KUWAIT Climate Fact Sheet

Kuwait Climate Fact Sheet

I- GENERAL CLIMATE OVERVIEW

Kuwait has a hyper arid desert climate that is highly variable with recurrent extremes. The climate is marked by four distinct seasons, with long, hot, and dry summers and short winters. Maximum daily temperatures can reach 45°C during summer in which there is no rainfall. Rainfall is concentrated in the winter and spring months. Rainfall totals are highly variable from year to year, and drought is a recurrent phenomenon. The average annual rainfall is typically approximately 112 mm per year and varies from 75 to 150 mm/yr. The annual recorded rainfall levels at Kuwait International Airport have been as low as 34.4 mm and as high as 218 mm, while a level of 319.5 mm was recorded in Umm Al-Maradim Island in October 2013 (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. Kuwait's ND-GAIN Index rank is 60. It is the 128th most vulnerable country and the 69th most ready country. The low vulnerability score and high readiness score of Kuwait places it in the lower-right quadrant of the ND-GAIN Matrix, which means that adaptation challenges still exist, but Kuwait is well positioned to adapt (University of Notre Dame, 2023).

From Past to Present:

The average annual mean temperature in Kuwait for the year 1901 was 25.77 °C. This number increased to reach 27.89 °C in 2021 (+ 2.12 °C) (figure 1).

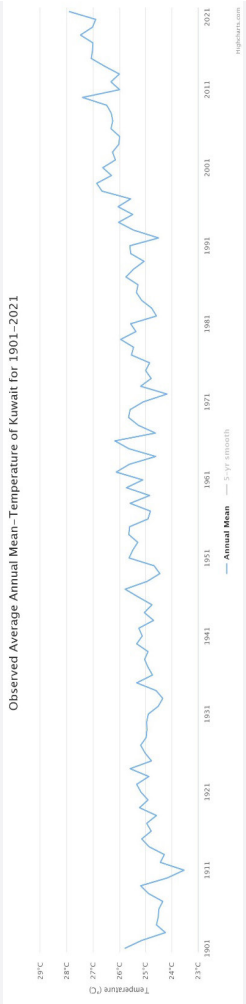


Figure 1: Observed Average Annual Mean Temperature (1901-2021) (WB CCKP, 2021)

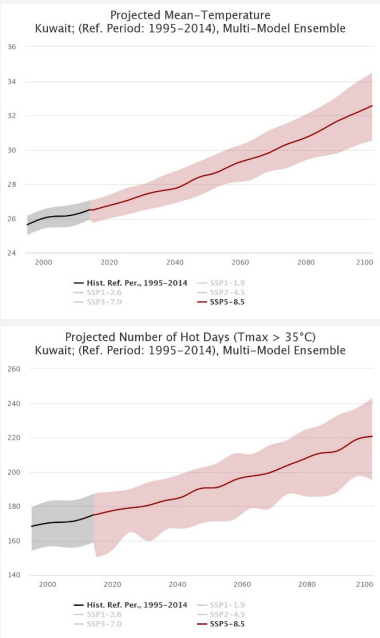


Figure 2: Projected Mean Temperature (Top) and Projected Number of Hot Days [Tmax greater than 35 °C] (Bottom) (WB CCKP, 2021)

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 25.64 and 26.51 ºC, it is expected to increase and reach 28.54 ºC by mid-century under a high-emission scenario(3), and 32.57 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 175 days (2014 reference) to reach 191 days by mid-century and 221 days by end of century under a high-emission scenario (figure 2, bottom).

- **Precipitation:** While the average precipitation for the reference period 2014 was 71.74 mm, it is projected to increase by mid-century under a high-emissions scenario to reach 74.44 mm and by end of century under a high-emissions scenario to reach 87.61 mm (figure 3).

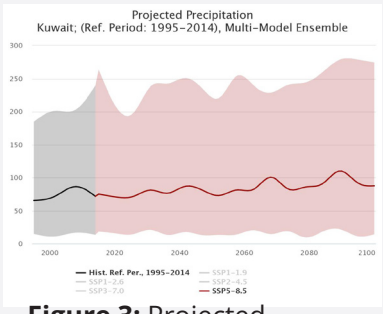


Figure 3: Projected Precipitation (WB CCKP, 2021)

III- CLIMATE CHANGE IMPACTS

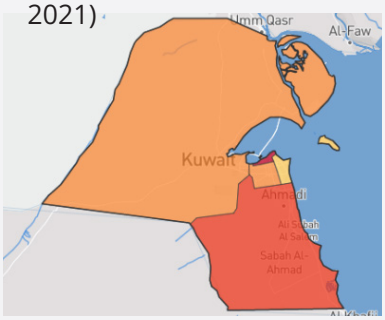
a- Natural Hazards

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 Kuwait. It shows that the country has a high risk of river and coastal floods, as well as extreme heat, and water scarcity that will increase due to climate change.

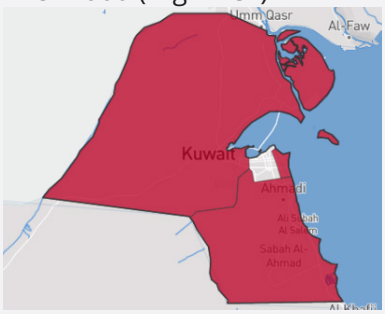
The main climate-related natural hazards that have occurred from 1900 till 2023 in Kuwait are seen in table 1:

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

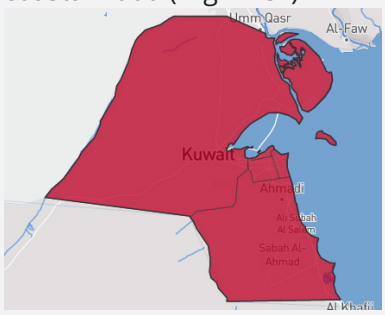
Disaster Type	Occurrence (1900-2023)
Flood	2 (of which 1 recorded flash flood)
	Total deaths: 3



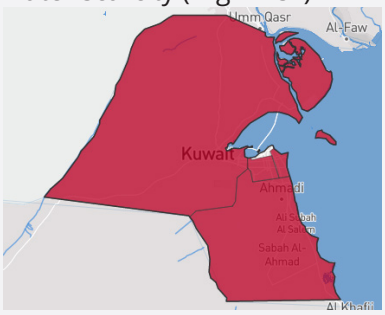
river flood (High Risk)



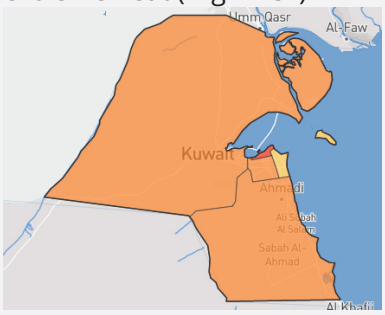
coastal flood (High Risk)



water scarcity (High Risk)



extreme heat (High Risk)



urban flood (Medium 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.

Rainfall in Kuwait tends to be erratic, often characterized by heavy storms that cause flash floods. The country's flat landscape increases the impact of floods on infrastructure and agriculture. Kuwait's arid climate is aggravated by low annual rainfall, which leads to an increase in drought occurrences. Climate change may increase the length, severity, and frequency of droughts, which will intensify existing water problems, and could severely affect plant cover, possibly leading to an increase in wind erosion and sand encroachment. In the desert areas, sandstorms are more frequent during the summer due to hot air over the desert. In recent years, Kuwait has witnessed sandstorms with speeds up to 60 km per hour (WB CCKP, 2021). A recent example are the sandstorms of May 2022 that hit the west and northwest of the country causing very low visibility levels.

Figure 5 shows that under a high-emissions scenario, sea level rise is projected to increase and reach 0.26 m by mid-century and 0.76 m by the end of the century.

Sea level rise will affect Kuwait which could lose 1.4 -3% of its coastal territory, thus affecting 5% of its GDP (Kuwait's INDC, 2015). Rising sea levels can also cause wetland flooding, aquifer and agricultural soil contamination, destructive erosion and habitat losses for fish, birds, and plants. In addition, sea level rise poses a threat to the built environment through the extension of Arabian Gulf waters farther inland, particularly under high tide conditions and especially in combination with storm surges associated with extreme storm events. Boubyan Island will be greatly impacted, with roughly half the island inundated in the highest sea level rise scenario. Only the relatively high land in the interior of the island will be visible by the end of this century. Coastal areas along Kuwait Bay are also projected to be negatively impacted by rising seas, especially the western coast near Doha Port and the densely populated neighbourhoods around Kuwait City (Kuwait's Second National Communication, 2019).

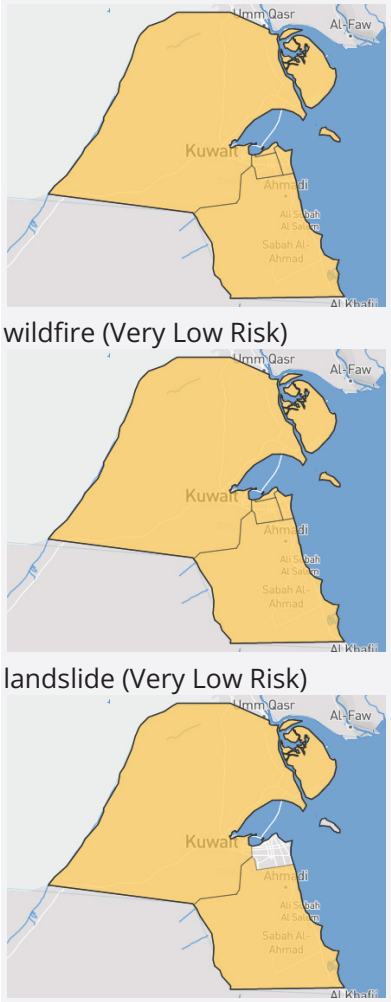


Figure 4: Climate-Related Natural Hazards Risk Level (ThinkHazard, 2020)

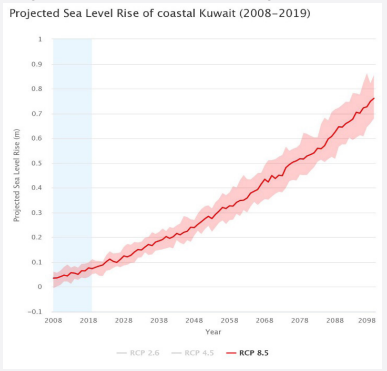


Figure 5: Projected Sea Level Rise of Coastal Kuwait (WB CCKP, 2021)

b- Water

Population growth, urbanization, industrial growth, and agricultural development are key drivers underlying Kuwait's high per capita water consumption. Coupled with a hyper-arid environment, low annual rainfall, no permanent lakes, or rivers, and limited fresh groundwater resources, sustainable water resource management should be a key national priority. Kuwait depends on four water resources: desalinated water, brackish groundwater, renewable groundwater, and treated wastewater, as shown in figure 6.

Climate change is not projected to adversely impact Kuwait's brackish/ fossil groundwater and desalinated water supplies which together account for about 90% of total supply. (Kuwait's Second National Communication, 2019). However, there will be an increasing high pressure

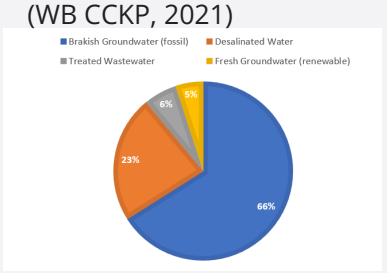


Figure 6: Water Consumption Profile (Kuwait's Second National Communication, 2019).

on fresh groundwater, as seen in figure 7 which shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in Kuwait. The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.39 by 2050 and will reach -3.13 by the end of the century, implying an increasing high pressure on renewable water resources, which could become 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).

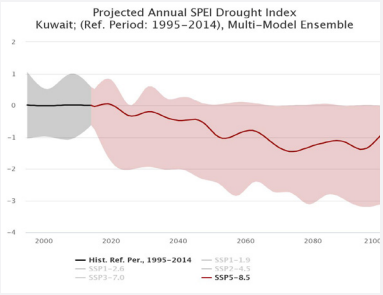


Figure 7: Projected Annual SPEI Drought Index (WB CCKP, 2021)

c- Agriculture

The total area that could be potentially used for agriculture in Kuwait is minimal (less than 1% of the total land), hence having a very small contribution to GDP (0.53 in 2016) (Kuwait's Second National Communication, 2019). In fact, the country imports more than 96% of its food (Berman, 2021). On the other hand, agriculture is a highly vulnerable sector relying on domestic water supply from desalination. Groundwater is a minor source for the agriculture in the country. Therefore, experiencing frequent drought events would increase the water demand for irrigations and other domestic needs (Kuwait National Adaptation Plan, 2019).

d- Energy

Figure 8 (left) shows that electricity consumption in Kuwait increased from 1990 (17.23 TWh) to 2019 (68.38 TWh). This rise in consumption also augmented the total CO2 emissions from the energy sector by 224.41% from 1990 to 2019 (figure 8, right). It is expected that electricity consumption will keep on increasing especially with the projected increase in the warm spell duration index(5) until the end of the century, under a high emission scenario (figure 9).

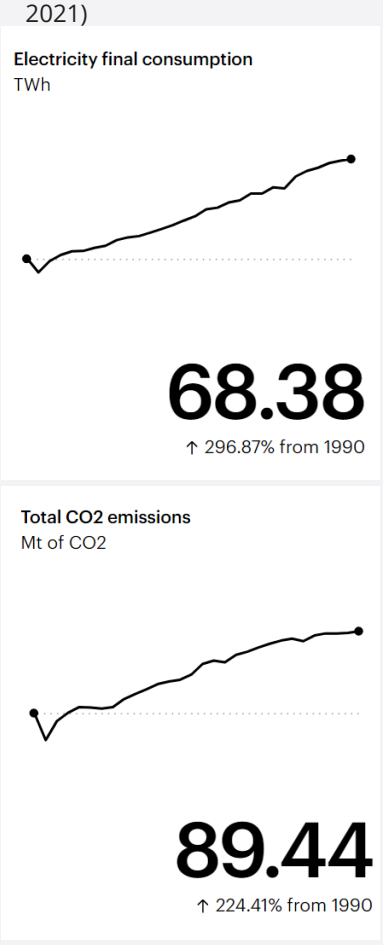


Figure 8: Electricity Final Consumption (top) and Total CO2 Emissions (bottom) (IEA, 2019)

Renewable Energy: Kuwait has announced its commitment to boost renewable energy use to 1% of the total energy mix in 2015 and to 15% in 2030. However, the total renewable energy use is still far below targets, standing at only around 0.3% of the country's total electricity production. One of the region's largest solar power projects is the Shagaya solar power station that was launched more than 10 years ago, but its implementation remains very slow. Shagaya plant, built on

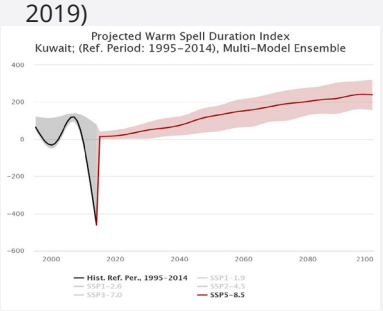


Figure 9: Projected Warm Spell Duration Index (WB CCKP, 2021)

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.

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

84 square kilometres in the desert of Al-Shagaya, is approximately 100 km west of the capital Kuwait City and comprises multiple renewable technologies (Kawach, 2022).

e- Health

Under a high emissions scenario, and without large investments in adaptation, an annual average of 594,500 people are projected to be affected by flooding due to sea level rise between 2070 and 2100. If emissions decrease rapidly and there is a major scale up in protection, the annual affected population could be limited to about 300 people. Kuwait also faces inland river flood risk. It is projected, that by 2030, an additional 4,300 people may be at risk of river floods annually because of climate change and 750 due to socioeconomic change above the estimated 360 annually affected population in 2010. In addition to deaths from drowning, flooding causes extensive indirect negative health effects. These include serious drawbacks on food production, water provision, ecosystem disruption, infectious disease outbreak and vector distribution. Longer term effects of flooding may also include post-traumatic stress and population displacement (WHO, 2015).

Some of the world's most contagious infections are highly sensitive to climate, as temperature, precipitation and humidity have a strong influence on the life cycles of the vectors and the infectious agents they carry, which will influence the transmission of water and foodborne diseases. Climate conditions are projected to become significantly more favourable for transmission, hence increasing the populations at risk if control measures are not implemented (WHO, 2015).

Climate change, through higher temperatures, land and water scarcity, flooding, drought, and displacement, negatively impacts agricultural production and causes breakdown in food systems. These will negatively impact those most vulnerable people at risk to hunger and can lead to food insecurity. Without considerable efforts made to improve climate resilience, it has been estimated that the global risk of hunger and malnutrition could increase by up to 20% by 2050. In Kuwait, the prevalence of underweight children under the age of 5 was 3% in 2014 (WHO, 2015).

Dust storms were seen to be the second contributors to PM2.5 concentrations thus increasing air pollution (Alahmad et al., 2021). 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.

IV- CLIMATE CHANGE RESPONSE: NATIONAL AND INTERATIONAL

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

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

Date	Document Submitted
2012	First National Communication
2015	INDC
2018	First NDC
2019	Second National Communication
2021	Updated First NDC* + National Adaptation Plan

*The state of Kuwait seeks to avoid emission of greenhouse gases equivalent to 7.4% of its total future emission on 2035 through its national efforts.

➔ **National laws and policies (IEA, 2022):**

Law No. 42 of 2014 as amended - The Environment Protection Law: aims to protect the environment and its natural resources, control environmental pollution and degradation in all its forms, and ensure the achievement sustainable development objectives and biodiversity conservation. Furthermore, it shall promote environmental culture in Kuwait and increase public awareness of environmental matters, sustainability, and proper use of natural resources

V- REFERENCES

Alahmad et al. (2021). A two-year assessment of particulate air pollution and sources in Kuwait. Retrieved from https://scholar.harvard.edu/barrak-alahmad/publications/two-year-assessment-particulate-air-pollution-and-sources-kuwait

Berman, A. (2021). 5 FACTS ABOUT FOOD SECURITY IN KUWAIT. The Borgen Project. Retrieved from https://borgenproject.org/food-security-in-kuwait/

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

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

IEA. (2019). Retrieved from https://www.iea.org/countries/kuwait

IEA. (2022). Retrieved from https://www.iea.org/policies/12004-law-no-42-of-2014-as-amended-the-environment-protection-law

Kawach, N. (2022). Kuwait lags behind in renewable energy projects: report. ZAWYA. Retrieved from https://www.zawya.com/en/projects/utilities/kuwait-lags-behind-in-renewable-energy-projects-report-m2yi658t

Kuwait National Adaptation Plan. (2019). Retrieved from https://unfccc.int/sites/default/files/resource/Kuwait-NAP-2019-2030.pdf

Kuwait's INDC. (2015). Retrieved from https://andp.unescwa.org/sites/default/files/2021-10/Kuwait%20First%20NDC_English%5B2%5D.pdf

Kuwait's Second National Communication. (2019). Retrieved from https://unfccc.int/sites/default/files/resource/94235106_Kuwait-NC2-2-KUWAIT%20SNC%20%20final%20v2.pdf

ThinkHazard. (2020). Retrieved from https://thinkhazard.org/en/report/137-kuwait

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

WHO. (2015). Retrieved from https://www.who.int/publications/i/item/WHO-FWC-PHE-EPE-15.24

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

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