CLIMATE LANDSCAPE ANALYSIS FOR CHILDREN IN YEMEN

Condensed version

November 2023

This report was prepared by Mark Henderson (consultant). He is solely responsible for the opinions and conclusions expressed in this report. Warm thanks are extended to everyone who contributed their time and shared their knowledge of the subject matter for this report.

RELIEF MAP OF YEMEN

Source: Maps of the world, Vidiani.com

TABLE OF CONTENTS

CCRI	Children's Climate Risk Index
CEED	Climate, Environment, Energy and DRR
CH_4	methane
CLAC	Climate Landscape Analysis for Children
CO_2	carbon dioxide
COVID-19	SARS-CoV-2
CWD	children with disabilities
DFA	de facto authorities
DRM	disaster risk management
DRR	disaster risk reduction
EE	energy efficiency
ESS	environmental and social safeguarding
EU	European Union
EPA	Environmental Protection Authority
FAO	United Nations Food and Agriculture Organization
GCF	Green Climate Fund
GEF	Global Environment Facility
GDP	gross domestic production
GFDRR	Global Facility for Disaster Reduction and Recovery
Gg CO_2e	Giga gram (billion grams/million tonnes) carbon dioxide-equivalent
GHG	greenhouse gas
GIZ	German Agency for International Cooperation
HCF	healthcare facility
HDP	humanitarian-development-peacebuilding
IDP	internally displace people
INDC	Intended Nationally Determined Contributions
IRG	Internationally Recognized Government of Yemen
IWRM	integrated water resources management
MENA	Middle East and North Africa
MoE	Ministry of Education
MoPHP	Ministry of Public Health and Population
MoWE	Ministry of Water and Environment
NAPA	National Adaptation Programme of Action
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions
NSREEE	National Strategy for Renewable Energy and Energy Efficiency
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NWSSIP	National Water Sector Strategy and Investment Plan
NWRA	National Water Resources Authority
O_3	ozone
PM	particulate matter
$PM_{2.5}$	ultra fine PM

PM_{10}	coarse PM
RE	renewable energy
SDG	Sustainable Development Goal
solar PV	solar photovoltaic
TEP	Transitional Education Plan
TVET	technical and vocational education and training
UCT	unconditional cash transfers
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Habitat	United Nations Human Settlements Programme
UNICEF	United Nations Children's Fund
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
WASH	water, sanitation and hygiene
WB	World Bank
WEC	Water and Environment Centre
WTU	waste treatment unit

EXECUTIVE SUMMARY

UNICEF ranks child risk in Yemen as "extremely high severity" due to exposure to climate and environmental shocks and vulnerabilities caused by limited access to essential health, water and sanitation, education and child protection services. Climate change and environmental degradation undermine the rights of every child.

The Climate Landscape Analysis for Children (CLAC) was commissioned by UNICEF Yemen to review the climate, environment, energy and disaster-risk reduction (CEED) situation and its impacts on children.

CLIMATE STAKEHOLDERS AND POLICIES

Yemen has signed and participates in key global climate agendas under the leadership of the Environmental Protection Authority (EPA), the nationally designated authority for the UN Framework Convention on Climate Change (UNFCCC). The management of natural resources and environment falls under the jurisdiction of several key ministries; however, institutional instability and dual governments have undermined their effectiveness. Fragmentation and duplication of complex CEED issues across sectors and institutions create a vast network of government stakeholders. The United Nations programmes, development partners and international financial institutions also play important roles in the CEED space in Yemen, but the focus in recent years has been on providing urgent humanitarian assistance.

In general, national climate policies and strategies that guide the climate, environment and energy agenda in Yemen are not child-sensitive, sometimes lacking any reference to children and youth. Similarly, child-relevant sectoral strategies make weak connections with climate challenges and how they affect their sectors, and many make no reference at all.

CLIMATE TRENDS AND ENVIRONMENTAL THREATS

Rising temperatures will intensify and extend heatwaves and droughts, exacerbating land degradation and water scarcity, and damage coastal ecosystems. Annual rainfall is decreasing while becoming more variable and unpredictable. Water scarcity coupled with flood events endanger livelihoods, trigger conflicts over land and water resources, and provoke greater displacement and urban migration.

Yemen's agriculture is under duress leading to food insecurity. Water is a key factor, either due to erratic rains or to flood damage. The agricultural sector consumes 91 per cent of water in Yemen, contributing to depleted groundwater resources. Urban encroachment, coastal groundwater salinity, overgrazing, soil erosion, droughts and desert locusts all impact the struggling sector.

The energy sector depends on petroleum products, with the largest consumers being transportation, households and electricity production. Domestic oil production has plummeted since 2015, and fuel prices have soared. Even prior to the conflict, Yemen had the lowest installed electricity generation capacity as well as the lowest electricity access rate in the region. Yemen contributes a tiny portion of global CO_2 emissions. Solar photovoltaic energy continues to gain ground as Yemenis seek reliable off-grid alternatives, and farmers have adopted solar for irrigation, placing additional pressure on fragile aquifers. Wind and geothermal energy potential are largely untapped but promising.

IMPACTS ON CHILDREN

Of the global burden of disease attributable to climate change, 88 per cent is borne by children. Children are most at risk of the impacts of extreme weather events and heatwaves, aggravated by malnutrition and scarcity of clean water. In Yemen, increases in water- and vector-borne diseases can be anticipated, as well as heightened child deprivation due to repeated climate shocks that overwhelm traditional coping mechanisms. And when urgent care for children is required, access to health services is a challenge for many Yemeni families.

Land degradation and food and water insecurity provoke displacement and contribute to poverty, conflict, violence, and exploitation, putting children at risk. Climate-driven humanitarian disasters drive large-scale displacement and require responsive child protection services – psychosocial support, prevention of gender-based violence, and family reunification – to meet the challenge. Population growth coupled with more frequent droughts will lead to greater competition for water for domestic uses, irrigation and industry. Water supply coverage in Yemen is dangerously low, and 39 per cent of the population either have limited access or unsafe drinking water.

Climate and environmental threats exacerbate poor access, poor retention and poor learning outcomes for Yemen's school children. Floods damage poorly designed or situated schools, and heatwaves call for investment in school ventilation and more green spaces. In urban environments, air pollution threatens children's health, raising their risk for chronic diseases such as cardiovascular disease later in life.

RECOMMENDATIONS

MAKE CHILDREN A FOCUS OF ENVIRONMENTAL STRATEGIES

UNICEF should seek to make children visible in new climate and environment policies and strategies in Yemen. UNICEF should advocate with government and business partners to put children first in their sustainability plans, budgets and actions towards a green transition.

EMPOWER CHILDREN AS AGENTS OF CHANGE

UNICEF should team up with youth-led organizations, fostering youth participation and engagement for a safe and protective environment. Joining forces with development partners, UNICEF should support initiatives to equip young people with the knowledge, tools, and resources to be effective advocates in the climate change debate.

PROTECT CHILDREN FROM CLIMATE CHANGE IMPACTS

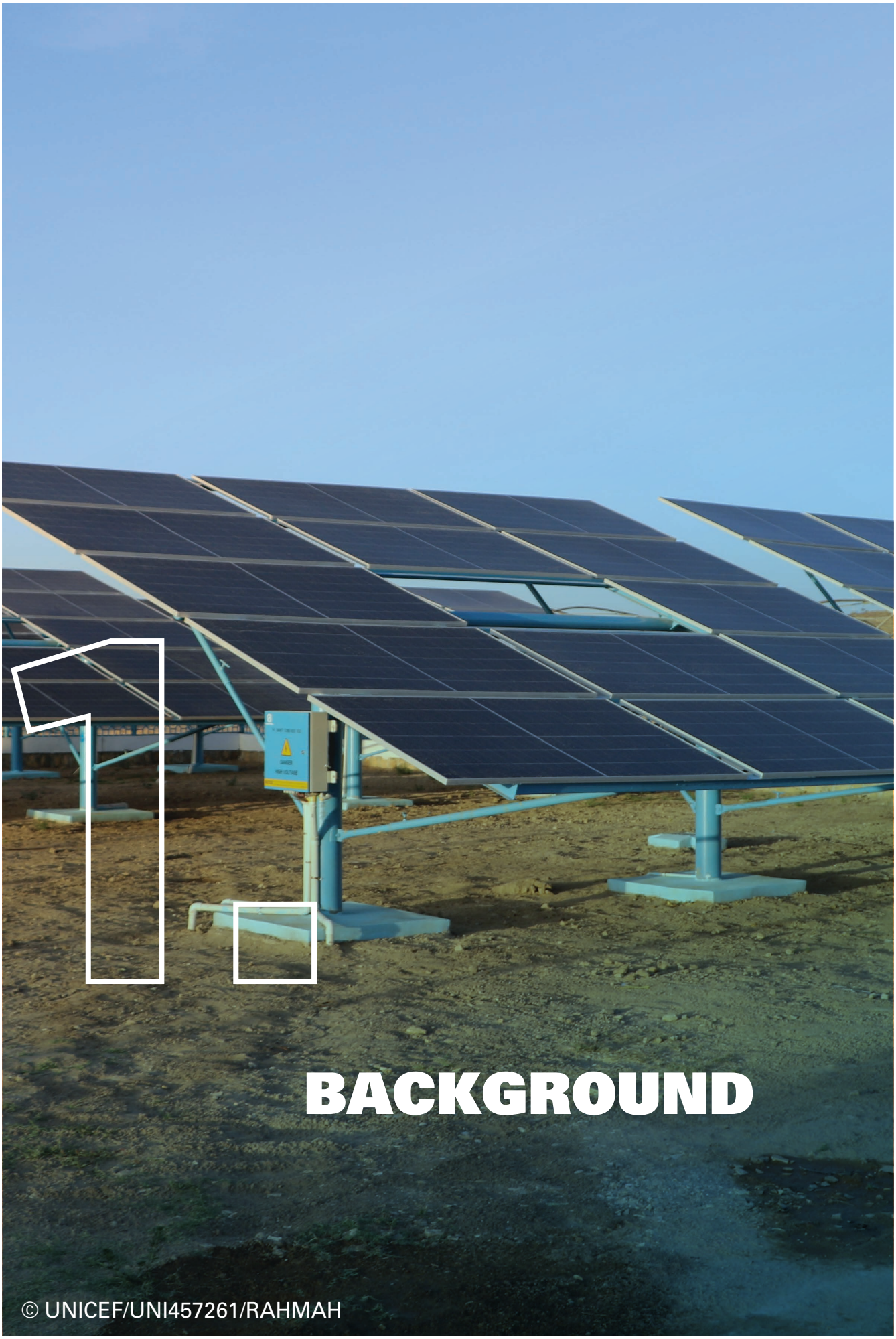
UNICEF should strengthen the resilience and continuity of social services to climate and environmental impacts, including disasters. UNICEF's support to health, nutrition, WASH, education, child protection and social protection is the core of its contribution to a better world for children.

REDUCE EMISSIONS AND POLLUTION

Greater investment in solar power for off-grid communities will contribute to better social services and community resilience. UNICEF, government authorities, development partners, and the private sector must commit to a safe environment for children, with clean water and improved waste management. UNICEF should examine child exposure to indoor and outdoor air pollution – in high-traffic areas, near dump sites, and at hazardous workplaces – to address evidence gaps.

CONCLUSION

A healthy environment is the best protection against the impacts of climate change. Economic prosperity, and human survival itself, depend upon nature. Functioning ecosystems and biodiversity buffer the planet from the worst effects of climate change. UNICEF in Yemen can work with all climate and environment stakeholders to ensure that investments in children produce tangible benefits for nature.



1 BACKGROUND

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1.1 COUNTRY SETTING

Yemen is home to a rapidly growing population of 33.7 million people[1]. Almost half are under the age of 18, and 40 per cent of the population live in urban areas.[2] There are about 4.3 million internally displaced people (IDP) due to war, disasters and economic hardship and about 100,000 migrants and asylum seekers from Ethiopia and Somalia.[3] Food insecurity, rising prices, floods, cholera and the COVID-19 pandemic have all exacerbated pre-existing vulnerabilities for Yemeni households. More than 2.3 million children under five years of age have acute malnutrition, including 538,000 suffering from severe acute malnutrition.[4] The United Nations estimates that 21.6 million people need humanitarian assistance in 2023.

The UNDP Human Development Index ranks Yemen 183rd among 191 countries in the composite measurement of long and healthy life, knowledge, and decent standard of living, placing it in the category of low human-development countries.[5]

1.2 CONFLICT

Yemen's current armed conflict started in 2015, setting the scene for a protracted political crisis characterized by fragmented governance reinforced by religious, tribal and regional divides.[6] Conflicts in Yemen have long been interwoven with tensions over access to natural resources such as water, land and oil. Currently, a fragile UN-negotiated truce is holding in which DFA controls most of North Yemen and IRG controls parts of Central and South Yemen.

Eight years of conflict have left Yemen with extensive damage to key infrastructure: roads and bridges have been bombed, critical facilities have been left without electricity, and water and sanitation services have been significantly impacted. The human toll has been staggering with 158,000 killed, including 15,700 civilians.[7] UNICEF reports over 11,000 children killed or maimed. The conflict has touched every aspect of life in Yemen.

1 Yemen, Rep. | Data (worldbank.org)
2 UNICEF State of the World's Children 2023 SOWC-2023-full-report-English.pdf (unicef.org)
3 UNOCHA Humanitarian Needs Overview 2023 Yemen_HNO_2023_final.pdf
4 UNICEF Yemen Nutrition Programme Update presentation, 2023
5 UNDP Human Development Index HDR21-22_Statistical_Annex_HDI_Table.xlsx (live.com)
6 World Bank Yemen Country Engagement Note, 2022 World Bank Document
7 Yemen: Uncertain Trajectory, ACLED, 2023 Conflict Watchlist 2023: Yemen (acleddata.com)

1.3 CHOLERA AND COVID-19

The shock of the cholera epidemic only deepened the economic and humanitarian disaster precipitated by the conflict. Starting in 2016, UNICEF, WHO and an army of partners contained one of the world's worst cholera outbreaks through community mobilization, WASH and health responses, deployment of rapid response teams and scaled-up treatment.

When COVID-19 hit Yemen in 2020, conflict had already disrupted children's education, and two million children were out of school. Many teachers and health workers had not been paid for years. The health sector in Yemen strained to provide services amid the pandemic and child vaccination rates stagnated, with 28 per cent of children under one year missing routine vaccinations[8].

The pandemic spotlighted the inter-relationship between climate change, environmental degradation and disease, and it amplified the inequities that result in differential impacts on communities that are most affected by water, food and livelihood insecurities. The health and socio-economic implications of COVID-19, as well as ongoing climate hazards of floods and drought continue to place millions of children and their families in Yemen under duress. Climate change remains the greatest long-term threat to child survival and well-being, and it is critical that climate action and resilience remain at the forefront of UNICEF programming.

8 UNICEF Yemen Country Office Annual Report, 2022 RAM3 COAR.rdl (unicef.org)

2

CLIMATE, ENVIRONMENT, ENERGY AND DISASTER RISK REDUCTION IN YEMEN

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2.1 CLIMATE

2.1.1 HISTORICAL TRENDS IN TEMPERATURE, PRECIPITATION AND SEA LEVEL

Yemen is a sub-tropical, largely arid country. It is hot and humid along the west coast, temperate in the western mountains, and hot, harsh desert in the east. Temperatures range widely depending on elevation or, in the coastal areas, distance from the sea. Mean temperatures in the highlands range from below 15°C in winter to 25°C in summer, and in the coastal lowlands from 22.5°C in winter to 35°C in the summer.[9]

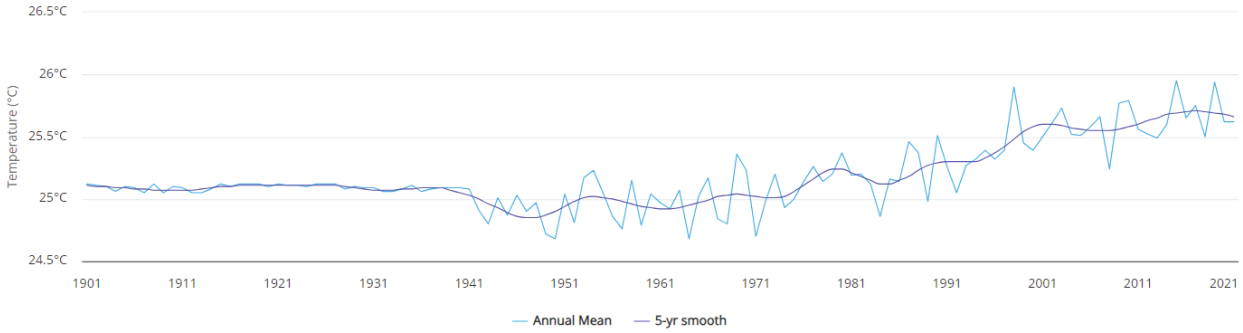


Fig. 2.1. Observed average annual mean temperature, 1901-2021

Source: Yemen, Rep. – Climatology | Climate Change Knowledge Portal (worldbank.org)

The annual mean temperature has increased at a rate of approximately 0.39˚C per decade since 1960, more rapidly than the global average. The increase has been faster in summer (Jun-Aug) at an average rate of 0.56˚C per decade and slower in winter (Dec-Feb) at 0.21˚C per decade.[10] The 120-year record of average annual mean temperature shows this increasing trend and greater variability (Figure 2.1).

Mean annual precipitation in Yemen is 190 mm, and two-thirds of the country is classified as hyper-arid with less than 50 mm per year. The coastal plain rainfall ranges from 10 to 100 mm per year, about 80 per cent of which is received during the winter months. Precipitation increases significantly with elevation, averaging 100 – 600 mm per year on the western side of the Sarawat mountains. Some areas of the western highlands, most notably Ibb and Ta'izz, receive about 1,000–1,500 mm of rain per year, and Sana'a receives around 300 mm per year.[11] Figure 2.3 shows the complex rainfall pattern that reflects topographic extremes.

9 UNDP Country Climate Profiles – Yemen 2012 Microsoft Word - Yemen (ox.ac.uk)
10 Ibid.
11 Water Availability in Yemen, Netherlands/KfW/UNDP/Acacia Water, 2021

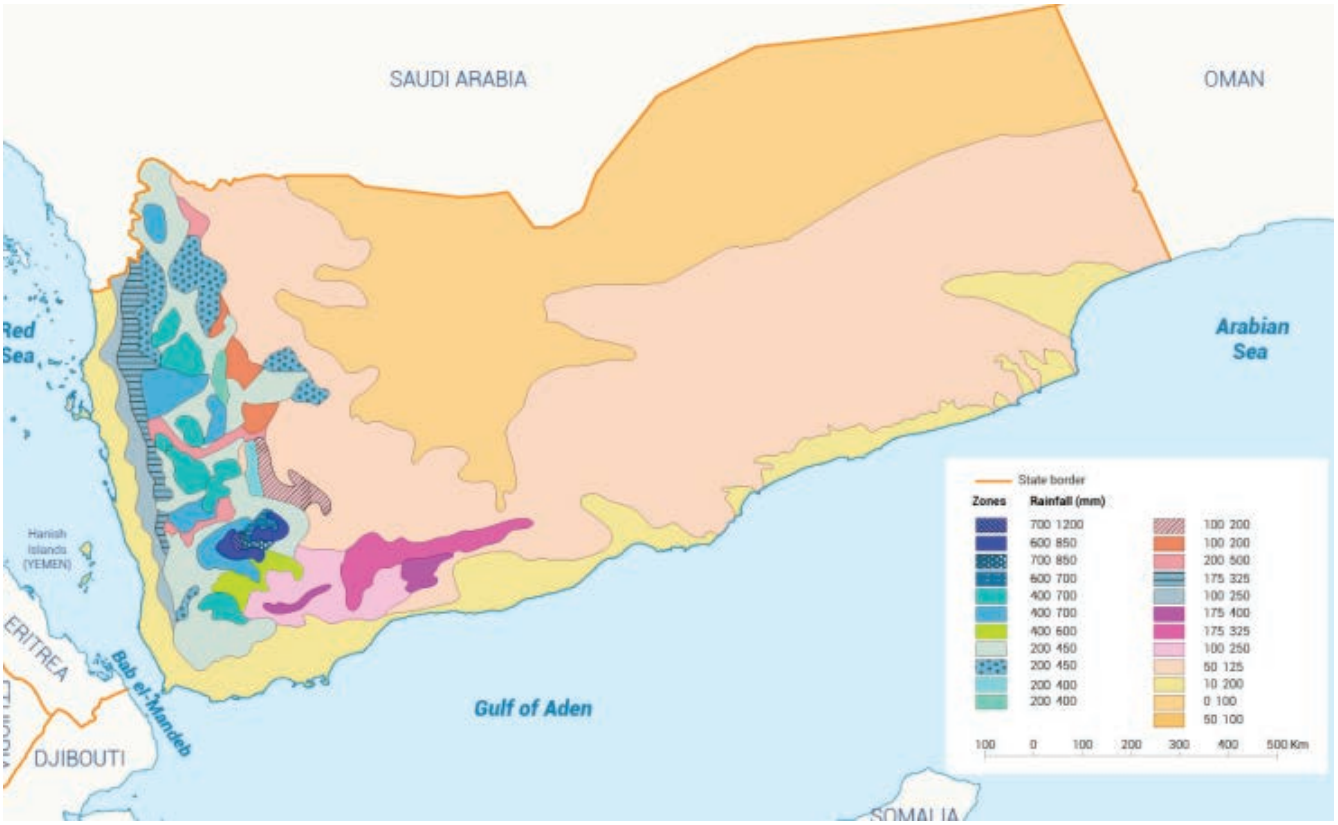


Fig. 2.2. Annual rainfall map of Yemen

Source: Yemen Water Report - Fanack Water

Mean annual precipitation has decreased since 1960 at a rate of 1.2 mm per month per decade, generally during the drier seasons.[12] Across most of the country, evapotranspiration rates far exceed rainfall, resulting in rainwater deficit. Rainfall exceeds evapotranspiration only during high rainfall periods when runoff recharges aquifers and wadi beds.

The Gulf of Aden sea level rose at the global rate of 1.8 mm per year over the period 1992–2012.[13]The rate of global rise of sea level has since accelerated, doubling to 3.6 mm per year.[14]

2.1.2 PROJECTED CLIMATE CHANGES

Average annual temperatures are projected to rise by 1.2°C to 3.3°C by 2060.[15] The projected rate of warming is similar in all seasons but is more rapid in the country's interior than in the coastal areas. The projected rise in temperature will result in an increase in the frequency, du-

12 UNDP Country Climate Profiles – Yemen 2012 Microsoft Word - Yemen (ox.ac.uk)
13 Third National Communication to the UNFCCC, GoY/EPA 2018
14 Climate Change: Global Sea Level | NOAA Climate.gov
15 UNDP Country Climate Profiles – Yemen 2012 Microsoft Word - Yemen (ox.ac.uk)

ration and intensity of droughts and heatwaves.

Precipitation projections are more uncertain than temperature projections, with models suggesting both higher and lower levels of total rainfall for Yemen. Seasonal rainfall will likely increase in variability and unpredictability.[16]

A predicted long-term sea-level rise of 0.30 m to 0.54 m by the end of the century, along with storm surge intensification, has the potential to affect the country's coastline area, coastal population and fisheries economy.[17]

Graphics illustrating Yemen's historical and projected climate trends under a number of scenarios can be generated on the World Bank Climate Change Knowledge Portal.[18]

2.1.3 HAZARDS AND RISKS

Greenhouse gases (GHGs) regulate the balance between incoming solar radiation and outgoing infrared radiation, and more GHGs in the atmosphere cause warming. Warming accelerates soil moisture evaporation, leading to drought, heatwaves and wildfires. Increased evaporation strengthens precipitation, which causes floods. Warming of the oceans enhances evaporation and wind speeds, intensifying storms and worsening floods. Land cover changes release GHGs but also directly modify temperature. Climate change in a nutshell is illustrated by Figure 2.4.

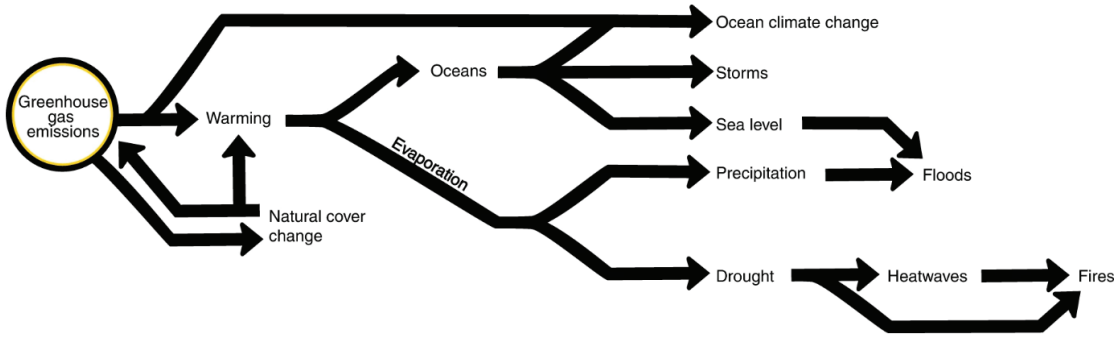


Fig. 2.4. Climate hazards of the Earth's system affected by GHG emissions

Source: Over half of known human pathogenic diseases can be aggravated by climate change | Nature Climate Change

Yemen has very limited capacity to deal with the impacts of climate change, which exacerbate the country's economic vulnerabilities, food insecurity and multiple other ongoing crises. [19]Higher temperatures and more variable rainfall affect agricultural production and hasten depletion of water resources. Crop yields have suffered, directly impacting rural populations and their ability to farm and raise livestock. Higher temperatures by 2060 will increase the risk for drought and heatwaves,

16 Projected climate over the Greater Horn of Africa under 1.5°C and 2°C global warming - IOPscience
17 USAID Climate Change Risk Profile Yemen, 2016 pa00mtzb.pdf (usaid.gov)
18 Yemen, Rep. - Climatology | Climate Change Knowledge Portal (worldbank.org)
19 World Bank Country Engagement Note 2022 World Bank Document

and heavy rains and regular flash floods will continue to cause urban flooding. Coastal cities will be exposed to storm surges, sea-level rise and flash floods. Disease outbreaks create risks with potentially devastating impacts on the health and well-being of the Yemeni people. Table 2.1 summarizes these main climate hazards and the risks they pose in key sectors.

Table 2.1. Climate hazards and risks in Yemen

Sectors	Hazards	Risks
Agriculture	Increased temperatures	Overall decreased agricultural productivity (although crop yields vary among regions)
	Drought	Shifted or shortened growing season
	Floods	Reduced yields and/or crop failure leading to food insecurity and malnutrition
	Increased rainfall variability	Loss of arable land due to desertification and soil erosion
		Increased rural to urban migration due to crop failures and strain on rural livelihoods
Water resources	Increased temperatures	Depleted aquifers due to increased evapotranspiration, reduced aquifer recharge, increased groundwater withdrawals
	Increased rainfall variability and intensity	Reduced access to safe drinking water
		Increased conflict over rights and access to water
	Water scarcity	Flood damage to water supply, sanitation and irrigation infrastructure
Coastal zones	Sea-level rise	Damage to existing infrastructure and acceleration of coastal erosion due to intensification of storm surges and cyclones
	Changes in seawater temperature and salinity	Deterioration of coastal ecosystems and low-lying wetlands, which provide habitats for many key species
	Increase in storm surges	Damage to mangrove systems, which provide vital ecosystem functions and protection against storm surges
		Saltwater intrusion into coastal groundwater aquifers
		Diminished fisheries and associated livelihoods and displacement of coastal communities
Human health	Increased temperatures	Increased risk of waterborne illness (e.g., cholera) due to reduced quality and quantity of safe drinking water
	Increased rainfall variability	Spread and growth of vector-borne diseases (e.g., malaria)
	Drought	Heightened food insecurity leading to increased and severe malnutrition (particularly in children)
	Floods	Displacement, injuries, and death from floods and storms
	Increased storm surges	Deterioration of vital infrastructure (e.g., water systems, roads) and reduced access to healthcare facilities

Adapted from: Climate Change Risk Profile Yemen, USAID, 2017

Floods

Extreme weather brings the risk of flooding that threatens lives and property, damages cultivated lands and infrastructure, disrupts transportation and causes economic losses. Yemen already experiences urban floods, where building has encroached on drainage courses and drainage infrastructure cannot accommodate intense rainfall, as well as wadi floods after heavy rains and coastal storm surges associated with cyclonic activity.

Droughts

Drought is a devastating natural hazard that affects more people than any other, and agriculture bears much of the impact. Drought is a slow-onset disaster and typically has impacts over large areas. Climate change is increasing the frequency, severity and duration of drought. Low annual rainfall directly and quickly impacts communities that are reliant on rain-fed agriculture and herding, disrupting livelihoods, causing malnutrition and disease, and forcing people to migrate in search of water, pasture or emergency relief. Persistent droughts exacerbate land degradation and reduce groundwater recharge.

Drought cannot be stopped, but better forecasting, drought-resistant crops, soil conservation and water-efficient irrigation are recommended drought management strategies for agriculture.

Coastal zone

Climate change-related hazards threatening the coastal zones are sea-level rise, seawater temperature increases and storm surges, jeopardizing both natural systems and the built environment. The Red Sea and Gulf of Aden's rich marine biodiversity and habitat are under threat (Section 2.2.6 below). Coral reefs are vulnerable to thermal stress and have low adaptive capacity. Increased water depths, changes in tidal variation and altered currents will increase shoreline inundation.

Continued sea-level rise poses a threat to natural systems, coastal development plans and valued cultural heritage sites. Sea-level rise combined with excessive groundwater withdrawals causes salt water to move inland and to enter freshwater aquifers, affecting agriculture and coastal communities. Aden, with its low-lying neighbourhoods, is at high risk and its main water sources, the Tuban and Abyan aquifers, are menaced by saltwater intrusion.

Health effects

Climate and weather are major stressors on human health, through the direct effects of extreme events such as heatwaves, floods and storms; through the indirect influences on the transmission of infectious diseases; and by affecting the availability of food and fresh water.

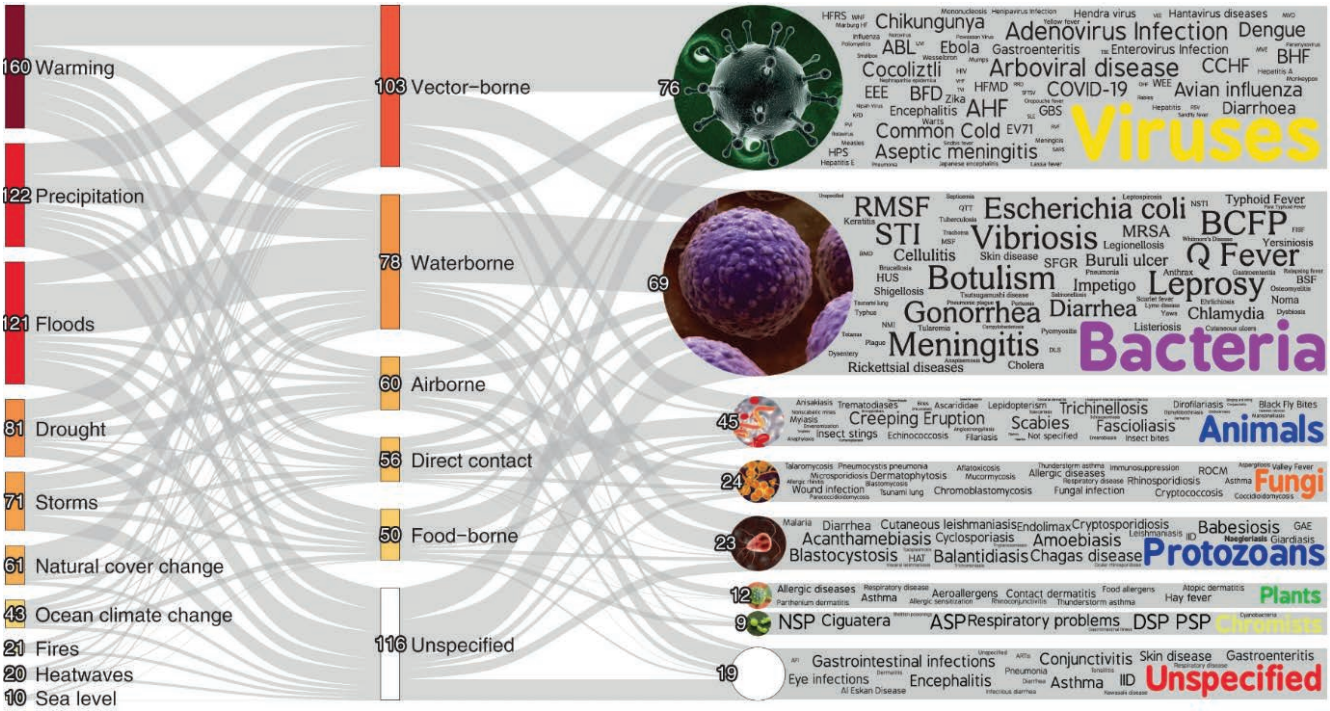


Fig. 2.5. Pathogenic diseases aggravated by climate change

Source: Over half of known human pathogenic diseases can be aggravated by climate change | Nature Climate Change

A review of 375 infectious diseases affecting humans revealed that 58 per cent have been aggravated by climate hazards, while 16 per cent were at times diminished.[20] The study identified over 1,000 pathways by which climatic hazards, via different transmission types, led to pathogenic diseases. Figure 2.5 illustrates the relationship between climate hazards, transmission types and disease.

Yemen can expect to experience increases in child morbidity and mortality resulting from higher temperatures, increases in water- and vector-borne disease, more frequent extreme weather events, increased malnutrition from droughts and floods that affect agriculture, and reduced availability of safe water. The highest risks to public health are in low-income communities with conditions of fragile housing, food insecurity and inadequate access to health services.

Malaria is the most common vector-borne disease in Yemen, with approximately 60 per cent of the total population at risk of the disease.[21] Even though deserts and lands at altitudes greater than 2,000 m are generally considered free of malaria, malaria case incidence and mortality rates in 2021 in those areas were about 40 per cent higher than in 2015.[22] UNICEF estimates that 12.2 million children in Yemen live in areas exposed to one or more vector-borne diseases.[23]

UNICEF's Children's Climate Risk Index[24] ranks Yemen 26th out of 163 countries ("extremely high severity") where children are most at risk due to exposure to climate and environmental shocks and their vulnerability to those shocks because of limited access to essential water and sanitation, education and health services. Children continue to die mainly from preventable or easily treatable conditions such as acute respiratory infections (inducing pneumonia), diarrhoea and malaria. Malnutrition is often an underlying cause of child mortality.

2.2 ENVIRONMENT

2.2.1 LAND USE

Yemen's land area covers 527,968 km2 and 52 per cent is desert.[25] Rangelands, pastures and woodlands make up about 45 per cent of the land area and 3 per cent is classified as arable, supporting rich crop diversity. Most of the highlands are steep and rugged, so agriculture is limited to hillside terraces that have been built over millennia. Lowland wadi bed farming is highly produc-

20 Over half of know human pathogenic diseases can be aggravated by climate change, Camilo Mora et al., Nature Climate Change, Aug 2022 https://www.nature.com/articles/s41558-022- 01426-1
21 WHO World Malaria Report, 2009 Int_001-200.pdf (who.int)
22 WHO World Malaria Report, 2022 world-malaria-report-2022-regional-briefing-kit-eng.pdf (who.int)
23 Analysis of the CCRI for Least Developed Countries, UNICEF, 2023
24 The Climate Crisis is a Child Rights Crisis, UNICEF, 2021
25 USAID, 2010 Microsoft Word - YEMEN Property Rights and Resource Governance Profile (amazonaws.com)

tive, but dependent on irrigation. Roughly one-third of the agricultural sector value is livestock, one-third is qat – a stimulant widely chewed by Yemenis – and one-third is other crops.[26]

Yemen's agriculture is under duress leading to reduced food security. Water is a key factor, either due to erratic rains and depleted groundwater or to flood damage. Urban encroachment, coastal groundwater salinity, overgrazing, soil erosion, droughts and desert locusts all impact the struggling sector. Restoration of neglected terrace systems, improved watershed management, wadi bank protection, tree planting and rehabilitation of water harvesting structures are promoted as ways to improve land and water resources sustainability.

Yemen has just 10 terrestrial and marine areas designated as protected areas; the most well-known is Socotra Archipelago.[27] These biodiversity sites are generally poorly protected, due to low priority, budget constraints and neighbouring population pressures.

2.2.2 DEFORESTATION AND LAND DEGRADATION

The world's soils store more carbon than the planet's biomass and atmosphere combined.[28]Land degradation and the release of soil carbon to the atmosphere, with the loss of biological or economic productivity, is one of the biggest contributors to climate change. In arid countries like Yemen, it results in desertification.

Land degradation contributes to higher prices for food and timber, higher rates of hunger or malnutrition, more unemployment, a heightened risk of conflict, greater dependence on disaster relief and an increase in rural to urban migration, in turn leading to greater poverty and social unrest. Due to oil and gas fuel shortages, demand for firewood is high, even from businesses such as restaurants and bakeries that previously used gas, and deforestation is accelerating.[29]

2.2.3 WATER RESOURCES5

Yemen's arid climate makes it a water-scarce country and its overall annual water availability is 74 m^3 per capita, while total water withdrawal is 125 m^3 per capita per year, far exceeding availability.[30] Yemen is one of the world's countries ranked as having "extremely high water stress."[31]

Thirty per cent of total freshwater withdrawal is from surface sources and the remaining 70 per

26 USAID, 2010 Microsoft Word - YEMEN Property Rights and Resource Governance Profile (amazonaws.com)
27 Report: Protected area conservation in Yemen's conflict - CEOBS
28 land_degradation_issues_brief_cop21_031215.pdf (iucn.org)
29 With fuel scarce, Yemen's forests are next casualty of war | Environment News | Al Jazeera
30 Water Scarcity and Climate Change Enabling Environment Analysis for WASH: Yemen, UNICEF, 2022
31 World Resources Institute, 2019 25 Countries Face Extremely High Water Stress | World Resources Institute (wri.org)

cent is from groundwater.[32] Agriculture accounts for 91 per cent of total withdrawals, municipal withdrawals are seven per cent and industrial withdrawals are two per cent.[33]

Yemenis have ancient traditions and methods for managing their limited water resources to benefit agriculture, livestock and human consumption through thousands of hydraulic structures.[34] These include large and small dams, rainwater harvesting structures, elaborate hillside terracing and spate irrigation channels in wadis. Spate irrigation is an ancient practice using check dams and diversion canals to divert short-duration flood waters from wadi beds to irrigate crops and grazing areas and to recharge groundwater. However, changing environmental conditions, increased groundwater usage and rapid urbanization are disrupting these traditional water management approaches.

Figure 2.6 shows the four major surface drainage basins and their networks of wadis. Dark-shaded areas on the map indicate high runoff and lightly shaded areas show high infiltration.

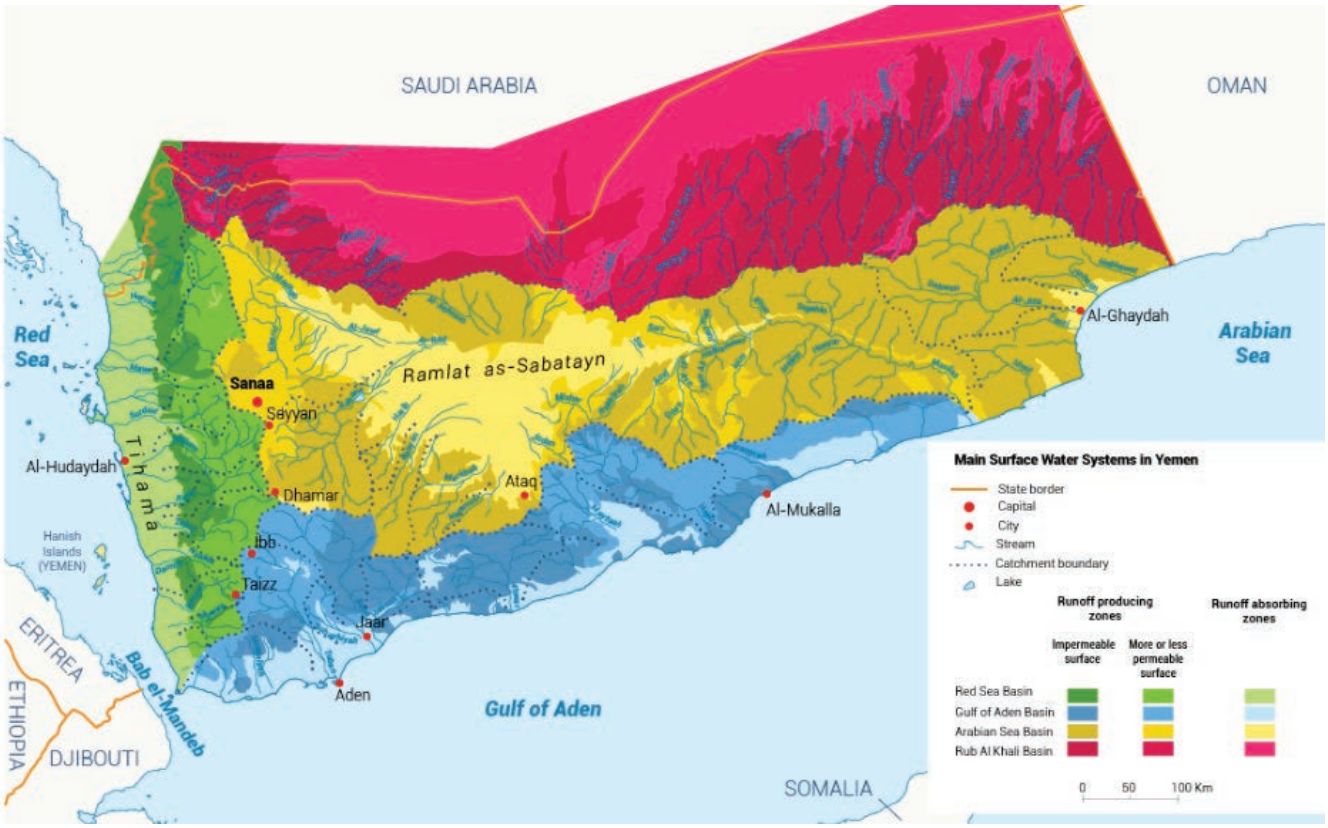


Fig. 2.6. Main drainage basins in Yemen

Source: Water Resources in Yemen, Fanack.com, 2019

32 Water Availability in Yemen, Netherlands/KfW/UNDP/Acacia Water, 2021 Water-Availability-Study-in-Yemen.pdf
33 Water Scarcity and Climate Change Enabling Environment Analysis for WASH: Yemen, UNICEF, 2022
34 FAO country profile 2008 CA0352EN.pdf (fao.org)

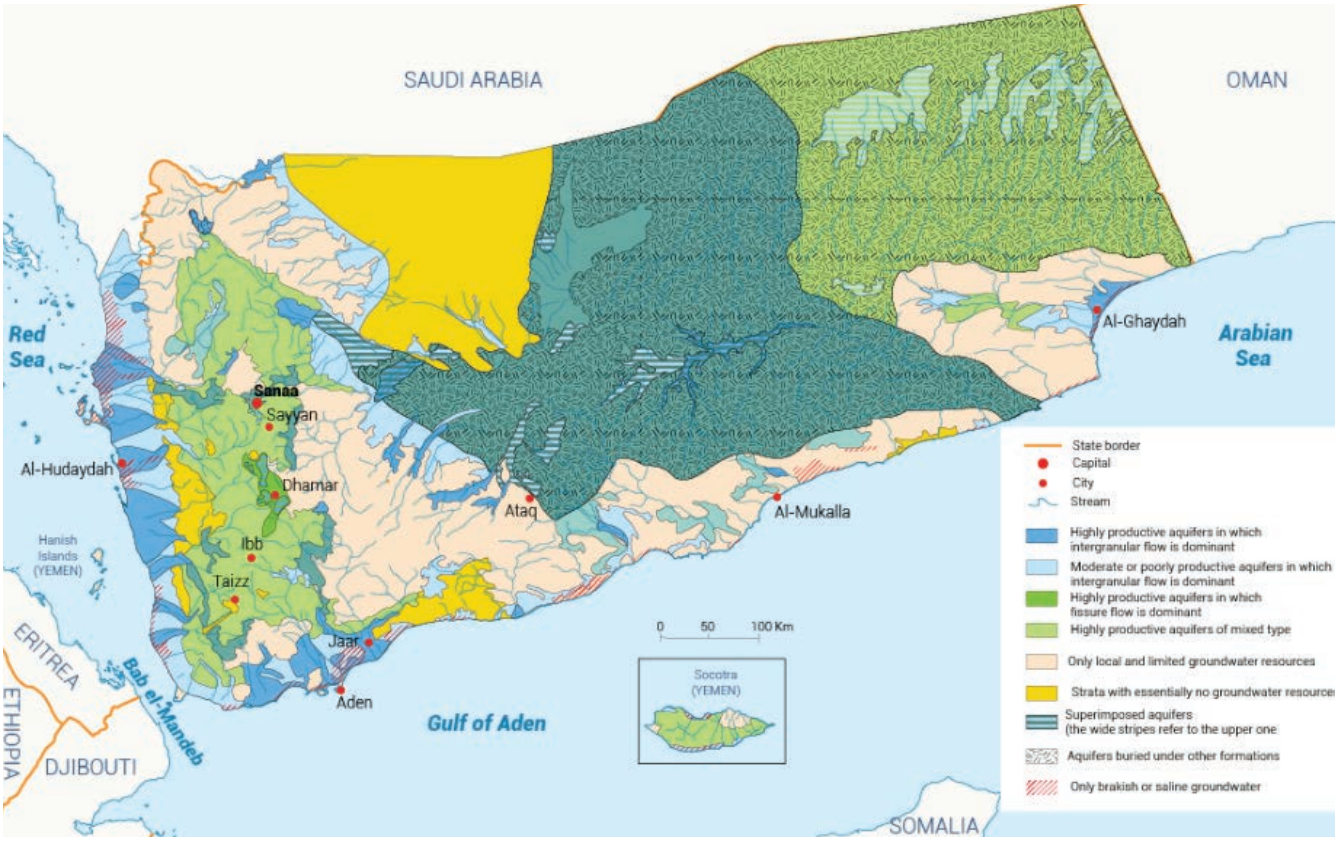


Fig. 2.7. Main groundwater aquifers in Yemen

Source: Water Resources in Yemen, Fanack.com, 2019

Highland aquifers tend to be deep and extensive; the most productive are sandstone aquifers. Highly productive alluvial aquifers are found along the coastal zone and wadis.[35] Figure 2.7 illustrates the diversity of aquifer systems across Yemen and the variation in hydrogeological conditions.

Yemen's groundwater resources are critical to its survival, but they are being exploited unsustainably. The total irrigated area has grown to 40 per cent of cultivated land, especially for the production of high value fruits, vegetables and qat.[36] As a consequence, withdrawals exceed aquifer recharge rates and ancient fossil groundwater is being tapped. Drilling depths have increased, in some cases reaching 1,200 m, driving up pumping costs and drying up springs. Pumping for irrigation accounts for 28 per cent of total electricity and diesel consumption in Yemen.[37]

35 Water Resources in Yemen, Fanack.com, 2019 Water Resources in Yemen - Fanack Water
36 Climate Change and Variability on Water and Agricultural Sectors, World Bank, 2010 World Bank Document
37 Simon Commander, et al. 2015 Estimating the Size of External Effects of Energy Subsidies (ssrn.com)

Key drivers of water scarcity in Yemen, beyond excessive and inefficient agricultural water use, are:

- Low or unpredictable rainfall, high evapotranspiration and low infiltration rates (physical scarcity);
- Lack of infrastructure, inadequate investments to supply water equitably and institutional constraints (economic scarcity);
- Increasing water demand from a growing and urbanizing population;
- Illegal well drilling and unregulated groundwater withdrawals;
- Significant damage to water infrastructure and disruptions caused by the conflict;
- Water contamination from untreated wastewater, agricultural fertilizers and pesticides, industrial discharges and sea level rise;
- Poor pricing structure, excessive pipe leakage and lack of conservation incentives.

For rural Yemenis, access to safe and reliable water supplies is a daily struggle. Only 51 per cent of rural households have improved drinking water sources within a 30-minute walk, and 34 per cent have even more limited access and must go further.[38] The remaining 16 per cent of the rural population access polluted water from unprotected sources or surface water. Urban water supply coverage is 77 per cent, with people accessing piped water at or near their premises, but 21 per cent must collect water more than 30 minutes away, and 2 per cent use unprotected sources. With frequent disruptions in services, many also depend on costly water trucking.

These statistics do not adequately convey the complexity of ensuring water and sanitation services to 15.4 million people in need in 2023, including IDP in displacement sites or with host communities, other vulnerable communities and households, and families impacted by seasonal floods.[39] The level of access and reliability of services under these conditions is in constant flux.

2.2.4 AIR QUALITY

Natural air pollution occurs in the form of sand and dust storms that can reduce visibility to zero. Chronic exposure can be linked to health impacts, such as respiratory disease, but other costs include crop and infrastructure damage, transport interruptions, loss of productivity and soil erosion

Air quality deteriorates around growing urban areas, with unplanned development, high traffic densities and greater industrialization – all causing air pollution. Old and inefficient trucks and cars emit PM, NO2 and CO. (Leaded gasoline sales were discontinued in 2011.) Thermal power

38 WHO-UNICEF Joint Monitoring Programme JMP (washdata.org)
39 UNOCHA Humanitarian Needs Overview 2023 Yemen_HNO_2023_final.pdf

plants, powered by fossil fuels, emit a range of pollutants. Polluting industries, including cement manufacturing and oil production and refining, do not take adequate air pollution control measures.[40] Burning of municipal and agricultural waste is widely practiced.

Indoor household air pollution from the combustion of biomass (e.g., fuelwood, crop residue, animal dung) for cooking is still common in rural households, increasing the risk of respiratory illnesses, mainly in women and young children. In Yemen, the share of population with access to clean fuel for cooking (e.g., LPG, electricity) was 61 per cent in 2021, below the global value. [41]

2.2.5 SOLID WASTE AND WASTEWATER

Waste in Yemen – whether solid, liquid, industrial or domestic – is typically managed in traditional ways. The production of solid waste is increasing with population growth and rapid urbanization, but the application of best practices for recycling, waste separation and sanitary landfills is rare. Collection and disposal services have been reduced or stopped due to out-of-order heavy machinery, loss of revenue, unpaid workers and lack of spare parts or fuel.[42]

There are 21 officially designated dump sites in major cities of Yemen but few operate with safeguards, contaminating groundwater with toxic leachate, releasing GHGs, emitting noxious odors and creating health concerns for people living nearby. [43],[44] Open burning and underground fires are common at 75 per cent of the sites, to reduce waste volumes or for the recovery of metals within the waste.[45]

Nationally, only 31 per cent of the population have access to adequate wastewater treatment services (safely managed sanitation).[46] In urban areas, about 80 per cent of households have septic tanks or are connected to sewerage networks. There are 23 wastewater treatment plants in Yemen located in cities and major towns.[47] The wastewater is treated to varying degrees, or not at all, and subsequently discharged to wadis or the sea.[48] Public sewage systems suffer from direct war damage, as well as insufficient upkeep of essential equipment. Interrupted electricity supplies force treatment plants to rely on expensive backup diesel generators. Sewage collection systems and wastewater treatment plants are unable to accommodate the needs of growing urban areas. Reuse of wastewater in agriculture is common in Yemen, but data on actual quantities used are unavailable.[49]

40 National Strategy for Environmental Sustainability 2005-2015, GoY/EPA
41 Household air pollution (who.int)
42 Emergency Waste Assessment, UNDP, 2015 UNDP-YEM-DWR.pdf
43 Third National Communication to the UNFCCC, GoY/EPA 2018
44 Sustainable solid waste management in Yemen: environmental, social aspects, and challenges | SpringerLink
45 Third National Communication to the UNFCCC, GoY/EPA 2018
46 WHO-UNICEF Joint Monitoring Programme JMP (washdata.org)
47 Third National Communication to the UNFCCC, GoY/EPA, 2018
48 Yemen Water Sector Damage Assessment, GIZ, 2018 giz2018-en_Yemen-Water-Sector_Stage-3-Part-1.pdf
49 Third National Communication to the UNFCCC, GoY/EPA, 2018

In rural areas, only 39 per cent of households use improved latrines, while 46 per cent use unimproved or shared facilities. Fifteen per cent use no sanitation facility at all but instead practice open defecation.[50]

2.2.6 COASTAL ENVIRONMENT

Yemen's western coast is on the Red Sea and its southern coast is on the Gulf of Aden and Arabian Sea, for a total coastline of 2,230 km. This extensive marine zone encompasses an ecosystem of great diversity, including coral reefs, sea-grass beds, wetlands and important feeding and nesting sites for a variety of shorebirds. The Gulf of Aden has levels of biological productivity that are amongst the highest in the world.[51]

Fisheries, both artisanal and commercial, constitute an important natural resource and a main source of income for poor coastal communities. Fisheries' contribution to GDP was estimated to be 15 per cent.[52] Oil spills, industrial pollution, on-land construction and dredging activities pose risks to coral reefs, fisheries and mangroves (with their extraordinary coast protection properties). A recent positive development has been the operation to secure tanker FSO Safer, moored off Yemen's Red Sea coast for many years, and potentially prevent a massive oil spill.

In 2008, Socotra Archipelago, 350 kms off the southern coast of Yemen in the Arabian Sea, was recognized as a UNESCO World Heritage Site because of its rich biodiversity and unique flora and fauna. Over one-third of its plant species, 90 per cent of its reptile species and 95 of its land snail species do not occur anywhere else in the world.[53] Threats to Socotra's pristine environment include overgrazing by goats, deforestation, illegal fishing, coral bleaching, urban development and plastic pollution.[54]


© UNICEF/UNI484438/ALFILASTINI

50 WHO-UNICEF Joint Monitoring Programme JMP (washdata.org)
51 Ibid.
52 National Strategy for Environmental Sustainability 2005-2015, GoY/EPA
53 Nature and people in the Socotra Archipelago - UNESCO Digital Library
54 Ibid.

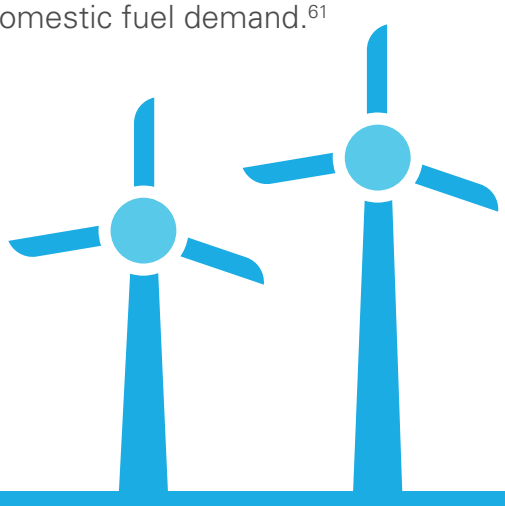
An increase in cyclonic events and destructive storm surges hasten coastal erosion, and turbidity impacts the capacity of sea organisms to photosynthesize.[55] In 2015, Cyclone Chapala was the first known hurricane-strength storm to make landfall in Yemen since modern records began in the 1940s. Over 36,000 people were displaced and an outbreak of dengue fever followed.[56]

Increasing sea temperature and acidity threaten ecosystems that support fish and birdlife, and promote coral bleaching. In 2023, the Gulf of Aden exhibited its highest temperatures since records began in 1984, and with it came coral bleaching alerts.[57]

2.3 ENERGY

In 2017, 76 per cent of Yemen's total primary energy supply came from petroleum products (diesel, gasoline, residual fuel oil), 16 per cent from natural gas, four per cent from biomass (fuel wood, agricultural residues, waste), two per cent from solar and wind energy, and about two per cent from coal.[58] The transport sector was the largest consumer of petroleum products, followed by households, electricity production, industry, agriculture and commerce.[59] From 1995 to 2012, the use of fossil fuels increased by 4.4 per cent per year. Diesel use grew at twice that rate due primarily to the transport sector, along with growth in private electricity generation.[60]

Prior to the war, the oil and gas sector was the main source of government revenue, exports and foreign exchange, and accounted for 88 per cent of foreign direct investment. Starting in 2009, liquified natural gas was produced at Marib, and five years later it generated 13 per cent of hydrocarbon revenues. However, Yemen maintained a dependence on imported heavy fuel oil and its only major refinery, in Aden, met less than half of domestic fuel demand.[61]



55 Third National Communication to the UNFCCC, GoY/EPA, 2018
56 Cyclone Chapala - Wikipedia
57 Aden, Yemen Regional Products 2023-09-01 (noaa.gov)
58 A review of Yemen's current energy situation, challenges, strategies, and prospects for using renewable energy systems | SpringerLink
59 Third National Communication under the UNFCCC, GoY/EPA, 2018
60 Ibid.
61 Yemen Country Economic Update, World Bank, 2022 World Bank Document

About half of Yemen's oil production comes from Hadramawt, where there is significant pollution that threatens human health. Toxic fluids and oil-laden water generated by drilling operations are re-injected underground in close proximity to the Mukalla aquifer used for drinking water. Between 2005 and 2014, local health authorities registered a large increase in cases of cancer, kidney disease and liver disease.[62]

2.3.1 ELECTRICITY

Even prior to the conflict, Yemen had the lowest installed electricity generation capacity (1.5 gigawatts) as well as the lowest electricity access rate in the region. Electricity was produced by thermal power generation using diesel, heavy fuel oil and gas. In 2014, only Aden, Hadramawt and Sana'a city had electricity coverage higher than 75 per cent, while more than half of the governorates had an access rate under 50 per cent.[63] The transmission and distribution system connected 13 cities, but system losses were 40 per cent. Only 23 per cent of the rural population had access in 2014. Due to outages, most industries, commercial shops and residences relied on their own diesel generators as main or backup systems.[64]

During the conflict, the national grid suffered damage to power plants, substations and transmission lines, as well as fuel shortages and technical problems. The estimated overall access to electricity in 2020 was 74 per cent. Three-quarters of the households with electricity used solar photovoltaic (solar PV) as their primary source, far outpacing those dependent on the national grid or private grids.[65]

2.3.2 GHG EMISSIONS

In 2010, five GHG emission source categories were identified: energy, agriculture, waste management, industrial processes, and land-use change and forestry. Sixty-five per cent of total GHG emissions were associated with the combustion of fossil fuels for electricity production and transport, as well as fugitive emissions from oil and gas operations. The other main emission sources were agriculture (e.g., livestock methane production), solid waste and wastewater, and industrial processes.[66] Yemen contributes a tiny portion of global CO2 emissions, only 0.03 per cent.[67] Box 2.2 highlights the three most common GHGs.

62 impact-of-oil-wells-drilling-process-on-human-health-in-hadhramout-yemen.pdf (hrmars.com)
63 Rethinking_Yemens_Economy_No8_En.pdf (sanaacenter.org)
64 Ibid.
65 Ibid.
66 Ibid
67 Yemen: CO2 Country Profile - Our World in Data

Box 2.2. Common greenhouse gases

Carbon dioxide (CO2)
is introduced into the atmosphere mainly through burning fossil fuels (coal, natural gas and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions. Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants and soil as part of the biological carbon cycle.
Methane (CH4)
is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
Nitrous oxide (N2O)
is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

2.3.3 RENEWABLE ENERGY/ENERGY EFFICIENCY

Yemen's 2009 National Strategy for Renewable Energy and Energy Efficiency (NSREEE) set out ambitious targets to make renewable energy 15 percent of the total power generation mix by 2025 by investing in solar PV, wind, geothermal, landfill methane capture and solar water heaters. Renewable energy plays a critical role in clean energy transitions, with solar, wind and geothermal having high potential for large-scale project investment in Yemen.
Solar energy continues to gain ground as Yemenis, especially in underserved rural and peri-urban areas, seek reliable off-grid alternatives.[68] Falling costs and financing from donors have helped to boost solar services to small-scale users such as households, farmers, water providers and health-care. Yemen has some of the windiest locations in the world and its geothermal potential for power production is promising but the resources has not yet been exploited.[69]

Biomass (fuel wood, charcoal) is categorized as renewable energy but due to its unsustainable sources, it cannot be considered a green solution in Yemen. Another biomass alternative is the so-called waste-to-energy option to generate electricity from solid waste and agricultural residues. In 2021, UNDP and the EPA launched Yemen's first project in Lahj and Hodeidah to install off-grid, decentralized power plants, while tackling the intractable solid waste disposal problem.[70]

The NSREEE set a 2025 target to increase energy efficiency by 15 per cent compared to 2010, through fuel switching to natural gas in electricity generation and transportation, and methane capture at wastewater treatment plants.[71] For households and agriculture, efficiency gains are foreseen

68 International Energy Agency 2020 Middle East – Countries & Regions - IEA
69 (PDF) Study of Geothermal Energy Resources of Yemen for Electric Power Generation (researchgate.net)
70 Decentralized renewable energy solutions for climate security Yemen_First Proposal.pdf (undp.org)
71 National Strategy for Renewable Energy and Energy Efficiency, MoEE, 2009 yem217398E.pdf (fao.org)

in lighting, solar water heaters, solar air conditioning and refrigeration, and solar irrigation pumps.

2.3.4 WATER-ENERGY-FOOD NEXUS

Water security (SDG 6), energy security (SDG 7), and food security (SDG 2) are inextricably linked. In Yemen, this nexus creates challenges for sustainable environmental and economic development, and it presents opportunities for integrated solutions (Figure 2.9).

Water supply depends upon electricity for groundwater extraction, water treatment and pumping stations. Gaps in electricity are filled with diesel generators that incur high bills and increase air pollution. Wastewater treatment plants also require electricity, and power cuts can result in incomplete treatment leading to raw sewage discharges that threaten the environment and public health.

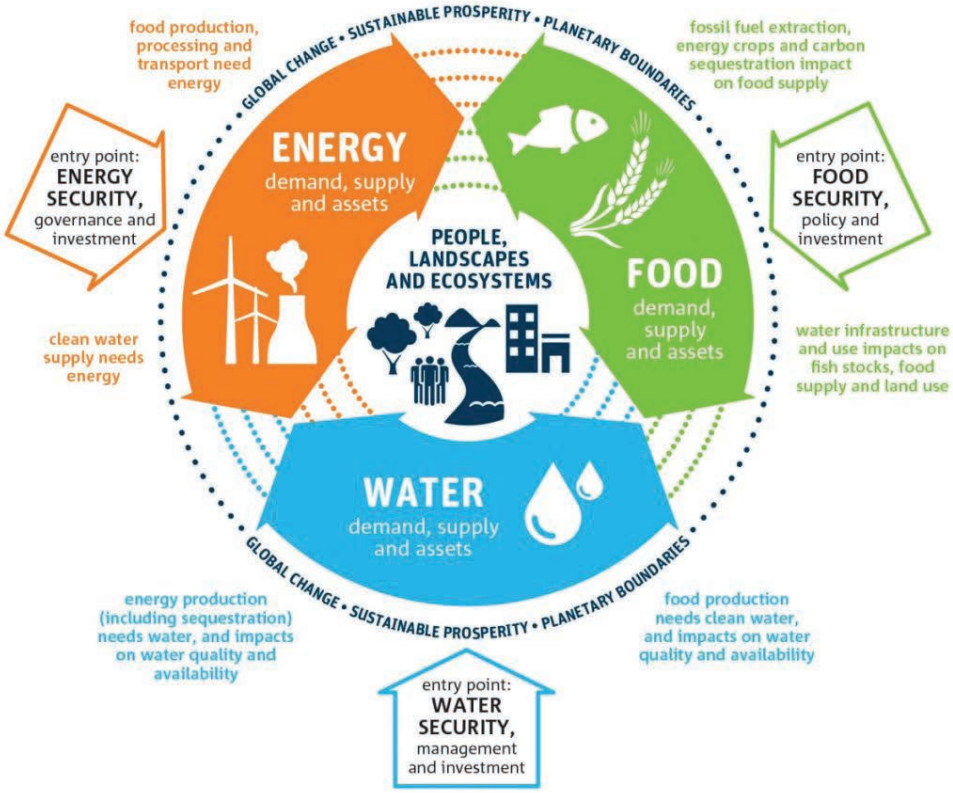


Fig. 2.9. Water – Energy – Food nexus

Source: International Water Association (IWA)

Food production is a major consumer of water resources — 91 per cent is used for agriculture in Yemen compared with about 70 per cent globally. Agriculture competes with cities, industries and ecosystems for water. Pumped irrigation accounts for 28 per cent of the total electricity

and diesel consumption in Yemen, much higher than the 6 per cent MENA regional average.[72]

Climate change adds a layer of complexity in terms of both mitigation and adaptation. Emissions are generated through water use, energy production and food production, and global warming, in turn, affects water availability and crop yields. Renewable energy can improve water security by providing the power needed by water-related activities, and it can strengthen energy security by reducing reliance on hydrocarbons.

The overall decline in domestic agricultural production and climate change are making Yemen one of the world's highest food import-dependent countries.[73] In 2000, Yemen used 10 per cent of its export earnings to import food, which rose to 35 per cent by 2012. In 2015, 80 per cent of cereal consumed was imported.[74]

Water, energy and food priorities intersect with the issue of desalinating seawater or brackish groundwater. Yemen will need to balance the costs of energy inputs with the value of freshwater for cities and agriculture, although lower-cost solar powered desalination technology is now available. Desalination is commonly employed across the region to narrow the water deficit, but many of these countries are exceedingly energy rich.

The water-energy-food nexus highlights the value of an integrated water resources management (IWRM) approach across sectors. Nexus solutions available to Yemen include solar or wind power; increased water efficiency (e.g., leak reduction, water conservation); water re-use for agriculture, industry, or urban landscapes; and improved irrigation efficiency, such as drip irrigation.

2.4 DISASTER RISK REDUCTION

The disaster risk reduction (DRR) approach aims to reduce risks through systematic efforts to analyze and manage the causal factors of disasters, by reducing exposure to hazards, minimizing vulnerability of people and property, applying good practices to manage the land and environment, and improving overall preparedness.[75] Those most affected by climate and environment crises are "the poorest and most marginalized communities, whose capacity to adapt is already strained, owing to armed conflict, displacement, weak governance, unplanned urbanization or poverty."[76]

72 Estimating the Size of External Effects of Energy Subsidies (ssrn.com)
73 World Bank Country Engagement Note 2022 World Bank Document
74 Estimating the Size of External Effects of Energy Subsidies (ssrn.com) 2015
75 Terminology on DRR, UN International Strategy on Risk Reduction, 2009
76 ClimateEnvironmentCharter-EN.pdf (climate-charter.org)

Natural disasters are not gender neutral; they affect women, men, girls, and boys differently due to gender inequalities caused by socioeconomic conditions, cultural beliefs and traditional practices that have repeatedly put females at a disadvantage.[77] In some cases, males may be more vulnerable to harm from events related to climate change, depending on livelihood or physical challenges, while in other situations women are more vulnerable. Men and women can also adapt, but in different ways, highlighting the importance of participatory gender analysis to inform recovery planning. Evidence demonstrates that women can be powerful agents of change during and after disasters.[78]

Yemen's most reported disasters during 1990-2014 were storms, landslides and earthquakes. Floods have been the deadliest.[79] After the 2008 tropical cyclone and massive floods in Hadramawt and Al-Mahara, the post-disaster Damage, Losses and Needs Assessment report[80] proposed five ways – both structural and non-structural – to improve disaster management and reduce flood risk:

- Multi-hazard risk identification, vulnerability modeling and proactive preparedness;
- Risk mitigation for reducing exposure to natural hazards, including hazard maps and climate change adaptation programmes;
- Strengthening and enhancing emergency preparedness, land-use planning and early warning systems;
- Institutional changes to reduce fragmentation and overlapping responsibilities between civil defense bodies and humanitarian actors;
- Financing reconstruction and recovery and long-term catastrophe risk financing.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77 Gender Equality and Women's Empowerment in Disaster Recovery, GFDRR, 2018
78 Ibid.
79 PreventionWeb.net Cyclone Chapala Disaster Risk Reduction Situation Report: DRR sitrep 2015-004 – 04 Nov 2015 (preventionweb.net)
80 Damage, Losses and Needs Assessment, 2008 Microsoft Word - YEMEN-DLNA-Jan23 _Final_.doc (gfdrr.org)

2.5 IMPACTS OF CLIMATE CHANGE IN YEMEN

2.5.1 CLIMATE CHANGE AND CONFLICT

Conflict sensitivity is crucial to recognize climate-related stressors of livelihood deterioration, migration, and resources mismanagement exacerbating conflict. Poor management by weak institutions has led to misguided agricultural expansion and degraded groundwater resources, heightening competition over water access.[81]

Scarcity of fresh water and fertile farmland results in intertribal conflicts. A 2010 estimate put annual loss of life due to violence over water or land at about 4,000 people.[82] Such conflicts can be expected to continue with climate change and environmental degradation, along with the waning of traditional tribal mechanisms for water governance and conflict resolution due to the war and political patronage.[83]

Approximately 4.3 million people have been displaced, and there are about 100,000 refugees and asylum seekers from countries such as Somalia and Ethiopia, many living in displacement sites and informal settlements, making them particularly vulnerable to extreme weather and natural hazards. Competition with host communities for food, shelter, water, energy and health-care put a stress on social cohesion and trigger local conflicts.[84]

Climate change and conflict have different impacts on men and women, due to factors that include access to education, resources and land ownership, and mobility options. Yemen is ranked as one of the least gender-equal countries.[85] A rural exodus of men in search of income opportunities in cities, or their deaths due to the conflict, has resulted in a significant increase in female-headed households in Yemen. Approximately 30 per cent of displaced households are now headed by women, compared to 9 per cent before 2015.[86]

81 Climate, Peace and Security Fact Sheet_ Yemen _ NUPI.pdf
82 Social Violence over Land and Water in Yemen, Small Arms Survey, 2010 SAS-Yemen-AVA-IB2-ENG.pdf (smallarmssurvey.org)
83 A perfect storm: the causes and consequences of severe water scarcity, institutional breakdown and conflict in Yemen: Water International: Vol 40, No 2 (tandfonline.com)
84 Water-Availability-Study-in-Yemen.pdf (undp.org)
85 Global Gender Gap Report, WEF, 2021 WEF_GGGR_2021.pdf (weforum.org)
86 Yemen - Women and girls' protection needs urgent, but resources are limited | Digital Situation Reports (unocha.org)

2.5.2 SUMMARY OF IMPACTS IN YEMEN

Table 2.3. Summary of climate change and environmental impacts in Yemen

Areas of impact	Climate change and environmental impacts
Increased drought periods	With modelling uncertainties, rainfall levels are projected to decrease, remain the same, or increase but with an increase in variability and unpredictability in seasonal rainfall. The trend is for greater frequency and duration of drought periods. Increased rural to urban migration due to prolonged droughts and strain on rural livelihoods.
Less water availability	Increased evaporation reduces water storage in reservoirs in the face of rising demand. Increased temperatures, higher evapotranspiration, rainfall variability, and extreme weather events reduce water availability and increase flood risk. Increased rainfall variability directly impacts subsistence farmers and herders, and jeopardizes rural livelihoods.
More water availability	More rainfall could occur in higher intensity events, and with it problems of flash floods. Under the scenario of a wetter future, greater water availability for rainfed agriculture, water harvesting and groundwater recharge can bring benefits. Even with more recharge, it will be insufficient to arrest aquifer depletion rates.
Increased flash floods	High intensity rainfall events provokes high-volume runoff, damaging crops and destroying the built environment. Intense rainfall on denuded landscapes infiltrates poorly, causing high runoff, eroding fields and flooding communities, and triggering wadis to swell into torrents.
Loss of agricultural productivity	Soil moisture declines in response to higher temperatures, reduced precipitation, and higher evapotranspiration, with rainfed agriculture at immediate risk. Expanded desertification leading to loss of productive land, pasture and water supplies. Rainfall variability and increased temperatures result in shorter (or shifting) growing seasons, reduced yields or crop failure.
Higher energy demand	Higher temperatures will increase demand for cooling, with increasing consumption of grid electricity which is generated using fossil fuels. Groundwater pumping energy demands and costs for diesel and electricity can increase as groundwater levels drop, absent a switch to renewable energy sources.

Areas of impact	Climate change and environmental impacts
Reduced social cohesion	Increased conflict over rights and access to water and prime agricultural land at the local and national levels. Increased tensions over limited land and water resources. Community social cohesion threatened by livelihood fragility and ethnic tensions with displaced populations. Displacement or migration of families and children for incomes, safety, basic services, food and water.
Weakened tourism potential	Potential coastal tourism could be undermined by threats to beach-front properties, reduced marine biodiversity (e.g., coral bleaching) and unsustainable fish yields. Ecosystem loss can affect ecotourism destinations and excessive heat can be an obstacle to cultural tourism, such as excursions to historic monuments.
Sea level rise	Sea-level rise, changes in seawater temperature and salinity. Intensification of storm surges, damaging infrastructure and threatening economic development. Irreversible damage to coral reef systems through bleaching and alteration of ecosystems and reduced biodiversity of mangrove systems, sea grass and salt marshes.
Forests at risk	Forests and woodlands will be adversely affected by climate change, and already suffer from fragmentation, wildfires, unsustainable wood extraction and loss of soil fertility.
Increased morbidity and mortality	Yemen can be expected to experience increased morbidity, mortality and the incidence of infectious diseases resulting from higher temperatures, more extreme weather events, increased malnutrition from droughts and floods that affect agriculture, and reduced availability of clean water. Children are most at risk from the impacts of climate change and a deteriorating environment resulting from exposure to extreme weather events and heatwaves, aggravated by malnutrition. Increases in water- and vector-borne diseases can be expected, as well as heightened child deprivation due to repeated climate shocks that overwhelm coping mechanisms. Children exposed to high levels of air pollution may be at greater risk for chronic diseases such as cardiovascular disease later in life.
Damaged infrastructure	Housing, transport networks, and public infrastructure will suffer damage from changing patterns in precipitation, especially by urban and wadi floods. Ports and coastal infrastructure will be threatened by sea level rise and increased frequency and intensity of storms, leading to coastal erosion, inundations and landslides.

3.

GOVERNMENT RESPONSE AND PRIORITIES ON CEED

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Strong climate and environmental governance is required that integrates institutions and society at all levels to protect and manage the nation's fragile wealth of natural resources, translating lofty climate mitigation and adaptation ambitions into feasible and comprehensive strategies. Only the well-coordinated and regulated exploitation of water, land, marine and soil resources will yield sustainable economic and social development for Yemen, while mitigating the worst impacts of climate change.

3.1 INSTITUTIONAL ARRANGEMENTS

Yemen ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1996, the Kyoto Protocol to the UNFCCC in 2008 and the historic Paris Agreement in 2016 (signed but not ratified).

The Environmental Protection Authority (EPA), under MoWE in Aden, is responsible for climate action and the environment, and is the national focal point for the UNFCCC. EPA's mandate includes:

- Coordination for the development of national policies, strategies and legislation.
- Ratification and implementation of multilateral environmental treaties.
- Managing environmental impact assessments for government projects.
- Serving as focal point to the UNFCCC for multilateral climate financing, such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF).

The EPA is responsible for reporting on the steps taken or planned to implement the provisions of the UNFCCC, for which it receives support from international development partners including UNDP, UNEP, World Bank, and Netherlands, and financing from GEF and GCF.

The EPA is responsible for reporting on the steps taken or planned to implement the provisions of the UNFCCC, for which it receives support from international development partners including UNDP, UNEP, World Bank, and Netherlands, and financing from GEF and GCF. The process for submission of national communications includes periodic comprehensive descriptions of the national context, institutional frameworks, GHG inventories, mitigation options analysis, economic impacts, and vulnerability and adaptation assessments. The Fourth National Communication to the UNFCCC is under preparation with the support of UNDP to be issued in 2025.

3.2 NATIONAL CEED PRIORITIES AND STRATEGIES

3.2.1 CLIMATE POLICIES

The main objective of Yemen's National Adaptation Programme of Action (NAPA), issued in 2009, was to communicate its immediate adaptation needs.[87] Priority sectors outlined in NAPA were agriculture, water resources, and coastal management and fisheries.

In the lead up to the 21st Conference of Parties in Paris in 2015, Yemen submitted its Intended Nationally Determined Contributions (INDC), along with over 160 other countries, which outlined its pursuit of low-carbon development through both mitigation and adaptation contributions. The INDC outlined such measures as: efficient power generation, transmission and distribution, with a 15 percent increase in energy efficiency in the power sector by 2025; rainwater harvesting, agriculture drought management, and land resources management; livelihood approaches for integrating natural resources management and preservation of sensitive ecosystems; and disaster risk management including flood and drought management.

Yemen is currently preparing its Nationally Determined Contributions (NDC), an update of the INDC, with support from UN-Habitat and funding from GEF. The new NDC should be ready in 2024.

The National Adaptation Plan (NAP) is another milestone planning document under the UNFCCC to lay out Yemen's climate adaptation strategy. The NAP preparation has stalled since 2019 but is now expected to be produced in 2024 with UNDP as the GCF executing entity, with UNEP oversight.

87 National Adaptation Programme of Action (NAPA), EPA, 2009

Yemen has struggled to achieve its GHG mitigation goals due to the economy's dependence on high carbon fuels and slow adoption of energy efficient technologies in power generation, transport, household and industry.[88] Weak institutional capacities to effectively pursue climate change policies are: conflicting legislative agendas; inadequate public and donor funding; limited specialized staff; inadequate enforcement regimes; and low public awareness on green energy. Successful implementation of Yemen's climate agenda will require significant support in international financing, capacity building, and technology development and transfer, while it continues to tackle environmental resource scarcity, climate-related hazards, poverty, and persistent political and security obstacles.[89]

3.2.2 ENVIRONMENT, ENERGY AND DRR STRATEGIES

The Environment Protection Law of 1995 is the overarching legal instrument for environmental laws in Yemen. It aims to protect the environment and natural ecosystems, combat all types of pollution, protect local species, protect human health, and implement international obligations, including those relating to climate.

The National Strategy for Environmental Sustainability 2005-2015 (NSES) and National Environmental Action Plan (NEAP) 2005-2010, from the MoWE and EPA, identifies four critical issues to be addressed: water, land, diversity and marine environment, and waste management.

The National Biodiversity and Action Plan II 2015-2025 (NBSAP II), also from the MoWE and EPA, focuses on halting biodiversity loss and maintaining functional ecosystems. It promotes restructured policies, empowered local communities and ensuring the benefits of ecosystem services to all.

The National Agriculture Sector Strategy 2012-2016 analyses the challenges facing the sector, climate change among them. Its section on water resources describes the myriad ways in which water needs to be more efficiently and effectively managed to avert a water crisis, including water reuse and regulatory incentives for water conservation. Since being issued, the ambitions in this blueprint have unfortunately been shattered by events, and food insecurity is the norm.

The National Strategy for Renewable Energy and Energy Efficiency (NSREEE), issued by the Ministry of Electricity and Energy in 2009, proposed 2025 energy targets to be: an electricity grid powered by wind farms, geothermal power stations and use of landfill gas (methane); solar PV home systems; and solar water heaters.

88 First Biennial Update Report to the UNFCCC, 2017
89 Yemen Intended Nationally Determined Contributions (INDC), GoY/EPA, 2015

A national Disaster Risk Management (DRM) plan was developed in 2006 and updated in 2010 after the Hadramawt floods, which triggered nationwide risk and water management studies, a flood retention study and a US $10 million multi-sectoral DRM programme. Most of these plans were put on hold due to political unrest in the country.

3.2.3 CEED IN CHILD-RELEVANT NATIONAL SECTORAL STRATEGIES

The National Health Strategy 2010-2025 was issued by the Ministry of Public Health and Population (MoPHP) with the vision of upgrading the health of all people, permitting Yemenis to live in a healthy environment through high quality and citizen-focused services as a human right. The lofty ideals in this dated national strategy do not link to current CEED realities in the health sector or in Yemen in general.

The National Strategy for Maternal and Child Health 2022-2025 (Preliminary draft) outlines a strategy to provide every mother and child with the highest standard of health. The draft document does not recognize climate and environmental factors affecting the provision of services, but it does highlight the importance of good WASH conditions for health and includes a pillar on the health system response to emergencies and disasters.

The National Strategy Framework of Nutrition Interventions in Yemen 2022-2030 of MOPHP with WHO misses the opportunity to link the response to the nutrition crisis with any of the factors impacting child nutrition: weather disasters, climate change, environmental degradation, power gaps, or even inadequate water supplies.

The National Water Sector Strategy and Investment Programme 2008-2015, jointly developed by the Ministry of Water and Environment (MoWE) and the Ministry of Agriculture and Irrigation (MoAI), underscores its intention to address water issues under a holistic IWRM approach. The NWSSIP stated goal is to strengthen capacity for IWRM, manage environmental impacts, and ensure efficient water development and use of urban and rural water supply, as well as water for irrigation. The water sector is directly and acutely impacted by climate change and natural disasters, which are expressed through shocks and changes to the hydrological cycle, but no mention is made of its profound effect on water scarcity.

Yemen's Ministry of Education 3-year Transitional Education Plan 2019-2022 (TEP) identifies four priorities: safe, equitable access; improving teaching and learning; rehabilitating educational infrastructure; and strengthening institutional capacities. Training in the management of education in emergencies features prominently in the plan, as well as the importance of schools to have disaster risk reduction plans in place and invest in WASH facilities and solar energy.

The National Children and Youth Strategy 2006-2015 was a joint product of the Ministry of Planning, Higher Council for Motherhood and Childhood, Ministry of Youth and Sport, Social Fund for Development, UNICEF and the World Bank. The strategy provides an operational framework for all Yemeni agencies and groups to work towards child and youth protection and development. It is dated, which may explain the lack of any references to the challenges of a changing climate and increasing environmental risks, especially for children and youth, and how they need to be addressed.

3.3 KEY CEED STAKEHOLDERS

The main stakeholders with direct involvement in the CEED landscape from government, UN, development partners, international financial institutions, academia, national NGOs and private sector in Yemen are presented in this section.

3.3.1 GOVERNMENT

The MoWE and EPA are responsible for coordinating the development of environmental policy, laws and standards. In addition, they are charged with enhancing environmental awareness, dissemination of information and development of national capacities. However, the management of natural resources, agriculture and environment falls under the jurisdiction of several ministries, so instability, fragmentation and duplication across sectors and institutions, at many levels, create a complex network of CEED stakeholders. Some of the other main actors are the ministries of Agriculture and Irrigation, Electricity and Energy, Oil and Minerals, Public Health and Population, Planning and International Cooperation, Transportation, and Interior.

3.3.2 UNITED NATIONS

UN agencies plan and implement their programmes under the UN Sustainable Development Cooperation Framework. In the Yemen UNSDCF 2022–2024, CEED-related objectives are primarily under Outcome 1/Output 2: National institutions and civil society develop and implement evidence based, gender-responsive, inclusive mechanisms, policies and legislation for sustainable climate-sensitive environmental management, supported by the following interventions:

- Strengthening women and youth participation and leadership in climate-change management and decision-making structures and in disaster risk reduction.
- Mitigation of water insecurity and reinforced water information systems.
- Strengthening climate change mitigation through disaster risk reduction.
- Safeguarding natural resources and reducing local conflicts.
- Promoting the establishment of nature reserves.
- Investments in renewable energy to improve income security (Outcome 3).

The key UN agencies involved in CEED in Yemen are UNDP, UNEP, FAO, WHO, UNICEF, WFP, UN-Habitat, UNOPS, UNIDO, IFAD, and UNESCO.

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3.3.3 ACADEMIC AND RESEARCH INSTITUTIONS

A leading CEED-related institution is the Water and Environment Centre (WEC) at Sana'a University. WEC offers graduate studies, short courses, and research and advisory services in IWRM, groundwater hydrology, water and sanitation, irrigation and water governance. The University of Aden's WEC offers similar degree programmes, and shares capacity building endeavors with WEC in Sana'a. Together, they are invaluable resources for advancing water and environment ideas and actions in the country.

3.3.4 YOUTH AND ENVIRONMENT ORGANIZATIONS

Yemen has a broad range of community-based organizations, which includes youth-oriented groups eager to engage in climate, environment and sustainable development activities. The reach and effectiveness of these organizations are often limited by a lack of sustained institutional and financial support. They undertake broad portfolios for relief and development across shelter, food assistance, WASH, education, health, and economic empowerment.
Community and youth-oriented organizations can play an important role in raising public awareness and organizing action on environmental, water, natural resources and climate change issues. UNICEF has already partnered with these groups, so opportunities to mobilize them around a strong climate and environmental action agenda appear promising. Such an investment would require careful vetting, consistent messaging, and a certain amount of capacity building to succeed.

3.3.5 PRIVATE SECTOR

The private sector can have both positive and negative significant impacts on the environment. Through their choices and investments – in transportation, product efficiencies, transformation processes, and distribution – companies can accelerate or retard the shift towards a climate-resilient economy. For example, strategies for the energy sector – developing minimum energy performance standards in line with international guidelines for refrigeration, lighting and household appliances – will take the full cooperation of the businesses that import, manufacture or sell these products. Businesses involved in livestock and crops, which depend on the management and protection of Yemen's fragile land, water and air resources, are especially critical to climate resilience.

The private sector has proven to be resilient to war and economic shocks; 75 per cent of private-sector enterprises are still operating, and the downturn in the private sector growth rate rebounded to pre-war levels by 2019.[90] Despite being vulnerable to inadequate infrastructure,

90 Yemen Country Economic Memorandum 2022, World Bank World Bank Document

limited electricity and water supplies and exchange-rate instability, the private sector contribution to the GDP is now about 70 per cent, as the public sector contribution fell amid declining oil and gas revenues.

Yemeni firms have been vital to humanitarian efforts, supplying logistical, storage, and distribution services for humanitarian agencies. They are key to implementation of cash transfer programmes, including for WFP and UNICEF, and worked with international agencies throughout the cholera and COVID-19 pandemic responses. Local suppliers are contracted by UNICEF for construction, water and sanitation installations, and turn-key solar systems. They are subject to the sustainability and environment clauses that are part of UNICEF's supply contracts and Environmental and Social Safeguarding (ESS) framework, and are being oriented to international standards, values and ethics through UNICEF's market engagement strategy.

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4.0 ARE CEED POLICIES AND STRATEGIES CHILD-SENSITIVE?

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Climate change and environmental degradation undermine the rights of every child, and the most vulnerable and disadvantaged children are most at risk. UNICEF advocates for national climate plans that are child-sensitive and gender-responsive. A global UNICEF review revealed that climate plans in many countries fail to address child vulnerabilities, or even mention children.[91] To raise the standard, UNICEF calls for climate policies that meet these principles:

- Ambitious and urgent. Ambitious mitigation and adaptation measures that protect the rights and best interests of the child from harm caused by climate change.
- Rights-based. Explicit and meaningful references to children and youth, considering them as rights-holders and important stakeholders.
- Holistic and multi-sectoral. Specific sector interventions that address children's specific risks and vulnerabilities.
- Inclusive. Systematic consultation and meaningful participation of all children, including children of different ages, gender and social backgrounds, will inform every step of the climate policymaking process at all levels.

Yemen's key climate and environment policies and strategies were reviewed to determine to what extent these documents consider the needs, vulnerabilities and capacities of children and youth. Similarly, Yemen's child-relevant sector strategies for the delivery of social services (e.g., education, health) were also reviewed to gauge if climate and environment considerations were factored into sector plans.

National climate policies, strategies and reports that guide the CEED agenda in Yemen are designed to contribute to global commitments and benefit the population as a whole. They vary in the extent to which children, youth and women are mentioned or included in planned actions. In general, youth and women are mentioned as beneficiaries or actors in these plans, but children are often absent. They are not child-sensitive to the extent advocated for by UNICEF.

Most of the child-relevant sectoral policies and strategies fail to link with CEED issues. The TEP highlights the importance of DRR plans and education in emergencies, but without any climate and environment mention in its sector analysis. The health, nutrition and water sector strategies are surprisingly remiss given their direct vulnerability to climate change impacts.

91 Are climate policies child sensitive? UNICEF, 2020 Are-climate-change-policies-child-sensitive-2020_0.pdf (unicef.org)

5.

IMPACT OF CEED SITUATION ON UNICEF OUTCOME AREAS

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5.1 HEALTH

Of the global burden of disease attributable to climate change, 88 per cent is borne by children.[92] Children's health is highly vulnerable to severe effects of climate change including heatwaves, droughts and floods, all of which are increasing in frequency and intensity. And when urgent care for children is required, access to health services is a challenge for many Yemeni families.

Changes in weather patterns are dangerous for children. They often create more conducive breeding conditions for mosquitoes, flies, and other insects, spreading or intensifying vector-borne diseases such as malaria, dengue and chikungunya. More frequent and more intense heatwaves can severely affect babies and young children, causing hyperthermia, cardiovascular disease, and death. Heat-related mortalities can also be linked to increased rates of food- and water-borne disease that provoke excessive fluid loss, such as diarrhea. Malnutrition is provoked by drought (reduced agricultural yields), increased pest populations, biodiversity loss and economic disruptions. Children living in crowded environments, such as slums or tented settlements, are especially vulnerable to all of these risks.

More frequent or more intense floods, storms and wildfires can cause significant injuries to children and expose them to more infections, disability or death. These risks to children can be catastrophic for families with limited access to a health facility; only about 55 per cent of Yemenis live within a 30-minute walk to a functional primary health care facility while 82 per cent are within a 60-minute walk.[93] While 56 per cent of health care facilities are fully functioning, 39 per cent are only partially functioning and 5 per cent are non-functional.[94]

Climate change impacts can affect vital health services for children when floods and storms damage facilities and transport infrastructure, disrupting service delivery, supply chains and physical access to care. Power cuts can also interrupt continuity of service delivery or require costly on-site electricity generation.

Air pollution is a threat to children's health. They are especially vulnerable to the damaging health effects of air pollution because their brains, lungs and other organs are still developing. Children are more exposed than adults because they breathe twice as fast, and they interact more with those pollutants that concentrate close to the ground.

According to WHO, 93 per cent of the world's children under 15 years old breathe poisonous air every day, risking their health, cognitive development and productive future.[95] Pre-existing

92 Global climate change and children's health: threats and strategies for prevention, PE Sheffield, PJ Landrigan, Environmental health perspectives, 2011 https://pubmed.ncbi.nlm.nih.gov/20947468/
93 UNICEF Health Programme Strategy Note 2023-2024
94 WHO Health Resources and Services Availability Monitoring System (HeRAMS) (who.int)
95 WHO News Release, More than 90% of the world's children breathe toxic air every day (who.int)

health conditions such as asthma and bronchitis are exacerbated by air pollution, as is cardiovascular disease later in life.[96] One in 10 deaths in children under the age of five are attributed to air pollution exposure.

Yemen's urban environments register eight times the WHO air quality guideline value for annual mean concentrations of fine particulate matter (PM2.5) pollution levels, although city-specific data is scarce.[97] In Yemen, 38 per cent of deaths from stroke and ischaemic heart disease are caused by air pollution.

Smoke from open burning of municipal or agricultural waste is a threat, as is indoor air pollution from the cooking smoke in rural areas. Thirty-nine per cent of the Yemeni population are without clean fuels and technology for cooking.[98] Pregnant women exposed to cooking smoke are also at risk of giving birth prematurely, and having small, low birth weight babies.

5.2 NUTRITION

Extreme climatological trends, exacerbated by climate change, have powerful consequences on nutritional status. Land degradation, droughts, and floods trigger food shortages in a subsistence economy, along with conflicts, can provoke population displacement leading to further declines in household food security. Under-nutrition is a major co-factor in young child mortality and morbidity. Poor water, sanitation and hygienic conditions only worsen a child's poor nutritional status; basic sanitation and water services are under stress due to climate shocks and water scarcity.

Yemen's stunting rate for children under 5 (too short for their age) is about 45 per cent, considered by WHO as 'very high prevalence', and has not improved significantly over the past 10 years.[99] The prevalence of wasting in children under 5 (too thin for their height) is about 10 per cent, representing 2 million cases.

Lack of sufficient nourishment for pregnant women and young children will increase the incidence of low birth weight and infant mortality and exacerbate child malnutrition. Stunted children who survive will experience greater incidence of disease, more extensive learning disabilities and reduced physical capabilities. Malnutrition among pregnant and lactating mothers in Yemen is also high at 24 per cent,[100] perpetuating the inter-generational cycle of malnutrition.

96 Ibid.
97 WHO Yemen Environmental health scorecard environmental-health-yem-2023.pdf (who.int)
98 Ibid.
99 UNICEF Nutrition Programme Strategy Note 2023-2024
100 UNICEF Yemen Nutrition Update presentation, 2023


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5.3 WASH

Climate change is a significant threat to the effective and equitable provision of WASH services. Children's access to safe water and sanitation services in Yemen is already a challenge and will become increasingly threatened by rising temperatures, greater water scarcity and environmental hazards. Nationally, water supply coverage is 61 per cent, leaving 39 per cent of the population with limited or unsafe drinking water.[101] Only 39 per cent of the rural population use improved (at least basic) household sanitation facilities.

Longer dry seasons and drought periods will increase water demand for industrial use, domestic water supply and irrigation. Increased evapotranspiration will reduce water flows and soil moisture. Groundwater, the source of most agriculture and domestic water supply, is buffered from short dry spells, but reduced recharge and uncontrolled withdrawals now raise the specter of depleted groundwater reserves.

Increasingly erratic and severe weather events can endanger sanitation infrastructures, particularly those that are poorly located or under-designed. Low-lying wastewater systems and on-site sanitation are especially at risk of flood damage and overflow, resulting in contamination of the environment with raw sewage and increasing the risks of cholera or diarrhoeal disease outbreaks. Inadequate urban drainage systems come under stress, highlighting the costs of underinvesting in climate-proofed infrastructure.

101 WHO-UNICEF Joint Monitoring Programme JMP (washdata.org)

Large-scale humanitarian responses to emergency situations divert away critical sector financial resources and technical capacities that are required for durable solutions and climate resilient WASH services. In Yemen, UNICEF's first priority has been to provide a life-saving WASH response, while still supporting institutional and community capacity building for long-term quality services.

saltwater intrusion into freshwater coastal aquifers is impacting water quality and will require expensive aquifer remediation or water treatment to make it potable.

Greater exposure to heatwaves may increase algal blooms and pathogens and decrease dissolved oxygen, necessitating enhanced wastewater treatment. Excessive heat can lead to malfunctions or increased odor, deterring the use of sanitation systems, and possibly leading people to revert to open defecation. In an effort to recycle water, poorly treated wastewater for agriculture may increase the risk of water-borne diseases.

School-age children are susceptible to lice, skin and eye infections and soil-transmitted helminths, all of which will persist under conditions of water scarcity and poor hygiene at home. Intestinal parasite infection is one of the most frequently reported diseases in Yemen and is a serious health issue for school children.[102] Hygiene practices and hygiene promotion messaging may need to be adapted to evolving environmental threats or changing disease prevalence. In addition, greater civic education about good water conservation at home, school or work will become essential.

5.4 EDUCATION AND LEARNING

Climate and environmental threats exacerbate poor access, poor retention and poor learning outcomes in basic education that reflect patterns of poverty, geographical disparities, gender inequities, disability, and conflict and displacement. Out of 10 million school-aged children (5–17 years old), an estimated 20 per cent are out of school.[103]

Increasingly frequent and extreme weather events can damage school facilities and disrupt education services, leading to absenteeism, possibly for extended periods. Emergency learning spaces may be needed to substitute for affected schools or in cases of forced displacement.

Schools in hot environments may have inadequate ventilation or cooling, making the classroom uncomfortable, leading to lower learning outcomes. Children have difficulty walking to school

102 (PDF) PREVALENCE OF INTESTINAL PROTOZOA, HELMINTHES, AND COCCIDIAN INFECTIONS AMONG PRIMARY SCHOOL CHILDREN IN THALAʾA DISTRICT AT AMRAN GOVERNORATE, YEMEN (researchgate.net)

103 Yemen_HNO_2021_Final.pdf

during heatwaves. Adaptation strategies include climate-proof school construction, solar-powered fans, shifting school hours to avoid the hottest periods and providing chilled drinking water. Only 51 per cent of schools have water for drinking, sanitation or hand hygiene.[104]

Droughts or environmental stress lead to the degradation of livelihoods and food insecurity, particularly in poverty-prone rural areas. Family budgets stretched to accommodate increasing costs of food and shelter may not be able to cover school-related costs. Children, mainly girls, often have to supplement the family income, sacrificing their education, as well as face the prospect of early marriage. An estimated 32 per cent of women aged 20–24 years were married before 18 years of age while 10 per cent were married when they were children, before age 15.[105]

Climate shocks and environmental degradation highlight the importance of providing disaster preparedness education in schools, to reduce children's vulnerability. In Yemen, TEP stresses training in the management of education in emergencies, as well as the importance of school DRR planning. In Lahj governorate, 65 per cent of all schools have DRR plans in place, and in Aden governorate, 60 per cent have such plans.[106]

School repair costs after natural disasters can drain budgets and divert resources from teaching and maintaining a protective school environment. School electricity supplies, where they exist, may be increasingly intermittent, and reliance on diesel generators is ever more costly, justifying greater investment in solar solutions in schools.

Without reliable, safe water supplies, schools must pay for deliveries of trucked water. The lack of water and sanitation facilities in schools has affected educational quality, children's ability to learn and the health of children. The collapse of health and WASH services during the COVID-19 period affected 5.8 million children in schools who needed adequate services, including hygiene promotion, to prevent the spread of disease.[107]

The threats of and exposure to climate impacts offer real-life opportunities for the education sector to address the risks associated with climate change, building appropriate science and problem-solving skills, as well as knowledge of environmental sustainability. Children and adolescents will need to be properly equipped with life skills and vocational training to thrive and realize their socio-economic potential, possibly in green employment.

104 Transition Education Plan 2019-2022 download (globalpartnership.org)
105 Yemen National DHS 2013 Yemen, Rep. - National Health and Demographic Survey 2013 (worldbank.org)
106 Yemen Transition Education Plan 2019-2022
107 UNICEF Yemen Education and Learning Strategy Note 2023-2024

5.5 CHILD PROTECTION AND CHILD LABOUR

Land degradation and food and water insecurity threaten rural livelihoods and contribute to tensions and conflict between individuals and groups. Child protection services need the tools and resources to protect children from violence, exploitation and abuse during these volatile situations, as well as to contribute to peacebuilding and social cohesion efforts.

Climate-driven humanitarian disasters, whether floods, droughts or other extreme events, drive large-scale displacement and require responsive child protection services. Interventions such as psychosocial support, prevention of gender-based violence and family reunification become ever more critical, and the capacities of child protection services must be strengthened to meet the growing challenge.

Affecting the poorest most, climate change increases inequality, prolonging existing poverty traps and creating new ones, leading to more deprivation and marginalization of vulnerable groups, including refugees and children with special needs. Among the consequences are increased likelihood of early marriage and sexual exploitation, abandonment by one or both parents who leave the home to find work, risks to child mental health or increased prevalence of child labour.

Children and families with subsistence agriculture and pastoral livelihoods are vulnerable to variable precipitation and increasing temperatures that trigger droughts, fires and crop pestilence. Child labour and exploitation can increase following these events. In some cases, poor families are forced out of their homes or communities in search of food relief or alternative income opportunities.[108] A 2013 study found that 17 per cent of Yemen's children in the 5–17 age group and 11 per cent of those aged 5–11 are involved in child labour. With the war, boys were recruited into armed groups.[109]

In Yemen, working children are primarily engaged in agriculture, on family farms or in qat production. Children working in the qat sector are exposed to hazards such as pesticides, dangerous tools and high ladders, as well as receiving qat as payment. In rural areas, the percentage of children in employment aged 5–14 is four times higher than in urban areas.[110]

108 The Neglected Link: Effects of Climate Change and Environmental Degradation on Child Labour, Terre des Hommes, 2017
109 ILO Yemen child labour Survey: More than 1.3 million child labourers in Yemen (ilo.org)
110 ILO regional child labour report wcms_675262.pdf (ilo.org)

Urban children work in factories, auto shops, domestic settings or street vending with specific risks such as physical injuries or exposure to toxic substances, waste, particulates, smoke and traffic pollutants, all of which can lead to respiratory problems or long-term damage to the central nervous system.[111]

Children with disabilities, including those that affect vision, hearing, speech, cognition and mobility, are one of the groups most vulnerable to climate and environmental stressors, requiring special considerations in health, education and protection.[112] They are at risk of physical injuries from extreme weather events like floods and debilitating heatwaves. Emergency warnings and important messages may not be designed with accessibility in mind.

5.6 YOUTH AND ADOLESCENTS

Climate change and environmental degradation can undermine social stability, a key factor in the well-being of youth and adolescents. The threats to health, education, and protection systems described above impact on youth and adolescents, highlighting the need to shift from addressing acute humanitarian needs to investing in systems strengthening, community resilience and peace building, increasing their resilience to future shocks.[113]

Conflicts over scarce resources and limited opportunities will increase as climate shocks create socio-economic hardships. Social instability can leave youth and adolescents exposed to violence or abuse at home, communities and schools. The impacts of the conflict in Yemen – displacement, deprivation, devastated infrastructure, limited access to services or employment – foreshadow the vulnerabilities of youth to climate stresses and environmental degradation.

A weak economy and poor job market particularly affect youth in Yemen. Estimates of youth unemployment range from 25-45 per cent. Of those employed, half work in the service sector and the rest work in family farming or are self-employed in the informal sector.

Youth engagement and environmental activism have helped to address pressing humanitarian challenges facing communities through responses to food insecurity, disasters or emergency relief. With growing awareness of climate change impacts, a sense of greater urgency is emerging among youth groups, thus offering opportunities to harness youth participation and empowerment for change.

111 2018 Findings on the Worst Forms of Child Labor, U.S. Bureau of International Labor Affairs
112 Mapping available assistance to children with disabilities in Yemen, UNICEF, 2020
113 UNICEF Yemen Situation Analysis of Children and Women, 2020

Psychosocial impacts can be experienced due to direct climate change effects but also from awareness of climate change and the uncertainties it casts over a secure future. Young people are expressing negative emotions such as fear, sadness, helplessness and anger at the prospect of climate change, which can contribute to increased risk of diminished long-term social and cognitive development.[114]

5.7 SOCIAL POLICY AND SOCIAL PROTECTION

Climate change and environmental impacts and threaten standards of living, hindering economic growth and putting considerable additional strain on public expenditures. High inflation and lack of investment in social sectors have already increased the vulnerabilities of families and children in Yemen. These mounting crises overload social protection mechanisms, like health insurance and pensions, at the very moment that they need to reach more people. After eight years of conflict, economic output has fallen by half, the country's infrastructure has been devastated and the poverty rate has reached over 66 per cent. [115]

The most **exposed and vulnerable** to the adverse impacts of climate change are people living in ecologically fragile areas and hazard-prone locations. Globally, about 80 per cent of the rural poor depend on biodiversity and ecosystem services for their livelihoods. This applies to Yemen where subsistence farmers and pastoralists live off the land, depending on rainfed agriculture and seasonal pastures for survival. In growing urban areas, low-income households commonly settle on marginal lands, subject to flooding, landslides or industrial harm. Poor households are exposed to land-use change, pollution (water, air, land), chaotic urbanization and inefficient transport systems. The depletion of natural resources is a trigger for competition and conflict, leaving entire communities vulnerable.

Access to affordable, reliable energy is required to sustain livelihoods, and is a prerequisite for overcoming poverty. Essential public services depend on energy, and so does human health and development. In Yemen, energy options for the rural poor can reduce drudgery and be transformational, especially for women and girls.

Climate impacts magnify gender inequality. They affect women disproportionately, especially in the areas where women play a central role—food security, subsistence agriculture, home energy and childcare. This vulnerability can lead to displacement and gender-based violence, and it makes women even more susceptible to the economic hardships of climate change. It is critical to reduce the barriers to decision-making power, financial resources and information

114 Climate Change and Children: An issue of intergenerational justice, Ann Sanson and Susie Burke, 2019
115 World Bank Yemen Economic Memorandum 2022 World Bank Document

that increase women's vulnerability through social protection instruments such as cash transfers, public works programmes, jobs and skills training and weather-based crop insurance.[116] Projected requirements and strategies for national social protection programmes will need to proactively consider climate change impacts on the population.

The direct and indirect impacts of climate change on children are illustrated in Figure 5.1.

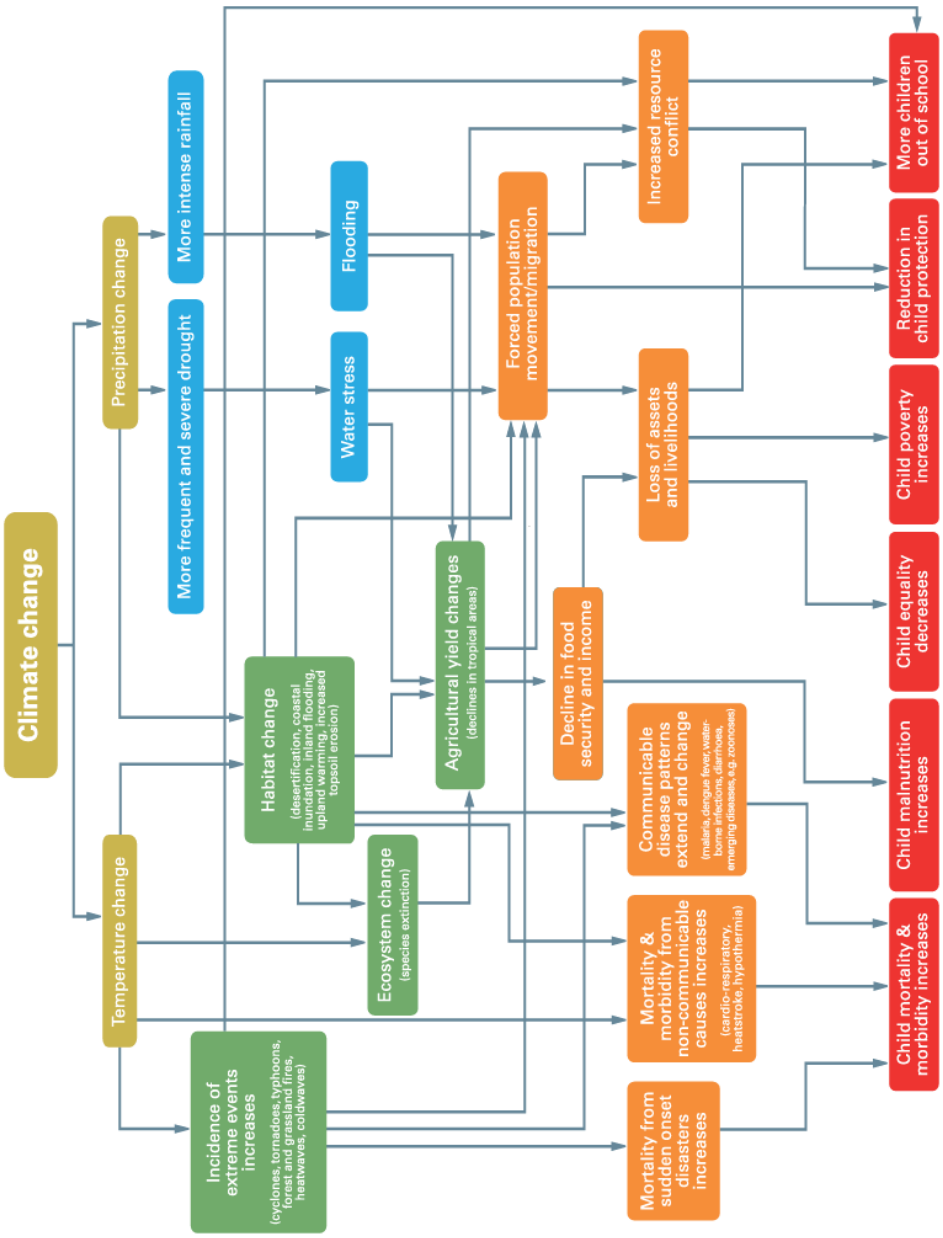

Fig. 5.1 Direct and indirect impacts of climate change on children

Source: Our climate, our children, our responsibility: The implications of climate change for the world's children, UNICEF UK, 2008

116 UNICEF Social protection, 2023 How_GRASSP_is_related_to_the_climate_crisis.pdf (unicef-irc.org)

6

UNICEF COUNTRY PROGRAMME AND LINKAGES TO CEED

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UNICEF Yemen has been implementing CEED-relevant initiatives that help mitigate the impact of climate and environment stressors and improve child-oriented services. The recommendations in Section 7 for strengthening current programme activities or exploring new strategies take into account these examples of ongoing foundational work.

- **Environmental and Social Safeguarding (ESS).** UNICEF has adopted ESS measures as part of the Unconditional Cash Transfer (UCT) programme, with support from an expanded ESS unit. ESS seeks to 'do no harm' to people and environment related to project activities, and it has raised the level of awareness about these issues with staff and contractors alike. UNICEF HQ is issuing a global policy on ESS and sustainability; ESS in Yemen paves the way for more robust environmental assessments and climate resilient design in its programming.
- **Adolescents and youth desk review.** The 2022 UNICEF-commissioned situation analysis of adolescents and youth in Yemen makes the case for greater UNICEF engagement with these important stakeholders. Unfortunately, the report missed the opportunity to examine youth in the climate and environment sphere, its impacts on this segment of society, or their role in responding to these challenges. However, the report recommendations offer many appropriate options for how UNICEF should proceed, among them: create an adolescent and youth development and participation section; incorporate youth participation in UNICEF-supported programmes; support youth-led organizations and platforms; support TVET and life-skills learning.
- **Installation of solar PV power across programmes.** Sustainable power supplies are a key ingredient in climate-resilient services and have been implemented widely.

  Solar-powered hybrid pumping at WASH facilities to reduce reliance on unstable electricity sup plies and costly diesel-powered systems.
  Solar installations at health facilities to ensure cold chain integrity and to power vital opera tions (O2 generators, fans, refrigerators, lighting).
- **Shifting to Climate Resilient WASH services.** In response to UNICEF's global shift, significant steps have been taken to apply a more holistic approach to water supply and sanitation sustainability, including IWRM. WASH has convened participatory planning with government and stakeholders on the WASH enabling environment, and contributes to the evidence-base with reports, financing studies and sector analyses to help address Yemen's huge water scarcity challenges.
- **Safe handling and disposal of medical wastes in healthcare facilities (HCFs).** The Health programme has started to tackle this huge environmental health threat by installing waste treatment units (WTUs) – incinerators and ash pits – along with conducting staff training at 90 HCFs.
- **Social protection.** The large-scale implementation of the UCT programme funded by the World Bank has since 2017 provided emergency cash assistance to 1.5 million vulnerable households and benefited 9 million Yemenis. This experience positions the UNICEF Social Protection programme to actively engage in the development of future safety net mechanisms.

UNICEF's global climate and environmental sustainability strategy rests on four pillars as a

7

RECOMMENDATIONS AND OPPORTUNITIES

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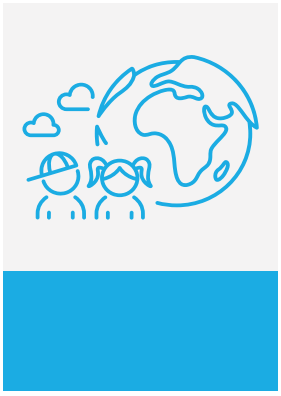
basis for advocacy, programmatic interventions and greening efforts.[117] The recommendations align with this structure:

- Make children and women/care givers the focus of environmental strategies.
- Empower children and women/care givers as agents of change.
- Protect children and women/care givers from impacts.
- Reduce emissions and pollution.



7.1 MAKE CHILDREN A FOCUS OF ENVIRONMEN TAL STRATEGIES

Advocate with governments and business partners to put children first in their own sustainability plans, budgets and actions towards a green transition.

7.1.1 MAKE CHILDREN VISIBLE IN NEW CLIMATE AND ENVIRONMENT POLICIES AND STRATEGIES IN YEMEN.

Existing climate policy documents rarely mention children, let alone highlight their unique needs and rights in the face of climate threats. Three new documents will be issued in 2024 and 2025, preceded by stakeholder consultations and inputs: the new NDC, the new NAP, and the 4th National Communication to the UNFCCC. This presents a clear and urgent opportunity for UNICEF to engage with EPA and sister agencies UNDP, UNEP, UN-Habitat, and FAO to pursue synergies, and advocate for child and youth inclusion.

7.1.2 ENSURE THAT NEW CHILD-RELEVANT SECTOR STRATEGIES AND PLANS ACCOUNT FOR CLIMATE IMPACTS AND CONTRIBUTE TO NATIONAL MITIGATION, ADAPTATION AND ENVIRONMENTAL PROTECTION GOALS.

Similar to child visibility in climate and environment policies, UNICEF has an important role in

117 An Environment Fit for Children: UNICEF's Approach to Climate Change, UNICEF, 2019

ensuring that child-relevant national sector strategies to which it aligns its programmes reflect climate and environment hazards and lay out measures to adapt to them. Numerous sector strategies updates – in education, child and adolescent health, social protection, nutrition, child protection, and WASH –present a timely opportunity to redress that situation.

7.1.3 WORK WITH THE PRIVATE SECTOR TO IDENTIFY HOW THEIR PRODUCTS, SERVICES AND SUPPLY CHAINS CAN BE HARNESSED TO PROMOTE ENVIRONMENTAL SUSTAINABILITY AND PROTECT NATURE.

UNICEF should ensure that business partners respect children's rights to a clean and safe environment by reducing negative impacts on water, soil and air. Business operations, manufacturing processes and supply chains should aim for safe waste disposal, water conservation and energy efficiency to avoid damage to the environment and natural resources. UNICEF should join forces with UN agencies, development partners and civil society organizations that are supporting waste transformation and plastics control efforts in Yemen to identify entry points and coordinate consistent approaches with the private sector.

7.2 EMPOWER CHILDREN AS AGENTS OF CHANGE

Support and empower children and young people to adapt and create a better world.

7.2.1 TEAM UP WITH YOUTH-LED ORGANIZATIONS ON CEED ISSUES, FOSTERING YOUTH PARTICIPATION AND ENGAGEMENT FOR A SAFE AND PROTECTIVE ENVIRONMENT.

UNICEF will use its well-established connections with children and youth to educate and energize participation on Yemen's pressing climate and environment issues. Youth-oriented groups have been involved in community services and are tapped by UNICEF to generate public awareness on immunization, handwashing with soap and child protection. UNICEF should identify potential partners, their capacities and modalities of engagement. Designing a set of consis-

tent messages on climate and environment, while accounting for rural and urban realities, is a challenging but necessary step.

A priority quality of life issue – the management of solid waste and plastics – is a fertile area for youth involvement, requiring behaviour change and actions starting at the most local levels, including at home, in schools and at community centres. Other topics are water conservation awareness campaigns, or pressing for urban parks and green spaces for recreation. Youth participation in monitoring biological water safety, an important element of the cholera response, can be a viable activity. UNICEF should work with UNDP and UNEP on their youth leadership and environment champions programmes to align messaging and channels of communication.

7.2.2 SUPPORT AN UPDATE OF YEMEN'S BASIC EDUCATION CURRICULUM TO REINFORCE CLIMATE, ENVIRONMENT, WASH AND NUTRITION ELEMENTS.

The four pillars of the UNESCO-led Greening Education Partnership provide a comprehensive approach to transforming schools, curriculum, teacher training and communities. An updated curriculum will require new materials and teacher training, reinforced by an array of out-of-classroom life skills through student councils, health and environment clubs, community outreach activities and hands-on greening experiences (school gardens, tree planting). Schoolchildren can be agents of change within their own families on improved hygiene practices, safe water handling, and sanitation promotion. Introducing nutrition and diet knowledge into school environments can have a life-long health benefit.

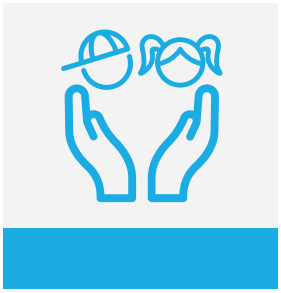
7.2.3 EXPLORE THE POSSIBILITIES AND ADVANTAGES OF INVESTING IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET).

The high level of youth unemployment points to a priority for UNICEF to give young people marketable skills and get them into the workplace. The Ministry of Technical Education and Vocational Training has jurisdiction over all 264 TVET centres and institutes, but most are privately run. UNICEF should explore collaboration with UNESCO, WB, USAID and ILO in this space to steer training towards green employment preparation and placement. Green skills training (e.g., RE/EE, water utilities, marine biodiversity, climate-smart agriculture) needs to be matched with placement in public and private sector jobs.[118] Internships could be created for young people with UNICEF contractors, such as in solarization or water infrastructure projects, giving them work experience to build upon. This action relies on strong alliances with the business community and a good understanding of the demand and supply requirements of the labour market.

118 ILO definition for green jobs: Improve energy and raw materials efficiency, eliminate GHG emissions, eliminate waste and pollution, protect and restore ecosystems and human health, support adaptation to the effects of climate change.

7.2.4 MOBILIZE INFLUENCERS AND CHAMPIONS ON CLIMATE AND ENVIRONMENT ISSUES THROUGH SOCIAL MEDIA TO REACH AUDIENCES ACROSS YEMEN, AS WELL AS TO PARTICIPATE IN REGIONAL AND GLOBAL YOUTH CLIMATE ACTION.

A strategy should be put into place to engage high visibility and high impact champions for effective broadcasting of key child-relevant messages during campaigns, event days and youth forums. As a resource, UNICEF MENA regional office and UNDP issued the Young Climate Activists Toolkit[119] which aims to equip young people with the knowledge, tools and resources to be well-informed advocates in the climate change debate.



7.3 PROTECT CHILDREN FROM IMPACTS

Strengthen the resilience and continuity of social services to climate and environmental impacts, including disasters.

7.3.1 ANTICIPATE CLIMATE AND ENVIRONMENTAL DEGRADATION IMPACTS ON CHILDREN AND IDENTIFY WAYS THAT PROGRAMMES CAN INCORPORATE EFFECTIVE ADAPTATION STRATEGIES THAT BOLSTER SOCIAL SERVICES.

The UNICEF CCRI report revealed the extent to which child vulnerability to climate change and environmental degradation increases when basic services are poor or non-existent – "extremely high severity" in the case of Yemen. UNICEF's programmes are the core of its contribution to a better world for children, based on systems strengthening, intersectoral collaboration and sustainable results. Programme sections must incorporate practical ways to reduce child vulnerability to climate and environment stresses, including DRR measures to prevent, reduce and prepare for disaster risk in their sectors and at community level. Addressing climate resilience through UNICEF programmes implies a longer-term planning perspective to achieve durable results, a shift that has gained traction in Yemen with government and development partners alike.

119 The Young Climate Activists Toolkit | UNICEF Middle East and North Africa

7.3.3 CONTINUE ROLLING OUT CLIMATE RESILIENT WASH WHILE MAINTAINING A FOCUS ON SUSTAINABILITY OF WASH SERVICES AND SCARCE WATER RESOURCES.

Ensuring water security in a water scarce country and in resource-poor communities will continue to be an immense challenge. UNICEF WASH should pursue its efforts to convene national stakeholders and institutions around a robust enabling environment, while ensuring the practical benefits of sustainable maintenance and quality services. Coordination with NWRA, FAO and others responsible for IWRM management information systems should be expanded to include hydrogeological modelling and aquifer protection. Groundwater quality assessments to delineate the presence of contaminants such as fluoride and arsenic that endanger children is needed. At the rural watershed level, WASH has an arsenal of interventions to match conditions on the ground, which should be deployed in concert with rural livelihoods and climate-smart agriculture programmes implemented by others.

Greater investment in urban sewage systems and wastewater treatment will be required to meet the burgeoning needs of cities, while improved household sanitation and the elimination of open defecation in rural areas cannot be neglected. Water re-use for agriculture and urban greening is part of the loop. Decentralized wastewater treatment (DEWATS), an affordable, low maintenance, passive treatment approach that can be sized for communities, schools, IDP sites and hospitals, should be part of the safe sanitation landscape in Yemen.

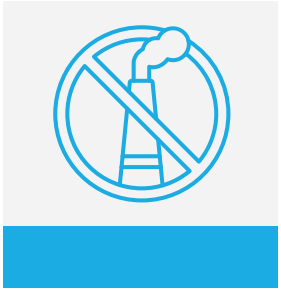
7.3.4 INVEST HEAVILY IN NEW IDEAS AND RESOURCES FOR CLIMATE RESILIENT EDUCATION.

Clean-safe-green schools and a climate-smart education system are central to the adaptations needed for protecting and educating children, while empowering them to be agents of change and stewards of a green community.

- Climate-proof school designs are needed to withstand flood events and heatwaves alike, in addition to accommodating students with disabilities. Schools should have solar power for fans for ventilation and to chill drinking water, critical for learners during heatwaves.
- The school curriculum needs updating to include climate change and the environment, as well as the importance of safe water and improved hygiene behaviours. Nutrition education is often neglected, but coupled with school gardens can become an opportunity to instill life skills as well as to improve diets.
- Risk-reduction education and school preparedness (drills, school risk maps, contingency plans) that prepare students to reduce their exposure to hazards are implemented in a few governorates but not all.
- With WASH facilities and water supply installed, children can practice improved sanitation and hand hygiene at school.
- Water onsite permits tree nurseries, which, coupled with student outreach, are a tangible way for students to appreciate their environment and turn their communities green.

7.3.5 PARLAY UNICEF SOCIAL PROTECTION CAPITAL INTO EXPANDED CLIMATE-RESILIENCE SAFETY NETS.

The UNICEF Social Protection programme should explore with government, WB and other major donors how future versions of social safety nets for Yemen can support climate adaptation and transformation. For instance, community adaptation grants could target rural livelihoods for climate-smart agriculture, sustainable watershed management and renewable energy, with household poverty and climate-risk reduction as outcomes.



7. 4 REDUCE EMISSIONS AND POLLUTION

Reduce emissions and pollution to avoid the worst impacts of climate change, including within UNICEF programmes.

7.4.1 EXPAND RENEWABLE ENERGY INVESTMENTS AND POWER OPTIONS FOR OFF-GRID COMMUNITIES AND SOCIAL SERVICES.

Renewable energy (RE), including the untapped potential of wind power, offers emissions-free electricity supplies to critical services and is a tool for household poverty reduction. UNICEF should expand its programme applications of solar PV in schools, safe spaces and youth centres, and explore synergies with other partners committed to RE, such as WB, UNDP, UNOPS and the Netherlands. Community mini-grids, large-scale solar for seawater desalination and small wind electric turbines are viable applications. UNICEF should promote private sector partnerships that accelerate solar PV and wind adoption in businesses, complemented by the creation of installation, repair and maintenance jobs for youth.

7.4.2 BUILD ON THE HEALTH WTU INITIATIVE TO IDENTIFY ENVIRONMENTALLY SOUND SOLUTIONS FOR MEDICAL WASTE HANDLING AND DISPOSAL AT THE HUNDREDS OF HCFS THAT WERE NOT INCLUDED IN THE ONGOING PROJECT.

Healthy environmental conditions at both urban and rural venues are endangered by poor handling/disposal of sharps, infectious waste, pharmaceutical waste and single-use polyvinyl chloride products. Health staff and the public are threatened by lack of environmentally sound waste management practices at the many HCFs. UNICEF should pursue options with MoPHP to address the gaps, while also identifying non-functioning medical devices and cold chain equipment, for which there should be proper decommissioning and disposal protocols.

7.4.3 RESEARCH CHILD EXPOSURE TO AMBIENT AIR POLLUTION AND HAZARDOUS WASTE.

Data on air pollution levels in urban areas (high-traffic areas, near dump sites, at hazardous workplaces where children work) are lacking, and evidence of risk where children are most exposed is needed. The findings could become a basis for multi-stakeholder engagement on the theme of 'clean air for healthy children'. The aim would be to build awareness and catalyze action on clean air solutions. Collection of local air quality data is becoming increasingly inexpensive and accessible using low-cost real-time devices at child-centric locations (homes, schools, HCFs). This activity is amenable to citizen and youth participation for local environmental awareness and action.

Hazardous waste is generally disposed of in municipal dumps, posing risks to the environment and to the health of waste pickers, many of them boys and girls. UNICEF should work with those involved in the waste sector to ensure that these children's vulnerability is addressed.

7.4.4 PROMOTE ENERGY-EFFICIENT COOKING OPTIONS AS PART OF COMMUNITY PROGRAMMING.

Indoor air pollution related to the use of wood, charcoal and agricultural residue for rural household cooking is a danger to mothers and children, and it deserves priority attention. The known benefits of greater fuel efficiency, health risk mitigation, reduction of land degradation and a decrease in the burden and cost of acquiring firewood or charcoal point to an urgent need for action. WHO estimates that 39 per cent of households in Yemen, mostly rural, do not have access to clean cooking fuel. Liquified petroleum gas conversion, solar cookers and energy efficient smokeless stoves are all options, with a natural role for local entrepreneurs.

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8 CONCLUSION

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A VISION FOR YEMEN

UNICEF should aim for a future Yemen where children and youth are stewards of the environment. All programme approaches – empowering young people, especially adolescent girls and young women generating evidence, delivering services, advocating for equity, shaping markets – should be geared towards preparing a generation with the knowledge and motivation to protect and foster a green, resilient country that benefits everyone.

The best protection from the impact of climate change is a healthy environment. Economic prosperity, and human survival itself, depend upon the goods and services generated by nature: food and raw materials, water filtration and climate regulation. Functioning ecosystems and biodiversity buffer the planet – including Yemen – from the worst impacts of climate change.

UNICEF can contribute by ensuring that its investments in children produce tangible benefits for nature. A green community is a resilient community.

Dragon's blood tree (Dracaena cinnabari)
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