

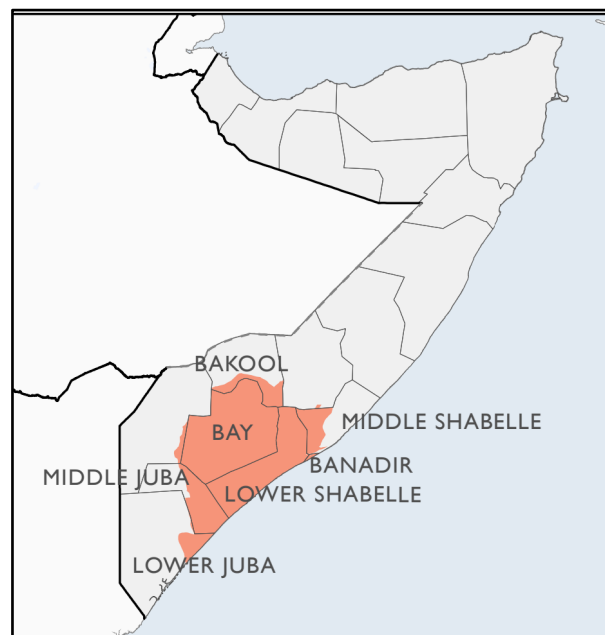


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# CLIMATE RISKS TO RESILIENCE & FOOD SECURITY IN BUREAU FOR HUMANITARIAN ASSISTANCE GEOGRAPHIES SOMALIA

## COUNTRY OVERVIEW

Somalia, located in the Horn of Africa, is an arid and desert country. It is also one of the poorest countries in Africa. During January 2021 to March 2023, Somalia faced its worst period of drought in four decades, killing 43,000 people, driving food insecurity for more than 7 million people, and forcing over 1 million people to leave their homes. Climate change and the effects of three decades of internal conflict and violence stemming from clan rivalries, political power struggles, and economic disparities continue to exacerbate the country's protracted food security crisis which disproportionately impacts marginalized populations like women and girls. Conflict challenges Somalia's low state capacity, particularly in its healthcare and education systems. As of mid-2023, these crises displaced 3.8 million Somalis; about 3.7 million people (22 percent of the population) still face high levels of acute food insecurity (integrated food security phase [IPC] 3 or 4), with many others experiencing food stress. Within this context, there is an increased risk of food insecurity, malnutrition, and continued displacement, particularly as climate change continues to drive erratic rainfall patterns, flash floods, and the potential of drought conditions in Somalia. (1, 2, 3, 4, 5)



*Highlighted area indicates "Resilience Zone" where BHA has planned food security activities in Somalia.*

The United States Agency for International Development (USAID) Bureau for Humanitarian Assistance (BHA) is proposing resilience and food security activity (RFSa) investments focused on household-level interventions in a Resilience Zone in Southern Somalia. This Zone includes rural, peri-urban, and urban areas of Mogadishu, Afgoye, Jowhar, Baidoa, Berdaale, Hudur, and Kismayo.<sup>1</sup> These regions experience climate hazards including prolonged droughts, flash floods, and erratic rainfall patterns that exacerbate food and water insecurity, affect agricultural and pastoral livelihoods, displace local populations, and may result in higher incidences of waterborne diseases like cholera, malaria, and dysentery. Climate change impacts disproportionately affect women and youth, ethnic minorities, and other

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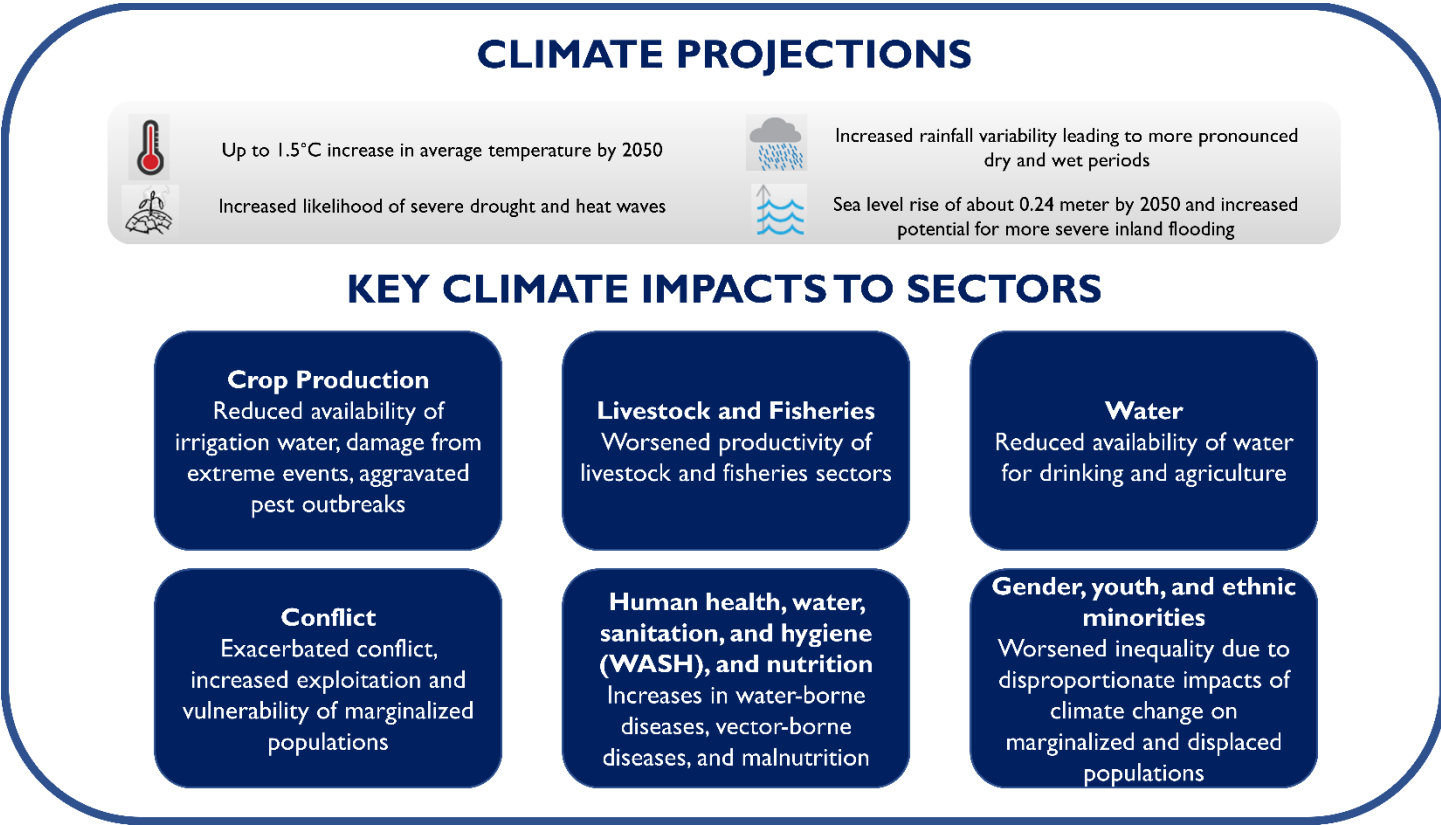
This document was prepared under the Environmental Compliance Services (ECOS) contract to support the United States Agency for International Development (USAID) Bureau for Humanitarian Assistance (BHA) and USAID/Somalia to advance Resilience Food Security Activities in Somalia. Additional support was provided by the Climate Adaptation Support Activity (CASA). It is meant to provide a brief overview of climate risk issues. The key resources at the end of this document provide more in-depth country and sectoral analysis. The contents of this report do not necessarily reflect the views of USAID.

<sup>1</sup> Note: there is a paucity of published climate data in BHA target geographies. This document contains information for all of Somalia and calls out details specific to the Resilience Zone when such information is available.

marginalized populations as these groups often lack adequate resources to adapt and face the increased risks that climate stressors exacerbate: internal displacement, food insecurity, poverty, health issues, and violence. (6, 7, 8, 9)

Climate projections indicate expected increases in annual average temperatures across Somalia by between 2040–2060, yielding an increase in average air temperature, very hot days, drought frequency, and drought intensity. Flood intensity and frequency are will likely increase, and rising sea levels may threaten Somalia’s coastal communities through driving coastal erosion, seawater intrusion into freshwater systems, and changes in marine habitat health. In line with USAID’s [Climate Risk Management](#) guidance, USAID resilience and food security investments in the Resilience Zone of Somalia must consider and adapt to changing conditions to reduce potential climate change risks. This report discusses projected climate stressors and associated risks in the specified geographic areas and proposes illustrative household-level climate risk management measures. (6, 10, 11)

The image below summarizes key climate projections and associated impacts to RFSA sectors.



**CLIMATE SUMMARY**

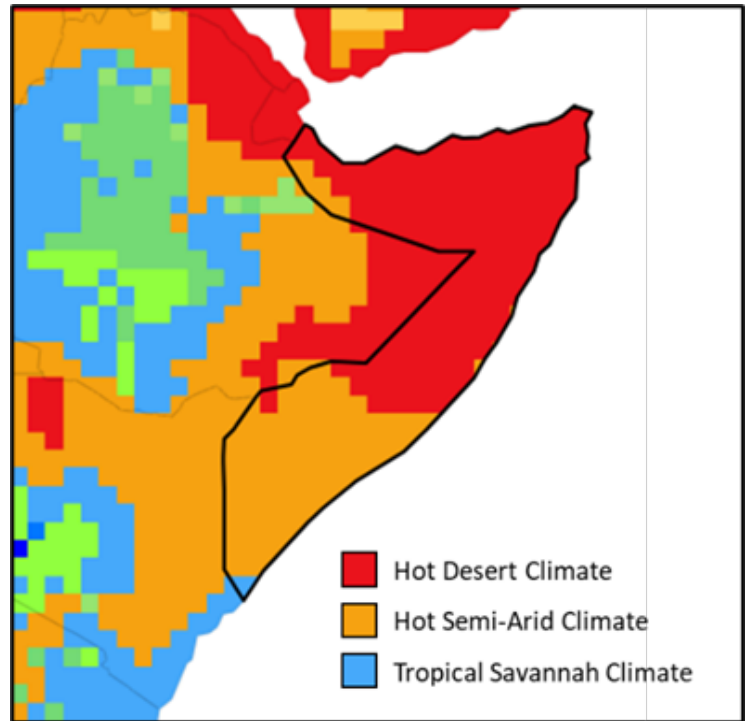
**HISTORICAL CLIMATE**

The Somali landscape spans highlands and plateaus in the north, the Ogo mountain range along the northern coast, and plains in the south across much of the Resilience Zone. The Juba and Shabelle Rivers bring water through southern Somalia into the Indian Ocean. Desert and semi-arid conditions characterize Somalia's climate, with limited rainfall and high temperatures prevailing throughout most of the year. Since 1950, annual average temperatures in Somalia have ranged from approximately 25°C to 27°C, with more recent years exhibiting higher average temperatures. Specifically, average annual temperatures have been rising at a rate of approximately 0.1°C to 0.3°C per decade. The average annual temperature in the 2010s was approximately 26.7°C, which is 1.1°C higher than that during the 1950s. Northern regions of the country are typically warmest from the months of June to September, while southern regions are warmest from December to March. (9, 11)

Somalia experiences, on average, very low precipitation levels year-round. Rainfall often manifests in the form of light showers or localized torrential downpours, with most occurring during the two rainy seasons: the Gu from April to June and the Deyr from October to December. Total annual precipitation averages approximately 200 mm across most of the country, with higher levels in the south (about 400 mm) and southwest (about 600 mm) and lower levels along the northern coast (about 50 mm). (11)

Somalia has, in the past, experienced fluctuations in climatic conditions, including cycles of drought and occasional periods of heavy rain. El Niño-Southern Oscillation (ENSO) events heavily influence rainfall patterns, increasing precipitation and chances of flooding. Conversely, there is a heightened risk of drought during La Niña events. Extreme rainfall followed the most recent period of severe drought (2021–2023), which led to overtopping at the Shabelle and Juba Rivers and flash flooding throughout much of the country, including in the Resilience Zone. The flood event washed away homes, crops, and livestock, and caused school and hospital closures in southern regions of the country. The Somali Disaster Management Agency estimated that the floods in Beledweyne alone, the hardest hit city, displaced more than 245,000 people. In some locations, floods were so severe that they submerged entire houses, leaving only roofs above water. (10, 12, 13)

In addition to extreme fluctuations in precipitation, Somalia experiences an average of one tropical cyclone per year, predominantly impacting the northern regions of Puntland, Somaliland, and Galmudug. Cyclone Gati, which struck in November 2020 as a Category 2 on the Saffir-Simpson scale, was the strongest cyclone on record to make landfall in Somalia, with sustained wind speeds reaching 170 km/hr. and dropping more than an average year's amount of rain in two days. In some areas of northeastern Somalia, Cyclone Gati destroyed or damaged 75 percent of schools, health facilities, water access points, transportation infrastructure, and privately owned properties. Gati also damaged livestock populations and fishing vessels in areas where nearly 80 percent of the population are either pastoralists or fishing communities. (14, 15)



*Köppen-Geiger Climate Classification Zones across the Country of Somalia.*  
Source: World Bank Climate Change Knowledge Portal (11)

## FUTURE CLIMATE

### Nationwide

While climate scenarios have varying degrees of uncertainty, most models show projected increases in average and extreme surface air temperatures across all regions of Somalia, with slightly higher increases occurring in the northern and inland regions of the country. Nationwide, annual average temperatures are projected to increase by almost 1°C by 2020-2039, and by 1.5°C to 2°C by 2040-2059 (mid-century) under a high emissions scenario. Annual maximum temperatures are also projected to increase across Somalia through mid-century, with highest increases occurring in the northwestern region of the country. Similarly, nationwide averages show that annual maximum temperatures could increase by almost 1°C by the 2030s, and by almost 2°C by mid-century. (16)

Projections indicate small increases in precipitation totals across Somalia, with slightly higher increases occurring during the months of October, November, and December. Nationwide, annual precipitation totals are projected to increase by approximately 15 mm by 2020-2039, and by approximately 50 mm by mid-century, though models show potential for both increases and decreases at both time horizons. Climate change is projected to drive increasing inter-annual variability in precipitation patterns, leading to increases in the intensities of both wetter and drier years. (16)

## Resilience Zone

Increases in annual average temperatures in the Resilience Zone generally mirror those of the larger country, with slightly higher temperature increases occurring in interior regions and during the months of February and March (see Table I for further detail). In the near-term (2020–2039), average temperatures in the Resilience Zone could increase by approximately 0.7°C from the historical baseline temperature of approximately 28°C (1995–2014 average). Regions of the Resilience Zone along the coast, such as in Shabelle Hoose and Juba Dhexe, are projected to experience relatively lower increases in temperatures, while those inland, such as in Bay, are projected to see slightly higher increases. Mid-century (2040–2059) projections show an even greater increase in average temperatures, and annual averages could slightly exceed 29°C in the Resilience Zone. (16)

In addition to warming average temperatures, the Resilience Zone is also projected to see an increase in annual maximum temperatures. In the near term, projections indicate that annual maximum temperatures could increase by almost 1°C in both coastal and inland regions of the Resilience Zone, relative to a historical baseline (1995–2014), leading to highs of approximately 38°C. By mid-century, increases are projected to be higher, and the annual maximum temperature in the Resilience Zone could reach almost 39°C. For both average and maximum temperatures, March and April are projected to prevail as the warmest months of the year, while October and November remain relatively cooler. In addition to increasing daytime temperatures, the Resilience Zone is projected to experience warming nighttime temperatures, with highest increases in the months of March, April, and May. (16)

Model average precipitation projections for the Resilience Zone demonstrate a high level of uncertainty and indicate minor changes in annual and monthly precipitation totals through mid-century, with the months of October and November getting slightly wetter, and the months of July, August, and September getting slightly drier. In the near-term (2020–2039), projections indicate that annual precipitation totals in the Resilience Zone could increase by approximately 20 mm (or 3 percent) relative to historical levels. Additionally, these regions could see annual precipitation totals increase by approximately 56 mm (or 9 percent) through mid-century, resulting in annual totals of approximately 650 mm. Table I (below) details these projected changes in the Resilience Zone. (16)

As stated above, climate change is projected to drive increasing variability in precipitation patterns, resulting in both wetter and drier extremes. As such, there is high potential for flash flood severity to increase in the future with more intense rainfall events, especially when following a period of prolonged drought. Climate change will also increase the likelihood of heat waves and severe drought in the Resilience Zone through mid-century. Studies show that increasing temperatures and evapotranspiration rates combined with changing rainfall patterns due to climate change have already made severe drought events 100 times more likely in this region. (17, 18)

In addition to changes in temperatures and precipitation patterns, the Somali Coast is expected to experience significant impacts from sea level rise. Somalia has the longest coastline of all countries in mainland Africa, and the Resilience Zone falls along the southern portion of this coastline. Projections show that sea level rise in 2030 could reach approximately 0.1 m relative to a baseline average sea level of 1995–2014, and that by 2050, this total could increase to approximately 0.24 m. Sea levels are projected to increase approximately 5.1 mm per year in the 2020–2039 period, and by approximately 7.2 mm per year from 2040–2059. (19)

While there is little research on the influence of climate change on tropical cyclones, climate change links to warming ocean temperatures and warmer waters are driving higher-intensity cyclones and tropical storms worldwide. A greater proportion of future tropical storms and cyclones are expected to be more extreme, bringing higher rainfall, more damaging wind speeds, and greater storm surges. The Indian Ocean is warming rapidly and storms often intensify quickly. This trend is expected to continue as ocean warming rises in the region and the Resilience Zone could see an increase in extreme storm risk moving forward. (17, 20, 21, 22)

Table 1: Key climate projections in the Resilience Zone in southern Somalia for the near and mid-term. Data for projections is averaged across the Resilience Zone. Data comes from representative concentration pathway (RCP) 8.5 CMIP5 ensemble projections and shows values in the 10<sup>th</sup> to 90<sup>th</sup> percentiles in parentheses. Source: World Bank Climate Change Knowledge Portal (16).

Climate Variable	Baseline (1995–2014)	Near-century (2020–2039)	Mid-century (2040–2059)
<b>Temperature</b>			
Annual average temperature	27.8°C	+0.7°C (-0.2°C – +1.4°C)	+1.5°C (-0.5°C – +2.3°C)
Annual maximum temperature	37.2°C	+0.8°C (-0.7°C – +2.2°C)	+1.7°C (0°C – +3.1°C)
Number of days per year with maximum temperatures >35°C	80 days	+22 days (-33 days – +72 days)	+56 days (-12 days – +110 days)
Number of nights per year with minimum temperatures >26°C	1 day	+6 days (0 days – +22 days)	+35 days (+8 days – +85 days)
<b>Precipitation</b>			
Total annual precipitation	598 mm*	+18 mm (-424 mm – +688 mm)	+56 mm (-403 mm – +718 mm)
Precipitation falling during the wettest days of the year	39.6 mm	+0.2 mm (-18.9 mm – +22.8 mm)	+12.6 mm (-16.4 mm – 42.8 mm)

\*Note that listed precipitation totals are from the Resilience Zone and higher than overall averages for the country.

## POLICY & INSTITUTIONAL CONTEXT

The 2012 Constitution of the Federal Republic of Somalia governs Somalia's development context. Under this framework, Somalia's Ministry of Environment and Climate Change, established August 2022, creates and carries out federal policy on climate planning and adaptation. The Ministry is Somalia's United Nations Framework Convention on Climate Change (UNFCCC) National Focal Point and the National Designated Authority for the Green Climate Fund. Another government body, the National Climate Change Committee, supervises climate change policy implementation. Somalia joined the UNFCCC in 2009, ratified the Kyoto Protocol in 2010, and ratified the Paris Climate Accord in 2016. In 2020, Somalia set National Voluntary Land Degradation Neutrality Targets under a global initiative of the United Nations Convention to Combat Desertification (UNCCD). Somalia set out its first climate action plan through the 2013 National Adaptation Programme of Action to Climate Change, identifying sustainable land management, water resources management, and disaster management as priority areas to develop climate resilience. The National Climate Change Policy Act of 2020 establishes roles and responsibilities within the government for tackling climate issues. Somalia submitted its initial National Communication to the UNFCCC in 2018 and the first update report in 2022, describing the nation's climate policy, greenhouse gas inventory, energy sector, climate challenges, and status of climate adaptation. The country updated its Nationally Determined Contribution (NDC) in 2021. To meet the adaptation goals set out in the NDC, Somalia is developing a National Adaptation Plan (NAP) guided by the 2022 NAP Framework.

Disaster risk management, social protection, and land tenure policies and institutions are also important to the management of climate risks to food security and resilience in Somalia. Since 1991, there has not been an official land policy in Somalia, resulting in insecure land tenure for many, especially in the context of ongoing violence. Land disputes are common, especially in Southern regions, and can limit livelihood opportunities for farmers and pastoralists. Somalia has a Social Protection Policy, adopted in 2019, which seeks to address poverty and food insecurity via establishing temporary seasonal safety nets to help meet the needs of food-insecure households. The policy aims to integrate climate adaptation and mitigation approaches as Somalia's government designs and implements these safety nets. The program's first government-led safety net program delivers nutrition-linked cash transfers to 200,000 poor and vulnerable

households (as of 2022). Somalia will also implement the Sendai Framework for Disaster Risk Reduction in accordance with its 2018 National Disaster Management Policy. (23, 24, 25, 26, 27)

Somalia faces many challenges to institutional governance and implementation of these policies, including the effects of ongoing civil war, violence, and significant gaps in government capacity to carry out monitoring and delivery of services. Southern Somalia (where the Resilience Zone is located) has especially fragmented public services due to a lack of staff, funding, and access to the most rural or remote areas. (24)

Legal frameworks and documents guiding climate action in Somalia include the following:

- [Constitution of the Federal Republic of Somalia](#) (2012)
- [Somalia National Adaptation Programme of Action on Climate Change](#) (2013)
- [Initial National Communication for Somalia to the UNFCCC](#) (2018)
- National Disaster Management Policy (2018)
- [Somalia Social Protection Policy](#) (2019)
- [Nationally Determined Contribution](#) (Updated 2021)
- [Somalia's First Biennial Update Report under the UNFCCC](#) (2022)
- [Somalia's National Adaptation Plan \(NAP\) Framework](#) (2022)
- [Somalia's First Adaptation Communication to the UNFCCC](#) (2022)

## IMPACTS AND VULNERABILITIES

In southern Somalia, multiple sectors face impacts under climate change. These sectors are critical to food security and resilience and include agriculture (which covers crop production, livestock, and food processing), fisheries, and water resources. Food security activities need to consider the impacts of climate change on conflict in the country, human health and nutrition, and marginalized communities such as women, youth, people living with disabilities, and ethnic minorities. The sections below describe how climate change will likely affect these sectors, particularly in the Resilience Zone where activities will take place.

Priority impacts identified across these sectors include:

- **Crop production:** Increasing temperatures, changes in frequency and severity of extremes like droughts and floods, and sea level rise may increase damage to crops and farmland, reduce availability of irrigation water, impact soil productivity adversely, and aggravate pest outbreaks. Livelihood loss for farming communities is likely to worsen the drivers of food insecurity, conflict, and internal displacement in Somalia.
- **Livestock:** Climate hazards are likely to reduce fodder, increase mortality due to more severe and frequent droughts, increase the risk of disease, and lower overall livestock productivity.
- **Fisheries:** Warming conditions, ocean acidification, and increased cyclones will affect fisheries. These risks decrease fish stock and decrease access as boats and other fishing capital become more at-risk.
- **Water resources availability:** Somalia will face cycles of drought and flood, and without long-term water storage solutions, these hazards threaten drinking and agricultural water availability.
- **Conflict:** Climate-induced scarcities exacerbate conflict in Somalia, escalating disputes between clans; military groups intensify and exploit these crises, undermining the nation's ability to adapt to changing climate conditions and further exacerbating the vulnerability of marginalized and already vulnerable groups.
- **Human health, WASH, nutrition, and health services:** Threats to clean drinking water availability may result in increased incidence of water-borne disease, while other climate hazards can increase vector-borne illnesses and malnutrition.
- **Gender, youth, and ethnic minorities:** Climate impacts disproportionately affect populations who have faced systematic marginalization due to the relatively fewer assets they can use to recover, which may provoke



tensions surrounding natural resources and existing conflict. Displaced groups, including ethnic minorities and pastoralists, are particularly vulnerable to impacts of climate hazards, including limited water accessibility.

## CROP PRODUCTION

Agriculture, which includes crop production and livestock, accounts for almost 65 percent of Somalia's gross domestic product (GDP). In southern Somalia, irrigated agriculture is common in the Juba and Shabelle river valleys, while rainfed farming and grazing are prevalent in the Middle Shabelle. Agriculture continues to be the main source of economic activity, employment, and exports in Somalia. However, growth in the sector has faltered due to vagaries of weather, extreme events, weak government institutions, lack of agricultural technology and extension services, deterioration of irrigation infrastructure, conflict, and political instability. (28, 29)

Before the civil war in 1991, crop production was the second largest contributor to both GDP and exports, after livestock. However, the share of crop production contributions to GDP and exports has since declined considerably, with total cereal production dropping by more than 50 percent compared to the 1980s baseline average. Constant food insecurity plagues Somalia: domestic production satisfies only 22 percent of per capita cereal needs on average, leaving imports and a persistent dependence on food aid to cover the dearth. There are high rates of chronic malnutrition among farming communities, driven primarily by poverty, population growth, and frequent exposure to extreme weather events like droughts. (9, 24)

Despite this declining trend, crop production remains critical for Somalia's food security. Nearly half of Somalia's population lives in rural areas and 25 percent are engaged in cultivation of crops. Major rainfed crops consist of sorghum and cowpea, while maize, sesame, and some fruits and vegetables are the main irrigated crops grown in the Juba and Shabelle river valleys. Production of staple food crops, such as sorghum and maize, and major export crops, mainly fruits like banana and grapefruits, have decreased in most of the agriculturally important regions of Somalia. Since 2020, major hindrances to crop production have included pest outbreaks, plant diseases, lack of irrigation water, and difficulty accessing inputs like fertilizer and quality seeds. (24, 30, 31)

Climate variability and occurrences of extreme events like floods, droughts, and cyclones increasingly affect Somali farmers. More than 80 percent of the country's land is desert or semi-desert and only 1.6 percent of the land is arable. Of this, almost two-thirds, both rainfed and irrigated, is in the floodplains of the Juba and Shabelle rivers in southern Somalia where agricultural potential is the highest (and is the Resilience Zone location). A smaller rainfed area in the northwestern region along with some cultivated areas along the northeastern coast constitute the remaining area under crop production. Overall, around 2.3 million hectares are rainfed and 700,000 hectares have irrigation potential, although farmers only irrigate and cultivate a fraction of that land area (around 20 percent). Frequent occurrences of floods (including flash floods) and droughts in these river basins negatively impact crop production and farmlands. Poor irrigation and soil management, as well as deteriorated flood control infrastructure, compound the risks from extreme events. (10, 24, 32, 33, 34)

Conflict over land and resources has led to increased violence and food insecurity in agricultural communities. Though South-Central Somalia has developed formal legal frameworks to manage land rights that complement customary community-based land tenure systems, there are disputes over ownership and control over land is unequal. State-owned enterprises, outsiders to a region, and/or those residing in towns/cities have received a disproportionate amount of land titles, often displacing small holder farmers and pastoralists. In addition, Al-Shabaab, a prolific militant group that rose to power in 2006, exerts control over most of southern Somalia, including over 80 percent of agricultural land and water resources. A historic, five-season 2020–2023 drought has exacerbated conflict further and impacted millions of Somalis, which has led to acute food shortage, threatened the viability of agricultural livelihoods, increased food prices, induced large-scale population displacement, and created a serious humanitarian crisis in many parts of the country. Drought has also led to increasing competition and tensions between farmers and herders over shared resources. Tensions over water flare up during the dry seasons and dry years when groups of pastoralists settle in new areas, which may create conflicts with sedentary agricultural communities. On the other end of the spectrum, flooding in 2020, 2021, and 2023 wiped out crop production in major river basins and caused the displacement of more than 850,000 people. In April and May 2023, recurrent flooding of the Juba and Shabelle Rivers inundated both irrigated and rainfed farms in Hiiraan, Middle Juba, Bardhere district of Gedo, and Jowhar District of Middle Shabelle, destroying staple and cash crops on

nearly 16,750 hectares of farmland in Hiiraan, 10,000 hectares in Middle Juba, and 70,000 hectares in Jowhar. (13, 35, 36, 37, 38, 39, 40)

CROP PRODUCTION	
Climate Stressors	Risks
Increased annual average temperatures and incidence of high heat events	<ul style="list-style-type: none"> <li>• Lowered crop productivity, crop loss and failure</li> <li>• Increased pest invasions</li> <li>• Increased crop water demand due to increased evapotranspiration</li> <li>• Increased risk of heat-related illness for farm workers on high heat days</li> </ul>
Increased frequency and severity of droughts	<ul style="list-style-type: none"> <li>• Reduced availability of irrigation water</li> <li>• Increased salinity of river water, which can impact irrigated crops</li> <li>• Increased conflict and tensions between livestock herders and settled farmers over competing resource use</li> <li>• Decreased agricultural inputs, such as seeds for replanting crops and irrigation water</li> <li>• Increased desertification, erosion of topsoil, and reduced soil fertility</li> <li>• Limited capacity of farmers to withstand extreme weather events</li> </ul>
Increased frequency and severity of floods  Intensification of cyclones	<ul style="list-style-type: none"> <li>• Destroyed standing crops</li> <li>• Eroded topsoil, eroded gullies, and soil fertility loss</li> <li>• Increased incidence of pest and diseases (e.g., maize stalk borer, coffee berry borer)</li> <li>• Waterlogged soil, which can lead to decreased crop productivity</li> <li>• Increased occurrences of soil-borne diseases that affect crops</li> <li>• Damaged fruit trees</li> <li>• Increased strain on farmers with limited resources to respond to increasingly unpredictable and frequent extreme weather events, such as women and smallholder farmers</li> </ul>
Sea level rise	<ul style="list-style-type: none"> <li>• Increased salinity of soil and groundwater used for irrigation due to saltwater intrusion in coastal areas</li> <li>• Destroyed agricultural fields due to inland migration of soggy marshland conditions</li> <li>• Inundated coastal area farmlands from storm surges</li> </ul>

### Crop Pests

Changes in temperature and precipitation patterns may increase the risks of crop pests and disease-causing vectors and pathogens. Infestations by large mobile swarms of locusts have been increasing and causing widespread damage in Somalia in recent years. Regionally, Somalia is a key breeding ground for desert locusts. Although locust outbreaks are common in this region of East Africa, recent intense outbreaks have links to climate change and the increased frequency of extreme weather events. The increase in temperature and rainfall over some areas of the desert, coupled with strong winds associated with tropical cyclones, have created ideal conditions for locust breeding, development, and migration. Swarms of desert locusts feed on a range of green vegetation (for example, crops, grass, shrubs, and trees), threatening both human and animal food security in Somalia and its neighbors. (9, 27, 41, 42)

Although high cost and limited availability in remote areas limits prevalent pesticide use, increasing incidences of pest outbreaks in the future may lead to a shift towards increasing pesticide usage among Somali farmers. (24)



Crop	Climate Sensitivities
Maize	<ul style="list-style-type: none"> <li>• Optimal growing temperature between 17–32°C.</li> <li>• Tolerant to hot and dry conditions but risk of crop damage above 45°C.</li> <li>• Requires 500 to 800 mm of annual rainfall.</li> <li>• Relatively tolerant to water deficit in vegetative phase but water stress during flowering period, silking, and pollination can lead to reduced grain yield or reduced grain size</li> </ul>
Cowpea	<ul style="list-style-type: none"> <li>• Optimal growing temperature between 20–35°C. Extreme temperatures can affect crop growth and development.</li> <li>• Requires annual rainfall between 300 to 700 mm.</li> <li>• Long dry spells can reduce crop yield.</li> <li>• Excessive rainfall during flowering can damage flowers and impact yield.</li> </ul>
Sesame	<ul style="list-style-type: none"> <li>• Optimal temperature between 25–37°C throughout the growing period.</li> <li>• Temperature above 40°C during the fruiting stage can adversely affect fertilization and capsule set.</li> <li>• Requires on average 625 to 1100 mm of annual rainfall.</li> <li>• Generally tolerant to drought but less tolerant to waterlogging and excessive rainfall.</li> </ul>
Sorghum	<ul style="list-style-type: none"> <li>• Optimal temperature for growth is above 25°C, but high temperatures (&gt;35°C) can lead to poor seed set, problems with ripening and reduced yields.</li> <li>• Average water requirement is between 450 to 600 mm.</li> <li>• Relatively drought tolerant but severe water deficits during the flowering stages can cause pollination failure or headblast which can result in yield reduction.</li> <li>• Not tolerant to long periods of water logging.</li> </ul>
Banana	<ul style="list-style-type: none"> <li>• Optimal temperature for growth between 27–38°C.</li> <li>• Temperature above 38°C can reduce growth and cause heat stress such as leaf scorching.</li> <li>• Requires average annual rainfall in the range of 2000 to 2500 mm.</li> <li>• Water deficits during vegetative phase can affect leaf development, which in turn can impact flowering and bunch production; water deficits in the fruiting stage can affect both fruit size and quality.</li> </ul>

## LIVESTOCK

Livestock is foundational to Somalia's economy. Around 60 percent of Somalia's population practices pastoralism and livestock makes up about 40 percent of GDP and over 50 percent of Somalia's exports. Somalia exports livestock to the Middle East, Kenya, Djibouti, and Ethiopia, and products include camel, cattle, sheep, goat, and fish. Juba Valley, where USAID focuses its resilience and food security investments, holds 16 percent of total livestock and 45 percent of all the cattle raised in Somalia. Multiple years-long livestock bans have affected the industry; countries banned livestock from Middle Eastern countries due to fear that livestock exports could transport Rift Valley Fever (RVF), which is quite common in the Middle and Lower Shabelle. Since 2020, livestock production difficulties have included lack of pasture, lack of veterinary services and inputs, and difficulty accessing feed. Women may experience significant impacts as particularly affected pastoralist families may marry off their daughters in exchange for livestock. (28, 31, 43, 44, 45, 46, 47)

Droughts, cyclones, and floods have had a large impact on Somalia's livestock population. Between 2020 and 2023, five failed rainy seasons have led to a loss of fodder for livestock, three million livestock deaths, and reverberating effects through the dairy, grocery, and garment sectors. Floods and cyclones carry livestock away and wipe out crops used to feed livestock, as shown by Cyclone Gati, which killed over 63,000 sheep and goats. Livestock productivity and milk production can also decrease as a result of malnutrition and heat stress. Many households in the central and southern areas of the country have abandoned homes to find more hospitable conditions for livestock. (8, 9, 48, 49)

Additionally, climate change could exacerbate RVF transmission. Both flash floods and water storage (built in response to drought) have the potential to spread RVF by expanding geographies with standing pools of water that may be

hospitable to RVF-transmitting mosquitoes. RVF cases rise during El Niño because heavy rainfalls causes flooding that expands mosquito breeding grounds. Because RVF can transmit from livestock to humans, this also poses a human health concern. (50, 51, 52, 53)

LIVESTOCK	
Climate Stressors	Risks
Increased frequency and severity of droughts	<ul style="list-style-type: none"> <li>• Lost water supplies for livestock</li> <li>• Lost livestock feed</li> <li>• Decreased livestock productivity</li> <li>• Increased RVF caseload due to drought-response water storage creating standing pools of water</li> </ul>
Increased frequency and severity of flooding	<ul style="list-style-type: none"> <li>• Increased incidence of Rift Valley Fever, potentially resulting in disease transfer between livestock and humans and miscarriage or fatality among livestock populations</li> <li>• Increased livestock fatality during flood events</li> </ul>
Intensification of cyclones	<ul style="list-style-type: none"> <li>• Increased crop production loss, decreased food for livestock</li> <li>• Increased livestock fatality during flood or high-wind events</li> </ul>
Increased annual average temperatures and incidence of high heat events	<ul style="list-style-type: none"> <li>• Lowered livestock productivity due to heat stress</li> </ul>

## FISHERIES

With more than 1,800 miles of coastline along the Indian Ocean, marine fisheries dominate Somalia's fisheries sector. The Somali Coastal Upwelling, or Somali Current, enriches the waters along Somalia's northern coastline, making them some of the most productive waters in the world. The southeastern shoreline near the Resilience Zone is further from the upwelling, benefiting less, yet productive fishing still occurs in that area. Historically, fisheries along Somalia's coastline have contributed about 2 percent to the nation's GDP. Despite this modest contribution, the fishing industry holds significant potential for growth. However, the lack of a domestic market, advanced fishing infrastructure, comprehensive regulation, and centralized planning currently limit the industry. Illegal unreported and unregulated fishing became common during the Somali civil war, with foreign vessels fishing in Somalia's Exclusive Economic Zone and domestic vessels fishing without a license. Approximately \$300 million worth of fish are estimated to be taken illegally from Somalia's seas each year. Moreover, conflict related to fishing in southern Somalia continues to intensify due to rising demand for seafood, declining fish supply from illegal fishing, and piracy. Poor resource management and limited governance continues to make the fishing industry extremely vulnerable to shocks. However, social factors also influence Somalis' willingness to expand into the fishing sector as agro-pastoralist communities historically excluded fishing communities. Before the Somali civil war, the government invested in training to develop the fishing industry, but this level of support has not resurfaced since. (54, 55, 56, 57, 58, 59, 60)

Climate change-related threats compound the challenges facing the fishing industry. Warmer waters, which typically contain less oxygen, may be inhospitable to certain fish species and could diminish fish populations while adversely affecting overall marine ecosystem health. Elevated ambient temperatures can lead to fish spoilage at markets and during transport, especially if coupled with a lack of sanitation. Additionally, increasing frequency and intensity of storms pose significant risks to Somalia's already vulnerable fishing infrastructure. Tropical cyclones have the potential to wreak havoc, causing extensive damage to boats and fishing equipment. While there is little data on ocean acidification in the North Indian Ocean, acidification likely will degrade fish habitat and food webs along the Somali coastline. (61, 62, 63, 64)

FISHERIES	
Climate Stressors	Risks
Increased annual average temperatures and incidence of high heat events	<ul style="list-style-type: none"> <li>● Increased rate of fish spoilage</li> <li>● Increased oceanic temperatures, creating oxygen dead-zones that kill marine life</li> </ul>
Intensification of cyclones	<ul style="list-style-type: none"> <li>● Damaged fishing boats and fishing supplies during storm events</li> <li>● Destroyed coastal community homes and critical infrastructure; hindered fishing community maintenance</li> <li>● Damaged marine habitats</li> </ul>
Ocean acidification	<ul style="list-style-type: none"> <li>● Lost fish habitats through reduced reef formation, which may lead to lost fish production and diversity</li> <li>● Diminished food chain for larger fish such as tuna</li> <li>● Lost protection from storm events through reduced reef formation</li> </ul>

## FOOD PROCESSING, STORAGE, IMPORTS, AND ACCESS TO MARKETS

Food producers lack adequate food storage facilities to protect against environmental hazards. Partially due to this, agriculturalists rarely produce large surpluses in Somalia. When such methods are available to them, agriculturalist communities utilize open-air covered shelters, underground pits, and hermetically sealed bags, which are found to protect crops from humidity-induced spoilage. Increases in temperature and flooding may pose a threat to food storage, but little is known about how storage methods respond to climate hazards. (65, 66, 67)

Somalia's fish markets are ill-equipped to handle heat as many communities lack working cold stores. As such, heat can limit fishing profitability. Fishermen discard parts of the catch that spoil before they reach the shore which can force them to sell at the docks for low prices. Investments in cold storage have increased profitability, allowed for export possibilities, and attracted more individuals to fisheries. Without cold storage, increases in temperature would increase the rate and severity of fish spoilage. (68, 69)

Weather associated with the rainy season limits access to markets. In 2022, strong winds in the rainy season brought high sea tides that delayed ships bringing food to the Bossaso port, decreasing the total quantity of food delivered to the port that season. Rainy season floods can also block or severely damage roads that lead to Mogadishu, Somalia's strongest economic hub. Challenges in sending goods to the market increase the high cost of transporting these goods and cause shortages in the variety of products. Potentially increased intense precipitation in the October–November rainy season could exacerbate these existing difficulties. (70, 71)

FOOD PROCESSING, STORAGE, IMPORTS, AND ACCESS TO MARKETS	
Climate Stressors	Risks
Increased incidence and severity of extreme precipitation events and floods	<ul style="list-style-type: none"> <li>● Damaged crop or fish storage systems</li> <li>● Damaged transportation networks or blocked roads; hindered transport of imports and access to markets</li> </ul>
Increased annual average temperatures and incidence of high heat events	<ul style="list-style-type: none"> <li>● Increased rate of fish or food spoilage</li> <li>● Decreased livestock productivity due to heat stress</li> <li>● Diminished crop productivity</li> <li>● Increased risk of heat-related illness for outdoor workers</li> </ul>
Intensification of cyclones	<ul style="list-style-type: none"> <li>● Limited access to ports during storm events</li> </ul>

## FOOD PROCESSING, STORAGE, IMPORTS, AND ACCESS TO MARKETS

Climate Stressors	Risks
	<ul style="list-style-type: none"> <li>Damaged food stores</li> <li>Disrupted food storage and packaging industries; lost earning potential</li> </ul>

## WATER RESOURCES AVAILABILITY

In 2020, Somalia had 363 thousand cubic meters of renewable internal freshwater resources per capita, qualifying it as a severely water scarce country. Only 52 percent of people in Somalia have access to water to meet basic needs. Somalia experiences extreme drought punctuated by extreme floods and lacks almost any natural surface water storage. Due to the ongoing conflict, Somalia's government has limited capacity to forecast droughts and floods or to communicate information that helps communities manage water resources effectively. Floods and drought have a disproportionate impact on women as internal displacement exposes women to gender-based violence from sleeping in open spaces or crowded camps. Women are also more likely to experience gender-based violence while traveling longer distances to retrieve water. (47, 72, 73, 74, 75, 76)

Northern communities primarily depend on groundwater for domestic and agricultural needs. While most of Somalia's groundwater resources are in the north, this water can have high salinity, affecting water quality. Sea level rise has also led to seawater intrusion in groundwater near coastal areas, thereby decreasing the amount of freshwater available for drinking and agricultural uses. Southern Somalia has the Juba and Shabelle Rivers and typically receives 700 mm of rainfall each year. Communities in the south, where the Resilience Zone is located, depend primarily on precipitation to meet water needs. Most croplands in this area use rainfed irrigation as the civil war destroyed most irrigation structures transporting water from the Juba and Shabelle Rivers. With groundwater and surface water combined, northern Somalia is still more water-stressed than southern Somalia, with southernmost regions containing up to three to four times the internally produced renewable water resources as some northern regions. However, southern Somalia remains vulnerable. In most areas of southern Somalia, drought affects 50 percent of cropland in one out of every 5 to 10 years. (74, 77, 78)

Recurring droughts cause extreme shortages in drinking water supplies. Insufficient surface water storage facilities means many communities depend on water trucking in times of drought. Water prices in Somalia show an average upward trend over time, although there is a wide range. Prices can reach up to USD \$6 per barrel while average daily income per household is USD \$1.25, but in Mogadishu the presence of competing private companies has brought water prices down to USD \$0.30 per barrel. This notably affects rural areas as there are often few-to-no major water sources nearby. (74, 77, 79)

Flash flooding in southern Somalia is common when the Juba and Shabelle Rivers overflow their banks in the rainy season. While floods recharge surface water, it is not enough to alleviate the effect of prolonged drought. Somalia still lacks the water storage facilities necessary to capture flood waters and combat recurring droughts. (74, 80)

## WATER RESOURCES AVAILABILITY

Climate Stressors	Risks
Increased incidence and severity of drought	<ul style="list-style-type: none"> <li>Decreased clean drinking water; increased water prices</li> <li>Decreased irrigation for crops and livestock fodder</li> <li>Over-extracted aquifers near coastal areas, resulting in seawater intrusion into groundwater</li> <li>Increased dependence on contaminated water storage</li> </ul>

WATER RESOURCES AVAILABILITY	
Climate Stressors	Risks
Increased frequency and severity of flooding (riverine).	<ul style="list-style-type: none"> <li>• Damaged/destroyed water infrastructure</li> <li>• Flooded latrines contributing to waterborne disease such as Acute Watery Diarrhea and cholera</li> <li>• Flooded and destroyed croplands</li> <li>• Displaced population with disproportionate impacts on women exposed to gender-based violence by sleeping in open spaces or crowded camps</li> </ul>
Sea level rise	<ul style="list-style-type: none"> <li>• Corrupted groundwater from saltwater intrusion into groundwater sources for drinking or irrigation</li> </ul>

## CONFLICT

### Background

The power vacuum left by the collapse of the central government in 1991 that led to civil war provided a base, in part, for the conflict found in Somalia today. The subsequent rise of the militant group Al-Shabaab further destabilized the region. This group, along with longstanding clan rivalries over resources and political influence, has perpetuated cycles of violence in the country, some of which has occurred within the Resilience Zone. (81)

### Climate Change Impacts

Although there are clear connections between conflict and climate change, the depth and type of these links vary based on numerous factors; climate change is just one of several elements that can drive violence and civil unrest. Some examples of how conflict in Somalia can link indirectly to climate change include:

- **Competition for Resources:** Diminishing water sources and grazing lands, crucial for cattle, goats, and camels exacerbates competition. As droughts worsen in severity and length, the amount of acceptable grazing areas may shrink. Community water availability may also decrease. Scarcity can lead to increased disputes among clans and communities over access to diminishing resources, amplifying existing land tenure ambiguity and conflict.
- **Population Displacement:** Climate hazards, such as droughts and floods, may force populations to migrate in search of better living conditions. As people move, they might encroach upon lands or traditional territories of other clans, potentially triggering or intensifying territorial disputes. Those in internally displaced person (IDP) camps experience identity-based discrimination; armed groups may target them with violence or coerce them into joining. (82, 83)
- **Exploitation by Armed Groups:** Militant groups often capitalize on severe climate events. They may take advantage of tumultuous circumstances to present themselves as rescuers, offering solutions to communities that lack governmental support. This strategy can better allow them to win loyalty and recruit from the affected communities. Additionally, armed groups may exert control over already scarce resources such as grazing lands, water, or wood used for the illegal charcoal trade. For example, in 2011, Al-Shabaab took control of arable land in many communities and charged them for the right to farm each hectare, diverting the flow of river water away from farmers who did not support them financially. As militant groups monopolize these resources, local communities may, to some extent, become reliant on the groups, exacerbating the cycle of recruitment and conflict. (84)

The presence of conflict and violence also exacerbates climate-strained food security issues. For example, conflict can affect the supply of domestic produce, especially if the conflict affects major supply routes. The cost of importing food may increase as a result of violence as well, which has happened with rice imports in rural areas. (85)

Hundreds of thousands of internally displaced people have fled rural and peri-urban areas in the Lower Shabelle and Bay regions to travel to large cities like Mogadishu, Kismayo, and Baidoa. Internally displaced people make up over 40

percent of the population of Mogadishu. Urban centers like Mogadishu are vulnerable to multiple climate shocks and stresses, including cyclones and severe storms. Climate risks and rapid urban growth stress local systems that cannot cope with increased service demands. (86, 87)

Compounding these challenges, specific groups in vulnerable situations in Somalia—such as women, children, and older persons—experience exacerbated effects. With climate-induced resource shortages, women, often responsible for gathering resources, face heightened risks of gender-based violence. Climate challenges disrupt children's educational opportunities, making them more susceptible to militant group recruitment. Older persons might grapple more with the physical demands of rapid climate-induced displacements. (24, 88, 89)

Violence-affected communities are less likely to adequately address climate impacts due to the vulnerabilities associated with and magnified by violence. The degradation of institutions that manage and safeguard natural resources and provide essential services, as well as the absence of reliable law enforcement in areas experiencing violence, could stifle efforts to adapt to climate change. (90)

## **HUMAN HEALTH: WASH, NUTRITION, AND HEALTH SERVICES**

Somalia experiences a lack of clean drinking water and sanitation services. Only 52 percent of Somalis have reliable access to water, leaving nearly half the country reliant upon contaminated open wells and sources that are far from the home.<sup>92</sup> Contaminated water intake can result in fatal diarrheal and respiratory diseases, intestinal worm infections, typhoid, polio, and more, and repeated infection contributes to pediatric stunting. Cholera is endemic and widespread throughout the country, particularly in drought- and violence-affected regions. During an outbreak at the heart of the recent drought (January to July 2022), 21.4 percent of stool samples from drought-affected populations tested positive for the bacteria that causes cholera. Affected areas included the Benadir region, Southwest State, and Hirshabelle State; Baidoa, Daynile, Jowhar, and Afgoi reported the highest incidences of cholera. (73, 91, 92, 93)

Climate change is expected to continue to exacerbate existing health and sanitation issues in Somalia. Increasingly severe drought threatens water supply and forces more Somalis to rely upon unsafe water sources. Furthermore, flooding, drought, and violent conflicts destroy infrastructure and force swaths of the population to seek refuge in displacement encampments. Close quarters and damaged pipelines create rapid breeding grounds for waterborne disease and accelerate related infection. Flooding events also degrade water quality, which can increase risk of disease, and extreme precipitation creates standing water stores susceptible to contamination and could expose people to risk of tetanus, gastrointestinal diseases, and skin infections. (73, 94)

The health implications of poor water quality are not equitable—women and children are disproportionately prone to harm. Women and girls are tasked more often with fetching water from distant sources, particularly when resources are sparse. Frequently, these water source locations are rife with conflict and women and girls have a heightened risk of violence and sexual assault while traveling to or at these sites. The time and labor-intensive excursion for water also detracts from time spent at school or work, and poor water quality is thus detrimental to the educational and economic well-being of these groups and their communities. Children are particularly susceptible to the effects of poor water quality; children under the age of five accounted for the majority of cholera-related mortality in Somalia over the past three years. From 2021 to 2022, wasting in Somali children increased from 11 to 16 percent and waterborne diseases led to excessive child mortality. Drought conditions and corresponding conflict through 2021 also increased the proportion of Somali children out of school by 15 percent to 4.8 million, due to increases in child labor, recruiting, gender-based violence, and early and forced marriage. (73, 95)

As weather extremes become more frequent, Somalis face increased risk of vector-borne disease. Heavy rainfall and flooding are acutely associated with increased incidence of mosquito-borne diseases. Transmission patterns are also affected by social and infrastructural conditions. Displaced populations face heightened risk of vector exposure due to crowded living quarters and temporary housing built of materials that are highly permeable to mosquitoes. Similarly, in times of severe drought, water stores dry out and become shallow waterbeds or require residents to depend increasingly on water collection barrels. These standing water stores serve as effective breeding grounds for mosquitoes. (96, 97)



Climate change impacts on other sectors also have implications for human health. The impacts described above to crop and livestock production can increase food insecurity and malnutrition. Malnutrition is a multifactorial health threat and is dangerous on its own, but it also increases susceptibility to bacterial and viral infection, particularly among pediatric populations. Disproportionately marginalized communities bear the brunt of climate-related health impacts. For example, with rising temperatures and extreme heat events across the country, the women and girls most often tasked with traveling for water will be at increasingly high risk for heat-related illness. (73, 98)

HUMAN HEALTH: WASH, NUTRITION, AND HEALTH SERVICES	
Climate Stressors	Risks
Increased annual temperatures and incidence of high heat events	<ul style="list-style-type: none"> <li>Altered vector habitats, prolonging exposure and expanding vector populations to new geographies</li> <li>Increased incidence of heat-related illnesses</li> </ul>
Increased frequency and severity of drought	<ul style="list-style-type: none"> <li>Reduced access to clean drinking water</li> <li>Increased exposure to waterborne disease</li> </ul>
Increased frequency and intensity of extreme precipitation and flooding	<ul style="list-style-type: none"> <li>Increased exposure to waterborne disease</li> <li>Altered mosquito habitats due to standing water stores, increasing risk of mosquito-borne disease</li> </ul>

## GENDER, YOUTH, AND ETHNIC MINORITIES

Climate change disproportionately affects groups in vulnerable situations like women, youth, and those living with disabilities. In Somali society, women and men have clearly differentiated domestic roles. Traditionally, men act as breadwinners and primary decision makers, whereas women are responsible for the full suite of household chores and child rearing. In agro-pastoral communities, women and men share responsibilities where women account for nearly 45 percent of labor involved in livestock rearing, farming, and natural resource harvesting. However, weak land tenure and limited access to agricultural extension services constrains women's productivity in the agricultural sector. The women-owned farmlands are often less productive and rainfall dependent, partly reflecting women's lack of access to economic and market opportunities, as well as the complex socio-cultural norms that undermine women's agency in Somali society. Combined, these factors drastically reduce their capacity to respond to climate stressors. Narrowing gender gaps in agricultural production can have significant benefits for growth of Somalia's economy, increased food security, and poverty alleviation. (24)

Men and women have adopted different coping strategies in conditions of crises and conflict. Recurrent droughts have driven male members to migrate with their livestock or to urban centers to engage in other economic activities, while women have often stayed behind to care for the children, elderly, or sick animals. While this shift in traditional roles affects both men and women, women often bear the brunt, finding alternate employment in often low-paying temporary jobs and in the informal sector. (99)

Climate and non-climate shock-triggered internal displacement and the ensuing humanitarian crises also expose Somali women and girls to heightened levels of gender-based violence and sexual exploitation. Overcrowding in shelters for internally displaced people not only creates challenges for access to adequate sanitation services, but also exposes women and girls to increased risk of sexual assault and violence. There is evidence that disproportionately, the COVID-19 pandemic has disadvantaged women, children, and other populations in vulnerable situations, including an increase in incidences of gender-based violence. Gender inequity already leads to higher rates of chronic malnutrition among women and girls, with high rates of infant and maternal mortality. Climate change may further limit the access of these vulnerable groups to food and nutritional resources. (24, 99)

The country also experiences ethnic inequality. Somalis are indigenous to Somalia and make up the majority ethnic group, while Bantus make up the largest ethnic minority and mostly live in the lower Juba Valley (largely within the Resilience Zone). Historically, Bantus have faced discrimination, land seizures and insecure land tenure, and increased

rates of poverty and displacement. Today, Bantus still face identity-based discrimination, particularly in IDP camps, or are targets of Al-Shabaab for religious and cultural reasons. Discrimination against Bantus and minority Somali clans is also visible in climate-related displacement; during the 2011 drought, Bantus and the agro-pastoral Rahanwey suffered the most, as better-connected groups diverted aid that could have benefitted those communities. Flooding along the Shabelle river basin has also displaced minority clans with fewer resources, and more powerful clans seized the land when the waters retreated. As the severity of droughts and flooding increases under climate change, this exacerbates land competition and minority group exploitation that leads to land grabs. (100, 101, 102, 103)

GENDER, YOUTH, AND ETHNIC MINORITIES	
Climate Stressors	Risks
All climate stressors	<ul style="list-style-type: none"> <li>• Reallocated funds from investment in activities for marginalized populations to recovery costs incurred during severe weather events</li> <li>• Impacted agricultural production, livelihoods, and access to water, health, and education services will disproportionately impact marginalized populations</li> </ul>
Increased frequency and severity of droughts	<ul style="list-style-type: none"> <li>• Increased distances for women and girls to walk to fetch water and wood</li> <li>• Increased potential for internal displacement and potential for women and girls to face gender-based violence in shelters</li> </ul>
Increased frequency and severity of extreme precipitation events and flooding	<ul style="list-style-type: none"> <li>• Land seized from ethnic minorities and other marginalized populations due to climate-related displacement</li> </ul>

## EXISTING AND POTENTIAL INTERVENTION MEASURES

Designing and implementing resilience and food security activities in the context of changing climate conditions requires informed decision-making that accounts for climate risks as well as contextualized experience from existing and past activities in Somalia. This section includes the following:

- A table titled **“Potential Climate Risk Management Measures”** to provide a snapshot of potential climate risk management measures for teams working in the Resilience Zone of southern Somalia to consider. These illustrative measures are applicable primarily at the household level.
- The table titled **“Selected Ongoing Experiences”** to outline examples of concurrent or active projects in Somalia. These projects have a climate adaptation or food security focus and could present potential lessons learned or opportunities for collaboration. USAID’s [Climate Risk Management \(CRM\) tools](#) provide further examples and resources for systematically addressing climate risks throughout the programming cycle.

Failure to account for climate risks in program or activity design and implementation can result in underperforming outcomes or even inadvertently increasing vulnerability or risk. This can range from failed agricultural projects that do not consider future water availability or weather patterns, to underperforming health initiatives that do not target potential new areas where vector-borne diseases may spread. Understanding the disproportionate impact of climate change on marginalized populations is critical to designing successful resilient food security activities.

However, accounting for climate risks does not always guarantee successful adaptation. Unintended community harm from implementing climate adaptation strategies would be a form of maladaptation instead; maladaptation especially affects marginalized and underrepresented populations (e.g., women, ethnic minorities, persons with disabilities, displaced individuals, and other groups) as these populations may lack resources and political representation compared to those that hold more socioeconomic power. Impacts of maladaptation may sometimes not be apparent for many years. For example, a crop production project developed to supplement agricultural products lost from climate hazards may result in landscape fragmentation, animal population isolation, and biodiversity loss, which could impact the food security and income of pastoralists or those dependent on hunting. Design and implementation of the risk management measures to address the climate risks outlined throughout this document must carefully consider and avoid potential adverse impacts given the environmental, social, and political contexts in the Somalia Resilience Zone. Ensuring that the

activities improve access to information on climate risks and adaptation strategies for participants through training, mentoring, and coaching can support building climate resilience.

In Somalia, populations living in vulnerable situations have unique perspectives and experiences to contribute towards efforts to manage climate risks and advance climate adaptation. Involving women, youth, and ethnic minorities in the process of identifying and leading climate risk management efforts can inform these efforts with diverse cultural values, traditional ecological knowledge, and local knowledge in addition to scientific knowledge. This can help prevent maladaptation, while local ownership can lead to more sustainable climate risk management and adaptation efforts in the long-term. Because climate change impacts disproportionately affect the most marginalized communities that BHA resilience and food security efforts support every day, all activities designed to strengthen climate resilience and food security should integrate diverse voices and perspectives and empower local communities, especially the most marginalized. Robust stakeholder engagement with participant communities and those who know the local context, such as civil society organizations, should be a part of designing and implementing climate risk management measures.

## POTENTIAL HOUSEHOLD-LEVEL CLIMATE RISK MANAGEMENT MEASURES

Climate Risk Area	Potential Climate Risk Management Measures
Cross-cutting	<ul style="list-style-type: none"> <li>• Integrate climate activities into the core components of the graduation approach, particularly livelihood skills building and coaching.</li> <li>• Meaningfully integrate diverse voices and perspectives into the contextualization period through the use of stakeholder engagement and local partnerships to distribute benefits and adverse impacts of climate activities equitably and to avoid maladaptation. When carrying out stakeholder engagement, consulting a social scientist knowledgeable in social inclusion techniques and having them fully engaged in the process can reduce the risk of missing diverse and innovative inputs.</li> <li>• Increase accessibility and usability of climate model-informed resources (such as early warning systems, Famine Early Warning Systems Network [FEWS NET] products and assessments, national weather information, and climate alerts) to inform livelihoods selection in diverse populations. Consider alternative ways of knowledge, communication, and learning to best adopt and use resources.</li> <li>• When possible, utilize or adapt local or traditional practices and knowledge in developing climate risk mitigation measures.</li> </ul>
Crop Production	<ul style="list-style-type: none"> <li>• Facilitate trainings to strengthen information on climate risks and early warning for farmers.</li> <li>• Increase training for farmers on integrated pest management.</li> <li>• Improve access agricultural tools and equipment, high quality inputs and seeds, and sustainable pesticides/insecticides through asset transfer.</li> <li>• Practice sustainable land management practices, soil conservation, and reforestation to reduce soil erosion and soil degradation.</li> <li>• Link participants to an agricultural credit system and agricultural cooperatives and associations.</li> <li>• Partner with local communities to identify and integrate Indigenous/local knowledge and land management techniques and encourage the establishment of local seed production systems.</li> <li>• Where possible, avoid planning cropland in flood prone areas, including coastal areas that may face inundation from sea level rise and storm surge.</li> <li>• Support culturally and context appropriate alternative livelihoods not dependent on crop production.</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>• Increase accessibility and usability of climate model-informed resources to help protect livestock and prevent RVF outbreaks.</li> <li>• Link participants to veterinary services and inputs to increase livestock vaccination to prevent RVF.</li> <li>• Promote cultivation of drought-resistant fodder.</li> <li>• Carry out sustainable pasture management in a way that reduces possibility of conflict and takes</li> </ul>

Climate Risk Area	Potential Climate Risk Management Measures
	<p>equity and land rights into account.</p> <ul style="list-style-type: none"> <li>• Improve access to weather information for pastoralists through training and coaching.</li> <li>• Support culturally and context appropriate alternative livelihoods not dependent on livestock.</li> </ul>
Fisheries	<ul style="list-style-type: none"> <li>• Provide input support to expand sustainable fishing and harvesting practices.</li> <li>• Support training and skills development focused on sustainable management and governance of fish stocks and supply chains in the face of climate change.</li> <li>• Strengthen disaster preparedness in households living in coastal reliant on fisheries.</li> </ul>
Food Processing, Storage, Imports, Access to Markets	<ul style="list-style-type: none"> <li>• Encourage use of effective food preservation methods to protect crops against damage from humidity and pests through training and coaching.</li> <li>• Strengthen farmers' direct access to the market, increasing efficiencies and empowering them to make improved decisions to build resilience.</li> <li>• Link farmers relevant market resources and information to reduce instances of price manipulation.</li> </ul>
Water Resources Availability	<ul style="list-style-type: none"> <li>• Improve household land management to enhance water capture and natural storage.</li> <li>• Encourage integrated water resource management to conserve water training and coaching.</li> <li>• Promote water conservation in agricultural, household, and business use through training and coaching.</li> <li>• Link households and communities in target areas with WASH and water resource services (such as those through active or ongoing projects identified below) to increase the access to reliable and safe water sources and reduce the distances women and girls must travel to find water.</li> </ul>
Conflict	<ul style="list-style-type: none"> <li>• Improve and protect livelihoods and natural resource management, including increasing awareness of land tenure rights and water and natural resource claims, including customary rights, of local peoples.</li> <li>• Integrate mental health and psychosocial support services for conflict-affected individuals and families, focused on gender and youth dynamics, social cohesion, and peace building.</li> <li>• Engage youth to strengthen relevant skills to facilitate positive and inclusive youth development and promote linkages with locally available services to support unemployed youth and reduce their potential recruitment into armed groups.</li> <li>• Use climate change, environmental sustainability, and sustainable natural/water resource management as entry points for group mentoring and coaching to reinforce participant cohesion and engagement.</li> </ul>
Human Health, WASH and Nutrition	<ul style="list-style-type: none"> <li>• Monitor seasonal forecasts to determine how excess rainfall may change and thus affect seasonal prevalence of waterborne diseases and WASH infrastructure vulnerable to flooding (utilizing tools including the Food and Agriculture Organization [FAO] Food Security and Nutrition Analysis Unit – Somalia). (104)</li> <li>• Encourage and build capacity for healthy hygiene and sanitation practices and preventative measures, especially in areas associated with water and vector-borne diseases.</li> <li>• Assess health and nutrition risks in populations experiencing higher levels of vulnerability and integrate appropriate safeguards, including linkages to existing government social protection systems and/or WASH services being implemented by other BHA implementing partners.</li> </ul>
Gender, Youth, and Ethnic Minorities	<ul style="list-style-type: none"> <li>• Promote context-specific livelihoods that are likely to expand women and socially marginalized group participation in economic activities and address barriers to entry, such as time burden and social exclusion.</li> <li>• Sensitize households around gender-based barriers to land and resource access.</li> <li>• Recognize the inequities of ethnic minorities and internally displaced populations and support them</li> </ul>

Climate Risk Area	Potential Climate Risk Management Measures
	<p>with alternative livelihoods opportunities to support food security and income generation.</p> <ul style="list-style-type: none"> <li>Co-create and fund women's groups, youth groups, and ethnic minority collectives that bring innovative climate solutions.</li> </ul>

Sources Include: Data in Emergencies (DIEM) - Monitoring of shocks and agricultural livelihoods in priority countries (31), The Initial National Communication for Somalia to the UNFCCC (30), NAP Global Network, "Somalia Moves Adaptation Strategies for its Livestock and Fisheries Sectors Forward"(56), World Bank and FAO, "Rebuilding Resilient and Sustainable Agriculture in Somalia"(24), Somalia Water and Land Information Management (SWALIM) and FAO, Flood Risk and Response Information Management and Drought Monitoring Tool (105), CIMMYT, "Announcing CIMMYT-derived fall armyworm tolerant elite maize hybrids for eastern and southern Africa"(106)

## SELECTED ONGOING EXPERIENCES

Diverse bilateral, multilateral philanthropic and religious organizations work across the sectors mentioned above. The table below represents ongoing projects in natural resource management, agriculture production and value chains, food security, and climate adaptation. The programs outlined in this table are illustrative and serve as examples and offer insight into ongoing efforts.

Program	Amount	Donor	Year	Implementer
<a href="#">USAID BHA Support for Somalia</a>	Varies	USAID	Varies	Varies
<a href="#">SERVIR's Eastern and Southern Africa hub</a>	N/A	NASA, USAID	2008–present	Regional Centre for Mapping of Resources for Development (RCMRD)
<a href="#">Scaling Durable Solutions</a>	USD \$11.5 million	USAID	2022–2025	International Organization for Migration (IOM)
<a href="#">Building Resilient Communities in Somalia (BRCiS)</a> <i>Mogadishu, Baidoa, Afgoye</i>	USD \$260 million	USAID, UKAid, the World Bank, and others	2013–2022	Norwegian Refugee Council (NRC), International Rescue Committee (IRC), Concern Worldwide, and others
<a href="#">Inclusive Resilience in Somalia (IriS)</a> <i>Mogadishu, Kismayo, Baidoa, Afgoye</i>	USD \$65 million	USAID, UK Foreign, Commonwealth and Development Office (FCDO)	2022–2027	DT Global, Mercy Corps, Save the Children, ITAD, and others
<a href="#">Danwadaag Durable Solutions</a> <i>Benadir, South West State, Jubaland State</i>	N/A	FCDO	2019–2022	IOM, Concern Worldwide, NRC, Juba Foundation, Gargaar Relief Development Organization, Shabelle Community Development Organization, Regional Durable Solutions Secretariat
<a href="#">Supporting Inclusive Growth in Somalia (SIGS)</a>	UK £36.5 million	FCDO	2020–2027	The World Bank, USAID, ITAD, Wilton Park, International Bank for Reconstruction and Development, and others
Green Urban Growth in Somalia	UK £39 million	FCDO	To be confirmed	Anticipated award

Program	Amount	Donor	Year	Implementer
<a href="#">Emergency Education Drought Response (EEDR)</a>	N/A	USAID	2022–2024	UNICEF
<a href="#">Enhancing Climate Resilience of Vulnerable Communities and Ecosystems in Somalia</a>	USD \$21.7 million	Global Environment Facility	2015–2022	United Nations Development Programme (UNDP)
<a href="#">Support for Integrated Water Resources Management to Ensure Water Access and Disaster Reduction for Somalia's Pastoralists</a>	USD \$10 million	Least Developed Countries Fund	2019–2023	UNDP, local and national governments, nongovernmental organizations
<a href="#">Strengthen Climate Change Adaptation Planning</a>	USD \$2.7 million	Green Climate Fund	2020–2023	UNDP
<a href="#">Rural Livelihoods' Adaptation to Climate Change in the Horn of Africa - Phase II (RLACC II)</a>	USD \$10 million	Global Environment Facility (GEF)	2016–2021	African Development Bank
<a href="#">Somalia Crisis Recovery Project (SCRIP)</a>	USD \$187.5 million	World Bank	2020–2025	Government of Somalia
<a href="#">Improving Disaster Risk Management and Food Security to Strengthen Resilience in 'Somaliland' (RDRM)</a>	N/A	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	2020–2023	Ministry of Planning and National Development in 'Somaliland'
<a href="#">FAO projects</a>	Varies	FAO	Varies	Varies
<a href="#">Adaptive Agriculture and Rangeland Rehabilitation Project (A2R2) - Somalia</a>	USD \$17 million	GEF	Ongoing	International Fund for Agricultural Development
<a href="#">Promoting the production and marketing of agricultural products in Somalia</a>	N/A	GIZ	2021–2024	GIZ
<a href="#">Supporting food security and resilience in Kismayo</a>	N/A	GIZ	2020–2023	Jubaland Ministry of Planning and International Cooperation
<a href="#">Somali Resilience Program (SomReP)</a>	USD \$114 million	SIDA	Ongoing	Multiple



## KEY RESOURCES

1. Hujale, M., (2022). [Somalis Abandon their Homes in Search of Food and Aid as Drought Deepens.](#)
2. Anna, C. (2023). [Report: 43,000 Estimated Dead in Somalia Drought Last Year.](#)
3. USAID (2020). [Somalia Country Development and Cooperation Strategy: December 2020-December 2025.](#)
4. Integrated Food Security Phase Classification (2023). [Somalia: IPC Food Security and Nutrition Snapshot: August – December 2023.](#)
5. UNHCR (2023). [Somalia Refugee Crisis Explained.](#)
6. USAID (n.d.). [USAID/Somalia Country Development Cooperation Strategy Climate Analysis.](#)
7. United Nations Somalia (n.d.). [Climate Security and Environment.](#)
8. United Nations Somalia (2021). [Responding to Cyclone Gati in Puntland: Immediate Assistance Needed for Prevention of Waterborne Diseases.](#)
9. WFP (2021). [WFP: Critical Corporate Initiative: Climate Response Analysis for Adaptation Somalia December 2021.](#)
10. Binder, L., et. al. (2022). [Climate Risk Profile: Somalia.](#)
11. World Bank Group (2024). [Somalia: Climate Change Knowledge Portal.](#)
12. NASA (2023). [Heavy Rains Hit Drought-Stricken Horn of Africa.](#)
13. Reuters (2023). [Almost 250,000 Flee Floods in Somali City that 'Became Like an Ocean'.](#)
14. NASA (2023). [Gati Makes Historic Landfall in Somalia.](#)
15. OCHA (2020). [Tropical Cyclone Gati: Nov 2020.](#)
16. The World Bank (2024). "Climate Projections – CMIP5 Data." [Climate Change Knowledge Portal: Somalia.](#)
17. IPCC (2023). [Sections In: Climate Change 2023: Synthesis Report.](#)
18. World Weather Attribution (2023). [Human-induced Climate Change Increased Drought Severity in Horn of Africa.](#)
19. IPCC (2023). [IPCC 6<sup>th</sup> Assessment Report Sea Level Projection Tool.](#) Accessed October, 2023.
20. NOAA (2021). [Climate Change is Probably Increasing the Intensity of Tropical Cyclones.](#)
21. Vallangi, N. (2021). [Rapid Heating of Indian Ocean Worsening Cyclones, Say Scientists.](#)
22. Singh, V.K., et. al. (2022). [A Review of Ocean-Atmosphere Interactions during Tropical Cyclones in the North Indian Ocean.](#)
23. Mohamed, Dr. S., 2023. Heritage Institute. [Somalia: Land Governance Review.](#)
24. World Bank & FAO (2018). [Rebuilding Resilient and Sustainable Agriculture in Somalia.](#)
25. Federal Government of Somalia (2019). [Somalia Social Protection Policy.](#)
26. The World Bank (2022). [Somalia Economic Update: Investing in Social Protection to Boost Resilience for Economic Growth.](#)
27. Directorate of Environment and Climate Change, Office of the Prime Minister (2022). [Somalia's National Adaptation Plan \(NAP\) Framework.](#)
28. The Federal Government of Somalia (2022). [Somalia's First Adaptation Communication to the UNFCCC.](#)
29. FAO (2014). [Country Profile: Somalia.](#)
30. Federal Republic of Somalia (2018). [The Initial National Communication for Somalia to the UNFCCC.](#)
31. FAO (2023). [Data in Emergencies – Monitoring of Shocks and Agricultural Livelihoods in Priority Countries.](#)
32. WFP (2021). [Climate Response Analysis for Somalia.](#)
33. UN Women (2022). [Guidance Note: Gender-Responsive Conflict Analysis.](#)
34. FAO (2016). [Somalia Water and Land Information Management \(SWALIM\).](#)
35. IGAD (n.d.). [Land Governance in IGAD Region: Somalia Country Profile.](#)
36. Springer, J., et al. (2022). [Comparative resilience of Somali grain and livestock market systems.](#)
37. USAID Famine Early Warning Systems Network (FEWS-NET) (2023). [Somalia Food Security Outlook for June 2023-January 2024.](#)
38. Federal Republic of Somalia (2013). [National Adaptation Programme of Action on Climate Change.](#)
39. UNHCR (2020). [Floods drive over 650,000 Somalis from their homes in 2020.](#)
40. Phys.org (2023). [Flooding in Somalia displaces 200,000 people: official.](#) Accessed March 5, 2024.
41. UN Women (2022). [Gender, Climate and Conflict Analysis Tool.](#)
42. Salih, A.A.M., et al. (2020). [Climate change and locust outbreak in East Africa.](#)
43. OEC (2022). [Somalia Country Profile.](#)
44. The Federal Government of Somalia, National Bureau of Statistics (2022). [Voluntary National Review Report.](#)
45. SOMInvest (n.d.). [Livestock Sector.](#)
46. Hassan-Kadle, A., et. al. (2021). [Rift Valley Fever and Brucella spp. in Ruminants, Somalia.](#)
47. UNFPA (2021). [Briefing Note: Situation of Women and Girls – Drought in Somalia.](#)
48. UNHCR (2023). [As the Horn of Africa drought enters a sixth failed rainy season, UNHCR calls for urgent assistance.](#)
49. OCHA and REACH (2022). [Hard-to-Reach Assessment - South and Central districts: Somalia, December 2021 - January 2022.](#)
50. Bett, B., et. Al. (2019). [Climate change and infectious livestock diseases: The case of Rift Valley fever and tick-borne diseases.](#)
51. Martin, V., et. al. (2008). [The impact of climate change on the epidemiology and control of Rift Valley fever.](#)
52. Omosa, E., et. al. (2022). [Climate change and Rift Valley fever disease outbreak: implications for the food environment of pastoralists.](#)
53. NOAA (2015). [El Niño, East Africa, and Rift Valley Fever.](#)
54. University of Rhode Island (2015). [Improving Development and Management of Somalia's Marine Fisheries and Controlling Illegal, Unreported, and Unregulated \(IUU\) Fishing.](#)
55. FAO (2014). [Somalia fisheries: data at a glance.](#)

56. NAP Global Network (2023). [Somalia Moves Adaptation Strategies for its Livestock and Fisheries Sectors Forward](#).
57. Tako, M. H. (2002). [Current status of marine fisheries in Somalia](#).
58. Global Initiative Against Transnational Organized Crime (2021). [Fishy Business: Illegal fishing in Somalia and the capture of state institutions](#).
59. Kulmiye, A. J. (2020). [Somalia Fisheries: Untapped potential held back by skills shortage](#).
60. One Earth Future (2021). [Fisheries Conflict Research](#).
61. FAO (2018). [Sun-dried fish production to build resilient coastal communities in Somalia](#).
62. OCHA (2018). [Flash Update #3 - Tropical Cyclone Sagar](#).
63. FAO (2021). [Fishing town restored after Somalia's most 'fearsome' storm](#).
64. Sumaila, U. R., et. al. (2014). [Economic Impacts of Ocean Acidification on Fisheries and Aquaculture in the Western Indian Ocean Current Knowledge and Recommendations](#).
65. COOPI (2020). [Somalia. Fodder storage helping communities to build resilience](#).
66. FAO (2017). [Somalia Emergency Drought and Resilience Project \(SEDRP\): Environmental and Social Management Framework \(ESMF\) Component 2](#).
67. Lane, B., et. al. (2017). [Impact of storage environment on the efficacy of hermetic storage bags](#).
68. Hiraan Online (2023). [Fishermen in Bosaso call for cold storage facilities](#).
69. USAID (2016). [Ice Machines Make Exports Possible Again for Somali Fishermen](#).
70. FSNAU & WFP (2022). [Somalia Cash and Markets Quarterly Dashboard \(July-September 2022\)](#).
71. WFP (2023). [Somalia - WFP Joint Markets and Supply Chain Update | 13 August -19 August 2023](#).
72. FAO Aquastat & The World Bank (2020). [Renewable internal freshwater resources per capita \(cubic meters\) – Somalia](#).
73. UNICEF Somalia (n.d.). [Water, sanitation, and hygiene](#). Accessed March 12, 2024.
74. World Bank (2021). [Somalia: Groundwater Assessment](#).
75. UNDP (2019). [Somalia and UNDP launch new US\\$10 million project for pastoralist communities to access scarce water resources and adapt to climate-related droughts and floods](#).
76. Svensson, K. and Carlson Rex, H. (2022). [Marking International Women's Day: Why women and girls matter in Somalia's climate crisis](#).
77. Ali, A., et. al. (2023). [Examining the impact of climate change on water resources in Somalia: The role of adaptation](#).
78. Ibrahim, Y., et. al. (2020). "Water Resource and Irrigation in Somalia: A Review." In: [Current Researches in Agriculture, Forestry and Aquaculture Sciences](#).
79. UNICEF (2022). [Somalia: Emergency Water Price Monitoring Dashboard](#).
80. OCHA. (2023). [Somalia: 2023 Flash and Riverine Floods Situation Report No. 1](#).
81. OWP (n.d.). [Somali Civil War](#).
82. UNHCR (2021). [Conflict, violence, climate change drove displacement higher in first half of 2021](#).
83. Norwegian Institute of International Affairs (2021). [Climate, Peace and Security Fact Sheet: Somalia](#).
84. Oberg, C., et. al. (2021). [Risk and Resilience of Somali Children in the Context of Climate Change, Famine, and Conflict](#).
85. Hussein, M., et. al. (2021). [An analysis of food demand in a fragile and insecure country: Somalia as a case study](#).
86. Aubrey, D., et. al. (2019). [Towards Sustainable Urban Development in Somalia and IDP Durable Solutions at Scale](#).
87. FEWSNET (2023). [Food Assistance Needs Remain High Amid Ongoing Recovery from Drought](#).
88. Bakaki, Z., and Haer, R. (2022). [The impact of climate variability on children: The recruitment of boys and girls by rebel groups](#).
89. UNHCR & HelpAge International (2000). [Older people in disasters and humanitarian crises: Guidelines for best practice](#).
90. Trisos, C.H., et. al. (2022). [Africa](#). In: *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.
91. WHO (2023). [Sanitation](#).
92. CDC (n.d.). [Somalia](#). Accessed March 12, 2024.
93. WHO (2022). [Disease Outbreak News: Cholera – Somalia](#).
94. CDC (n.d.). [Flood Waters or Standing Waters](#). Accessed March 12, 2024.
95. UNICEF Somalia (2022). [Somalia Situation Reports 2022](#).
96. Seldenrich, N. (2021). [Standing water and missing data: The murky relationship between flooding and mosquito-borne diseases](#).
97. Brown, L., et. al. (2013). [Impact of drought on vector-borne diseases – how does one manage the risk?](#)
98. Fan, Y., et. al. (2022). [Underlying causes and co-existence of malnutrition and infections: An exceedingly common death risk in cancer](#).
99. OCHA (2022). [Humanitarian Needs Overview Somalia](#).
100. Minority Rights Group International (n.d.). [Somalia](#). Updated June 2019.
101. UNHCR & Minority Rights Group International (2018). [World Directory of Minorities and Indigenous Peoples – Somalia: Bantu](#).
102. Stockholm International Peace Research Institute (2019). [Climate-related security risks and peacebuilding in Somalia](#).
103. Busby, J., 2022. [Droughts don't need to result in famine: Ethiopia and Somalia show what makes the difference](#).
104. FSNAU (n.d.). [FAO Food Security and Nutrition Analysis Unit, Somalia](#). Accessed March 5, 2024.
105. Somalia Water and Land Information Management (SWALIM) and FAO. [Flood Risk and Response Information Management and Drought Monitoring Tool](#).
106. CIMMYT (2020). [Announcing CIMMYT-derived fall armyworm tolerant elite maize hybrids for eastern and southern Africa](#).