes in the climate in your area over the last 20 years?

Question	1	2	3	NA/
	No change	Some change	Big change	Don't know
Location and timing of rainfall				
Amounts of seasonal and annual rainfall				
Amount and intensity (power) of rain on single rainfall event				
Number, intensity and duration of droughts, floods and/or hail events				
Seasonal and annual temperature				
Number of hot days during summer months				
Number, intensity and duration of winter storms and cold weather (dzud)				
Amount and intensity of snowfall and duration of snow cover on the ground				
Onset and length of growing season				
Other (*please list and score*)				

Section C2: Sensitivity to climate change

4) How do you rate your level of concern about the following climatic changes for your livestock farming operations?

Question	1	2	3	NA/Don't know
	Not concerned	Somewhat concerned	Very much concerned	
Reduced amounts of rainfall during the growing season				
Increased number of flood and hail storm events				
Increased number and duration of harsh (hot) summers				
Increased number and duration of harsh (cold) winters				
Reduced amount of snowfall and snow cover on the ground				
Altered onset and length of growing seasons				

5) Do you think the following environmental issues result from recent climate changes if emerging in your area?

Question	1	2	3	NA/Don't know
	Not at all from CC	Somewhat from CC	Very much CC	
Shift in agricultural lands and increase in land cultivation				
Livestock number increases				
Increasing pressure of trampling and grazing intensity				
Increasing out of season grazing events and migrations/ seasonal movements of livestock				
Shift in steppe vegetation (native, palatable plants to invasive, weedy unpalatable plants)				
Increasing frequency and severity of steppe fires				
Expanded size of bare ground and barren patches				

Question	1	2	3	NA/Don't know
	Not at all from CC	Somewhat from CC	Very much CC	
Increasing runoff and water-related soil erosion events				
More frequent dust storms and wind-related soil erosion				
Reductions in crop and forage yield and quality				
Dropping water level of lakes, wetlands, rivers, wells, springs and other water resources				
Other (*please list and score*)				

6) How sensitive do you think your livestock farming operations are to the following climate change effects?

Question	1	2	3	4	5	NA/Don't know
	Not sensitive at all.				Most sensitive	
Increase in the frequency and severity of steppe fires						
Uncertainty in grass available from the pasture						
Limited supplemental feed and fodder availability in harsh summers and winters						
Uncertainty in access of livestock to water						
Increase in the rates of livestock health issues						
Uncertainty in the productivity of livestock herds						
Damage to the critical local infrastructures for livestock						
Increase in operating and maintenance costs and a decrease in profitability						
Other (*please list and score*)						

Section C3: Adaptive capacity to climate change

7) How do you rate your ability and existing capacity to undertake/ continue adaptation actions to address the risks of climate change associated with the following aspects of your livestock farming operation during harsh and extreme seasons and years?

Question	1	2	3	4	5	NA/Don't know
	No ability				High ability	
Livestock access to feed/ fodder and feed supplements						
Livestock access to water						
Livestock diseases and health control						
Livestock protection from steppe fires						
Livestock shelters and other critical infrastructures						
Livestock seasonal movements, transportation and retailing						
Other (please list and score)						

8) Please rate which of the following you consider as major barriers limiting the adaptive capacity of your livestock farming operations to climate change effects.

Question	1	2	3	4	5	NA/
	No barrier				Major barrier	Don't know
Lack of financial means and capacity to cover costs of implementing adaptation strategies						
Lack of practical and technological knowledge of effective adaptation strategies						
Lack of operational capacity to undertake adaptation strategies (no inputs, machinery, buildings etc))						
Labor shortage (since single or two people from household actively carries household farming)						
Lack of or incapacity of government institutions to support the implementation of adaptation strategies						
Lack of or incapacity of the land/ water to support the suggested adaption change)						
Other (please list and score)						

D. Gender Assessment Questions

Annex A Herder survey

1) Who is more at risk (whose income decreasing or whose workload increasing) by the following climatic changes? (single answer in each row)

Question	Man	Woman	Boy	Girl	NA/Don't know
Reduced amounts of rainfall during the growing season	1	2	3	4	98
Increased number of drought, flood and hail storm events	1	2	3	4	98
Increased number and duration of harsh summers	1	2	3	4	98
Increased number and duration of harsh winters	1	2	3	4	98
Reduced amount of snowfall and snow cover on the ground	1	2	3	4	98
Altered onset and length of growing seasons	1	2	3	4	98

2) Who is owner of your household livestock according to the official registration?

1. Head of household - husband
2. Head of household - wife
3. Co-owned
4. Children
5. Parents and relatives
6. Others .....(please write)

3) Who owns following properties or facilities? (single answer in each row)

Properties and facilities	Man\husband	Woman\Wife	Father	Mother	No
13. Winter camp	1	2	3	4	0
14. Spring camp	1	2	3	4	0
15. Well	1	2	3	4	0
16. House	1	2	3	4	0
17. Apartment in town	1	2	3	4	0
18. House with yard in town	1	2	3	4	0
19. Land for crop, vegetable and etc.	1	2	3	4	0
20. Business premises and facilities	1	2	3	4	0
21. Truck	1	2	3	4	0
22. Sedan car	1	2	3	4	0
23. Tractor	1	2	3	4	0
24. Motorbike	1	2	3	4	0

25. Labor facilities	1	2	3	4	0
26. Other	1	2	3	4	0

4) Who is most responsible for the following livestock farming and house chores? (single answer in each row)

	Man\husband	Woman\Wife	Boy	Girl	No
11. Herding, watching and caring animals	1	2	3	4	0
12. Search for animals	1	2	3	4	0
13. Milking and preparing diaries	1	2	3	4	0
14. Haymaking and harvesting	1	2	3	4	0
15. Fencing pasture	1	2	3	4	0
16. Малын тэжээл тарих,	1	2	3	4	0
17. Housework (take care of child, clean houses, wash, cook and etc.)	1	2	3	4	0
18. Meet with officials for business	1	2	3	4	0
19. Participating in herders' group's activities such as meetings, trainings and etc.,	1	2	3	4	0
20. Treating animals, preventing diseases, washing and tec.	1	2	3	4	0

5) Who is most responsible in meat producing? (single answer in each row)

	Эрэгтэй	Эмэгтэй	Ийм ажил хийдэггүй
1. Feeding	1	2	0
2. Driving and transporting	1	2	0
3. Slaughtering	1	2	0
9. Breaking, dividing and classifying	1	2	0
10. Skinning and cleaning it	1	2	0
11. Cleaning intestines of the slaughtered animals	1	2	0

12. Selling animals or meats	1	2	0
13. Communicating with partners and negotiate prices	1	2	0
14. Distribute income from selling livestock or meats	1	2	0
15. Attending at training on meat producing	1	2	0

9) Who usually makes decisionson meat producing?
   a) Man
   b) Woman
   c) Senior members of household
   d) Young members of household
10) Do you add income to your savings from income of meat processing?
   a) Yes
   b) No
11) What is income source that you have the authority to dispose of without asking anyone?
   a) Selling livestock or meat
   b) Skins and hides
   c) Wools and cashmere
   d) Milk and diaries
   e) Pension
   f) Allowances
   g) No one
   h) Others .....
12) Are you planning to increase number of livestock?
   a) Yes
   b) No
   c) Don't know
13) If yes, what animals are you planning to increase? ..... \write\
14) Do you think is it possible to increase your household's income without increasing the number of livestock?
   a) Yes, it is
   b) I doubt it
   c) No, it is not
   d) Don't know
15) If yes, what are the possibilities?

Thank you for participation!