CLIMATE RISK COUNTRY PROFILE

EGYPT

WORLD BANK GROUP

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ACKNOWLEDGEMENTS

This profile is part of a series of Climate Risk Country Profiles developed by the World Bank Group (WBG). The country profile synthesizes most relevant data and information on climate change, disaster risk reduction, and adaptation actions and policies at the country level. The country profile series are designed as a quick reference source for development practitioners to better integrate climate resilience in development planning and policy making. This effort is managed and led by Ana E. Bucher (Senior Climate Change Specialist, WBG).

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Climate and climate-related information is largely drawn from the Climate Change Knowledge Portal (CCKP), a WBG online platform with available global climate data and analysis based on the latest Intergovernmental Panel on Climate Change (IPCC) reports and datasets. The team is grateful for all comments and suggestions received from the sector, regional, and country development specialists, as well as climate research scientists and institutions for their advice and guidance on use of climate related datasets.

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FOREWORD

Climate change is a major risk to good development outcomes, and the World Bank Group is committed to playing an important role in helping countries integrate climate action into their core development agendas. The World Bank Group is committed to supporting client countries to invest in and build a low-carbon, climate-resilient future, helping them to be better prepared to adapt to current and future climate impacts.

The World Bank Group is investing in incorporating and systematically managing climate risks in development operations through its individual corporate commitments.

A key aspect of the World Bank Group's Action Plan on Adaptation and Resilience (2019) is to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation and evaluation of development outcomes. For all IDA and IBRD operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the Bank Group's Climate and Disaster Risk Screening Tool which enables all Bank staff to assess short- and long-term climate and disaster risks in operations and national or sectoral planning processes. This screening tool draws up-to-date and relevant information from the World Bank's Climate Change Knowledge Portal, a comprehensive online 'one stop shop' for global, regional, and country data related to climate change and development.

Recognizing the value of consistent, easy-to-use technical resources for client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group has developed this content. Standardizing and pooling expertise facilitates the World Bank Group in conducting initial assessments of climate risks and opportunities across sectors within a country, within institutional portfolios across regions, and acts as a global resource for development practitioners.

For developing countries, the climate risk profiles are intended to serve as public goods to facilitate upstream country diagnostics, policy dialogue, and strategic planning by providing comprehensive overviews of trends and projected changes in key climate parameters, sector-specific implications, relevant policies and programs, adaptation priorities and opportunities for further actions.

It is my hope that these efforts will spur deepening of long-term risk management in developing countries and our engagement in supporting climate change adaptation planning at operational levels.

Bernice Van Bronkhorst
Global Director
Climate Change Group (CCG)
The World Bank Group (WBG)

COUNTRY OVERVIEW

The Arab Republic of Egypt is located in the north-eastern corner of Africa. Egypt's northern border is the Mediterranean Sea, with Sudan to the south, the Red Sea, Palestine, and Israel to the east, and Libya to the west. The country has a total land area of 995,450 km^2 and a coastline of 3,500 km along the Mediterranean and the Red Sea. The topography ranges from 133 m below sea level in the Western Desert to 2,629 m above sea level in the Sinai Peninsula. Egypt's coastal zones extend for over 3,500 km along the Mediterranean and Red Sea. The Mediterranean shoreline is most vulnerable to sea level rise due to its relative low elevation compared to the land around it. The Delta and its north coast are hosts to several primary towns and cities such as Alexandria, Port Said, Damietta, and Rosetta, all with populations of several million, and large investments in industrial, touristic and agricultural activities as well as in the infra structure serving these activities.[1]

Egypt is classified as a lower-middle income country (**Table 1**), the government has been relatively successful in implementing macro-economic and structural reforms in order to stabilize the economy, sustain growth, and support more dynamic participation of the private sector.[2] Egypt has a population of 98.4 million people (2018) with an annual population growth rate of 2.0% (2018),[3] and is projected to reach 120.8 million people by 2030 and 159.9 million by 2050. An estimated 43% of the current population resides in urban areas, which is expected to reach 56% in 2050. The country has a Gross Domestic Product (GDP) of $250.9 trillion (2018), and has experienced relatively volatile growth rates over the past decade; Egypt has a current annual growth rate of 5.3% in 2018.[4]

TABLE 1. Data snapshot: Key development indicators

Indicator	2018
Life expectancy at birth, total (years)	71.8
Population density (people per sq. km land area)	98.9
% of Population with access to electricity	100%
GDP per capita (current US$)	$2,549.10

The ND-GAIN Index[5] ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. This Index aims to help businesses and the public sector better identify vulnerability and readiness in order to better prioritize investment for more efficient responses to global challenges. Due to a combination of political, geographic, and social factors, Egypt is recognized as highly vulnerable to climate change impacts, ranked 107 out of 181 countries in the 2019 ND-GAIN Index. The more vulnerable a country is the lower their score, while the more ready a country is to improve its resilience

[1] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[2] World Bank (2019). Overview – Egypt. URL: https://www.worldbank.org/en/country/egypt/overview

[3] World Bank Open Data, Data Retrieved December 2019. Data Bank: World Development Indicators, Egypt. URL: https://databank.worldbank.org/source/world-development-indicators

[4] World Bank Open Data, Data Retrieved December 2019. Data Bank: Population Estimates and Projections, Egypt. URL: https://databank.worldbank.org/data/reports.aspx?source=health-nutrition-and-population-statistics:-population-estimates-and-projections

[5] University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: https://gain.nd.edu/our-work/country-index/

the higher it will be. Norway has the highest score and is ranked 1st. **Figure 1** is a time-series plot of the ND-GAIN Index showing Egypt's progress

FIGURE 1. ND-GAIN Index for Egypt

Egypt is considered highly vulnerable to climate change due to its primary dependence on the Nile River, which serves needs for potable water, agriculture, industry, fish farming, power generation, inland river navigation, mining, oil and gas exploration, cooling of machinery and power generation. This dependence on the Nile River's water makes the country vulnerable to rising temperatures, reduced rainfall for the upper Nile Basins as well as the reduction of rainfall on the east Mediterranean coastal zone.[6]

Egypt submitted its Nationally-Determined Contribution (NDC) and Third National Communication (NC3) to the UNFCCC in 2016, in support of the its efforts to realize its development and economic goals and increase its adaptive capacity to climate change. The country is particularly vulnerable to the impacts of climate variability and change, particularly with respect to water security, agriculture and livestock, increasingly adverse conditions to health, human settlements, and energy demand and supply. Egypt's NDC is consistent with the country's overall goals of reducing vulnerability and poverty, and achieving long-term sustainable, economic development. Key areas of focus include the sustainability of the environment, water resources, energy, sustainable land management, agriculture, and health.[7]

CLIMATOLOGY

Climate Baseline

Overview

Egypt's climate is dry, hot, and dominated by 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

[6] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[7] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

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.[8] Egypt also experiences hot wind storms, 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.[9]

Egypt is a highly arid country and receives very little annual precipitation. The majority of rain falls along the coast, with the highest amounts of rainfall received in the city of Alexandria, of 200 mm of precipitation per year. Alexandria has relatively high humidity, however sea breeze modulates moisture. Precipitation decreases southward and Cairo receives a little more than one cm of precipitation each year, although it experiences humidity during the summer months. Areas south of Cairo receive only traces of rainfall, yet can suddenly experience extreme precipitation events resulting in flash floods. Sinai receives somewhat more rainfall than other desert areas, and the region is dotted by numerous wells and oases, which support small population centers that were former focal points on trade routes. Water drains toward the Mediterranean Sea from the main plateau and supplies sufficient moisture to permit some agriculture in the coastal area, particularly near Al Arish.[10] The combination of the country's high evaporation rate and the virtual absence of permanent surface water over large parts of the country result in water as a highly scarce resource. Primary challenges are centered around water resource availability, changing precipitation patterns and increasing population demands.

Analysis of data from the World Bank's Climate Change Knowledge Portal (CCKP) (**Table 2**) shows historical information for 1901–2019. Mean annual mean temperature for Egypt is 22.5°C, with average monthly temperatures ranging between 30°C (July) and 13°C (January). Mean annual precipitation is 33.3 mm, with highest rainfall occurring December to February, with very low levels of precipitation occurring nearly all year round (**Figure 2**).[11] **Figure 3** shows the spatial variation of observed average annual precipitation and temperature across Egypt.

TABLE 2. Data snapshot: Summary statistics

Climate Variables	1901–2019
Mean Annual Temperature (°C)	22.5°C
Mean Annual Precipitation (mm)	33.3 mm
Mean Maximum Annual Temperature (°C)	29.9°C
Mean Minimum Annual Temperature (°C)	15.1°C

8 Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

9 USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

10 Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

11 WB Climate Change Knowledge Portal (CCKP, 2020). Egypt. URL: https://climateknowledgeportal.worldbank.org/country/egypt

FIGURE 2. Average monthly temperature and rainfall of Egypt for 1991–2019[12]

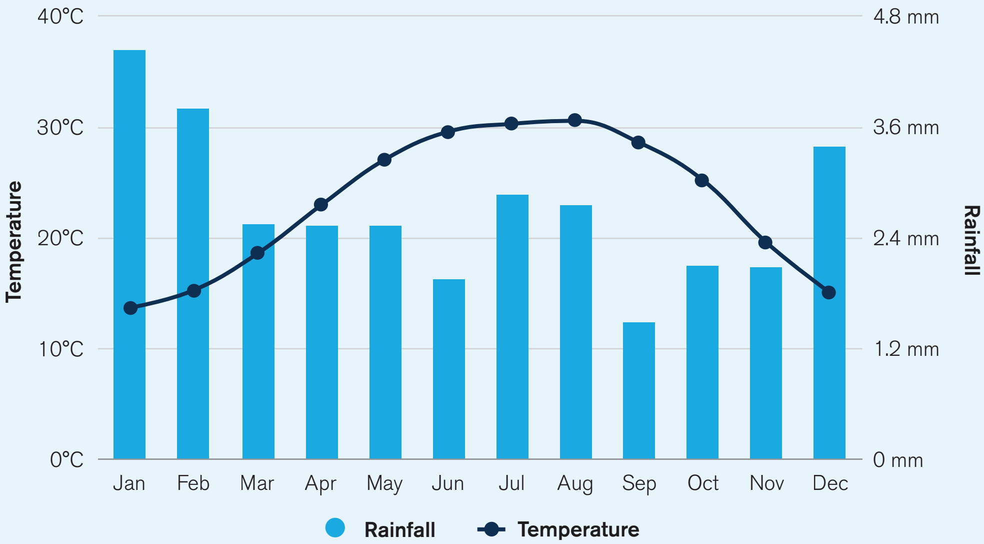
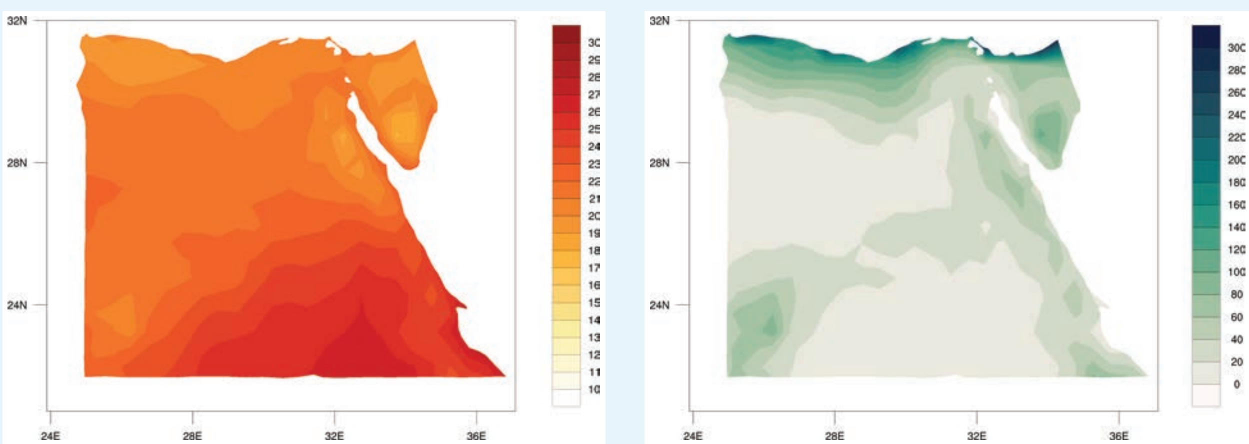


FIGURE 3. Map of average annual temperature (left); annual precipitation (right) of Egypt, 1901–2019[13]



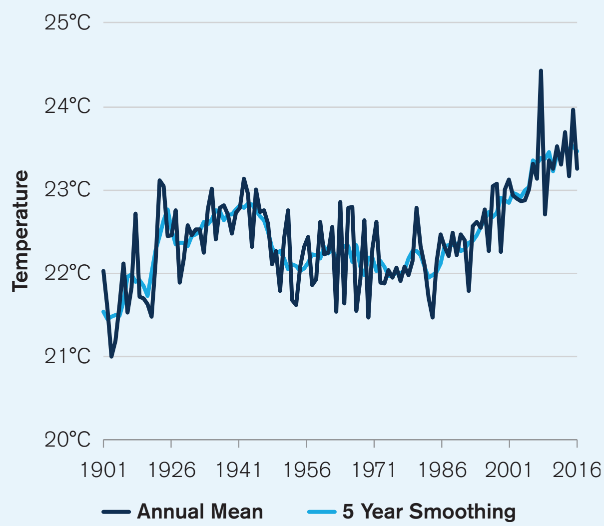
[12] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt. URL: https://climateknowledgeportal.worldbank.org/country/egypt
[13] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt. URL: https://climateknowledgeportal.worldbank.org/country/egypt

Key Trends

Temperature

Temperatures in Egypt have increased at a rate of 0.1°C per decade on average between 1901–2013. However, substantially stronger warming was observed over the past 30 years, with average annual temperatures increasing by 0.53°C per decade.[14] Warming has been most pronounced during the summer than the winter with 0.31°C and 0.07°C per decade increase in average temperatures since 1960, respectively (**Figure 4**). Additionally, daily minimum temperatures have increased throughout Egypt, with a reduction in cool nights and an increase in warm nights since 1960.[15]

FIGURE 4. Observed temperature for Egypt, 1901–2019[16]



Precipitation

Egypt has observed a statistically significant reduction of annual total precipitation amounts over the past 30 years, a reduction by approximately 22%. This has resulted in reduced water availability in some areas and increased periods of drought and dry spells.[17] Decreases in precipitation occurred in the winter and early spring months. The frequency and severity of flash flooding in recent years also was also observed.[18]

Climate Future

Overview

The main data source for Climate Change Knowledge Portal (CCKP) is the CMIP5 (Coupled Inter-comparison Project No.5) data ensemble, which builds the database for the global climate change projections presented in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. The RCP2.6 for example represents a very strong mitigation scenario, whereas the RCP8.5 assumes business-as-usual scenario. For more information, please refer to RCP Database. For simplification, these scenarios are referred to as a low (RCP2.6); a medium (RCP4.5) and a high (RCP8.5) emission scenario in this profile. **Table 3** provides

[14] GERICS (2019). Climate Fact Sheet – Egypt. URL: https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en
[15] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf
[16] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-data-historical
[17] GERICS (2019). Climate Fact Sheet – Egypt. URL: https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en
[18] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

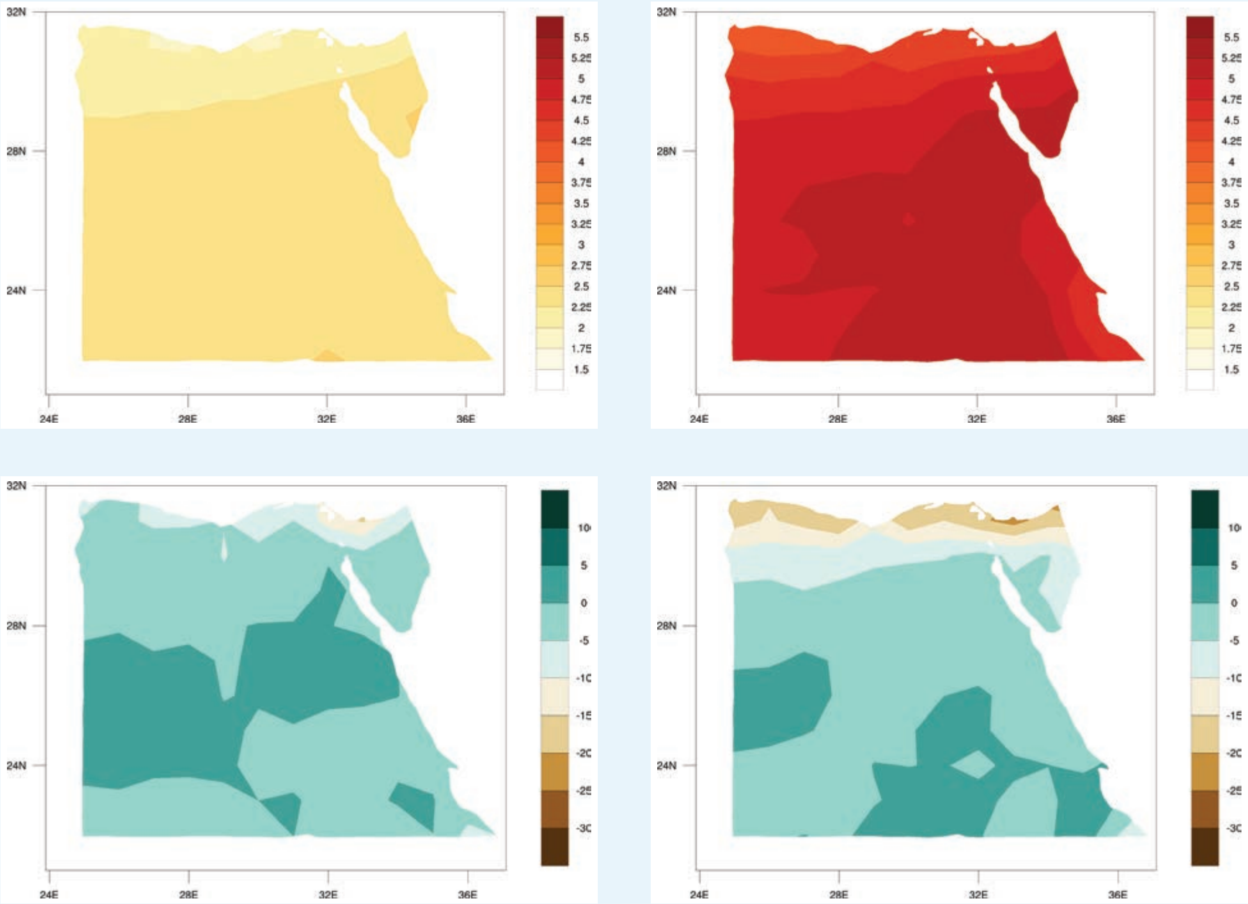
CMIP5 projections for essential climate variables under high emission scenario (RCP 8.5) over 4 different time horizons. **Figure 5** presents the multi-model (CMIP5) ensemble of 32 Global Circulation Models (GCMs) showing the projected changes in annual precipitation and temperature for the periods 2040–2059 and 2080–2099.

TABLE 3. Data snapshot: CMIP5 ensemble projections

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Temperature Anomaly (°C)	**+0.6°C to +1.7°C** (+1.6°C)	**+1.5°C to +3.0°C** (+2.1°C)	**+2.4°C to +4.5°C** (+3.3°C)	**+3.4°C to +6.2°C** (+4.4°C)
Precipitation Anomaly (mm)	**–21.6 to +20.1** (–0.5 mm)	**–27.3 to +21.0** (–1.9 mm)	**–26.5 to +26.7** (–1.6 mm)	**–30.2 to +28.2** (–2.9 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

FIGURE 5. CMIP5 ensemble projected change (32 GCMs) in annual temperature (top) and precipitation (bottom) by 2040–2059 (left) and by 2080–2099 (right), relative to 1986–2005 baseline under RCP8.5[19]



[19] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Projected Future Climate. URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-data-projections

Key Trends

Temperature

According to analysis from the German Climate Service Center (GERICS) of 32 Global Climate Models (GCMs), Egypt is expected to experience a change in annual mean temperature from 1.8°C to 5.2°C by the 2080s. Maximum temperatures are expected to increase by 2.1°C to 5.7°C by the 2080s, with minimum temperatures increasing by 1.5°C to 4.6°C over the same period. Heat waves will also increase significantly in their severity, frequency and duration, with heat waves expected to last an additional 9 days to as much as an additional 77 days; cold spells will decrease.[20] By mid-century, temperatures are expected to increase between 2°C to 3°C, with the highest increases occurring in the summer months of July to September, with more rapid increases experienced across the country's interior regions.[21]

Across all emission scenarios, temperatures will continue to increase for Egypt throughout the end of the century. As seen in **Figure 6**, under a high-emission scenario, average temperatures will increase rapidly by mid-century. Across the seasonal cycle, temperature increases will spike will be felt from October to April (**Figure 7**). Increased heat and extreme heat conditions will result in significant implications for human and animal health, agriculture, water resources, and ecosystems.

FIGURE 6. Historical and projected average temperature for Egypt from 1986 to 2099[22]

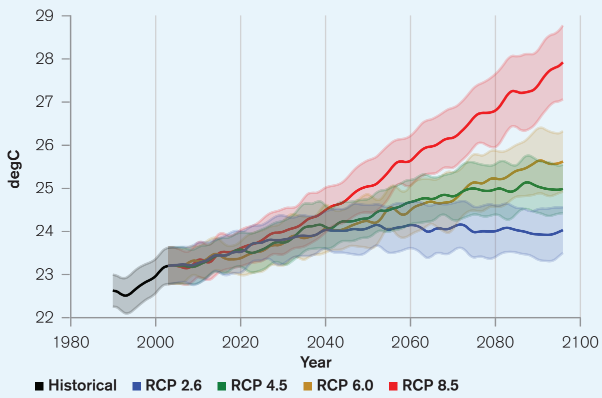
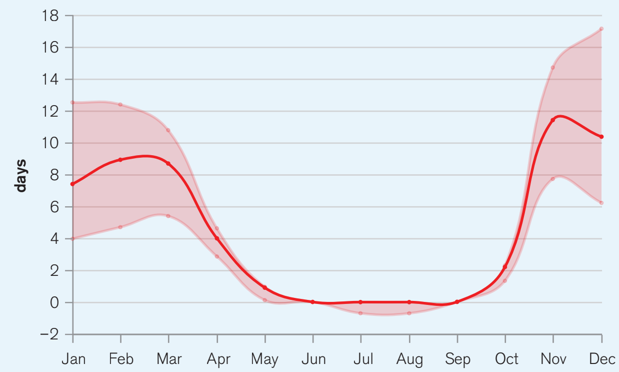


FIGURE 7. Projected change in summer days (Tmax > 25°C)[23]



Precipitation

Rainfall trends in Egypt are highly variable. Analysis from the German Climate Service Center (GERICS) global climate models (GCMs) indicate that the reduction in precipitation, observed over the past 30 years, is expected to continue by the end of the century, with projections indicating a trend of even longer dry spells and the possibility of dry

[20] GERICS (2019). Climate Fact Sheet – Egypt. URL: https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en

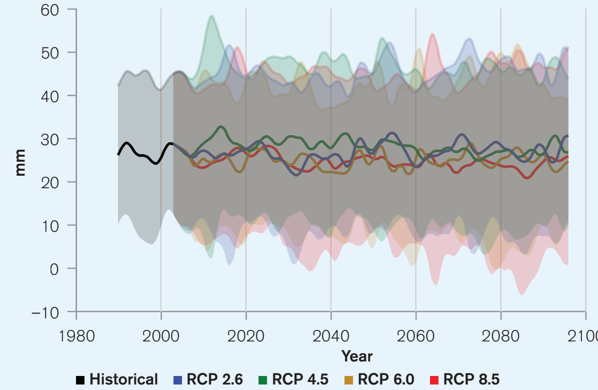
[21] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

[22] WB Climate Change Knowledge Portal (CCKP, 2020). Interactive Climate Indicator Dashboard - Agriculture. Egypt. URL https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=EGY&period=2080-2099

[23] WB Climate Change Knowledge Portal (CCKP, 2020). Interactive Climate Indicator Dashboard - Agriculture. Egypt. URL https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=EGY&period=2080-2099

spells to increase by 75 days by the 2080s. Reduced precipitation and increased temperature are expected to impact evaporation, water balance as well as drought conditions. Water routing, storage and other management options can be highly varied depending if the precipitation input comes frequently or with long periods of aridity in between rainfall. While overall, annual mean precipitation is expected to decrease, the intensity of heavy rain events is expected to increase by the 2080s.[24] **Figure 8** below, shows the change in the projected annual average precipitation for Egypt.[25] As seen below, annual average precipitation is low and is expected to decrease slightly by the of the century under a high emissions scenario of RCP8.5.

FIGURE 8. Annual average precipitation in Egypt for 1986 to 2099[26]



CLIMATE RELATED NATURAL HAZARDS

Overview

Egypt has a high degree of risk to natural hazards and is highly vulnerable to climate change impacts. Egypt's Nile Delta is recognized as one of the world's three 'extreme' vulnerability hotspots.[27] Future projections indicate Egypt will suffer from sea level rise, water scarcities and deficits, as well as an increase in the frequency and intensity of extreme weather events such as heat waves, sand and dust storms, flash floods, rock slides and heavy rains. The country is expected to become generally hotter and drier under a projected future climate. Egypt is already severely impacted by and susceptible to droughts, which are expected to be more frequent and pronounced. Additionally, sea level rise is projected to lead to the loss of a sizable proportion of the northern part of the Nile Delta due to a combination of inundation and erosion, with consequential loss of agricultural land, infrastructure and urban areas. Key sectors impacted include water resources, agriculture, fisheries, health, housing, biodiversity, telecommunications, energy, tourism, and coastal zones.[28]

[24] GERICS (2019). Climate Fact Sheet – Egypt. URL: https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en

[25] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Water Dashboard. Data Description. URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-sector-water

[26] WB Climate Change Knowledge Portal (CCKP, 2020). Climate Data-Projections. Egypt. URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-sector-water

[27] UNDP (2018). National Adaptation Plans in Focus: Lessons from Egypt. URL: https://www.adaptation-undp.org/sites/default/files/resources/naps_in_focus_lessons_from_egypt.pdf

[28] UNDP (2018). National Adaptation Plans in Focus: Lessons from Egypt. URL: https://www.adaptation-undp.org/sites/default/files/resources/naps_in_focus_lessons_from_egypt.pdf

Over the last 20 years, natural hazards have killed nearly 1,500 people, with estimated economic damages resulting in $346.7 million. In 2009, a rockslide buried an informal settlement south of Cairo, causing severe damage to infrastructure and significant loss of life. In 2010, heavy flooding displaced thousands of people and over 4,000 houses were damaged or completely destroyed. Climate change is expected to increase the potential impact of hazards for Egypt.[29]

Data from the Emergency Event Database: EM-Dat database, presented in **Table 4**, shows the country has endured various natural hazards, including floods, landslides, epidemic diseases, and storms.

TABLE 4. Natural disasters in Egypt, 1900–2020[30]

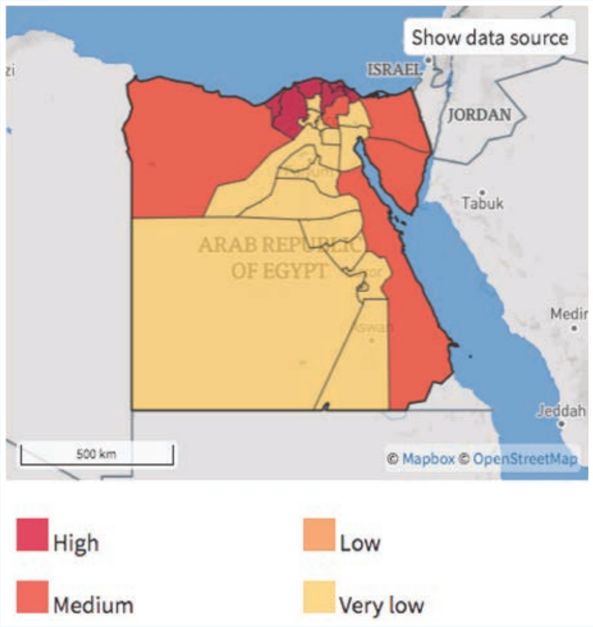
Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Earthquake	Ground Movement	5	594	92,996	1,200,000
Epidemic	Bacterial Disease	1	10,276	0	0
	Viral Disease	2	15	143	0
Extreme Temperature	Cold Wave	1	3	105	0
	Heat Wave	3	164	66	0
Flood	Flash Flood	2	13	468	0
	Riverine Flood	6	638	167,960	140,000
Storm	Convective Storm	6	109	47,807	126,000
Mass Movement (dry)	Rockfall	1	98	697	0
	Subsidence	1	34	300	0

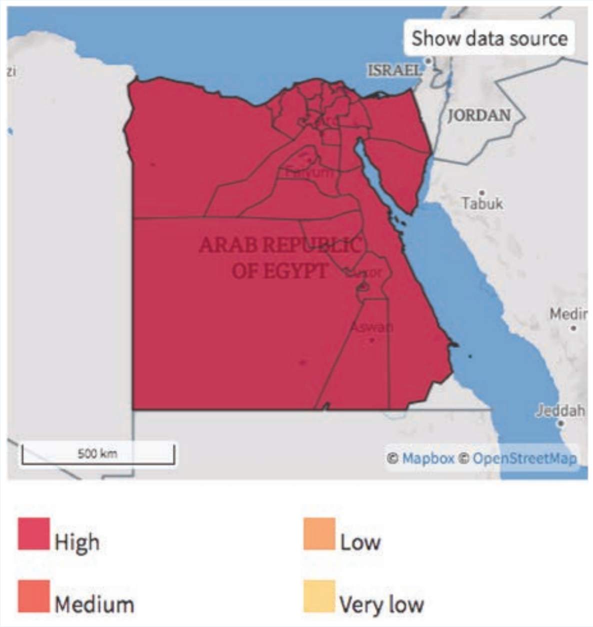
Key Trends

Disaster risks arising from increased temperatures are expected to exacerbate existing tensions for water resources between agricultural and livestock needs and human population needs, especially during periods of high aridity and drought. The existing quality of available water from surface water and groundwater, is also expected to be altered. Water scarcity and changing rainfall patterns are also expected to play a significant role for the agricultural sector. Increased temperatures and degraded agricultural conditions will adversely affect 'working days', impacting livelihoods and economic resilience of vulnerable groups. Most of the country's population and infrastructure are concentrated in the Nile Delta and along the Mediterranean coast, making the country additionally vulnerable to the impacts of sea level rise, particularly inundation and saltwater intrusion. **Figure 9** presents the risk of coastal flooding and water scarcity for Egypt.[31]

[29] GFDRR (2019). Egypt. URL: https://www.gfdrr.org/en/egypt
[30] EM-DAT: The Emergency Events Database - Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir, Brussels, Belgium. URL: http://emdat.be/emdat_db/
[31] FAO (2018). Drought Characteristics and management in North African and the Near East. URL: http://www.fao.org/3/CA0034EN/ca0034en.pdf

FIGURE 9. Risk of coastal flood (left)[32]; risks of water scarcity (right)[33]





Climate change is expected to increase the risk and intensity of water scarcity and drought across the country. The primary sectors affected are water, agriculture, forestry, human health, and livestock. Additionally, increased frequency of intense precipitation events will lead to a heightened risk of flooding, river bank overflow and flash flooding. This may also result in soil erosion and water logging of crops, thus decreasing yields with the potential to increase food insecurity; particularly for subsistence-scale farmers. Higher temperatures, coupled with increased aridity may also lead to livestock stress and reduced crop yields. This is likely to result in economic losses, damage to agricultural lands and infrastructure as well as human casualties. Furthermore, land degradation and soil erosion, exacerbated by recurrent flood and drought adversely impacts agricultural production, further affecting the livelihoods of the rural poor. Small rural farmers, are more sensitive to impacts of disasters (floods, dry periods) because they have limited resources with which to influence and increase adaptive capacity.[34]

Implications for DRM

The Egyptian Government is focused on advancing the country's disaster risk management (DRM) efforts and capabilities. A dedicated crisis and disaster management department was established in 2000 at the Information and Decision Support Center of the Egyptian Cabinet of Ministers (IDSC). This department has a mandate to set up national DRM policies and guidelines. This has culminated in the development of the country's National Strategy

[32] ThinkHazard! (2020). Egypt - Coastal Flooding. URL: http://thinkhazard.org/en/report/40765-egypt/CF
[33] ThinkHazard! (2020). Egypt – Water Scarcity. URL: http://thinkhazard.org/en/report/40765-egypt/DG
[34] FAO (2018). Drought Characteristics and management in North African and the Near East. URL: http://www.fao.org/3/CA0034EN/ca0034en.pdf

for Adaptation to Climate Change and Disaster Risk Reduction. The Strategy includes plans for risk reduction, mitigation, and adaptation across different sectors. In order to strengthen DRM in the country, the department requires additional financial resources and institutional capacity. These priorities include, strengthening regional coordination and investment in technological innovations to address water scarcity; exploring disaster risk financing and insurance mechanisms; enhancing early warning systems; and, building the capacity and financial resources of its Information and Decision Support Center. Additional areas of needed investment include strengthening the country's early warning system; developing disaster risk financing mechanisms; and, integrating resilience into urban infrastructure investments.[35]

CLIMATE CHANGE IMPACTS TO KEY SECTORS

Egypt remains highly vulnerable to climate variability and change in the immediate as well as longer-term, particularly for the country's water, agriculture, energy, and health sectors. Impacts from climate change are already being experienced across the already highly arid country. Water scarcity and drought conditions are expected to continue to increase risks of food insecurity and may exacerbate conflict situations over scarce resources, settlements, and population movements. The country faces increasing challenges to agriculture, loss of livelihoods and food security, which are expected to be further compounded by climate stressors. Furthermore, environmental degradation, impacted water resources, and loss of biodiversity constitute significant obstacles to the country's continued development and poverty reduction efforts, increases vulnerability to risks and hazards as well as increases the importance for sustainable adaptation and resilience measures.[36]

Agriculture

Overview

Egypt's agricultural sector, located primarily along the coastline, is particularly vulnerable to climate change, due to its dependence on the Nile River as the primary water source, its large traditional agricultural base as well as the intensifying development and erosion along coastal areas. The country's water scarcity, dependence on the Nile River and high temperatures make agriculture productivity increasingly vulnerable to climate variability and future projected climate change trends. An estimated 55% of the labor is engaged in agricultural activities, a sector which consumes about 80% of the freshwater resources and contributes about 13.5 % of GDP. Just 2.8% of Egypt's land is arable, largely located along the Nile and some oases in the Sinai Peninsula. The country's agriculture is predominantly irrigated and almost entirely dependent upon the flow of the Nile River.[37] Egypt's agricultural land can be classified into: 'Old-land' comprising the lands of the Nile Valley and the Nile Delta, which

[35] GFDRR (2019). Egypt. URL: https://www.gfdrr.org/en/egypt
[36] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf
[37] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

have been irrigated and intensively cultivated since early civilizations in the area, and represent about 80% of the cultivated area. 'New-land' includes lands that have been reclaimed relatively recently or are in the process of being reclaimed, representing approximately 20% of the cultivated area. Cultivation and modern irrigation techniques in new lands are relatively well-developed.

Due to the different soil, availability and quality of water, as well as climate characteristics, there are two primary cropping seasons per year: winter (November to April) and summer (May to October) cultivation seasons. In some areas, farmers can cultivate a third crop during the period between summer and winter. Fruit trees are the country's most important perennial crops. Cultivated field crops include maize, rice, cotton, and sugarcane in the summer, and alfalfa, wheat, barley, green bean, clover, and sugar beet in the winter. The productivity of field crops has increased significantly over the last two decades, primarily due to the use of new cultivars, modern agricultural technologies and improved management activities.[38]

Climate Change Impacts

Projected climate change impacts to food production, agricultural livelihoods and food security in Egypt are significant national concerns. Impacts on food production and food security are linked to future projected water supply constraints as well as temperature rise. Subsistence dry-land farmers are more vulnerable to climate change than commercial farmers due to their small scale and reliance on rain-fed agriculture and existing water resources. Egypt's agriculture sector is vulnerable to higher temperatures, particularly concerning the ecological regions for some deciduous fruits, expected to shift towards northern Egypt. Fruit species are grown under marginal chilling conditions and are susceptible to even small increases in warming trends. Additionally, these trends are expected to adversely impact yields, which will have varying effects on irrigated yields across regions as all crops grown are expected to experience significant yield declines. This is likely to result in price increases for the most important agricultural crops: rice, wheat, and maize.[39] It is anticipated that crops will consume more water as the evaporation rates increase, leading to a decrease in the productivity of staple foods (wheat, maize, rice, tomatoes), and also sugar cane and milk. Reduction in the growth rates of cattle and poultry are also anticipated due to higher temperatures and possibility of reduced nutrition.[40] Crops such as wheat, rice, maize, and citrus are expected to decrease between 10% and 20%; cotton yields are expected to increase by as much as 20% by the 2060s.[41]

In Egypt, livestock production represents approximately 24.5% of the agricultural GDP. In general, meat production is more important than milk, with cows, buffaloes, sheep, goats, and camels dominating the sub-sector. The majority of farms are family farms of less than one hectare, with mixed livestock and crop production. During the last 20 years, stocking numbers have increased sharply (except for camels). However, these increases remain insufficient to meet the requirements of a rapidly growing population. Especially for dairy products,

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[38] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

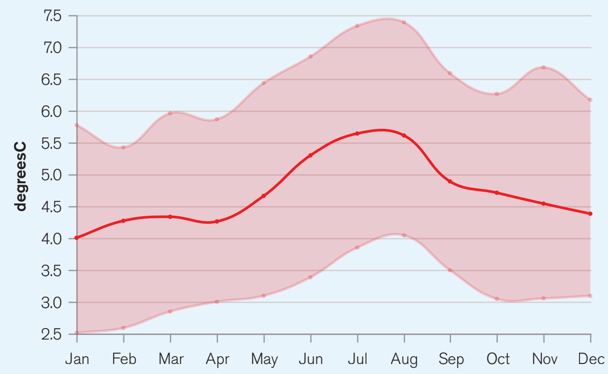
[39] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[40] UNDP (2018). National Adaptation Plans in Focus: Lessons from Egypt. URL: https://www.adaptation-undp.org/sites/default/files/resources/naps_in_focus_lessons_from_egypt.pdf

[41] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

the rapidly growing demand is increasingly met by imports. The direct impacts of climate change on livestock are related to heat, including the effects of radiation, temperature, humidity and wind speed. Under present climate conditions, heat stress makes it difficult for animals to keep up with heat dissipation, rendering them vulnerable to heat stress during, at least, part of the year. Heat stress has a variety of detrimental effects on livestock, but can include reductions on milk production and reproduction, particularly for dairy cows. Extreme events, such as heat waves, may particularly affect beef and dairy cattle. The projected increased heat will increase stress on crops and is also likely to alter the length of the growing seasons. Decreased water availability is likely to reduce yields and the reduction in soil moisture may alter suitable areas for agriculture or the production of specific crops. Increased heat and water scarcity conditions are likely to increase evapotranspiration, expected to contribute to crop failure and overall yield reductions.[42] **Figure 10** shows the average daily max-temperature across seasonal cycles. These higher temperatures have implications for impacts to soil moisture and crop growth and as seen in the graph below, summer spikes in temperature for traditional harvest seasons.

FIGURE 10. Average daily max temperature for Egypt[43]



An increased likelihood of droughts and prolonged dry periods will also exacerbate land degradation. As temperatures rise, so will the likely increase of pests and risk of fire. Increased frequency and intensity of extreme events may change or impact species composition and alter 'regulating services' such as soil water maintenance, base flows, and filtration.[44]

Adaptation Options

Egypt's agriculture sector already faces challenges due to environmental degradation, disease outbreaks, and higher input costs as well as challenges regarding land rights and inequality. Adaptation strategies in the country include the implementation of climate smart agriculture practices, improved water management, improved monitoring and early warning, the development of knowledge and decision-support systems, and the development of new crop varieties and technologies to support farming. Additionally, the allocation of land and production to high value crops and changed breeding for livestock could help to increase adaptation success and improve income generation as well as adoption of drought resistant crops and the further development of water harvesting techniques throughout the country will lessen the impacts of climate change.[45] Egypt is committed to improving

[42] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[43] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Agriculture. Dashboard URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=EGY&period=2080-2099

[44] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[45] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

the biological diversity of livestock, fishery and poultry for improved food security. Developing agro-economic systems and introducing new structures to more efficiently manage crop productivity is aimed at protecting land from degradation, as well as improving the effectiveness of the agricultural systems ability to manage and respond to climate change related stress.[46]

Water

Overview

Water is of primary importance for Egypt. Rain only falls effectively on the North Coast running parallel to the Mediterranean. The intensity varies from 300 mm/year on the far eastern border city of Rafah and decreases towards the west direction until it reaches 200 mm/year at Port Said, 150 mm/year at Alexandria and it increases again towards the west reaching 250 mm/ year at El-Salloum on the border with Libya. Rainfall diminishes quickly the further south and internally to the country where it reaches 30 mm/year at Cairo and practically zero at the far southern end at Aswan. The Red Sea area enjoys high intensity rates of rain at the southern end in Halayeb, Shalatin and Abu Ramad which sometimes is close to 500 mm/year, while the northern oil cities Hurgada, Kousair, Safaga and MarsaAlam have less intensity of 100 mm/year and less. The Red Sea area can be subject to flash floods which occur once every number of years (5–10) caused by differences in pressures coming from cool Europe and warm Asia. The flash flood waters are also effective for the recharge of groundwater aquifers and storage for use by humans and animals.

As the majority of the country is composed of a very large desert area, which remains largely uninhabited, Egypt is solely dependent on the Nile river for water. This wide range of water utilization increases concern and vulnerability regarding climate change trends which may impact the natural flow of the River Nile due to the reduction of rainfall on the upper Nile Basins, reduction of rainfall on the east Mediterranean coastal zone as well as the effect of sea level rise on the quality of groundwater in the coastal aquifers.[47]

Climate Change Impacts

There remains significant uncertainty regarding the anticipated impacts of climate change on Nile River flows, with some studies suggesting increased evaporation rates due to rising temperatures could decrease water availability by up to 70%, while other studies suggest that increased rainfall in the Ethiopian highlands and Blue Nile Basin may increase flows by 15% to 25%. As the Nile River's sources are located outside Egypt, the country is highly vulnerable to changing climate conditions and shocks both within and outside the country's borders. Additionally, the majority of the population lives in close proximity to the Nile River, increasing potential exposure to flood events, with the urban poor particularly exposed and vulnerable. The expected impacts from increased temperatures and decreased rainfall is likely to increase water demand, particularly from the agricultural sector which currently

[46] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

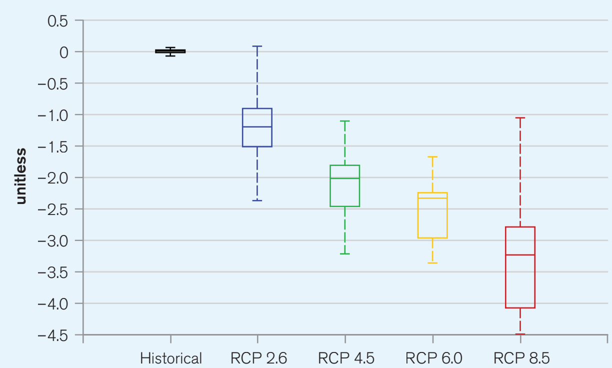
[47] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

consumes approximately 80% of all available freshwater resources. Water demand will not only be tied to rising temperatures but also by the rising population for the North African region, which is projected to be home to nearly a billion people by mid-century.[48] Additional projected climate impacts on the Nile include, the Upper Blue Nile River Basin becoming wetter and warmer in the 2050s. However, the potential of planned future dam projects is unlikely to significantly affect water availability to Egypt and Sudan.[49]

Rainfall and evaporation changes also impact rates of surface water infiltration and the recharge rates for groundwater. Low-water storage capacity increases the country's dependence on unreliable rainfall patterns. Changes in rainfall and evaporation translate directly to changes in surface water infiltration and groundwater re-charge. This has the potential for further decreased reliability of unimproved groundwater sources and surface water sources during droughts or prolonged dry seasons. Increased strain on pumping mechanisms leading to breakdowns if maintenance is neglected and the potential for falling water levels in the immediate vicinity of wells or boreholes, particularly in areas of high demand. Additionally, temperature increases have the potential to result in increased soil moisture deficits even under conditions of increasing rainfall.

Figure 11 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI), through the end of the century. The SPEI is 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. This is an important metric for the water sector in regards to quantity and quality of supply for human consumption and agriculture use as well as for the energy sector as reductions in water availability impacts river flow and the hydropower generating capabilities. At a national scale, Egypt is projected to experience significantly heightened dry conditions and significant drought severity, which will increase pressure on water resources for the country While Figure 11 shows nationally aggregated trends, **Figure 12** shows the spatial representation of SPEI across the country for the periods 2040–2059 and 2080–2099. As shown, the entire country will be under significant water stress, most acutely occurring in the central and northwestern areas in the 2050s and 2090s, respectively.

FIGURE 11. Annual SPEI Drought Index in Egypt for the period, 1986 to 2099[50]

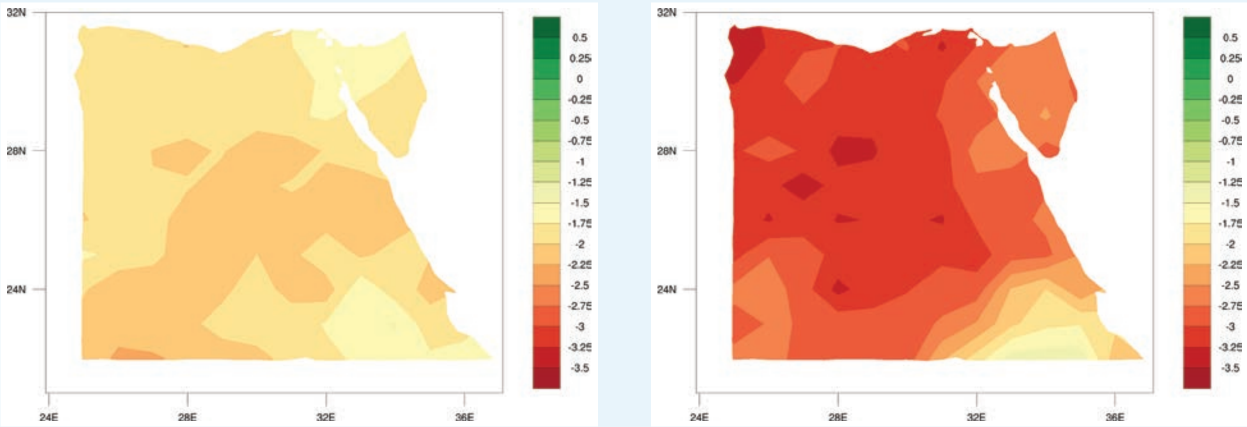


[48] USAID (2018). Climate Risk Profile – Egypt. Fact Sheet. URL: https://www.climatelinks.org/sites/default/files/asset/document/2018_USAID-ATLAS-Project_Climate-Risk-Profile-Egypt.pdf

[49] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[50] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Water Sector Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/water/land-use-/-watershed-management?country=EGY&period=2080-2099

FIGURE 12. Spatial representation of SPEI across Egypt for the period 2040–2059 (left) and 2080–2099 (right), under RCP8.5



Adaptation Options

To enhance and secure the long-term sustainable management of its water resources, diplomatic discussions and agreements are required as source waters of the Nile are outside of Egypt's boundaries. Appropriate management of this resource requires continued and increased diplomatic discussions with all regional countries relying on the Nile River: Ethiopia, Sudan, Uganda. Egypt has already implemented national adaptation actions aimed at improving water resource management, including water conservation measures for agriculture, industry and municipal supplies, upgrading water quality and sanitation to minimize pollution, constructing new infrastructure for water collection in flash flood areas (e.g. Sinai, Red Sea, and Upper and Middle Egypt), increasing use of renewable energy (solar and wind) for water desalination, increasing storage of drainage and fresh water in coastal lakes, and improving public awareness campaign on water scarcity and water shortage.[51] Egypt is committed to increasing its investment in modern irrigation systems developing policies to encourage citizens for responsible water use, as well as cooperating with Nile Basin countries to reduce water evaporation and safeguard river flows.[52]

Energy

Overview

Egypt is the largest non-OPEC oil producer in Africa and the country's energy systems are largely driven by fossil fuels. Crude oil reserves are estimated at 4.4 billion barrels. New oil discoveries boosting oil reserves have been made every year since 2008, particularly in the Western dessert. Egypt's oil production comes from the Gulf of Suez, Nile Delta, Western Desert, Eastern Desert, Sinai, and the Mediterranean Sea. The majority of production

[51] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[52] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

is derived from relatively small fields that are connected to larger regional production systems. Overall production for the country is in decline, particularly from the older fields in the Gulf of Suez and Nile Delta. However, declines have been partially offset by small new finds, particularly in the Western Desert and offshore areas. While in the mid-1990s, Egypt's output began to decline as oil fields matured, natural gas liquids output has increased over the past decade as a result of expanding natural gas production, which has offset some of the decline in crude oil production. A continued challenge for the country's energy sector is to satisfy an increasing domestic demand for oil amid falling domestic production. Total oil consumption grew by an annual average of 3% over the past decade.[53]

Climate Change Impacts

The unsustainable use of energy resources continues to be a major reason for continued environmental degradation. Additionally, the country's energy scarcity and rising energy prices are straining national budgets and jeopardize Egypt's economic competitiveness for the future. The increase in temperatures and reduction in rainfall will bring additional challenges for energy demands, such as changes (seasonal expansion, prolonged usage) of peak-hour demand patterns, including increasing the need for air conditioning and expanding the high energy demand of water desalination efforts. The existing infrastructure is ill-prepared to cope with the projected effects of climate change, especially when coupled with increased demand. Existing energy systems are at risk of system failures and increasing outages and brownouts due to low supply capacity.[54] Planned dams upstream of Egypt, which are designed to improve energy availability across the continent, also have the potential to significantly reduce flows for Egypt. This could impact not only agricultural, industrial and domestic water consumption, but also cut hydropower generation at the Aswan Dam, the country's largest. Climatic and international pressures on the Nile River also have high potential to not only affect economic activity and water availability in Egypt, but also to raise tensions amongst users of the river.[55] The projected decrease in precipitation and change in seasonal rainfall patterns are likely to reduce hydropower potential, coupled with revenue losses. Increased evaporation rates from existing water storage facilities will also increase production costs, costs that will inevitably be transferred to the consumer.

Cooling Degree Days show the relationship between daily heat and cooling demand, typically sourced through a form of active cooling or an evaporative process. The change in cooling degree days provides insight into the potential for extended seasons of power demand or periods in which cooling demand (power demand) might increase. As seen in **Figure 13**, seasonal increases for cooling demands are expected to increase over an extended summer period (May to October). The Warm Spell Duration Index represents the number of days in a sequence of at least six days in which the daily maximum temperature is greater than the 90th percentile of daily maximum temperature. As shown in **Figure 14**, warm spells are expected to sharply increase in the second half of the century.

[53] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[54] Middle East Institute (2012). Implications of Climate Change on Energy and Security in the MENA Region. URL: https://www.mei.edu/publications/implications-climate-change-energy-and-security-mena-region

[55] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

FIGURE 13. Change in Cooling Degree Days (65°F) in Egypt for the period 2040–2059[56]

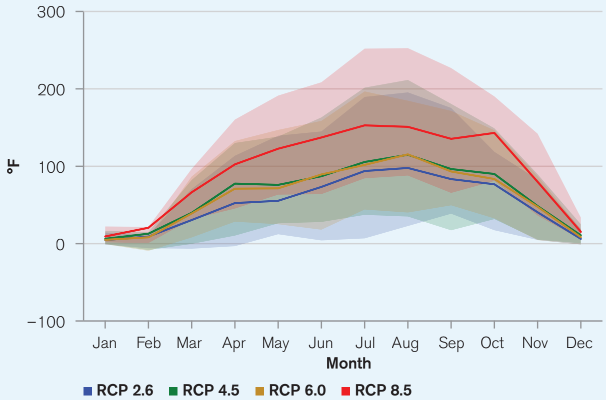
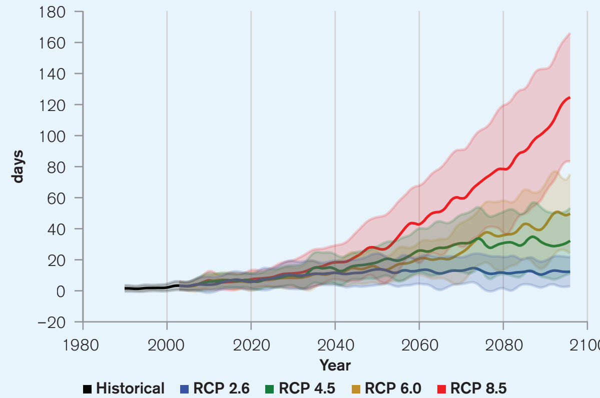


FIGURE 14. Warm Spell Duration Index in Egypt for the period 1986 to 2099[57]



Adaptation Options

As a result of Egypt's growing domestic energy demand, the government is working to diversify its energy supply and to increase the amount of power generated from renewable sources, particularly wind and solar. The country is also fostering nuclear power development. However, electricity consumption continues to outpace generation capacity and expansion. Coal imports are rising in order to meet immediate demands. The country is working on innovative new regulatory models to increase energy production and use-efficiency, especially for utilities and, ultimately, their customers through energy savings programs and new approaches to transmission and accounting. To improve its adaptive capacity in the energy sector, Egypt has committed to conducting comprehensive studies of the energy sector to define the role that climate will play in energy demand and supply, and also to identify appropriate adaptation measures, and estimate the economic cost of the proposed adaptation measures. The government has committed to building the institutional and technical capacities of different units in the energy sector, particularly with regards to climate change.[58]

Health

Overview

The Egyptian health care system faces multiple challenges in improving and ensuring the health and wellbeing of the Egyptian people. Egypt has a highly pluralistic health care system, with multiple public and private providers and financing agents. Health services are currently managed, financed, and provided by agencies in all three sectors of

[56] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt – Energy. URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-sector-energy
[57] WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Energy Sector Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/energy/oil-gas-and-coal-mining?country=LSO&period=2080-2099
[58] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

the economy: government, parastatal, and private. As in many lower- and middle-income countries, the government health services are organized as an integrated delivery system in which the financing and provider functions are included under the same organizational structure.[59] Health challenges continue to disproportionately affect the rural poor and have the potential to impact the country's economic prosperity more broadly over the long-term. Poor women are 20% less likely to receive regular antenatal care than wealthy women, and under-5 mortality for the poorest children is high at 42 deaths per 1,000 live births. Current threats include high rates of stunting as a result of chronic malnutrition and one of the highest rates of Hepatitis C in the world, as 7% of Egyptians between the ages of 15 and 59 suffer from chronic Hepatitis C.[60]

Climate Change Impacts

For Egypt, projected increase in heat waves, dust storms, storms along the Mediterranean coast and extreme weather events are likely to have a significant impact on the health of the population, with the urban poor particularly at risk. The intensity and frequency of dust storms and sand storms, already a common feature of Egyptian weather, are expected to increase in severity and frequency. Dust and sand storms are associated with numerous infectious diseases, such as influenza and pneumonia as well as non-infectious diseases, such as asthma and pulmonary fibrosis and pose significant respiratory health risks to children, the elderly, and those with chronic cardiopulmonary diseases. Egypt is especially at risk from increasing temperatures and heatwaves, which will adversely impact vulnerable groups such as children, the elderly and outdoor laborers.[61]

Impacts from sea level rise along the coast is expected to harm approximately 2.4 million people by the 2080s from coastal flooding and sea level rise inundation. Flood risk due to inland river flooding and flash flooding could increase. Under a high emissions scenario, RCP8.5, it is projected that by the 2030s, an additional 1.1 million people annually are at risk of river floods due to changing precipitation patterns, extreme rainfall events and flash floods. 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. Under RCP8.5, diarrheal deaths attributable to climate change in children under 15 years old is projected to be reach 10.9% of about 1,000 diarrheal deaths projected in the 2030s. Although diarrheal deaths are projected to decline to about 300 deaths by the 2050s, the proportion of deaths attributable to climate change in Egypt could rise to approximately 15.2%. Egypt's increasing temperatures and severe heatwaves are expected to significantly impact heat-related deaths. Particularly in the elderly (65+ years), these deaths are projected to increase to approximately 47 deaths per 100,000 by the 2080s as compared to the estimated baseline of one death per 100,000 annually between 1961 and 1990.[62] Vector borne diseases such as malaria and dengue fever as well as respiratory infections are highly sensitive to shifts in climatological environments and are expected to worsen across Egypt.[63]

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[59] USAID (2017). Overview of the Health System in Egypt. Demographic and Health Survey. URL: https://dhsprogram.com/pubs/pdf/SPA5/02chapter02.pdf

[60] USAID (2019). Health and Population – Egypt. URL: https://www.usaid.gov/sites/default/files/documents/1883/USAIDEgypt_Health_Fact_Sheet_EN.pdf

[61] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[62] WHO (2015). Climate and Health Profile – Egypt. URL: https://apps.who.int/iris/bitstream/handle/10665/208860/WHO_FWC_PHE_EPE_15.06_eng.pdf?sequence=1

[63] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

Rising temperatures are of increasing concern. The annual distribution of days with a high-heat index provides insight into the health hazard of heat. **Figure 15** shows the expected Number of Days with a Heat Index >35°C for the 2090s; showing a sharp increase in high heat index days, starting to accelerate by mid-century and continuing to sharply increase under a high-emission scenario by end of the century. It also shows night temperatures (>20°C), which are expected to rapidly increase in a high-emission scenario. Increased health threats can be projected and monitored through the frequency of tropical nights. Tropical Nights (**Figure 16**) represents the projected increase in tropical nights for different emission scenarios to demonstrate the difference in expected numbers of tropical nights.

FIGURE 15. Days with a Heat Index >35°C[64]

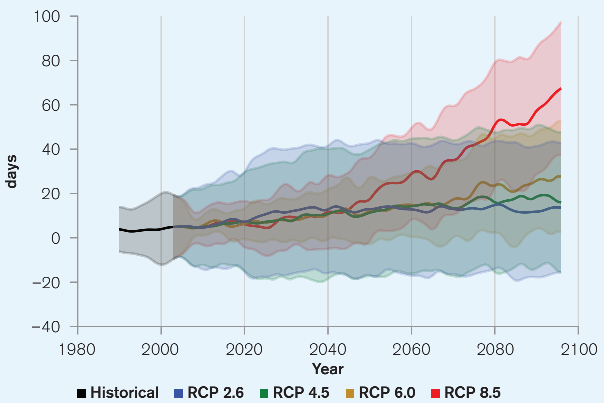
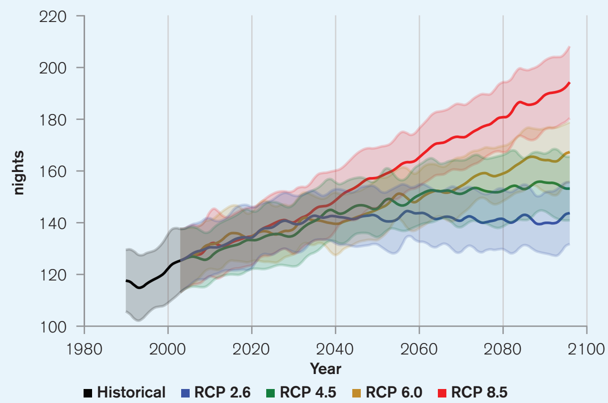


FIGURE 16. Number of Tropical Nights (Tmin >20°C)[65]



Adaptation Options

Egypt's health sector is currently investing on health surveillance, risk mapping, and monitoring systems to address the potential adverse outcomes to health and strengthen the country's knowledge management and communication networks. Research underway aims to identify key health vulnerabilities, such as urban heat islands, as well as vector borne and communicable diseases. The Ministry of Health and Population (MOHP) is working to integrate laboratory and epidemiological services to optimize public health practices. The country is also working to expand its health system, including the expansion of district health offices, surveillance systems and vaccination for children.[66] Egypt has committed to raising community awareness about climate change induced risks and adaptation options, increasing the efficiency of the healthcare sector to improve the capacity for dealing with climate change related health concerns, and to provide greater support to the MOHP.[67]

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64 WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Health Sector Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/health/systems-and-service?country=EGY&period=2080-2099

65 WB Climate Change Knowledge Portal (CCKP, 2020). Egypt Health Sector. URL: https://climateknowledgeportal.worldbank.org/country/egypt/climate-sector-health

66 Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

67 Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

Institutional Framework for Adaptation

Egypt's Environmental Affairs Agency and Ministry of State for Environmental Affairs are responsible for supporting and coordinating the country's actions on climate change adaptation and resilience efforts. The National Committee of Climate Change (established 2007) spearheads full implementation and representation to the UNFCCC. Efforts around implementation and mitigation are coordinated and implemented through key national partners the Ministry of Foreign Affairs, Ministry of Water Resources and Irrigation, the Ministry of Agriculture and Land Reclamation, the Ministry of Electricity and Energy, Ministry of Trade and Industry, Economic Development and Defense, and the New and Renewable Energy Authority. Egypt also engages with its climate change policies and strategies with stakeholders in the public and private sector organizations, including Non-Governmental Organizations (NGOs), civil society, the donor community, and local communities.[68]

Policy Framework for Adaptation

Egypt submitted its Third National Communication to the UNFCCC and its Nationally-Determined Contributions to the UNFCCC in 2016. These documents, in conjunction with the country's Sustainable Development Strategy and Egypt's Vision 2030 provide the guidance and policy goals for sustainable economic development and responsible environmental management to meet climate change adaptation strategies and development priorities. To date, Egypt has taken several actions toward both climate mitigation and adaptation through isolated projects, such as efforts to transition El Gouna City to carbon neutrality, and through several strategies and institutions dedicated to climate adaptation.[69] To increase its adaptive capacity to projected impacts from climate change, Egypt is committed to the increased use of renewable energy, advancing locally-appropriate and more efficient technologies to reduce its dependency on fossil fuels, and reform the country's energy efficiency.[70]

National Frameworks and Plans

- Nationally-Determined Contribution (2016)
- Third National Communication (2016)
- Climate Change Adaptation Strategy (2013)
- National Strategy for Mainstreaming Gender (2011)
- National Strategy for Adaption to Climate Change and Disaster Risk Reduction (2011)
- Egypt National Environmental, Economic and Development Study for Climate Change (2010)
- Egyptian National Action Plan to Combat Desertification (2005)

[68] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[69] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[70] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

Recommendations

Research Gaps

- Improve understanding of key vulnerabilities and development impacts from projected climate change trends across Egypt, as well as possible adaptation responses
- Increase participation of the public, scientific institutions, women and local communities in planning and management, accounting for approaches and methods of gender equity
- Strengthen environmental monitoring capabilities for more effective environmental management
- Increase understanding of impacts to Egypt's coastal zones, including investment in risk assessments and adaptation options.
- Research is needed into vulnerability and adaptation of Egypt's biodiversity to the impacts of climate change, specifically to the country's forests
- Strengthen the technical capacity to integrate climate-smart agriculture and climate change risk management into farmer's and the wider agricultural sector
- Design and implement a Technology Needs Assessment to understand needs of technology transfer and capacity building[71]

Data and Information Gaps

- Mapping of Egypt's agricultural products (rubber, livestock, forestry and fisheries) for more effective land use and future resource management
- Improve early warning systems specifically for agriculture for improved water management techniques and preparedness for longer dry seasons
- Ensure that nation-wide climate change and atmosphere monitoring systems are maintained and enhanced where necessary, including through monitoring networks at appropriate spatial density and frequency[72]

Institutional Gaps

- Ensure integration of National Environmental Strategy goals are developed within sectoral and regional plans and in line with financial opportunities with donors
- The institutionalization of systematic observations of sea surface temperature, coastal land use and sea level variations is needed to ensure the availability of results for to the scientific community and policy makers[73]
- Support facilitation of energy efficiency options through improved financing options and legal backing for public-private partnerships[74]
- Implement cross-sectoral climate-smart solutions at national and subnational levels for Egypt's agriculture and water management sectors

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[71] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[72] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

[73] Egyptian Environmental Affairs Agency (2016). Egypt Third National Communication under the United Nations Framework Convention on Climate Change. URL: https://unfccc.int/sites/default/files/resource/TNC%20report.pdf

[74] Egypt (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Egypt%20First/Egyptian%20INDC.pdf

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