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EGYPT Climate Fact Sheet

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Egypt Climate Fact Sheet

I- GENERAL CLIMATE OVERVIEW

Egypt's climate is dry, hot, and dominated by a desert. It has a mild winter season with rain falling along coastal areas, and a hot and dry summer season (May to September).

Daytime temperatures vary by season and change with the prevailing winds.

In the coastal regions, temperatures range between average winter minimums of 14°C (November to April) and average summer maximums of 30°C (May to October).

Temperatures vary widely in the inland desert areas, especially during the summer, where they range from 7°C at night to 43°C during the day. During winter, temperatures in the desert fluctuate less dramatically, but can reach 0°C at night and as high as 18°C during the day.

Egypt also experiences hot windstorms, known as "khamsin", which carry sand and dust and sweep across the northern coast of Africa. These khamsin storms typically occur between March and May and can increase the temperature by 20°C in two hours; and can last for several days.

Egypt is a highly arid country and receives very little annual precipitation. Most of the rain falls along the coast, with the highest amounts of rainfall received in the city of Alexandria; approximately 200 mm of precipitation per year. Precipitation decreases southward and Cairo receives a little more than 10 mm of precipitation each year (WB CCKP, 2021).

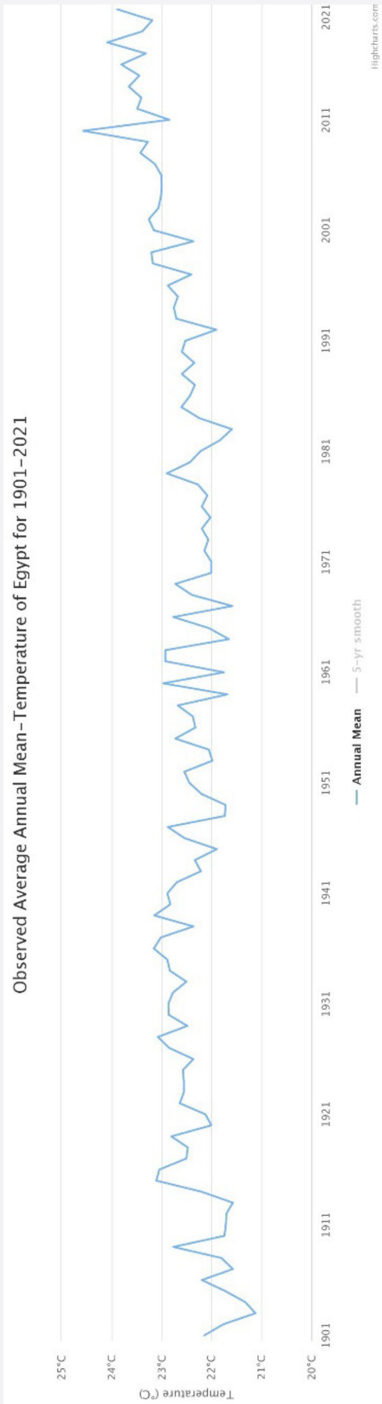

Figure-1: Observed Average Annual Mean Temperature (1901-2021) (WB CCKP, 2021)

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. Egypt's ND-GAIN Index rank is 107. It is the 83rd most vulnerable country and the 129th most ready country. The high vulnerability score and low readiness score of Egypt places it in the upper-left quadrant of the ND-GAIN Matrix, which means it has both a great need for investment and innovations to improve readiness and a

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.

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great urgency for action (University of Notre Dame, 2023).

From Past to Present:

The average annual mean temperature in Egypt for the year 1901 was 22.14 °C. This number increased to reach 23.88 °C in 2021 (+ 1.74 °C) (figure 1).

Projected:

- **Temperature:** While mean temperature for the reference period 1995-2014 was between 22.55 and 23.41 °C, it is expected to increase and reach 25.23 °C by mid-century under a high-emission scenario[3], and 28.86 °C by the end of the century under a high-emission scenario (figure 2, top). In addition, the number of hot days where maximum temperature (Tmax) is greater than 35 °C is expected to rise from 135.92 days (2014 reference) to reach 158.83 days by mid-century and 195.32 days by end of century under a high-emission scenario (figure 2, bottom).

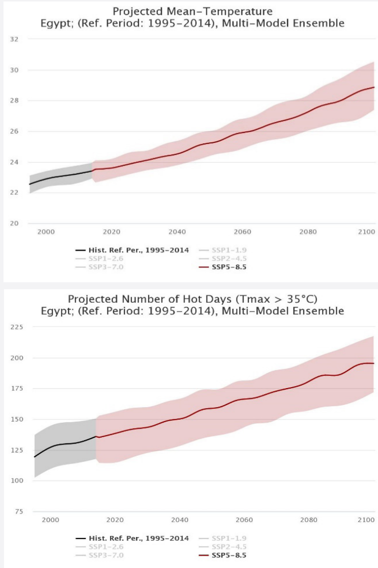


Figure-2: Projected Mean Temperature (Top) and Projected Number of Hot Days [Tmax greater than 35 °C] (Bottom) (WB CCKP, 2021)

- **Precipitation:** While the average precipitation for the reference period 2014 was 19.63 mm, it is projected to slightly increase by end of century under a high-emissions scenario to reach 21.45 mm (figure 3).

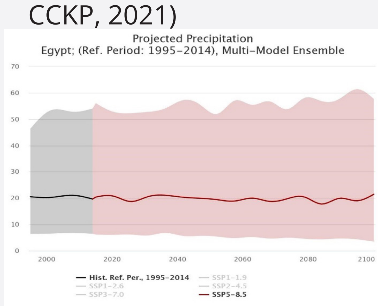


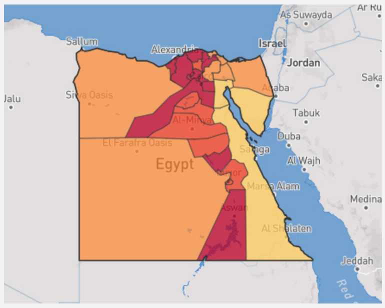
Figure-3: Projected Precipitation (WB CCKP, 2021)

III- CLIMATE CHANGE IMPACTS

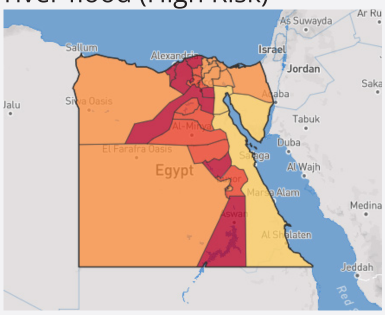
a- Natural Hazards

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 Egypt. It shows that the country has a high risk of river, urban, and coastal floods as well as extreme heat, water scarcity and wildfire.

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



river flood (High Risk)



urban flood (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)

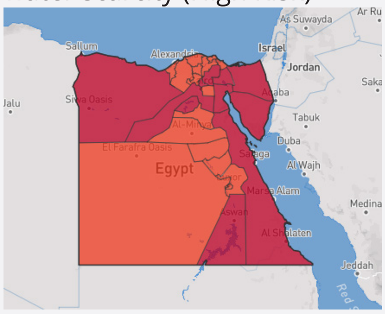
Disaster Type	Occurrence (1900-2023)
Flood	14 (of which 6 recorded riverine floods, 3 recorded flash floods)
Storm	8 (of which 6 recorded convective storms)
Extreme temperature	4 (of which 3 recorded heat waves, 1 recorded cold wave)
	Total deaths: 1 096 **Total damages ('000 US$): 576 411**

recent examples of such hazards include the November 2021 floods in the Aswan Governorate caused by heavy rains. A total of 1,100 people (220 families) who lost their houses due to complete damage were hosted in 220 temporary houses run by the local authority of Aswan Governorate, while 4,685 people (937 families) refused to leave their partially damaged houses (ReliefWeb, 2021). In addition, a flooding event occurred in March 2020 across Egypt which was also caused by heavy rains. The number of people affected by this flood in the country was estimated at 20,000 people (4,000 families), with at least 40 people dead (ReliefWeb, 2020).

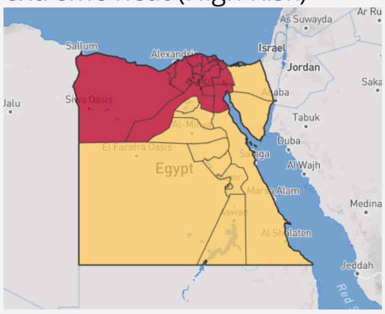
The coastal zones of Egypt extend for over 3,500 km in length along the Mediterranean and Red Sea coasts, with the Mediterranean shoreline being most vulnerable to sea level rise due to its relative low elevation compared to the land around it. This coast comprises several main cities such as Alexandria, Port Said, Damietta, and Rosetta, and accommodates several millions of people, along with large investments in industrial, touristic, and agricultural activities (Egypt's Second National Communication, 2010). In addition, the Nile Delta is one of the world's three most vulnerable hotspots to rising sea levels. It is home to around 40% of Egypt's 104 million people and accounts for half of the country's economy. Farms and fisheries along the two Nile branches, Rosetta in the west and Damietta in the east, help feed the country and provide products for export (Magdy, 2022). Sea level rise will affect groundwater aquifers in the Nile Delta, which is situated on Egypt's northern coast, especially those close to the northern strip. These aquifers, although brackish, were considered future hope; however, increased salinity may cause them to be unusable (Egypt's Second National Communication, 2010). The rise in sea levels will also disrupt coastal investments vital for millions of Egyptians which will eventually prompt them to flee their homes (UNDP, 2018).

coastal flood (High Risk)

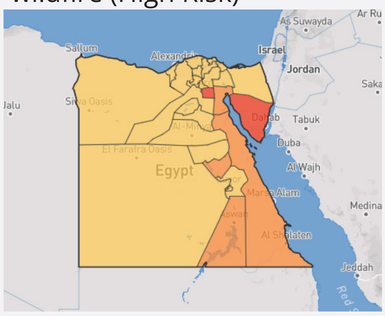
water scarcity (High Risk)



extreme heat (High Risk)



wildfire (High Risk)



landslide (Medium Risk)

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

b- Water

Egypt's water resources are limited to the natural flow of the Nile River which represents about 95% of the country's water budget. Groundwater (Nubian Sandstone aquifer and the Limestone aquifer) and rainfall constitute the remaining 5%. The total yearly water budget in Egypt is composed of 58 billion m3 of fresh water, 15 billion m3 of recycled water and 4 billion m3 of treated sewage water, thus amounting to a total of 77 billion m3 of available waters for use per year. This amount is used by the different sectors as shown in table 2:

Table 2: Water Demand per Sector (Egypt's Second National Communication, 2010)

Sector	Water Consumption
Agriculture	~ 62 billion m3 per year (80% of the country's water budget)
Industrial	~ 8 billion m3 per year (10% of the country's water budget)
Household (drinking)	~ 7.5 billion m3 per year (10% of the country's water budget)

Figure 5 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in Egypt. The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.48 by 2050 and will reach -3.44 by the end of the century, implying an increasing high pressure on water resources mainly coming from the Nile River. In the country, population, landuse, agriculture, and economic activities are all constrained along the Nile Valley and its Delta. All these are therefore extremely vulnerable to any adverse impact on the Nile's water availability (Egypt's Second National Communication, 2010).

Since 2011, water security in Egypt came into focus when Ethiopia announced the construction of the $4.8 billion Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile (Figure 6).

The operation and filling of the dam will have significant economic, environmental, and social repercussions, as Egypt's 100 million population depends on the Nile for more than 95% of its renewable water resources. In fact, a decrease of only 1 BCM of water caused by the GERD could eliminate more than 1 million jobs for Egyptians, which

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.

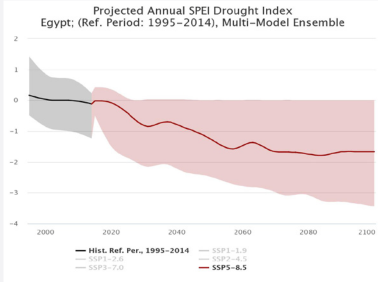


Figure-5: Projected Annual SPEI Drought Index (WB CCKP, 2021)

Figure-6: Location of the Grand Ethiopian Renaissance Dam (GERD)

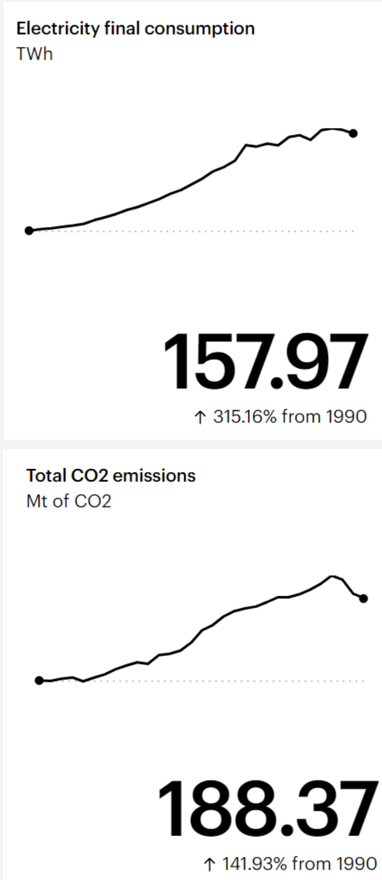


Figure-7: Electricity Final Consumption (Top) and Total CO2 Emissions (Bottom) (IEA, 2022) will reduce economic production in all sectors by 1.8 billion dollars annually. In addition, there will be a big sudden increase in urbanization due to rural depopulation which leads to a rise in unemployment and crime rates (Egypt Embassy, 2021).

c- Agriculture

Agriculture is of importance to the Egyptian economy, providing an estimated 14.5% of the GDP and 28% of all employment. Agriculture is also the main water-using sector in Egypt, using 80% of all fresh water that is mainly provided by the Nile River (USAID, 2018). The Nile Delta region, that accounts for 30%-40% of Egypt's agricultural production, is subsiding and becoming less fertile since it is no longer replenished each year by flood sediments from the Nile (Ministry of Foreign Affairs of the Netherlands, 2018). The potential impact of climate change could decrease national food production by 11 to 51% (Egypt's Third National Communication, 2016). By 2050 it is expected that the productivity of two major crops in Egypt- wheat and maize- will be reduced by 15% and 19%, respectively. It is also anticipated that 12-15% of the most fertile land in the Nile Delta will start to deteriorate due to sea level rise that leads to saltwater intrusion (Ministry of Foreign Affairs of the Netherlands, 2018). In fact, the state of Egypt's food security is fragile, and this is caused by the inability of the agricultural sector to produce enough cereal grains to meet the country's domestic demand. For that reason, Egypt heavily relies on imports, which has led it to become the world's largest importer of wheat and among the world's top 10 importers of sunflower oil. The Russia-Ukraine conflict also had severe drawbacks on prices, as the price of wheat rapidly increased by 44%, and the price of sunflower oil increased by 32%. The conflict also threatens Egypt's supply since 85% of its wheat and 73% of its sunflower oil comes from Russia and Ukraine, which is prompting the country to seek alternative suppliers (Tanchum, 2022).

d- Energy

Figure 7 (top) shows that electricity consumption in Egypt increased from 1990 (38.05 TWh) to 2020 (157.97 TWh). This increase in consumption also increased the total CO2 emissions from the energy sector by 141.93% from 1990 to 2020 (figure 7, bottom). It is expected that electricity consumption will keep on augmenting (along with CO2 emissions) especially with the expected rise in the warm spell duration index(5) until the end of the century under a high emission scenario (figure 8).

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

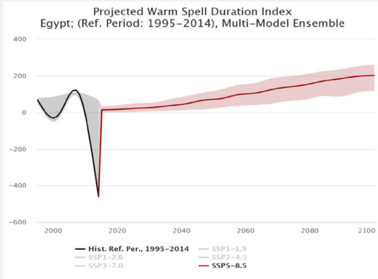


Figure-8: Projected Warm Spell Duration Index (WB CCKP, 2021)

Severity of climate change scenario		Without Adaptation	With Adaptation
	RCP2.6	566,200	700
	RCP8.5	2,420,600	1,500

Figure-9: Exposure to Flooding Due to Sea Level Rise (WHO, 2015)

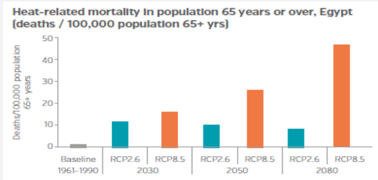


Figure-10: Heat-Related Mortality in Population 65 Years or Over (WHO, 2015)

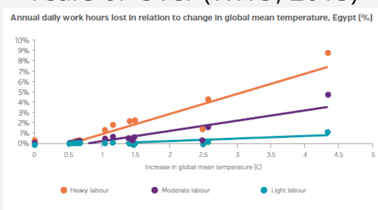


Figure-11: Annual Daily Work Hours Lost in Relation to Change in Global Mean Temperature (WHO, 2015)

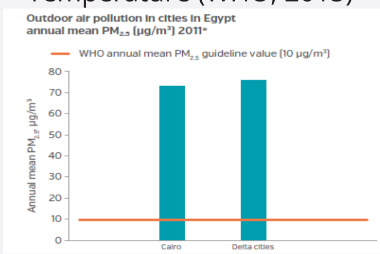


Figure-12: Outdoor Air Pollution (WHO, 2015)

Renewable Energy: Egypt possesses an abundance of land, sunny weather, and high wind speeds, making it a prime location for renewable energy projects. The Egyptian government is aware of the need for a sustainable energy mix to both address increasing demand, and to move to a more environmentally sustainable and diverse electricity sector. Egypt is in fact working on increasing the supply of electricity generated from renewable sources by 2035, with wind providing 14%, hydropower 1.98%, photovoltaic (PV) 21.3%, concentrating solar power (CSP) 5.52%. Egypt enjoys excellent wind along the Gulf of Suez with an average wind speed of 10.5 m/sec. The country's wind-generated power capacity is expected to reach 7 GW by 2022. In fact, and since 2001, a series of large-scale wind farms with a total capacity of 1.2 GW were established. In addition, the Egyptian government recently allocated around 7,845 square kilometers in the Gulf of Suez region and the Nile Banks for The New & Renewable Energy Authority (NREA) to implement additional wind energy projects, one of them being the 262.5 MW Ras Ghareb wind farm project near the Gulf of Suez inaugurated in December 2019 which will supply power to approximately 500,000 households. Concerning solar energy, Egypt is considered a "sun belt" country with 2,000 to 3,000 kWh/m2/year of direct solar radiation. The sun shines 9-11 hours a day from north to south, with few cloudy days. The first solar thermal power plant was built in 2011 in Kuraymat. In addition, a 10 MW power plant has been operating in Siwa since 2015, and the remaining plants are expected to be implemented and operated consecutively. The 37 square kilometer Benban Solar Park in Egypt's Western Desert was completed in 2019. Composed of 32 individual plants, each producing 20-50 MW, and four substations, the Park generates almost 1.5 GW of power (International Trade Administration, 2022).

e- Health

Under a high emissions scenario and without large investments in adaptation, an annual average of about 2.4 million 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 700 people (figure 9).

Egypt also faces inland river flood risk due to climate change. Under a high emissions scenario, it is projected that by 2030, 1.1 million additional people may be at risk of river floods annually due to climate change and 839,700 due to socio-economic change above the estimated 986,100 annual affected population in 2010. In addition to deaths from drowning, flooding causes extensive indirect health effects, including impacts on food production, water provision, ecosystem disruption, infectious disease outbreak and vector distribution. Longer term effects of flooding may include posttraumatic stress and population displacement (WHO, 2015).

Under a high emissions scenario heat-related death in the elderly (65+ years) are projected to increase to approximately 47 deaths per 100,000 by 2080 compared to the estimated baseline of about one death per 100,000 annually between 1961 and 1990. A rapid reduction in emissions could limit heat-related deaths in the elderly to under 9 deaths per 100,000 in 2080 (figure 10).

Labour productivity is projected to decline significantly under a high emissions scenario. If global mean temperature rises 4 degrees, about 6% of annual daily work hours is projected to be lost by workers carrying out heavy labour (agricultural and industrial workers) (figure 11).

Climate change through higher temperatures, land and water scarcity, flooding, drought, and displacement, negatively impacts agricultural production and causes breakdown in food systems. These disproportionally affect those most vulnerable to hunger and can lead to food insecurity. Vulnerable groups risk further deterioration into food and nutrition crises if exposed to extreme weather events. Without considerable efforts made to improve climate resilience, it has been estimated that the risk of hunger and malnutrition globally could increase by up to 20 percent by 2050. In Egypt, the prevalence of child malnutrition in children under age 5 was 7.0% in 2014 (WHO, 2015).

Outdoor 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. In 2011, Cairo and Delta cities, for which there was air quality data available, had annual mean PM2.5 levels that were above the WHO guideline value of 10 µg/m3 (figure 12).

An estimated 33% of Cairo's PM2.5 air pollution concentrations are attributable to road transport, while the second source is agricultural slash-and-burn, followed by industrial power and electricity generation. Other sources of air pollution include the mismanagement of waste, desert dust, biomass burning, and domestic and commercial combustion (Clean Air Fund, n.d.)

CLIMATE CHANGE RESPONSE: NATIONAL AND INTERATIONAL

➔ National laws and policies include:

Environment Law No. 4 of 1994 (ILO, 2014)

2050 National Climate Change Strategy (NCCS), 2022. DRM is one of the components of the strategy; 'Objective 2: Enhancing Adaptive Capacity and Resilience to Climate Change and Alleviating the Associated Negative Impacts'. It emphasizes forecasting and warning as the mechanisms to address climate risks.

The different international documents submitted as part of the UNFCCC are seen in table 3:

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Table 3: Timeline of UNFCCC Document Submission (ClimateWatch, 2022)

Date	Document Submitted
1999	First National Communication
2010	Second National Communication
2015	INDC
2016	Third National Communication
2017	First NDC
2022	Updated First NDC

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