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CLIMATE CHANGE IMPACTS ON HEALTH:

ETHIOPIA ASSESSMENT

IFRC

Climate Centre

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EXECUTIVE SUMMARY

The global climate crisis will affect Ethiopia through increased temperatures in all seasons, leading to more 'hot' days (certain); changes in rainfall patterns and timing that, overall, may see a decrease in rainfall and an increased frequency of droughts (uncertain); and increases in the amount of rainfall during extreme events leading to floods (highly likely). These climatic stresses and shocks will overlay on pre-existing complex situations of localized internal conflict and international displacement (notably from South Sudan, Sudan, Somalia and Eritrea). The climate crisis will exacerbate humanitarian needs, compounding vulnerabilities and deepening the health burden of many climate-sensitive diseases directly and indirectly (e.g., via the displacement of people).

Encouragingly, responding to public health vulnerabilities caused by climate change is one of the country's primary goals within the National Adaptation Programme of Action and the Nationally Determined Contributions. In particular, these policy instruments focus on the effective management of drought in order to safeguard human, animal and environmental health.

The most urgent risks of the climate crisis to human health in Ethiopia, identified within this scoping study, are the spread and increased incidence of climate-sensitive vector-borne diseases such as Malaria and Dengue Fever to highland areas; the increased risk of diarrhoeal diseases, due to both too much water and too little water at times; and the risk of undernutrition due to food shortages as a result of droughts and crop failures, especially in the eastern regions.

Climatic stresses and shocks will also influence displacement as the majority of the population depend on agriculture and pastoralism. Droughts have historically led to displacement and migration, and been linked with exacerbating pre-existing tensions leading to conflict. Water scarcity due to droughts has also been shown to negatively impact mental health, for example, of pastoralist communities who find it harder and harder to source water and maintain their livestock.

In addition, stressors on livelihoods, food supplies and access to water for hygiene purposes are all associated with challenges to sexual and reproductive health and rights (SRHR). It is unclear whether climate change may contribute to an already extremely high proportion of child marriages in Ethiopia, but a changing climate will have implications on menstrual hygiene management, maternal nutrition and the adequate hydration of pregnant and lactating women. The gendered constitution of pastoral communities typically means that women have less control over their livelihoods finances, and access to SRHR services.

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.

PHENOMENON AND DIRECTION OF TREND	LIKELIHOOD OF FUTURE TREND	MAJOR PROJECTED IMPACTS PER SECTOR	
		HEALTH (INCL. WASH)	SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS
SLOW ONSET/ STRESSORS			
Timing and duration of rainy seasons continue to change as sea-surface temperatures increase.	Likely	Erratic rainfall impacts crop production and agricultural yield, which impacts food security. People working in fields will have increased exposure to vector-borne diseases.	Increased seasonal transmission of vector-borne diseases (such as Malaria) pose risk of complications to pregnant women.
Increased daily temperatures across all seasons over most regions, more 'hot' and 'very hot' days and nights.	Certain	Number of heat-related deaths increases in the elderly, people with comorbidities, children and outdoor workers; vector-borne diseases (Chikungunya, Dengue Fever, Malaria and Yellow Fever) expand in geographic scope (towards the highlands) and transmission increases with longer favourable warm conditions. Malaria transmission by A. aegypti peaks around 25°C; Chikungunya, Dengue Fever and Zika Virus transmission by A. aegypti peaks around 29°C; reduced crop yields due to heat stress may also impact people's nutritional status.	Pregnant women at risk of heat stress and heat exhaustion, and pregnant and lactating women at risk of dehydration.

PHENOMENON AND DIRECTION OF TREND	LIKELIHOOD OF FUTURE TREND	MAJOR PROJECTED IMPACTS PER SECTOR	
		HEALTH (INCL. WASH)	SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS
Reduction in rainfall (especially in the south-central region), increased number of dry days, elongated dry periods, and the increasing frequency of droughts especially in Tigray, Afar and Somalia as well as central and northern parts of the country in February–May.	Uncertain	Water storage in containers may lead to breeding sites for mosquitoes and increase vector-borne disease transmission; water scarcity can lead to the contamination of water sources and the concentration of pathogens increasing water-borne disease transmission; skin rashes may increase where water is a scarce as hygienic practices are impacted; food insecurity is likely to increase, which will negatively impact people's nutritional status (especially of the poor, women, children and the elderly); increasing chronic undernutrition especially in children born during a drought; populations in arid and semi-arid land may face water scarcity (which could exacerbate tensions and conflict) and be forced to migrate (internally and cross-border) leading to increases in communicable diseases such as Measles and Meningitis; water insecurity has been associated with stress and anxiety, especially of pastoralist communities.	Pregnant and lactating women are particularly vulnerable to changes in food availability and undernourishment, including micronutrient deficiencies; child marriages may increase due to droughts as families attempt to reduce the number of mouths to feed; adolescent boys and girls also face the effects of undernutrition on their physical and psychosocial development and sexual maturation; implications for menstrual hygiene management.
RAPID ONSET/ SHOCKS			
Increased amount of extreme rainfall in certain areas increasing the chances of riverine and flash flooding	Certain	By 2030, it is projected that there will be an additional 248,200 people per year at risk of riverine flooding; stagnant water post-flooding contributes to an increase in vector-borne diseases; waterborne diseases (such as Cholera) are likely to increase as a result of contaminated water; flooding also contributes towards displacement.	Increased vector-borne diseases (such as Malaria) pose a risk of complications to pregnant women; flooding may reduce access to healthcare facilities or disrupt the supplies of medication and personnel, impacting women's access to care.

1. INTRODUCTION

1.1. POLICY LANDSCAPE

Ethiopia's 'Climate-resilient Green Economy Strategy' (2012) is the key climate policy framework in the country (Federal Democratic Republic of Ethiopia 2012). It lays out the vision to 2025 – of achieving middle-income status in a climate-resilient economy – and the plan to achieve this via a green growth path that "fosters development and sustainability". The strategy recognizes Ethiopia's role in mitigating greenhouse gas (GHG) emissions as it seeks a sustainable model of growth. The green economy plan is based on four pillars:

1. improving crop and livestock production practices for higher food security and farmer income, while reducing emissions
2. protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks
3. expanding electricity generation from renewable sources of energy for domestic and regional markets
4. leapfrogging to modern and energy-efficient technologies in transport, industrial sectors and buildings.

Interwoven in this strategy are the important co-benefits that these initiatives would bring. For example, they "would improve public health, through better air and water quality, and would promote rural economic development by increasing soil fertility and food security." Indeed, responding to public health vulnerabilities caused by climate change is one of the country's primary goals in the Nationally Determined Contributions (NDC).

The NDC explicitly recognizes the negative impacts of climate change on health as well as on economic growth. As a result, Ethiopia's medium- and long-term actions prioritize both reducing net GHG emissions by 64 per cent (by 2030) and the effective management of drought, animal and ecosystem services. Responses to drought include a critical consideration of the protection of humans by ensuring sufficient access to drinking water (e.g. diverting streams, digging wells and enhancing water harvesting techniques in rural woredas/districts, including urban areas). Drought and flood management also includes improving traditional methods of food storage in the event of extreme weather. In terms of animal and ecosystem health, the NDC focuses on ensuring sufficient feed, ecological farming – including sustainable land management practices – and calls for ways to strengthen local capacity to deal with the emergence of human, animal and crop diseases that are exacerbated by climate change.

2. CLIMATE PROJECTIONS

2.1. GENERAL CLIMATE AND CLIMATIC ZONES

Ethiopia has a complex climate profile due to its highly varied geography, with a wide range of climate classifications from very arid to very humid. Variations are driven by altitude, with the country's highlands and lowlands showing significant differences in temperature and rainfall (Fazzini *et al.* 2015). Rainfall, in general, decreases along a gradient from the north of Ethiopia to the south (Fazzini *et al.* 2015). Temperatures range from 15°C in the highlands to an average of 25°C in the lowlands, with a mean annual temperature of 22.6°C (World Bank 2020). Ethiopia's seasons are greatly influenced by the country's position in the Intertropical Convergence Zone (ITCZ) and the country sees two rainy seasons, the *kiremt* long rains in from mid-June–mid-September and the shorter *belg* rains from February–May (Segele and Lamb 2005).

Table 1. Seasonal calendar

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	Belg Rains					Kiremt Rains					

2.2. EXTREME WEATHER EVENTS

Ethiopia is highly susceptible to drought and floods, especially in the northern and eastern regions (World Bank 2019). Prolonged droughts occurred between 1983 and 1985, and in 2002–2003, 2011–2012, and 2015–2018 affecting millions of people across the country. These hydrological droughts are especially likely in the water deficit regions of Tigray, Afar and Somali. Droughts in Ethiopia affect at least 1.5 million people of the 100 million population every year, but the number of affected people can quickly increase in dry years (World Bank 2019). Up to 5 million people per year may be affected by drought in 2015–2025 (*ibid*).

Ethiopia is also flood-prone, particularly during the *kiremt* rainy season (in June–August) and in the country's lowlands; in the highlands, heavy rain causes both flash flooding and landslides (World Bank 2019; Addis Standard 2020). Approximately 60 per cent of the population lives in the highlands, in which rainfall-triggered landslides affect approximately 1,000 people a year and contribute towards significant infrastructure damage (World Bank 2019). The capital city of Addis Ababa also experiences surface flooding, notably due to poor drainage systems (Addis Standard 2020). Riverine floods affect, on average, over 250,000 people every year as well as over 200 essential education and health facilities (World Bank, 2019). It is projected that the number of people impacted by these events will increase to 1 million in 2015–2025, and to 1.5 million by 2050 (*ibid*).

2.3. CLIMATE CHANGE

OBSERVED CHANGES	CLIMATE PROJECTIONS
RAINFALL	**RAINFALL**
Long-term trends in rainfall across the whole of Ethiopia are unclear and highly variable year-to-year. Overall, since the 1960s, the south-central region of Ethiopia has experienced a 20 per cent reduction in rainfall (World Bank 2019). The rains in the central and northern areas occurring in February–May have become increasingly less predictable (Ministry of Environment and Forest 2015). There is some indication that changes in the sea-surface temperature, which in turn influences the ITCZ, may have altered the timing and duration of the seasons leading to more frequent drought (Ministry of Environment and Forest 2015).	The overall increases or decreases in rainfall are difficult to predict in Ethiopia and there is a high level of uncertainty (World Bank 2019). Changes in rainfall will not be experienced uniformly across the country. In the south, overall rainfall projections are mixed: rainfall may decrease in central and southern areas, but may increase in south-west and southeastern areas (World Bank 2019). In the north of Ethiopia, is it expected that there will be a general decrease in rainfall (World Bank 2019). It is expected that the intensity of rainfall during extreme events may increase by 18 per cent annually (World Bank 2019).
TEMPERATURE	**TEMPERATURE**
Since the 1960s, the mean annual average temperature has increased by 1°C – approximately 0.25°C each decade. The increase in temperature has been felt the most in July–September (World Bank 2019). This corresponds to a significant increase in the number of 'hot' days (i.e. average daily temperature above 30°C) and nights (McSweeney et al 2015). The number of cold days the country experiences has decreased (World Bank 2019).	Mean annual temperatures are projected to continue to increase throughout the century. By the 2050s, it is estimated that Ethiopia may see a further warming of 1.4–2.9°C in all seasons (Ministry of Environment and Forest 2015), and by 3.7C by the end of the century (World Bank 2019). There is likely a further increase – beyond the additional days already being experienced – in the number of days and nights considered 'hot' and 'very hot' (i.e. >35°C). By 2060, 19–40 per cent of the days may be 'hot'. By the end of the century an additional 100 days would be considered 'very hot' (World Bank 2019).

3. AT-RISK POPULATIONS

The risk certain populations face when it comes to climate impacts is mediated by a combination of social, economic and political factors. Populations, and the people that comprise them, may face heightened exposure to natural hazards and weather events, or barriers that limit their individual coping capacity. In general, displaced people, women, children and the elderly are disproportionately at risk of climate change due to their limited access to information, technology and financial resources. Specifically, in this scoping assessment, existing evidence of the impacts of climate change on certain health outcomes are identified for the following populations (but are not limited to these populations):

- The elderly (see mortality/injury)
- Children (see infectious diseases; WASH; undernutrition; mental health; SRHR)
- Displaced people (see WASH)
- Rural households (see food security and undernutrition)
- Female-headed households (see food security and undernutrition)
- Women (see SRHR)

Whilst it is known that people with disabilities may experience the impacts of climate change differently and more severely than others, there was limited data and research available on these interactions in Ethiopia. The United Nations High Commissioner for Refugees (UNHCR) has highlighted that people with disabilities are among those that suffer the highest mortality and morbidity in an emergency or when access to healthcare and social protection systems is disrupted. In particular, people with multiple vulnerabilities, such as women and girls with disabilities, are at heightened risk of abuse, violence and sexual exploitation during periods of stress or crisis (UNHCR 2020).

4. HEALTH IMPACTS

> *People who have underlying chronic diseases (like Hypertension, Diabetes or Malnutrition) are also vulnerable to climate-related issues" (KII7)*

Health is impacted by a number of socioeconomic as well as environmental factors. This report and section focuses only on how climate change will contribute to adverse health outcomes. Other factors – such as population growth, resource use, global recessions, international trade, conflict etc. – also intersect with the global climate crisis and influence health. However, these are beyond the scope of this research.

In general, Ethiopia has poor health conditions. Proper sanitation infrastructure and access to clean water are still lacking for the majority of the population, maternal mortality and acute malnutrition remain high, infectious diseases (waterborne, airborne and vector-borne) are highly prevalent, and access to healthcare services is difficult. This report synthesizes the existing evidence on the impacts of climate change on health in terms of 1) direct mortality and injury (from natural hazards) and indirectly mediated through the environment via 2) vector-borne diseases, 3) waterborne diseases, 4) malnutrition and food insecurity as well as considering 5) displacement. Additionally, the evidence of the impacts on mental health is presented, alongside the impacts on critical infrastructure and health systems. Particular focus is given to possible links between the changing climate and sexual and reproductive health rights. The most urgent risks to human health identified in this report as a result of the changing climate include: the increased risk of diarrhoeal diseases; the expanded range of Malaria to highlands; and increased food insecurity.

4.1. MORTALITY AND INJURY

The rising frequency and intensity of natural hazard-related stressors and shocks increase the risk of direct mortality and/or injury along the following lines:

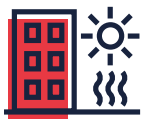
Flooding (riverine flooding and flash floods). Ethiopia already experiences a high flood risk. During the 2020 *kiremt* season, numerous rivers flooded (including the Akobo, Alwero, Awash, Baro, Bilate, Dawa, Genale, Gilo, Gumera, Megech, Rib and Wabe Shebelle rivers as well as floodplains around Lake Tana and several dams (Kesem, Koko, Kuraz and Tendaho) affecting more than 1 million people and displacing 292,863 of them (Government of Ethiopia and OCHA 2020). By 2030, it is projected that there will be an additional 248,200 people per year at risk of riverine flooding due to climate change and more intense rainfall per extreme event (WHO and UN 2015). The increased flood risk may increase: 1) mortality, either directly from

drowning or indirectly through the increased transmission of waterborne diseases (such as Dysentery and Cholera); and 2) morbidity, through injuries as people try to escape the approaching water or are hit by objects in rapidly moving water or by the increased incidence of waterborne diseases (Abaya *et al.* 2009).

Higher temperatures. The number of 'hot' and 'very hot' days are increasing which will increase heat stress, heat exhaustion and heat stroke, posing major health threats to the elderly, those with comorbidities (e.g. cardiovascular problems), and young children (Leal Filho *et al.* 2018)(KI1). In Ethiopia, the "extreme heat" hazard is ranked as "high" and is expected to occur at least once every five years (WHO and UN 2015; Ministry of Foreign Affairs of the Netherlands 2018). The following risks bare additional consideration:

- *heat-related deaths* among elderly people (65+) are projected to reach over 65 deaths per 100,000 people by 2080 compared to the estimated baseline of less than 3 deaths per 100,000 people per year (WHO and UN 2015; Ministry of Foreign Affairs of the Netherlands 2018).
- *workers* engaged in outdoor jobs in low-altitude[1] areas – e.g. farmers and builders – are likely to be adversely affected by exposure to heat (USAID 2016; Irish Aid 2018; Ethiopian Academy of Sciences 2015).
- the behavioural impacts of extreme heat exposure subject 63 per cent of an estimated 36,800 children to increased mortality/morbidity due to acute lower respiratory infections caused by household air pollution (Irish Aid 2018). This issue is compounded by drought and extremely hot weather when children tend to spend most of their time indoors to avoid the heat, where their exposure to indoor air pollution may increase due to the raised ambient temperature (USAID 2016) (KI9).

By 2030, around 248,200 additional people per year will be at risk of RIVERINE FLOODING



By 2080, HEAT-RELATED DEATHS among elderly people (65+) will reach over 65 deaths per 100,000 people

1 Workers in high-altitude regions have less risk of exposure compared to other countries in sub-Saharan Africa (ILO 2019).

4.2. INFECTIOUS DISEASE PATTERNS

Vector-borne diseases

Vector-borne diseases – such as Chikungunya, Dengue Fever, Leishmaniasis, Malaria and Yellow Fever – pose significant health impacts and are highly sensitive to changing climatic conditions (temperature, precipitation, humidity), which exert a strong influence on the life cycles of the vectors (such as mosquitoes) (WHO and UN 2015). Vector-borne diseases are also influenced by anthropogenic factors – population growth, urbanization and control measures – although these are not the focus of this research.

> *"Regarding the geographical locations of vulnerable groups, well, the landscapes which are highly susceptible to climate-sensitive disease are the lower and middle regions of the country, such as the west, eastern and northeastern part of Ethiopia. They are mainly affected by Malaria, Yellow Fever and Chikungunya." (KII9)*

Rising temperatures impact the geographic distribution of mosquitos – resulting in their spreading from lower altitudes (e.g. in Somalia and Afar) to higher altitudes (e.g. in the Tigray and Amhara regions) that were previously too cold for endemic levels of mosquitoes (Simane *et al.* 2017; Team and Hassen 2016; Dasgupta 2018). In addition, increased extreme rainfall resulting in floods and post-flood stagnant water is a major factor that also facilitates the spread of vector-borne diseases by creating breeding sites of mosquito larvae (Campbell *et al.* 2015; Wakuma Abaya *et al.* 2009). The earlier onset of the rainy season could increase the density of mosquito vectors that will further exacerbate the risk of vector-borne disease spread. People working in fields inundated with standing floodwater and without effective protection may experience higher exposure to mosquitoes.

Malaria is endemic and responsible for 20 per cent of mortality in children under five years old (USAID 2016). Populations in the western lowlands of Amhara, Oromia and Tigray, and almost the entire regions of Afar, Benishangul-Gumuz, Gambella, Jimma and South Omo as well as southern Ethiopia are highly exposed to Malaria (Simane *et al.* 2017; Aschalew and Tadesse 2016). However, populations in the previously Malaria-free highlands are more vulnerable to the disease as they have a lower immunity and show weak coping strategies compared to populations in endemic areas (KI2). The majority of cases of Malaria occur during the rainy season in April–October (Alemu *et al.* 2011). Currently, approximately 70 per cent (76 million people) of the total population (109.2 million people) are exposed to mosquitos carrying Malaria (USAID 2016). By 2070, almost 130 million people are projected to be at risk of Malaria assuming a high emissions scenario (WHO and UN 2015). In this context, Malaria is especially problematic for pregnant women due to the risk of complications in

pregnancy e.g. miscarriages, preterm labour, low birth weight, congenital Malaria, and maternal and infant death (Team and Hassen 2016).

75 million at risk (2020) → **130 million** at risk (2070)

> *Every year in the Amhara region, more than 400,000 people are infected with Malaria. Outbreaks are common, but controlling and preventive mechanisms are poor. The pastoralist community, in particular, has more Malaria." (KII5)*

Dengue Fever. High rainfall and high temperatures are the strongest predictors of Dengue Fever outbreaks, and incidences of Dengue Fever are highly likely to increase with climate change (WHO and UN 2015; Federal Ministry of Health 2015). While Dengue Fever is endemic in Ethiopia, the disease has increasingly affected eastern parts of the country, especially in Dire Dawa. This trend is expected to intensify with the continued rise in temperature (WHO, UKAID and Ministry of Health 2016) (KI3). The vectorial capacity (the total number of potentially infectious bites that could arise from mosquitoes biting a single human on a single day) will increase slightly towards 2070 from a mean relative of 0.44 to about 0.57 under high emission scenarios (WHO 2015).

Other vector-borne diseases:

- **Yellow Fever** has re-emerged as endemic in Ethiopia since 2013 (following 65 years of zero cases). Climate change is predicted to affect the magnitude of the disease burden of Yellow Fever along with its distribution via mosquitoes (Gaythorpe *et al.* 2020).
- **Chikungunya** – another mosquito-borne disease – is of growing concern in Ethiopia and may not be "gaining the attention needed" (KI12; KI9). Data was not available on the projected incidence as a result of climate change.
- **Leishmaniasis** is transmitted by the bite of infected female phlebotomine sandflies and is caused by protozoan Leishmania parasites. Kala-azar (one of the main forms of Leishmaniasis) is endemic in Ethiopia and if untreated is fatal in over 95 per cent of cases (WHO 2020). Changes in temperature (as well as rainfall and humidity) effect the developmental cycle of Leishmania protozoan as well as the sandflies and reservoir hosts, meaning that climate change is likely to influence the distribution of this disease into areas in which it was not previously endemic; for example, into the highlands as well as into Libo and Fogera in the Amhara region, Tahtay Adiabo in the Tigray region, and Imey in the Somali region (Simane *et al.* 2017; WHO 2020).

Zoonotic diseases

The spread of zoonotic diseases is a high risk in Ethiopia, which has the largest livestock population on the African continent so that 80 per cent of the population has direct contact with livestock or domesticated animals (Pieracci *et al.* 2016). Relatively few studies have examined the specific effects of climate change and zoonotic diseases in Ethiopia, despite it being a "hotspot" for zoonotic disease events (Simane *et al.* 2017). In general, climate change may affect the prevalence of pathogens in animal reservoirs, shift the spatial distribution of pathogens in livestock or wild reservoirs, and increase the environmental survival of pathogens. Specifically in Ethiopia, temperature changes and flooding may greatly increase the incidences of Leptospirosis for which Ethiopia already has the highest burden globally (Simane *et al.* 2017).

Communicable diseases

Communicable disease outbreaks are primarily caused by displacement, including cross-border displacement. In Ethiopia, many communities are displaced due to the double burden of extreme weather events and conflict. As a result, outbreaks of communicable diseases are an urgent concern, particularly as they hamper the efficiency of the country's public health infrastructure (Team and Hassen 2016; Irish Aid 2018).

Meningitis has historically affected the Southern Nations, Nationalities and Peoples' Region (SNNPR) of the country as well as the Amhara, Gambella, Oromia and Tigray regions (Simane *et al.* 2017). According to the World Health Organization (WHO), variable and unpredictable climate patterns such as dry seasons, dust winds and cold nights increase the risk of meningococcal outbreaks (WHO 2018). Recently, Meningitis has spread to regions beyond the "Meningitis belt" as a result of climate/environmental changes in these areas (KI1).

Measles is one of the primary causes of infant mortality in Ethiopia – nearly 70 per cent of the reported cases of Measles are among children under the age of 15 years (Belete Akalu 2016). Some modelling studies have indicated that there could be as many as 1.5 million cases of Measles (all age groups) and 70,000 deaths (assuming a 4 per cent case fatality ratio) in Ethiopia annually (Belete Akalu 2016). Measles outbreaks occur frequently especially in the Amhara, Afar, Oromia, SNNPR and Somali regions (southern) (Belete Akalu 2016). Whilst there is some association between climate variability and the occurrence of Measles outbreaks (e.g. a low relative humidity was found to be a risk factor for Measles morbidity), the links between Measles and climate change are more directly mediated by the dynamics of displaced populations (Yang *et al.* 2014). For example, a prevailing drought in the Horn of Africa in 2011 led to an influx of mostly unvaccinated refugees from Somalia which led to an increase in Measles cases among Ethiopian children (Federal Ministry of Health 2015).

4.3. WATER, SANITATION AND HYGIENE (WASH)

Water supply and sanitation systems

Rainfall variability and patterns of distribution create regional differences in the amount of water available and the quality of this water. Overall, Ethiopia has relatively abundant water resources. However, it is considered 'water stressed' due to challenges in managing the existing water resources and because some regions face extreme water insecurity due to natural variability in rainfall patterns (USAID 2019). Increased water scarcity disproportionately impacts women and girls in rural areas who have to travel longer distances to fetch water, which increases school absenteeism and overall participation in community life (wearewater.org 2020). Additionally, in areas where water is scarce (e.g. Oromia and SNNPR), communities may be forced to share unprotected water sources with livestock, which can increase the risk of water contamination.

At the other extreme, flooding can also affect the quality of existing water sources, flushing pathogens and contaminants into unprotected water sources (ground wells or surface water). Nearly one-third of the population (33 million people) lack access to an improved water source (Water.org 2020). While open defecation practices have decreased from 92 per cent (44 million people) in 1990 to 29 per cent (28 million people) in 2015 (WHO 2015) the Afar, Gambella and Somali regions still account for the majority (89 per cent) of rural households using 'traditional' latrines that cannot be considered safe (UNICEF 2017). Despite these challenges, solid waste management systems and infrastructure are poor throughout Ethiopia and can lead to urban flash flooding and subsequent waterborne disease outbreaks. Schoolchildren are more prone to water-related diseases because they spend most of their time at school where the toilet infrastructure may be poor and water shortages common. These conditions expose schoolchildren to an increased risk of contracting Diarrhoea, Trachoma and other diseases related to hygiene and sanitation (KI2, KI13). Furthermore, drought and a reduction in water availability for hygiene purposes has been linked with a Scabies outbreak in Amhara state which affected more than 370,000 people (WHO, UKAID, and Ministry of Health 2016) (KI15)

Waterborne diseases

Diarrhoeal diseases account for approximately 20 per cent of deaths in the country, and are the third leading cause of mortality in children under five years old, as well as 17 per cent of childhood deaths (Federal Ministry of Health 2015). Ninety per cent of diarrhoeal diseases are caused by poor sanitation, lack of access to a clean water supply and inadequate personal hygiene (World Vision International 2020). Though diarrhoeal deaths are projected to decline (due to sanitation gains) in the coming decades, the proportion of diarrhoeal deaths attributable to climate change is

projected to rise from 9.6 per cent by 2050 to approximately 14.1 per cent by 2070 (WHO 2015). Poorer populations in rural areas, and especially pastoralist communities, are particularly vulnerable to diarrhoeal diseases due to a lack of sanitation and limited access to clean water (Team and Hassen 2016) (KI6).

Of particular concern are outbreaks of **Cholera** – an acute diarrhoeal disease with high fatality if not treated. Nearly 70 million people are at risk of Cholera in Ethiopia, and an estimated 275,221 cases and 10,458 deaths occur annually (a rate of 4 cases per 1,000 people per year) (Ali *et al.* 2015; Dinede *et al.* 2020). Historically, Cholera outbreaks have occurred following extreme flooding; however, studies are limited on the connection between climate change and Cholera in Ethiopia (Simane *et al.* 2017).

> *In Fogera District, the toilet was destroyed during flooding and all waste from the toilet sewerage entered the community's source of water. As a result there was a huge Cholera outbreak" (KII5)*

4.4. FOOD INSECURITY AND UNDERNUTRITION

> *Ethiopia has many drought-prone areas that are very susceptible to malnutrition. Malnutrition and climate change have an established relationship and are a big health problem here." (KII2)*

Climate change-induced undernutrition mainly occurs in areas that are already food insecure across the globe (IPCC 2018). Ethiopia's Global Hunger Index Score is 26.2, placing it in the middle of the 'serious' category (GHI 2020). The risk of food insecurity and undernutrition is highly likely to increase due to higher temperatures, land and water scarcity, flooding, drought and displacement which, together, will negatively impact agricultural production (IPCC 2018; WHO and UN 2015). In particular, there is high confidence that traditional pastoralist systems are highly vulnerable to the impacts of climate change and that poorer regions will bear the brunt of food insecurity (IPCC 2019).

Food insecurity

> *Pastoralist communities cover the northeastern part of Ethiopia up to the southeastern part. Their livelihoods depend on agriculture and animal farming. So, at the time of drought, animals will die and there will not be milk and food. As a result, displacement will be common, which will expose these communities to disease and malnutrition." (KII2)*

According to the Food and Agriculture Organization (FAO) (2001), "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." Whilst food security relates to nutrition, food insecurity relates to malnutrition that is often linked to poverty and poor diets.

Ethiopia is one of the world's most drought-prone countries and, already, at least seven million people (roughly 7 per cent of the population) are at risk of food insecurity due to a combination of droughts and floods (Simane *et al.* 2017). The vulnerability of the agricultural and livestock sector from high temperatures causing heat stress and crop failure as well as livestock death will affect both Ethiopian's livelihoods (and thus their ability to produce and purchase food) and agricultural production (and thus the population's access to food) (USAID 2016). Severe droughts in Ethiopia can shrink farm production by up to 90 per cent (*ibid*). Areas in Agar, the eastern lowlands, southern Oromia, the central Rift Valley, Somali andTigray represent hotspots of food insecurity linked with climate change (World Bank 2020; Ministry of Foreign Affairs of the Netherlands 2018).

Undernutrition

The following population groups are most at risk of undernutrition due to climate change:

- **Children under the age of five years old.** Children aged five or under are 36 per cent more likely to be undernourished if they are born in a drought season in Ethiopia (Simane *et al.* 2017). Severe acute malnutrition is believed to currently affect approximately 400,000 children and at least 2.7 million more children suffer from moderate acute malnutrition in the country (Irish Aid 2018). These numbers risk increasing dramatically if food systems are destabilized as a result of climate change.
- **Women.** When there are food shortages, women will preferentially feed members of their families first, increasing the women's risks of undernutrition. Female-headed households also suffer greater impacts from droughts than male-headed households (Amsalu 2013). In general, pregnant women have a higher risk of being deficient in

micronutrients, which could increase during food shortages as explained by the cultural practices of eating last. In a systematic study of micronutrient deficiencies, women of reproductive age were found to have the following prevalence of deficiencies: anaemia (18 per cent), folate (46 per cent), iodine (59 per cent), vitamin A (4 per cent) and zinc (34 per cent). Pregnant women, specifically, were shown to have an overall higher prevalence of deficiencies: anaemia (32 per cent), folate (12 per cent), iodine (87 per cent), vitamin A (31 per cent) and zinc (56%) (Harika *et al.* 2017).

- **Growing girls.** In poor families, young women are at an increased risk of undernutrition because of food shortages. This has implications for their physical and psychosocial development and sexual maturation (Team and Hassen 2016).

4.5. DISPLACEMENT AND MIGRATION

In Ethiopia, displacement and migration due to conflict or climatic stressors and shocks is a common occurrence. The vast majority of the population (>80 per cent) depend on agriculture and pastoralism. In this context, unpredictable or changing rainfall patterns, drought and flooding can increase the amount of migration or displacements as communities search for livelihoods, food and water (IDMC 2019) (KI16). Alternating periods of drought and flooding have historically resulted in the displacement of hundreds of thousands of people, which may give an indication of future trends (IDMC 2019; 2020; WHO 2020). The impact of drought, in particular, has been linked with exacerbating tensions and conflicts between displaced and host communities as they compete for access to scarce water resources and agricultural land (IDMC 2020). The potential for significant future displacement will have implications for the demand on healthcare facilities, the mental health burden and sexual and gender-based violence as well as other sexual and reproductive health needs (WHO 2020). In Ethiopia's situation, resettlement camps are congested and favourable for disease transmission (KI17, KI10) (Wakuma Abaya *et al.* 2009).

4.6. MENTAL HEALTH

The WHO notes that water insecurity is one of the primary challenges associated with climate change in Ethiopia (WHO 2020). Recent studies suggest that water insecurity, including limited access to water during droughts, caused mental health concerns within pastoralist communities in the country (Cooper *et al.* 2019). Incidences of 'extreme worry' are especially high during the dry season (Cooper *et al.* 2019). However, there is no evidence to indicate that local policies and projects have addressed or begun to substantively consider the climate–mental health nexus in Ethiopia as there is relatively little information on this.

4.7. CRITICAL INFRASTRUCTURE

> *Our health system and institutions are weak. Health vulnerability differs from one region to another. We tried to relate institutional adaptive capacity with institutional strength and found that in the Afar, Somali and Benishangul-Gumuz regions, and also in the peripheral area of our country, the health system is very weak. These regions do not have strong infrastructure, there are a limited number of health professionals in this area, and there are a limited number of hospitals and pharmacies in this area." (KII1)*

Overall, Ethiopia ranks 84/195 countries in the Global Health Security Index, and is ranked among the most secure in Africa (5th in 54 countries). However, Ethiopia has very few doctors: 2.2 doctors per 100,000 people (GHSI 2020). As highlighted in previous sections, critical infrastructure – such as hospitals and water and sanitation services – is vulnerable to extreme weather events, such as flooding (Federal Democratic Republic of Ethiopia 2019).

5. SEXUAL AND REPRODUCTIVE HEALTH AND RIGHTS

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). Ethiopia is one of several African countries pursuing universal access to high quality and comprehensive sexual and reproductive health and rights (SRHR) as a matter of economic development (IGAD 2020). Ethiopia's National Adaptation Programme of Action (NAPA) lists rapid population growth as a main priority and one which is influenced by climate change (Federal Democratic Republic of Ethiopia 2019; Rovin *et al.* 2013). As a result, the Government of Ethiopia has integrated rights-based family planning services, including those related to communicable diseases (HIV/AIDS), as an important complementary measure to its climate change adaptation strategy (Bryant *et al.* 2009). Despite this, considerable gaps exist in the literature linking climate change and SRHR both globally and in Ethiopia.

Some key trends bear consideration with regards to SRHR and climate change:

- **Accessing sexual and reproductive health services:** Floods and other extreme events may limit women's access to healthcare facilities or interrupt supplies of contraceptives or medication.

- **Menstrual hygiene:** A report on UNICEF's survey of schools in six regions of Ethiopia: Afar, Amhara, Gambella, Oromia, the SNNPR and Somali, showed that only 16.1 per cent of adolescent schoolgirls reported the availability of water for menstrual hygiene (UNICEF 2017).

- **Sexual and reproductive health:** UNICEF indicates that Ethiopia has one of the highest rates of child marriage in the world (World Bank 2012). A 2005 study listed the country as having the fifth highest absolute number of child brides (World Bank 2012). Policy-makers argue that a desire to decrease the number of mouths to feed in rural households during droughts may lead to increased child marriages (Gray and Mueller 2012). However, Gray and Mueller (2012) observed that the immobilizing effects of drought (including an inclination to limit marriage-related expenses in the receiving household) may counteract this trend.

- **Maternal health:** Climate change impacts the patterns of agricultural harvests and crop production. This has negative effects on the SRHR of women in rural Ethiopia as unpredictable harvests and limited access to contraception limit these women's choices about when and under what conditions to have children (Rovin *et al.* 2013)

Additionally, women's access to alternative crop production technologies is overlooked due to the gendered constitution of pastoral communities (Tsige *et al.* 2020). As a result, maternal and child nutrition is affected.

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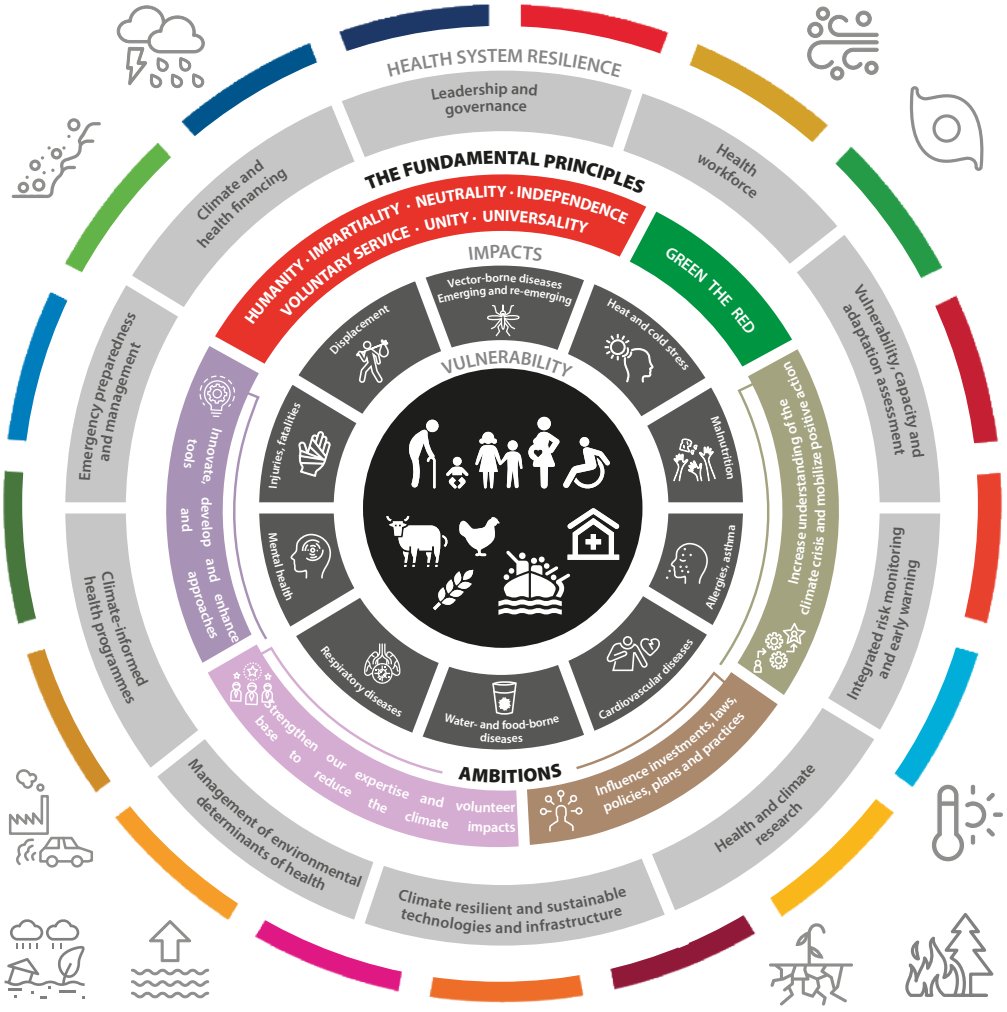
6. RECOMMENDATIONS AND OPPORTUNITIES

This section is based upon the findings in this assessment and inspired by the *IFRC Position paper on health and climate (2021)*, which includes a roadmap to address climate change-related health risks. Figure 1. explains how local action, centred around vulnerability, is key for delivering national and international ambitions on climate change, the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction. Each recommendation is supported by the evidence of a gap or opportunity for further work to strengthen programming on the health–climate change nexus.

Figure 1: Addressing the drivers of health and climate vulnerability at the community level (reducing vulnerabilities (centre) and strengthening community resilience through IFRC action on the ground will support health systems' resilience as well as country progress towards the Sendai Framework for Disaster Risk Reduction as well as the Sustainable Development Goals (outer ring))



RECOMMENDATION 1: Continue to increase knowledge and awareness of the impact that climate change will have on health through effective communication and the translation of findings at the local level to communities, local governments and CSOs.

Gap: The impacts that climate change will have on health outcomes are not always well understood outside of practitioners' circles, yet knowledge on the impacts is key to spur the necessary local action of communities, grass root organizations, CSOs and local governments. Often, this knowledge is lacking at the local level as complex information is not translated in terms of lived experience or the risk to health and well-being in communities and individuals.

Opportunity for action: There are three key opportunities for action. 1) In climate awareness training at all scales, and especially the local, continue to translate the impacts of the projections on health into simple, understandable information, possibly via the use of tools and games developed by the Red Cross Red Crescent Climate Centre. Examples of simplified explanations could be that increasing temperatures mean more days are likely to reach temperatures that are very uncomfortable. Heat can be deadly to the elderly and people with underlying conditions like heart problems (problems that people may not know they have). Heat can also make it harder or more unpleasant to work, particularly outdoors, which can put a real strain on the body. Heat at night can also stress the body and make one less able to work the day after, which can affect productivity and income. Warmer temperatures also typically increase the growth of bacteria which can cause Diarrhoea. 2) Work with communities, volunteers and local health workers or health departments to systematically collate local data, evidence and stories on the health impacts of climate change in order to channel this upwards to policy discussions on health system strengthening. 3) Ensure that climate information reaches the 'last mile' and that local communities, CSOs and local government can access climate information in a timely manner and are equipped with the knowledge of the key, early public health actions to initiate through the sharing of good practice in climate–health risk assessments (i.e. knowledge mobilization).

RECOMMENDATION 2: Scale-up climate-smart and preventative health measures that adopt a multi-hazard Early Warning Early Action approach to preparedness.

Gap: Relatively few Early Warning Early Action programmes are in place across Ethiopia. Local capacity to conduct data collection, monitoring and evaluation – in order to develop early warning systems and responsive infrastructure – is limited by a lack of expertise, research and financial capacity across sectors. There is a silo between climate and health practitioners which compounds this issue.

Opportunity for action: 1) Climate-smart programmes and projects can be introduced and scaled up significantly. These programmes need to adopt a **multi-hazard Early Warning Early Action approach** to preparedness and prioritize risk-informed early action programming (such as forecast-based action/financing, ideally using an impact-based forecast that provides a warning about what the weather will do, rather than only an indication of the parameters of the hazard). These programmes also need to systematically integrate **medium- and long-term climate information to anticipate, prepare for and reduce the health impacts in high-risk areas.** Materials to advance climate risk management, including climate-smart health programming, can be found in the Climate Training Kit. These programmes must continually seek to identify and adapt to specific drivers of vulnerability for health, social and economic impacts of environmental and climate change and develop stronger analytical capability for integrated health and climate risk assessments (using an all-hazard approach) at the local level. 3) Programmes should increase the integration of DRR and public health work, and work with communities to holistically map the interactions in their environment to identify where health risks specifically, and risks in general, can be reduced. For example, a) by identifying areas at risk of flash floods and mapping the essential assets that could be affected – e.g. cropland or key roads; b) building communities' preparedness using climate information – e.g. weather bulletins, river monitoring or the stocking of sand bags to help stem the flow of water; and c) investigating if there are non-climatic factors that may be exacerbating the risk of flooding – e.g. poor solid waste management clogging drainage.

In addition, the seasonal planning conferences in the country, organized by the Ethiopian Government and its national meteorological service, often in collaboration with the Ethiopia Red Cross Society (ERCS), offer a great opportunity for ERCS health teams to enhance the planning of seasonal preventative health actions:

https://vimeo.com/255939235 (English voice over)
https://vimeo.com/255935445 (Amharic voice over)

RECOMMENDATION 3: Explore the use of anticipatory actions (forecast-based actions) for health, especially with regards to vector-borne diseases

Gap: Relatively few Early Warning Early Action programmes that use forecast-based actions for health are in place across Ethiopia. Despite Malaria's endemicity in Ethiopia, there are limited preventive mechanisms in key at-risk areas. For example, in the Amhara region, more than 400,000 people are infected with Malaria every year, but experts expressed concern about limited stocks of antimalarial drugs in this area (KI3, KI9, KI11).

Opportunity for action: The relationship between disease outbreaks/burden and climate change/climate variability, coupled with the predictability of climate variability events like ENSO, provide good opportunities for humanitarian organizations to strengthen health preparedness activities, including Early Warning Early Action. Another opportunity lies in exploring the introduction or scaling up of anticipatory actions (forecast-based financing or impact-based forecasting) for floods and droughts and the health risks they pose. Activities include, for example: 1) interventions for vulnerable urban communities to buffer increasingly high prices before or during food shortages (e.g. cash for work); 2) food distribution for displaced communities; 3) identifying and disseminating the necessary anti-Cholera outbreak packages prior to exceptionally heavy rainfall predictions; 4) identifying and communicating evacuation/access routes for critical healthcare facilities ahead of heavy rains; 5) heat action plan for the most vulnerable regions to reduce the impact of heat on the most vulnerable people; and 6) increasing community-based surveillance and exploring options for real-time monitoring and the digitization of surveillance data to monitor vector-borne disease outbreaks. ERCS is well-positioned to run assessments on the provision of antimalarial drugs in key at-risk areas and indicate if stocks are low in newly exposed or highly at-risk areas.

RECOMMENDATION 4: Advocate for increased access to climate and health financing to reduce future vulnerabilities

Gap: Climate and health financing remains limited or siloed between departments within the National Society.

Opportunities for action: 1) ERCS should advocate for increased access to climate and health financing to invest in climate and health research/action. In particular, the research should focus on the link between climate change and mental health; the impact of heat in informal settlements; and the influence of climate change on SRHR. 2) ERCS should also integrate climate risk management into all social protection programmes that provide consistent support to people known to be vulnerable to climate change. This approach would enable the programmes to function well during times of climate shocks and potentially to provide additional support during times of acute need (or in anticipation of acute need). 3) Climate and health financing could also be used in building back better (and greener) approaches to reduce future vulnerabilities (e.g. addressing the root causes of risks arising from ecosystem degradation or the drivers of environmentally motivated voluntary and involuntary displacement). This engagement should be guided by the Green Response Framework, "Green the Red'', and incorporate environmentally sustainable practice into all operations, programmes and advocacy work in order to "do no harm" both now and in the future.

RECOMMENDATION 5: Employ a One Health approach to the routine monitoring of health risks

Gap: The spread of zoonotic diseases is a high risk in Ethiopia, which has the largest livestock population on the African continent – 80 per cent of the population has direct contact with livestock or domesticated animals. Over 70 per cent of emerging and re-emerging diseases are of vector-borne or zoonotic origin, which calls for the effective routine monitoring of evolving risks and vulnerabilities using a One Health approach (plants, animals and humans health surveillance and response).

Opportunity for action: One Health approaches strengthen the ability of communities, National Societies and other partners to detect, respond to and prevent disease threats and play a significant role in preparing for future risks. One Health adopts a whole society, all-hazard approach to epidemic and pandemic preparedness through community health promotion activities and community-based surveillance (CBS). The approach builds the greater buy-in and sustainability of those involved and leads to improved community engagement in human and animal disease prevention. It also alerts local health authorities earlier and ensures earlier action for the timely control of possible outbreaks. Overall, it reflects the interconnected nature of human and animal health as well as the environment, which is often considered to be the neglected component of the triad.

RECOMMENDATION 6: Integrate mental health and coping with stress into all programmes

Gap: The mental health impacts of climate change are under-researched in Ethiopia.

Opportunity for action: Identify and work with groups (e.g. farmers and pastoralists) who are seeing significant changes in their traditional livelihoods and the environment, or experiencing cyclical losses, e.g. repeated dry seasons; broaden existing climate–health monitoring and intervention efforts to include mental health.

RECOMMENDATION 7: Enhance the capacity to undertake integrated health and climate risk assessments and action (using an all-hazard approach) for highly vulnerable or at-risk groups.

Gap: Data on the specific drivers of vulnerability for different groups is limited e.g. women and especially female-headed households, people living with disabilities, or displaced populations from across borders. Women and children, in particular, are often disproportionately impacted by climate change and yet there is limited research and awareness about the gendered implications of climate change in Ethiopia. Most of Ethiopia's policy and strategies to address the climate crisis do not explicitly incorporate gender dimensions or tailored adaptation solutions for women and girls (Simane *et al.* 2017).

Opportunities for action: 1) Work with communities to identify the specific health impacts of environmental and climate change on vulnerable people, such as female-headed households, outdoor workers, people living in informal settlements, households with people with disabilities, or displaced people. 2) In the face of climate-induced stresses and displacement, urgent attention must be given to increasing knowledge and awareness of sanitation, hygiene and SRHR among vulnerable communities in informal settlements as well as in displaced communities, before and during the climate-related event. The message should be easy to understand and shared on widely accessed media – for example, if phone utilization is high and phone signal coverage is good, then public health SMSs could be issued to keep people aware of key hygiene practices. 3) Volunteers working closely with at-risk communities can amplify at higher levels within their organization the voices and experiences of, for example, women and girls who are displaced, so there is a better understanding of the unique challenges they face as a result of climate impacts. Piloting evidence-based projects that safeguard women and girls – for example, by supporting and empowering women with livelihood options and education – will help to avoid adverse coping strategies during crises.

RECOMMENDATION 8: Continue to foster cross-sector collaboration across programmes and organizations.

Gap: No organization can tackle the increased risks posed by climate change alone or alleviate the exacerbated risks of vulnerable populations. A key study found that there is "inadequate inter-sectoral collaboration and poor coordination and communication amongst stakeholders" and that "the monitoring and evaluation efforts exerted on climate change and health activities are not strong enough to address the climate change and health issues in the country" (Simane *et al.* 2017a; Simane *et al.* 2017b).

Opportunities for action: 1) ERCS is well-placed to empower those most at-risk through capacity building and capability enhancing activities that take an inclusive and gender-sensitive approach. The focus should be on empowering youth, volunteers, marginalized groups and women to understand their risks better and take up, or call for, dedicated evidence-informed climate action at the local and national levels. 2) ERCS should continue to foster and strengthen partnerships both within and outside the humanitarian and development sectors. There are opportunities to work closely with national agencies and donors to improve finance flows, strengthen infrastructure and facilitate access to technology-based solutions and innovations for climate adaptation and resilience as well as to support Forecast-based Financing mechanisms to scale-up anticipatory on the ground adaptation. More internal integration is needed with the disaster management, communication and policy teams; and, in tandem, closer collaboration with external partners such as the national meteorological service, private sector, academia and CSOs is key in delivering holistic early warning systems and disseminating accessible information about disease outbreaks as well as the adverse health outcomes to at-risk communities. 3) ERCS is well-positioned to showcase the local action required to address the risks and needs of the most vulnerable and to broker collaborations to support policies and cross-sectoral planning processes, including the national ambitions for health within the Nationally Determined Contributions (NDCs) and the National Adaptation Plan (NAP).

RECOMMENDATION 9: Increasingly engage in policy dialogues on climate change adaptation.

Gap: The local perspective is not consistently reflected in national policies, nor is local-level data used to help inform policy decisions.

Opportunity for action: ERCS has ample experience on local climate and resilience programming that could enrich nationwide adaptation dialogues and efforts to address the climate and environmental crisis in Ethiopia. ERCS is well connected and positioned to engage in dialogue to increase the integration of the health needs of those most at-risk into climate change adaptation programmes at the national level and within the National Society's programmes. It can also engage in policy dialogue to ensure that a new health infrastructure is established, based on available climate information, while ensuring that the existing infrastructure is protected from extreme weather.

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ANNEX A
EXISTING PROJECTS

INTERNATIONAL NONGOVERNMENTAL ORGANIZATION PROJECTS

U.S. Agency for International Development (USAID): In partnership with Transform WASH, USAID is leading a project to conduct WASH research, following a climate resilient approach. It also employs an integrated water resource management approach, working with the agriculture sector to promote small irrigation systems in drought-prone areas of Ethiopia along with crop cycling in rainy areas of the country. Importantly, the project builds community awareness relating to environmental protection.

World Health Organization (WHO): The WHO's Climate Sensitive Disease Surveillance project along with its Emergency WASH/Climate Resilient Water Safety Plan were developed in collaboration with Ethiopia's Ministry of Water, Irrigation and Electricity. The Ethiopian Public Health Institute (EPHI) established 11 sentinel sites in eight regions of the country (Bahir Dar, Dilla hospital, Diredawa, Dupty hospital, Gambella, Jinka, Kombolcha and Mekelle) to integrate meteorological and environmental health information into a health early warning system. The system was set up to ensure the timely communication, preparedness and response to climate-induced health emergencies to reduce/prevent the risk of their occurence. Training and advocacy workshops were also conducted on climate change and health. The project's particular focus is on Cholera, Malaria, Meningitis and Yellow Fever.

NATIONAL GOVERNMENT PROJECTS

Ministry of Health: The EPHI's Malaria surveillance project uses the National Meteorology Agency's map room to explore how the areas of Ethiopia where Malaria is endemic are going to be affected by seasonal variability in rainfall and temperature. Rainfall forecasts are specifically developed for *Bega* (dry season), *Belg* (minor rainy season) and *Kiremt* (main rainy season). The project aims to assess how seasonal rainfall, dryness and wetness affect Malaria, Cholera and other viral diseases like Dengue Fever.

The Health National Adaptation Plan (HNAP) and the National Framework for a Climate Resilient Health Sector have also been disseminated across the country.

National Meteorology Agency of Ethiopia: provides a monthly health bulletin on the environmental suitability for a Malaria outbreak along with a 'comfort ability index' for people.

ACADEMIC INSTITUTIONS AND RESEARCH PROJECTS

Addis Ababa University: The University's School of Public Health, Environmental Health Department runs a Global Environmental and Occupational Health (GEOHealth) project that focuses on pollution and air quality monitoring. Through air quality monitoring equipment set up on site at the University, the project measures daily air pollution levels and investigates the specific causes of respiratory diseases or morbidity in the area.

This Environmental and Occupational Health project has also analyzed heat stress in flower-farm workers in Ziway and Debre Zeyit. The findings will be presented to influence policy- and decision-making soon.

CIVIL SOCIETY AND NGO PROJECTS

PSI Ethiopia: This agency works to implement WASH projects supported by different organizations such as USAID as well as projects working on solving basic sanitation problems in Ethiopia. These projects are both urban and rural in their reach and span the country. PSI uses a market-based approach to create accessible and improved hygiene and sanitation services for communities.

https://www.psi.org/country/ethiopia/

IFRC

Climate Centre