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CLIMATE CHANGE IMPACTS ON HEALTH AND LIVELIHOODS: MONGOLIA ASSESSMENT

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EXECUTIVE SUMMARY

Mongolia already has encountered and will continue to experience significant warming and drying as a result of the climate crisis (*certain*). Temperatures are rising faster than the global average (*certain*). This is already being felt by communities across Mongolia, challenging traditional pastoralist–herder lifestyles and catalyzing a strong rural-urban migration trend. The higher temperatures are likely to increase the frequency and severity of heatwaves and droughts, especially in the south and south-west. Seasons will become more pronounced (*highly likely*) and the peculiar and uniquely Mongolian phenomenon of the Dzud, which creates drought-like summer conditions followed by extremely cold, harsh winters, will become more frequent and fiercer (*highly likely*). Extreme rainfall will become more intense and more frequent, with more rain falling during very wet days, and this may translate into increased intense rainfall-linked extreme events such as landslides, flash floods and land erosion (*highly likely*). The impacts that these changes will have on livelihoods and health, without substantial global action and national adaptation, are significant.

Climate change has the potential to trigger wide-ranging and strong negative feedback loops between livelihoods and health. The impacts of rising temperatures, changes in rainfall, more winter snowfall and mounting pressures on water resources all negatively affect the traditionally important agricultural sector and especially livestock herding. The Dzud, in particular, can cause catastrophic loss of livestock in the harsh winters, which hugely affects rural incomes and has ramifications throughout markets creating price spikes and supply gaps. The increased frequency and intensity of natural hazard-related disasters like the Dzud, intense rainfall, heavy snowfall, dust storms and floods resulted in a doubling of the damage to livelihoods over a 20-year period (UNDP 2019). Pasture degradation has been increasing in recent years across the country following worsening droughts, higher temperatures and the drying up of water sources. With the majority of the population overwhelmingly dependent on their livestock, climate shocks have led to declining incomes due to a decrease in the weight of the animals as well as in the yields of wool and cashmere.

Climate change will impact human health directly through more extreme weather events such as the Dzud, which has been linked to reduced growth in children. It also increases the incidence of respiratory illnesses as people remain indoors burning coal – a necessary measure to ward off the extreme cold, but one that intensifies their exposure to indoor air pollution. Climate change will also indirectly impact people's health through environmentally mediated changes, notably, the growing risk of zoonotic or tick-borne diseases. The proximity of pastoralist-herders to their livestock as they range across pasturelands, hosting natural reservoirs of serious diseases (such as Plague), highlights the importance of One Health approaches. Whilst undernutrition is not a major issue, micronutrient deficiencies are high across the whole population and especially in children. As climate change continues to catalyze rural-urban migration, urban populations increasingly consume abundant highly processed, low quality, cheap food contributing to the high burden of noncommunicable diseases

(NCDs). A number of gaps were found related to the impacts of climate change on mental health, sexual and reproductive health and rights, and on water quality and supplies and how this relates to the health of pastoralist herders.

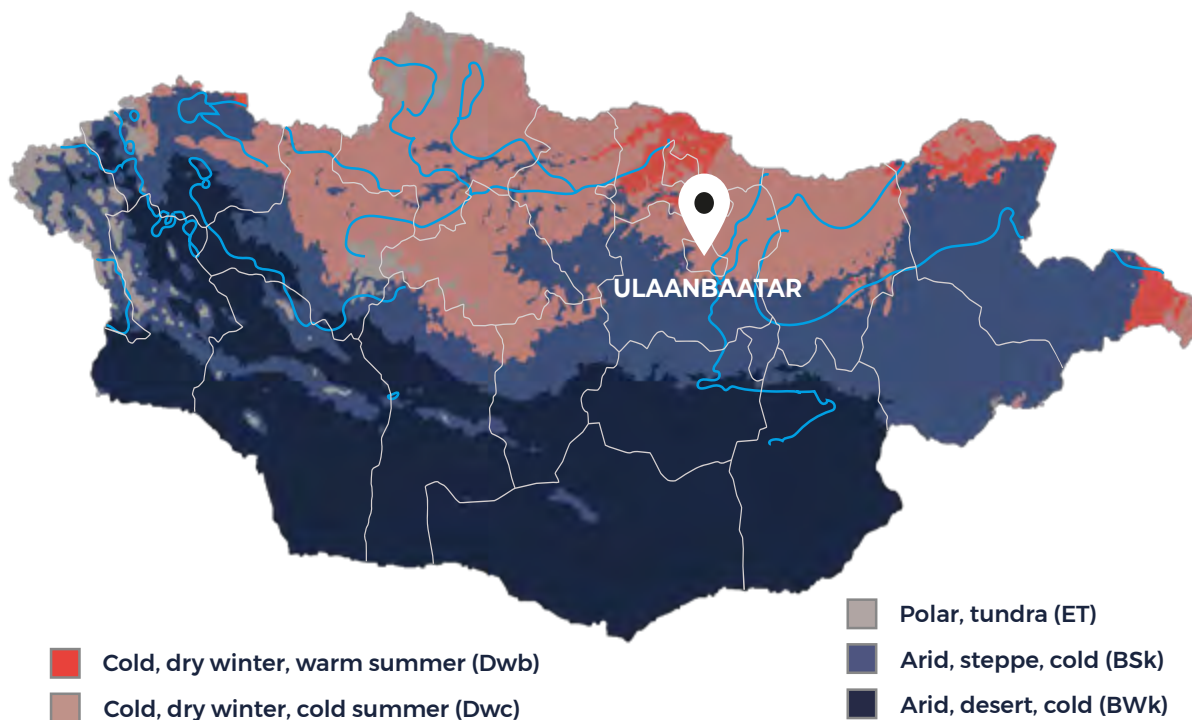
The urgency to act is clear. The purpose of the report is to act as a reference document on the likely impacts – direct and indirect – of the climate crisis on the wellbeing of people in terms of their health and livelihoods. The intention is that this report can act as a springboard for planning and implementing activities and programmes focused on climate action and adaptation. Some recommendations and opportunities for action have been offered, however, these should be considered as only a starting point to further complement and expand existing programmes and projects. Cross-sector and widespread collaboration between National Societies, government agencies and services, the private sector, NGOs, civil societies and our communities is key as no one organization alone can tackle the increased risks posed by climate change nor alleviate the exacerbated risks of vulnerable populations. Together, acting now, with the evidence at hand, it is possible to avert the most dire consequences of the climate crisis.

1. CLIMATE

1.1. GENERAL CLIMATE

Mongolia is a landlocked country with an average altitude of 1,580 metres above sea level. It is characterized by a strong continental climate (relatively dry, with hot summers and cold winters), with four distinct seasons (UNDP 2019, p. 2010; MoE n.d.). There are large variations in climate from region to region and over the course of the year, according to the differences in altitude and latitude. Overall, the country is dry: rainfall hardly exceeds 400mm per year and predominantly falls during the warm summer months (70 per cent of total rainfall falls in April–September) (TNC 2018). The northern mountain districts receive the most rainfall and the south and central desert

Figure 1. Map of climate regions in Mongolia and temperatures



Annual rainfall hardly exceeds **400mm**, with northern mountain districts receiving the most rainfall and the south and central desert and steppe region receives much less rainfall (World Bank Portal, 2020). An estimate of **85% of the annual rainfall falls during the warm months from April to September** and only 3% even less is precipitated as snow in winter. Therefore, annual rainfall dynamics is characterized by **summer rainfall**, which is equal to **70% of total precipitation** (TNC, 2018).



Annual average temperature of the country ranges from **-22°C to 17°C**, where maximum temperature reaches **24°C in July**, while January minimum temperatures drop to around **-28°C** (WBCKKP 2020; USAID 2017). Across the mountain ranges, the average temperature fluctuates between **-4 and -8°C**, while the temperature reaches up to **2°C in the steppe desert region** and around **6°C in the southern desert** bordering China (World Bank Portal, 2020).

and steppe region receives much less rainfall (WBCKP 2020; World Bank 2020). Temperatures vary hugely between the mountains and the desert steppe and between the seasons (Figure 1). Annual average temperature of the country ranges from -22–17°C, where the maximum temperature reaches 24°C in July and minimum temperatures drop to around -28°C in January (USAID 2017; WBCKP 2020).

Table 1. Seasonal calendar

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Winter: extremely cold		Spring: strong winds			Summer: hot, rains			Autumn: harvest, cooling			
 Rainfall											

1.2. CLIMATE CHANGE TRENDS

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020–2039)	LONG- TERM PROJECTIONS (UP TO 2100)
<p>TEMPERATURE</p> <p>The annual average temperature has increased three times faster since 1940 than the global average (by 2.24°C) (TNC 2018; WBCKP 2020). This has led to high rates of evaporation and drying of the climate (USAID 2017; MoE n.d.).</p> <p>The number of summer days (Tmax>25°C) has increased by 19 days, while the number of frost days has decreased by nearly 15 days since the 1970s (TNC 2018).</p> <p>Warming rates are higher in the mountainous regions and less pronounced in the steppe and Gobi region (TNC 2018).</p>	<p>TEMPERATURE</p> <p>Projections suggest a further increase of monthly temperature in the short-term by 2.0–2.3°C degrees compared to the baseline (1986–2005) (TNC 2018; WBCKP 2020).</p> <p>This will add another 9–11 more summer days compared to the baseline and lead to a reduction in frost days (Tmin<0°C) of 8–11 days in spring (March–May) and autumn (Sep–Nov) – although this change varies across the country (WBCKP 2020).</p>	<p>TEMPERATURE</p> <p>Temperatures will continue to rise above the global average in the range 2.4–6.3°C by 2081–2100 (depending on the emissions scenario considered) especially in the summer months (TNC 2018). The eastern regions of Mongolia are expected to continue to warm significantly in winter, while the western regions will warm significantly in both summer and winter (TNC 2018).</p> <p>Melting of permafrost will continue throughout the century (USAID 2017; TNC 2018).</p>

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020–2039)	LONG- TERM PROJECTIONS (UP TO 2100)
<p>RAINFALL</p> <p>A slight decline (7 per cent) in annual rainfall has been observed, which is most pronounced in the central regions (TNC 2018).</p> <p>Whilst, overall, rainfall has decreased slightly, wet days have got wetter (especially over the steppe, forest-steppe and in the Gobi region) and winter snowfall has also increased across most of the country (TNC 2018; WBCKP 2020).</p> <p>The Altai region receives slightly more summer precipitation, while the Gobi region is seeing a later onset of summer rainfall (IFRC and MRCS 2016).</p>	<p>RAINFALL</p> <p>Near-term changes in rainfall and snow are uncertain, especially for the summer months. There will be a slight increase in monthly averages (0.68–3mm), driven by an increase of 10–14 per cent in winter snow (depending on the emissions scenario considered) (TNC 2018).</p> <p>The differences in seasons will become more pronounced (i.e drier seasons will become drier and wetter seasons will become wetter), especially in the east (WBCKP 2020).</p>	<p>RAINFALL</p> <p>An overall increase in annual rainfall is projected (8–14 per cent by 2080–2099), changing seasonal patterns (WBCKP 2020; USAID 2017).</p> <p>Winter snow is projected to increase by 15.5–50.2 per cent in the long-term (TNC 2018) and in the range of 50–75 per cent for the central, western, and eastern regions of Mongolia.</p> <p>Most of the territory is likely to see a slight increase (10 per cent) in summer rainfall. However the central and western regions are projected to observe a slight decrease (5–10 per cent) in summer rainfall (TNC 2018).</p>
<p>EXTREME EVENTS</p> <p>Drought conditions have increased, as have the number of consecutive drought years since 2000 (TNC 2018). This is associated with the continued trend of warming and drying conditions.</p>	<p>EXTREME EVENTS</p> <p>Drought conditions are likely to worsen in the next twenty years, with severe droughts becoming 15–18 per cent more likely across the country (WBCKP 2020). The south and south-west regions are expected to see a relatively intense increase in drought frequency in the near-term (TNC 2018).</p>	<p>EXTREME EVENTS</p> <p>The country is expected to see an increase in drought conditions, with more incidences of consecutive drought years in future, especially in the western and eastern regions (TNC 2018).</p>
<p>Consecutive wet days and the days with heavy rainfall have declined over the period 1971–2015 (WBCKP 2020).</p>	<p>The frequency of extreme rainfall events is to increase slightly, especially in the eastern region (WBCKP 2020). In the short-term, 4.5–5 per cent more rain will fall during very wet days (WBCKP 2020).</p>	<p>Projections for extreme rainfall suggest more intense events by 2050 with rainfall amounts increasing by 15 per cent during events (WBCKP 2020).</p>

OBSERVED CHANGES	SHORT-TERM PROJECTIONS (2020-2039)	LONG- TERM PROJECTIONS (UP TO 2100)
EXTREME EVENTS	EXTREME EVENTS	EXTREME EVENTS
<p>The intensity of the Dzud has increased (TNC 2018). The frequency of the Dzud had been in a decreasing trend until the early 1990s, but has been increasing since then (TNC 2018; MoE n.d.).</p>	<p>Projections suggest that there may be a temporary reduction in Dzud likelihood in the near term. From 2035 onwards the likelihood and severity will increase drastically (MARCC 2014; TNC 2018).</p> <p>While temperatures will rise slightly in winter, increasing snowfall will make winters harsher (TNC 2018).</p>	<p>The frequency of Dzud is expected to increase by 5–20 per cent under moderate global emissions scenarios and for high emission scenarios by 5–40 per cent. By 2080, the south-east will see a 15 per cent increase under moderate scenarios, while a 40–45 per cent increase is projected in the north of Mongolia (TNC 2018).</p>
<p>The average consecutive number of 'hot' (temperatures > 35°C) days has increased by 13 days compared to the baseline across the country. The central and northwestern regions have experienced the greatest increase in the number of hot days (TNC 2018).</p>	<p>Near-term projections suggest that summer will have 2–3 more hot days (WBCKP 2020).</p> <p>Warm spell duration is projected to increase by 3.2–3.75 days, while heatwave risk remains stable (WBCKP 2020).</p>	<p>Consecutive hot days and warm spell duration are expected to continue to increase, and frozen and cold days are expected to decrease most across the central and northwestern parts of the country (TNC 2018).</p>
<p>The number of days of dust storms has increased significantly, from 18 days to 57 days over the period 1960–2007 and occur mainly in spring (MoE n.d.).</p>	<p>There are no projections available for dust- and snowstorms specifically, although continued land degradation will likely increase dust formation.</p>	<p>The frequency of extreme events like heatwaves, windstorms and snowstorms will also increase by 23–60 per cent by 2050 (USAID 2017).</p>

1.3. CLIMATIC VARIABILITY AND EXTREME WEATHER

While climate change may drive changes in the exposure to and the frequency of natural hazards, existing natural climate variability also affects weather and extreme events. Mongolia’s varied climate exposes people to a range of extreme events, sometimes within a single year, including: drought, dust storms, extreme cold, flash floods, forest fires and heavy snowfall (USAID 2017). The number of extreme weather events has doubled in the last 20 years (USAID 2017). Drought, Dzud and flooding cause particularly huge socioeconomic damage and loss across the country (TNC 2018).

- **Drought:** Mongolia is already a dry country, where some regions experience next to no rainfall at all, and small year-to-year variations in rainfall can lead to severe drought events (WBCKP 2020). On average, drought occurs every two years in the desert-steppe zone, every three years in the transition zone and one or two times every 10

years across the mountain, forest and steppe zones (TNC 2018). The above-average projected temperature rise in Mongolia will further increase the evaporation of water from the soil thereby increasing drought frequency and severity (TNC 2018). Water stress has also become worse due to a steady decline in the water level of Mongolia's lakes since 1993, where some lakes have dried up and the glacier area has receded by about 30 per cent over 70 years (TNC 2018).

- **Dzud** events are characterized by "... deterioration of the weather conditions in winter and spring leading to shortage of pasture and water for livestock suffering massive die-off" (UN Mongolia 2016). While Dzud is a weather phenomenon, socioeconomic conditions largely determine the vulnerability and ability of people to cope with its harsh conditions. More frequent and more severe Dzuds and other climatic pressures may erode rural communities' ability to recover from such shocks (IFRC and MRCS 2016). There are five types of Dzud, each posing specific challenges to herders and rural communities (Hahn 2017):
 - *Tsagaan Dzud*: A white Dzud identified by deep snow, covering animals and food sources. Melting snow can cause flooding in spring and summer. It occurs every two years in the Tes River Basin, while it prevails every three years in Khangai, Khentii, Khankhohii, Kharkhiraa and Turgen mountain regions (TNC 2018). The northern Dundgovi Aimag, is prone to frequently occurring white Dzud (TNC 2018).
 - *Khar Dzud*: A black Dzud identified by harsh cold but no snow. This kind of Dzud is dangerous during storms, as humans and herds can freeze from exposure. Often associated with springtime drought.
 - *Tumor Dzud*: An "iron" Dzud, identified by impenetrable ice. Rainfall followed by a quick drop in temperature causes waterlogging and the ice makes food inaccessible and travel dangerous.
 - *Khuiten Dzud*: A cold Dzud typified by a combination of high-speed winds and deep snow.
 - *Khavsarcan Dzud*: A combined form of Dzud, in which deep snowfall is accompanied by a sudden drop in temperature. Its sudden onset often catches people off-guard.

“Extreme winter situations happen more often and are becoming more problematic in the Gobi Desert due to the summer droughts, and this is related to not only having not enough rainfall during summertime and improper pasture management. It is also related to pest control, because it affects the roots of the grasslands.” KI 3

“I do observe that in the Gobi Desert people say that they did not see any rain over the summer. It influences desertification in some Gobi areas. In the last few years rain and in wintertime snow is not so high anymore, which means there are no grasses and less grazing for their livestock and this increases the risk of Dzud.” KI 1

While flash flooding historically occurs in the mountainous western region of Mongolia in spring due to rapid snow melt and intense rainfall, it is increasingly occurring in the Gobi region and urban areas (KI 1, 3 and 5). As rain falling during wet days (especially in summer) is expected to increase and soils become drier as temperatures rise, the risk of flash flooding increases. These events are short-lived and highly localized, but cause major damage to assets and the natural environment, affecting most people nationally following Dzud (TNC 2018).

“ We do experience flash flooding in different parts of the country more frequently nowadays. (...) We see a dryer summer in the southern part of the country, where usually rainfall would start in May and last until September/October. In recent years we see no rainfall up until August/July and more drier weather. Once there is heavy rainfall happening in drought-stricken provinces, people are more affected by flash flooding. In some areas we see constant rainfall and warm temperatures and this affects the livestock.” KI 3



SUMMARY: PAST CLIMATE TRENDS AND FUTURE CLIMATE PROJECTIONS

Temperatures are rising at a rate in Mongolia that is much faster than the global average, which will have far-reaching effects for the environment, water resources and human health. Due to higher temperatures coupled with faster glacier melt, water stress and drought severity are increasing across the country, especially in the south and south-west. Heatwaves and warm spells will also increase in the near future. Dzud events will become more frequent and more intense, due to increasing drought frequency and increases in winter snowfall. Extreme rainfall will become more intense and more frequent, with more rain falling during very wet days, and this may translate into the increased risk of events linked to intense rainfall such as landslides, flash floods and land erosion.

RECOMMENDATIONS

1. Raise the awareness and education of communities on the risks during droughts and very hot days, and other climate hazards.
2. MRCS to contribute to (re)establishing community-based systems for emergency fodder production and storage, building skills among "new" herders (those who cannot rely on generations of herders before them are often more affected by Dzud) to help manage more frequent Dzud events.
3. Explore expansion opportunities of existing Early Warning Early Action protocols for (flash) floods, extreme temperatures and drought.
4. Address the problem of water stress, especially for the nomadic herders cum farming community.
5. A focus on stormwater drainage, floodplain management and climate-smart water and sanitation systems in activities can prevent damage to the environment and protect communities' health and livelihoods.

2. MOST AT-RISK POPULATIONS

2.1 NOMADIC PASTORALISTS

The traditional lifestyle of Mongolians is slowly disappearing, partly due to the continued degradation of the natural environment along with socioeconomic changes in the post-Soviet era. Desertification, the effects of human-induced climate change, groundwater that is diminishing in quality and quantity, and loss of biodiversity all limit the viability of the nomadic pastoralist lifestyle and catalyze rural-urban migration. The dependency on nature for their livelihoods and the rapid change of the environment are rendering this group particularly vulnerable to the impacts of climate change. This is especially true for herders, who depend solely on livestock for their income (approximately 30 per cent of all herders). Those relatively new to the occupation and people with limited access to prevention measures, disaster information and health checks are similarly vulnerable (IFRC and MRCS 2016).



The herders are the most affected by changing patterns of climate.” KI 3

2.2 THOSE LIVING IN URBAN GER SETTLEMENTS

Mongolia is experiencing rapid urbanization, with approximately 50 per cent of the population now living in the capital Ulaanbaatar (1.5 million people). Those newly arriving in the city often settle in Ger areas – widely dispersed informal and unplanned settlements lacking basic services. The Ger settlements are home to almost 60 per cent of the city’s population. Issues in the Ger areas include the absence of solid waste management, limited education and work opportunities, limited access to electricity, water and sanitation and poor housing. These problems are aggravated by poor governance, corruption and underinvestment (The Asia Foundation 2017).

Regardless of their location and occupation, the MRCS identifies poor families, female-headed families, elderly people and children as more vulnerable to climate change and the impacts of disasters, due to their limited access to information, services and income as well as their already heightened health vulnerabilities (IFRC and MRCS 2016).

“Children are the most vulnerable to the adverse health effects of air pollution from the day they are conceived. Pneumonia is now the second leading cause of under-five child mortality in the country. Children living in a highly polluted district of central Ulaanbaatar were found to have **40 per cent lower** lung function than children living in a rural area. Air pollution is also linked with diseases that can be highly damaging for children, such as **Bronchitis and Asthma**, causing children to miss school and other important learning and development opportunities. This affects their long-term livelihood security as well.” KI 5

2.3 WOMEN PASTORALISTS AND POOR WOMEN IN URBAN GER SETTLEMENTS

Women in Mongolia face gender-based barriers in their socio-cultural, economic and political spheres, including the gender-based division of labour among the nomadic herder community; the largely patrilineal inheritance of tangible assets, especially in rural areas; and the ‘proliferating tolerance’ of violence against women (ADB 2019). In addition to household and care duties, in rural areas women are responsible for milking livestock and processing the milk into products ; men have common property rights over the pasture lands, manage the livestock and take them for grazing (Ahearn 2018). Climate change shocks are affecting women differently to men by leading to an increase in the number of mothers migrating to urban Ger settlements with their children; splitting their families so that the children can get schooling, while their fathers continue to herd livestock in the rural areas (Ahearn 2018; ADB 2019). Winter migration means women are not able to find seasonal work in urban areas even as climate change impacts are reducing herders’ resilience and incomes (Ahearn 2018) so it is a risky strategy. Within Ger settlements, poor living conditions, air pollution and environmental degradation are increasing pregnancy risks and leading to a rise in the mortality rates of children under five years old (ADB 2019).

SUMMARY: MOST AT-RISK POPULATIONS

Rural communities involved in livestock herding and agriculture are highly dependent on natural resources and the environment, which are increasingly under pressure from rising temperatures, erratic rainfall and more extreme events. Those who cannot overcome climate and related economic shocks often move to urban informal Ger areas, where limited access to government services, poor living conditions and limited income opportunities enforce a cycle of vulnerability. Both in rural and urban areas, poor families, female-headed families, elderly people and children are at risk of climate change and disaster impacts due to their limited access to information, services and income as well as their pre-existing health vulnerabilities.

RECOMMENDATIONS

1. The vulnerability to impacts from climate change are highly linked to nature-based livelihoods, so risk reduction strategies and medium- to long-term adaptive interventions have to be specific to the climate risks.
2. Build on existing community needs assessments among vulnerable groups to tailor interventions to the most vulnerable.
3. Focus on at-risk community groups through vulnerability capacity assessments to ensure their needs and concerns are mapped and addressed in interventions on the added risks to health and livelihoods due to climate change.

3. HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

Livelihoods are the collection of “capabilities, assets and activities required for generating income and securing a means of living” (IFRC, 2010). Livelihoods are dynamic, and depending on internal and external stressors, people may shift, adapt and transform their livelihoods. Some livelihoods, in particular, are more sensitive to a changing climate, such as pastoral livestock herding and rainfed farming in the context of Mongolia. According to the IPCC (2014), there is high confidence that climate change, climate variability, and climate-related hazards exacerbate other stressors, worsen existing poverty, exacerbate inequalities, trigger new vulnerabilities and typically have negative outcomes on livelihoods. The following sections briefly outline the main livelihood strategies in Mongolia, and particular vulnerabilities to climate change. A summary of the impacts of climate change on livelihoods in Mongolia is shown in Annex B.



Climate-related disasters are one of the drivers for poverty in Mongolia.” K15

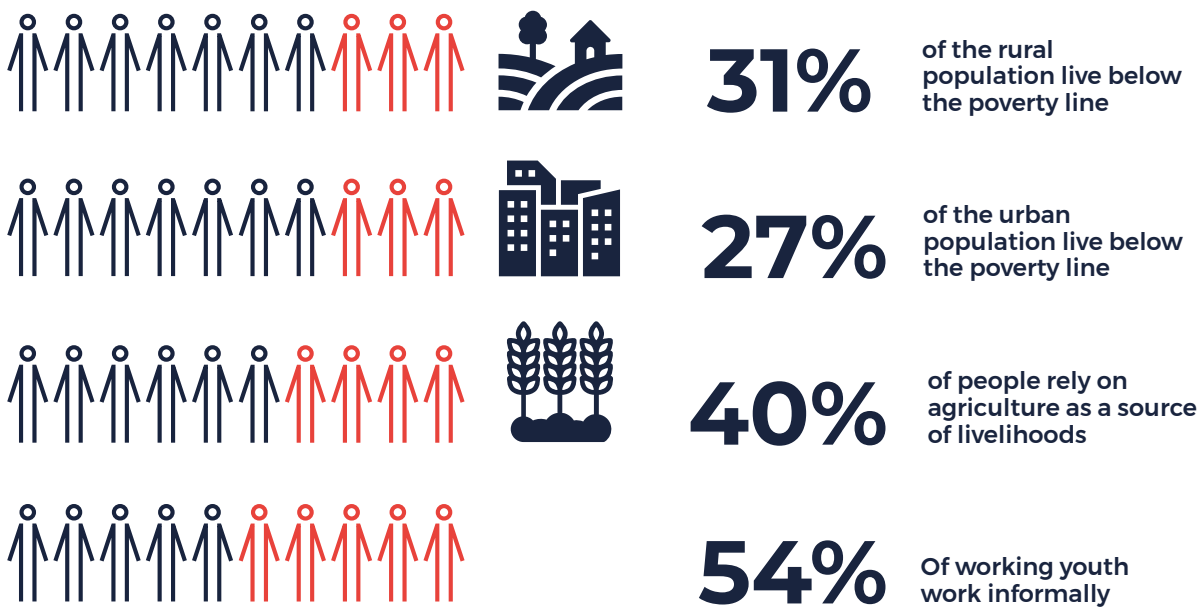
3.1. COUNTRY LIVELIHOODS PROFILE

The traditional lifestyle and culture of Mongolia as nomadic herders is deeply connected to the vast steppe landscape, now increasingly under pressure from climatic and socioeconomic drivers. Roughly 40 per cent of the population remains engaged in agriculture and livestock herding and the number of herders has tripled since the transition from the Soviet era to a market-driven economy in the early 1990s (USAID 2017). Furthermore, livestock products (such as meat, dairy, wool and cashmere) are important components of the country’s economy, and constitute over 80 per cent of the food sector (USAID 2017). The recent start of mining in Mongolia resulted in an economic boom between 2010–2014 (World Bank 2020). The industry sector accounts for one-third of Mongolia’s GDP and drove rapid economic development from 2007–2014 (especially mining). More recently, drops in commodity prices and international contracting issues have caused a decline in revenues, and an economic downturn (Park *et al.* 2017). This has, for instance, affected women who either take up work like sewing in rural areas or look for seasonal jobs to make ends meet when they move to Ger settlements to educate their children (Ahearn 2018).

Benefits from the economic developments have not reached everyone: national poverty rates remain relatively high at 28.4 per cent in 2016 (NSO 2020). Poverty is increasingly concentrated in urban areas, partly driven by continued high rural-urban migration as rural livelihoods are eroding (World Bank 2020). For the unemployed and

people in low-productivity non-waged or informal jobs, their limited income and high dependency limit their ability to overcome shocks. Youth unemployment is a particular concern, with long unemployment spells and over 90 per cent of working youth employed in the informal economy (EPCRC 2017).

Figure 2. Employment statistics.



3.2. AGRICULTURE

The agricultural sector in Mongolia consists of four main sub-sectors: '(i) extensive livestock, which is the traditional semi-nomadic pastoral system, where camels, horses, cattle, sheep and goats are grazed together; (ii) mechanized large-area crop production of cereals and fodder crops; (iii) intensive farming, producing potatoes and other vegetables, with both mechanized and simple production methods; and (iv) intensive livestock, with housed dairy cattle, pigs and poultry' (FAO n.d.). The livestock sector contributes over 80 per cent of the total agricultural production, although the Government is attempting to expand farming activities (USAID 2017).

Livestock

Herding livestock is a key subsistence and cash-producing activity in Mongolia, where traditionally families migrate across the steppe and Gobi Desert with large herds of sheep, which are quick to adapt to different ecological zones, and goats, the numbers of which have been increasing rapidly. Herders also have camels that are used for loading and pulling carts. Here, horses are small but hardy and are highly valued for their meat, milk and sport. Cattle are the local small breed and also provide household

nutrition. In the higher regions, there are yaks along with their hybrid with cattle, the khainag. Animals are typically well suited to the harsh climate, as are the herder families. However, a complex combination of increasing drought, land degradation via desertification, more winter snowfall and heat-stress pose direct and indirect risks to herder lifestyles (IFRC and MRCS 2016; TNC 2018). The Government's index-based livestock insurance (IBLI) is available in every province to provide financial security in case of loss of animals due to extreme events, though there are still challenges that need to be overcome to reach out to everyone.

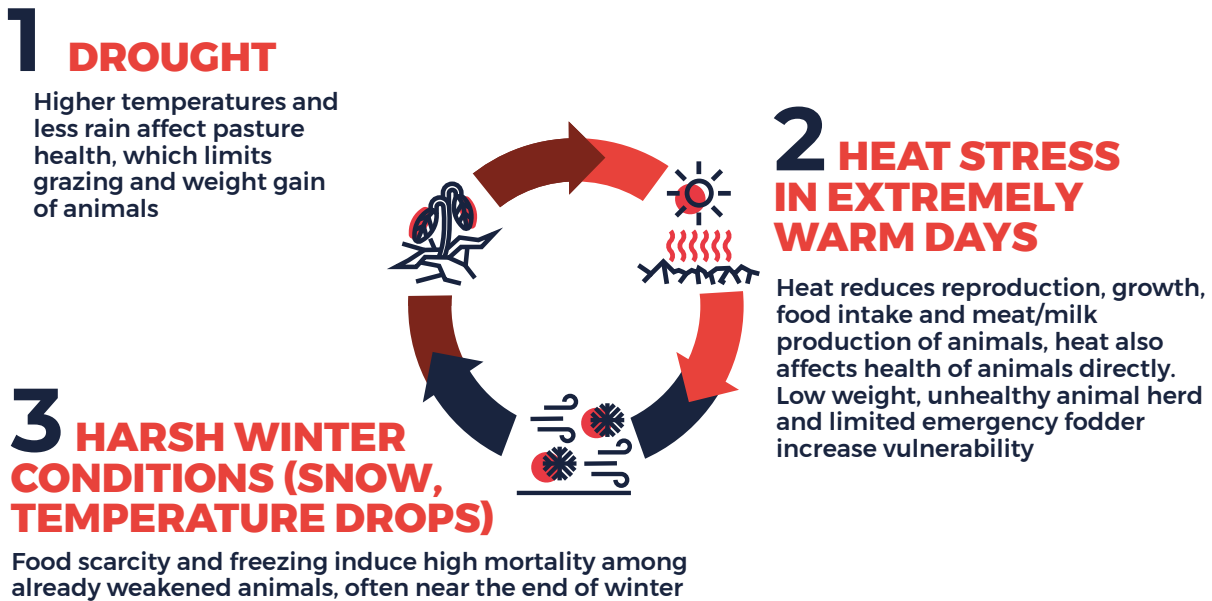
“We see a drier weather pattern in the southern part of the country, causing drought situations with risks for wintertime. This will have impacts on herders' communities. When losing herds, they lose their livelihoods and they move to urban cities. Without skills they have little prospects.” KI 3

Changes in climate which limit food (loss of fodder and grazing) as well as water availability, along with an increased exposure to extreme weather and temperatures may negatively influence livestock health and their ability to withstand the harsh climate of Mongolia, leading to losses (IFRC and MRCS 2016). Temperature and rainfall shifts have also increased the risk of and prolonged insect outbreaks (USAID 2017). By 2050, around 5.5 per cent of livestock could be lost annually attributed to climate change, rising to 7.6 per cent by the end of the century (RCP4.5 projections) (TNC 2018). In particular, the Dzud is responsible for 91 per cent of non-natural animal deaths nationally (TNC 2018). As the Dzud will occur more frequently (every four years instead of every ten years) and may become more intense as a result of more snowfall during winter, the impacts on herders may be catastrophic (TNC 2018; Kwong 2019).

“More than 30 per cent of herders depend solely on livestock for their income. Temperature changes especially affect this population most harshly.” KI 3

More frequent and intense spring and summer drought conditions accelerate the rate of desertification of previously productive pasture and grazing land, compounded by human factors. Dust formation is affecting air quality and causes respiratory diseases among herders. Reduced fodder availability affects the health of livestock and their preparation for winter. In the Gobi Desert, this is causing high livestock mortality (Dzud-like outcomes) even under normal winter conditions (KI 3). Land degradation forces herders to migrate across larger distances with associated health risks (distance from healthcare increases, exposure to extreme weather). Furthermore, there is an increased risk of coming into contact with wild reservoirs of tick-borne diseases and water sources are reduced.

Figure 3. Dzud cycle and climate.



“ Pastureland health and the availability of biomass heavily affect livestock and the livelihoods of herders. Winter pasture yield and grazing capacity following a dry summer versus a relatively mild summer significantly affects the survival rates of animals. Ecosystems of the forest steppe and the high mountains are projected to decrease and the steppe and the desert steppe are expected to expand. Pasture biomass is expected to decrease significantly in all regions, especially in the forest steppe and steppe regions. This reduction of the pasture biomass will result in low productivity of the agriculture sector (due to the increased livestock number) and will have a big impact on food security.” KI 4

DZUD AND FORECAST-BASED FINANCING BY THE MONGOLIAN RED CROSS SOCIETY AND THE RED CROSS RED CRESCENT CLIMATE CENTRE

The Mongolian Red Cross Society (MRCS) – with financial support from the British Red Cross and technical support from the Red Cross Red Crescent Climate Centre – initiated a Forecast-based Financing (FbF) mechanism in Mongolia in 2017 to reduce the risks of highly vulnerable herder households from Dzud using risk maps, early warning and anticipatory actions.

In mid-November, the Mongolian National Agency for Meteorology and Environmental Monitoring published Dzud risk maps, which showed that 50 per cent of the country would be at high risk of Dzud and another 30 per cent would face medium Dzud risk, especially in the central and western areas of the country. The MRCS used these risk maps to identify 40 most at-risk soums (districts) across 12 provinces of the country. It then selected 2,000 of the most vulnerable herder households, using eligibility criteria based on the number of family members with a disability. These herders were given support in cash and kind before the winter conditions reached their peak. The support comprised unrestricted cash grants of 100 US dollars (equivalent at that time to the monthly minimum wage) and animal care kits comprising essential medical and feed supplies which did not require veterinary training to administer.

The MRCS collaborated with a university department to conduct a post FbF impact study. A comparative methodology was used to collect data from FbF target households and non-FbF target households using the same eligibility criteria on vulnerability. The results showed that:

- a) The FbF intervention had successfully identified the most vulnerable herder households.
- b) A majority of herders used the cash support to buy animal feed.
- c) A 50 per cent reduction in the mortality of horses saved the herders their most valued animal.
- d) Survival rates of goats and sheep also improved significantly.
- e) A higher number of herders getting FbF support sold off their animals before Dzud compared to those who were not supported by FbF, in a region where destocking of herds is one coping mechanism to avoid livestock death later in the Dzud season.
- f) There was a reduction in existing indebtedness among targeted households where a significantly higher proportion, almost one-third (32 per cent), used some of the cash to pay back earlier debts, compared to just one-fifth of the non-targeted households. This, in turn, allowed a higher proportion (43 per cent) of FbF targeted households to take new bank loans compared to a lower (37 per cent) proportion of non-FbF households. Most of the new loans were used to buy animal feed.

Sedentary farming

Traditionally arable farming was limited in Mongolia, but in recent years the total cultivated and planted land (mostly rainfed) has increased substantially – however, this, too, is now under pressure from climate change. Crops produced include cereals, vegetables and potatoes for domestic consumption and fodder for the rapidly expanding livestock sector (TNC 2018). Slight increases in total annual rainfall, the changing seasonality and higher portion of rain falling during extreme events may complicate rainfed agriculture. The agricultural sector may also be deeply affected by the rapid rise in temperatures in Mongolia, which will increase drought risk and severity in the short-term, as these increase the evaporation of water, reduce surface- and groundwater, and increase crop water requirements (INDC 2015; USAID 2017; TNC 2018). Rainfed wheat production might decrease by 15 per cent by 2030 (INDC 2015; TNC 2018), mainly driven by reduced water availability. Already, harvests are highly variable and unstable due to frequent drought conditions (TNC 2018). With drought risk increasing, a focus on water management and irrigation will become more important to protect agricultural production (USAID 2017).

Food security

According to the Committee on World Food Security (CFS) (2012), “food security is a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” Food security remains a major challenge in Mongolia, where nationally 65 per cent of households experience some form of food insecurity and 23 per cent suffer from severe food insecurity with hunger (MoH 2017). Climate change may exacerbate existing food security challenges, primarily when market access or supply are disturbed due to extreme weather and especially the Dzud (limiting animal products) or droughts (limiting wheat, maize and potatoes). If harvests fail due to natural hazard-related disasters or weather conditions complicate food transport, food prices may spike, which tends to affect urban and peri-urban populations who are dependent on markets. People in rural areas, on the other hand, primarily live off their own livestock products with some limited market purchases (Park *et al.* 2017). Extreme weather, which negatively impacts herd size and health, directly influences rural household subsistence food supply and the opportunity to earn cash by selling animal products that can be used to buy extra food at markets (Hahn 2017). While food insecurity levels are high, the Government of Mongolia has made rapid progress in covering domestic needs for the staple grains and potatoes (90 per cent) and now covers half of the vegetable needs (TNC 2018). However, the climatic pressures on water availability and land degradation pose risks to domestic food production.

3.3 TOURISM

Tourism is a growing industry in Mongolia with the national Government setting targets on increasing the contribution of the sector to the country's income. Natural beauty along with diverse, distinctive and even rare flora and fauna are part of the tourist attraction package, which includes hiking, horse-riding and staying in Ger camps with nomadic families while participating in seasonal and other cultural events. Tourists also visit historical and cultural heritage sites. Climate change-induced ecological changes, seasonal changes and extreme weather events are already impacting grasslands and water bodies and posing a threat to nature-based tourism and biodiversity. Climate change is also a threat to core infrastructure, such as the requirement for adequate all-weather roads essential for tourism because of the long distances that tourists have to travel. The projected harsher Dzud will reduce the already small summer window for tourism. This will impact livelihoods which are already fragile. This is because much of the western tourism is in the form of groups that bring their own personnel and equipment and so very little local resources are used (Vargas Koch *et al.* 2020). In urban areas, the workforce are young migrants, often living in urban Ger areas with few amenities. Any extreme weather disrupting flights or climate shocks like flash floods affect these people's ability to earn from this fragile industry. The national Government has been part of the Global Sustainable Tourism Council since April 2019, so factoring climate change adaptation into tourism is on the table.

3.4. MINING

For many, the development of the mining and quarrying industry in Mongolia since the early 2000s offered an alternative income opportunity – especially after the three subsequent Dzuds in 1999–2002. However, due to weak environmental regulation, mining activities may be compounding the effects of climate change by competing for scarce water and land resources, particularly challenging the traditional migration routes of herders (Suzuki 2013; Sharma *et al.* 2016). Furthermore, there are reports of the pollution of critical water resources along with the acceleration of desertification and land degradation (Suzuki 2013). In the Gobi Desert large-scale mining has also been blamed for increased dust production and resulting health problems (Sternberg and Edwards 2017). On the other hand, the economically important sector is also at risk from climate change impacts. While resources are extracted underground, extreme events, rainfall and related flash- and riverine flooding as well as temperature extremes may complicate mining activities and transport (Sharma and Franks 2013). Gold, copper and coal mining require water throughout the production process, and decreasing water supply may limit the growth of the sector (USAID 2017).

3.5 URBAN LIVELIHOODS

There has been a massive boom in GDP, but this development has not benefited everyone equally. Poverty rates remain relatively high at 29.6 per cent nationally (2016), and are increasingly concentrated in urban areas. This is partly driven by high rural-urban migration to unplanned settlements around Ulaanbaatar with very limited access to public services (healthcare, social security, education and water and sanitation). Climate change-induced extreme events like heat and drought conditions bring major risks to people's health and erode working capacity among those who are already engaged in insecure livelihoods in the urban Ger settlements. While for many the promise of a different modern lifestyle is a primary cause of migration, an important push factor is that rural livelihood security is increasingly affected by climate change and environmental degradation.

The services industry and retail are primary income sources for the large urban population (68 per cent of total population), but unemployment is high, especially in the peri-urban Ger settlements. Major challenges caused by climate change are the very poor air quality and water availability. Ulaanbaatar is one of the world's most polluted cities as well as the coldest capital in the world. The use of solid fuels and coal contributes to the severe air pollution problem, which affects people's ability to work through an established link with several noncommunicable diseases (See section 4.1).

Economic opportunities in urban areas are few and not very diversified for both men and women, chiefly because micro-, small- and medium-sized enterprises still face poor business environments and women-owned businesses are fewer than men-owned businesses, with fewer employees and smaller turnovers (ADB 2019). Significantly, women's labour force participation has been falling steadily and even urban businesses and jobs continue to be heavily influenced by family relationships, including the attitudes and behaviours of male members of the family (ADB 2019). Livelihoods in urban areas are also affected by rural-urban migration with most migrants living in Ger settlements without adequate opportunities to reskill themselves and acquire capacities for urban jobs (Cui *et al.* 2019). Some limited livelihood opportunities are available in the construction industry, which grew slowly at a rate of 10 per cent in 1980–2016 (Cui *et al.* 2019). Ger settlements dominate urban centres; for instance, 60 per cent of people in Ulaanbaatar live in Ger areas where migrants lack basic infrastructure including sanitation and clean drinking water and, therefore face health challenges that impact their productive potential (Cui *et al.* 2019). Among informal occupations many migrants work as waste recyclers, facing challenges like homelessness, extreme cold weather, insecurity of income as well as occupational health problems that include skin and stomach diseases (Uddin and Gutberlet 2018).

“Some unusual weather happened in the city, for example, a sudden few minutes of heavy flood followed by a sudden large-size hail or dust storm and so on. To strengthen flood management in the city is crucial, climate-affected rural communities have started informal settlements in the city where there is a high-risk of flood. Also, infrastructure development, particularly in roads, needs improved accounting flood management.” KI 5

“People living in apartment blocks do not see the impact yet, they do not think of it as a serious issue. Many organizations are doing awareness-raising activities.” KI 3

3.6 PHYSICAL ASSETS (HOMES AND WORKPLACES)

The main causes of damage to physical assets such as houses, factories, land and infrastructure are snow- and dust-storms, floods, and gusty winds (TNC 2018). Gers are particularly vulnerable, as these frequently collapse under too much snow or can be swept away in a flash flood when the snow melts (Hahn 2017). Losses incurred due to disasters are expected to increase due to more frequent and more intense strong winds, storms, rain, floods and thunderstorms (IFRC and MRCS 2016).



SUMMARY: HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

The negative impacts of rising temperatures, changes in rainfall, more winter snowfall and mounting pressures on water resources all negatively affect the traditionally important agricultural sector. Livestock herding especially – the main livelihood of rural communities – is directly affected by climate stressors on animal health and nutrition. It is also affected indirectly as land degradation continues in Mongolia. Domestic food production (livestock and crops) may be challenged due to more frequent and intense Dzuds and droughts. Erosion of rural livelihood opportunities due to the rapidly changing environment is driving rural-urban migration where, in particular, air quality, water stress and heat are issues. A majority of the urban dwellers work in the informal sector, with women facing additional gender-based barriers, and face challenges like extreme cold weather without adequate homes and heating.

RECOMMENDATIONS

1. Focus on water, land and animal health management skills in rural programmes, emphasizing emergency preparedness.
2. Help communities to understand how the seasons are projected to change and how they can adapt their practices; explore the use of drought-resistant crops.
3. Expand Forecast-based Financing schemes to other natural hazards such as floods, droughts and heatwaves.
4. Ensure livelihood information and diversification strategies target women and vulnerable groups.
5. Work with migrants, especially women, in Ger settlements to ensure them access to adequate health and livelihood options, so they are able to adapt to climate risks like harsher winters, worsening droughts and water stress.

4. HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

4.1. MORTALITY AND NONCOMMUNICABLE DISEASES

The rising temperatures, increased frequency and duration of heatwaves and more frequent Dzud (droughts in summer and extremely harsh winters) along with the increased likelihood of flash floods have the potential to affect a huge proportion of the population. They are also closely linked to contributing towards the already high burden of noncommunicable diseases in Mongolia.

Whilst direct mortality from floods, landslides and storms in the past 50 years has been relatively low (269 lives recorded as lost), these events affected over 2 million people (EM-DAT 2020). Flooding is likely to be of increasing concern as the rapid urbanization of lower income groups is marginalized to the flood-prone outskirts of Ulaanbaatar (Batimaa *et al.* 2011). Extremely cold winters (as part of the Dzud) have been recorded annually since 2015, affecting 157,000–965,000 people (nearly one-third of the population) and forcing both rural and urban residents to remain indoors where they burn raw coal as the primary source of heat, contributing to respiratory illnesses (USAID 2017). As the Dzud is projected to become more frequent (as seen between 2015–2019), this health risk will rise as coal-derived heat is used as a buffer against the extreme cold temperatures.

Rising temperatures and heatwaves are likely to increase the incidence of heat-stress and cardiovascular disease “which already represent the greatest burden of disease in Mongolia” (IFRC and MRCS 2016; USAID 2017; TNC 2018). There are reports of reduced worker productivity during heatwaves (KI 1 and 4), yet this remains a large gap in the literature. Additionally, rising temperatures and more frequent droughts (as well as poor land management practices) are contributing to desertification which, in turn, is increasing the amount of dust in the air with implications for air quality and respiratory illnesses (Jadambaa *et al.* 2014; USAID 2017).

“Air pollution is one of the environmental challenges in the city. On the coldest days of the year, the daily average of PM 2.5 pollution levels reach over 20 times the level WHO recommends as safe. The most important source of air pollution comes from coal-burning stoves in the Ger areas during the winter. Rapid urbanisation continues to cause a problem of unplanned settlements and increased air, water and soil pollution.” KI 5

4.2. VECTOR-BORNE AND ZONOTIC DISEASES

Vector-borne diseases pose significant health impacts and are highly sensitive to changing climatic conditions (temperature, rainfall, humidity), which exert a strong influence on the life cycles of the vectors (such as mosquitoes and ticks) (WHO 2015). Vector-borne diseases are also influenced by non-anthropogenic factors – which are not the focus of this report – such as population growth, urbanization and prevention and control measures.

Whilst mosquito-borne diseases (Malaria and Dengue Fever) are not endemic in Mongolia, other climate-sensitive vectors, such as ticks and fleas, do carry infectious diseases (WHO 2012) (see Figure 3). Pastoral-herders (who comprise 26 per cent of the population) spend prolonged periods of each day in close contact with their livestock; however, little is known about the scope of tick-borne diseases and the effects of climate change on these diseases in Mongolia specifically (Boldbaatar *et al.* 2017). Plague, spread by fleas and transmitted to humans through the hunting of wild marmots or other rodents, is endemic in Mongolia and particularly focalized in the western part of Mongolia (Galdan *et al.* 2010; WHO 2012). The dynamics between climate change and the life cycle of fleas and their rodent hosts is also not well documented in Mongolia.

Figure 3. Seasonal calendar for ticks. Source: WHO 2012



Ticks carrying tick borne **ENCEPHALITIS** (prevalent in the Bulgan, Selenge, Bayanhongor, and Hovd provinces particularly between April and October), **LYME DISEASE, RICKETTSIOSES, ANAPLASMOSIS** and **Q FEVER**



The contact between wildlife, domesticated animals and humans provides the opportunity for zoonotic disease to spread. As highlighted by a previous study, “climate change and extreme weather conditions have had an adverse effect on biodiversity, distribution of animals, and microflora, which can lead to the emergence of zoonotic agents and create favourable conditions for disease outbreaks. Over 20 bacterial and viral and 18 parasitic zoonotic diseases were reported in animals. Six out of 15 diseases listed as transmissible diseases notifiable to the OIE (World Organisation for Animal Health) were reported in Mongolia, and four diseases have a potential risk for further spread.” (Batsukh *et al.* 2013).

“In Mongolia we have marmot (Bubonic) Plague in the western part. We do have this rodent in many places and they naturally have this disease with them. It is prohibited by law that people eat meat from this animal. People sometimes illegally hunt these animals and then people get this Plague. The professionals are well prepared in taking care of these cases.” KI3

4.3. WATER, SANITATION AND HYGIENE

This section covers the main health issues related to Water, Sanitation and Hygiene (WASH) and how they will be impacted by climate change.

Water supply

Freshwater availability has, over the past decades, become a major concern in Mongolia due to climate change (erratic rainfall and higher temperatures) and increased desertification (in combination with human activities). Over 12 per cent of rivers, 21 per cent of lakes and 15 per cent of springs have already dried up in Mongolia (INDC 2015). Water shortages are likely to worsen in low water periods during the summer, reducing the amount of water in the aquifers on which 80 per cent of drinking water is drawn from (Batimaa *et al.* 2011). Only one-third of the population is connected to improved drinking water supply networks (both in rural and urban areas) (MoH 2017; USAID 2017), whilst the rest of the population access water via private or public wells, purchase trucked water, or collect it directly from the rapidly drying rivers and streams (USAID 2017). An assessment by IFRC/MRCS found that 17.3 per cent of total drinking water had microbial growth (IFRC and MRCS 2016). Therefore the risk of concentrating contaminants in reduced water supplies is high (USAID 2017). The water consumption of the population living in the Ger districts has been shown to be four to five times lower than the accepted sanitary norms (Batimaa *et al.* 2011), therefore, this population is likely to be very at risk to any further reduction in access to water. The level of water quality for pastoralist-herders and nomads appears to be a gap in the literature.

Sanitation

Climate change will also impact infrastructure such as the sewage system design, stormwater infiltration systems and subsurface drainage systems which will affect urban water management practices, in particular (as the majority of infrastructure is centred in urban contexts) (Batimaa *et al.* 2011). Peri-urban settlers in the Ger districts located in flood plains are particularly at risk as they typically extract water from shallow groundwater via wells, which can easily be contaminated from nearby unsealed pit latrines (open defecation is very low in Mongolia) or from the excreta of animals (Ochirbold *et al.* 2020).

Water-borne diseases

Despite the relatively high use of unimproved water sources (such as springs, wells, surface water and vendor-supplied water) that have been shown to be contaminated (e.g. with *E. coli*), the incidence of Acute Watery Diarrhoea and foodborne diarrhoea is low (Davgasuren *et al.* 2019). Acute Watery Diarrhoea shows a strong seasonal trend, increasing from spring (May), peaking in summer and decreasing in autumn (October)(Davgasuren *et al.* 2019). The positive correlations between temperature and bacteria (such as *E. coli*) indicate that further warming is likely to increase the risk of bacterial water pollution (Ochirbold *et al.* 2020). This risk is exacerbated as water is likely to become scarcer. Historical severe droughts, which led to the drying of small rivers and springs, have been linked with Acute Watery Diarrhoea, Salmonella and deaths in children under five years old (UNICEF 2011). Overall, there is limited data available on water quality and the microbial condition of surface waters in Mongolia, which means that the “related risks to public health are only partially understood” (Ochirbold *et al.* 2020).

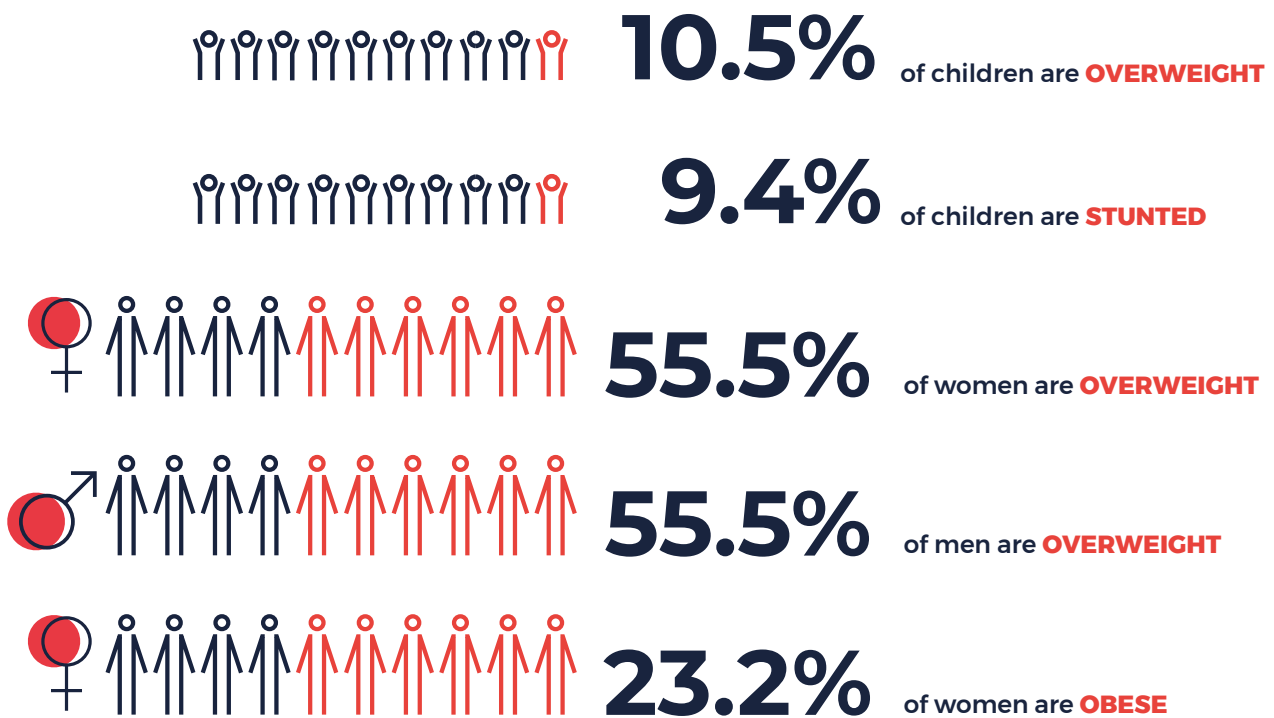
“The clear gaps are the persistent differences in access to both water supply and sanitation between urban and rural areas, the limited number of households connected to central sewerage systems in urban areas and the very low percentage of rural population estimated to have access to adequate sanitation.” KI 5

4.4. MALNUTRITION

Mongolia faces a double burden of malnutrition. A sizeable proportion of the population is obese, and yet some chronic undernutrition persists resulting in stunted children. As highlighted previously, the impact of climate change on traditional pastoralist lifestyles is not only reducing the availability of food (livestock deaths) but also influencing migration dynamics – acting as a push factor towards urban centres for better income opportunities. Urban populations, who may find themselves trapped in informal seasonal employment, are reliant on markets and can only afford the abundant low-quality, highly processed foods that are high in fat, sugar and salt (MoH 2017). Obesity and other comorbidities increase an individual’s likelihood to suffer from heat exhaustion and heat stress as temperatures continue to rise, as highlighted in Section 4.1 (Mortality and NCDs). Therefore, whilst obesity is not directly caused by climate change, it is inextricably linked to the secondary risks and impacts influenced by a changing climate.

Undernutrition has been linked to catastrophic Dzud events. For example, in 2009–10 a Dzud caused 10.3 million livestock to perish, and children from herding households showed slowed growth in the subsequent years (Grosso and Kraehnert 2016). The death of livestock leads to severe food shortages in spring, which can affect adults, but especially children by: 1) causing lowered immunity (from increased food and micronutrient deficiencies), increasing the risk of infectious diseases; and 2) increasing the risk of malnutrition (UNICEF 2011). Mongolia, positively, is on course to meet its targets to reduce stunting (which is already below the Asia average) and wasting (which is amongst the lowest in the world) (GNR 2020). However, undernutrition should avoid being transformed into overnutrition and obesity from the consumption of poor-quality processed foods, wherever possible. Beyond processed foods in urban centres, the consumption of fruits, vegetables, eggs, nuts, seeds, fish and poultry is low, but red meat and whole-fat dairy and refined grains is high (MoH 2017). As the dietary diversity is in general low, micronutrient deficiencies are high throughout the population.

Figure 4: Source: NNS 2017 and Global Nutrition Report 2020





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4.5. DISPLACEMENT AND MIGRATION

More than half of the population is now urbanized and predominantly living in or around Ulaanbaatar, the capital city. Many have moved to the capital in search of economic opportunities as the winters become harsher (causing the widespread loss of livestock) and seasonal patterns change. The result is a decline in rural livelihood opportunities and the abandonment of traditional livelihood systems (Neve *et al.* 2017; USAID 2017; IOM 2018; Schoening 2020). Major historic disasters related to the Dzud have forced people to leave rural homes and migrate to the city. In the aftermath, it has been found that people displaced from the eastern regions do return there, but those living in western regions remain in Ulaanbaatar and other cities as the climate conditions in the west become less and less favourable for pastoralism (Schoening 2020; Xu *et al.* 2021). Climate change will continue to challenge the traditional pastoralist way of life, putting pressure on traditional seasonal migration to range over bigger distances to reach pasture land further away, and is likely to sustain the rural-urban pressure (Neve *et al.* 2017). Large populations settling in peri-urban areas do not have access to basic services, which increases their vulnerability to new urban climate risks, even as they have tried to escape the rural risks they were experiencing (USAID 2017).

“Climate change is influencing internal migration which poses a lot of challenges to us. Most of the families live in Ulaanbaatar city because of climate change and internal migration – we need to focus on urban resilience. Mostly rural to urban areas migrate for job and employment, and climate issues are connecting together and jointly the environment is changing. We have some risk studies into the climate. We do not have information on studies and assessments on migration pattern changes. But in the last two years with a lot of international cooperation we have established a small working group to evaluate this. After people marry, they move to city areas, young people want to change their way of life. As a developing country, Ulaanbaatar is developing quickly while in rural areas there is sometimes no internet even.” KI 1

“Due to the Dzud and drought that occurred in the past, many rural families lost their livestock and livelihood sources, and as a result herders are left with no choice but to migrate to the cities in search of jobs.” KI 5

4.6. MENTAL HEALTH

Climate change has been shown to lead to increases in anxiety and depression (Berry *et al.* 2010; Paranjothy *et al.* 2011), possibly related to concerns over diminishing livelihoods and physical stresses on the body (e.g. from heat). There is limited data on mental health issues in Mongolia and how these may be exacerbated by climate change. The national prevalence of self-reported mental health issues was low (1.17 per cent), urban respondents were more likely to highlight mental health issues, and especially people from lower income households (Battuvshin *et al.* 2008; Dagvadorj *et al.* 2019; Dorjdagva *et al.* 2020). Whilst no previous studies have explicitly linked mental health in Mongolia to climate change, it is well-known that climate change impacts the poorest households first who, as highlighted, already report a higher burden of mental health issues.

“The herders are at greater risk of suffering from noncommunicable diseases and mental health illnesses in the event of increasing climate-induced disasters such as drought and Dzud.” KI 5

4.7. CRITICAL INFRASTRUCTURE AND HEALTH SYSTEMS

Healthcare in Mongolia is provided at three state-owned service levels: tertiary, secondary and primary healthcare (WHO cooperation strategy 2017–2021). Treatment at the primary healthcare level is quite basic (Devi 2020) and many healthcare facilities are not connected to central water supplies, nor to the sewage system (WHO 2017). Although over 90 per cent of Mongolians are covered by health insurance, out-of-pocket expenditure to cover costs for anything more than basic healthcare is high (WHO 2017). The basic level of services and costs as well as geographical and administrative barriers, result in delays in accessing healthcare, treatment failure and a high number of patients who do not receive follow-up care. Critically, this also prevents some communities from accessing quality healthcare services altogether. Since 2015, administrative barriers for urban migrants unable to become registered with a healthcare provider is a particular concern.

“For urban migrants there are many barriers to Government services like healthcare. We closed our migrant registration system in Ulaanbaatar in 2015 – so for five years already people cannot register at the decision of the city administration. They cannot access Government services like education and healthcare and this is a really big problem. Children are an exception – they can go to kindergarten and schools and access healthcare services.” KI 1

Geographical barriers exist for both urban and rural populations. Those living in peri-urban areas tend to have heightened exposure to climate risks but these areas also have limited public health infrastructure and services, potentially widening the health disparities between the poor and wealthy (UNICEF 2017). In the rural context, geographical barriers manifest due to the long distances (and associated travel costs) to reach healthcare facilities (WHO 2017). Isolation in remote areas is likely to increase with climate change – especially in the more frequent harsh winters – as snow blizzards, snowfall and ice make road travel particularly dangerous and cut people off from access to fuel supplies, medical services and facilities (Nenova-Knight 2011). For the people cut off from healthcare services, this can result in conditions (e.g. Pneumonia) being left untreated for months as well as babies being delivered in unsafe and unsanitary conditions leading to complications for mother and child, amongst others (Nenova-Knight 2011).

4.8. SEXUAL, REPRODUCTIVE, MATERNAL, NEWBORN AND CHILD HEALTH

Climate change already is, and will continue to, affect men and women as well as boys and girls differently. Key areas of concern from global studies have shown how a changing climate is altering the dynamics and risk of negative maternal health outcomes, forced child marriages, human trafficking, sexual exploitation and gender-based violence (Castañeda Carney *et al.* 2020; Women Deliver 2021). However, considerable gaps in research and evidence that link climate change and sexual and reproductive health rights exist both globally (Women Deliver 2021) and in Mongolia.

Some key trends bear consideration with regards to sexual, reproductive, maternal, newborn and child health and climate change:

- **Accessing sexual and reproductive healthcare services:** Harsh winters in Mongolia hamper the access of healthcare workers to remote villages or women's ability to get to a healthcare facility, resulting in them giving birth in unsafe conditions, which may impact the mother and child (Nenova-Knight 2011).
- **Reproductive and maternal health:** Impacts of harsher winters as well as reduced food and water supplies will deepen the challenge of maternal deaths – which already occur more frequently in rural Mongolia, especially in nomadic herding families (50 per cent of deaths) that are increasingly facing a higher livelihoods loss due to climate change. Maternal mortality is also high among unemployed women (30 per cent of deaths) and higher rural-urban migration threatens to increase this figure. The high rural and economic disparities in maternal healthcare (Hill *et al.* 2006) will deepen due to climate change impacts.
- **Newborn and child health:** Lower food production due to climate change impacts will deepen the already high micronutrient deficiencies, especially Vitamin D, Iron and Vitamin A (MoH 2017). The adverse impacts on income levels due to climate change will affect the ability of children and their parents to access nutritious food (UNICEF

2011). Cultural feeding practices have tended to provide low dietary diversity to children (MoH 2017) and this diversity may further reduce due to climate change-induced lower food production and the increase in migration to urban areas. A 2014 study (Gantuya *et al.* 2014) shows a direct link between urban pollution and low birth weight in Mongolia and worsening pollution will aggravate this problem.

SUMMARY: HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

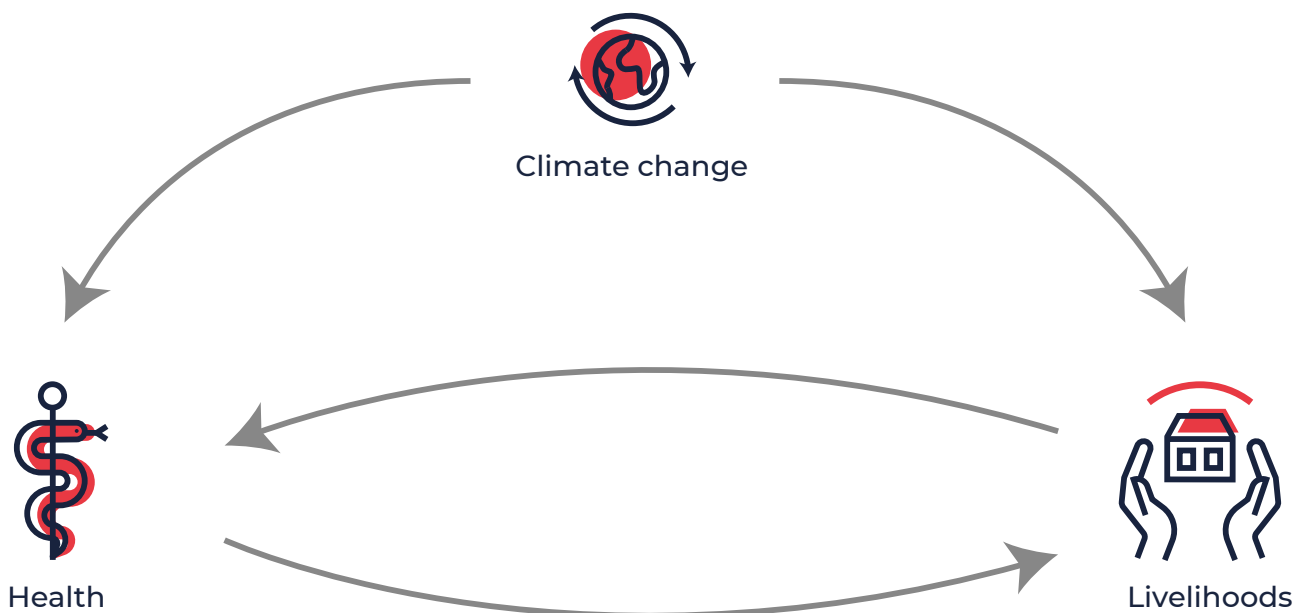
The main climate change-related health risks in Mongolia include access to healthcare services for recent urban migrants (since 2015), One Health issues (zoonotic disease and tick-borne diseases), and respiratory issues from dust and indoor air pollution, especially as the winters become harsher (from Dzud) forcing people to remain indoors and burn coal for warmth. Climate change risks degrading the natural environment, which poses problems for domestic food security. Whilst undernutrition is not a major issue, micronutrient deficiencies are high across the whole population and especially in children. Any reduction in the domestic production of fruit and vegetables could spiral the already high prevalence of poor dietary diversity and high micronutrient deficiencies (which are largely driven by cultural dietary practices). Climate change catalyzes rural-urban migration where abundant highly processed, low quality, cheap food exists, contributing to the high burden of NCDs. A number of gaps were found related to the impacts of climate change on mental health, sexual and reproductive health and rights, and on water quality and supplies and how this relates to the health of pastoralist-herders.

RECOMMENDATIONS

- 1.** Ensure One Health approaches are mainstreamed in health programmes.
- 2.** Carry out urban specific assessments on the health risks and needs of recently migrated urban poor.
- 3.** Pilot nature-based solutions to help prevent environmental degradation (especially desertification), improve local fruit and vegetable production, and link with dietary diversity and healthy balanced diet planning.
- 4.** Focus especially on pregnant and lactating women and on newborn babies to ensure better health parameters for children at the beginning of their lives.

5. LINKAGE BETWEEN CLIMATE IMPACTS ON HEALTH AND LIVELIHOOD

Climate change has the potential to affect health and livelihoods in a negative feedback loop. When climate change negatively affects livelihoods, people do not have sufficient money to ensure good health and pay for healthcare, causing a spiralling of acute or chronic conditions. Or, when people’s health is affected by climate change, they are often unable to put in as much work and thereby earn sufficient money to pay for the healthcare they need... thereby further reducing their ability to get better. No wonder, a popular idiom in South Asia says: *jaan hai to jahan hai* – “the world exists when health exists.”



Climate risks compound dangers to health and livelihoods, causing an unending cycle of impoverishment and require integrated adaptation measures to deal with these. At-risk groups especially find it difficult to deal with these cascading effects. Impacts of climate change on the natural capital of rural people will directly affect their livelihoods and result in reduced incomes to meet healthcare expenses. Climate change impacts contributing to this downward spiral will include more frequent and longer drought conditions, increased flash flooding risk, forest fires, the drying up of rivers and lakes and more dust in the air. The most severe risk in Mongolia to both health and livelihoods will be intensification of Dzud that will lead to far higher livestock mortality. The actual climate change impacts vary across the different regions within the country (see table on climate projections for more detail on this).

“Climate change policies are required to integrate and interlink to many sectoral policies, such as agriculture, livestock, tourism, transport, infrastructure, public health and so on. Although on the national policy level the country is fully committed, in practice those policies’ applications are not fully enforced.” KI 5

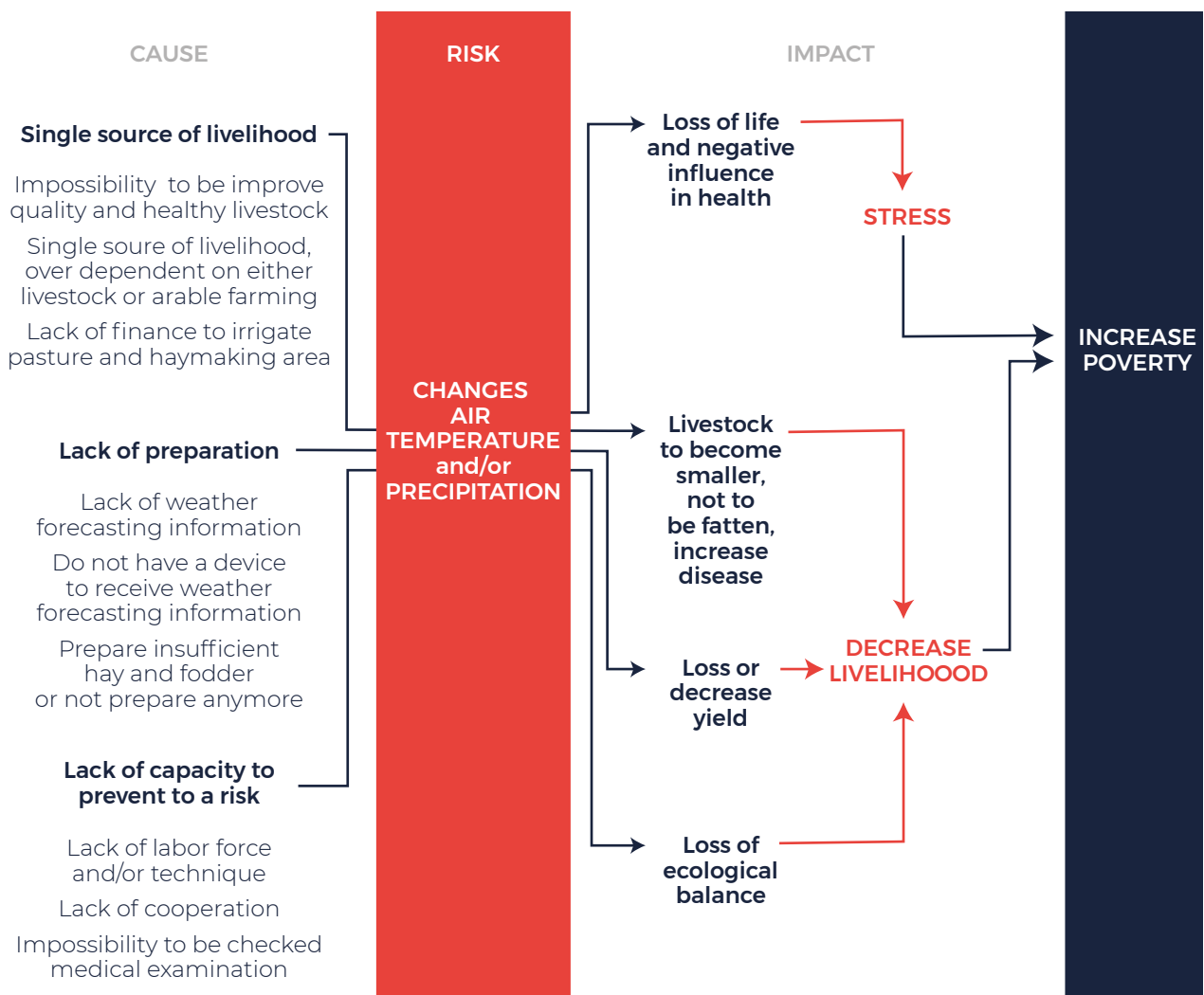
In the hot season, Mongolia will experience more hot and extremely hot days. Although heat remains an under-explored topic in the literature and informants did not consider it the main challenge, they did report heat-stress, heat-exhaustion and possible implications for underlying NCDs as issues – especially for pregnant women and the elderly (KI 1 & 3). A longer warm season makes vectors such as ticks more active and lengthens exposure. Furthermore, warmer weather increases microbial growth in water sources and food that is not properly stored. Already, 32 per cent of the population are without access to improved water sources and health impacts due to more warmer days will be an additional challenge, leading to illnesses and loss of income. Diarrhoea (especially Acute Watery Diarrhoea) shows a seasonal trend already, peaking in the warmest months and any worsening will make it extremely stressful to do any physical job, especially in the hot season. Heat-related illnesses reduce people’s productivity which, in turn, also leads to higher mental stress. People working in mining, herding, construction and street-based vending in urban areas are more prone to heat-related health impacts and the subsequent loss of livelihoods and lower incomes.

While overall conditions will become hotter and drier, extreme rainfall events will also become more frequent and, in combination with drier soils, will increase the risk of flash floods, leading to loss of assets, livelihoods, health impacts and a downward spiral between them. This is already being reported as a new phenomenon in some parts of the Gobi Desert (KI 1). Flash flooding often catches families by surprise, and can wash away tents and possessions, injure livestock and damage infrastructure. The ability to recover from such shocks may require taking on debt or cutting food and health expenditures – associated with mental health stress as well as physical health risks. Although flash flooding is likely to affect water quality, there is very little information on WASH and related public health risks and how these, in turn, influence work-related activities and if they have any links with rural-urban migration.

The projected increase in the frequency and intensity of Dzud is the main concern for health and livelihoods according to many key informants (KI 1, 3, 5 – see Figure 5). The combination of harsh winter conditions (a lot of snow, sudden drops in temperature, long duration of cold) and the limited preparation of livestock during dry summers leads to large-scale livestock mortality and catastrophic loss of livelihoods, with ramifications on people’s nutritional health and mental health. Children from herding households born in Dzud years experience slower growth rates possibly caused by undernutrition, disruption to healthcare access and markets and increased exposure to indoor air pollution from heating. This puts an extra burden on their parents to earn enough to provide their children with a better quality of life, but their challenges on this account deepen in the face of climate change.

The impact of climate change on traditional pastoralist lifestyles is not only reducing the availability of food through livestock deaths and loss of income, but also influencing migration dynamics. Loss of livestock is a major push factor towards urban centres for better income opportunities. However, as newly arriving migrants cannot currently register for Government services in Ulaanbaatar, they have limited access to healthcare (KI 1). Ulaanbaatar is also considered one of the most polluted cities in the world (air pollution mainly), which affects child development, the incidence of NCDs and mental health. Furthermore, abundant low quality, highly processed food is eaten instead of a traditional diet, leading to micronutrient deficiencies. The fall in city dwellers' health makes it difficult for them to put in more hard work and earn better.

Figure 5. The interconnected challenge of climate change for the health and livelihoods of herders. Source: IFRC and MRCs 2016



SUMMARY: WHAT ARE THE KEY LINKAGES BETWEEN CLIMATE CHANGE, HEALTH AND LIVELIHOODS?

The combined and cascading effects of climate change on health and livelihoods as part of a negative feedback loop are acutely felt on the ground, especially by at-risk groups of people. These require more integrated approaches to climate change adaptation. Impacts on livelihoods due to more frequent and longer drought conditions, flash floods, forest fires and the drying up of rivers and lakes as well as there being more dust in the air due to a greater number of windstorms all lead to a lowering of incomes resulting in declining food and water security and an inability to access healthcare facilities. Poor health parameters lower levels of productivity and reduce income levels. Loss of livelihoods, combined with health impacts, may also lead to mental stress further impacting work productivity.

RECOMMENDATIONS

- 1. Adopt an integrated approach to resilience-building by mapping health and livelihood impacts to climate change and the interlinkages between them.**
- 2. Ensure interventions on health and WASH also are sufficient to improve people's ability to work.**
- 3. Combine adaptation measures on livelihoods with improvements in food and water security to contribute to health benefits.**
- 4. Ensure the focus on at-risk groups is not in silos but follows an integrated approach to resilience-building.**

6. EXISTING CAPACITIES, STAKEHOLDERS AND PROGRAMMES

6.1. POLICY LANDSCAPE



MINISTRY OF ENVIRONMENT, GREEN DEVELOPMENT AND TOURISM coordinates climate change adaptation through its National Climate Committee (NCC), managing national level policies and UNFCCC commitments



NATIONAL EMERGENCY MANAGEMENT AGENCY is the leading agency responding to natural disasters



NATIONAL AGENCY FOR METEOROLOGY AND ENVIRONMENT MONITORING (NAMEM), THE INFORMATION AND RESEARCH INSTITUTE OF METEOROLOGY, HYDROLOGY AND ENVIRONMENT (IRIMHE) AND THE ENVIRONMENTAL INFORMATION CENTER (EIC) are responsible for weather, climate and environmental information.

Table 2: National policies and plans

POLICY, REVIEW OR PROGRAMME	CLIMATE-HEALTH-LIVELIHOODS LINKAGE
National Action Programme on Climate Change (NAPCC) (2011)	This policy is focused on national capacity-building for adaptation with an important role for public awareness and participation, which are emphasized as important barriers and gaps in the climate change work of the National Society (KI 1 and 2).
Government policy on disaster protection (2011)	An important basis of the ongoing forecasting efforts for disaster risk reduction in Mongolia, as this policy document explicitly emphasizes the importance of technology and early warning to prevent disaster impacts.
Green Development Policy (2014)	Aims to ensure environmentally friendly economic growth and is, therefore, an important document for work on climate adaptation (IFRC and MRCS 2016).

POLICY, REVIEW OR PROGRAMME	CLIMATE-HEALTH-LIVELIHOODS LINKAGE
Mongolia's Sustainable Development Vision – 2030 (2016)	Envisages Mongolia as a leading middle-income country that preserves its ecological balance while eradicating poverty (TNC 2018).
Law on Legal Status of the Mongolian Red Cross Society (2016)	Confirms the purpose of the Mongolian Red Cross Society is "...to provide health, social and psychological support in case of disasters affecting the public as well as assistance in the preservation of humanity...". The objectives of the MRCS are to organize activities to: promote human health; prevent diseases, disasters and accidents; ensure preparedness; and reduce risk. (IFRC and MRCS 2016).
The Action Programme 2016–2020 (2016)	Reflects Mongolia's Sustainable Development Vision 2030. Point four of the policy is focused on green growth and human health, which intersects with climate-health-livelihoods issues.
Mongolia's Initial Biennial Update Report (2017)	An important step in climate mitigation on a national scale. While the BUR recognizes health and livelihoods as key vulnerabilities, the emphasis is on mitigation and greenhouse gas reduction rather than adaptation.
Third National Communication (2018)	Discusses climate change knowledge, a greenhouse gas inventory, mitigation and adaptation. The five key vulnerable sectors are animal husbandry, arable farming, water resources, forest resources and public health – thereby adding public health to the original INDC (2015) priorities.
Voluntary Review Report of the Sustainable Development Goals Mongolia (2019)	More frequent natural disasters, the erosion of natural resources and altered climates are considered major impediments to economic growth. Furthermore, climate change shocks are among the main reasons for people to be left behind in development. The VNR (2019) says: "in addressing these development challenges, sound development policy planning that incorporates sustainability will be critical."
Mongolia's Nationally Determined Contribution (NDC, 2019)	Addresses explicitly public health (health systems and anticipatory action), food security and livelihoods vulnerability.
Revised NDC in 2020	Discusses adaptation needs in health and livelihoods that offer action points where the National Society can play a significant role. Health: assess risks, build knowledge, strengthen response capacity. Livelihoods: identify the most vulnerable, diversify livelihoods, consider equity.

6.2. CAPACITIES

GOVERNMENT*

STRENGTHS

- Mongolia has developed a broad set of climate-related policy frameworks that enable adaptation and mitigation actions
- The country is comparatively successful in accessing global climate finance, although challenges in financing remain
- In coordination with the MRCS there is an established early warning early action protocol for Dzud



CHALLENGES

- Need for more transparent governance and budget planning
- Stronger implementation of national level policies
- Need for improved public awareness and prioritization of climate change among the general public
- Prioritizing the monitoring of food security, heat impacts and water quality

* Data derived from key informant interviews and literature review

MONGOLIA RED CROSS SOCIETY*

STRENGTHS

- Existence of skills and expertise at the National Society level with a strong team working on climate change
- Nationally embedded coordination between MRCS, disaster management authorities and the Government as well as experience in working closely with the National Agency for Meteorology and Environment Monitoring to implement a successful Forecast-based Financing programme so that herders can be prepared for Dzud
- The nationwide network of volunteers that allows the MRCS to work at the community level and have a large outreach



CHALLENGES

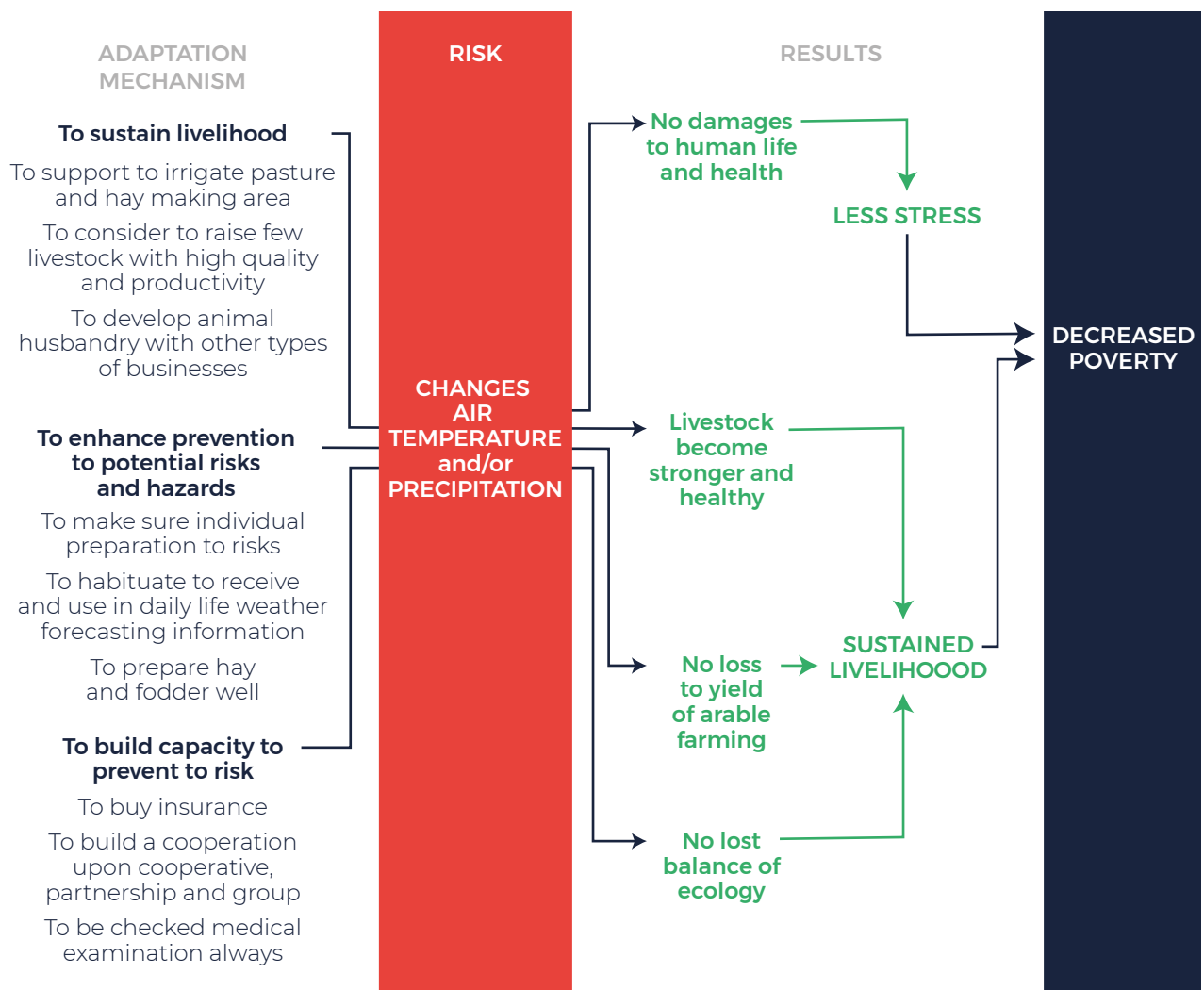
- Lack of funding to implement and use climate studies and risk assessments, the existing plans for projects and known vulnerabilities – especially at the mid-level (KI 1 and 3)
- Limited knowledge of climate change and limited capacities to respond to risks at the mid- and community level (KI 1 and 3)
- Processing and communicating emergency and long-term weather and climate data to the general public and lower level branches remains a challenge (KI 3)

* Data derived from key informant interviews

7. RECOMMENDATIONS AND OPPORTUNITIES

Figure 6: Targets and desired outcomes to prevent negative impacts of climate change in Mongolia.

Source: IFRC and MRCs 2016



OVERARCHING RECOMMENDATIONS

RECOMMENDATION 1: Enhance knowledge and awareness about the science and impacts of weather and climate change within the National Society and at the community-level with a focus on their potential impacts on disasters and on people's health and livelihoods.

Gap: The impacts that climate change will have on health and livelihood outcomes are not always well understood within the National Society and among communities. Yet, this knowledge is key to spur the necessary local action of communities, grassroot organizations, CSOs and government agencies. Often, the lack of knowledge is because complex information is not translated in terms of lived experiences or linked to risks to the health and work of individuals and communities. There is also little local capacity to do data collection, monitoring and evaluation as well as capacities to understand how weather and climate science are linked and how they play out in people's everyday lives.

Opportunity for action: There are three key opportunities for action: 1) Training and campaigns on weather and climate science to build awareness and knowledge, especially at the local level and through participative means. This includes providing information and enhancing understanding of the projected impacts on health, water security, livelihoods and disaster risk reduction. Tools and training modules are available through the IFRC and the Red Cross Red Crescent Climate Centre. 2) Communicating weather and climate information to reach the 'last mile' in local communities, CSOs and local government agencies for timely health-related and livelihoods-related public action. 3) Initiating, collating and sharing good, locally led practices in knowledge generation, mobilization etc., for scaling up through horizontal learning, use on policy engagement platforms and in working with government agencies.

RECOMMENDATION 2: Implement and scale-up community-based climate-smart programming in health and livelihoods, including anticipatory action and nature-based solutions.

Gap: An integrated approach to climate change, health and livelihoods is required to build local resilience to multi-level impacts of climate shocks, but this is not yet adopted by practitioners or policy-makers. The adoption of this approach is limited by the unavailability of relevant expertise, adequate research and required financial resources.

“Long-term planning for climate change is really difficult. You can have a lot of assessments and studies, but if there is no funding coming in these can be very useless sometimes. To make sure that you can do something with knowledge and work with community members to make changes, I myself personally try to stick with what we can actually do ourselves like training and awareness-raising and try to avoid bigger activities to not raise any expectations in the community to change their lives for the longer term.” KI 3

Opportunity for action: [Climate-smart programmes](#) and projects can be introduced and significantly scaled up to anticipate, prepare for and reduce the health and livelihood impacts of climate change in high-risk areas. These include anticipatory action, especially Forecast based Financing; community-based assessments and natural resource management; the promotion of nature-based solutions for medium- to long-term resilience-building; and, the adoption of risk reduction measures such as climate-based livestock insurance and the use of social protection platforms for adaptation. Materials on climate risk management, including climate-smart health programming and module 2 on building community resilience in the [Climate Training Kit](#) are available from the IFRC/Red Cross Red Crescent Climate Centre. 2) Programmes must seek to continually identify and adapt to specific environmental and climate change-related drivers of vulnerability for health and livelihoods by developing stronger analytical capabilities that include using the information available from Governments as well as research and technical organizations within the country and outside. 3) Programmes should increase the integration of DRR and public health livelihood work at the community level.

RECOMMENDATION 3: Continue to foster cross-sector collaboration across programmes

Gap: No organization can tackle the increased risks posed by climate change alone, or alleviate the exacerbated risks of vulnerable populations.

Opportunity for action: 1) MRCS is well placed to empower those most at-risk with capacity building and enhancing activities that take an inclusive and gender sensitive approach. 2) MRCS is in a good position to continue to foster and strengthen partnerships both within and outside the humanitarian, climate change and development sectors to expand its work on policy engagement. Engaging with the Nationally Determined Contributions process provides opportunities to work closely on integrated adaptation with national agencies and donors to improve finance flows, strengthen infrastructure, facilitate access to technology-based solutions and innovations for climate adaptation and resilience as well as support Forecast-based Financing mechanisms to scale-up anticipatory on the ground adaptation. 3) More internal integration between disaster management, communication and policy teams of the MRCS can expand its collaboration with external collaborators such as the National Agency for Meteorology and Environment Monitoring, the private sector, academia and CSOs to do evidence-based policy engagement on areas such as anticipatory action, an integrated approach to climate-smart programming and inclusive local action to support cross-sectoral planning, policies and processes and contribute to the national ambitions on health and livelihoods.

PROGRAMMATIC AND PROJECT RECOMMENDATIONS

- Forecast-based Financing for droughts, supporting herders and farmers to ensure they can harvest/prepare for winter sufficiently.
- EWS to reach the last mile: expand Early Warning Early Action work for Dzud to other disasters, especially flash floods and summer droughts, to improve vulnerable households' resilience to harsh winter conditions and avoid livestock death, food insecurity and damage to assets.
- One Health approaches: recognize the importance of herd health and awareness of zoonotic and vector-borne diseases among herders and rural communities, and expand monitoring of these diseases (geographically, number of cases and the development of diseases).
- Focus on access to climate-related financing to expand healthcare access and social protection coverage, along with risk reduction – drawing upon existing research and knowledge on community vulnerability within MRCS.
- Expand on existing training modules and materials to build capacity at the mid- and lower level branches and community outreach, to increase operational awareness of climate change impacts.
- Consider integrating climate change modules into volunteer training and educational activities and establish a trainer-of-trainers pool.
- Contribute to the monitoring of important climate-related indicators such as heat-stress, water quality/WASH-related disease outbreaks etc., for which currently there is little information available
- Focus herder-targeted activities on both the development of life skills and environmental management, and strengthen emergency fodder supply networks and access.
- Integrate appropriate knowledge of managing the environment (primarily water, air and land) to reduce vulnerability and human-induced environmental change.

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ANNEX A

NEAR-TERM CLIMATE PROJECTIONS MONGOLIA FOR 2020–2039¹

Basic climatology. For monthly average, minimum and maximum temperature, all models predict an increase of monthly temperature by 1.4–2°C by 2020–2039 with the high global emissions scenario (RCP8.5), resulting in slightly higher monthly changes. For monthly rain and snowfall (precipitation), there is only a very slight change projected (0.68–3mm) per month. However, the range of uncertainty is especially large in the summer months with some models predicting decreases and some projecting strong increases in summer precipitation.

Climatic extremes. The amount of rain falling during events with a return period of 25 years is expected to increase by 3.8–9.7mm – with lower global emission scenarios causing more extreme rainfall, especially in the eastern region. This means that the total amount of rain falling during the most extreme periods will be greater compared to the historical period, and this may translate into the increased risk of events linked to intense rainfall such as landslides, flash floods, erosion etc. In the short-term, no change in days with more than 50mm of rainfall is expected, although 4.5–5 per cent more rain will fall during ‘very wet days’ and the amount of rain falling during five-day rainfall events is expected to slightly increase, especially in the eastern region.

The rapid temperature rise in Mongolia will result in 9–11 more summer days ($T_{max} > 25^{\circ}\text{C}$) and a reduction in frost days ($T_{min} < 0^{\circ}\text{C}$) of 8–11 days, with changes particularly occurring in the spring (March–May) and autumn (September–November) – although this change is variable across the country. June, July and August will see 2.3–3.25 more days with temperatures exceeding 35°C (considered hot). On a country-scale the number of days exceeding 40°C are not changing notably in the next 20 years, although regionally this might be the case. The projected probability of a heatwave is expected to increase by 2 per cent by 2020–2039 and warm spell duration is projected to increase by 3.26–3.75 days. Cold wave probability and cold spell duration trends are very modest and difficult to discern.

Agricultural conditions. With persistent warming of the climate already occurring in the next twenty years, the growing season length increases by 5–9 days across the country, although there are regional differences. It should be noted that this indicator only considers temperature, while water availability considerations may also be

¹ All images in this Annex are sourced from the World Bank Climate Change Portal (WBCKP 2020), supplied under the Creative Commons 4.0 licence.

important. Trends in wet and dry spells are difficult to discern due to large uncertainty. Nonetheless, across Mongolia, the Mean Drought Index is changing with -0.32 SPEI, indicating a shift to drier conditions. There are marked differences across the country with especially the south and south-west experiencing strong drying. Severe Drought Probability is increasing by an average of 10 per cent across the country, and again this risk increases most in the south-west.

SUMMARY OF KEY POINTS:

1. Drought severity and likelihood are increasing across the country, especially in the south and south-west. Heatwaves and warm spells will increase in the near future, with implications for health, livelihoods and infrastructure.
2. Extreme rainfall will become more intense and more rain will fall during very wet days. More extreme rainfall events increase the risk of flash floods, landslides and the erosion of land resources if no action is taken.

ANNEX B

SUMMARY TABLE OF CLIMATE CHANGE IMPACTS ON LIVELIHOODS

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS	IMPACTS ON URBAN LIVELIHOODS	HEALTH	DRR
Changing seasonal rainfall patterns with an increase in winter rainfall/snow and a decrease in summer rainfall	Increase in drought conditions (more consecutive drought days)	Desertification and land erosion limits grazing grounds for livestock; forest-fire risk increases thereby affecting forest-based livelihoods	The impacts on agriculture cascade down to affect food security, food diversity and prices for urban dwellers.	Respiratory issues from dust-storms as a result of desertification Malnourishment and malnutrition may increase if livestock and agriculture are negatively affected	Early warning required for extreme snowfall, access issues may arise, dry conditions in summer require education on drought preparedness and hydration
	Increase in the intensity of Dzud in the drought-affected Gobi regions (severe drought in summer followed by harsh conditions next winter)	Rainfed agriculture affected during the growing season months (mostly summer) Food security and market access jeopardized during extreme snowfall or longer snowfall periods due to access and transport limitations in winter	More snowfall in winter may impact infrastructure in urban areas and lead to more coal-burning in Ulaanbaatar, with air quality implications.	Cold-related respiratory infections, Tuberculosis risk and Ischaemic Heart Disease increase if families have to stay indoors more and use more fuel for cooking	
	Increase in snowstorms and windstorms	Accessibility of rural markets, services and infrastructure jeopardized Damage to households' physical assets may affect resilience of the (near) poor	Damage to households' physical assets may affect resilience of the poor	Risk of injury and mortality from accidents or impediment to the access of healthcare may increase Other cold related issues	Access challenges may arise, more damage control and scope for improvement of wind-related early warning

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS	IMPACTS ON URBAN LIVELIHOODS	HEALTH	DRR
<p>Temperatures will continue to rise</p> <p>Change/increase in the summer temperature will be more significant.</p>	<p>Increases in consecutive hot days and warm spell duration (relatively more in central and north-western parts)</p>	<p>Productivity of outside workers affected</p> <p>Heat stress on people, livestock and crops</p> <p>Water access challenges may arise</p> <p>Pests and diseases in animals and crops/plants may increase</p>	<p>Productivity of outside workers affected</p> <p>Water access issues may arise</p>	<p>Risk of water- and food-borne diseases increases</p> <p>NCD risk increases with heat stress</p> <p>Heat impacts on elderly and pregnant women</p> <p>Vector-borne disease area and transmission intensity may change (particularly tick-borne diseases, Plague and other zoonotic diseases)</p>	<p>Education on heat-stress impacts required especially for elderly and young people, emergency assistance to avoid large livestock loss</p>
<p>Winter temperature change will be relatively small</p>	<p>Decrease of frozen and cold days</p>	<p>Forest impacts</p> <p>Potentially positive for agriculture although impacts on the water cycle may reduce overall water availability and groundwater recharge</p>	<p>Changes in timing and quantity of meltwaters may affect the water cycle and may reduce overall water availability and groundwater recharge</p>	<p>Potentially positive for cold-related illnesses, although winters will remain harsh</p>	<p>Earlier melting in spring poses a risk of flash flooding</p>

ANNEX C

RECENT CLIMATE CHANGE AND ENVIRONMENTAL ACTION DOCUMENTS

2009	Mongolia Assessment Report on Climate Change
2011	National Action Programme on Climate Change (NAPCC)
2011	Government policy on disaster protection
Amended in 2012	National Action Programme to Promote Quality and Environmental Management Systems (2002 original, amended in 2012)
2012	Law on Air Quality
2014	Green Development Policy
2015	Intended Nationally Determined Contribution (INDC) 2020 Agriculture Sector Policy
2016	Mongolia’s Sustainable Development Vision–2030, approved in 2016
2016	Law on Legal Status of the Mongolian Red Cross Society
2016	The Action Programme 2016–2020
2019	Voluntary Review Report of the Sustainable Development Goals Mongolia
Unknown	National Agriculture Development Policy
Unknown	National Plan of Action to Combat Desertification
Unknown	Mongolian Livestock Programme
UNFCCC COMMUNICATION	
2001	Initial National Communication
2010	Second National Communication
2017	Mongolia’s Initial Biennial Update Report (BUR)
2018	Third National Communication (2018)
2019	Mongolia’s Nationally Determined Contribution (NDC)
2020	Revised NDC in 2020

