IRAN Climate Fact Sheet

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I- GENERAL CLIMATE OVERVIEW

Iran's climate is mainly arid and semiarid except for the northern coastal areas and parts of western Iran. The climate is continental with hot and dry summer and very cold winter particularly in inland areas. Apart from the coastal areas, the temperature in Iran is characterized by relatively large annual range about 22°C to 26°C. The rainy period in most of the country is from November to May followed by dry period between May and October with rare precipitation. The average annual rainfall of the country is about 240 mm with maximum amounts in the Caspian Sea plains, Alborz, and Zagros slopes with more than 1,800 and 480 mm, respectively (WB CCKP, 2021).

II- CLIMATE CHANGE TRENDS

The ND-GAIN Country Index summarizes a country's vulnerability(1) to climate change and other global challenges in combination with its readiness(2) to improve resilience. Iran's ND-GAIN Index rank is 78. It is the 125th most vulnerable country and the 102nd most ready country. The low vulnerability score and high readiness score of Iran places it in the lower-right quadrant of the ND-GAIN Matrix, which means adaptation challenges still exist, but Iran is well positioned to adapt (University of Notre Dame, 2023).

From Past to Present:

The average annual mean temperature in Iran for the year 1901 was 17.64 °C. This number increased to reach 19.54 °C in 2021 (+ 1.90 °C) (figure 1).

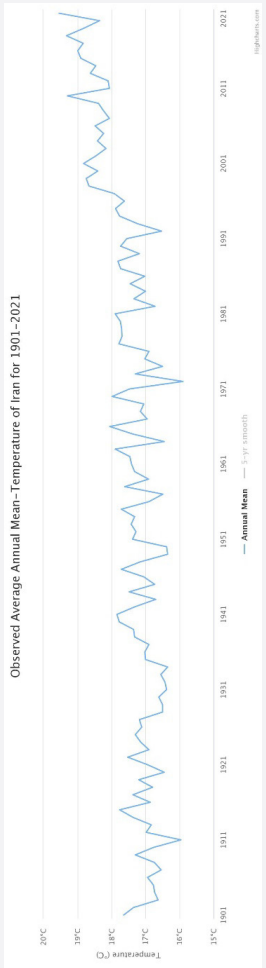


Figure 1: Observed Average Annual Mean Temperature (1901-2021) (WB CCKP, 2021)

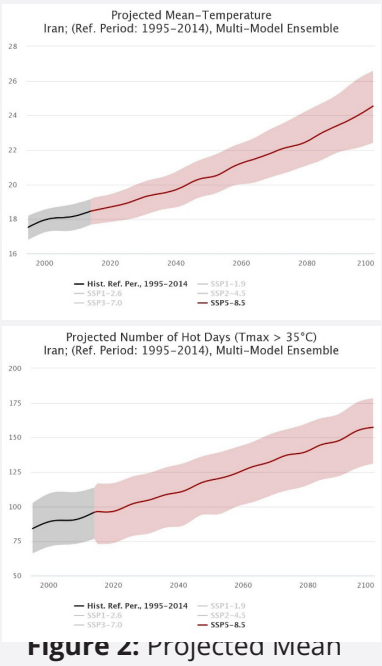


Figure 2: Projected Mean Temperature (top) and Projected Number of Hot Days [Tmax greater than 35 °C] (bottom) (WB CCKP, 2021)

1 Vulnerability measures a country's exposure, sensitivity, and ability to adapt to the negative impact of climate change. ND-GAIN measures the overall vulnerability by considering vulnerability in six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure.

2 Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness by considering three components – economic readiness, governance readiness and social readiness.

Projected:

- **Temperature:** While mean temperature for the reference period 1995-2014 was between 17.53 and 18.46 ºC, it is expected to increase and reach 20.42 ºC by mid-century under a high-emission scenario(3), and 24.54 ºC by the end of the century under a high-emission scenario (figure 2, top). In addition, the number of hot days where the maximum temperature (Tmax) is greater than 35 ºC is expected to rise from 95.89 days (2014 reference) to reach 119.15 days by mid-century and 157.34 days by end of century under a high-emission scenario (figure 2, bottom).

- **Precipitation:** While the average precipitation for the reference period 2014 was 204.82 mm, it is projected to increase by mid-century under a high-emissions scenario to reach 209.39 mm and by end of century under a high-emissions scenario to reach 230.48 mm (figure 3).

III- CLIMATE CHANGE IMPACTS

a- Natural Hazards

One of the main impacts of the change in temperature and rainfall patterns is the occurrence of natural hazards. Figure 4 summarizes the risk level of natural hazards in Iran. It shows that the country has a high risk of river, urban, and coastal floods as well as landslides, water scarcity, extreme heat, and wildfire.

The main climate-related natural hazards that have occurred from 1900 till 2023 in Iran are seen in table 1:

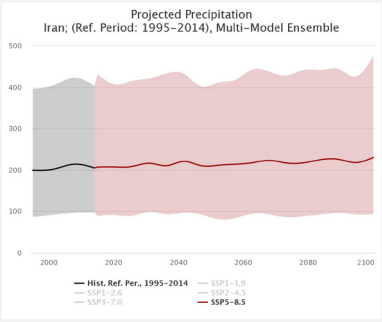
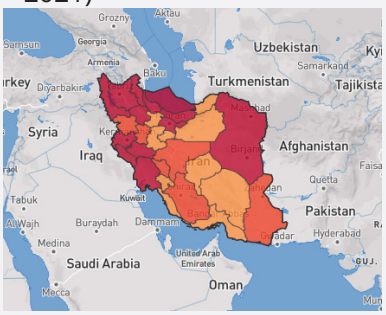
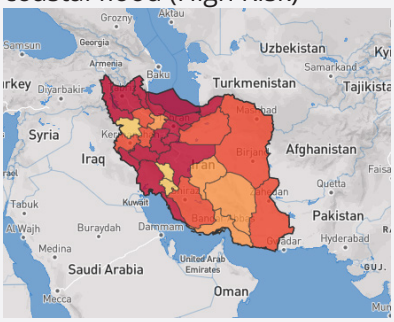


Figure-3: Projected Precipitation (WB CCKP, 2021)

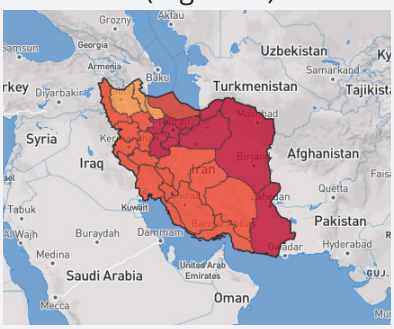


urban flood (High Risk)

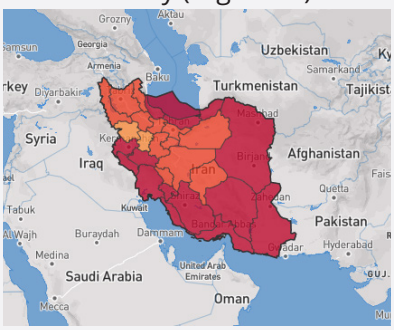
coastal flood (High Risk)



river flood (High Risk)



water scarcity (High Risk)



extreme heat (High Risk)

3 SSP5\RCP8.5-The highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century, depicting a world of rapid and unconstrained growth in economic output and energy use.

Table 1: Climate-related Natural Hazards (from 1900 till 2023) (EM-DAT, 2023)

Disaster Type	Occurrence (1900-2023)
Flood	95 (of which 32 recorded riverine floods, 23 recorded flash floods)
Storm	15 (of which 5 recorded convective storms, 2 recorded tropicalcyclones)
Landslide	5
Drought	3
Wildfire	1
Extreme temperature	1 recorded heatwave
	Total deaths: 8 813 **Total damages ('000 US$): 29 885 719**

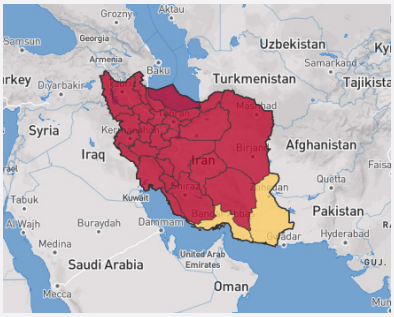
Specific recent examples of such hazards include the July 2022 flash floods caused by heavy rains, which left over 72,000 people affected in 25 provinces with 90 deaths. The floods resulted in tremendous damages to agricultural lands, roads and infrastructure, residential buildings, and drinking water supply facilities (ReliefWeb, 2022).

Figure 5 shows that under a high-emissions scenario, sea level rise is projected to increase and reach 0.22 m by mid-century and 0.67 m by the end of the century.

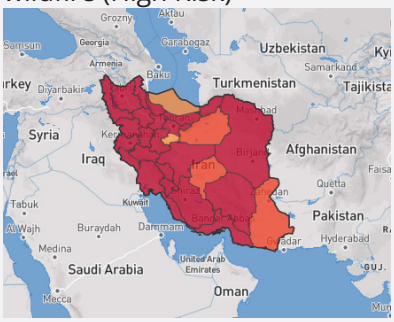
Sea level rise will have the biggest impact on the Persian Gulf area by 2100, where the low-lying coasts of Khuzestan Province and some locations in Hormozgan Province will get inundated. In addition, under a high emissions scenario, and without large investments in adaptation, an annual average of about 184,700 people is projected to be affected by flooding due to sea level rise between 2070 and 2100. If global emissions decrease rapidly, the annual affected population could be reduced to about 200 people (Iran's Third National Communication, 2017).

b- Water

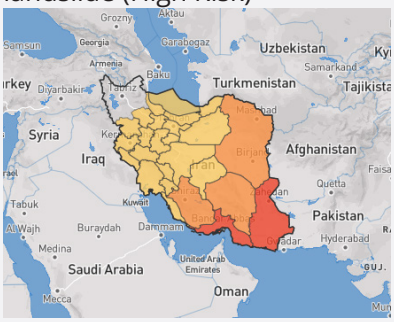
Groundwater utilization in Iran is increasing due to rainfall and runoff reduction that leads to water demand increase in different sectors such as industry, agriculture, and the domestic sector. In fact, the severe deficit of the country's aquifers has happened during recent year: in the last 15 years, about 5 to 6 billion cubic meters reduction of water in



wildfire (High Risk)



landslide (High Risk)



cyclone (Medium Risk)

Figure 4: Climate-Related Natural Hazards Risk Level (ThinkHazard, 2020)

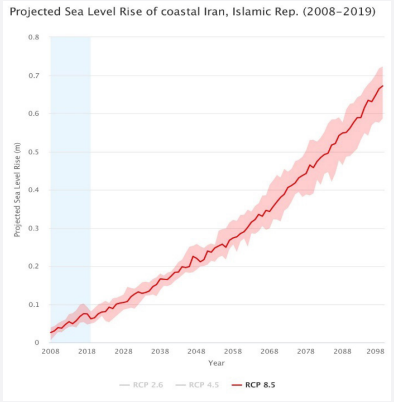


Figure 5: Projected Sea Level Rise of Coastal Iran (WB CCKP, 2021)

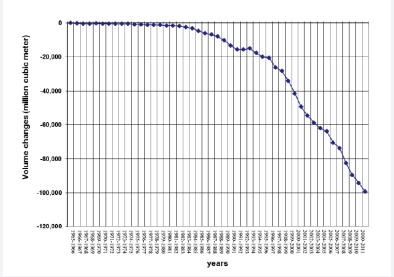


Figure 6: Aquifer Reservoir Volume Reduction in Iran (from 1964-1965 to 2010-2011) (Iran's Third National Communication, 2017)

reservoirs has occurred per annum, so the cumulative deficit of aquifers is about 100 billion cubic meters in the 15-year period (about 80% of the deficit) (figure 6).

Figure 7 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in Iran. The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.01 by 2050 and will reach -2.84 by the end of the century, implying an increasing high pressure on water resources that are already scarce. A consequence of water scarcity could be a decline in agricultural productivity especially for crops that need irrigation. Other consequences include inadequate sanitation which can lead to deadly diarrheal diseases and other water-borne illnesses (WWF, 2023).

c- Agriculture and Fisheries

The agriculture sector in Iran accounts for about 18% of the national GDP, as 11% of Iran's land is used for agriculture. Some northern and western areas support rainfed agriculture, while others mostly require irrigation. In addition, about 22.3% of the employed population of the country is engaged in the agriculture sector. In 2008 and 2009, cold weather and droughts have caused considerable decline in agricultural production. In two separate studies, economic effects of climate change on wheat and corn and its impacts on the farmers' income were investigated. Results indicated that temperature increase, and rain decrease would cause 41% decline in wheat output or 777,000 IRR (approximately 77.8 USD) decline per hectare. For corn, output decline was 29% or 584,000 IRR (approximately 54.9 USD) decline per hectare (Iran's Third National Communication, 2017). In fact, and as seen in figure 8, many crop yields have decreased with time between 1981 and 2019 due to a reduced crop growth duration, which is expected to continue in the future, hence increasing the chances of imports from other countries.

On the other hand, the vulnerability of the fisheries sector to future climate change was assessed for three general fisheries activities in Iran, including fishing in the Caspian Sea, the Persian Gulf and Oman Sea, and aquaculture in inland waters. Results show that by 2030, fish species will start to decrease in number causing an imbalance of species, which will reduce the productivity in the fisheries sector. This reduction will consequently negatively impact the livelihoods of people dependent on this sector (Iran's Third National Communication, 2017).

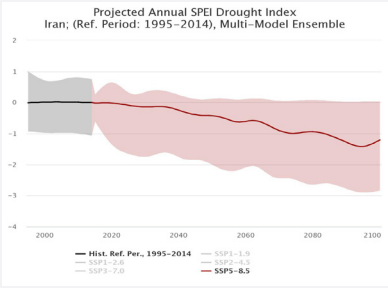


Figure 7: Projected Annual SPEI Drought Index (WB CCKP, 2021)

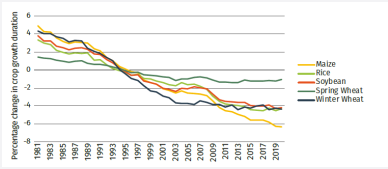


Figure 8: Percentage Change in Crop Growth Duration (1981-2019) (WHO, 2022)

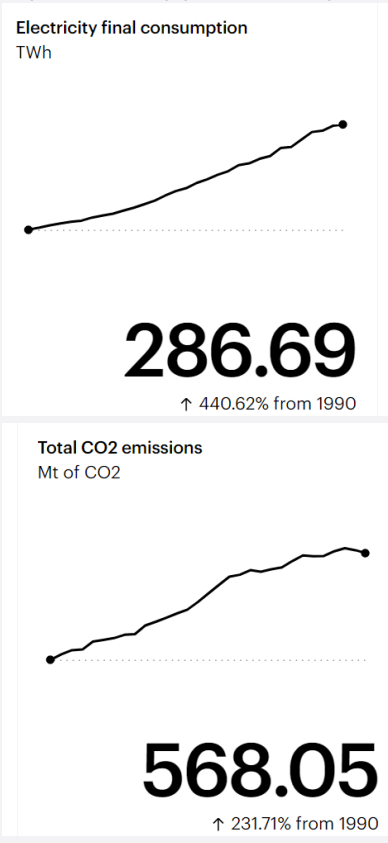


Figure 9: Electricity Final Consumption (top) and Total CO2 Emissions (bottom) (IEA, 2022)

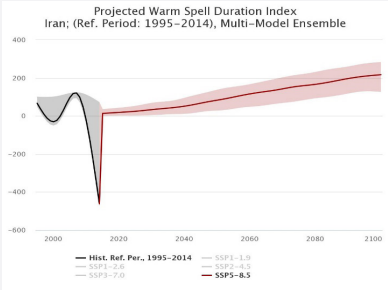


Figure 10: Projected Warm Spell Duration Index (WB CCKP, 2021)

4 An index which represents the measure of the given water deficit in a specific location, accounting for contributions of temperature-dependent evapotranspiration and providing insight into increasing or decreasing pressure on water resources. Negative values for SPEI represent dry conditions, with values below −2 indicating severe drought conditions, likewise positive values indicate increased wet conditions.

d- Energy

Iran is considered an energy-intensive country. In recent decades, the urbanization and industrialization processes along with population growth have changed the energy production and consumption patterns. Final energy demand which was 610.7 million barrels of oil equivalent (mboe) in 1996, has reached to 1,215 mboe in 2010, experiencing an average annual growth rate of 5%, and primary energy supply has boosted from 816.4 mboe to 1766.4 mboe in the same period. As a result of the intense reliance of Iran's energy system on inefficient fossil-fuelled technologies, GHG emissions from the energy sector have risen to reach 81% of total greenhouse gas effect in the country (Iran's Third National Communication, 2017).

Figure 9 (Top) shows that electricity consumption in Iran increased from 1990 (53.03 TWh) to 2020 (286.69 TWh). This increase in consumption also increased the total CO2 emissions from the energy sector by 231.71% from 1990 to 2020 (figure 9, Bottom). It is expected that electricity consumption will keep on increasing especially with the expected increase in the warm spell duration index(5) until the end of the century, under a high emission scenario (figure 10).

Renewable Energy: In January 2022, the Iranian Energy Ministry announced plans to add 10GW of renewable capacity by the end of 2026 to achieve the long-term target of a renewable cumulative capacity of 30GW. The Renewable Energy and Energy Efficiency Organization (SATBA) signed a Memorandum of Understanding (MOU) with private investors to execute the plan and has indicated that it would allocate around IRR30tn ($71.4m) towards the first set of projects in the upcoming budget. SATBA has revealed that applications have been received for more than 80GW of renewable power projects. There have been positive developments in the renewables sector following the commission of the country's first solar cell factory in early 2022 with an initial capacity of 150MW. There are plans to increase the factory's photovoltaic (PV) module capacity to 1.5GW by the end of 2023. The removal of the sanctions will provide the boost the Iranian renewable sector requires as foreign investments in this sector will enable stakeholders to exploit the potential of the Iranian renewable market that is still untapped (GlobalData Energy, 2022).

e- Health

The health risks of heat stress include heat-related illnesses such as dehydration, rash, cramps, heatstroke, heat exhaustion and death. Baseline (1961–1990) heat-related deaths among the elderly (65+ years) are less than 6 deaths per 100 000 population. Under a high emissions scenario, heat-related deaths among the elderly (65+ years) are projected

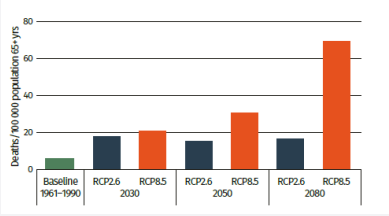


Figure 11: Heat-Related Death Among Elderly People (65+ years) (WHO, 2022)

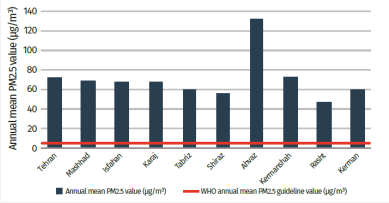


Figure 12: Annual Mean PM2.5 in the Ten Most Populated Cities of Iran (WHO, 2022)

5 An index that depicts periods characterised by several days of very warm temperatures compared to local or regional averages.

to rise to about 69 per 100 000 by 2080. A rapid reduction in emissions (RCP2.6) could significantly reduce deaths among the elderly in 2080 to around 16 per 100 000 population (figure 11).

Climate change increases the intensity and frequency of floods which can lead to population displacement and affect water and sanitation infrastructure and services by contaminating water with faecal bacteria (E. coli, salmonella) from runoff or sewer overflow.

Figure 12 shows that the ten most populated cities of Iran have annual mean PM2.5 values way higher than the WHO guideline value (5 µg/m3). Ambient air pollution can have direct and sometimes severe consequences for health as fine particles which penetrate deep into the respiratory tract increase mortality from respiratory infections, lung cancer and cardiovascular disease. In fact, there was 27 178 deaths from ambient air pollution in Iran in 2016. In addition, sand and dust storms have severe impacts on human health, by increasing particulate matter and carrying harmful substances and pathogens, all of which contribute to air pollution and associated respiratory problems.

PM2.5 from natural origins such as dust and sand contribute to about one-in-four particles in Tehran. Prevailing winds from west of Tehran bring dust storms either from other areas near Tehran or even from neighboring countries. The one-in-four dust share of particles for Tehran is significant, but dust in Tehran is far less important than it is elsewhere in Iran, for example in the cities of Zabol, Ahvaz, and Bosher, where the majority of PM pollution originates from dust and sand (Heger & Sarraf, 2018).

IV- CLIMATE CHANGE RESPONSE: NATIONAL AND INTERATIONAL

➔ National laws and policies include:

- The Environmental Protection Law of 1974 specifies rules and measures for the protection and management of the environment. The objectives of this Law, consisting of 21 articles, are the protection and improvement of the environment. Appropriate measures must be taken by the department of Environment (DOE) and the High Council for Environmental Protection in order to: (a) Preserve the ecological balance; (b) Prevent and control waste and noise pollution considered harmful to the environment; (c) Establish a system of supervision and monitoring for wildlife and marine resources; (d) Conduct environmental scientific research aimed at protecting and improving the environment; (e) Adopt effective measures against polluting units in order to prevent air, water, and soil pollution; (f) Arrange public training courses in order to raise awareness about environmental protection and improvement; and (g) Establish limitations for hunting and shooting in some protected areas. Designated local authorities shall cooperate with DOE and cooperation should also be established between DOE

and relevant International Organizations (ILO, 2014).

- National Strategic Plan on Climate Change (2017). This document is only available in Persian and focuses on mitigation though mitigation, water resource management, agriculture, food security, natural resources, biodiversity, and human health.

➔ The different international documents submitted as part of the UNFCCC are seen in table 2:

Table 2: Timeline of UNFCCC Document Submission (ClimateWatch, 2022)

Date	Document Submitted
2003	First National Communication
2011	Second National Communication
2015	INDC
2017	Third National Communication

V- REFERENCES

ClimateWatch. (2022). Retrieved from https://www.climatewatchdata.org/countries/IRN

EM-DAT. (2023). Retrieved from https://public.emdat.be/

GlobalData Energy. (2022). Retrieved from https://www.power-technology.com/comment/irans-renewable-energy/#:~:text=Despite%20the%20sanctions%2C%20in%20January,renewable%20cumulative%20capacity%20of%2030GW

Heger, M. & Sarraf M. (2018). Air Pollution in Tehran: Health Costs, Sources, And Policies. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/29909/126402-NWP-PUBLIC-Tehran-WEB-updated.pdf?sequence=1&isAllowed=y

IEA. (2022). Retrieved from https://www.iea.org/countries/iran

ILO. (2014). Retrieved from https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=84327&p_country=IRN&p_count=168

Iran's Third National Communication. (2017). Retrieved from https://unfccc.int/sites/default/files/resource/Third%20National%20communication%20IRAN.pdf

ReliefWeb. (2022). Retrieved from https://reliefweb.int/disaster/ff-2022-000274-irn

ThinkHazard. (2020). Retrieved from https://thinkhazard.org/en/report/117-islamic-republic-of-iran

University of Notre Dame. (2023). Retrieved from https://gain.nd.edu/our-work/country-index/rankings/

WHO. (2022). Retrieved from https://www.who.int/publications/i/item/WHO-HEP-ECH-CCH-22.01.01

World Bank Climate Change Knowledge Portal (WB CCKP). (2021). Retrieved from https://climateknowledgeportal.worldbank.org/country/iran-islamic-rep

WWF. (2023). Water scarcity. Retrieved from https://www.worldwildlife.org/threats/water-scarcity#:~:text=When%20waters%20run%20dry%2C%20people,and%20other%20water%2Dborne%20illnesses