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CLIMATE CHANGE IMPACTS ON HEALTH AND LIVELIHOODS: **NEPAL ASSESSMENT**

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CONTENTS

EXECUTIVE SUMMARY	4
1. CLIMATE PROFILE AND PROJECTIONS	6
1.1. CLIMATE	6
1.2. CLIMATE CHANGE TRENDS	7
1.3. CLIMATIC VARIABILITY AND EXTREME WEATHER	8
2. MOST AT-RISK POPULATIONS	10
2.1. LOWER INCOME-GROUPS AND ETHNIC MINORITIES	10
2.2. FARMERS	10
2.3. WOMEN	11
3. HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?	13
3.1. COUNTRY LIVELIHOODS PROFILE	14
3.2. AGRICULTURE AND LIVESTOCK	15
3.4. PHYSICAL ASSETS (HOUSES AND WORKPLACES)	17
4. HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?	19
4.1. MORTALITY AND NON-COMMUNICABLE DISEASES	19
4.2. VECTOR-BORNE DISEASES	20
4.3. WATER, SANITATION AND HYGIENE	20
4.4. MALNUTRITION	22
4.5. DISPLACEMENT AND MIGRATION	23
4.6. MENTAL HEALTH	24
4.7. CRITICAL INFRASTRUCTURE AND HEALTHCARE SYSTEMS	24
4.8. SEXUAL, REPRODUCTIVE, MATERNAL, NEWBORN AND CHILD HEALTH	25
5. LINKAGE BETWEEN CLIMATE IMPACTS ON HEALTH AND LIVELIHOODS	28
6. EXISTING CAPACITIES, STAKEHOLDERS AND PROGRAMMES	34
6.1. POLICY LANDSCAPE	34
6.2. CAPACITIES	37
7. RECOMMENDATIONS AND OPPORTUNITIES	38
REFERENCES	40
ANNEX A: NEAR-TERM CLIMATE PROJECTIONS FOR NEPAL (2020-2039)	46
ANNEX B: SUMMARY TABLE OF CLIMATE CHANGE IMPACTS ON LIVELIHOODS	48
ANNEX C: EXISTING POLICIES AND STRATEGIES	50

EXECUTIVE SUMMARY

The Federal Democratic Republic of Nepal is a landlocked and geographically varied country located in South Asia, situated between India and Tibet. Within a span of less than 200km the country features the high Himalayan Mountains in the north and the low-lying Gangetic Plains in the south. As such, it experiences a range of different climates and climatic extreme events, both of which are being influenced by climate change. The already dry winters will be drier, and the wet summer monsoon season will be wetter by a staggering threefold increase (likely). Temperatures have been increasing and will continue to increase (certain), especially in the dry months (December–May) and warming is most pronounced in the mountains where snow is increasingly falling as rain. This will continue to lead to changes in water runoff from the mountains and hills, with numerous impacts downstream, including on livelihoods. Strong glacial melt will trigger landslides, mudflows and flash floods with increased runoff initially, before there sets in a steady decline in the flow (Ramasamy and Regmi 2014). Nepal faces a range of extreme weather-related events like floods, droughts, landslides, avalanches, high and low temperature, and glacier lake outburst floods (GLOFs). Over 80 per cent of its population is exposed to at least one of these hazards (UNDRR 2019). The impacts these changes will have on livelihoods and health, without substantial global action and national adaptation, are significant.

Nepal ranks among the world's 30 poorest nations (World Population Review 2021) with one-third of its people experiencing multidimensional poverty (GON and UNDP 2020). Multidimensional poverty differs significantly based on ethnic background and gender, rural or urban areas, ecological region and province (GON and UNDP 2020). A Least Developed Country (LDC), Nepal falls in the medium Human Development category, ranking 147 out of 189 countries (GON and UNDP 2020). Essentially a rural economy, 70 per cent of the people are employed in largely subsistence agriculture, with tourism and wage remittances being the other economic drivers (MoFe *et al.* 2018; ADB 2019). Climate change has the potential to trigger a negative feedback loop between livelihoods and health. As agriculture and tourism are disrupted from changing rainfall patterns, river system disruptions, and more intense monsoon rains, families may have less income, impacting their ability to afford healthcare.

Impacts on health, in turn, reduce people's ability to work and earn a livelihood. The main climate-change health risks include direct mortality from natural hazards (especially landslides and floods); increased expansion of vector-borne disease into highland areas (as temperatures increase), which were previously devoid of these diseases; and increasing food and water insecurity, which affects water contamination, waterborne disease transmission and the risk of malnutrition. Women are likely to shoulder a high proportion of the burden as they are typically the caregivers of the family, responsible for subsistence farming and feeding the family; and, therefore, cannot migrate to find alternative employment. There are some links between how climate change will impact mental health as well as sexual and reproductive health, but there remain considerable gaps in the research and evidence.

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 PROFILE AND PROJECTIONS

1.1. CLIMATE

Nepal's climate varies greatly as within a span of less than 200km the country features the high Himalayan Mountains in the north and the low-lying Gangetic Plains in the south (USAID, 2017). As a consequence, Nepal encounters almost all types of climates, from subtropical to alpine (Karki *et al.* 2016). The rainfall pattern is dominated by the presence of the monsoon circulation and its interaction with the high mountains and low plains (Kansakar *et al.* 2004). The average annual rainfall is 1,311mm, of which most falls during the monsoon season (June–September) and specifically in July (330mm) and falls to below 50mm per month in November–April (USAID 2017). The highest temperatures are recorded in the southern Terai and Siwalik regions (25°C) while the lowest temperatures are observed in the northern high Himalayan regions (-1°C) (USAID 2017).

Figure 1. Map of Nepal

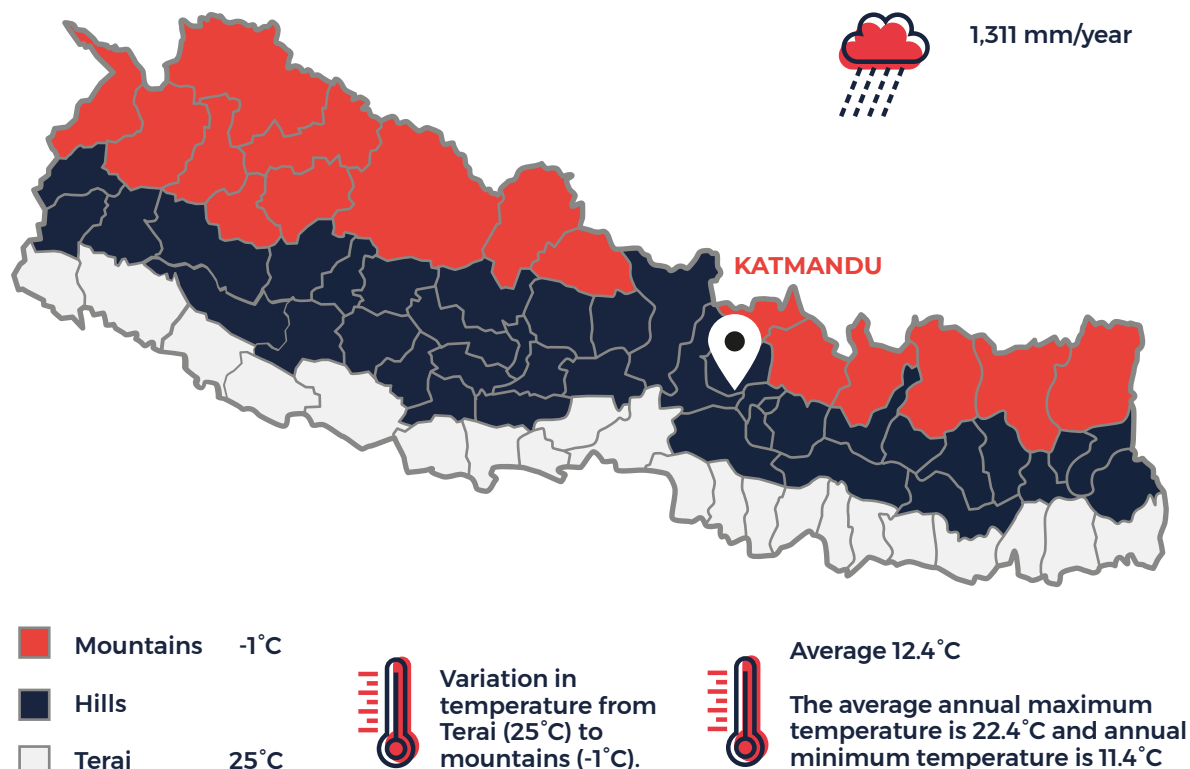


Table 1. Seasonal calendar (Karki *et.al.* 2017)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Winter (cold, snow in high altitude mountains)		Pre-monsoon (hot, dry, windy)			Monsoon (80 per cent of annual rainfall falls in this period)				Post-monsoon (dry)		Winter

1.2. CLIMATE CHANGE TRENDS

OBSERVED CHANGES	CLIMATE PROJECTIONS
TEMPERATURE <p>Temperatures have been increasing over the decades, and the number of 'cold' days and nights have decreased significantly (MoFe <i>et al.</i> 2018; World Bank 2020).</p>	TEMPERATURE <p>Temperatures will continue to increase under both high and low emissions scenarios and in the medium- (0.92–1.07°C) and long-term (1.72–1.82°C) (MoFE 2019). This increase in temperature will especially be felt during the dry months (December–May) (World Bank 2020). An increase in the number of 'hot' days will be felt in the medium-term (19–27 days by 2045) and in the long-term (26–43 days by 2065 (MoFE 2019). The High mountains will experience the greatest warming of all the regions, and the west is likely to warm more than the eastern regions (MoFE 2019).</p>
RAINFALL <p>Rainfall has decreased each month over the decades, and especially during the monsoon period (June–September) (World Bank 2020). Rainfall is increasingly falling as rain instead of snow in the high mountains, resulting in a loss of water (174 gigatons) in the Himalayan glaciers (USAID 2017).</p>	RAINFALL <p>Rainfall may be more erratic, though it is likely that it will increase in the future throughout the country; but, particularly in the central and western regions. Winters are projected to be drier (these are already the typically dry months), whilst summers (with the monsoon) will be wetter (MoFE 2019).</p>

OBSERVED CHANGES	CLIMATE PROJECTIONS
EXTREME EVENTS	EXTREME EVENTS
<p>Extreme rainfall events are increasing: there has been an upward trend in the number of days with extreme rainfall, particularly over western mid-hills and central high mountain regions. Central lowland regions have been receiving more daily extreme rainfall leading to increased incidences of flash floods (Karki <i>et al.</i> 2017). The increasing high intensity rainfall over the western mountainous region is indicative of a higher risk of soil erosion and landslides (Karki <i>et al.</i> 2017). The severity and frequency of drought is increasing, which are more significant for droughts of longer timescales (Dahal <i>et al.</i> 2016).</p>	<p>Summer monsoon rains may increase threefold, resulting in more frequent summer flooding (World Bank 2020). The number of wet and extremely wet days will not only increase the likelihood of flash flooding, but also other water-induced hazards like landslides and soil erosion (MoFE 2019).</p> <p>The rapid retreating of the Himalayan glaciers are projected to increase the risk of GLOFs (Dube 2014) with worsening landslides, soil erosion and flash floods downstream.</p>

1.3. CLIMATIC VARIABILITY AND EXTREME WEATHER

Rainfall is likely to be more erratic in Nepal. Already there is a high degree of variability in the amount of rainfall received across the country: the south-eastern regions receive more rain during the monsoon season, while the north-western high mountain regions receive more rainfall (or snow) in the winter season (Karki *et al.* 2017). Hilly regions typically receive more pre-monsoon rain as compared to the southern Terai plains. The high mountains are predicted to experience greater changes in rainfall patterns than other regions in future (MoFE 2019).

Winters are projected to be drier, while the monsoon summers are predicted to be wetter (World Bank 2020). This could result in more frequent summer floods and winter droughts (MoFE 2019). Pre-monsoon precipitation is decreasing in the central, western and eastern parts of the country and increasing in the rest of the country (NAPA 2010). Monsoonal floods are an annual feature in June–September in the floodplains of Terai (UNDRR 2019) but, due to the changing rainfall patterns, the flood season is changing and flash floods (caused by faster glacial melt and more extreme daily rainfall) are becoming more frequent (DHM 2015). Frequent extreme rainfall over the mid-hill regions is resulting in more instances of monsoon landslides; while, in some cases, damming and the subsequent breaching of these dams across certain rivers has resulted in rapid, short duration flooding (known locally as *bishyari*) in downstream rivers (Dixit 2003). Rapidly retreating Himalayan glaciers and the subsequent formation of a glacier dammed and flanked lake of melted water is also increasing the risk of GLOFs in the Himalayan region (Dube 2014). Bajracharya (2020) identifies 47 potentially dangerous glacial lakes in the Koshi, Gandaki and Karnali Basin.¹



The arrival timing of the monsoon is changing which impacts agriculture.” (KI 10)

SUMMARY: PAST CLIMATE TRENDS AND FUTURE CLIMATE PROJECTIONS

Temperatures have been increasing and will continue to increase, especially in the dry months (December–May), leading to more ‘hot’ days. The warming will be most pronounced in the mountains which have fragile alpine ecosystems, while glaciers are retreating rapidly. More precipitation is projected to fall as rain instead of snow, leading to changes in water runoff from the mountains and hills with numerous effects downstream. Glaciers are projected to recede faster, leading to downstream flash floods. The already dry winters will be drier, and the wet summer monsoon season will be three times wetter. Summer floods are likely to be more extreme in the Terai and the incidence of flash flooding will increase. Additionally, the mid-hills may experience more monsoon landslides due to extreme summer rainfall.

RECOMMENDATIONS

1. Raise awareness of the main climate change stressors and shocks, especially in remote mountainous areas where people may have less access to this information and be less aware of how exposed they are (share risk maps with these communities).
2. Work towards getting weather alerts, forecasts and climate projections to reach the ‘last mile’, so that people remain aware and prepared, with projects on flooding early warning and flooding mitigation in Terai and the mid-hills.

2. MOST AT-RISK POPULATIONS

2.1 LOWER INCOME-GROUPS AND ETHNIC MINORITIES

In a society comprising 125 different castes/ethnic groups (CBS 2012), it is necessary to be inclusive when assessing and addressing vulnerabilities on livelihoods and health parameters (Sujakhu *et al.* 2019; UNDRR 2019). *Dalits*, *Janajati* and landless labourers (the *sukumbasi*), who are typically economically marginalized, are particularly vulnerable to the impacts of climate change (Ramasamy and Regmi 2014). The *sukumbasi*, for example, often live next to forests and rely heavily on forest resources to meet their basic needs (Ramasamy and Regmi 2014). They face loss of livelihoods linked to deforestation caused by landslides, soil erosion or forest fires due to droughts. This increased vulnerability is driven by existing deficiencies in food availability, the ownership of smaller-sized land, the scarcity of water, a higher dependency on natural resources (especially rainfed agriculture) for livelihoods and a lower financial capacity to deal with the adverse impacts of climate change (Ramasamy and Regmi 2014; Sujakhu *et al.* 2019). These groups often live on marginalized land that is low-lying, adjacent to rivers or in urban slums also situated in exposed areas (Ramasamy and Regmi 2014).


“There is a lack of awareness about how vulnerable people are. Although people understand the anthropogenic causes of climate change, it is not understood well enough or how much it influences the extent of their vulnerability, which is really high.” (KI 12)

2.2 FARMERS

Over 80 per cent of the farmers rely on subsistence rainfed farming on less than 1 hectare of land and with only 2–3 livestock units (Ramasamy and Regmi 2014; Government of Nepal 2015). High levels of poverty mean they lack the ability to invest in improved farming techniques, access formal finance or diversify livelihoods, and are at high risk of food insecurity if livelihoods are lost and crops fail (Ramasamy and Regmi 2014; ADB 2019; UNDRR 2019). Because climate change will increase vectorial capacities and shift weather patterns, new pests are likely to emerge and threaten sensitive crops (Ramasamy and Regmi 2014). Farmers are vulnerable to erratic rainfall patterns as well as increases in peak temperatures, floods, droughts, and landslides. Farmers are not a homogeneous class and poorer farmers as well as those from disadvantaged social groups face additional barriers in accessing financial, technical or social support to help overcome climatic (and non-climatic) challenges (Gautam and Andersen 2016).

2.3 WOMEN

Women face a number of challenges due to the prevailing gender-based norms, and climate change impacts are expected to deepen the gender gap. Poor, rural, female-headed families will face higher vulnerabilities as the climate continues to change. The factors that put women at higher climate risk include: 1) structural discrimination in access to education and healthcare in what is still a highly patriarchal society, especially in rural areas (UNDRR 2019); 2) exclusion from employment opportunities, especially in rural areas, which means the majority of women workers are engaged in small-scale climate-sensitive agriculture or informal work with no safety nets (ADB 2019); and 3) women shoulder the whole household's care responsibilities and are becoming increasingly responsible for all farm-related activities too. This is due to the climate change-induced increase in the out-migration of men, especially from the mountainous regions. This is resulting in a higher number of female-headed households in mountain villages with women shouldering the triple burden of farm production, household chores and care duties, even as climate threats are deepening (NAPA 2010). Where men have migrated, women are highly dependent on subsistence farming and remittances and continue to face gender barriers – for instance, with regard to their limited access to alternative livelihoods – and so are unable to address their vulnerabilities to worsening local climate risks like flash floods or landslides or longer dry days (UNDRR 2019).


Women face more challenges due to the socio-cultural context because water, agriculture, livestock rearing and household responsibilities, in both rural and urban areas, are women's responsibilities. Due to climate change impacts, women have to walk longer distances to fetch water and, with children, are most at risk due to polluted waters. They are most at risk with regard to vector-borne diseases too." (KI 12)

SUMMARY: MOST AT-RISK POPULATIONS

The poor – and especially women – who depend on natural resources, including farmers and often ethnic minorities, will be at increased risk of the impacts of climate change. This increased vulnerability is driven by existing deficiencies in food availability, the ownership of smaller-sized land, the higher dependency on natural resources and, especially, rainfed agriculture for livelihoods, the lower level of technical capacities and the lower financial capacity to deal with the adverse impacts of climate change. The high mountains are some of the most fragile ecosystems in Nepal and are experiencing profound changes as a result of rising temperatures. These factors, coupled with the remoteness of communities here, places these groups at high risk.

RECOMMENDATIONS

1. The impacts of climate change are highly linked to geographic location, requiring local context-specific risk reduction strategies, early warning, and awareness raising plans.
2. Continue to look at the multiple vulnerabilities of people exposed to climate change impacts, e.g. low-income female-headed households in flood-prone regions of Terai.

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. According to the IPCC, 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 (Olsson *et al.* 2014). Some livelihoods, in particular, are more sensitive to a changing climate, such as – in the context of Nepal – **rainfed agriculture**. Nepal is also particularly at risk to **recurrent large-scale disasters** (floods and non-weather-related natural hazards such as earthquakes), which lead to substantial economic losses and impede infrastructure development and the diversification of livelihoods (CBS 2019b; UNDRR 2019)). In Nepal, in general the service sector has grown, whilst the manufacturing sector has declined over the decades, and high levels of remittances have been a strong driver of poverty reduction (World Bank 2018), all of which has implications for climate change adaptation strategies.

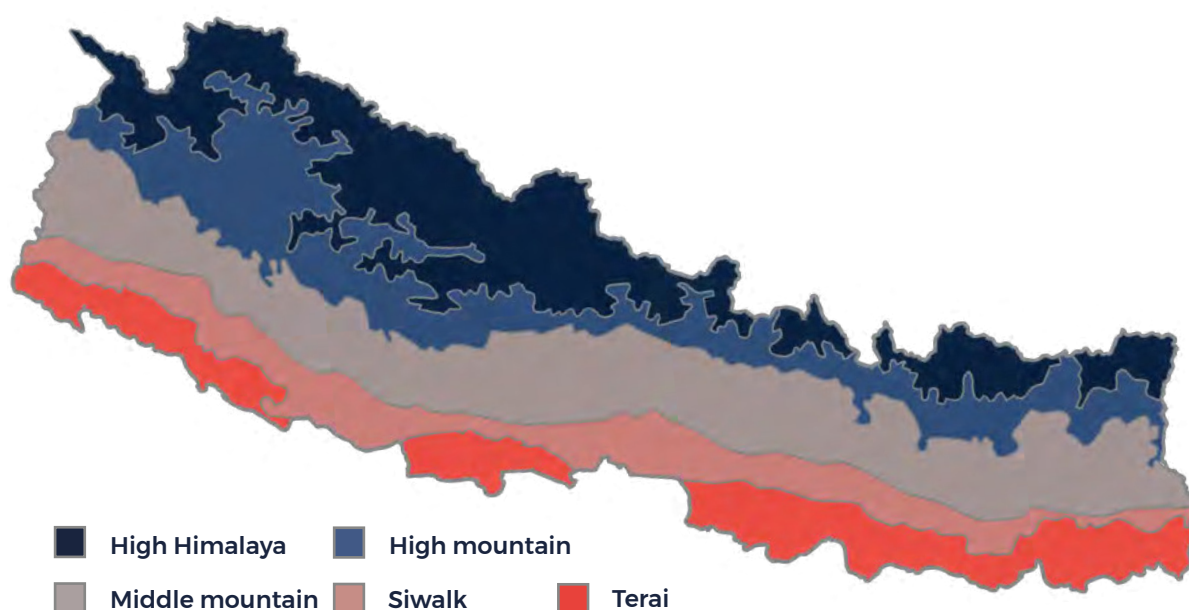
The following sections briefly outline: 1) the livelihood profile of Nepal; 2) how climate change is going to affect the major sectors of agriculture (including food security) and services; and 3) how assets may be affected.

“The Nepal Red Cross Society does not engage directly on livelihoods; but, by addressing public health issues, especially concerning disability, livelihoods are touched upon. There has been a lack of an integrated approach. In National Adaptation Plans, NAPA, livelihood issues are included, but in our focused health adaptation plans, which are made separately, a lot of activities have not been completed yet. Issues of livelihoods are not covered either, but hopefully they will be in the future.” (KI 12)

3.1. COUNTRY LIVELIHOODS PROFILE

Nepal has three distinct agro-ecological zones: the Terai and Siwalik (the floodplains), the mid-hills, and the mountain regions (high Himalaya and high mountains) (See Figure 1). Each has its own soil and climatic conditions as well as climate change projections, which determine the livelihoods of the people.

Figure 2. Agro ecological zones of Nepal



The Terai region is the northernmost part of the Indo-Gangetic floodplains. It has a hot, humid subtropical-to-tropical climate and rich alluvial soil which lends itself to diverse agricultural crops like cereals, legumes and oilseeds. As such, farmers engage in commercial agriculture, rear livestock such as cows, buffalo, poultry and goats, catch freshwater fish and cultivate homestead gardens (Ramasamy and Regmi 2014). People in the Terai region have better access to credit facilities and non-farm opportunities than people living at higher altitudes (Ramasamy and Regmi 2014).

The mid-hills, at 250–4000m above sea level, comprise steep valleys where farmers grow maize and vegetable crops like beans, ginger and soyabean on terraced hillsides. Forests also provide non-timber produce, which are collected by women and people from marginalized social groups (NAPA 2010). Male out-migration from the Terai (floodplains) and the mid-hills is high and is usually towards Gulf countries for better work opportunities (Ramasamy and Regmi 2014). Women are left behind to manage the agriculture, housework and childcare. Out-migration leads to a shortage in the availability of agricultural labour, which leads to lower food production and the higher exposure of women living off subsistence farming to climate change risks (Ramasamy and Regmi 2014).

The mountain region is characterized by several microclimates. Mountain areas are steep, rugged, cold and sparsely populated. Climate change is already resulting in drier winters and less snowfall, leading to the drying up of water sources prior to the monsoons (Ramasamy and Regmi 2014). Farmers grow crops like barley, buckwheat, potatoes and amaranthus and adopt inter-cropping as an adaptive practice to ensure some crops, at least, are able to withstand the long dry and cold spells of weather (FAO 2014). Farmers also rear animals like yak, *chauri* (a Himalayan cow breed), sheep, goats and poultry (Ramasamy and Regmi 2014). Medicinal herbs, small businesses and tourism are other forms of livelihoods available here (Ramasamy and Regmi 2014).

Agriculture is the main employment sector across all regions, with women being the majority (61 per cent) of the workers (CBS 2019a). Over one-quarter of Nepalese live in poverty and almost 80 per cent of all workers have insecure or 'vulnerable' employment (ADB 2019; GON and UNDP 2020). The COVID-19 pandemic has worsened people's financial circumstances as the country's economic activity slowed, jobs were lost and incomes reduced. Remittances contribute up to 26 per cent of the country's GDP (GON and UNDP 2020).

3.2. AGRICULTURE AND LIVESTOCK

Estimates reveal that up to 90 per cent of crop losses in Nepal are caused by weather and climatic events, with drought causing about 40 per cent of the losses and floods resulting in another 23 per cent of the damage (Ramasamy and Regmi 2014). Droughts and increased water evaporation due to higher temperatures are already a reality and are projected to worsen affecting: 1) streams, which are vital for irrigation; and b) the availability of water during the growing season. This will adversely affect agricultural productivity and contribute towards further crop losses (Joshi and Joshi 2019). Delayed monsoons, longer dry spells and increased wetter periods are already affecting crops planted in spring; whilst winter crops are experiencing less water availability during critical growth periods due to drier winters (Joshi and Joshi 2019). Increasing extreme rainfall and a rise in the number of wet and very wet days will lead to more frequent and worse flash floods and landslides. Erosion of the fertile topsoil on deforested hillsides and on riverbanks will also expose crops to damage and destruction from more frequent hailstorms and thunderstorms (Joshi and Joshi 2019).

The higher altitudes of the Himalayas, and the people who live there, are at higher risk from climate change due to a number of reasons. First, increasing temperatures on the snowy mountains are already increasing the frequency of GLOF, leading to landslides, soil erosion and flash floods downstream. Second, mountain people rely completely on rainfed agro-based livelihoods with little opportunities for non-farm employment or livelihood diversification (the latter only being possible in the Terai region). Third, people living in the mid-hills and mountains rely heavily on livestock rearing, more than in the Terai region, and livestock are sensitive to increases in temperatures, the lower production of fodder and worsening extreme weather

events like landslides, drought and increased rainfall intensity. These changes may lead to the reduced weight of animals, lower feed conversion, lower milk production and lower reproduction. Fourth, storage of animal products, like meat and milk, become a challenge as temperatures rise because of inadequate cold chains, while poor and small-scale farmers and agri-entrepreneurs have little access to those that exist (Ramasamy and Regmi 2014; Joshi and Joshi 2019).

Higher temperatures, an increase in wetter days and longer droughts will result in the emergence of new pests and diseases in crops and livestock (Ramasamy and Regmi 2014). Farmers have traditional knowledge about existing pests and diseases, but have no experience of emerging diseases (Ramasamy and Regmi 2014). There is currently inadequate agricultural knowledge or extension services to cope with this.

Food security

The adverse impacts of climate change on agriculture are going to increase food insecurity at the household level across all three agro-ecological zones of the country (WHO 2016; Joshi and Joshi 2019). Household food requirements are mostly met by subsistence production, but the main staple crops like rice, millet and maize, as well as livestock, are highly sensitive to temperature and rainfall fluctuations (Pant 2013; ADB 2019). Women, in particular, shoulder a higher responsibility to secure food for the household (and provide care to children and the elderly) and comprise a larger proportion of agricultural labour. As such, women, children and the elderly will predominantly be impacted by future food insecurity (Joshi and Joshi 2019).

3.3. NON-FARMING LIVELIHOODS

Tourism, including 'eco-tourism,' is one of the main non-farm livelihoods to be affected by climate change. An increase in GLOF, mudflows, water scarcity, landslides, higher temperatures and an increase in intense rainfall days is going to impact the tourism industry which gives seasonal employment to 20 per cent of the population and generates additional incomes for villagers (UNDP Nepal 2018).

The services sector contribution to the value-added economy stands at 57.8 per cent, but the expanding sector is also characterized by low productivity and informal, poor quality employment (GON and UNDP 2020). Multiple extreme events and ecological and climate vulnerabilities makes this sector highly fragile (GON and UNDP 2020). Manufacturing is focused mainly on household goods like furniture, textiles and clothing, footwear and other durables (CBS 2019a). Making local tools and handicrafts is part of a diversified livelihood strategy, especially among poorer farming households, but these have low returns (Gautam and Andersen 2016). Construction workers, street vendors and those living in informal settlements and densely populated areas are highly exposed to heatwaves and flash floods. Following

COVID-19, tens of thousands of Nepalese have returned home, and 5–7 million people back from India alone have settled in urban areas as landless squatters without jobs (GON and UNDP 2020). These people are now extremely vulnerable to increasing flash floods and GLOF, more frequent heatwaves, extreme rainfall events and longer droughts (CBS 2016).

3.4 PHYSICAL ASSETS (HOUSES AND WORKPLACES)

Homes, workplaces and cultivated lands that are already exposed to landslides or lie close to flood-prone areas are at increasing risk as the frequency and intensity of weather-related events rises with climate change. Many of the major cities and towns, and especially the informal settlements within them, are located on steep slopes and next to riverbanks, leading to the higher exposure of people's physical assets and workplaces (MoFe *et al.* 2018). Tourism infrastructure comprising hotels, roads and well-used trekking pathways, basic amenities and cultural heritage attractions are also threatened by climate change, and this will have adverse impacts on associated livelihoods (MoFe *et al.* 2018). The months of July and August witness most deaths and damage to land and property due to landslides and floods (MoHA 2012). These impacts are projected to worsen following the higher frequency of extreme rainfall events and GLOF.



SUMMARY: HOW WILL LIVELIHOODS BE AFFECTED BY CLIMATE CHANGE?

Increasing temperatures, droughts and heavier monsoon rains will significantly impact agricultural productivity, resulting in the loss and damage of crops (especially in the Terai and mid-hills) and affect livestock and their products (especially in the high mountains). Increased distress migration from rural areas will impact the availability of farm labour in rural areas and put pressure on urban areas for jobs and decent remuneration. Agri-business and trade will also be affected by lower crop, livestock and forest production. Non-farm work in tourism will be acutely affected as landslides and changing weather patterns affect traditional tourist routes. Internal migrants and returnee migrants during times of emergency will put more pressure on natural resources, especially in urban and ecologically fragile areas. Key challenges to adaptive livelihoods also lie in the limited opportunities to diversify livelihoods as well as a lack of institutional and human capacity to adapt to extreme weather events in the long run.

RECOMMENDATIONS

1. Help communities to understand how the seasons are projected to change and how the agricultural calendar could be shifted to match the changing seasonal patterns; improve forecasting to know whether to harvest early.
2. Explore traditional practices in crop rotating and older variety of seeds, which were more resilient to climatic changes to help safeguard food security of predominantly subsistence farming.
3. Protect crops from flooding using natural barriers wherever possible, or sandbags and other strategies.
4. Engage with communities, the national meteorological service and decision-makers on impact-based forecasts and forecast-based financing/early action in areas where recurrent disasters are expected.
5. Promote the use of climate-smart practices, for example: conservation agriculture (mulching, residue retention); improved home gardening; improved cattle sheds for shelter and protection; use of plastic for ponds and greenhouses/tunnels; drip irrigation; mixed farming (legume integration); introducing a system of rice intensification; water-harvesting ponds; encouraging the multiple use and protection of water sources; plantation agriculture; and agroforestry.

4. HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

4.1. MORTALITY AND NON-COMMUNICABLE DISEASES

Mortality and injury. Nepal is the 20th most disaster-prone country in the world, and is highly vulnerable to climate change ranking 44th globally (ND Index n.d.). Multiple geophysical and hydro-meteorological extreme events (landslides, cold waves, heatwaves, wildfires, floods) occur every year. Estimates are that Nepal experiences around 500 disaster events annually, which have been increasing as the changing climate affects natural hazard frequency and intensity (Bhandari 2015; Shrestha 2019). Climate change is anticipated to exacerbate inland flooding, putting an estimated 200,000 additional people at risk of river floods each year (WHO 2016). Data from 1971–2007 show that floods tend to affect a large number of people (over 4.6 million), but cause fewer deaths (per event), yet cumulatively cause a significant number of lost lives (3,902 people in 1971–2007). Conversely, per event, landslides tend to kill or injure more people (as high as 5,000 per event) but affect less of the population (though still a high number) at 607,091 in that time period (Shrestha 2019).

Heat. As temperatures are projected to increase across the country, heat-related morbidity and mortality will become of increasing concern in Nepal. Under a high emissions scenario, heat-related deaths are expected to increase from a baseline of four deaths per 100,000 people annually to 53 deaths per 100,000 people annually by 2080 in Nepal (WHO 2016).

Non-communicable diseases. Mortality from non-communicable diseases may also increase from outdoor and indoor air pollution which are caused by activities that are contributing to greenhouse gas emissions (e.g. burning of fossil fuels) and, consequently, climate change. Fine particulate matter (PM_{2.5}) contributes both to global warming and the risk of non-communicable diseases (including excess respiratory disorders, allergy, asthma, ischaemic heart disease, stroke, lung cancer and chronic obstructive pulmonary disease), making exposure to particulate matter particularly concerning in the context of climate change. Over 42 per cent of all deaths from ischaemic heart disease, stroke, lung cancer, chronic obstructive pulmonary disease, and acute lower respiratory infections are attributable to household air pollution in Nepal (WHO 2016). Women and children are particularly vulnerable to these non-communicable diseases, as they are primarily responsible for cooking. Rural populations, where 91 per cent of the population uses solid fuel for cooking, are also especially vulnerable to these health outcomes from indoor air pollution (WHO 2016). Urban populations (especially in the Kathmandu Valley which traps air between the mountain ranges) face higher exposure to fine particulate matter pollution from automobile exhausts (Adhikari 2012). Without action to

improve air pollution and reduce the emission of these harmful pollutants, mortality and morbidity will increase in a feedback loop with a worsening climate scenario.

4.2. VECTOR-BORNE DISEASES

Climate change is likely to result in a shift in vector-borne diseases in the highlands of Nepal (Dhimal *et al.* 2015). Currently, vector-borne diseases such as Chikungunya, Dengue Fever, Japanese Encephalitis, Malaria, and Visceral Leishmaniasis are endemic to the lowland Terai and hills of Nepal (NMICS 2019). However, as climate change is shifting and expanding the vectors of these diseases into highland areas, the population at risk is expected to rise (NMICS, 2019).

Malaria. Climate projections indicate an increase in temperature and precipitation in Nepal, which would substantially expand the spatial distribution and risk of Malaria within the country (Bhandari 2015; Dhimal *et al.* 2015). Malaria is particularly sensitive to temperature variations – a 1°C increase in mean temperature is projected to increase Malaria incidence by approximately 26 per cent (Dhimal *et al.* 2015). This is particularly concerning as temperatures are projected to increase between 1–1.82°C across the medium- to long-term in Nepal.

Dengue Fever has been endemic in Nepal since 2004, with yearly outbreaks across the country (Pandey and Costello 2019). Climate change is likely to increase the spatial distribution and severity of these outbreaks, as was made clear in 2019 when Nepal saw unexpected early rains with a shifting monsoon season. Over 10,000 cases of Dengue Fever were reported that year, a dramatic increase from 3,425 cases the year before (Pandey and Costello 2019). This case study represents an important example that is likely to worsen as climate change alters the temperature and rainfall in Nepal, towards conditions which are more favourable for the mosquitos that transmit Dengue Fever.

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 is also related to vector-borne diseases (Section 4.2).

Water supply

Changing weather patterns (increased and more extreme rainfall in the rainy season and droughts in the winter season) will impact water supplies by: 1) damaging water supply infrastructure; 2) contaminating water sources; and 3) reducing water sources leading to water shortages (MoE 2010; NPC 2011; Bhandari 2015; MoFe *et al.* 2018).

Despite gains in the recent decades, 75 per cent of improved water supply systems are poorly functioning and 32 per cent do not provide year-round supply (Budhathoki 2019). The increased frequency of extreme weather events may damage a relatively fragile water supply infrastructure (MoFe *et al.* 2018). The increased flooding, as a result of heavy rainfall events, is likely to contribute towards an increased risk of terrestrial water supply contamination throughout the country (Bhandari 2015). This contamination, often by faecal matter, may lead to an increase in the incidence of waterborne diseases like Amoebiasis, Cryptosporidiosis, Diarrhoea, Dysentery, Gastritis, Giardiasis Infectious Hepatitis and Typhoid (Bhandari 2015). one-quarter of the total population (largely the poor, living in remote areas) still do not have access to improved drinking water supplies and rely on streams, ponds and unprotected wells (Budhathoki 2019). Droughts and increasing temperatures are already causing these water sources to dry up, concentrating the pathogens that exist or are introduced into these water bodies (NAPA 2010). These factors will affect the overall water supply of the country, but are likely to affect the poorest first who are reliant on unimproved water sources.



75%

of improved water sources are **POORLY** functioning
(Budhathoki 2019)

Sanitation

Floods and heavy rainfall aggravate environmental contamination – especially of water sources – from improper sanitation. Already, access to sanitation among the poor is extremely low (2.8 per cent) (The World Bank and Ministry of Economy 2015); and, of the households that do have toilets, only about 40 per cent are considered safe (i.e. hygienically separate human waste from human contact) (UNICEF 2019). Both limited access to clean drinking water and a lack of proper handling of waste leave many people exposed to a contaminated environment with negative health impacts.



97%

of the population had access to basic sanitation (Budhathoki 2019)

“A lot of issues are connected to waterborne diseases as water is tied to people’s hygiene and sanitation.” KI2

Waterborne diseases. Diarrhoeal diseases (including Cholera, Gastroenteritis and Typhoid) are endemic in Nepal, and one of the top five infectious diseases recorded in hospital admissions (Bhandari 2015). They have been increasing in incidence (though mortality has been decreasing) with increasing temperatures and increased rainfall, especially during the rainy summer season (Karki *et al.* 2010; Bhandari 2015; NMICS 2019). The effect of climate change on the incidence of diarrhoeal diseases is more pronounced in the mountain and hill regions, which are warming faster than the Terai region (NHRC 2016). Children under the age of five are particularly vulnerable to diarrhoeal diseases during the rainy months of June and July, and especially in the mid-western and far western regions (Bhandari 2015).

4.4. MALNUTRITION

In 2020, 10 per cent of the population were food insecure (WFP 2020). Changing climatic conditions and extreme weather patterns may increase crop failures or crop damage, which may increase food shortages for subsistence production and disrupt food supply systems. Negative coping strategies tend to disproportionately affect women. Women will often consume less during food shortages as compared to the rest of the family, which can have significant consequences such as undernourishment in pregnant and lactating women (MoE 2010).

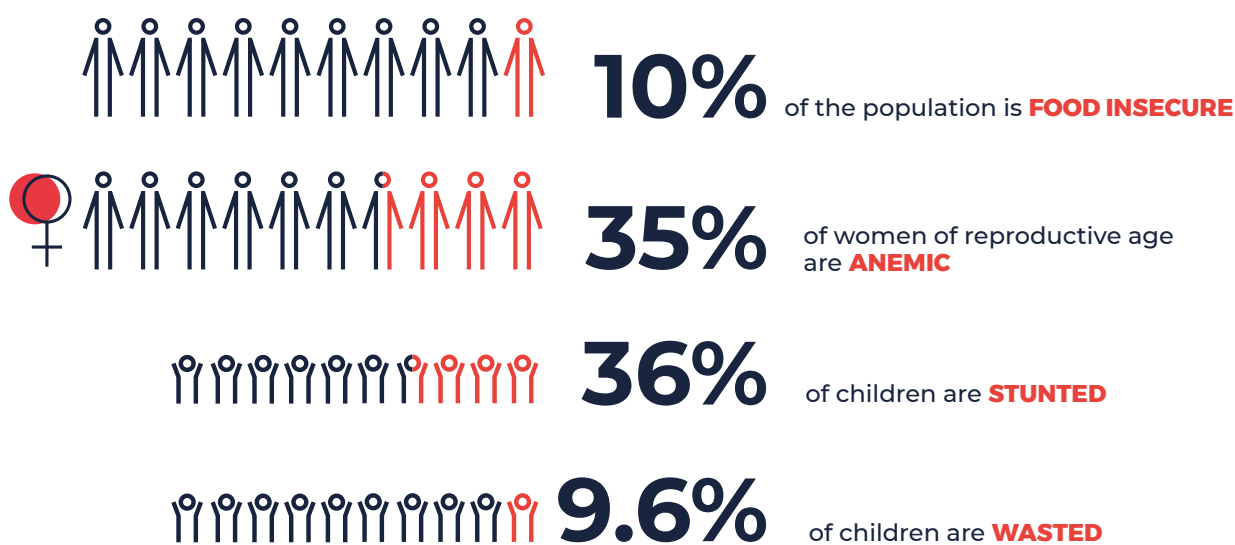
Targeted nutrition programmes have successfully resulted in a decline in malnutrition over the decades, but the prevalence of malnutrition in children under the age of five remains high (higher than the average – 21.8 per cent – for South Asia). Stunting among children under five years of age is associated with larger family size, being from the Dalit caste/ethnic group, being part of a household from the poorest wealth quintile, residing in rural and mountain regions, coming from a severely food insecure household, and having a mother with a low level of education (Adhikari *et al.* 2019). However, the prevalence of undernutrition could easily increase again if food systems are destabilized.

The negative effects of climate change are likely to disproportionately affect those already living in or close to poverty who – because of disruptions to livelihoods – are unable to afford to buy sufficient food, which may be in both rural and urban contexts. For example, the hills and mountains have a higher food energy deficiency than the Terai. In general, both can be affected if agricultural cycles are perturbed as a result of changing seasonal patterns (Bhandari 2015; KI2). Interestingly, urban areas report on average higher food energy deficiency than rural areas (43 per cent and 37 per cent respectively) (Bhandari 2015). This is because urban households are dependent

on markets to access food, and low incomes force them to buy low-quality, cheaper food, while women even skip meals when incomes fail (Boonyabancha *et al.* 2019).

“In the Terai, during monsoon, there are more issues causing changes and problems in agricultural cycles, which in turn has caused problems in nutrition.” K12

Figure 4: Source: Global Nutrition Report 2020



Source: Global Nutrition Report 2020

4.5. DISPLACEMENT AND MIGRATION

Internal migration is complex. Already, seasonal migration is common in Nepal, particularly among farmers who farm in the summer and migrate to work in unskilled, low-paid jobs in cities during the winter months (Gautam 2017). As climate change progresses and agricultural livelihoods become less reliable, this migration pattern is likely to increase and extend into multiple seasons (Gautam 2017). As many as 75 per cent of men aged 19–44 currently migrate from areas (such as the hills and high mountains) prone to natural hazard-related disasters – far above the national average (FAO 2017). This migration often leaves women and children to care for agricultural lands and homes, deepening the pressures on women and the families left behind (FAO 2017). It also has implications for the urbanization of health outcomes, such as malnutrition, infectious disease transmission and water sanitation issues, as rural to urban migration increases.

4.6. MENTAL HEALTH

Mental health issues are likely to increase in Nepal due to climate change. Challenges to livelihoods and the destruction of assets are the primary drivers of this. These outcomes are closely related to social violence, anxiety and depression in women, who are often left behind (MoE 2010). For example, climate change is already destroying croplands, causing farmers to seek seasonal work and migration to escape food insecurity. This leaves their wives victimized in the community, leading to stress and mental illness in these women (WOREC and ARROW 2015).

4.7. CRITICAL INFRASTRUCTURE AND HEALTHCARE SYSTEMS

Nepal has a total of 4,863 public healthcare facilities across the country. The majority of these are health posts (78 per cent) that provide basic healthcare services to people living in rural areas. Often, these health posts are in remote locations and lack electricity and running water; they may consist of only one or two rooms. In addition, they are unlikely to be able to keep medication refrigerated, and may administer medication that is beyond its use by date. There are urban health centres (8 per cent), community health units (6 per cent), primary healthcare centres (4 per cent) and hospitals (2.5 per cent). In addition, there are 2,071 non-public health facilities in the country (Department of Health Services 2020). Nepal has a road map towards achieving Universal Health Coverage, but it has not yet been enacted (UHC 2020). Healthcare facilities and other critical infrastructure may be damaged due to shifting weather patterns which may bring an increase in extreme weather events. Flooding, drought and other climatic hazards have the potential to damage critical healthcare facilities, further damaging the resilience of the nation. Much of Nepal (91 per cent) is reliant on hydropower for electricity (Agrawala *et al.* 2003). Hydropower may become unreliable as climate change results in variations in climate, shifting seasons and irregularities in rainfall. This has implications for the healthcare centres' and hospitals' ability to keep key medication refrigerated, maintain adequate lighting, and power other critical healthcare equipment.

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 climate change 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 globally (Women Deliver 2021) and in Nepal.

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

- **Accessing sexual and reproductive health services:** Extreme weather or climate-related disasters (such as landslides, floods etc.) may cut people off from accessing services (such as antenatal care) and supplies (Women Deliver 2021). Vulnerability during displacement and a lack of access to health facilities during the floods, has led to sleeping and sexual activity in unhygienic places leading to abdominal pain, sexual violence, unwanted pregnancy and stress (WOREC and ARROW 2015).
- **Menstrual hygiene:** Negative cultural practices such as chhaupadi (seclusion of women during menstruation) continues in some regions (e.g., far and mid-western regions), despite having been outlawed by the Supreme Court in 2005 (Morrison *et al.* 2016). Most girls and women manage their menstruation with reusable cloths, which require washing (Morrison *et al.* 2016). Climatic changes which affect local water supply may make the menstrual hygiene management more difficult, and increase the use of negative cultural practices (including missing days from school) (*ibid.*).
- **Sexual health:** Women's workloads are already high, including taking care of elderly or sick family members, childcare, subsistence farming and labour working, and tend to increase during extreme climate events (MoE 2010; WOREC and ARROW 2015; ARROW 2017). In one study, over one-in-three of the women interviewed reported suffering from uterine prolapse because of the increased walking distance of 1.5–2 hours to fetch water and collect firewood due to climatic changes (MoE 2010; WOREC and ARROW 2015). The additional time spent walking to collect water and firewood also exposes women and girls to the increased risk of sexual violence and harassment.
- **Reproductive health:** Climate change will impact crop growth, and reduced food intake is particularly concerning for pregnant women and their unborn children. Already, studies show that a lack of nutritious food has led to anaemia (in 41 per cent of women of reproductive age), pregnancy issues, increased intrauterine growth retardation, low birth weight and perinatal mortality (WOREC and ARROW 2015). Additionally, young girls drop out of school during climatic disasters, robbing them of the opportunity to study about sexual and reproductive health rights, in a country where adolescent sexual education is limited, despite a high teenage birth rate at 88 per 1000 women (WOREC and ARROW 2015; Bajracharya *et al.* 2020).

- Maternal health:** The risk of pregnant women experiencing dehydration, micronutrient deficiencies and infections (e.g., with Malaria) is expected to be increased by climate change, increasing the chance of complications (e.g. preterm birth, eclampsia, low-weight births amongst others) (Women Deliver 2021). Whilst 58 per cent of the population has access to skilled birth attendants, this still leaves 42 per cent of women without skilled attendance (WHO 2020). Maternal mortality is at 239 per 100,000 births and pregnancy-related mortality is at 259 per 100,000 births, suggesting a need to prioritize pregnant women's health as the climate crisis deepens (Ministry of Health, New Era and ICF 2017). Typically, these women are in remote locations and as predictions indicate more extreme weather, it is likely to become even more challenging to access healthcare either via women descending from the high mountains, or by mobile clinics not being able to travel to reach more remote areas.
- Newborn and child health:** The level of malnutrition amongst children is high (stunting and anaemia is found in half of children under five years of age) and may be exacerbated as climate-related food insecurity increases, with lifelong consequences on the children affected (Ministry of Health, New Era and ICF 2017).



SUMMARY: HOW WILL HEALTH BE AFFECTED BY CLIMATE CHANGE?

The main climate-change health risks include direct mortality from natural hazards (especially landslides and floods) and the expansion of vector-borne diseases into highland areas (as temperatures increase) that were previously devoid of these diseases. Other impacts include increasing food insecurity, malnutrition and water contamination along with the associated water-borne diseases. Women are likely to shoulder a high proportion of the burden as they are carers and cannot migrate – they are responsible for feeding the family primarily through subsistence farming. There are some links between how climate change will impact mental health and sexual, reproductive, maternal, newborn and child health (SRMNCH), such as women having to travel further to collect water and the weight of carrying it back home causing uterine prolapse. However, the full range of impacts on women and young girls in a highly patriarchal society are not well understood.

RECOMMENDATIONS

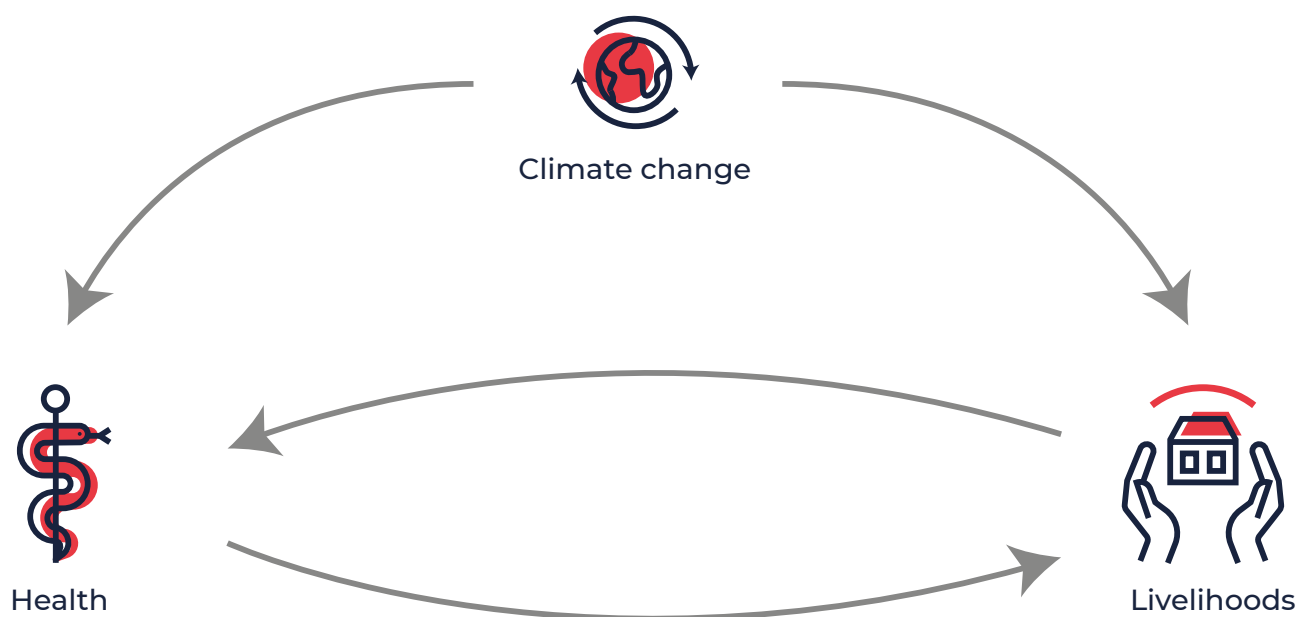
1. Conduct further research and programming on how climate change will affect the health of women and women-headed households.
2. Improve surveillance systems for vector-borne diseases at higher altitudes.
3. Facilitate WASH awareness-raising, including how to clean hands using very little water (as water needs to be saved).
4. Work with women or community groups to grow gardens of fruit for the community to effectively combat micronutrient deficiencies in children under five years of age, elderly people and pregnant and lactating women; also ensure there is awareness-raising on nutrition practices and diversified diets.

5. LINKAGE BETWEEN CLIMATE IMPACTS ON HEALTH AND LIVELIHOODS

“Livelihoods are directly connected to health impacts, as without timely check-ups health will be obstructed and therefore opportunities to work will also be obstructed.” (KI 10)

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 spiraling of acute or chronic conditions. Likewise, when climate change negatively affects health, people may be unable to work and thereby earn sufficient money to pay for the healthcare they need, further reducing their ability to get better. A popular idiom in South Asia says: *jaan hai to jahan hai* – “the world exists when life exists” where ‘life’ denotes a healthy, well-provisioned existence.

“Livelihoods are affected by floods and landslides, and because health services are expensive the timely attention to healthcare is lacking.” (KI 7)



“Due to flooding, waterborne diseases and vector-borne diseases are on the rise, causing health issues. People then take loans to pay for the hospital bills, which continues to put them in a poverty cycle, and loss of livelihood opportunities.” (KI 11)

Climate change is likely to exacerbate many rapid onset disasters which can significantly harm health (by causing injury or death from landslides), damage and destroy assets (especially crops) and property, which erodes the ability to remain in good health over the long run and to earn a good living, which in turn has adverse health outcomes.

Monsoons are expected to be three times wetter, which will mean more extreme rainfall and a higher likelihood of flash floods. This can lead to the contamination of water bodies and an increased burden of waterborne diseases. These, in turn, can interact with the body's ability to absorb nutrients, worsening the nutritional status of children and adults, and potentially leading to more days where people cannot work, or when they need to take time off work to care for others. Additionally, an increased burden of waterborne diseases will require higher incomes for treatment and healthcare. The risk of Cholera is particularly concerning, with increasing flood and water-logging events requiring households to increase their expenditure on clean water and healthcare.

The shifting of seasons (likely), in particular the onset and end of the monsoon season – which are projected to be delayed – will affect crop cycles, especially in the Terai and the mid-hills. Crop losses will lower family incomes, food security and health outcomes. The dangerous feedback loop between malnutrition at a young age and the lifelong consequences this has on health and the ability to work are well documented. Women already face a higher burden of micronutrient deficiencies and undernutrition and will be more vulnerable to health challenges and the consequent inability to shoulder their workload.

Extreme weather conditions will also damage the healthcare infrastructure (such as the community health posts in remote locations), leading to a further loss of work days for people. This is because they may either have to walk greater distances to access staffed healthcare facilities that have the medicine and equipment they require, or they will not be able to access the services for considerable periods of time. In a mountainous country, the proximity of healthcare facilities is critical for people's well-being.

The higher frequency and intensity of extreme weather events will lead to increased rural-urban migration and deepen the challenges for urban migrants. Living in informal, overcrowded, unsanitary conditions will undermine their health and affect their employment, which is already fragile. In turn, rural areas will be further drained of labour, impacting again the rural economy. This will also deepen the health crisis in rural areas.

The increase in the number of ‘hot’ days (certain) will affect people’s ability to work, especially during the day. The greatest warming will be felt in the fragile mountain ecosystems, leading to food and water insecurity, lower incomes and higher health challenges. It will also fuel out-migration. The warming will expand the range of vector-borne diseases to higher altitudes where people may not have experienced diseases like Malaria or Dengue Fever before. This will further impinge on their availability for work and lower incomes, especially for agricultural daily wagers, many of whom are women.

Nepal experiences droughts, which have significant consequences. For example, the loss of crops during the 2006–2009 droughts resulted in huge food deficits which increased food prices at 117–300% in various places (UNDRR 2019). This led to higher food insecurity and adverse health outcomes. The effects are felt more by the already disadvantaged social groups as they have more insecure livelihoods and limited resources (UNDRR 2019). It also leads to higher distress migration among men and more female-headed households in rural areas where they have hardly any access to productive assets to earn a good living. Water scarcity is already leading women to travel further to collect water and this has already been linked with SRMNCH challenges such as uterine collapse.

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

Rising temperatures will result in heat stress and the higher incidence of vector-borne diseases, while exacerbating existing heart and lung conditions thereby hampering the productivity of people. More frequent floods will also lead to increases in waterborne diseases, increase healthcare bills and lower workers' output. The effects of a changing climate on food and water security will, in turn, have health impacts, especially worsening the already low nutritional status of women. Pregnant and lactating women will become more vulnerable and this will further hamper their ability to work; it also poses risks to their children during pregnancy, delivery and their early years of life.

RECOMMENDATIONS

- 1.** The linkages between climate, health and livelihoods need to be highlighted and factored into risk reduction programmes as well as health and WASH programmes.
- 2.** Health interventions need medium- to long-term inputs by factoring in food and water security dimensions.
- 3.** Gender-based health outreach and capacity-building programmes in rural and urban poor families need to build knowledge and awareness of the importance of women's health and productivity during heightened climate risks.



CITY ASSESSMENT: BIRGUNJ

In Birgunj – which lies in Parsa district, Province 2 – heatwaves leading to dehydration, weakness, skin allergies as well as breathing problems along with cold-waves leading to deaths, are the main climate–health impacts. Vector-borne diseases like Dengue Fever, Encephalitis and Malaria are also on the rise in Birgunj (KI1). Previously unforeseen erratic weather occurrences, like the massive rainstorm and hurricane of 2019, have killed more than 20 people in Birgunj, further obstructing livelihoods, weakening healthcare infrastructures and raising concerns among local residents about future climate–health hazards (UNICEF 2019, n.d.).

The impact of heatwaves is first and foremost felt by people in lower income groups, including city-to-city migrant workers and lower caste groups like the Dalits, Chamar and Janajati, as most of their livelihood opportunities are outside in the field, working in others' farms, or on the road as street vendors (KI1). The heatwaves and cold waves have affected women's reproductive health leading to birth defects – during heatwaves, for example, pregnant women find it difficult to breathe, which can lead to complications (KI1). The urban poor, who consist of the community responsible for picking up waste and animal carcasses – known locally as the *dome* – live in isolation on the outskirts of the city and work in unsanitary and dirty conditions, exacerbating their climate–health vulnerability.

Birgunj is the industrial capital of Nepal, hence, the majority of livelihood opportunities for low- to medium-income households is to work on the factory floor or as technical assistance staff. For educated and higher income profiles, job opportunities to work as engineers or set up a small business are common. The lower-income communities have poor access to healthcare facilities and nutritious food, which not only impacts their productivity but also makes them more prone to sickness and a shortened lifespan (KI1).

Each ward in Birgunj has a health post whose technical staff collect data, but most of the health data is collected by Female Community Health Volunteers (FCHV) (KI1). Birgunj Metropolitan City collaborates with state and provincial government bodies along with non-state agencies. However, there are no specific climate–health initiatives in Birgunj (KI1). Previous initiatives to address climate–health impacts have included planting trees in partnership with the National Planning Commission. This has introduced a rule that, upon approval of the construction of a new house, two trees distributed by the local government must be planted. Currently, Birgunj Metropolitan City's Fiscal Year 2077–2078 includes the use of Temephos (larvicide) and Melathoin (adulticide) to control mosquitoes (Birgunj Metropolitan City, 2020). Local government also distributes firewood during winters to help during cold waves.

6. EXISTING CAPACITIES, STAKEHOLDERS AND PROGRAMMES

6.1. POLICY LANDSCAPE

There are several relevant climate policies and action plans as outlined in Annex C. A brief summary is provided in Table 2, below.

Table 2: Brief overview of the main climate policy documents

POLICY	DESCRIPTION OF CLIMATE-LIVELIHOODS-HEALTH FOCUS
National Health Policy 2019	Provides for the access to quality healthcare based on social justice to all citizens in all levels of government (MOHP 2019). The policy is guided by principles of free basic healthcare services with equal access to all as well as reform in healthcare systems with multi-sectoral partnerships and collaborations to maintain good health governance (MOHP 2019). The Government plans to develop preventive and curative diagnostic services throughout the country; enhance Government investment in the health sector; train healthcare professionals; create public-health disaster preparedness plans; and promote a nutritional diet as well as specialized healthcare services to increase the life expectancy of citizens and reduce infant and maternal mortality (MOHP 2019). The policy recognizes that the increase of communicable and noncommunicable diseases will impact the health and productivity of Nepalese citizens.
The National Health Sector Strategy 2015–2020, alongside the National Health Sector Strategy Implementation Plan 2016–2021	Both guide the health sector to carry out the ethos described in the National Health Policy as well as in the Constitution of Nepal by holding the new decentralized governance system in Nepal to account (MOHP, 2015).
Health–National Adaptation Plan (H–NAP)	Created with the assistance of WHO Nepal, the plan’s objectives are to develop a climate-resilient health system and strategies to protect human health from climate change in Nepal (Ministry of Health 2015).

POLICY	DESCRIPTION OF CLIMATE-LIVELIHOODS-HEALTH FOCUS
Climate Change Policy 2019	<p>Aims to uplift the socioeconomic prosperity of Nepal by building a climate-resilient society. To do this, this intersectoral policy aims to enhance the adaptive capacity of the most vulnerable people and communities, build resilient ecosystems, adopt low carbon development, research effective technologies and IT delivery services related to climate change, and mainstream gender equity and social inclusion as well as climate change issues into mitigation and adaptation programmes, national policies and strategies. A key priority mentioned in the policy is a reduction in climate-induced disasters and the impacts on human health by focusing on preparedness, forecasting, prevention measures and early-warning systems for disasters, including cold waves, droughts, epidemics, floods, heatwaves, land erosion, landslides, lightning, wildfires and windstorms at the national, provincial and local levels (GoN 2019). The Climate Change Policy 2019 has a directive to mobilize 80 per cent of the funds gained through international mechanisms and used at the local level (GoN 2019).</p>
National Adaptation Programme of Action (NAPA) 2010	<p>Identifies health adaptation as one of the priority sectors, which includes activities focused on “reducing the public health impacts of climate change through evidence-based research as well as piloting and empowering communities through education for responding to the adverse effects of climate change on public health; investing in disease outbreak and other emergency responses; scaling-up programmes on vector-, water- and food-borne diseases; and strengthening forecasting/early warning and surveillance systems on climate change and health” (Ministry of Health 2015). Local governments further incorporate their local adaptation actions into local development plans following the National Framework on Local Adaptation Plans of Action (LAPA) 2011.</p>

POLICY	DESCRIPTION OF CLIMATE-LIVELIHOODS-HEALTH FOCUS
Second Nationally Determined Contribution (NDC) 2020	<p>Covers the period 2021–2030 following the Paris Agreement and aims to achieve net-zero greenhouse gas emissions by 2050, with the cost of conditional mitigation targets estimated at 25 billion US dollars and unconditional targets at 3.4 billion US dollars (GON 2020). To further achieve this goal, the Government of Nepal plans to ensure that 25 per cent of households use electric cooking stoves by 2030; maintain 45 per cent of forest cover; treat 380 million litres of wastewater per day and manage 60,000 cubic metres per year of faecal sludge by 2025; create 200 climate-smart villages by 2030 with 500 climate-smart farms; implement nature-based tourism in at least five major tourist destinations by 2025; introduce a measure to offset the travel carbon footprint by 2030; and adopt national building codes and prepare Integrated Urban Development Plans for low carbon urban settlements (GON 2020). Specific adaptation targets include creating and implementing climate-resilience and gender responsive adaptation plans by 2030; strengthening the climate-sensitive disease surveillance system by integrating climate and weather information into existing surveillance systems by 2025; increasing basic water supply from 88–99 per cent and increasing improved water supply from 20–40 per cent by 2030; integrating climate-risk assessments into WASH programme planning and implementation by 2025; establishing and strengthening public weather services, including agro-meteorological information systems; and establishing a multi-hazard monitoring and early warning system covering all provinces by 2030 (GON 2020).</p>

6.2. CAPACITIES

STRENGTHS	CHALLENGES
<p style="text-align: center;">NEPAL RED CROSS</p>	
<ul style="list-style-type: none"> • Leading NS in DRR and CCA work, supporting the Government of the Nepal closely • Community Disaster Response Team (CDRT), District Disaster Response Team (DDRT) and National Disaster Response Team (NDRT) provide training from local – national. • Enthusiastic and committed youth, especially in schools via a 'Junior Circle' • NRCS is following a Climate Change Strategy • Female Community Health Volunteers (FCHV) in local level are mobilized and are given basic health care training along with training in basic reproductive health • 'Swawalamban Samuha,' which translates to 'Empowered Group,' focused on providing seed funding to women's groups. The local community group was later registered as an independent organization to continue to work on women's empowerment • Runs emergency clinic to address small epidemic outbreak needs 	<ul style="list-style-type: none"> • A gap in being able to respond to large epidemic outbreaks • There is a need to address SRHR needs post-disasters that are inclusive of members of LGBTQI community

Figure 2: Institutional framework



MINISTRY OF FOREST
AND ENVIRONMENT



MINISTRY OF HEALTH
AND POPULATION



NEPAL HEALTH
RESEARCH COUNCIL

“Ongoing activities like water quality surveillance activities have started including addressing neglected tropical disease and surveillance of new diseases in vulnerable areas, however, there is a lack of integrated work model approach as livelihood issues are not connected with climate health impacts” (KI2)

The Nepal Health Research Council (NHRC) and Ministry of Health and Population (MOHP) are the two bodies conducting research and working on policy.

7. RECOMMENDATIONS AND OPPORTUNITIES

RECOMMENDATION 1: Scale-up climate-smart programming and preventative health activities, which adopt a multi-hazard early warning, early action approach to preparedness

Gap: Early warning and early action approaches are limited in Nepal.

Opportunity for action: [Climate-smart programmes](#) and projects will need to be scaled. These initiatives need to adopt a multi-hazard early warning, early action approach to preparedness and prioritize risk-informed early action programming (forecast based action/financing). Existing programmes that are climate-smart (especially for climate-sensitive diseases e.g. vector-, water- and food-borne diseases etc.) can systematically integrate medium- and long-term climate information to anticipate, prepare for and reduce the health impacts in high-risk areas. This can be achieved by working in close collaboration with the national hydro-meteorology services and health authorities for projection information based on historical health and weather data. Materials to advance climate-risk management, including climate-smart health programming can be found in the [Climate Training Kit](#).

RECOMMENDATION 2: Focus on emerging disease risks posed by climate change (e.g. the upward movement of vector-borne diseases)

Gap: Higher temperatures, an increase in wetter days and longer droughts will result in the emergence of new vector-borne diseases at higher altitudes and communities have no knowledge about these.

Opportunity for action: The risks mapped in different geographies may be used to gauge emerging health risks as part of community-based knowledge and capacity-building programmes. Surveillance of Malaria and Dengue Fever in the mid-mountains and above may be taken up with communities and public health institutions. Epidemiological forecasting coupled with community-based early warning systems in high-risk areas for Malaria (and other vector-borne diseases), diarrhoeal disease and nutritional disorders may help safeguard climate change-induced health risks.

RECOMMENDATION 3: Explore resilient crop varieties and agricultural techniques

Gap: Agriculture is a major employment sector in Nepal, but is also the most vulnerable sector to climate change. Without changes to current agricultural techniques and seasonal calendars, farmers and their families will be negatively impacted by a changing climate.

Opportunity for action: Enhance the National Society's capacities on food security, livelihoods and climate change. Work with Government/local authorities to provide technical support and training on new techniques, for example: methods to diversify agricultural techniques and grow new climate-resilient varieties of crops represent an opportunity for farmers to keep their livelihoods while reducing malnutrition across the country. Though climate change will have dramatic effects on agriculture through temperature increases and changes in rainfall patterns, techniques and weather-resistant crop varieties represent an opportunity for this vulnerable population. Successful diversification of techniques and crop varieties will have positive downstream effects on both rural and urban populations by preserving livelihoods, reducing migration and increasing food access. Actions to protect livestock could include: cattle-shed improvement, fodder management and rainwater harvesting.

RECOMMENDATION 4: Engage with the National Adaptation Plan (NAP) more deeply to highlight the linkages between climate change, health and livelihoods

Gap: How climate change will affect health and livelihoods in a mutually negative way is not well understood.

Opportunity for action: Community-based data and case studies on the linkages between health and livelihoods will contribute to the NAP plans and their implementation at the sub-national and national levels. These linkages will also make the plans more effective adaptation plans by generating cross-sector co-benefits. Engaging with multiple government agencies which include the health and agriculture departments will help to break down silos and help shape more robust adaptation programmes. Consulting with the community to engage people in this process and monitor the outcomes will help to build robust medium- to long-term adaptation interventions.

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ANNEX A

NEAR-TERM CLIMATE PROJECTIONS FOR NEPAL (2020–2039)²

Basic climatology. For monthly temperature (average, minimum and maximum) there is a general increase observed by 2020–2039 of 0.7–1.26°C (RCP2.6) up to 0.8–1.3°C per month (RCP8.5). Temperatures rise especially fast during the dry season in March–May. Rainfall trends are heterogeneous across the country, but under RCP8.5 especially the mountainous regions will receive more rainfall and under RCP2.6 there may be a decrease in rainfall in the far west. Nationally, and across both RCP2.6 and RCP8.5, the monsoon months (June–September) are projected to get wetter.

Climatic extremes. For extreme rainfall events, model uncertainty is very high and projections should therefore be interpreted extra carefully. Trends for the amount of rainfall during extreme events (of 10- and 25-year return levels) differ regionally, but national average projections suggest large increases in the maximum daily rainfall (means of 10–14mm RCP2.6 and RCP8.5) and maximum 5-day rainfall (38mm RCP2.6 mean; 36mm RCP8.5 mean). Especially the eastern and central regions are projected to see more rain falling during extreme events. Nationally, there may be a mean increase of 6–13 per cent of rain falling during ‘very wet days’, although there is no clear trend in the number of days with extreme rainfall. Extreme rainfall is particularly concerning in the mountainous regions of Nepal due to the risk of flash flooding, although other regions are also at a high flooding risk.

Extreme temperatures will become more frequent, especially in the Terai and southern hilly regions. Nationally, hot days (temperatures exceeding 35°C) will increase by a mean of 10 days under RCP2.6. Warm spells may already last 12–15 days (RCP2.6 and RCP8.5 means) longer by 2040. By the end of the century, duration may increase with up to 146 days (RCP8.5 mean) projected, while under RCP2.6 duration would only be 17 days longer – while differences in the short-term are small, this clearly illustrates the long-term differences between global emission scenarios and the importance of global mitigation.

Agricultural conditions. Due to temperature rise, the mountainous regions of Nepal might see up to an extra 25 days added to the growing season length –

2 Projections in this Annex are based on the AR5 CMIP5 dataset used by the IPCC, sourced from the World Bank Climate Portal – supplied under the Creative Commons 4.0 license. For more information, please refer to the methodology section.

although this is only based on temperature data. At the same time, nationally dry spells will become longer 2.7–5 days (mean of RCP2.6 and RCP8.5) and this will particularly affect the central regions. Drought indicators suggest that general drought conditions and the probability of a severe drought will likely remain stable in the next 20 years (mean SPEI of 0.04–0.08).

SUMMARY OF KEY POINTS:

- 1.** Temperatures are rising fast across Nepal, which will result in more hot days and longer warm spells.
- 2.** The wet season will become wetter and the dry season drier, with annual rainfall increasing slightly.
- 3.** Extreme rainfall events will become more intense in the next 20 years.

ANNEX B

SUMMARY TABLE OF CLIMATE CHANGE IMPACTS ON LIVELIHOODS

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS M/F	IMPACTS ON URBAN LIVELIHOODS M/F
Average annual temperature increasing	Increased evapo-transpiration from soils increases drought-risk; crop damage, change in crop suitability to latitudes.	Loss of livelihoods, especially of farmers and women-headed households; poor households also dependent on livestock and forests; higher remittances due to increased distress out-migration of males; poverty trap as livelihoods get affected more frequently; loss of assets – grave long-term economic impacts.	Rural-to-urban migration increases; influx of labour force to urban centres; droughts affect food availability and food prices in urban centres; water access may be impaired if evaporation is high and recharge is low.
	Increased risk of heatwaves and extremely hot days: warm spells will likely increase substantially in the future.	Heat-stress impacts rural farm and non-farm workers, especially older workers – reducing productivity and causing health impacts. Heat stress also reduces livestock reproduction and milk production; can cause crop damage and lead to issues around the access to water – all negatively affecting the livelihoods of rural communities	GLOFs primarily affect the more sparsely populated high mountain areas with few major urban centres – there may, however, be cascading effects from displacement and supply systems disrupted.
	More frequent GLOFs	Widespread losses and damage to fields, home gardens and livestock; health issues and mortality may all affect households and cause deprivation – especially affecting female-headed households.	GLOFs primarily affect the more sparsely populated high mountain areas with few major urban centres – there may, however, be cascading effects from displacement and supply systems disrupted.

CLIMATE CHANGE TRENDS	PHYSICAL IMPACT	IMPACTS ON RURAL LIVELIHOODS M/F	IMPACTS ON URBAN LIVELIHOODS M/F
Erratic precipitation	Extremely wet days and very wet days are likely to increase in the future.	Flash floods, landslides, soil erosion, more thunderstorms and hailstorms may cause the destruction of standing and harvested crops; loss of livestock and fodder as well as firewood and edible food trees, especially on denuded hillsides, may result in loss of income, distress migration, food insecurity and an increase in women-headed households; loss of income in small agri-businesses.	Loss of daily wages, jobs and assets and an increase in credit and/or poverty levels; health impacts and an increase in healthcare bills and/or loss of livelihoods; food insecurity leading to lower productivity.
	<p>Changing precipitation patterns:</p> <p>Monsoon: the onset and withdrawal of the summer monsoon are being delayed, suggesting a temporal shift in the monsoon pattern.</p> <p>Winter precipitation is decreasing and more rain is falling instead of snow.</p>	<p>Hydrological shifts: changing stream flows where streams are used for irrigation and water for livestock and small agri-businesses.</p>	Loss of daily wages, jobs and assets and an increase in credit and/or poverty levels; health impacts and an increase in healthcare bills and/or loss of livelihoods; food insecurity leading to lower productivity.
Cold spell duration has increased in western and northern districts, while it is a decreasing trend for southeastern districts of Nepal; might decrease substantially in the future.	Changing temperature regimes.	<p>The shift in cold-spell duration and frequency may challenge traditional agricultural knowledge – although fewer cold spells may have positive implications for rural areas.</p> <p>Cold spells are generally linked to increased indoor air pollution from heating and this shift may cause changes in noncommunicable diseases (NCDs) and, therefore, people's ability to work.</p>	<p>Cold spells are generally linked to increased indoor air pollution from heating, and this shift may cause changes in NCDs and, therefore, people's ability to work.</p> <p>Shorter and fewer cold spells would alleviate the impacts of cold weather, especially for those living in poorly constructed settlements and people working outside.</p>

ANNEX C

EXISTING POLICIES AND STRATEGIES

The table below provides an overview of existing policies and strategies relating to climate change, and readers are encouraged to read the specific documents.

CLIMATE CHANGE AND ENVIRONMENTAL ACTION DOCUMENTS (2007 ONWARDS)	
National Adaptation Programme of Action (NAPA) to climate change	2010
National Framework on Local Adaptation Plans of Action (LAPA) 2011	2011
The Constitution of Nepal 2072	2015
Nepal Health Sector Strategy (2015–2020)	2015
Nepal Health Sector Strategy: Implementation Plan (2016–2021)	2016
Health National Adaptation Plan (2017–2022)	2017
National Health Policy 2076	2019
Second Nationally Determined Contributions 2020	2020

