LEBANON Climate Fact Sheet

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I- GENERAL CLIMATE OVERVIEW

Lebanon has a Mediterranean climate characterized by hot and dry summers and cool and rainy winters, with an average annual temperature of 15°C. Along the coast, summers are hot and humid with temperatures crossing 35°C in August. But due to the moderating effect of the sea, the daily temperature range is narrower than it is inland. January is the coldest month, with temperatures around 5 to 10°C. The mean annual rainfall on the coast ranges between 700 and 1,000 mm. About 70% of the average rainfall in the country falls between November and March and is concentrated during only a few days of the rainy season, falling in heavy cloudbursts or violent storms. Rainfall in inland Lebanon is higher than along the coast, with snow on the mountains (Ministry of Foreign Affairs of the Netherlands, 2018).

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. Lebanon's ND-GAIN Index rank is 117. It is the 97th most vulnerable country and the 158th most ready country. The low vulnerability score and low readiness score of Lebanon places it in the lower-top quadrant of the ND-GAIN Matrix, which means that relative to other countries, its current vulnerabilities are manageable but improvements in readiness will help it better adapt to future challenges (University of Notre Dame, 2023).

From Past to Present:

The average annual mean temperature in Lebanon for the year 1901 was 14.22 °C. This number increased to reach 16.23 °C in 2021 (+ 2.01 °C) (figure 1).

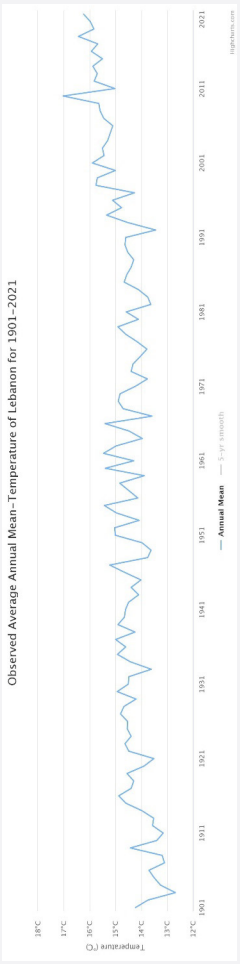


Figure 1: Observed Average Annual Mean Temperature (1901-2021) (WB CCKP, 2021)

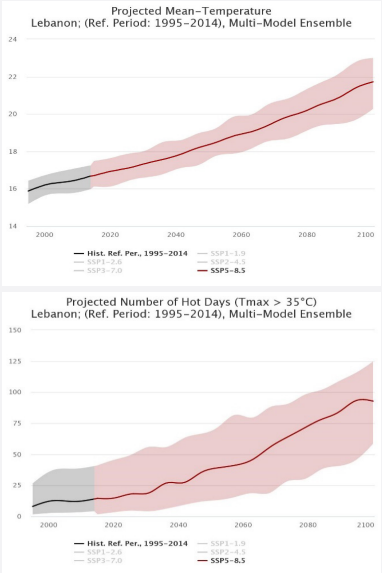


Figure 2: Projected Mean Temperature (top) and Projected Number of Hot Days [Tmax greater than 35 °C] (bottom) (WB CCKP, 2021)

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.

On the other hand, a decrease in precipitation of 11 mm/month was observed since 1950 (Ministry of Foreign Affairs of the Netherlands, 2018).

Projected:

- **Temperature:** While mean temperature for the reference period 1995-2014 was between 15.88 and 16.68 ºC, it is expected to increase and reach 18.36 ºC by mid-century under a high-emission scenario(3), and 21.72 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 13.99 days (2014 reference) to reach 38.15 days by mid-century and 92.78 days by end of century under a high-emission scenario (figure 2, Bottom).

- **Precipitation:** While the average precipitation for the reference period 2014 was 367.63 mm, it is projected to decrease by mid-century under a high-emissions scenario to reach 356.54 mm and by end of century under a high-emissions scenario to reach 299.65 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 Lebanon. It shows that the country has a high risk of landslides, extreme heat, water scarcity, and wildfires.

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

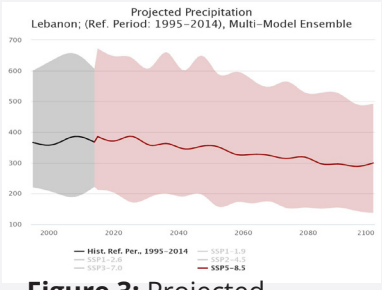
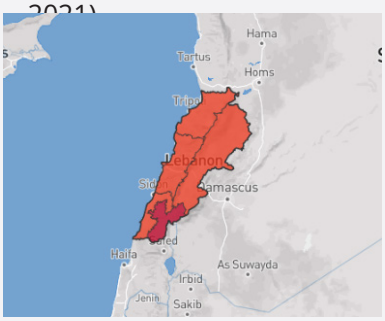
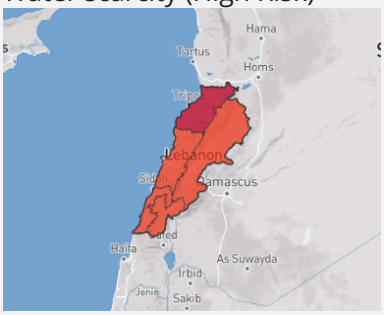


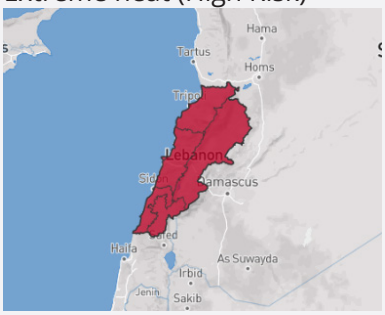
Figure 3: Projected Precipitation (WB CCKP, 2021)



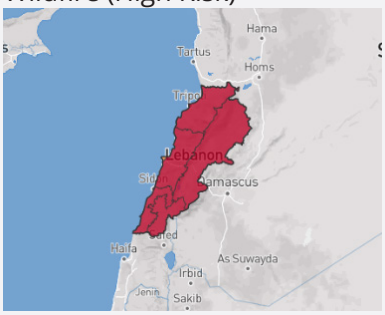
Water scarcity (High Risk)



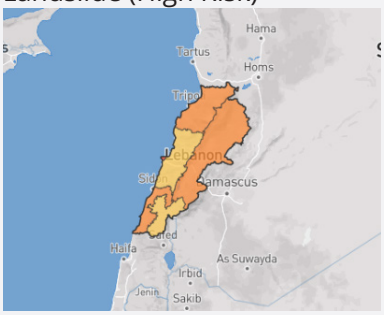
Extreme heat (High Risk)



Wildfire (High Risk)



Landslide (High Risk)



River flood (Medium Risk)

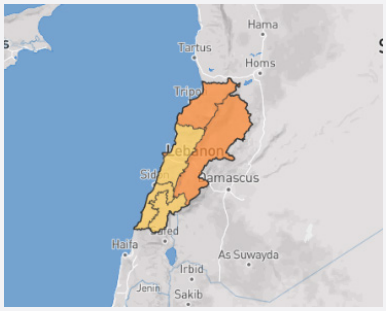
3 SSP5\RCP8.5-The highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century, depicting a world of rapid and unconstrained growth in economic output and energy use.

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

Disaster Type	Occurrence (1900-2023)
Storm	7 (of which 6 recorded convective storms)
Flood	(of which 1 recorded riverine flood) 3
Wildfire	2 (of which 1 recorded forest fire)
	Total deaths: 489 **Total damages ('000 US$): 349 035**

Flooding in Lebanon is mainly caused by irregularities in rainfall patterns. The country experiences 1 to 2 cases of flooding annually, a number that is likely to rise with climate change. Heavy rains measure up to 100 mm per hour during storm events and have significant impacts on the Lebanese population and economy, as storms damage property and agricultural lands, and often set off landslides that deposit tons of solid waste and other pollution into the Mediterranean Sea. On the other hand, about 10% of the Lebanese population is susceptible to drought. Increased surface runoff coupled with reduced precipitation is likely to increase with rising temperatures, leading to increased drought severity. In addition, about 16,000 ha (or 1% of the forested area) were burned in 2007 (WB CCKP, 2021). In 2019, a total of 194 fires were reported, affecting a total area of 3,155 ha (University of Balamand, 2020). The frequency of forest fires is expected to grow due to ongoing replacement of forest stands with fire-prone shrubs and the increased intensity and duration of drought periods. Fire-prone areas in Lebanon include woodland/forests in rural and mountain areas; however, plantations and natural woodlands/forests near urban areas are highly susceptible and pose risks to populations given the high rate of urbanization (WB CCKP, 2021).

Sea levels in Lebanon's coastal areas have been continuously rising and are expected to rise by 30 to 60 cm in 30 years. This means that large coastal strips, where 70% of the population live, will erode, or even disappear completely into the sea. In addition, there are sandy beaches and coastal natural reserves in the north and south, such as Palm Island and the Tyre nature reserve, which will be affected as parts of coastal Lebanon become submerged under water. Rising sea levels will cause a considerable disruption of socio-economic activities taking place on the coast, such as fishing, agriculture, industry, and tourism. Also, the risk of seawater intrusion into aquifers will increase, causing their salinization (USAID, 2019).



Urban flood (Low Risk)

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

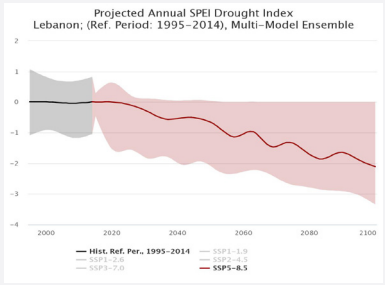


Figure 5: Projected Annual SPEI Drought Index (WB CCKP, 2021)

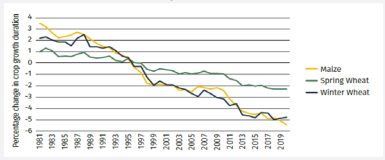


Figure 6: Percentage Change in Crop Growth Duration (1981-2019) (WHO, 2021)

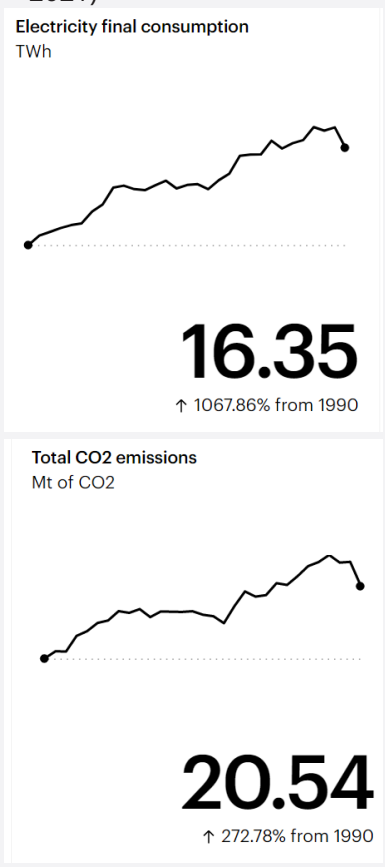


Figure 7: Electricity Final Consumption (top) and Total CO2 Emissions (bottom) (IEA, 2022)

b- Water

The expected decrease in precipitation, change in rainfall patterns, and increase in evapotranspiration will lead to earlier drought occurrence (15-30 days sooner than normal), which will exacerbate the existing water shortage that is already under pressure from urbanization and population growth. Changes in weather patterns such as temperatures rising by 1°C will reduce the total volume of water by 6-8%, shrink the snow cover by 40%, and lengthen drought periods. In addition, climate change will cause a shift of snowfall elevation from 1,500m to 1,900m, and a shortening of snow residence time from 110 days to 45 days. This will reduce the flow of rivers and groundwater recharge, which will decrease water availability during the summer season (USAID, 2019). Increasing pressure on water resources is also shown in figure 5, which displays the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in Lebanon.

The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.09 by 2050 and will reach -3.28 by the end of the century, which are values that imply an increasing high pressure on water resources which will become scarcer. 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

While agriculture employs approximately 60% of the population in Lebanon, it contributes only around 5.5% to GDP and around 80% of the country's food needs are covered by imports (WHO, 2021). This makes Lebanon a highly dependent country, where 80% of the wheat comes from Russia and Ukraine which are in conflict, hence highly increasing prices (Kroll, 2022).

Agriculture in Lebanon is one of the most vulnerable sectors to climate change due to the limited availability of water and land resources and the pressure applied by population growth and urbanization. In Lebanon, agriculture uses 60-70% of the country's available water which is already under high pressure (USAID, 2019). Climate change is also reducing crop growth duration (figure 6) which will consequently decrease crop yields, leading to food insecurity. Food security problems can cause malnutrition, micronutrient deficiencies, other noncommunicable diseases (NCDs), foodborne diseases, and mortality. It is estimated that

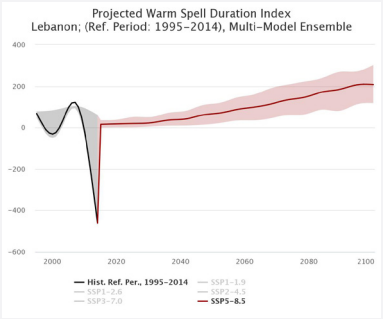


Figure 8: Projected Warm Spell Duration Index (WB CCKP, 2021)

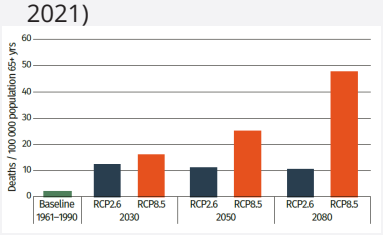


Figure 9: Heat-Related Mortality in Population 65 years and Over (WHO, 2021)

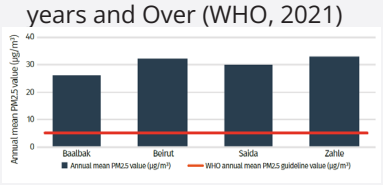


Figure 10: Annual mean PM2.5 in Lebanon cities (WHO, 2021)

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.

1.35 million people need food in Lebanon, a number that is projected to increase especially with the ongoing conflicts in neighbouring countries which is increasing the refugee population in Lebanon (WHO, 2021).

d- Energy

Figure 7 (Top) shows that electricity consumption in Lebanon increased from 1990 (1.4 TWh) to 2020 (16.35 TWh). This increase in consumption also increased the total CO2 emissions from the energy sector by 272.78% from 1990 to 2020 (figure 7, 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 8).

Current Crisis and Renewable Energy: There's a chronic energy crisis happening in Lebanon which has massively increased the use of private generators. This has caused increased pollution, harmed the environment, and negatively affected the population's health, which proves that Lebanon has an urgent need to diversify its energy sources. The country has in fact a very high potential investing in renewable energy as it possesses around 300 days of sun as well as enormous wind energy potential. In addition, hydropower is Lebanon's oldest form of alternative energy, and provided around 75% of its electricity from water in the pre-conflict years. However, this number has dropped to 6.1% in 2010 (Nasser, 2021). Due to the recent economic crisis as well as the above-mentioned chronic energy crisis, people started switching to solar energy as it is considered a convenient option and because it is the cheapest source of electricity now compared to conventional energy sources that use diesel fuel. In fact, between 2010 and 2020, Lebanon witnessed 100 megawatts of solar installations, while just in 2021 another 100 megawatts of solar installations were reported with an expected additional 250 megawatts by the end of 2022. Although there is a soaring demand for solar installations, Lebanon cannot achieve its energy targets without large solar and wind power plants that must be implemented. In addition, a report by the International Renewable Energy Agency (IRENA) predicts that Lebanon could obtain 30% of its electricity supply from renewable sources by 2030 if proper plans are implemented (Raydan, 2022).

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

e- Health

The health risks of heat stress include heat-related illnesses such as dehydration, rash, cramps, heatstroke, heat exhaustion and death. Current heat-related deaths among the elderly (65+ years) are approximately 2 per 100 000 population. Under a high emissions scenario, heat-related deaths among the elderly (65+ years) are projected to rise to about 48 per 100 000. A rapid reduction in emissions (RCP2.6) could significantly reduce deaths to around 10 per 100 000 among the elderly in 2080 (figure 9).

On another note, rising temperatures can also lead to increases in foodborne illnesses through spoiled food from refrigeration failure in transport/storage or changes in patterns of salmonella growth.

Recent data indicate that in all four Lebanese cities for which data have been reported, annual mean PM2.5 levels were above the WHO guideline value of 5 µg/m3 (figure 10). Ambient air pollution can have direct and sometimes severe consequences for health. Fine particles, which penetrate deep into the respiratory tract, subsequently increase mortality from respiratory infections, lung cancer and cardiovascular disease. 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. In Lebanon, 3 124 deaths from ambient air pollution were reported in 2016 (WHO, 2021).

Cholera Outbreak: Since the first case was confirmed on 5 October 2022, over 1400 suspected cases have been reported across the country, including 17 deaths. While the outbreak was initially confined to northern districts, it rapidly spread, with laboratory-confirmed cases now reported from all eight governorates. As of 11 November 2022, a total of 3,253 suspected cholera cases have been reported along with a total of 18 associated deaths. As of 18 November 2022, a total of 3970 cholera cases have been reported along with a total of 20 associated deaths. As of 9 December 2022, a total of 5105 cholera suspected and confirmed cases have been reported along with a total of 23 associated deaths. Most cases continue to be predominantly reported from Akkar, Mennieh-Donnieh and Tripoli, and to a lesser extent from Mount Lebanon and Baalbek-Hermel (ReliefWeb, 2022).

IV- CLIMATE CHANGE RESPONSE: NATIONAL AND INTERATIONAL

➔ **National laws and policies include:**

• On July 26, 2002, the Lebanese Parliament ratified the Law 444-

Environmental Protection Act- which set the basic principles and general provisions to regulate the environmental protection and management, preservation and maintenance of environmental basins, and assessment of environmental impact assessment of projects. Moreover, this law has defined the responsibilities and penalties for those who abuse the environmental resources and cause environmental pollution (MOE, 2017).

- The national renewable energy action plan (2016-2020): sets Lebanon's quantitative objectives of renewable energy penetration in the energy supply market. One climate target is included in this law: 12% renewable energy by 2020

- National energy efficiency action plans (2011-2015, 2016-2020): mid-term vision that determines horizontal and sectoral policies and targets to improve energy efficiency in the country. It focuses on primary energy savings (generation, transmission, and distribution sectors of the Lebanese power network) and end-use measures. One climate target is addressed under this: 12% renewable energy by 2020

- National forest program (2015-2025): constitutes the main forestry policy instrument that is being used by the ministry of agriculture over the decade. The NFP details the government's intentions aimed at fostering sustainable management, coordination, and cooperation mechanisms among both the public and private sectors.

- Ministry of agriculture strategy 2015-2019: sets the government's vision over the executive approach to agriculture over the period 2015-2019. Its aim is to ensure food safety and supply, plant, and animal health, making sure that the agricultural sector enjoys good infrastructure, and adequate harvesting and marketing techniques.

➔ **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
1999	First National Communication
2011	Second National Communication
2015	INDC
2016	Third National Communication
2020	First NDC
2021	*Revised First NDC
2022	Fourth National Communication

*Lebanon commits to unconditionally increase its greenhouse gas emission reduction target relative to the Business-as-Usual (BAU) scenario from 15% to 20%, and conditionally increasing its GHG emission reduction target relative to the BAU scenario from 30% to 31%.

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