

Yemen

This climate factsheet summarizes the available information on the climate of Yemen and the impact of climate change on humanitarian activities in-country. Each fact sheet in the series was written using information from peer-reviewed academic papers, government publications, and other documentation from international non-governmental organizations

1. Climate overview

Average temperature: Annual average temperature in Yemen is 25.5°C. The country has a tropical arid and semiarid climate along its coast and inland desert, while in the highlands it's subtropical and temperate with wide temperature ranges. There are two monsoonal rainy and dry seasons. During the warm season, between May and September, the temperature range is between a minimum of 22.4°C in September and maximum of 36.5°C in June. The coolest months are between November and February, with an average minimum of 13°C in January and maximum of 28.9°C in November.

Average rainfall: The coastal plain usually remains dry and hot and receives less than 50mm of rainfall per year, while the high plateaux receive between 100–600mm of rainfall annually (USAID, 2016). In some places, the annual rainfall has been decreasing in recent decades, generally affecting the hot, dry summer months of June to September (USAID, 2016). The majority of Yemen's north-eastern plain is a desert.

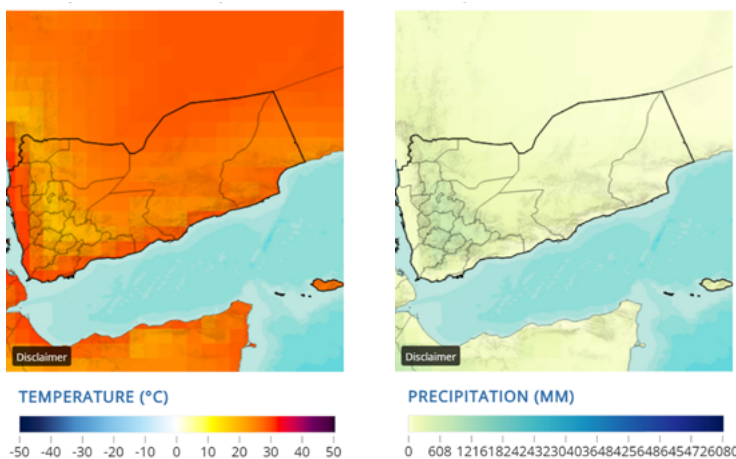


Figure 1: Observed climatology of (left to right) mean temperature and mean precipitation over 1991–2020 (from the World Bank Climate Change Knowledge Portal).

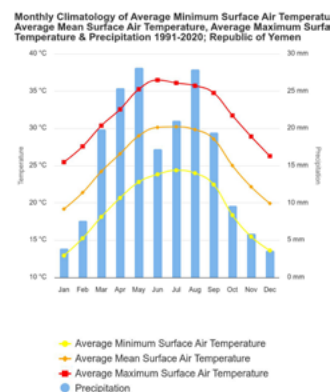


Figure 2: Observed average monthly climatology between 1991–2020 (from the World Bank Climate Change Knowledge Portal).

Short overview

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

In general, winters in the high plateaux can be cold (below 0°C) and summers are temperate and dry. "Monsoon climate patterns dictate the seasons, with winter (December to March) and summer (June to September) corresponding to different monsoon seasons. Spring (April to May) and fall/autumn (October to November) are transition periods that separate the seasons" (Republic of Yemen, 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 1971–2020, the temperature has increased by 0.42°C per decade (World Bank, 2023). 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 (Republic of Yemen, 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 plateaux (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 to November (MoFA, 2018). ▪ Sea levels are projected to continue rising, with estimates of 0.30–0.54m by 2100 (Republic of Yemen, 2013). |
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2. Priorities of the Red Cross Red Crescent Movement under climate change

2.1 Scale up climate-smart disaster risk reduction (DRR), early action and preparedness

Ranked 3rd out of 191 countries by the 2022 Inform Risk Index, Yemen is considered one of the most at risk countries in the world (DRMKC, 2022).

Observed hazard

Projected risk

Droughts

- Yemen’s water crisis is among the worst in the world (World Bank, 2021). Most of the country is considered at high risk (except for Abyan, Lahij, and Shabwah where the risk is medium), meaning that ‘droughts are expected to occur on average every five years’ (Think Hazard!, n.d.).
- 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 per cent (World Bank, 2021). Additional pressure on agriculture will be felt with the projected increases in temperature and prolonged drought periods. This could result in some areas losing ‘their economic viability as well as drinking water supplies, causing displacement and resettlement’ (World Bank, 2021).

Floods

- In 2018–2022, IFRC supported multiple interventions related to floods each year (IFRC, 2022). Yemen is prone to coastal flooding as well as floods resulting from extreme weather (Think Hazard!, n.d.). Rainfall is seasonally intense, with short heavy storms often resulting in (flash) floods causing soil degradation – which is amplified by frequent subsequent periods of drought (World Bank, 2021).
- Rainfall is projected to increase in intensity, especially from September to November, which could result in floods with more severe impacts (World Bank, 2021).

Cyclones

- In 2015, Cyclone Chapala was the first known hurricane-strength storm to make landfall in Yemen since modern records began in 1940s (Republic of Yemen, 2018).

It is important to note that many of these hazards are interrelated and produce compound risks in the same areas and communities. In addition, risk must be understood as the interplay between hazard, exposure and vulnerability which makes certain individuals, communities and sectors more impacted by the hazards. All project design should take such compounding risks into account.

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). The conflict in Yemen began in 2014 when the Houthis took control of Sana'a, Yemen's capital, demanding lower fuel prices and a new government. However, with the involvement of other regional and international actors, the violence and unrest has been intensified (GCT, 2024). Malnutrition and waterborne diseases due to drought-related water scarcity as well as poor hygiene and sanitation are some of Yemen's worst health challenges. The healthcare system in the country is already almost collapsing, with the addition of climatic stress expected to compound and complicate healthcare access challenges (Al-Mekhlafi, 2018).

In addition, frequent droughts are driving water scarcity and are the leading cause of disease outbreaks in the country (Mohamed *et al.*, 2017). For example, water scarcity along with inadequate waste management and sanitation facilities have led to some of the worst cholera outbreaks (IOM, 2021). In fact, Yemen was hit by the worst outbreak of cholera in the world in 2016 (Al-Mekhlafi, 2018). Today, over 2.1 million people out of an estimated population of 28.6 million people in Yemen have been infected with cholera, and more than 3,000 people reportedly died as a result of the disease in June 2020 alone (Ng *et al.*, 2020). In this context, the already high malnutrition rates compound the risks related to cholera infection (Simpson *et al.*, 2021).

Whereas economic crises 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). Although 2023 was the most peaceful year in Yemen since the start of the war, 16.7 million people – around half of the population – suffered acute hunger; out of which 6.1 million people were facing emergency levels of food insecurity. Malnutrition persisted widely affecting 2.2 million children and 1.3 million pregnant or breastfeeding women and girls who needed treatment for acute malnutrition. Almost half of children under five years old were estimated to suffer from chronic malnutrition, with one-in-five severely stunted. Approximately 21.6 million people – close to 70 per cent of Yemen's population – are in need of humanitarian assistance (WFP, 2024).

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 along with food and water insecurity will further exacerbate the mental health challenges caused by long periods of armed conflict (Al-Akel, 2020).

Floods also damage medical infrastructure 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 due to increasing droughts will worsen the existing mental health challenges.

2.3 Ensure sustainable water supplies

Water, Sanitation, Hygiene (WASH)

Water scarcity is another significant challenge faced by Yemen. Droughts and temperature increases will worsen the water crisis, which is already 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 along with decreased water infiltration (Petersen *et al.*, 2022; Suliman, 2019).

Recent studies indicate that high population growth, inefficient agriculture, lack of regulation of water abstraction, 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 – Yemen's capital city – is the world's most water-stressed area, drawing water from the Arabian aquifer system, the most stressed aquifer in the world (USAID, 2017). The city could run out of water due to recurrent droughts and the increasing urban population. When water is scarce, women and girls suffer more, and water can easily be weaponized in contexts such as Yemen (Harrison, 2022; Suliman, 2019). Women often lead households and spend a considerably larger portion of their time on domestic tasks including laundry, cooking and cleaning, which are largely water-dependant. Thus, when water shortages occur, women are the ones who must cope with the practical consequences of water insecurity, such as making longer journeys to collect freshwater. These bring health issues associated with expending higher energy, time and stress. Moreover, lack of clean running water and sanitation facilities lead to specific gynaecological problems for women such as urinary tract infections and cystitis (Harrison, 2022).

Decreasing precipitation will also lead to low groundwater recharge rates. Combined with the high population growth rate (estimated at 4 per cent annually), groundwater abstraction rates already exceed recharge by 400 per cent, leading to an annual decline in water tables by 6–8m (Aljawzi *et al.*, 2022), depleting water reserves, creating inequity and shortages, with negative socioeconomic consequences. Declines in rainfall will further push unsustainable agriculture towards the greater 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 (UNICEF, 2018). Droughts due to climate change, in addition to mismanagement and weak institutionalization, 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 (Republic of Yemen, 2015).

Infrastructure 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, which affected the 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 these risks; 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 more 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). An increase in sea levels could lead to the deterioration of Yemeni wetlands, coastal mangrove migration, land erosion, infrastructure damage and seawater intrusion (Republic of Yemen, 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 per cent of GDP, 50 per cent of the national budget revenue, and 70 per cent of all exports (Republic of Yemen, 2015). Rainfall-dependent traditional agriculture, using primitive methods, employs 50 per cent of the population and makes up 11.4 per cent 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 per cent of water withdrawals in the country, and climate change will seriously 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 per cent annual loss of agricultural land (USAID, 2017).

During growing seasons, the temperature is rising, rainfall is becoming increasingly variable and there is 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 (MoFA, 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 fruit trees, killing animals and damaging agricultural infrastructure such as irrigation facilities and roads. The impact of flooding is enhanced by desertification, drought 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 already precarious and unpredictable 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 already be intense in the summer months of July and August, Yemen usually experiences soil erosion and flooding at this time (MoFA, 2018). Adaptation to prepare for more extreme precipitation events in the future will be critical. Rising temperatures also affect many of the critical factors for livestock production, which is affected by the erratic water balance too; for example, the availability of forage as well as water quantity and quality for animals. Animal production, reproduction and health are all affected. One adaptation possibility is to centralize livestock feed storage to maintain a fodder bank for community use. Other climate change adaptation initiatives have included the provision of high-quality farming supplies and seeds, as well as training to expand farmers' skill sets.

A large percentage of the population is food insecure; the Famine Early Warning Systems Network (FEWS NET) estimates that, in 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 its impacts in other countries have implications 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 a changing climate, researchers recommend investing in rural non-farm employment, such as construction and food processing, while also encouraging opportunities in urban areas (Wiebelt *et al.*, 2013).

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 people in need of humanitarian assistance at the end of 2021, including 4.3 million internally displaced persons (IDPs) (IDMC, 2022). Over 377,000 people were displaced in 2021 alone (*ibid*). In 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 urbanization has also led to the environmental degradation of cities in Yemen (Republic of Yemen, 2018).

IDP 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 per cent) of IDP sites are at risk (REACH/CCCM, 2022). Recent floods in 2020 in Marib 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 increases the likelihood that they will be forced to move again (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 socioeconomic variables with the poorest often lacking the resources to move (Joseph & Wodon 2013; Joseph *et al.*, 2014).

Potential needs of migrants and displaced people

IDPs in Yemen – particularly those in camps – are in need of durable WASH support, as most assistance comes from water trucking and temporary latrines, rather than permanent infrastructure (OCHA 2022). This becomes even 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 outbreaks of waterborne disease.

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 that is a 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 support from the International Organization for Migration (IOM) and the European Union (EU) – Yemen initiated a national migration policy; however, it is currently 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 & 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 Nationally Determined Contribution \(INDC\)](#)

To date, Yemen has signed but not ratified the Paris Agreement; nor has Yemen submitted a Nationally Determined Contribution or transferred its INDC to be used as such.

Emission target: A 14 per cent reduction in greenhouse gas emissions by 2030, below business and usual.

Area of focus on adaptation: Water management (including rainwater), agriculture, land management, livelihood and ecosystem management, coastal 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, coastal zones, agriculture, public health and ecotourism. Disaster preparedness is part of the adaptation assessment framework of the country and objectives relate to increasing the resilience of 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, as well as a National Adaptation Programme of Action (NAPA), which has already been partially implemented since 2008 (Republic of Yemen, 2015).
- The environmental framework of the country includes the National Strategy for Renewable Energy and Energy Efficiency as well as the National Water Sector Strategy and Investment Program and the National Biodiversity Strategy and Action Plan (Republic of Yemen, 2015).

Climate finance

There are currently five Green Climate Fund (GCF) readiness activities taking place in Yemen (GCF, 2022). These are: i) [Strengthening and country programming support of National Designated Authority](#); ii) [enabling strategic frameworks for engagement with the GCF](#); iii) [strengthening the capacities of sub-national authorities and key actors in the water sector to adapt to climate change in the Tuban delta](#); iv) [supporting Yemen's low emissions development through the preparation of Nationally Determined Contribution](#) and v) [supporting Yemen in developing its long-term low emission development strategy and measuring, reporting and verifying system for climate finance and support received](#). National Societies cannot apply directly 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 the 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). *Fact sheet on climate finance*. Red Cross Red Crescent Climate Centre. <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*. Red Cross Red Crescent Climate Centre. <https://www.climatecentre.org/wp-content/uploads/Entry-Points-for-Climate-Finance-Partnerships.pdf>

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