



Yemen

The following climate factsheet summarizes available information on the climate of Yemen, climate change and impacts of these changes on humanitarian activities in country. Each of the factsheets were written as a compilation of information from peer-reviewed academic papers, government publications, and INGO documentation.

1. Climate overview

Short overview

Average temperature: Annual average temperature in Yemen is 23.4°C (World Bank, n.d.).

Average rainfall: The coastal plain usually remains dry and hot and receives less than 50 millimeters (mm) of rainfall annually. In some places, the annual rainfall has been decreasing in recent decades, generally affecting the hot, dry summer months of June–September (USAID, 2016). The majority of Yemen's northeastern plain is a desert.

Yemen has a semi-arid to arid-tropical climate with significant variability geographically. There are five main ecological zones: coastal plain, temperate highlands, high plateaus, desert interior, and the islands archipelago (USAID, 2016).

The high plateaus, however, receive between 100–600mm of rainfall annually (USAID, 2016). In general, winters in the high plateaus can be cold (below 0°C) and summers are temperate and dry. “Monsoon climate patterns dictate the seasons, with winter (December–March) and summer (June–September) corresponding to different monsoon seasons. Spring (April–May) and fall/autumn (October–November) are transition periods that separate the seasons” (UNFCCC, 2013).

Climate Change in Yemen

Historical climate change

Projected climate change

Temperature

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| <ul style="list-style-type: none"> ▪ In general, Yemen’s temperatures have been rising steadily for the last three decades; rising at a rate faster than the global average. In many places in Yemen, temperatures are 2°C higher than they were before climate change (USAID, 2016). | <ul style="list-style-type: none"> ▪ Research shows that temperatures will likely rise further; with estimates of 1.2–3.3°C by 2060, depending on the rate of climate change (UNFCCC, 2013). ▪ Temperature extremes will also continue to rise. By the end of this century, the hottest day of the year is projected to be 3–7°C hotter than it is today. Using a heat index, scientists estimate that there are about 14 extremely uncomfortable days per year at present, and there could be over 100 such days by the end of the century (World Bank, 2014). |
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Precipitation

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| <ul style="list-style-type: none"> ▪ Trends in precipitation are more difficult to identify for the entire country. There are studies showing a reduction of rainfall in the high plateau (USAID 2016), while others show an increase in some areas (GERICS, 2015). | <ul style="list-style-type: none"> ▪ The country will likely face more extreme weather, with stronger and more intense flooding and droughts. The frequency of storms is expected to increase as well (USAID, 2016). ▪ There is a wide range of potential projections for whether rainfall will increase or decrease overall, with models showing different results. Very heavy precipitation events will likely increase in the late summer and autumn seasons in September–November (MFA, 2018). ▪ Sea levels are projected to continue rising, with estimates of 0.30–0.54 meters (m) by 2100 (UNFCCC, 2013). |
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It is essential to note that many of these hazards are interrelated and produced compound risks to the same areas and communities. In addition, risk must be understood as the interplay between hazard risk, exposure, and vulnerability which make certain communities, individuals, and sectors more impacted by the hazards. All project design should consider the risk mentioned above and the compounding risks they represent.

2. Priorities of the Movement and climate change

2.1 Scale up climate-smart DRR, early action and preparedness: DRR portrait

Ranked 3 out of 191 countries by the 2022 Inform Risk Index (DRMKC, 2022), Yemen is one of the higher hazard risk countries in the world.

Observed Hazard	Projected Risk
Drought	
<ul style="list-style-type: none"> The water crisis is among the worst in the world (World Bank, 2021). Most of the country is considered at high risk (except for Lahj, Abyan and Sahbwah where the risk is medium), meaning that 'droughts are expected to occur on average every 5 years' (Think Hazard, n/a). 	<ul style="list-style-type: none"> Groundwater reserves are likely to be mostly depleted before 2050 regardless of climate change. This could result in drastic agricultural losses of up to 40% (World Bank, 2021). Additional pressure on agriculture will be felt with the projected increases in temperature and prolonged drought periods. It could result in some areas losing 'their economic viability as well as drinking water supplies, causing displacement and resettlement' (World Bank, 2021).
Flood	
<ul style="list-style-type: none"> Between 2018 and 2022, the IFRC have supported interventions related to flood multiple times every year (IFRC, 2022). Yemen is prone to coastal floods and floods resulting from extreme weather (Think Hazard, n/a). Rainfall is seasonally intense, with short heavy storms often resulting in (flash) floods causing soil degradation – which is amplified by frequent subsequent periods of droughts (World Bank, 2021). 	<ul style="list-style-type: none"> Rainfall is projected to increase in intensity, especially from September to November, which could result in floods with more severe issues (World Bank, 2021).
Cyclone	
<ul style="list-style-type: none"> In 2015, cyclone Chapala was the first known hurricane-strength storm to make landfall in Yemen since modern records began in the 1940s (Republic of Yemen, 2018). 	

2.2 Reduce health impacts of climate change

Yemen's health sector is in a dire state due to water scarcity, declines in agricultural production and the ongoing war (Mohamed *et al.*, 2017; USAID, 2017). Malnutrition and waterborne diseases due to drought-related water scarcity and poor hygiene and sanitation are some of Yemen's worst health challenges. In addition, the health care system in the country is almost collapsing, with the addition of climatic stress expected to compound and complicate health care access challenges (Al-Mekhlafi, 2018).

In addition to other challenges, frequent droughts are driving water scarcity and are the leading cause of disease outbreaks (Mohamed *et al.*, 2017). Limited access to safe and affordable water has increased the number of people exposed to waterborne diseases, especially cholera. In this context, the relatively high malnutrition rates increase and compound risks related to cholera infection (Simpson *et al.*, 2021). In addition, water scarcity and inadequate waste management and sanitation facilities have led to some of the worst cholera outbreaks (IOM, 2021). Yemen was hit by the worst cholera outbreak in the world starting in 2016 (Al-Mekhlafi, 2018). Over 2.1 million out of the estimated 28.6 million people in Yemen have been infected with cholera, and more than 3000 people reportedly died as a result of this disease in June 2020 (Ng *et al.*, 2020).

Whereas economic crisis and conflict are the primary causes of food insecurity and malnutrition in the country, declining agricultural productivity due to climate change related droughts is also a contributing factor (UNICEF *et al.*, 2022; USAID, 2017). About 17.4 million Yemenis are food insecure, which could increase to 19 million in December 2022 (WFP, 2022). In 2021, 2.3 million children under the age of five suffered from acute malnutrition and of these, 400,000 faced severe acute malnutrition with high risks of death (WHO, 2021).

The incidence and prevalence of vector-borne diseases, especially malaria, are expected to increase due to climate change (Al-Akel, 2020; Mohamed *et al.*, 2017; USAID, 2017). In addition, increased floods and storm surges could lead to displacements, deaths and injuries (OCHA, 2021; USAID, 2017). Furthermore, displacements and food and water insecurity will further exacerbate mental health challenges caused by long periods of armed conflict (Al-Akel, 2020).

Floods also damage medical infrastructures and prevent medical service delivery (UN RC/HC Yemen, 2021). More than one in four (8 million) Yemenis suffer from mental and psychological problems (Cook & Eshaq, 2022). Food and water insecurity will worsen the existing mental health challenge due to increasing droughts.

2.3 Sustainable water: resources management, infrastructure and access

Water, Sanitation, Hygiene

Water scarcity is one of the most significant challenges faced by Yemen. Droughts and temperature increases will worsen the water crisis, which is one of the worst in the world (USAID, 2022). Excessive droughts and higher temperatures are expected to compound the crisis through increased evaporation and runoff and decreasing water infiltration (Petersen *et al.*, 2022; Suliman, 2019).

Recent studies indicate that high population growth, inefficient agriculture, lack of water abstraction regulation, excessive use of water to grow qat and intensive droughts are the five fundamental causes of Yemen's water crises (Glass, 2010). The country has the lowest water per capita in the world (Netherlands Ministry of Foreign Affairs, 2018). Sana'a is the world's most water-stressed area, drawing water from the Arabian aquifer system, the most stressed aquifer (USAID, 2017). The city could run out of water due to drought and increasing population. When water is scarce, women and girls suffer more, and water can easily be weaponised in contexts such as Yemen (Harrison, 2022; Suliman, 2019).

Decreasing precipitation will also lead to low groundwater recharge rates. Combined with the high population growth rate (estimated at 4% annually), the groundwater abstraction rates exceed recharge by 400% leading to an annual decline in water tables by 6-8 m (Aljawzi *et al.*, 2022), depleting water reserves, creating inequity and shortages, with negative socioeconomic consequences. Therefore, declines in rainfall will further push unsustainable agriculture to more use of groundwater. Overexploitation of groundwater combined with the projected sea-level rise due to climate change will increase the risk of saltwater intrusion, further complicating the water crisis (Netherlands Ministry of Foreign Affairs, 2018; USAID, 2017).

The war has already devastated water infrastructure, including desalination plants (Al-Meh, 2018). Droughts due to climate change, in addition to mismanagement and weak institutionalisation, will likely worsen the country's water crises and may further exacerbate conflicts.

Climate change adaptation investments include efficient irrigation systems and training on harvesting techniques as well as cropping patterns. Integrated management of water resources at all levels is imperative if Yemen is to slow down its current water crisis. An increase in sea levels could lead to the deterioration of Yemeni wetlands, coastal mangrove migration, land erosion, infrastructure damage, and seawater intrusion (UNFCCC, 2015).

Infrastructure, Power and Electricity

Flood events have had major impacts on infrastructure in Yemen, and the risk of heavy rainfall events and flooding is expected to increase with climate change. In 1993–2008, researchers found 19 flood or flash flood events recorded in the country. Irrigation facilities and rural roads were heavily affected by flood events in 2008, which caused high surges in the valleys (Wiebelt *et al.* 2011). In 2020, flash flood events caused impacts in several places across the country, and this has affected infrastructure that delivers power and water to the population (IFRC, 2020). Roads are very susceptible to flood events, and climate change adaptation strategies include techniques for siting roads to address flood risk; building them with attention to permeability and drainage (Willway *et al.* 2008). In rapidly urbanizing areas, the design of adequate drainage systems is critical for adapting to the increased risk of flood events or more erratic rainfall with climate change.

Increased temperature extremes, especially for extended periods, can result in increased morbidity and mortality. This necessitates the promotion of passive (and sometimes active) cooling strategies in building design and construction. Increased temperatures affect the durability of construction materials; for example, the asphalt used for roads can buckle during a heatwave if not designed with rising temperatures in mind (Willway *et al.* 2008). Increased temperatures cause an increase in water evaporation, which can have implications for the availability of surface water and the operation of hydropower facilities.

Additionally, concerns are being raised about the significant risk to Yemeni infrastructure posed by sea level rise and extreme weather events (such as tropical cyclones) on the coasts. Indeed, Yemen has been listed as one of the five most vulnerable low-income countries to these phenomena – more than 50 per cent of its coasts are considered at risk of sea level rise, and 50 per cent of its coastal urban areas are exposed to potential impacts (Al Safaani *et al.* 2015).

2.4 Enable climate resilient livelihoods and economic security

Oil and agriculture are the two most important sectors in Yemen's economy. Oil accounts for almost 30% of GDP, 50% of the national budget revenue, and 70% of all exports (UNFCCC, 2015). Rainfall-dependent traditional agriculture, using primitive methods, employs 50% of the population and makes up 11.4% of the GDP (Mohamed *et al.*, 2017). However, increasing floods and droughts threaten the country's agricultural production and other livelihood sources (UN RC/ HC Yemen, 2021).

In Yemen, reduced water availability due to increasing droughts and rising temperature is the greatest threat to agriculture (FAO, 2019). Agriculture accounts for 90% of water withdrawals in the country, and climate change will reduce water availability (Netherlands Ministry of Foreign Affairs, 2018). Water scarcity will affect agricultural production and negatively impact livelihoods and food security. In addition, droughts account for a 3-5% annual loss of agricultural land (USAID, 2017).

During growing seasons, temperature is rising, rainfall is becoming increasingly variable and an increase in heavy precipitation events, causing significant crop damage and the death of livestock (USAID, 2017). The increase in heavy rains in combination with rising temperatures, especially in the north, could lead to shortened growing seasons. Shorter growing seasons pose another threat to food security (MFA 2018). Historically, regular flooding was beneficial, but the increasing rainfall intensity results in high-magnitude flooding (Netherlands Ministry of Foreign Affairs, 2018). Flooding leads to crop destruction, uprooting of fruit trees, death of animals and damage to agricultural infrastructures such as irrigation facilities and roads. Flood impact is enhanced by desertification, droughts and land degradation, which are partly caused by climate change (Netherlands Ministry of Foreign Affairs, 2018). Damage to coastal ecosystems is anticipated to affect fisheries and hence the precarious livelihoods of **fishing communities** (USAID, 2017).

Yemen's agricultural practices are unique in the sense that it is mostly dominated by small-scale farmers and uses a terrace system of irrigation (Republic of Yemen, 2012). Since precipitation events can be intense in the summer months of July and August, Yemen usually experiences soil erosion and flooding at this time (MFA, 2018). Adaptation to prepare for such extreme precipitation events in the future will be critical. Livestock has been affected by the erratic water balance as well. Rising temperatures affect many of the critical factors for livestock production. Water availability as well as animal production, reproduction and health are all affected, as are forage and water quantity and quality. One adaptation to centralize livestock feed storage is to grow and maintain a fodder bank for community use. Other climate change adaptation supports have included high quality farming supply and seeds, as well as training to expand farmer skill sets.

A large per cent of the population is food insecure; the Famine Early Warning Systems Network (FEWS NET) estimates that, for 2020, 17–19 million people needed humanitarian assistance (FEWS NET 2020a). Yemen is highly vulnerable to food insecurity exacerbated by climate change and faces financial insecurities related to the dwindling of oil revenues (World Bank, 2010).

The country is a net importer of food, and changes in global food prices due to climate change and climate impacts in other countries will have impacts on the purchasing power of Yemenis, especially non-farm rural households. These households are also affected by the lack of agricultural labour opportunities during droughts. To support these households in an era of climate change, researchers recommend investments in rural non-farm employment, such as construction and food processing, while also encouraging opportunities in urban areas (Wiebelt *et al.* 2013).

Climate change adaptation efforts can include diversification of livelihoods, renewable energy projects, enforcement of laws and regulations on the use of natural resources, as well as providing technical solutions to develop and disseminate technology to the rural poor.

2.5 Address climate displacement and protection

Current and future displacement challenges

Yemen is one of the world's worst humanitarian emergencies, with approximately 20.7 million in need of humanitarian assistance at the end of 2021, including 4.3 million IDPs (IDMC 2022). Over 377,000 people were displaced in 2021 alone (*ibid.*). Between 2008-2021, over half a million (518,167) disaster displacements were recorded, primarily due to flooding and storms (IDMC 2022). Yemen also hosts 95,815 refugees and asylum-seekers, mainly from Somalia and Ethiopia (UNHCR 2022).

The climate crisis is compounding the humanitarian situation and displacement crisis in Yemen, and will likely continue to exacerbate it as extreme rainfall and related flooding, alongside drought and other hazards become more frequent and severe (UN RC/HC Yemen 2021). The conflict is also contributing to environmental degradation such as deforestation due to fuel shortages arising from blockades and restrictions (Islamic Relief 2022), which will have long-term negative impacts on the country's development and may necessitate future migration. Rapid urbanisation has also led to the environmental degradation of cities in Yemen (Republic of Yemen 2018).

IDPS camps in Yemen are particularly vulnerable to extreme weather events such as flooding, in part due to poor infrastructure and limited disaster risk reduction safeguards which do not tend to consider the impacts of climate change. Hazards include flood events that can quickly destroy the limited infrastructure in camps, as well as heatwaves that leave people with few options for cooling and shelter. A recent flood risk score for IDP sites in Yemen found that 307 sites were at high risk of flooding, 23 at medium/high risk and 338 sites were at medium risk – meaning that almost half (45%) of IDP sites are at risk (REACH/CCCM 2022). Recent floods in 2020 in Maarib province, for example, destroyed tents and assets of 1,340 families in camps for displaced people in Yemen (Aljazeera 2020) while 2013 flooding affected more than 8,000 IDPs in camps and destroyed local infrastructure including latrines, schools and a health clinic (The New Humanitarian 2013).

Secondary displacement is a rising problem in Yemen, wherein already displaced people are displaced again due to conflict and/or climate disasters (IDMC 2022). Research finds that displaced people are more likely to settle in hazard-prone parts of cities or regions, often in informal settlements, which increase the likelihood that they will be forced to move again (Migration and Global Environmental Change 2011, IDMC 2018). This is a particular issue as displacement may have cut or eroded social networks and depleted assets, leaving displaced people with fewer resources for coping or adaptation.

While climate factors play a role in migration between districts in Yemen, most migration is driven by socio-economic variables with the poorest in fact lacking the resources to move (Joseph and Wodon 2013, Joseph *et al.* 2014).

Potential needs for migrants and displaced people

IDPs in Yemen, particularly those in camps, are in need of durable WASH support, as most assistance come from water trucking and temporary latrines rather than permanent infrastructure (OCHA 2022). This becomes all the more necessary in the face of extreme weather events such as flooding, as poor solid waste management increases public health concerns in camps, such as water-borne disease outbreaks.

Migration Law and Policies

- [1951 Convention relating to the Status of Refugees and its 1967 Protocol, 1980](#). Yemen is the only country in the Arabian Peninsula signatory to the 1951 Refugee Convention, which is particularly important as it is a transit point for migrants and asylum seekers from the Horn of Africa and beyond.
- [National Migration Policy](#), 2010. In 2010 with the support of IOM and the EU, Yemen initiated a national migration policy; however it is unclear if it was ever completed or is functional.

Protection

People in detention frequently have heightened vulnerability to disasters due to spatial marginalization resulting from prison locations on hazard-prone land and/or isolation from emergency evacuation services; limited to no connections to social networks, which are crucial aspects to hazard resilience; and political marginalization, including lack of policies and services to prevent disaster impacts on imprisoned populations (Gaillard and Navizet 2012). These vulnerabilities, coupled with more frequent and intense disasters due to climate change, may leave prison populations in especially precarious positions to hazards such as extreme heat and flooding.

2.6 Policy

Relevant information from the [Intended National Determined Contribution \(INDC\)](#)

Yemen has signed by not ratified the Paris Agreement to date. Yemen have not submitted a National Determined Contribution nor transferred its INDC to be used as such.

Emission target: 14 percent GHG emission reduction target by 2030 below BAU

Area of focus on Adaptation: water management (including rainwater), agriculture, land management, livelihood and ecosystem management, costal and marine resources management, and institutional capacity building on resilience.

Inclusion of DRR: Yes, 'disaster risk management including flood and drought management' is one of the adaptation priorities.

National Designated Entity: Environment Protection Agency

Other National Policies on Climate

- [Third National Communication to the UNFCCC](#) (2018). The communication includes detailed adaptation measures on water resources, costal zones, agriculture, public health and ecotourism. Disaster preparedness is part of the adaptation assessment framework of the country and the objectives related to increasing the resilience communities along the Red Sea. It also includes references to climate-induced migration as an issue to be addressed through adaptation, particularly in relation to the impacts of sea level rise and increase cyclonic activity in coastal areas. (Republic of Yemen, 2018).
- Yemen aims to develop a National Adaptation Plan building on its INDC and National Adaptation Programme of Action (NAPA) from 2008 which as already been partially implemented (Republic of Yemen, 2015).
- The environmental framework of the country includes the National Strategy for Renewable Energy and Energy Efficiency and the National Water Sector Strategy and Investment Program, the Strategy Sector Agriculture and the National Biodiversity Strategy and Action Plan (NWSSIP-2009) (Republic of Yemen, 2015).

Climate finance

Green Climate Fund Readiness activities are taking place in Yemen (GCF, 2022). National societies cannot directly apply for climate finance from [the GCF](#), but they can be an implementing partner for an accredited entity (Climate Centre, 2022a).

National Societies can explore options for accessing climate funds through smaller funds, such as the [GEF's Small Grants Programme](#) or the [FFEM's Small Scale Initiatives Program](#). Other funding from bilateral donors, national climate funds, or multilateral climate funds like Adaptation Fund, CREWS, or GCCA+ could be explored (Climate Centre, 2022a).

Engaging in national climate adaptation planning is vital for accessing climate finance.

Additional Resources

Climate Centre. (2022a). Factsheet on Climate Finance. <https://www.climatecentre.org/wp-content/uploads/Fact-Sheet-on-Climate-Finance.pdf>

Climate Centre. (2022b). Entry points for National Societies on Climate Finance partnerships. <https://www.climatecentre.org/wp-content/uploads/Entry-Points-for-Climate-Finance-Partnerships.pdf>

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