Ministry of Foreign Affairs

Climate Change Profile

Egypt

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Introduction

This climate change profile is designed to help integrate climate actions into development activities. It complements the publication 'Climate-smart = Future-Proof! – Guidelines for Integrating climate-smart actions into development policies and activities' and provides answers to some of the questions that are raised in the step-by-step approach in these guidelines.

The current and expected effects of climate change differ locally, nationally and regionally. The impacts of climate change effects on livelihoods, food and water security, ecosystems, infrastructure etc. differ per country and region as well as community and individual, with gender a particularly important vulnerability factor. This profile aims to give insight in the climate change effects and impacts in Egypt, with particular attention for food security and water but also touching on conflict and migration.
It also sheds light on the policies, priorities and commitments of the government in responding to climate change and important climate-relevant activities that are being implemented, including activities being internationally financed.

Summary

Egypt is highly vulnerable to climate change due to the dependence of its large and growing population on the Nile River for fresh water and its long coastline, which is already experiencing sea level rise[1]. With 98% of its population living on 4% of its total land area in the Nile Valley and Delta, the largest oasis of the Sahara Desert[2], the future of Egypt is directly linked to the flow of the Nile River and its endangered delta. As a threat multiplier, climate change will amplify the demographic, economic, and political pressures on Egypt's stability.

Overall ranking

Egypt has an emission ranking of 28 out of 215 countries and regions[3] contributing about 0.60% of global GHG emission[4]. For climate vulnerability Egypt has a ranking of

91 out of 181 countries in the ND-Gain Index[5] (ranking 1 being the least vulnerable). Egypt is the 87th most vulnerable country and the 73rd least ready country. *Vulnerability* measures the exposure, sensitivity, and ability to cope with climate related hazards by accounting for the overall status of food, water, environment, health, and infrastructure within a country. *Readiness* measures a country's ability to leverage investments and convert them to adaptation actions by looking at the country's economic, governance and social readiness. Globally, relative to other countries its current vulnerabilities are manageable but improvements in readiness will help it better adapt to future challenges.

Biophysical vulnerability

Egypt is bordered by the Mediterranean Sea to the north, by Sudan to the South, by the Red Sea, Palestinian Territories and Israel to the east and by Libya to the west with a coastline of 3500 km on the Mediterranean and Red Sea[6]. The Egyptian terrain is a desert plateau that is interrupted by the Nile Valley and Delta with the elevation ranging from 133 m below sea level in the Western Desert to 2,627 m above sea level in the Sinai Peninsula[7].

Most of Egypt is a desert and is classified as arid, except for the semi-arid Mediterranean coast. Egypt has only two seasons: a mild winter from November to April and a hot summer from May to October. The differences between the seasons are variations in daytime temperatures and changes in prevailing winds in the coastal regions; temperatures

1 Egypt's Third National Communication (TNC) to the UNFCCC. Available at https://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/application/pdf/tnc_report.pdf
2 Map of the Nile River and Delta available: http://www.bitsofscience.org/north-africa-climate-change-egypt-nile-delta-sea-level-rise-climate-migrants-6716/
3 Global Carbon Atlas (2016). Available at http://www.globalcarbonatlas.org/en/CO2-emissions
4 Climate Analysis Indicators Tool (CAIT) Version 2.0. (Washington, DC: World Resources Institute, 2014)". World Resources Institute.
5 GAIN index summarizes a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. http://gain.nd.edu/our-work/country-index/rankings/
6 TNC (2016)
7 TNC (2016).

range between an average minimum of 14°C in winter and an average maximum of 30°C in summer. Average temperatures increase as moving south from the Mediterranean coastline[8]. Temperatures vary widely in the inland desert areas, especially in summer, when they may range from 7°C at night to 43°C during the day. Throughout Egypt, days are commonly warm or hot, and nights are cool. During winter, temperatures in the desert can be as low as 0°C at night and as high as 18°C during the day[9].

In the winter season there are rains over the coastal area with summers hot and dry. Precipitation is generally very low with an annual average rainfall of 41.8 mm (1961-1990) of which about half falls from December through March. While the Mediterranean coastline averages more than 200 mm/yr, precipitation rates drop when moving away from the coast with most of Egypt receiving only about 2 mm of precipitation per year[10].

For 95% of its freshwater needs Egypt is dependent on the Nile River, whose source is outside of Egypt, (see Map 1)[11]. The Egyptian part of the Nile River Basin covers over 10% of the entire basin in a narrow corridor that contains the Nile River from where it enters Egypt in the south to where it reaches the Mediterranean Sea in the north[12].

Egypt experiences dust storms in spring and early summer, with dry and dust-laden Khamsin winds usually arriving in April, but occasionally occurring in March and May. The winds form in low pressure areas in the Isthmus of Suez and sweep across the northern coast of Africa reaching high velocities and carrying great quantities of sand and dust from the deserts. These sandstorms, often accompanied by winds of up to 140 kilometers per hour, can cause temperatures to rise as much as 20°C in two hours and may blow continuously for three or four days at a time, then followed by an inflow of much cooler air[13].

Climate trends

There have been widespread warming trends since 1960 with greater warming in summer (0.31°C per decade) than during winter (0.07°C per decade). There has also been an increase in the frequency of warm nights and a decrease in the frequency of cool nights, and a general increase in the average summer temperatures[14].

Although there is high annual variability in rainfall records, the linear trend for seasonal average and decadal variability indicates a reduction of 2.76 mm/month since 1960[15]. There is evidence that the severity and frequency of flash flooding across Egypt has increased in recent years. While there is a lack of historical data, an increase severity and frequency of sand storms has been documented[16].

Climate Change Projections

There is agreement across climate models that temperatures will increase significantly under climate change with mean annual temperature increasing 2-3°C by 2050 with warming projected to increase more rapidly in the interior regions[17]. Increases will be highest in the summer months (July-September) with increases in the number of hot days (especially in summer) and decreases in the number of cool days[18].

A reduction in rainfall over northern Africa (including Egypt) is very likely by 2100[19]. While projections of future rainfall are uncertain, for Egypt there are indications of a 7% reduction in rainfall near the coast by 2050, while a 9% reduction is projected for the central parts of the country with the greatest reductions projected during June, July and August at 22%, followed by September, October and November by 11%. However, model projections diverge for the central regions. The highest reductions are projected for June, July and August by 27% and September, October and November by 11%[20].

Sea level rise. Due to its low elevation, the Mediterranean shoreline, including the Nile Delta, is very vulnerable to sea level rise[21]. Projections for 2100 suggests a one-meter sea level rise with a high tide of 30m which will significantly change the Nile Delta region (see Map 2)[22]. As a result, the Nile Delta's major urban areas, agricultural areas and coastal wetlands will be significantly affected by saltwater intrusion and groundwater contamination, soil salinization, deterioration of crop quality and losses of

8 TNC (2016); USAID Climate Change Information Fact Sheet: Egypt (September 2015). Available at https://www.climatelinks.org/resources/climate-information-factsheet-egypt

9 Egypt's Third National Communication (TNC) to the UNFCCC. Available at https://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/application/pdf/tnc_report.pdf

10 USAID (2015)

11 TNC (2016)

12 UNEP (2013)

13 USAID (2015); TNC (2015)

14 USAID (2015)

15 World Bank Climate Knowledge Portal, Egypt (2018). Available at http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=EGY&ThisTab=RiskOverview

16 USAID (2015)

17 World Bank Climate Knowledge Portal (2018). The reference period is 1986-2005.

18 USAID (2015).

19 USAID (2015) citing IPCC WGII (2014) Climate Change 2014: Impacts, Adaptation, and Vulnerability. Chapter 22 (Africa) available at http://www.ipcc.ch/report/ar5/wg2/

20 World Bank Climate Knowledge Portal (2018)

21 TNC (2016); M. El-Raey (2010). Impact of Sea Level Rise on the Arab Region. Available at http://www.arabclimateinitiative.org/Countries/egypt/ElRaey_Impact_of_Sea_Level_Rise_on_the_Arab_Region.pdf

22 International Center for Agricultural Research in Dry Areas (ICARDA) (2008). Nile Basin: Effect of a 1300 cm Sea Level Rise. Available at http://geoagro.icarda.org/en/cms/metadata/index/142/Nile%25252B-Delta%25253A%25252BEffect%25252Bof%25252Ba%25252B130c-m%25252BSea%25252BLevel%25252BRise

productivity and other social and economic impacts[23] [24]. Anticipated climate change-related sea level rise in the Nile Delta will exacerbate the reduced sediment flows that occurred with the construction of the Aswan Dam, weakening and potentially destroying the protective offshore sand belt and amplifying the current on-going land subsidence (5.0 cm/year) and tidal range of about 20 cm[25]. It is estimated that a one-meter sea level rise will affect approximately 6 million people, mostly poor, living in the Nile Delta basin and jeopardize more than a third of the freshwater volume of the delta[26]. Egyptian coastal populations, already affected by coastal erosion, pollution, land use pressure, demographic growth and ecosystem degradation, will be increasingly vulnerable to the effects of sea level rise, with its accompanying flooding.

Extreme events. Climate projections suggest an increase in the occurrence of sand storms following the current pattern of moving across Egypt from the Isthmus of Suez to the north. The coastal zones will experience an increasing frequency and severity of extreme climate events, including storm and tidal surges and associated flash flooding[27].

Climate change in the Nile Basin

Since Egypt receives very little rainfall and is dependent on the Nile River for all but a small percentage of its freshwater, the flow of the Nile is of greater importance to Egypt than rainfall variability[28] [29]. The Nile is one of the world's major rivers with a basin area shared among 11 countries: Burundi, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, United Republic of Tanzania and Uganda. The Nile Basin extends over five climatic zones — Mediterranean, arid, semiarid, subtropical and tropical with landscapes ranging from mountains, grasslands, forests and woodlands, wetlands, lakes and desert to a delta[30].The two main tributaries of the Nile River are the White Nile, with sources on the Equatorial Plateau and the Blue Nile originating in the Ethiopian Highlands (See Map 3). The Blue Nile contributes more than 60% of the total flow of the Nile (measured at the Aswan Dam) and the White Nile about 18%. The other major river systems (e.g. Sobat and the Atbara) contribute less than 15% each[31].

Since the Basin is sensitive to changes in rainfall and temperature, the potential impact of climate change on the Nile River regime is significant.[32] The vulnerability of the Nile River Basin to climate change is due to: [33]

- High fragility of its natural systems: two-fifths of the basin is arid and semi-arid drylands;
- Rapidly growing population putting unprecedented pressure on the natural resource base;
- Poverty of the rural people in the upstream countries that limits diversification from agriculture, fishing, and forestry into less climate-sensitive sectors;
- High exposure to natural disasters, including droughts and floods;
- High sensitivity of many of the Nile sub-basins to changes in precipitation;
- Agriculture sector in the downstream countries (e.g. Egypt) that is almost totally reliant on the Nile-fed irrigation;
- High dependency on hydropower for energy across the basin.

Since the Blue Nile is its major contributor, the Nile is particularly sensitive to the variability of runoff from the Ethiopian part of the basin. Potential climate-change impacts on the smaller White Nile flows are mitigated by the Sudd in South Sudan and the other large wetlands in the White Nile Basin[34]. Changes projected for temperature, precipitation and related extreme events suggest an overall increase in temperatures with a continuing rise in temperature by 2100 for the Basin. For precipitation some models suggest an increase in precipitation for the Basin until 2040, followed by decreases in rainfall by 2100.

A significant rise in temperatures increases the possibility of enhanced water losses from evapotranspiration which will reduce the stream flows and stored water[35]. According to

23 RICCAR (2017)

24 TNC (2016)

25 UNEP (2013); USAID (2017) citing A. El-Nahry and R. Doluschitz (2009). Climate change and its impacts on the coastal zone of the Nile Delta, Egypt. Environ Earth Sci (2009) 59: 1497-1506 available at https://www.researchgate.net/publication/225312594_Climate_change_and_its_impacts_on_the_coastal_zone_of_the_Nile_Delta_Egypt

26 R. Conniff (2017). The vanishing Nile: A great river faces a multitude of threats. Yale Environment 360. Available at https://e360.yale.edu/features/vanishing-nile-a-great-river-faces-a-multitude-of-threats-egypt-dam

27 TNC (2016)

28 World Bank Climate Knowledge Portal (2018).

29 L. El Hatow (2015b)

30 UNEP (2013) Adaptation to climate change-induced water stress in the Nile Basin: A Vulnerability Assessment Report. Available at https://www.unenvironment.org/resources/report/adaptation-climate-change-induced-water-stress-nile-basin-vulnerability-assessment

31 Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR) (2017). Arab Climate Change Assessment Report (2017). Available at https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report

32 NBI (2012).

33 NBI (2012).

34 Nile Basin Initiative (NBI) (2012) Nile River Basin Status Report. Climate Change and its implications for the Nile Basin. Chapter 8. Available at http://nileis.nilebasin.org/system/files/Nile%20SoB%20Report%20Chapter%208%20-%20Climate%20Change.pdf
The outflow from the Sudd - the great wetland in South Sudan - is relatively insensitive to changes in rainfall or evaporation because an increase in Sudd inflow leads to a greater surface area of wetlands, which in turn leads to higher evaporation losses, and vice versa.

35 TNC (2016)

current estimates, evapotranspiration losses account for more than 70% of the water balance in the wettest areas of the Nile Basin, such as the Blue Nile and the equatorial lakes sub-basins, with even higher percentages in the drier areas, such as Egypt and the Sudan[36]. Shifts in temperature and rainfall patterns due to climate change will also have an impact on the recurrence of extreme conditions (drought and flooding), as well as contribute to changes in the river's flow[37].

The impact of climate change on the *variability* in the annual output of the Nile River is a major concern.
The ability to predict the amount of the flow, especially the likely years of reduced flow, is of increasing importance, especially since the population of the Nile River Basin is expected to double by 2050 (see below). A recent well-received study, using a range of global climate models and records of rainfall and flow rates over the last half-century, suggests an increase of 50% in the annual variation of the amount of flow this century[38]. The study bases its analysis on the increase in the intensity and duration of the Pacific Ocean phenomenon of the El Niño/La Niña cycle, which is strongly connected to annual rainfall variations in the Ethiopian highlands and adjacent eastern Nile basins which provides an estimated 80% of the Nile river's total flow. While the changing rainfall pattern is likely to lead to an *average* increase of the Nile's flow of 10-15% until 2040 (see above), there will be substantially fewer 'normal' years and many more extreme years with greater flows and more years of drought.

Current water storage capacity and current plans for additional storage capacity in the Basin do not consider the projected enhancement of interannual variability in the future flow of the Nile river. Both increased and reduced flows will have negative effects on Egypt and other countries in the Basin. In years in which the natural flow is considerably increased, the storage capacity of water systems might not be sufficient to accommodate these high flows, resulting in destructive floods. Also, of concern is the high probability that the conveyance and distribution network of Egypt's canals and drains might not be able to cope with the high flows. In years in which the opposite happens (natural flows are substantially reduced) Egypt and other basin countries such as the Sudan will face drought[39].

Changing climatic conditions have the potential to impact the operational regimes of dams built on the Nile River and its tributaries, with effects on hydropower generation and flow volumes to downstream countries.[40] As the most downstream nation of the Nile River Basin, Egypt is most at risk. Variability in Nile flows into Egypt is moderated by the High Aswan Dam, which has one year's worth of storage capacity that helps in handling periodic drought. However, Egypt remains vulnerable to the multi-year droughts that are likely to occur[41].

Socio-economic and political vulnerability

Table 1: Socio-economic situation in Egypt

Indicators	Egypt
GDP(PPP) per capita (USD) [42]	11,129
Population (2018 est) [43]	99,375,741
Population growth rate [44]	2.0
Population estimate for 2050 [45]	153,433,000
Population density per km2 [46]	96 (national) 1,435 (Nile Valley and Delta) [47]
Human Development Index (HDI) (2016) [48] (188 countries)	111
Corruption Perception Index (CPI) (2017) [49] (180 countries)	117
Gender Inequality Index (GII) (2016) [50] (188 countries)	135
Africa Gender Equality Index (2015) [51] (52 countries)	35
Fragile State Index (2017) [52] (178 countries)	36
Adult literacy % (2013) [53]	75

36 RICCAR (2017)
37 TNC (2016); NBI (2012); USAID (2015)
38 M.S. Siam and E.A.B. Elthahir (2017). Climate change enhances interannual variability of the river Nile flow. Nature Climate Change 7 350-354 (2017) Available at https://www.nature.com/articles/nclimate3273
39 UNEP (2013)
40 RICCAR (2017)
41 TNC (2016)
42 https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD
43 World Population Review 2018 estimates http://worldpopulationreview.com/countries/
44 https://data.worldbank.org/indicator/SP.POP.GROW
45 UNDESA (2017): *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP/248. https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf
46 https://data.worldbank.org/indicator/EN.POP.DNST
47 World Bank Climate Knowledge Portal (2018).
48 http://hdr.undp.org/en/content/human-development-index-hdi
49 https://www.transparency.org/news/feature/corruption_perceptions_index_2017
50 http://hdr.undp.org/en/composite/GII
51 Developed by the African Development Bank, it reflects the status of women along three dimensions of equality: economic opportunities, social development, and law and institutions. The index ranks 52 African countries according to their overall score and to these distinct dimensions of equality. Available at https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/African_Gender_Equality_Index_2015-EN.pdf
52 http://fundforpeace.org/fsi/
53 https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=EG

Although categorized as a medium development county in the HDI, Egypt faces major political, social and economic challenges. High population growth rates will result in a population of over 150 million by 2050 (and 200 million by 2100) and impose major pressure on the economic, social, and environmental resources needed for sustainable development[54]. As the population grows, for example, Egypt's rapidly growing urban centers will be hard pressed to provide basic services such as housing, sanitation, health care, education, and energy. Productive, arable land will also be under pressure to increase yields, exacerbating water shortages as the country increasingly feels the effects of climate change[55]. With 98% of its population and most of its infrastructure concentrated along the Nile River and the Nile delta, Egypt is especially vulnerable to variability in the flow of Nile, changing weather patterns, and inundation and salt intrusion of rising seas[56]. Acting as a threat multiplier, climate change will intensify the interactive effective effect of political, economic, and demographic forces.

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[57]. The agricultural sector is dominated by small farms using traditional practices[58]. About 80% of cultivated land is 'old-land' in the Nile Valley and the Nile Delta that has been irrigated and intensively cultivated for thousands of years. 'New-lands' that have been reclaimed from the desert relatively recently or are in the process of being reclaimed represent the remaining 20% of cultivated land[59]. 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[60].

There are two main cropping seasons a year - winter and summer cultivation seasons. Fruit trees are the most important perennial crops. Field crops cultivated include maize, rice, cotton and sugarcane as main summer crops, while alfalfa, wheat, barley, green bean, clover, and sugar beet are the main winter field crops[61].

Agricultural production is at risk from the direct effects of climate change, including[62] :

- Expected rise in temperatures and change of seasonal patterns as well as a change in environmental agricultural zones;
- Marginal agricultural areas negatively affected and increasing desertification;
- Higher temperatures increasing water evaporation and water consumption;
- Decreasing water supplies reducing the availability of water for irrigation;
- Sea level rise inundating coastal areas and increased salinization.

Projections suggest agricultural will experience the largest loss in the Egyptian economy due to climate change with a significant decrease in agricultural production (except for cotton). Because of the rise in temperature and the increase in the number of hot days and nights, water needs for all crops are projected to increase with reduction in water supplies further decreasing agricultural production [63]. The potential impact of climate change could decrease national food production by 11 to 51% (range reflecting projections of low to high temperature models)[64]. 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 be negatively affected by sea level rise and salt water intrusion[65].

Climate change impacts in Egypt are not gender neutral. Agriculture employs about 45% of all women in the labor force[66]. Rural women in agriculture are usually seasonal workers with unstable earnings and vulnerability to food insecurity. Illiteracy rates for women are higher than those for men (one third of adult women are estimated to be illiterate compared to 15% of males) which means that up to 10 million women cannot read or write[67] and have limited opportunities outside of the agriculture sector for employment. While a large percentage of the female labor is engaged in agricultural labor, a very small percentage of women (5%) are agricultural land owners due to inheritance

54 Egypt's Nationally Determined Contribution (NDC) (2015). Available at http://www4.unfccc.int/ndcregistry/Pages/Search.aspx?k=Egypt

55 A.A. Ghafar (2018). Order from chaos: Egypt's long-term stability and the role of the European Union. Brookings. Citing Ghafar (2018) A Stable Egypt for a Stable Region: Socio-economic challenges and prospects. Available at https://www.brookings.edu/blog/order-from-chaos/2018/03/01/egypts-long-term-stability-and-the-role-of-the-european-union/

56 World Bank Climate Knowledge Portal (2018).

57 USAID (2018). Egypt: Agriculture and Food security. Available at https://www.usaid.gov/egypt/agriculture-and-food-security

58 USAID (2018)

59 TNC (2016)

60 R. Conniff (2017)

61 TNC (2016)

62 J. B. Smith et al. (2014). Egypt's economic vulnerability to climate change. Climate Research, Vol.62: 59-70, 2014. Available at https://www.researchgate.net/publication/269038349_Egypt's_economic_vulnerability_to_climate_change; ND (2015)

63 Smith et al (2014).

64 TNC (2016)

65 NDC (2015)

66 USAID (2018)

67 The literacy rate for youths (14-25 years) of both men and women is estimated to be 90%.

customs in Egypt. The vulnerability of Egypt's agriculture to climate change presents considerable risks to the fragile socioeconomic situation of many rural Egyptian women who are already facing the challenges of high illiteracy, little asset ownership and a weak capacity for economic mobility and adaptation[68].

Conflict, migration and climate change

Population growth, unemployment and climate change is anticipated to create a 'combustible mix'[69] to its stability. Due to its geographic location, its large population, and its significant role in the politics of the Arab world, Egypt's stability affects the region as a whole.

Contributing to Egypt's vulnerability is its lack of self-sufficiency in grain production -– a situation that will not change in future due to its growing population and decreasing agricultural land - and its dependence on the international commodity markets[70]. From 2007-2017 Egypt was the world's largest importer of wheat (for 2018 it is estimated that Indonesia will be the largest with Egypt a close 2nd)[71]. Egypt's national system to supply the population with subsidized bread costs 3% of its annual GDP. While economically unsustainable, proposing changes to the subsidized bread system is politically volatile, as demonstrated by the bread riots in 2008[72]. The reliance on the changing international commodity markets to meet domestic demand exposes Egypt to external forces, in particular fluctuations in wheat prices. In the past higher wheat prices influenced the cost and availability of bread in Egypt, motivated citizen protests, and indirectly led to regime change in Egypt[73].

Climate related flooding in the Nile Delta and the subsequent decrease in agricultural production will also push down employment in the agricultural sector. Scenarios conducted by the United Nations Environment Programme (UNEP) and other organizations suggest that a 0.5-meter rise in sea level could displace 2 to 4 million Egyptians by 2050 and encourage migration of people from the coastal zone to other areas[74].

Transboundary management of the Nile. The impact of climate change and climate variability will further complicate the management of shared water resources of the Nile River[75]. The riparian countries are members of the Nile Basin Initiative (NBI) established in 1999 and intended to transition to a Nile River Commission after the signing of a cooperative agreement by its members. Currently, there is no cooperative agreement in place for the Nile Basin, primarily because of the opposition of Egypt and the Sudan. There are colonial-era treaties governing the Nile that predominantly benefit the downstream states, Sudan and Egypt, without much benefit to the upstream states. The effect of these treaties is to inhibit upstream projects so as to secure a continuous and undiminished flow of water to the Sudan and Egypt. Egypt has adopted a position consistent with the colonial-era treaties and an Egyptian-Sudan treaty of 1959 that stipulate that Egypt has an historical right to the full volume of the Nile and that upstream states may not disturb that right by impeding or otherwise affecting that flow[76].

Since Ethiopia announced its plan to build the Grand Ethiopian Renaissance Dam (GERD) there has been tensions and threats by Egypt over interference in the natural flow of the Nile (see Map 4). In 2015 Egypt, the Sudan and Ethiopia signed a mutual do-no-harm agreement[77]. While there have been discussions by Egypt, Ethiopia and the Sudan (which supports the dam), a formal agreement for sharing the Nile resources has not been reached, in part due to the flare up of political tensions between Egypt and the Sudan over other issues[78]. The GERD, the largest dam in Africa, will have a reservoir that will ultimately store 74 billion cubic meters of Blue Nile water and will take an estimated 5 to 15 years to fill. During the period of fill, the Nile's fresh water flow to Egypt may be cut up to 25% with a loss of a third of the electricity generated by the Aswan High Dam and a potentially decrease in the availability of water for agricultural production [79].

68 A. Kandeel (2017). Millions of rural working women in Egypt at risk from climate change. Middle East Institute. Available at http://www.mei.edu/content/article/millions-rural-working-women-egypt-risk-climate-change

69 A.A. Ghafar (2018). Order from chaos: Egypt's long-term stability and the role of the European Union. Brookings. Citing Ghafar (2018) A Stable Egypt for a Stable Region: Socio-economic challenges and prospects. Available at https://www.brookings.edu/blog/order-from-chaos/2018/03/01/egypts-long-term-stability-and-the-role-of-the-eu-ropean-union/

70 D. Sternberg (2013). Chinese drought, wheat, and the Egyptian uprising: how a localized hazard became globalized. The Arab Spring and Climate Change. Edited by C.E.Werrell and F. Femia. The Center for Climate and Security. Available at https://www.americanprogress.org/issues/security/reports/2013/02/28/54579/the-arab-spring-and-climate-change/

71 https://www.ft.com/content/a6545786-0da8-11e8-8eb7-42f857ea9f09

72 http://www.world-grain.com/Departments/Country-Focus/Country-Focus-Home/Focus-on-Egypt.aspx

73 Sternberg (2013).

74 TNC (2016)

75 RICCAR (2017)

76 R.K Paisley and T.W. Henshaw (2013) Transboundary Governance of the Nile River Basin: Past, Present and Future. http://www.internationalwatersgovernance.com/uploads/1/3/5/2/13524076/transboundary_governance_of_the_nile_river_basin.pdf

77 Conniff (2017)

78 Sudan Vision (March 2018). Ethiopia's Grand Dam and the end of Egypt's control of the Nile. Available at http://www.svdaily.net/index.php/new-posts/reports/13194-worldview-ethiopia-s-grand-dam-and-the-end-of-egypt-s-control-of-the-nile

79 R. Conniff (2017).

National Government Strategies and Policies

Egypt ratified the UN Framework Convention on Climate Change (UNFCCC) in 1994, the Kyoto Protocol in 2005 and the United Nations Framework Convention to Combat Desertification (UNCCD) in 1995. Egypt has prepared three National Communications to the UNFCCC (1990, 2010, 2016). The Second National Communication (SNC) addressed the vulnerability and adaptation of various sectors in Egypt to potential impacts of climatic changes. The Third National Communication (TNC) updated the vulnerability and adaptation assessment with a focus on health, tourism and biodiversity[80]. Egypt signed the Paris agreement on climate change in April 2016 and ratified the agreement in September 2017.

In Egypt, the Ministry of State for Environmental Affairs (MOE) is the responsible body for compiling the data needed for the National Climate Change Communications from the relevant ministries[81]. The National Council of Climate Change (NCCC) established in 2015 is leading the National Adaptation Plan (NAP) process. This Council replaces the National Committee on Climate Change, its predecessor, which was established in 2007.
Egypt has a climate policy framework, underpinned by the 2011 National Adaptation Strategy (NAS) and high-level political institutions consisting of line ministries which have the mandate for implementation. The strategy aims to increase the flexibility of Egypt to tackle the risks and negative impacts of climate change in various sectors. It also aims at strengthening the capacity to absorb and reduce the risks and disasters to be caused by such changes[82].

Egypt has also developed a 'Sustainable Development Strategy (SDS) — Egypt's Vision 2030' which provides the roadmap for achieving the sustainable development goals. Among its priorities are: expanding the scope of sustainable growth, increasing real per capita GDP to reach the level of middle-income countries; and promoting the dynamics of sustainable and decentralization development[83]. Projects identified in the SDS, which are climate change related include: sustainable agriculture, protection of coastal establishments, and the efficient use of water resources. The updating of the SDS 2030, which is underway, provides an opportunity to mainstream climate change into national strategies, which will lead to better national budget allocation across key development sectors[84].

Nationally Determined Contributions (NDC)[85] [86]

Egypt submitted its first NDC to the UNFCCC in June 2017. In its NDC Egypt does not provide a quantified target for the reduction of its greenhouse gas emissions by 2030. Instead the NDC provides actions that will be undertaken to reduce emissions. It notes that Egypt's economic growth and expanding urban population are contributing to fast rising greenhouse gas emissions. Its fossil fuel-based power and transport sectors are among the most carbon intensive and are at the center of Egypt's commitment to increase use of low carbon technologies and renewable resources.
All the proposed actions are conditional on receiving international funding. Energy is the primary sector for which mitigation actions are proposed, other sectors include agriculture, waste, industrial processes, and oil and natural gas. Actions to promote resilience focus on water resources, agricultural security, coastal zones, and adaptation policies and measures (see Table 2). Also proposed in the NDC is the establishment of a national market for carbon trading which may be developed into a regional market to attract foreign direct investment in national carbon credit transactions, especially in the Arab and African region.

[80] Submitted national communications available at: https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-update-reports-non-annex-i-parties/national-communication-submissions-from-non-annex-i-parties

[81] L. El Hatow (2015b). The Impact of climate change on water resources in the Arab World. Khamsoon Policy Paper. December 2015. Available at http://khamsoon.com/publications/files/1453474288pdf3TheImpactofClimateChangeonWaterResourcesintheArabWorld1.pdf

[82] UNDP-UN Environment National Adaptation Plan Global Support Programme (NAP-GSP) (2018) National Adaptation Programs in focus: Lessons from Egypt. http://globalsupportprogramme.org/sites/default/files/resources/egypt_nap_country_briefing_final_online.pdf

[83] NDC (2015).

[84] NAP-GSP (2018)

[85] http://www4.unfccc.int/ndcregistry/Pages/Search.aspx?k=Egypt

[86] World Bank Group (2016) Egypt : (I)ntended Nationally Determined Contribution: Egypt available at http://spappssecext.worldbank.org/sites/indc/PDF_Library/EG.pdf

Table 2: Egypt's proposed mitigation and adaptation actions

Actions to Promote Resilience	
Sector	Key Proposed Actions
Water Resources	• Maintaining water level in Lake Nasser • Increasing water storage capacity • Improving irrigation and drainage systems • Changing cropping patterns and farm irrigation systems • Reducing surface water evaporation by redesigning canal cross sections • Developing new water resources through upper Nile projects • Rain water harvesting • Desalination • Treated wastewater recycling • Increased use of deep groundwater reservoirs • In addition: raise public awareness of need for rationalizing water use, encouraging data exchange between Nile Basin countries; and developing circulation models to predict the impact of climate change on local and regional water resources.
Agricultural security	• Changing dates and good management practices • Changing cultivars to those more tolerant to heat, salinity and pests • Changing crop patterns • Livestock: improving low productivity of cattle and improving feeding programs
Coastal Zones	• Changes in land use • Integrated coastal zone management • Proactive planning for protecting coastal zones
Adaptation Policies and Measures	• Building institutional capacities of comprehensive collection and analysis of monitoring and observations and geographic data • Identifying indicators and conducting full assessment of vulnerable sectors and stakeholders • Enforcing environmental regulations • Building capacities for using regional water circulation models • Increasing awareness of stakeholders for energy and water utilization
Mitigation Actions	
Sector	Key proposed actions
Energy (primary focus of the NDC)	• Energy efficiency improvements in industry, transportation, agriculture, residential and commercial buildings, electricity, and petroleum • Utilization of solar energy for water heating for industry, residential and commercial buildings • Renewable energy for power generation • Increase share of passengers using railways and microbuses • Shift from road to river and rail transport • Nuclear energy use for power generation
Agriculture	• Enteric fermentation • Manure management • Rice cultivation • Agricultural soils • Field burning of agriculture residues
Waste	• Solid waste • Waste water • Incineration
Industrial Processes	• Encourage waste management and recycling • Optimize the production of cement, lime, iron and steel, ammonia not used in urea, nitrogenous fertilizers and nitric acid;
Oil and Natural Gas	• Production and processing • Venting and flaring (waste heat)

Climate Finance

International agencies are providing climate finance, grants and loans, for the implementation of climate change projects in Egypt. See Table 3 below for internationally and multilaterally financed climate projects.

Table 3: Current Internationally Financed Climate Change Projects[87]

Name of Project	Fund (implementing agency)	Amount of Funding Approved (USD millions)	Date of approval (GEF) / Implementation dates (others)
Integrated management and innovation in rural settlements	GEF (IFAD)	7.8	2015
Grid-connected small scale photovoltaic systems	GEF (UNDP)	3.5	2014
Utilizing solar energy for industrial process heat in Egyptian industry	GEF (UNIDO)	6.5	2014
Building Resilient Food Security Systems to Benefit the Southern Egypt Region [88]	Adaptation Fund (World Food Program)	6.9	2013-2018
Egypt Renewable Energy Financing Framework [89]	Green Climate Fund (European Bank for Reconstruction and Development-EBRD)	150 (loan) 4.7 (grant)	2017-2022
Wind Power Development Project [90]	Climate Investment Funds (CIF) Clean Technology Fund	150 (loan)	2010

87 Climate Fund Update available at https://climatefundsupdate.org//; GEF project information available at https://www.thegef.org/projects?f[]=field_country:57&f[]=field_p_focalareas:2207&f[]=field_p_latesttimelinestatus:606

88 https://www.adaptation-fund.org/project/building-resilient-food-security-systems-to-benefit-the-southern-egypt-region/

89 https://www.greenclimate.fund/-/gcf-ebrd-egypt-renewable-energy-financing-framework?inheritRedirect=true&redirect=%2Fwhat-we-do%2Fprojects-programmes%3Fp_p_id%3D122_INSTANCE_VKj2s9qVF7MH%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26

90 http://www.climateinvestmentfunds.org/country/egypt

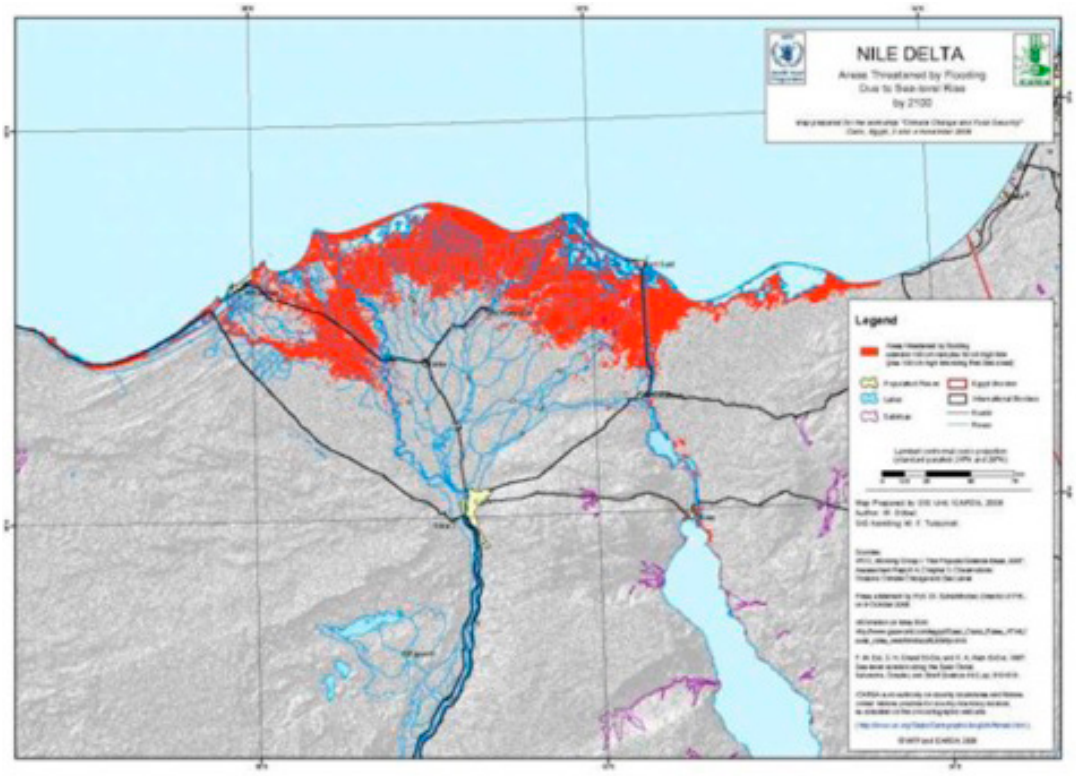
Maps

Map 1 Egypt and the Nile Basin

Source: UNEP (2013) Adaptation to climate change-induced water stress in the Nile Basin: A Vulnerability Assessment Report.

Available at https://www.unenvironment.org/resources/report/adaptation-climate-change-induced-water-stress-nile-basin-vulnerability-assessment

Map 2 Impact of Climate Change on Nile Delta (2100)
(assuming a SLR of 100 cm plus a high tide of 30 cm along the Mediterranean coast)



Source: International Center for Agricultural Research in Dry Areas (ICARDA) (2008). Nile Basin: Effect of a 1300 cm Sea Level Rise.

Available at http://geoagro.icarda.org/en/cms/metadata/index/142/Nile%25252BDelta%25253A%25252BEffect%25252Bof%25252Ba%25252B130cm%25252BSea%25252BLevel%25252BRise

Map 3 The Blue and the White Nile

Source: Available at https://commons.wikimedia.org/w/index.php?curid=10634725

Map 4 The Grand Ethiopian Renaissance Dam (GERD)

The Grand Ethiopian Renaissance Dam (GERD) is being built on the Ethiopian-Sudanese border on the Blue Nile.

Source: R. Conniff (2017). The vanishing Nile: A great river faces a multitude of threats. Yale Environment 360.

Available at https://e360.yale.edu/features/vanishing-nile-a-great-river-faces-a-multitude-of-threats-egypt-dam

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