Arab Republic of Egypt

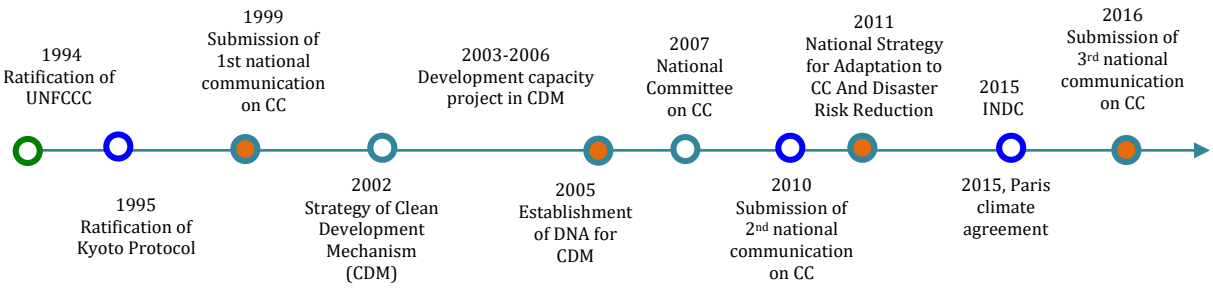
Policy fiche: Managing the impact of climate change on agriculture

1. Climate change impact areas

Egypt ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and the Kyoto Protocol to the Convention in 1995. Egypt has been identified as particularly vulnerable to the impacts of climate change. Significant vulnerabilities have been detailed in Egypt's First and Second National Communications as well as international reports such as IPCC 2014 and UNDP Human Development Report 2007/08. The reports presented several adaptation measures to climate change impacts, as well as many mitigation measures to play an effective role in achieving the main target of the UNFCCC. The Third National Communication was built on the First and Second National Communications and other relevant studies and national reports to identify priorities for interventions, and further translate assessments into concrete sector policies and measures. Egypt's most vulnerable sectors to climate change are identified as: 1) coastal zones, 2) water resources and 3) agriculture.

As Egypt is considered as one of five highly vulnerable countries in the world to climate change, agriculture sector is significantly correlated being the main water-using sector. Agriculture in Egypt is expected to be especially vulnerable because of hot climate. Further warming is consequently expected to reduce crop productivity. Adaptation is a key factor that will shape the future severity of climate change impacts on food production. Since then, the country adopted a range of policy actions to respond to climate change challenges as visualised below.

Figure 1. Main steps and dates of climate change in Egypt



By signing and ratifying the Paris Agreement in 2016 (binding to all parties), Egypt officially committed to shift to a low-carbon economy and published a national program (National Plan for Implementation of the Paris Agreement) to implement both the Paris Agreement and the national plan.

Table 1. Climate change impact "assessment fiche"

High impact (strong impact & requires major measures and immediate action)		*Negligible impact* (impact is limited but requires monitoring)	
Medium impact (impact is growing and requires minor measures, monitoring and mid-term action)		*Uncertain impact* (not enough evidence and need for further monitoring and analysis)	

Areas of impact	Currently (2017)		Near future (2020-2030)		Longer term (2030-2050-2100)	
Direct effects on costs Risks and insurance	Climate model projections over most of the Nile Basin show warming in all four seasons across the countries but a wide range of rainfall patterns, with no clear direction of change. This high level of uncertainty in the future behavior of rainfall is a significant challenge to understand and act upon the risks posed by climate change.					
Climate variability	Evidence of increasing mean °C and decreasing in annual precipitation. Egypt is characterized by its mild T° in winter, thus the effects of CC will mainly be in the summer months, as they are faced with loss of comfort resulting from rising temperature and with water shortages. Egypt is known for high temperature in the summer months. Precipitation is generally very low throughout the country although along the Mediterranean coastline it averages more than 200 mm/yr [UNDP]. Precipitation rates drop quickly as one moves away from the coast and most of Egypt receives only about 2 mm of precipitation per year. Most of Egypt is a desert and is classified as arid (except for the Mediterranean coast, which is semi-arid). Given lack of precipitation data, there is low statistical confidence regarding historical trends [IPCC Ch 22]. There is a small region of drying in the northeast, where confidence in the signal is higher. There is evidence that the severity and frequency of flash flooding across Egypt has increased in recent years. Over the last few decades the northern regions of North Africa have experienced a strong decrease in the amount of precipitation received in winter and early spring.		An average annual rainfall change of 0 mm/day, and 0.1mm/day, by the middle of the 2020s [USGS]. Increase in country averaged mean temperatures of 1°C by 2030. The annual decrease in precipitation is estimated to be 5.2% in 2030. The flow in the Blue Nile in 2025 could change within the range of a 15% increase to a 9% decrease. By 2020, the flow could decrease by 10 to 50%.		Increase in averaged mean temperatures of 1.4°C by 2050 and 2.4°C by 2100. The annual decrease in precipitation is estimated to be 7.6% in 2050 and 13.2% in 2100. An average[1] of 15% reduction in flow of the Blue Nile by the end of the century, and a range of change from a 60% decrease to a 45% increase. Increases are highest in summer months of July-September A reduction in rainfall over northern Africa is very likely by the end of the 21st century [IPCC Ch 22]. The annual and seasonal drying/warming signal over the northern African region (including Egypt) is a consistent feature in the global and the regional climate change projections for the 21st century. Rainfall projections are highly uncertain, but indicate slight reductions in rainfall in Egypt for most months by midcentury. There is uncertainty regarding the magnitude to which flood season discharge into the Nile River could be affected by climate change and GCMs are not consistent in simulating the same signs of change [UKMO].	
Direct effects on demand water resources	Current (based on historical climate conditions and recent trends, generally over the past few decades) rainfall variability within Egypt is almost inconsequential, given that the country receives very		Estimates are highly uncertain and information is not readily available. Consider future drought conditions based on the most extreme past experience.		There is considerable uncertainty with regard to the projections of rainfall—both over Egypt as well as over the principal headwaters of the Nile [UNEP, OECD]. There is agreement across climate models that temperatures are projected to increase	

[1] Used bias-corrected statistical downscaling of 17 general circulation models (GCMs)

	little rainfall, as well as the fact that its agriculture is irrigated and not rain-fed [UNEP]. Variability in Nile flows are moderated by the High Aswan Dam. The dam has one year's worth of storage capacity, to help in handling periodic droughts, although Egypt remains vulnerable to multiyear droughts.				significantly under climate change, increasing the possibility of enhanced water losses from evapotranspiration—particularly given the arid climates of Egypt and Sudan— which might imply reduction in streamflows and stored water.	
Agriculture Production	Agricultural activities in Egypt engages about 55% of the labour force, while contributing about 14% to the GDP (for 2006), and consuming about 80% of the fresh water resources. The "Old-land" which comprises the lands of the Nile Valley and the Nile Delta represents about 80% of the cultivated area, with "New-land", the recently reclaimed areas, representing the rest. The Ministry of Agriculture and Land Reclamation and the Ministry of Water Resources and Irrigation set an integrated plan for land reclamation through several large projects targeting about 1.4 million hectares to be reclaimed by 2017. This strategy considers two types of mechanisms to procure the required water resources for reclaiming the targeted areas. The first entails increasing the efficiency of the current agricultural water use, minimizing irrigation water losses, while the second entails increasing non-conventional water resources share in agriculture.		• Expected rise in temperature and change of its seasonal pattern would lead to decreasing the productivity of some crops and livestock, as well as a change in environmental agricultural zones; • Marginal agricultural areas would be negatively affected, and desertification rates would increase; • High temperatures would increase water evaporation and water consumption; • Socio-economic effects such as labor migration from marginal and coastal areas; and • The probable rise in sea water level, and its negative effects on coastal areas, tourism and agricultural land in the Delta area.		• Agriculture sector, climate change studies predict a reduction in the productivity of two major crops in Egypt - wheat and maize - by 15% and 19% respectively by 2050 • Losses in crop productivity are mainly attributed to the projected temperature increase, crop-water stress, pests and disease, as well as the inundation and Stalinization of 12% to 15% of the most fertile arable land in the Nile Delta as a result of sea level rise and salt water intrusion • Crop water requirements of the important strategic crops in Egypt are expected to increase by a range of 6% to 16% by 2100.	
Sea level rise and Coastal erosion	Sea levels have risen across the Mediterranean by an average of more than 3.1 mm each year since 1992, although records from further back indicate considerable local variability. One array of tide gauges indicates that since 1990, Mediterranean Sea levels have risen at a rate 5–10% faster than the 20th-century mean rate. Measurements on the Egyptian coast indicate that sea level is continuously rising at a rate of 1.8 and 4.9 mm/year with an average of 3 mm/year. The relative sea level shows an upward increasing trend as a result of land subsidence and eustatic sea level. In recent years (December 2003, December 2010, and January 2011),		• Estimates are highly uncertain and information is not readily available. Consider future winds and storms based on the most extreme past experience		Sea levels are projected to rise between 3 and 61 cm this century, depending upon local heat and salinity levels of the Mediterranean [WB]. Sea level rise projections in Egypt's delta are exacerbated by considerable land subsidence (5.0 cm/year), and a tidal range of about 20 cm [El-Nahry and Doluschitz]. Particular risk areas in the Alexandria region are: Mandara and El Tarh (east of the city), and risk areas in the Nile Delta region are: The Manzala Lagoon barrier, east and west of the Rosetta City, Gamil, and the Tineh plain [Frihy and El-Sayed].	
Vector borne-diseases					Increased risk of death/ malnutrition, diarrhea, floods, malaria	
Energy			Demand for natural gas has been			

			increasing quickly at 8% per year, with 76% of electricity generated by natural gas. Egypt needs to add additional generation capacity of 2.7 gigawatts annually through 2020 to meet demand.			
Biodiversity loss	• Climate change will probably affect marine species through ocean acidification, or ecosystem stratification or increasing oceanic dead zones. Adaptation actions are undertaken either to avoid, or take advantage of, actual and projected climate change impacts either by decreasing system 's vulnerability or increasing its resilience • Coral reefs in Red Sea are highly vulnerable to CC (bleaching). • Severe epidemics of tomato late blight (Phytophthora infestans) emerged in the last years.		CC is expected to increase water temperature, shift in fish distributions northwards to live in deeper waters. In addition, increased water salinity in the coastal lakes in Egypt is expected to negatively affect fish species. An epidemic onset is expected to lead to 2-4 additional sprays to be applied at the coming decades of the 2025-2100's. Furthermore, it is a challenge for potato late-blight researches in the future to find a balance between reduction use of pesticides usage and the pressure to increase pesticide utilize due to CC and challenging the pathogen populations.		The expected generation numbers of the pest at 2050 and 2100 are be 12-14 and 13-15 generations per year, respectively. The similar results revealed to cotton pink bollworm Pectinophoragossypiella. The insect generation period will be shorter under CC conditions in Egypt. For example, peach fruit flies (Bactrocerazonata) and potato tubeworm, the generation number will increase during the growing seasons.	
Infrastructural issues	Shoreline erosion specially those due to infrastructure and shoreline protection projects leading to loss of properties		SLR threatens the electric power plants and networks located along the coasts. Also, the negative impact of CC on rainfall rates and rain distribution across different regions negatively affects power generation from hydropower plants.		The possibility of hurricanes and tsunamis will lead to heavy loss of life in addition to the destruction of houses and infrastructure. Extreme events will also impact on infrastructure, ranging from landing and farming sites to post harvest facilities and transportation routes.	
Greenhouse Gas (GHG) Emissions	Egypt emitted 288 million metric tons (MtCO2e) in 2012, with the energy sector contributing 74 percent of overall greenhouse gas emissions. Egypt's emissions grew 133 percent from 1990 - 2012. From 1990 - 2012 Egypt's gross domestic product increased at a faster rate than greenhouse gas emissions, which suggests that carbon intensity of the economy had decreased over the same time period.		Egypt's long-term development goals promote renewable energy resources and energy efficiency which will reduce greenhouse gas emissions and support sustainable development Attracting more investments to expand access to renewable energy resources such as wind energy and solar, to reach a contribution of 20% of the total electrical energy demand by 2020.			
Fisheries	Egypt produces 93% of its fish consumption. Egypt fish food contributes an estimated 20% to animal protein intake. Egypt's limited freshwater resources are the major constraint to aquaculture development. With the absolute priority given to drinking water supply and irrigation, more than 90 % of the country's fish farms are depending on agricultural drainage run-off.		• CC is expected to increase sea T°C causing fish distribution to shift northwards and to move to deeper water. Aquaculture may suffer from water shortages due to the expected scarcity in fresh water supply, and increased T°C might also affect the production of some fish species. • Increased salinity of water in the coastal lakes may gradually reduce the existence of fresh water fish, increasing the portion of saline water fish (more sensitive to environmental changes).		• Fish farms will face stronger competition in water use, with a direct impact of T°C on the productivity of fish. • The expected SLR will have a significant impact on the rates and locations of egg hatching. The increased salinity will limit the spread of fresh water fish in the northern areas of the Delta. • Changes in production and distribution of species, including change in migratory paths, when combined with the warming coastal waters.	
Broader indirect effects Ecosystems	Severities of current cultivars of wheat to leaf rust caused by Pucciniatriticina and stripe rust disease caused by Pucciniastriiformis increase with increasing T°C.				20 to 35% of coral reefs in the Red Sea would be decimated by 2030 (assuming a linear increase in coral reef loss since 1990), and that 50 to 80% of coral reefs would be lost by 2060.	

Public Health	Climate change can affect health directly in case of extreme weather events; in the form of storms, floods, and heat waves, or indirectly through changes in the ecological ranges and distribution of vectors-borne diseases, water-borne pathogens, air quality, water and food availability and quality. Major killers; such as diarrheal diseases, malnutrition, malaria and dengue fever, are high climate-sensitive health problem, and expected to be worst with the climate changes. Adaptation response to the national planning and policy include mapping of the areas at risk, mapping of vulnerable populations, mapping the effects of a given event attributed to climate change, decreasing of the urban heat islands can be reduced through proactive urban planning and environmental preservation and controlling for the communicable (infectious) and noncommunicable diseases.		Climate change can affect health directly in case of extreme weather events; in the form of storms, floods, and heat waves, or indirectly through changes in the ecological ranges and distribution of vectors-borne diseases, water-borne pathogens, air quality, water and food availability and quality (IPCC, 2014). Major killers; such as diarrheal diseases, malnutrition, malaria and dengue fever, are high climate-sensitive health problem, and expected to be worst with the climate changes.			
Coastal Zone	major storms have struck the Mediterranean coastline of Egypt and have produced—during a short period—a surge of up to about one meter above the mean sea level.		Estimates are highly uncertain and information is not readily available.			
Livestock	Livestock production, current evidence shows that temperature increases induce harmful heat stress impacts on animals' productivity. New animal diseases emerged in Egypt, and have strong negative impacts on livestock production.				•	

How do the measures identified intend to address each specific impact?
What outputs (documents) and outcomes (actions) are foreseen and by when?

Strategic document	Year & Leader	Objectives et consistency	How do the measures identified intend to address each specific impact?
Egypt Third National Communication on Climate Change	2016 Egyptian Environmental Affairs Agency (EEAA)	This TNC-CC provides an overview on the CC issues and status to the key stakeholders at local, national, regional and global arena. This document contains National Circumstances, GHG, measures to mitigate CC, Vulnerability and Adaptation and the lines of research, education and systematic observation specific to the topic. Egypt's TNC-CC, funded by the GEF through the UNDP, has been able to create a solid foundation for further work on scientific and policy issues. Define the concerns relevant within the national context and has identified potential areas for further action.	The key for Egypt to mitigation of climate change is to lay a sound foundation for further evolution to zero- and low-carbon energy supply technologies, with substantial reductions in energy intensity along with comprehensive mitigation efforts covering all major emitters and technology and financial transfers from industrialized countries to support decarbonization, Most policies that aim at a more sustainable development rest upon four main pillars: more efficient use of energy, especially at the point of end use; increased utilization of renewable energy as a substitute for non-renewable energy sources; accelerated development and deployment of new energy technologies – particularly next-generation fossil fuel technologies that produce near-zero harmful emissions and open up opportunities for CO2 sequestration, in addition to the new generations of nuclear power; and bio

			sequestration of carbon in terrestrial ecosystems, including soils and biota
Egypt's National Strategy for Adaptation to Climate Change And Disaster Risk Reduction	2011 Egyptian Cabinet, Information and Decision Support Centre* Support UNDP	The main objective of Egypt's National Strategy for Adaptation to CC and Disaster Risk Reduction is to increase the flexibility of the Egyptian community when dealing with the risks and disasters that might be caused by climate change and its impact on different sectors and activities. It also aims at strengthening the capacity to absorb and reduce the risks and disasters to be caused by such changes.	The development of a strategy for adaptation to climate change that is based on the general principles of crisis and disaster management and risk reduction depends on the following factors: • Flexibility of the policy. • Use of modern technology. • Diversity in the proposed systems. • Development of a system for the management of risks and crises. • The strengthening of systems protecting agricultural productivity and rural communities against negative impacts of climate change.
The Intended Nationally Determined Contributions (INDCs)[2]	2015	The INDC is submitted towards achieving the objectives of the UNFCCC. This report define the measures determined and intended to be applied by the country to face climate change in terms of adaptation (to climate change impacts) and mitigation (reducing greenhouse gas emissions).	**Mitigation Policies (i.** more efficient use of energy, especially by end users. ii. Increased use of renewable energy. iii. Reform energy subsidies[3]). **Additional Adaptation Policies and Measures (i.** Building institutional capacities of monitoring-observations. Ii. Identifying indicators and conducting full assessment of agriculture sector and stakeholders. Iii. Enforcing environmental regulations. Iv. Identifying and applying protection measures against extreme natural phenomena such as floods, dust storms and extreme weather conditions. V. Risk reduction; and increasing awareness of stakeholders for energy and water utilization)
Sustainable Agricultural Development Strategy (SADS) towards 2030	2009 Arab Republic of Egypt	The aforementioned vision and mission are the building blocks of the main strategic objectives of the SADS towards 2030, and are as follows: • Sustainable use of natural agricultural resources; • Increasing the productivity of both the land and water units; • Raising the degree of food security of the strategic food commodities; • Increasing the competitiveness of agricultural products in local and international markets; • Improving the climate for agricultural investment; and • Improving the living standards of the rural inhabitants and reducing poverty rates in the rural areas.	Modernizing Egyptian agriculture based on to achieve food security and improving the livelihood of the rural inhabitants, through the efficient use of development resources and the utilization of the geopolitical and environmental advantages, and the advantages of the different agricultural regions Proposed Implementation Mechanisms for Achieving the Strategic Objectives: I. Institutional Reform II. Reviewing and Developing Different Agricultural Policies III. Development Programs and Projects

[2] In accordance with Decisions 1/CP.19 and 1/CP.20.

[3] This policy is implemented using 4 pillars: set different prices for petroleum products based on energy generation efficiency; increase the efficiency of energy use; provide support to certain sectors to promote switching from conventional energy sources to clean energy sources; and apply the fuel subsidy smartcard system to ensure that subsidies are received by target beneficiaries.

2. Policy options to address such impacts

Elaboration of the policies and measures and advancements

What main steps have been followed and what is the stage of the process?

Strategies/policies	Leader	Process	Main actors associated in the process
Egypt Third National Communication on Climate Change	2016, Egyptian Environmental Affairs Agency (EEAA)	Preparatory process with large stakeholders consultations	• Institutional bodies • Scientists and experts • International experts • Public & Private sectors • NGO's • Medias
Egypt's National Strategy for Adaptation to Climate Change And Disaster Risk Reduction	2011, Egyptian Cabinet, Information and Decision Support Centre. Support[4] UNDP		
The Intended Nationally Determined Contributions (INDCs)[5]	2015		
Sustainable Agricultural Development Strategy (SADS) towards 2030	2009, Arab Republic of Egypt	• Wider stakeholders' participation in preparing the strategy • Adopting a comprehensive approach in preparing the strategy • Objective analysis • Careful identification of implementation mechanisms • Objective identification of the roles of both the public and the private sectors and civil society	• Ministry of Agriculture and Land Reclamation • FAO • IFAD • Agricultural Research and Development Council • World Bank • Additional teams of agricultural experts in the various ministries (Ministry of Water Resources and Irrigation, Ministry of Local Development, and Ministry of Communications) and concerned institutions and representatives of the private sector and the civil society • Egyptian universities (Faculties of Agriculture and Veterinary Science), research centers (the Agricultural Research Center, The Desert Research Center, the Water Resources Research Center, and the National Research Center) business men, • Farmers' associations, service institutions in each region, leading staff of the faculties of agriculture and veterinary science and research centers in the region
Adaptation to CC in the Nile Delta through ICZM in Egypt (enhanced resilience to CC impacts by integrating sea level rise risks within an adaptive capacity approach for human/natural systems)	2010-2017 UNDP[6] (the GEF Implementing Agency in this project)	The Project Management Unit (PMU) is located within CoRI[7] in Alexandria.	Multi stakeholders involved: Ministry of Water Resources and Irrigation (MWRI), through its components: CoRI[8] and SPA[9]. The third major national stakeholder is the Egyptian Environmental Affairs Agency (EEAA)[10]. It houses the Secretariat of the National Committee for Integrated Coastal Zone Management (NCICZM).
CC adaptation and preparedness for natural disasters in the coastal cities of North Africa (Egypt case: Alexandria).	Environmental Affairs Agency 2008-2011	Technical process with multi-stakeholders consultations and participations.	Multi-stakeholders process in order to identify the main challenges associated with the protection of 60 million people living in Mediterranean cities & enhances decision-making capacity.
Monitoring the risks of CC and SLR above that of groundwater and agriculture	2009-2012		Multi-stakeholders process in order to enhance decision-making capacity for predicting and mitigating CC impacts on agriculture and the

[4] The National Strategy for Adaptation to Climate Change and Disaster Risk Reduction expresses Egypt's vision of the problem. It benefited indirectly from the strategies of countries such as: Spain, Turkey, Germany, and the United Kingdom.
[5] In accordance with Decisions 1/CP.19 and 1/CP.20.
[6] UNDP-CO supports the implementation of the project by contracting project personnel, experts and subcontractors, undertaking procurement, and providing other assistance upon request of the National Executing Agency
[7] Coastal Research Institute
[8] the Coastal Research Institute (CoRI) is responsible for investigating the coastal processes along the Nile Delta as well as along the entire Egyptian coast. It monitors the evolution of the Egyptian coast, studies the dynamics of its shores in order to find out efficient and cost-effective control methods to protect valuable coastal infrastructure from erosion
[9] The Shore Protection Authority (SPA) is responsible for physically managing the shoreline in coastal areas that have socioeconomic value or natural resource value, and that are threatened by erosion. It develops shore protection plans, designs projects for shore protection and prepares all studies for shore protection. It also issues license for projects located in the coastal zone area
[10] which is the national organisation responsible for development, promotion and implementation of ICZM. Housed in Egypt's Ministry of State for Environmental Affairs, it should be the "champion" for ICZM, as the coordinating organization for ICZM planning and activities

in the Nile Delta			environment along the Nile Delta coast Identification of migration and human.
CC Risk Management Program (CCRMP) (Adaptation project).	Supported by Spanish Development Fund		Include many ministries and sectors (Ministry of Irrigation and Water Resources, Agriculture, Environment, International Cooperation and Foreign Affairs)

Other projects and programs:

- Assessment and Strategy to Respond to the impact of SLR on Human Mobility in Egypt. Project aims to understand effects and potential consequences of SLR on the issue of migration and human security in the Nil Delta and some coastal cities in Egypt (Adaptation project). Project implanted by (IMO)[11]. In cooperation with the Ministry of Man power and Immigration, The Ministry of Environment, The Coastal Researches Institute and number of Non-Governmental Partners.
- Climate change Adaptation and Natural Disaster Preparedness in the Coastal City of Alexandria. Expected impacts of CC and ND (Adaptation project). Collaboration with World Bank & AASTMT[12].
- CC & Human Mobility Project (Various dimensions of internal and external migration and impact of CC on migration (Adaptation project). Supported by (AFD[13], Partnership with IEHS[14]-UN, University and WB.

What actors have been involved, how and at what stage?

- Egypt realize very early the threat of CC to its development. After signing the UNFCCC in 1992 and with the support of international donors, the Egyptian scientific community started to assess the vulnerability of different economic sectors to the potential adverse impacts of CC.

- The climate change department within the organizational structure of Egyptian Environmental Affairs Agency (EEAA), and the vital role played by the sustainable development department of the Ministry of Foreign Affairs (MOFA).

- National Committee on Climate Change has been established in 2007 (Prime Minister Decree #272). The committee includes representatives from the Ministries of Foreign Affairs, Water Resources & Irrigation, Agriculture & Land Reclamation, Electricity & Energy, Petroleum, Trade & Industry, Economic Development and Defence, besides experts from national and relevant agencies. The National Committee is concerned with developing mitigation and adaptation strategies to address phenomenon of climate change. Reviewing and activating the National Strategy for Climate Change with the preparation of plans and programs required in the near term and long term and integrated into national action plans for development in Egypt.

- Climate change department is (i) reporting for UNFCCC: INC 1999, SNC 2010 and TNC, (ii) reviewing IPCC reports, particularly SPMs, (iii) negotiating UNFCCC, (iv) designing National Policy related to Mitigation and Adaptation, (v) mainstreaming policies within national Planning, Top Down and Top Down approaches, (vi) piloting projects.

- Egyptian Cabinet's Information and Decision Support Center (IDSC) Crisis Management and Disaster Risk Reduction Sector is the Cabinet's Think Tank. Its main task is to support decision makers with regard to economic, social and political issues.

- Crisis Management and DRR Sector is the technical secretariat for the National Committee for Crisis Management and Disaster Risk Reduction (DRR) which is the National Platform for DRR according to Hyogo Framework for Action.

- IDSC coordinates among all ministries and bodies concerned with the implementation of requirements of the strategy for adaptation to climate change to ensure their incorporation into development plans. IDSC Follow up on the development of mechanisms for monitoring and early warning in the areas of climate change and disaster impact reduction.

- Alexandria Research Center for Adaptation to CC (ARCA) aims to establish a multidisciplinary and rigorous hub for climate change adaptation research to support cross-cutting decision and policy making.

[11] International Organization of Migration
[12] the Arab Academy for Science, Technology and Maritime Transport.
[13] French Agency of Development
[14] the Institute for Environment and Human Security of UN

- Water Institute of the Nile (WIN) is a think tank based in Cairo that began in 2011 by a group of professionals working in various sectors looking for an alternative space to deal with water issues surrounding the Nile Basin. WIN provides a platform for youth engagement in Nile basin issues, including climate change issue. WIN is doing research on HIMA for CBA under Climate Change.

What data has been considered and from what sources?

- Scientific research: Academic research (The multi-criteria approach 'Adaptation Simulation Evaluator' (ASE).
- Scientific/ technical modelling: Climate model predictions, Global Climate Model (GCM) projections).
- CAPMAS (information centers and information banks), as well as governmental institutions issuing licenses to targeted entities relevant to the GHG inventory.
- Egyptian General Petroleum Corporation (EGPC), Egyptian Natural Gas Holding Company (EGAS), Egyptian Electricity Holding Company (EEHC), New and Renewable Energy Authority (NREA), Ministry of Planning, Ministry of Transport, Egyptian Electricity Holding Company (EEHC), National Electricity Dispatch Center (NDC).
- Ministry of Interior (MOI), the Egyptian National Railways (ENR) and the Ministry of Transport (MOT). Ministry of petroleum (MOP) and the Organization of Energy Planning (OEP).
- CAPMAS and the State Information Service (SIS).

3. Policy options to address such impacts

Table 2. Agriculture and climate change "cross-analysis fiche"

Completely considered		Weakly considered	
Main components considered		Not considered or Non known	

Areas of impact	TNC		Sustainable Agricultural Development Strategy 2030	
Risks and insurance	• Despite the national and local efforts to tackle the solid waste management crisis in Egypt, the improper waste handling, storage, collection, treatment and disposal practices still pose serious environmental and public health risks • Climate model projections over most of the Nile Basin show warming in all four seasons across the countries but a wide range of rainfall patterns, with no clear direction of change. This high level of uncertainty in the future behaviour of rainfall is a significant challenge to understand and act upon the risks posed by climate change • Agriculture in Egypt is expected to be especially vulnerable because of hot climate. Further warming is consequently expected to reduce crop productivity. These effects are exacerbated by the fact that agriculture and agro-ecological systems are especially prominent in the economics of Egypt		• Political will to support agricultural development in order to reduce the food crisis risks • Policies to Improve the Livelihood of Rural Inhabitants • Policies to increase the Competitiveness of Agricultural Products in Local and Foreign Markets • Ensuring the sustainability of ground water resources, this may lead to high investments' risks • Establishment of Risk Management and Mitigation Technical Unit to be responsible for monitoring changes in the international and regional arenas and taking actions to anticipate risks and develop suitable mitigation measures	
Climate variability	• Egypt appears to be particularly vulnerable to climate change, because of its dependence on the Nile River as the primary water source, its large traditional agricultural base, and its long coastline, which is already undergoing both intensifying development and erosion • Agriculture in Egypt is expected to be especially vulnerable because of hot climate. Further warming is consequently expected to reduce crop productivity. • Egypt Climate Change Adaptation Policy Framework is to outline a set of principles, actions, roles and responsibilities, and financing recommendations to guide different stakeholders engagement in implementing agriculture- related climate change adaptation programmes in Egypt		• Climate variability was mainly considered for the SADS due to greenhouse effect with its probable negative effects on agricultural areas and the cropping pattern, in addition to other changes that would require a focused review of applied agricultural policies. • Establishing a modern and integrated national network for monitoring climate change affecting agriculture.	
Water Resources	The national and regional policies for adaptation for water resources management		• Increase the efficiency of water conveyance and distribution systems, starting with tertiary	

	include: • Water conservation measures in agriculture, industry and municipal supplies. • Upgrading water quality and sanitation to minimize pollution. • Construction of infrastructure for water collection in flash flood areas (e.g. Sinai, Red Sea and Upper • and Middle Egypt). • Use of renewable energy (solar and wind) for water desalination. • Storage of drainage and fresh water in coastal lakes.		irrigation canals, as well as increasing the efficiency of on-farm irrigation systems. The strategy aims at applying policies and procedures that would help improve water use efficiency from 50% at present to 75% by the year 2017, and to 80% by the year 2030. • Meeting the needs of land reclamation plans; • Achieving an appropriate rate of vertical agricultural development, as the application of a rationalized irrigation system would normally lead to developing agricultural practices and operations that would improve agricultural productivity; • Implementing a voluntary change in the cropping pattern that would lead to increasing return per water unit, and consequently improve farmers' income;	
Agriculture Production	• Agriculture in Egypt is expected to be especially vulnerable because of hot climate. Further warming is consequently expected to reduce crop productivity. These effects are exacerbated by the fact that agriculture and agro-ecological systems are especially prominent in the economics of Egypt as one of the African countries. Adaptation is a key factor that will shape the future severity of climate change impacts on food production. Adaptation measures includes inexpensive ones such as shifting planting dates or switching to an existing crop variety and more costly measures including the development of new crop varieties and expansion of irrigation. These adaptations will require substantial investments by farmers, governments, scientists, and development organizations, all of whom face many other demands on their resources. Prioritization of investment needs, such as through the identification of "climate risk hot spots" is a critical issue.		• Rationalizing water use efficiency through developing the irrigation systems; • Increasing areas planted to high-value products, provided enough marketing capacity is available; and • Developing economically viable technical packages. • Paying greater attention to the cultivation of salinity- and drought-resistant varieties • Using early-maturing varieties • Developing clover production • Developing long and medium staple cotton varieties • Giving greater attention to horticultural crops with limited water consumption • Giving greater attention to integrated farm management and cultural practices • Increasing land productivity, through development and breeding programs executed at present by the Agricultural Research and Development Center, while making use of genetic engineering techniques; • Continuing present and proposed research programs for the development of tolerant varieties to unsuitable environmental conditions, such as temperature, soil salinity and water shortage, as well as early-maturing, high-yielding crop varieties, as it is the case with rice and wheat; and • Improving farm management systems.	
Sea level rise and Coastal erosion	• Public awareness campaign on water scarcity and water shortage.			
Vector-borne diseases	• Better accessibility and analysis of existing historical data and more detailed data for all regions in relation to different CC scenarios. • The best economic strategy for farmers is to use integrated pest management practices to closely monitor insect and disease occurrence. • Develop a map for the observation of plant diseases and their causes, their prevalence.		• Taking all necessary arrangements for ensuring food quality and safety; • Establishing standards for safe quality food; • Establishing standards for ensuring that food is not contaminated with pesticides; • Determining the maximum levels of chemical and pesticide residues in food; • Developing and applying necessary policies for evaluating risks related to the use of chemical or biological compounds in food production; • Establishing conditions and standards for the registration of food products and preservatives; and • Exercising control on imported food.	
Energy	• Low-emission farming systems • Climate Smart agriculture • Change in agricultural water management • Agricultural advisory service and information systems • Promote Practices for Postharvest Handling and Food Waste		• The impending climate change due to the greenhouse effect with its probable negative effects on agricultural areas and the cropping pattern, in addition to other changes that would require a focused review of applied agricultural policies.	
Biodiversity loss	• Adaptation actions are undertaken either to avoid, or take advantage of, actual and projected climate change impacts either by decreasing a system's vulnerability or increasing its resilience. This may entail reprioritizing current efforts as well as identifying new goals and objectives to reduce		• National program to maintain and upgrade the productive capacity of agricultural land by protecting agricultural land, rangeland and biodiversity against quantitative and qualitative deterioration;	

	overall ecosystem vulnerability to climate change. The following is the number of actions that should be done: • Conduct/gather additional research, data, models and products • Create/enhance technological resources to make adaptation actions easier and more accessible. • Conduct vulnerability assessments and studies to evaluate potential effects of climatic changes on ecosystems, species, and human communities • Increase organizational capacity to support adaptation activities at all levels of government • Provide training for people whose livelihoods are threatened by climate change • Create new institutions • Create stakeholder engagement processes. • Increase/improve public awareness, education, and outreach efforts. • Evaluate existing monitoring programs for wildlife and key ecosystem components • Improve coordinated management and monitoring of wetlands • Incorporate predicted climate change impacts into species and land management • Incorporate climate change considerations into aquatic invasive species management plans. •			
Infrastructure Issues	• Egypt will work on modernizing, expanding, and securing energy infrastructure because no energy source -traditional or alternative- can reach the market without a modern and vibrant infrastructure • In the foreseeable future, the increased demand for food and feed will continue to be met through conversion production and wetlands into agricultural lands as well as use of post-green revolution conventional forms of agricultural intensification that usually base on much higher inputs of fossil fuels, fertilizers, pesticides and irrigation infrastructure		• Developing the infrastructure and services in rural areas is a high priority area in the national development strategy. The main objective is to endeavour to take the rural areas out of the restricted one-sided "agricultural" development and place them within a wider perspective involving the different production and services sector in an integrated framework, in accordance with the conditions and capacities of each area.	
Greenhouse Gas (GHG) Emissions	GHGs emissions mitigation opportunities for agriculture sector: • Mitigation of Methane Emissions from Paddy Rice • Mitigation of GHG emission from Fertilizer • Develop agricultural wastes management for reducing gas emission • Wetlands and Fishing farms • Bioenergy • Mitigation of GHG emissions in livestock production • Mitigation of GHG emission from poultry production • Agro-forestry & afforestation and mitigation GHG		• Global climate changes due to the greenhouse effect and its probable adverse effects on agricultural production, the lands of the Delta and the northern lakes of Egypt	
Fisheries	• Climate change adaptation and mitigation measures in fisheries		• National program to maintain and upgrade the productive capacity of agricultural land by protecting agricultural land, rangeland and biodiversity against quantitative and qualitative deterioration;	
Ecosystems	• Incorporate climate change considerations into Ecosystem-Based Management. •		• National program to maintain and upgrade the productive capacity of agricultural land by protecting agricultural land, rangeland and biodiversity against quantitative and qualitative deterioration;	
public health			• Improving environmental conditions and public health in rural areas.	
Coastal Zone	• Estimates are highly uncertain and information is not readily available.			
Livestock	• Livestock production, current evidence shows that temperature increases induce harmful heat stress impacts on animals' productivity. New animal diseases emerged			

	in Egypt, and have strong negative impacts on livestock production.		
Decline of landscape	• The use of the coastal land is under an extreme pressure from various stakeholders including agriculture • To support the implementation of the ICZM among the Mediterranean riparian states a "Protocol on the integrated management of the Mediterranean coastal zones" was issued for signatures beginning of 2008. The Protocol was elaborated under the auspices of the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution signed by Egypt in 1976. This purpose of the protocol is to establish a common framework for the integrated management of the Mediterranean coastal zone and to strengthen regional cooperation for thispurpose (EEAA Strategy for Implementing ICZM Process in Egypt.2008).		• Expand reclaimed areas through the use of water quantities to be saved through the improvement of water conveyance and distribution, as well as field irrigation systems. Information contained in Table 2.1 indicates that it would be possible to reclaim about 1.250m feddans by the year 2017, to be increased to about 3.10m feddans by 2030. This would represent an annual increase of 130,000 – 140,000 feddans of newly developed areas. • Continued restoration and maintenance of agricultural drainage systems, as well as establishing drainage systems in the areas lacking such systems should be defined. This is also very important for the maintenance of agricultural areas and developing and maintaining their physical and economic productivity • Reducing agricultural land loss to the minimum; and • Establishing an integrated framework to achieve balance between rural population urbanization requirements, due to the fast population increase of rural inhabitants, and protecting agricultural land.

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