

Tunisia

Policy fiche: Managing the impact of climate change on agriculture

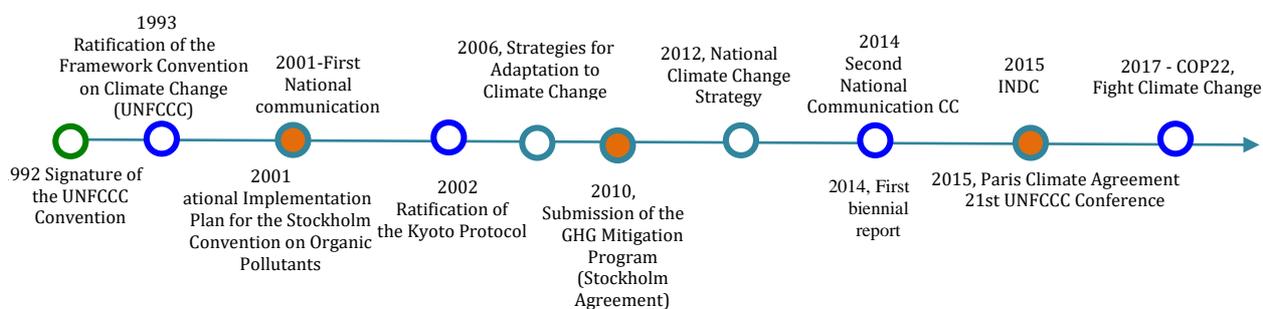
1. Context of the impact of climate change

Since its ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol, Tunisia has embarked on a momentum to organize its national framework to combat the adverse effects of climate change and improve the resilience of the most strategic national sectors to climate change. These actions are aimed at maintaining and consolidating development gains and sustainably preserving natural resources. During this process, special attention was paid to the economic activities and ecosystems most vulnerable to climate change.

Under the UNFCCC, the initial communication was prepared in 2001. Since then, several strategies for adapting sectors to climate change have been developed, in particular for the following activities: (i) agriculture and ecosystem conservation (2007), (ii) health (2010), and (iii) tourism (2011). A national strategy to combat climate change was also developed (2012) and a plan to reduce the vulnerability of the coast (2012). The second National Communication from Tunisia to the UNFCCC was submitted in December 2013, its INDC in 2015. Tunisia also signed the Paris Climate Agreement (COP 21) in 2016.

Since the entry into force of the Kyoto Protocol in 2005, several projects related to skills development, training, technical and financial logistics have been implemented in coordination with the various structures involved, in order to access important opportunities provided by the sustainable development mechanisms set up by the Kyoto Protocol. At the national level, these efforts led to the signing of the agreement for more than 40 programs and projects in all sectors eligible for sustainable development mechanisms. Some of these programs and projects have begun to be effectively implemented in the field. These programs and projects cover the following sectors: Renewable energies (wind turbines, solar energy and energy of the living masses), energy optimization (energy saving light bulbs, the creation of new energies and insulation of buildings), better management of solid detritus and improvement of public transport (fast rail networks in Greater Tunis).

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



Summary of the main characteristics of the policy and the risks in Tunisia

The various studies have all highlighted the high environmental and socio-economic vulnerability of Tunisia to climate change and demonstrated the important need for adaptation of the sectors as well as the need to develop anticipatory capacities. During this process, from its ratification of the United Nations Framework Convention and the Kyoto Protocol, to the submission to the UNFCCC Secretariat of its Nationally Determined Contribution (NDC), Tunisia has been able to achieve major progress in addressing climate change and adapting its key sectors to the effects of these changes.

In this sense, an important effort has been provided by Tunisia, supported in its dynamics by international actors, to organize its legal and institutional framework to fight against climate change, either in a bilateral framework (Agencies of German-GIZ cooperation) or multilateral, in particular by the United Nations system (United Nations Environment Program-UNEP, United Nations Development Program-UNDP, Center UNEP DTU Partnership (UDP) in collaboration with the Center ENDA Energy (Environment and Third World Development - Energy), by international organizations (Global Environment Facility-GEF) or by international financial institutions (World Bank).

This dynamic has helped to define the strategic framework for Tunisia's action to fight and adapt to climate change, in particular through a few key sectors (agriculture, tourism, health, coastal areas). However, to be effective and efficient

and operational, this framework requires complementary measures, in particular the improvement of institutional coordination, a better visibility among stakeholders of the strategies and action plans put in place, a quantitative and qualitative reinforcement. human resources at different levels of these strategies / plans. The issue of mobilizing adapted financing is also considered as a crucial element of this process. Especially as the issues of stability and lack of funding, decreasing the revenues of agriculture and the state budget in general, limit investments. These challenges are particularly important for the agriculture sector in Tunisia, and the hierarchy of national priorities in terms of budget spending can become a constraint to adapting agriculture to climate change, a sector that is at the heart of base very "stressed" since it displays a great dependence on external demand and its vulnerability is to be included in this challenge of global competition.

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)	Long term (2030-2050)
Direct effects on costs Risks and insurance		- Extreme weather events.	Extreme weather events (i.e. extreme storms) may threaten cultivations.
climate variability	- Increased temperature and its impacts on the agricultural sector and water resources; -Risk of urban floods; - Health risks related to the emergence / reappearance of vector-borne diseases and the proliferation of respiratory and water-borne diseases;	- T + 1.1 ° C at 1.5 ° C, downward trend of average rainfall (2-16%) (2030). - Moderate decline in 2020. -More extreme weather events. ENM = 30 cm in 2030 (from Tunis, Gulf of Hammamet and Djerba). - An increase in the frequency of Extreme events such as heat waves, droughts or floods	The Tunisian climate will undergo very important changes in the future. By 2050, an average temperature increase of + 1.8 ° C to + 2.7 ° C by 2050 and a decrease in average rainfall of -10% to -30%
Direct effects on demand water resources	-Deterioration of water resources in quantity and quality in a country already suffering from water stress Sea level rise and its impacts in terms of coastal degradation, land submersion and marine intrusion of coastal water tables; -Coastal aquifers are overexploited and exposed to marine intrusions. Conventional water resource mobilization rate = 95%. -The water tables are mainly located on the coast and their vulnerability is high (pressure due to the high density of population / economic activities). -Intrusion of marine water into coastal water tables -The losses of water resources that will be caused by the marine intrusion are estimated at 53% of the waters of the coastal water tables	-Reduced Conventional water resource in the order of 28% to 2030 -Decreased stock in dams, the reduction of surface water will be around 5% in 2030. -Degradation of water quality, groundwater (groundwater, deep and coastal plies plies), surface waters in natural and artificial wetlands -The coastal webs undergo an acceleration of the water intrusion (risk disappearance of 53% of coastal reserves). 3000 ha of urban coasts are threatened with flooding due Elevation Level Medium ¹ (ENM). -Decreased of the recharge. conventional water resource decline by approximately 28% in 2030 -If NHS and without effective adaptation measures, these sheets will be threatened by the intrusion of seawater and therefore salinization. The pressure will be moved to deep aquifers to compensate for the shortage of water. -Augmentation frequency of extreme events (floods and drought) due to CC and the regression of vegetation cover, soil loss by erosion will be higher which greatly reduce soil fertility. Wet -Areas especially in coastal areas because of EANM (erosion and salinisation of coastal	-Conventional water resources will decrease by 28 % (2030). This will affect coastal aquifers shallow high salinity. - The surface water reserves will fall by 5% -in 2050, losses in coastal aquifers due to sea intrusion (IM) and salinization would be 152 million m3 / year (vulnerable area 1400 km2). MI result in the loss of 53% of reserves coastal aquifer.

¹ Selon l'étude de vulnérabilité au changement climatique (APAL-PNUD, 2012).

		aquifers and soils) -South Tunisia, which has water resources of deep groundwater, is the most vulnerable region	
Agriculture Production	<ul style="list-style-type: none"> - the elevation of Economic effects of accelerated sea level on agriculture, tourism, urbanization and coastal infrastructure; - Loss of arable land by accelerating desertification, CC effects are manifested in the proliferation of introduced species and the impact of warming waters on reproduction (even minimal effects and controllable). -In 2009, the global food needs coverage rate is 80% - the coverage of national needs through domestic production is almost 48% for cereals from all, species of 100% for products of livestock and 88% for oils 	<ul style="list-style-type: none"> -Loss of arable land by accelerating desertification, estimated at about 20% of the areas dedicated to cereal and 800,000 hectares of tree areas in 2030; -The traditional fishing and lagoon fishing will be most affected by rising temperatures and rising sea levels (MEE, 2013). -In 2030 the coverage rate of global food needs is 70% - From the 2030 impacts of climate change increasingly prominent, combined with a lack of adaptation involves heavy questioned. Some cultures must be abandoned without farmers were able to anticipate evolving business (investment, training), hence an increase in the rural exodus and unemployment in the end. -The consequent droughts to climate change particularly affect the speculations of rainfed cereals, whose area would increase from 1.5 million hectares on average now about one million hectares in 2030, a decrease of about 30 %. Agricultural GDP, go bump lower acreage and yields identical to the baseline, would show a decrease of 5% to 10% in 2030. 	<ul style="list-style-type: none"> - In 2050 the rate of coverage of global food needs is 60% - Succession years of drought (high case) - olive production in dry will decline by an average of half the horizons 2030 and 2050. If successive extreme droughts, areas of crops and orchards experience a respective decrease of approximately 200,000 hectares and 800,000 hectares and mainly concern the regions of Central and South.
Sea level rise and Coastal erosion	<ul style="list-style-type: none"> -Particular vulnerability of low areas to marine submersion - Retreat of the coastline and beach loss 	-Degradation the activity of waterfront hotels, with a total capacity of approximately 30,000 beds, because of the withdrawal of the beaches.	Degradation port and Coastal infrastructure.
Vector borne-diseases		-Uncontrolled sewage disposal and no monitoring of septic tanks;	Increased risk of death/malnutrition, diarrhea, floods, malaria, cardiovascular disease
Energy		-Considered a discrete set of measures feeding into the transition to a low-emission development	
Biodiversity loss	- Rate of plant cover = 13%.	- Loss of 20% of arable land in 2030	-Rate plant cover: 18% in 2050.
Infrastructural issues	impacts on coastal infrastructure. About 1% of the total coastline is protected by various structures (dams: 55%, offshore breakwater: 25%). The ears are used to prevent marine erosion. Tunisia has 41 fishing ports, six commercial ports and 10 marinas.	The NHS would result in losses and rising maintenance costs ² of ports. An NHS and a heavy swell, flooding result of these protective structures. Tourism infrastructure may be damaged and must then be raised or strengthened. A downgrading of some hotels can be conducted resulting in the loss of ³ jobs.	3 vulnerability scenarios (V) 2100 ⁽¹⁾ optimistic assumption effective coastal policy and adaptation to CC (V-moderate), NHS = 38 cm. ⁽²⁾ a trend to V-high and ENM = 50 cm. ⁽³⁾ lack of protection and adaptation measures ENM for a V-extreme (VE) and ENM = 100 cm.
emissions greenhouse gas (GHG) emissions	between 1994 and 2000, gross GHG emissions increased from 28.8724 to 37.825CO ₂ MTE CO ₂ MTE, an average annual	<ul style="list-style-type: none"> - In the energy sector, in 2020, GHG emissions from the mitigation scenario should reach 29, 3 MTE CO₂ against 45, 6 MTE CO₂ in the baseline scenario. - In the industrial processes 	<ul style="list-style-type: none"> -Increased energy demand due to increased cooling requirements consistent with the increase in temperature and the extension of the summer. -A 2030 ALCOR-TEC 2011 - SNCC

² Les ouvrages de protection des ports et abris de pêche seraient particulièrement vulnérables à l'ENM ce qui engendrerait des coûts supplémentaires de gestion et de maintenance (coûts annuels occasionnés par l'ENM seraient de 0,13% du PIB, ils s'élèveraient à 0.63% du PIB si on tient compte des pertes économiques directes (BM, 2004).

³ Ministère de l'Équipement et de l'Environnement, 2013.

	<p>growth of 4.6%. Net emissions per capita reached 3.4 TE CO2 in 2000.</p> <p>- CO2 accounts for the largest share with 63.9% in 2000 against 65.6% in 1994. In 2000, CH4 and N2O have almost the same share or 18.2% and 17.9% respectively.</p>	<p>sector, in 2020, emissions mitigation scenario should reach 6.4 MT CO2 against 8 MTE CO2 in the baseline scenario.</p> <p>- In the agricultural sector, in 2020, emissions of the baseline scenario would reach 9.7 against 7.4 MTE MTE CO2 CO2 in the mitigation scenario.</p> <p>- In the area of land use and land use change and forest in 2020, emissions of the baseline scenario would reach - 3 MTE against CO2 - 9.2 MTE CO2 in the mitigation scenario.</p> <p>- In the waste sector, in 2020, emissions of the baseline scenario should reach 6.7 MTE MTE CO2 CO2 against 4.8 in the mitigation scenario.</p>	<p>88/148 wind will represent the first sector with 2,700 MW CSP followed 1,700 MW and 300 MW photovoltaic.</p> <p>- The cumulative emissions avoided from the development of electricity generation Renewable should reach 54 MTE CO2 in 2030.</p>
Fisheries		<p>Aquaculture development has been identified as a strategic priority by the Government which has recently launched an ambitious development</p>	<p>•Changes will be noticed in the productivity of fisheries and fishing areas</p>
Broader indirect effects	<p>-Degradation pastoral ecosystems and soils (for some threatened with desertification)</p> <p>- Transfer of wetland ecosystems, degradation of forest ecosystems and increased risk of fires;</p> <p>-Case of mass mortality of sea fans and sponges in the South (2000-2006) (thermal anomaly: Case Cap Bon And Tabarka) & invasive species.</p>	<p>-Rate of plant cover: 12% in 2030. Number and abundance of introduced species increases (new signs of growing).</p> <p>- 180,000 hectares, the loss of forest area by 2030. In the North, this risk will weigh on disponibility of water resources, heritage and people.</p>	<p>-Rate plant cover: 18% in 2050.</p> <p>- The contribution of steppe ecosystems should cancel 2050.</p>
Ecosystems			
Public Health	<p>- The health risks associated with heat waves</p> <p>-The health risks from flooding</p> <p>-The diseases linked to air pollution</p> <p>-The infectious waterborne diseases and vector</p>	<p>-The resurgence and proliferation of certain origins vector diseases such as malaria, leishmaniasis where dengue,</p> <p>-The respiratory diseases because the temperature rise,</p> <p>-The water-borne diseases due to the deterioration of the bacteriological and physico-chemical quality of water resources</p>	<p>Additional research needs are identified (toxicological studies and biological, ecological, entomological and other studies)</p>
Coastal Zone	<p>8% (127 km) of coastline is affected by⁴ erosion. Several coastal dunes have disappeared or are threatened. 1% of the beaches is naturally fertilized. Submersible lands are located on the east coast and on the islands.</p>	<p>in case of an ENM sebkhas will be flooded more often and become permanent water bodies⁵(lagoons).</p> <p>- Marine submersion affect 30% of the total area of kerkennah islands.</p> <p>- Loss submergence of about 16,000 hectares of agricultural land in low-lying coastal areas, flood - decrease by about 700,000 hectares of built-up areas,</p> <p>-Loss by salinization of about 50% of the resources currently available in coastal aquifers,</p>	<p>-A rising sea level by about 50 cm (Horizon 2100) with withdrawal of beaches 20 to 135 cm in 2050</p> <p>-En2100, losing 4,500 hectares in the archipelago of Kerkennah (30% of its area) . Potentially submersible areas are estimated at 18 000 ha.</p> <p>Indirect -Loss potential irrigable area of about 38,000 hectares in 2050, or 10% of the current irrigated area</p>
Livestock			<p>Livestock numbers decline by about 80% in Central and in the South, against 20% in the North, for loss of grazing routes.</p>

MTD: Million Tunisian Dinars

⁴ Près de 40% des plages et des côtes basses sont considérées comme moyennement vulnérables à très vulnérables à l'ENM (golfe de Hammamet (40% de ces plages), de Tunis (30%), les îles de Kerkennah (14%) et Djerba (24%) sont les plages les plus vulnérables.

⁵ Dans le golfe de Hammamet par exemple, les surfaces risquant d'être annexées par la mer sont estimées à 4500 ha (1900 ha pour la sebkha de Sidi Khelifa, 1400 ha pour la Sebkha de Halk El Menjel et 1200 ha pour la sebkha de Skanès).

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

Strategy Document	Year & Carrier	Objectives and consistency	How do the measures identified intend to address each specific impact?
National Implementation Plan of the Stockholm Convention on Persistent Organic Pollutants (POPs)	in 2001 MEATDD	<ul style="list-style-type: none"> Prohibit and restrict production, trade and use 10 chemicals (used as pesticides and industrial products) Mitigate emissions to a minimum of two called dioxins and furans byproducts mainly from industrial processes and waste incineration. Environmentally Sound Disposal of POPs 	<ul style="list-style-type: none"> Development of specific national action plan for management of equipment and waste contaminated with Polychlorinated biphenyls (PCBs). Development of specific national action plan obsolete pesticide management with the characteristics of persistent organic pollutants and waste contaminated with hexachlorobenzene (HCB). Development of specific national mitigation of emissions of persistent organic pollutants and released unintentionally from anthropogenic sources: dioxins and furans.
National Adaptation Strategy of agriculture Tunisian and ecosystems to change climate	in 2011 MEATDD	<ul style="list-style-type: none"> raise awareness of the challenge of climate change Reduce the vulnerability of the Agriculture and Water Resources sector to the adverse effects of climate change. thematic strategies Climate, Water Resources, Ecosystems and Agrosystems and Agricultural Sector 	<ul style="list-style-type: none"> Maintaining a policy of mitigation of emissions of greenhouse gases (control of externalities) Maintain a policy of adapting to changes in the availability of biophysical resources (control externalities)
DCS	2012 Ministry of the environment	<p>- the social and economic development in the short term (for the social rebalancing and spatial particular) incorporating a number of warning --- crazy in view of a green development in the medium term (Masters resources, etc.)</p> <p>- a 60% of the order reduction target of carbon intensity by 2030 compared to 2009 and an policy Interventionist 2050 to achieve a stabilization of emissions at this horizon.</p> <p>- A policy of proactive and preventive adaptation supported by international assistance under the financing mechanisms and technology transfer put in place by the World Climate Governance (green funds, etc.).</p>	<ul style="list-style-type: none"> The establishment of a monitoring and evaluation system of the SNCC Reducing GHG emissions in all sectors (energy, industrial processes, agriculture, forestry and other land use, and waste) to lower its intensity carbon 41% in 2030 compared to the base year 2010 emission reductions compared to baseline would be around 26 million tCO₂e in 2030 and 207 million tCO₂sur the period 2015-2030.
National Water Strategy in the horizon 2050	2012 MAREP	<ul style="list-style-type: none"> contribute to socio-economic development by securing <ul style="list-style-type: none"> Availability and access to water resources in Tunisia by 2050, efficiently, equitably and sustainably to have a structured, integrated and participative strategy allowing long-term visibility etc. have terms of reference for the preparation of master plans and action plans, in five-year steps, until 2050. integration of the CC problem in the 2050 Water Vision Studies 	<ul style="list-style-type: none"> Rehabilitation and maintenance in good working order of all the country's hydraulic infrastructure Rainfed agriculture The mastery of techniques and technologies in all areas of water and in particular in the artificial recharge of groundwater, the treatment of third-degree wastewater, the siltation of dams, the desalination of water, the selection of plants and seeds adapted to the Tunisian climate Optimum management of resources and water saving Access to water for all citizens Conservation and sustainable management of water, positive discrimination for disadvantaged regions, decentralization and local governance
1st biennial report of the Tunisia-United Nations framework Convention on climate change	in 2014 MEATDD / EDDS	<ul style="list-style-type: none"> Establishing the national inventory of anthropogenic GHG emissions by the different sources. Balance with respect to the Montreal Protocol (IPCC Guidelines (2006)) Identify mitigation of anthropogenic emissions of greenhouse gases. Highlighting the progress made by the implementation of NAMAs (tap the potential mitigation E-GES. 	<ul style="list-style-type: none"> Establish a baseline for measuring the effectiveness of measures taken by the greenhouse gas producers to reduce their emissions. Establish a monitoring system, Reporting and Verification of GHG-E. Facilitate the identification of financial needs, technology transfer and capacity building.
NDC	2015 MEDD	<ul style="list-style-type: none"> Identifying needs and priorities of control against the effects climate change in Tunisia in all sectors. 	<ul style="list-style-type: none"> Developing a roadmap for the implementation of the NDC Tunisia by participate stakeholders in consultation

		<ul style="list-style-type: none"> • unit Designation or national entity that will handle the management and monitoring of the implementation of the NDC. • Enhancing Adaptation strategy through the implementation a " National Adaptation Plan " by asking the National Adaptation Plan Global Network. 	<ul style="list-style-type: none"> • processes, implementation and monitoring. • Reduce economic losses from environmental damage related to CC or amplified by these changes. • Help optimize the management of water resources, space and ecosystem services related to tourism and desalination mini stations installed seawater using renewable energy.
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2. Policy options to address such impacts

Development of policies and measures and progress

Tunisia has benefited from several frames of bilateral and multilateral cooperation in order to implement its strategic framework for the fight against climate change in general and the adaptation of the sector (activities) of agriculture and water resources to the adverse effects (known and / or expected) of climate change. As such, the Agency of German Cooperation (GIZ), the United Nations Development Program and the World Bank have contributed financially and have mobilized expertise adapted to support the preparation and development of various strategic documents mentioned in this analysis.

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

Strategies/policies	Leader	Process	Main actors associated in the process
First Biennial Report under the UNFCCC	ERM ⁶	The preparation process: - Establishment of a steering committee for the monitoring and coordination of the first biennial report preparation work (this committee coordinated by CC focal point. - Setting up a working group responsible for the preparation of the national inventory of GHG emissions and work on mitigation.	- Mainly institutions and concerned by the issue of mitigation in Tunisia in terms of inventory and mitigation sub-clusters. - Grouping of 3 energy and industrial processes, agriculture, forestry and land use, and solid and liquid wastes(SNCC).
National Strategy against climate change	ERM	Large consultation ⁷ process: Workshop 1:ownership of the theme, and overview Workshop 2.Assess the feasibility s instruments for the implementation of climate policy (multi-criteria). Workshop 3:validate the instruments of implementation of the preferential vision, initiate the preparation of a support plan for the implementation of these instruments through the identification of accompanying measures. Definition implementation responsibilities.	A broad consultation process involving all stakeholders. The work was conducted by a group of national and international experts in forecasting, vulnerability and adaptation, attenuation, member of the IPCC climate change, adaptation and mitigation in carbon finance, economist and agricultural economist and institutional experts.
Contribution determined at national level (NDC / UNFCCC)	MEDD	The preparatory phases of INDC were initiated in July 2014 with the launch of a series of consultation workshops involving key actors in the climate change process.	The actors involved in the adaptation and mitigation of CC (institutional and non-institutional, private sector and experts from the industry and energy, science and civil society).
National Strategy for Adaptation to change Climate in the tourism sector(SNATCC)	MEATDD ⁸	Large participatory process with the holding of several brainstorming workshops.	All actors in agriculture and water, including professional, private, scientific actors, civil society. This process was supported by the German Cooperation Agency.

What actors were involved, how and at what stage?

- **Coordinating work on climate change under the Ministry for the Environment.** This responsibility also concerns the implementation of the UNFCCC and the preparation of national communications, biennial reports and INDC. To carry out enabling activities relating to the obligations of Tunisia to the UNFCCC and ensure national ownership, the approach is that of consultation and participation of all stakeholders (public and private institutions, NGOs, university / research ... departments, agencies, working groups.
- **National Commission for Sustainable Development(CNDD)**was created by Decree No. 2061 of 11 October

⁶ Ministère chargé de l'environnement

⁷ Trois rapports ont été produits : le rapport de diagnostic sur le changement climatique en Tunisie, la note de synthèse présentant les principales recommandations en matière de SNCC et le rapport final (SNCC)

⁸ Ministère de l'Équipement, de l'Aménagement du Territoire et du Développement Durable

1993, two years after the creation of the Ministry for the environment. the CNDD came to strengthen the institutional framework established for the protection of the environment and anchoring the principles of sustainable development. the CNDD is the fundamental instance of Tunisia to design the comprehensive approach to sustainable development, to draw strategic guidelines the country in this field and to ensure the implementation of the various programs that result.

- **National Committee on Climate Change (CNCC):** Created in 2000, it brings together the focal-point of DC (coordinator) and representatives of the National Agency for Energy Management, the Ministry of Agriculture, the National Institute. Meteorology, the National Engineering School of Tunis and NGO. The mission of the CNCC is to monitor the work on climate change and the implementation of the UNFCCC. CNCC was replaced at first by Structure-Focal DC and from 2005, other organizations, structures and working groups were tasked to continue work on CC.
- **National mobilization of water resources strategy (1991-2000 / 2002 - 2011):** boreholes recognition and operation and monitoring piezometers and monitoring in the improvement and development of measurement networks and monitoring of water resources in the creation of 32 dams, 253 hillside dams and 580 hillside lakes and improving the quality of drinking water served in urban areas to below 1.5 g / l.
- **Project PISEAU 2 (2009 – 2013) :** This is (i) consolidate the gains IPWS 1, (ii) complete the conventional resource mobilization program and further develop unconventional resources, and (iii) better protection / preserve any available resources
- **National Water Council,** created in 2010, chaired by the Minister of Agriculture, water resources and Fisheries, is composed of members representing several ministries, national companies and organizations. He is responsible for assisting the Minister of Agriculture, Water Resources and Fisheries, including the proposal of the general principles of mobilization and enhancement of the use of water resources. It contributes, moreover, to the development of programs and mobilization plans of the country's water resources and measures to optimize their use and sustainability through the development of treated wastewater in agriculture and sectors non-agricultural, desalination of saline water and seawater and encouraging production. Meanwhile, the council is expected to present proposals for the development of a national political economy of water through programs designed to rationalize water consumption and its pricing and treatment of specific situations groundwaters to limit overexploitation and secure the means to develop their resources.
- **National Agency for Energy Management (ANME) :** National Agency for Energy Management (ANME): One of the missions of ANME is an inventory of GHG emissions and to conduct all studies on mitigation in the area of energy. In collaboration with UNDP, ANME also created an Information Sustainable Energy and Environment Unit (CIEDE) whose main mandate the implementation of Article 6 of the UNFCCC and strengthening capacity in DC.
- **Designated National Authority (AND):** The MAEDD (Decree 2008-4114) created December 30, 2008 the National Office of Clean Development Mechanism (CDM). The office is headed by the Minister for the Environment and includes the institutions involved in the CDM and sale of certified reduction units of greenhouse gas (CERs). The main mission of the NDA is to approve the projects' contribution to sustainable development and facilitate the sale of CERs.

Which sources and which data were considered?

The achievement of the main strategic documents related to the effects of climate change since 2010 was conducted based on data from three main sources:

- (i) The data produced by the sectors themselves (environment, industry, agriculture, resources in water, etc.). Some of these data are held in national databases (eg, forests), regional or local or covering several themes or are specific (eg weather observing⁹network).
- (ii) The data produced by scientific research conducted as part of research projects, the end of study work (PhD thesis, MSc etc.) (eg coastal erosion).
- (iii) Data simulations, especially for climate change scenarios (temperature and precipitation, rising sea levels, energy consumption).

Document	Source
Review - GHG	industrial and energy sector (companies), forests and agriculture, waste and other (expert ¹⁰ sector).
DCS	Data areas
NDC	Essentially the industry data, energy, transport, waste, agriculture and forestry, habitat.
SNATCC	Essentially data of the tourism sector and climate models of the biennial report.

⁹ The National Institute of Meteorology (INM) (i) Density of weather and climate observation network is satisfactory in the North and in the Center; However, it is insufficient in the Southwest. (ii) climate services are developed for certain sectors. (iii) The low radar coverage does not have an early warning system to extremes. (iv) A twinning project with the EU to develop a strategic plan was formulated. The strategic plan is based on four pillars: strengthen the technical capacity, improve administrative and financial management, strengthen capacity at regional level, and improve communication with partners. Modeling / climate simulations have been used to offset shortfalls given.

¹⁰ Emission estimates were conducted in accordance with the IPCC Guide 2006. Regarding indirect emissions (NO_x, CO, NMVOC and SO₂), the methodologies proposed by the EMEP / EEA guide 2013. In some cases the means of composition indicators of the carbon input sector were used.

3. Cross Analysis: Climate Impacts and Policy Options

Analysis of the relevance and coherence of Tunisia to fight against climate change is conducted from three strategic documents (the national struggle against the changes strategy climate, adaptation strategy for agriculture to climate change and the strategy of the industry).

However in the table analysis (below), will be mentioned only the first two strategies, because the tourism strategy for Tunisia, even developed in 2012 contains important provisions and / or policies that directly affect climate change . However, the strategy of agriculture and water resources highlights three key elements of the action against the CC that may have a direct impact on the development of agriculture and water resources and maintaining competitiveness regionally. These measures are related to (i) the risk / insurance against climatic hazards, (ii) the consideration of vulnerability when planning and developments in tourism facilities and infrastructure and (iii) the development of the internal network for transport air and rail.

Table 2. Agriculture and climate change "crosstab sheet"

Consider entirely		Recognizes low
Recognizes key components		Do not consider or no precise knowledge
Areas of Impact	Policy A (CC)	National Adaptation Strategy of the tourism sector
risks and insurance	<ul style="list-style-type: none"> Insurance against climatic hazards & Payment for environmental services 	<ul style="list-style-type: none"> Maximizing the climatic potential by improving agricultural management and water resources.
climate variability	<ul style="list-style-type: none"> Consider climate variability as an essential basis of the specific adaptation strategy CC. 	<ul style="list-style-type: none"> Consider climate variability in the temporal and spatial planning in the development
Water Resources	<ul style="list-style-type: none"> setting up transfer projects and reuse of treated wastewater and strengthening and securing the water supply of large urban centers, including Greater Tunis, Cape good, the Sahel and Sfax. Incentives for saving water, reuse of treated wastewater and rainwater capture the new national development plan taking into account the DC National and Regional Councils of Natural Resources Transformation of water property rights in the right¹¹ of use of existing structures changes, subject to authorization¹² and scope of¹³prohibition. 	<ul style="list-style-type: none"> Reducing the vulnerability of agriculture by limiting its dependence on freshwater resources. Strengthening the policy of saving water in hotels and regulatory controls. Adapting coastal stations to reduce the risks related to the decline of the coastline and marine submersion and change the planning rules to take account of the NHS and verify compliance with these rules. Continue the "Water" program in agricultural policy by ecosystems rather than watershed continue the review of water pricing and create global spare capacity system of incentives for water saving incentives to reuse treated wastewater and for collecting rain water pricing system for agricultural water reflecting the scarcity
Agriculture Production	<ul style="list-style-type: none"> Adaptation of irrigated crops in the Central regions Adaptation of mixed crop-livestock production systems to climate change in vulnerable regions, Updating the agricultural map taking into account the impacts of climate change, Establishment of a climate watch and early warning system and an insurance mechanism against climatic hazards due to climate change, 	<ul style="list-style-type: none"> System of incentives for development of export crops with low impact Strict allow Agricole Map Incorporate climate risk insurance systems provide for non-agricultural conversions for farms weakened by climate extremes
Sea level rise and Coastal erosion	<ul style="list-style-type: none"> Develop innovative and sustainable economic and financial instruments to accelerate the adoption of coastal adaptation measures 	<ul style="list-style-type: none"> the rehabilitation and the fight against coastal erosion, redevelopment and relocation of coastal industrial areas, rehabilitation and protection of existing infrastructure against the risks of climate impacts and siting of farms and infrastructure
Vector borne-diseases	<ul style="list-style-type: none"> Include improving knowledge about and awareness of the interactions between CC and public health 	<ul style="list-style-type: none"> Ensure public health concerns and health protection from CC
Energy	<ul style="list-style-type: none"> Elaborate and implement a plan for the use of 	<ul style="list-style-type: none"> Modernizing the irrigation system in Tunisia and

¹¹ Forcing users to seek a concession to the state that sets the allocation priorities (clean water, agricultural, industrial and commercial) and the terms of evolution of ancient rights

¹² area where any research or exploitation, in excluding changes to existing facilities must be subject to authorization (code - Water / Art. 15)

¹³ area where the state requires a permit for any changes on existing structures and may limit their debit or eliminate harmful withdrawals conservation of resources (Water Code, Art. 13). Where conservation or water quality are endangered by the operation

	alternative energy in agriculture		promoting the use of alternative sources of water and energy in agriculture
Biodiversity loss	<ul style="list-style-type: none"> regulations for opening the national grid to renewable energy generation by the private plan energy / climate territory urban transport schemes rail to inland areas national greenhouse gas reduction quotas system (businesses / regions) National Council (CNRN)¹⁴ & Tips regional Natural Resources (CRRN) 		<ul style="list-style-type: none"> tourism Reducing vulnerability to energy prices, the "carbon constraint" in limited ant its dependence on fossil fuels and reducing CO2 emissions. Strengthen the upgrade program for hotels on thermal renovation component and the development of solar energy Rewarding environmental services ecosystem
Infrastructure Issues	<ul style="list-style-type: none"> Consider the vulnerability and adaptation in the regionalization of Tunisia CC included in the National Plan of Development and Management Plans Urban Buildings and infrastructure account¹⁵ for climate risks (do not impose additional costs prohibitive). 		<p>Review the architectural design (for new construction) adapting traditional designs improve urban planning to address climate risks and propose solutions to the climate in urban development projects Establish an early warning system and more effective communication face natural hazards Improve and strengthen urban infrastructure such as protection works and systems drainage</p>
Greenhouse Gas (GHG) Emissions	<ul style="list-style-type: none"> This strategy will contribute through its various courses of actions/areas of intervention to reducing impacts of climate change and GHG emissions in the agricultural sector. 		
Fisheries	<ul style="list-style-type: none"> Conservation and enhancement of the local genetic heritage for the adaptation of crops to climate change and the development of innovative field crop systems. 		<ul style="list-style-type: none"> insurance against climatic hazards
Ecosystems	<ul style="list-style-type: none"> pricing system for agricultural water reflecting the scarcity incentives for the development of export crops, low-impact 		<ul style="list-style-type: none"> Rehabilitation of Mediterranean ecosystems resilience capacity Placing an economic value on the regulatory climate ecosystem functions
public health	<ul style="list-style-type: none"> water resources degradation and coastline, with the flooding of land have consequences on the socio-economic activities (agriculture, tourism, urban planning, port facilities, etc.), health risks associated with the emergence of some vector-borne diseases. 		<ul style="list-style-type: none"> Strengthening health protection Strengthen health information system
Coastal Zone	<ul style="list-style-type: none"> Enhance institutional capacity for planning and response to increased risks due to climate change in coastal areas. Improving resilience in priority coastal areas to climate change through the implementation and dissemination of innovative measures for risk reduction. Programmed activities will cover 22 km of coastline, 670 hectares of wetlands and will involve 150,000 residents 		<ul style="list-style-type: none"> -Establish a monitoring strategy monitoring of sea level -Apply adaptation strategies advocated in favor of low areas, sensitive coasts to erosion -Apply adaptation strategies advocated for resources in coastal waters, ecological and fisheries resources, coastal infrastructure
Livestock	<ul style="list-style-type: none"> Food insecurity is already 		<ul style="list-style-type: none"> Food insecurity is already
Declining landscapes	<ul style="list-style-type: none"> New National development plan taking into CC CC Integration Requirements for Urban Management Plans 		<p>Reducing vulnerability of Tunisian tourism by limiting its dependence on resources likely to deteriorate (priority beaches and fresh water) and valuing less vulnerable resources;</p>

¹⁴ for planning and resource arbitration between

¹⁵ uses, for example by adopting a law on the obligation to use some materials and construction techniques

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