



Ministry of Foreign Affairs

Climate Change Profile

Tunisia

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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 Tunisia, 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

Tunisia is a highly urbanized, lower middle-income country with the majority of its population residing along its coastline which is vulnerable to climate-related sea level rise. Sea level rise will increase the current erosion of sandy beaches, saltwater intrusion into coastal aquifers, salinization of agricultural field and inundation of low lying wetland areas. Reduced rainfall and increased temperature will negatively impact on two important economic sectors – agriculture and tourism - and intensify current water stress.

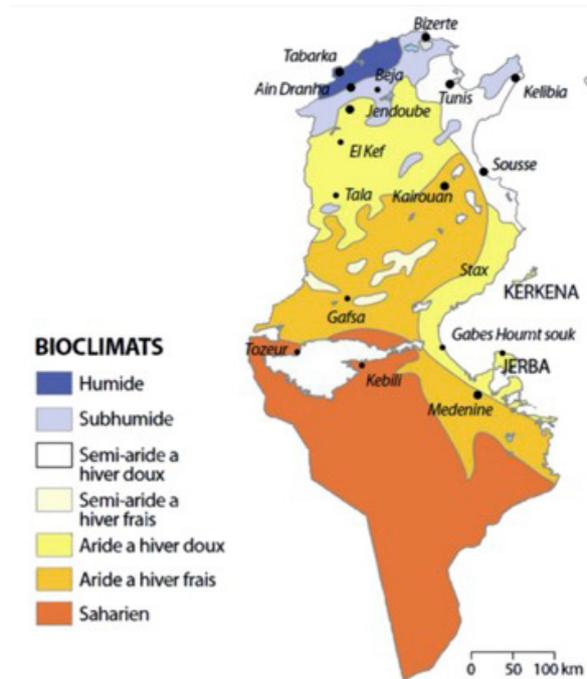
Overall ranking

Tunisia has an emission ranking of 78 out of 215 countries and territories¹ contributing 0.08% of global GHG emissions.² Its primary source of emissions is its energy sector with industrial processes a distant second.³ For climate vulnerability, Tunisia has a rank of 84 out of 181

¹ Global Carbon Atlas (2018) Ranking based on 2016 data. Available at <http://www.globalcarbonatlas.org/en/CO2-emissions>

² Climate Analysis Indicators Tool (CAIT) Version 2.0. (Washington, DC: World Resources Institute, 2014)". World Resources Institute.

³ USAID (2015b). Greenhouse Gas Emissions Factsheet: Tunisia. Available at <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-tunisia>



countries in the ND-Gain Index⁴ (ranking 1 being the least vulnerable). Tunisia is the 71st least vulnerable country and the 86th 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

Located in North Africa, Tunisia has an extensive Mediterranean coastline of 1,148 kilometers on the north and east, and shares borders with Algeria to the west and Libya to the southeast. The Atlas Mountains at the northeastern edge of Tunisia provide relief from the dry desert and are characterized by cooler temperatures and much higher precipitation (see below)⁵. The humid

⁴ ND-GAIN country 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/>

⁵ 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. Available at <https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report>

conditions in the Atlas Mountains enable the occurrence of several coastal rivers in the region, including the Medjerda River in Tunisia.⁶ Tunisia's temperatures range from an average monthly high of 30.5°C in mid-summer (July and August) to an average monthly low of 10°C in mid-winter (January).⁷

With its relatively high latitude and its geographical range from north to south, Tunisia is divided into three main climatic zones: a northern Mediterranean climate zone (humid to sub-humid), a central steppe climate zone (semi-arid to arid) which also experiences the greatest temperature range, and a southern desert climate zone (See Map 1).^{8, 9} In general, topography and distance from the coast influence the temperature and amount of precipitation.¹⁰ In the North, the rainfall is over 400 mm/yr reaching 1500 mm in the extreme Northeast in the Atlas Mountains. In the central areas, rainfall is in a range between 150 and 300 mm/yr, while in the south, rainfall decreases as moving southward, falling from 150 mm/yr to 50 mm/yr in the extreme south. However, rainfall is highly variable, with both drought years and years of higher rainfall.¹¹ Tunisia experienced drought in 1982, 1987 to 1989, 1993 to 1995, and its worst drought in over 50 years from 1999 to 2002.¹²

Tunisia has scarce water resources with the national per capita sustainable water availability of roughly 400 m³/yr, well below the average for the Middle East and North Africa (MENA) (1,250 m³/yr) and United Nations criteria as water scarce (1000 m³/yr). Assessments of water availability-to-withdrawals, by consumption-to-dry flow volumes or by per capita water availability suggest that Tunisia could suffer from severe water stress by the 2050s.¹³

Having a long history of cultural and economic importance, oases occur in the southern area of Tunisia characterized by a Saharan climate receiving less than 150 mm/yr of rainfall.¹⁴ There are 200 oases located across the country's

four southern governorates, covering about 41,000 ha of Tunisia's land area and home to 10% of the country's population.¹⁵ Also in Tunisia, with a surface area of more than 5,000 km², is the Shott el Djerid, the largest saltpan of the Sahara Desert. It is part of a series of seasonal saltpans in the country, some of which extend into Algeria, fed from groundwater in the Atlas Mountains.¹⁶

The Medjerda river, the longest river in Tunisia, provides totally or partially the water supply for more than half the Tunisian population (see Map 2). Originating in the mountains in north-eastern Algeria, it flows eastwards to Tunisia and ultimately to the Gulf of Utica in the Mediterranean Sea. About 32% of the Medjerda river basin is in Algeria with 68% in Tunisia. A perennial river, its hydrological regime is variable, characterized by low flows but with the regular occurrence of extreme floods which threaten towns and rural populations along the river as well as irrigation systems and other infrastructure.¹⁷

Climate trends

Based on global climate scenarios, the Mediterranean Sea is considered one of the most sensitive regions to climate change. Tunisia's mean annual temperatures rose by about 1.4°C in the 20th century, well above current global warming trends, with the most rapid warming taking place in the summer (1.8°C) and the least in the spring (1.2°C).¹⁸ However, local rates of warming can be greater than the national rates; in Tunis, for example, temperatures rose by approximately 3°C during the 20th century.¹⁹ Most of the warming has occurred since the 1970s, though summer mean maximum temperatures have risen since the 1960s. The number of warm days per year has also increased.²⁰

Over the last few decades, the northern region of North Africa (including Tunisia) has experienced a significant decrease in the amount of precipitation received in winter and early spring.²¹ Within Tunisia there is regional variation: Annual rainfall has decreased 5% per decade in the northern part of Tunisia since 1950, while heavy rainfall events have become more frequent. Western areas have experienced stable or declining rainfall while the east has

⁶ RICCAR (2017)

⁷ USAID (2015a) Climate Change Information Fact Sheet: Tunisia. Available at

⁸ H You et al. (2016) Plant diversity in different bioclimatic zones in Tunisia. *Journal of Asia-Pacific Biodiversity* 9 (2016), 56-62. Available at https://ac.els-cdn.com/S2287884X16000108/1-s2.0-S2287884X16000108-main.pdf?_tid=7bb66d50-c31f-42e0-bb38-fbec123bba6&acdnat=1527221113_6cfcf7e9b5b6b484b5d463be7b9d891a

⁹ Tunisia's Second National Communication to the UNFCCC (SNC) (2013)

¹⁰ Verner (2013)

¹¹ SNC (2013)

¹² USAID (2015a)

¹³ Verner (2013)

¹⁴ D. Ben Ahmed Zaag (2017). The economic importance of dates production in Tunisia. Ministry of Agriculture, Water Resources and Fisheries. Presentation available at <http://cisr.ucr.edu/blog/wp-content/uploads/2017/05/dorsaf-ben-ahmad-zaag-tunisia-rpw-conference-2017.pdf>

¹⁵ ClimaSouth Initiative (2016). Tunisian oases: a case study to assess agricultural vulnerability to climate change. Available at <http://www.climasouth.eu/en/node/139>

¹⁶ RICCAR (2017)

¹⁷ RICCAR (2017)

¹⁸ Mediterranean Experts on climate and environmental change (MedECC) (2108) Climate and environmental change in the Mediterranean – Main Facts. Available at <http://www.medecc.org/?p=1086>

¹⁹ D Verner (ed) (2013). *Tunisia in a Changing Climate: Assessment and Actions for Increased Resilience and Development*. Washington, DC: World Bank. doi:10.1596/978-0-8213-9857-9 Also a=456789 available at <https://openknowledge.worldbank.org/handle/10986/13114>

²⁰ USAID (2015a) citing Verner (2013)

²¹ IPCC 2014.

experienced increasing winter totals since the 1950s. Spring rainfall, however, had decreased in most areas, particularly in the eastern half of the country. Autumn rainfall has declined mostly in the south.²²

Sea-level rise is occurring across the Mediterranean by an average of more than 3.1 mm each year since 1992. Some data suggests that since 1990 the Mediterranean Sea levels have risen at a rate 5-10% faster than the mean rate for the 20th century.²³

Climate Change Projections

Scientific reports and analysis, including Tunisia's Second National Communication (SNC) to the UNFCCC, suggest a hotter, drier and less predictable climate with increasing temperature, declining rainfall and water availability and more intense and frequent extreme weather events (floods and droughts) over the century.²⁴ Climate change reports in Tunisia and other countries in Northern Africa and the Middle East commonly refer to the relative concentration pathways (RCP) that were utilized in the IPCC/UNFCCC reports.²⁵ Using 2000 as the base year, the moderate projection (RCP 4.5) suggests a maximum annual temperature increase by 1.06°C and minimum annual temperatures by 0.98°C by 2030 and by 2050 a minimum annual temperature increase of 1.57°C and a maximum annual temperature increase of 1.64°C with the highest increase in temperatures in the summer months of July and August.²⁶ Tunisia's SNC suggests a greater increase with an average annual temperature increase across the entire country of +2.1°C by 2050. One scenario suggests that a summer hotspot could emerge on the Tunisian border with Algeria, with local temperature increases as much as 5.3°C by the 2050s.²⁷ Increases in the number of hot days (especially July, August, September) with long heat waves and warm nights and decreases in the number of cool days are also projected by 2050 in Tunisia and other countries in North Africa.²⁸

There is less certainty for rainfall projections. While the projections suggest an overall decline in mean annual rainfall, there is variation in the amount of the decline with the moderate projection suggesting a mid-century annual rainfall reduction of 4.1% while other projections suggest a larger decrease (36%).²⁹ Tunisia's SNC suggests by 2050 a decrease between 10 and 30%, depending on the region, in the annual precipitation rate compared to the situation in 2010.³⁰ Mid-century projections suggest a drying trend, particularly along the Mediterranean Coast, the result of the expected decreases in summer precipitation. As with other countries in North Africa, Tunisia will be affected by droughts that will be more frequent, more intense and longer-lasting.³¹ Climate projections suggest that the frequency of drought years will increase by 10% to 30% by 2050.³²

It is estimated that up to 75% of Tunisia is threatened by desertification due to climate change and land management (e.g. overgrazing and deforestation).³³ The combination of higher temperatures and declining rainfall will further reduce water resources. Models suggest that conventional water resources will decrease about 28% by 2030. This decrease will mainly affect shallow aquifers with high salinity, coastal aquifers and non-renewable aquifers. A decrease in surface water of about 5% is also anticipated by 2030.³⁴

Sea level rise (SLR). Scenarios suggest that the total Mediterranean basin SLR will be between 6.86 and 17.92 cm by 2030 and between 9.8 and 25.6 cm by 2050.³⁵ Climate change-induced sea level rise is expected to be up to 0.98 m by 2100.³⁶ Within Tunisia it is generally accepted that rising sea levels are the most crucial aspect of its vulnerability to climate change.³⁷ Likely impacts of SLR along the coast of Tunisia will be an increase in shoreline erosion and extended coastal inundation or permanent submersion of

²² USAID (2015a); Verner (2013)

²³ USAID (2015a)

²⁴ SNC (2013)

²⁵ The RCPs are consistent with a wide range of possible changes in future anthropogenic (i.e., human) greenhouse gas (GHG) emissions and aim to represent their atmospheric concentrations. RCP 2.6 assumes that global annual GHG emissions (measured in CO₂-equivalents) peak between 2010-2020, with emissions declining substantially thereafter. Emissions in RCP 4.5 peak around 2040, then decline. In RCP 6, emissions peak around 2080, then decline. In RCP 8.5, emissions continue to rise throughout the 21st century. The moderate (RCP 4.5) projections are used in the Profile, reflecting that a peaking of emissions is now considered likely around 2040 (after 2030). Global emissions would need to peak in 2020 to meet the two-degree global temperature target. See <http://www.wri.org/blog/2017/11/turning-point-which-countries-ghg-emissions-have-peaked-which-will-future>

²⁶ USAID (2015a)

²⁷ USAID (2015a) citing Verner (2013).

²⁸ USAID (2015a) citing Verner (2013).

²⁹ USAID (2015a)

³⁰ SNC (2013)

³¹ Verner et al (2013) ; L. Radhouane (2013). Climate change impacts on North African countries and on some Tunisian economic sectors. Journal of Agriculture and Environment for International Development (JAEID) 107 (1): 101-113 Available at <http://www.iao.florence.it/ojs/index.php/JAEID/article/view/123>

³² SNC (2013)

³³ Revolve and GIZ (2013) Tunisia Report: Adapting to climate change. Available at <http://revolve.media/adapting-to-climate-change/>

³⁴ SNC (2013)

³⁵ USAID (2015) citing G. Galassi and G. Spada (2104) Sea-level rise in the Mediterranean Sea by 2050: Roles of terrestrial ice melt, steric effects and glacial isostatic adjustment. Global and Planetary Change 123 (2014) 55-66. Available at <https://www.sciencedirect.com/science/article/pii/S0921818114002008>

³⁶ IPCC 2014

³⁷ 12 Ministry of Environment and Sustainable Development (MEDD) (Tunisia) (2012), "Vulnerability and Adaptation", Tunis (http://www.environnement.gov.tn/index.php?option=com_content&task=view&id=118&Itemid=173&limit=1&limitstart=0).

low lying coastal areas. Salinization of fresh coastal groundwater and estuaries will also occur - by 2030 salt water intrusion could result in the loss of about 50% of total freshwater reserves from coastal water tables.³⁸

Socio-economic and political vulnerability

Table 1: Socio-economic situation in Tunisia

Indicators	Tunisia
GDP (PPP) per capita (USD) ³⁹	11,596
Population (2018 est) ⁴⁰	11,659,174
Annual population growth rate ⁴¹	1.1
Population estimate for 2050 ⁴²	13,884,000
Population Density per km2 ⁴³	73
Human Development Index (HDI) (2016) ⁴⁴ (188 countries)	97
Corruption Perception Index (CPI) (2017) ⁴⁵ (180 countries)	74
Gender Inequality Index (GII) (2016) ⁴⁶ (188 countries)	58
Africa Gender Equality Index (2015) ⁴⁷ (52 countries)	17
Fragile State Index (2017) ⁴⁸ (178 countries)	92
Adult Literacy % (2014) ⁴⁹	79

Tunisia is a lower- middle income primarily urban (67%) country ranking in the middle of the HDI and Fragile State Index, while also having higher positive rankings for gender equality and a low population growth rate.⁵⁰ Tunisia has experienced major political and economic changes since its Jasmin Revolution in 2011 began the Arab Spring of political

change in the Middle East and North Africa (MENA). In Tunisia the Revolution resulted in the overthrow of the regime and a period of instability while it moved towards a more open and democratic system of governance. The economic transition has not kept pace with the political transition. The post-Revolution economy averaged 1.5% growth compared to the 4.5% in the five years before with modest recent gains in 2017 of 1.9% compared to 1% in 2016. The economic growth in 2017 was driven mainly by agriculture (+2.5 percent) and services (+4.1 percent).⁵¹ A degree of political instability continues, as shown by the country-wide demonstrations on the 7th anniversary of the Jasmin Revolution in early 2018 that not only opposed austerity measures in the budget, but also protested against conditions similar to those that led to the Revolution (corruption, high levels of poverty, inequality and youth unemployment).^{52 53}

Youth and women particularly in inland rural areas have been especially affected by the lack of economic opportunity. Tunisia is one of the few countries where a higher level of education *decreases* employability, especially for women.⁵⁴ While the gender gap is smaller in Tunisia than in other MENA countries, the employment rate is much lower for women than men, and women often have less skilled jobs. There are also significant regional inequalities in living standards and employment.⁵⁵

Tunisia has a more diverse economy than other Maghreb⁵⁶ countries, with agriculture, industry, mining⁵⁷ and tourism as important sectors. Climate change will have a greater direct impact on two of the major sectors of the Tunisian economy – agriculture and tourism (and related services). In

³⁸ SNC (2013)

³⁹ <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>

⁴⁰ World Population Review 2018 estimates
<http://worldpopulationreview.com/countries/>

⁴¹ <https://data.worldbank.org/indicator/SP.POP.GROW>

⁴² 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

⁴³ <https://data.worldbank.org/indicator/EN.POP.DNST>

⁴⁴ <http://hdr.undp.org/en/content/human-development-index-hdi>

⁴⁵ https://www.transparency.org/news/feature/corruption_perceptions_index_2017

⁴⁶ <http://hdr.undp.org/en/composite/GII>

⁴⁷ 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

⁴⁸ <http://fundforpeace.org/fsi/>

⁴⁹ <https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=EG>

⁵⁰ Low population growth rate is the result of small family size and emigration.

⁵¹ World Bank (2018). Tunisia. Available at <http://www.worldbank.org/en/country/tunisia>

⁵² J. Burke and S. Cordall (2018) Tunisia protests: Authorities accused of indiscriminate crackdown. Available at <https://www.theguardian.com/world/2018/jan/11/tunisia-hundreds-arrested-violent-protests-army-deployed-cities>

⁵³ N. Aboueldahab. (2018) Unrest in Tunisia: Another turning point in a legacy of economic injustice. Brookings. Available at <https://www.brookings.edu/blog/order-from-chaos/2018/01/29/unrest-in-tunisia-another-turning-point-in-a-legacy-of-economic-injustice/>

⁵⁴ World Bank (2018)

⁵⁵ OECD (2018) Economic Survey: Tunisia. Available at <http://www.oecd.org/eco/surveys/economic-survey-tunisia.htm>

⁵⁶ Traditionally the Maghreb was the Berber region in North Africa which included the Atlas Mountains and the coastal plains of Morocco, Algeria, Tunisia and Libya. Currently, Mauritania is sometimes also included.

⁵⁷ Climate change will have a limited impact on the mining sector.

Extraction of phosphates is the most important product of the mining sector. Prior to the Revolution Tunisia was the fifth largest exporter of phosphates in the world and phosphate exports contributed about 3% of the GDP. Phosphate mining output has fallen sharply since the Revolution by over 50%, but still accounted for 2% of Tunisia's GDP in 2017. See H. Waszkewitz (2018) Tunisia's phosphate mines – between a rock and a hard place. Global Risk Insights. Feb.28, 2018. Available at <https://globalriskinsights.com/2018/02/tunisia-phosphate-mines-strikes/>

the long-term, the impact on agriculture and food security in Tunisia will be two-fold: (i) world market prices for food are projected to *increase* under climate change which will impact on the costs and availability of many of the food commodities which Tunisia imports (see below) and (ii) local climate change impacts in Tunisia will be felt through *falling* agricultural yields of staple and commercial crops.⁵⁸ However, the impact of climate change is already being felt in spikes in global food prices. As a result of extreme weather events in other countries or regions, the prices for agricultural commodities that Tunisia imports, such as wheat, may suddenly and sharply rise, undermining food security in poor non-farm and urban households.⁵⁹

Tunisia's agriculture is primarily rainfed and highly vulnerable to rainfall variability and the impact of long droughts and higher temperatures.⁶⁰ Consisting principally of small scale family farms, the agricultural sector contributes 11-12% of the GDP, generates around 6% of export earnings and employs an estimated 16% of the labor force.⁶¹ ⁶² The main agricultural products are olives, olive oil, grain, tomatoes, citrus fruit, dairy products and dates. While self-sufficient in dairy products, vegetables and fruit, Tunisia imports wheat, soybeans, maize, barley and raw sugar.⁶³

The droughts caused by climate change will particularly affect rainfed cereal farming with an anticipated reduction of approximately 30% in agricultural land area and lower production of crops such as wheat and barley.⁶⁴ ⁶⁵ However, climate change will also impact on Tunisia's major export agricultural products. Tunisia is a major world producer and exporter of olive oil (globally ranked 5th in 2018) and dates (accounting for 24% of the world trade).⁶⁶ ⁶⁷ Currently about 40% of all cultivated land is used for growing olives.⁶⁸ In response to climate change it is estimated that olive production could drop by 50% with the land suitable for olive cultivation decreasing by 42% in the southern part of the country (see Map 3).⁶⁹ The date palm, which provides an

income for about 12% of the population, is primarily produced in the oases in the south⁷⁰, a region that is already experiencing water shortage - a situation that will worsen with the rising temperatures and decreasing rainfall anticipated with climate change.⁷¹ Together, higher global food prices and local lower yields will reduce economic growth in Tunisia. Farm incomes are projected to be reduced by 2-7% annually on average over 30 years (2000-2030). While farm households will be hardest hit by climate change, rural nonfarm and urban households will also be affected by the rising global food prices because of climate change.⁷²

The Tunisian coast is where 2/3rds of the country's population resides and more than 70% of its economic activities takes place, including tourism, as well as the greater part of its irrigated agriculture. The anticipated sea level rise of 1 meter by 2100 will directly impact on 5% of the Tunisian population and on its water resources, natural ecosystems, coastal infrastructure, agriculture (e.g. reduction by 10% of irrigated areas)⁷³ and tourism. Due to the importance of coastal tourism such a rise could have a disproportionate impact on the economy.⁷⁴ The more extreme climatic conditions of droughts and floods, heat waves and strong winds in combination with the climate-induced decrease in water availability and increased water costs is likely to have a significant negative impact on tourism in the coastal areas.⁷⁵ ⁷⁶ Climate change will intensify the pressure on Tunisia's water resources to meet the demands of a growing urban population and the agricultural and industrial sectors.⁷⁷

Migration and climate change

Traditionally, Tunisia is a country of emigration with a significant portion of its population living in other countries – in 2012, 11% of the population was recorded by

⁵⁸ Verner (2013)

⁵⁹ Verner(2013)

⁶⁰ Verner (2013)

⁶¹ Revolve and GIZ (2013) Tunisia Report: Adapting to climate change. Available at <http://revolve.media/adapting-to-climate-change/>

⁶² M. Van der Gaast (2018) Tunisia: Business Opportunity Report, Focus on Agriculture. NABC. Available at https://nabc.nl/uploads/content/files/NABC-Tunisia-Report_FINAL.pdf

⁶³ Van der Gaast (2018) citing <http://www.nationsencyclopedia.com/economies/Africa/Tunisia-AGRICULTURE.html>

⁶⁴ SNC (2013)

⁶⁵ Verner (2013)

⁶⁶ C. Jacobs and K. van 't Klooster (2012) Water and Agriculture in the Maghreb. Alterra, Wageningen. Available at <http://edepot.wur.nl/262881>

⁶⁷ Ben Ahmed Zaag (2017)

⁶⁸ Van der Gaast (2018)

⁶⁹ Revolve and GIZ (2013)

⁷⁰ The oasis constitutes a specific natural landscape in which an agricultural system of production has been created adapted to the oasis context; the biophysical and socio-economic structures of the oasis ecosystem are based on the date palm (*Phoenix dactylifera* L.). Source: Ben Ahmed Zaag (2017)

⁷¹ Ben Ahmed Zaag (2017);

⁷² Verner (2013)

⁷³ SNC (2013)

⁷⁴ Verner (2013)

⁷⁵ Revolve and GIZ (2013)

⁷⁶ J. Koberi, F. Pretenthaler, and D. Bird (2016) Modelling climate change impacts on tourism demand: A comparative study from Sardinia (Italy) and Cap Bon (Tunisia). *Sci.Total.Env* 2016 Feb 1;543(Pt B):1039-53. doi: 10.1016/j.scitotenv.2015.03.099 available at <https://www.ncbi.nlm.nih.gov/pubmed/25891683>

⁷⁷ World Bank (2018) Water: Tunisia's other development challenge. Available at <http://www.worldbank.org/en/news/feature/2014/09/04/water-tunisia-s-other-development-challenge>

the Ministry of Foreign Affairs as residing outside Tunisia.⁷⁸ The main drivers of migration are economic factors, such as high levels of unemployment and poverty, political events and social factors such as family migration and migrant networks. The main destination of Tunisian emigrants is Europe (e.g. France, Italy, Germany). The inflow of remittances has significant macro- and micro-economic impacts; in 2014, remittances contributed an estimated 4.9% of Tunisia's GDP.⁷⁹ In Tunisia there are also significant immigrant populations, particularly from Sub-Saharan Africa, that are in transit to other countries. Tunisia's geographical position between Sub-Saharan Africa and Europe, changes in migration routes, events in neighboring countries such as Libya, and increased migration restrictions have resulted in transit migrants staying for longer periods.⁸⁰

The urban population in Tunisia has grown rapidly and will continue to do so in the future. If the urbanization trend continues, by 2050 the urban population of Tunisia will increase from the current 67% to 77% of the total population. Differences in real income, fewer employment opportunities, disparities in social and health services and education have contributed to increasing migration trends from rural to urban areas. Increasingly climate related factors such as accelerating desertification, recurring drought and sea level rise are also contributing to increased rural-urban migration. It is considered likely that migration and remittances will function as coping mechanisms and increase in response to climate change.⁸¹

However, there is concern that urbanization decreases resilience in rural areas. In date producing oases, for example, the lack of farmers due to rural outmigration has resulted in parts of the oasis falling into a state of neglect and leading to decreased water resources, loss of tree cover and decreased agricultural productivity.⁸² There are also concerns that since climate change is associated with a decrease of available resources, it may increase potential conflict within and between different localities, especially over water resources. The dynamic interplay of increased climate-induced and socioeconomic rural migration, decreased rural resilience, water scarcity, and political instability may escalate Tunisia's vulnerability to conflict.⁸³

National Government Strategies and Policies

Tunisia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol in 2002. Tunisia has prepared two National Communications to the UNFCCC (2001, 2014) and submitted its first Biennial report in December 2014. Tunisia signed the Paris agreement in April 2016 and ratified the agreement in February 2017 with entry into force in March 2017.

Following the political changes triggered by the Jasmin Revolution, a new constitution was adopted in 2014 which incorporated climate change as a permanent feature – Tunisia is one out of only three countries to have done so. Under Article 44 of the new constitution, the State shall “provide the means necessary to guarantee a healthy and balanced environment and contribute to the climate's integrity”.⁸⁴ The response to climate change has been emphasized in the energy sector. Tunisia has pursued a proactive energy policy for 30 years and has one of the lowest GHG emissions in the MENA region. Between 1990 and 2009, efforts to improve industries' energy efficiency successfully reduced the Tunisian economy's carbon emissions by 25%.⁸⁵ It has also made progress in the reforestation and preservation of forested ecosystems, resulting in its agriculture, forestry and other land use (AFLOU) recognized as a net CO₂ sink in its 2010 greenhouse gas inventory.^{86 87}

Tunisia's National Climate Change Strategy (NCCS), developed by the Ministry of Environment, was launched in October 2012. The Strategy proposes an anticipatory approach to adaptation and a proactive mitigation policy to reduce the economy's carbon emissions. An ambitious quantitative goal was formulated and later updated to align with the actions in Tunisia's Intended Nationally Determined Contribution (INDC) (see below).⁸⁸ The NCCS promotes NAMAs (nationally appropriate mitigation actions) and market-based instruments as key elements of Tunisia's mitigation policy, particularly in the energy sector. It highlights the need for establishing strong governance

⁷⁸ K. Natter (2015). Revolution and political transition in Tunisia: A Migration Game Changers? Migration Policy Institute. Available at <https://www.migrationpolicy.org/article/revolution-and-political-transition-tunisia-migration-game-changer>

⁷⁹ O. Bilgili and K. Marchand (2016) Migration, development and climate change in North Africa. Available at <https://www.weadapt.org/knowledge-base/sdc-climate-change-environment-network/migration-development-and-climate-change-in-north-africa>

⁸⁰ Bilgili and Marchand (2016)

⁸¹ Bilgili and Marchand (2016)

⁸² Ben Ahmed Zaag (2017)

⁸³ Bilgili and Marchand (2016).

⁸⁴ <http://www.unfccc.int/ndcregistry/Pages/Party.aspx?party=TUN>

⁸⁵ Revolve and GIZ (2103)

⁸⁶ <http://www.unfccc.int/ndcregistry/Pages/Party.aspx?party=TUN>

⁸⁷ Revolve and GIZ (2103)

⁸⁸ In preparation for the UNFCCC meetings in Paris, December 2015, countries prepared an Intended Nationally Determined Contribution (INDC) that identified the actions the country intended to take to reduce its emissions. INDCs are, therefore, the basis of post-2020 global emissions reduction commitments included in the climate agreement. Many developing countries also included actions for adaptation to climate change. After a country ratified the Paris Agreement, their INDC (or a revised INDC) was submitted to the UNFCCC as its first NDC (National Determined Contribution). <http://climateobserver.org/open-and-shut/indc/>; <http://www.wri.org/indc-definition>

for climate change based on appropriate institutional arrangements that will allow cross-sectoral (i.e. horizontal) interactions and proposes that the governance structure should foster better linkages between national and regional (sub-national) levels of government. A strong emphasis for both climate change mitigation and adaptation is job creation and poverty alleviation.⁸⁹

Tunisia is also planning on developing a Low Carbon Development Strategy (LCDS) that will support a sustainable energy transition process through the transformation of public policies.⁹⁰

Nationally Determined Contributions (NDC)⁹¹

Tunisia submitted its first NDC to the UNFCCC in February 2017. Its NDC includes both mitigation and adaptation with an estimate of USD 20 billion of international financing required for implementation.

For mitigation Tunisia proposes to:

- lower its carbon emissions by 41 percent in 2030 (relative to the base year 2010) by reducing its greenhouse gas

Table 2: Tunisia’s Indicative mitigation and adaptation actions

Actions to Promote Resilience	
Sector	Key proposed actions (water, agriculture, coastline, and tourism)
Water Resources	<ul style="list-style-type: none"> • Transfer and reuse of treated wastewater • Improve and secure the water supplies of large urban centres especially Greater Tis, Cap-bon, Sahel and Sfax.
Agriculture	<p>Actions proposed focus on capacity-building and institutional development measures:</p> <ul style="list-style-type: none"> • Adapting irrigation in the central region; • Adapting mixed farming-livestock production to climate change in vulnerable regions; • Updating the agriculture map to take into account the impacts of climate change; • Introducing climate monitoring and early warning systems, as well as insurance mechanism against climatic hazards due to climate change; • Conserving and exploiting genetic heritage to adapt cereal crops to climate change, developing innovative systems for arable crops.
Coastline	<p>Actions proposed concern the rehabilitation of coasts and prevention of coastal erosion:</p> <ul style="list-style-type: none"> • Redeveloping and displacing coastal industrial zones; • Rehabilitating and protecting existing infrastructure against the risks of climatic impacts and developing farms and agricultural infrastructure.
Tourism	<ul style="list-style-type: none"> • Restoration of the Tunisian touristic sea coast and protection of tourism areas against the advance of the sea; • Optimization of the management of water resources by the tourist sector and installation of mini-seawater desalination plants using renewable energies.
Mitigation Actions	
Sector	Key proposed actions
Energy (primary focus of the NDC)	<ul style="list-style-type: none"> • Intensify the promotion of energy efficiency in all consumer sectors and for all energy usages; • Increase the use of renewable energy in electricity production to 14% in 2020 and to 30% in 2030 (2015 share was 4%).
Agriculture, forestry and changes in Land Use	<ul style="list-style-type: none"> • Increasing reforestation and consolidating and increasing carbon reserves in forest and pastoral environment; • Improve carbon footprinting for agriculture by using practices that generate fewer emissions, such as optimizing the diets of domestic animals, promoting biological agriculture or conservation-oriented agricultural practices, or recovering energy from animal waste.
Waste	<ul style="list-style-type: none"> • Install facilities to transform solid waste into RDF (reuse derived fuel) (intended for cement facilities), as well as a programme for introducing degasification systems in controlled landfills; • Installation of solar PV capacity at water treatment plants, biogas digesters for electricity production and a reduction in the chemical oxygen demand of industrial wastewater.
Industrial Processes	<ul style="list-style-type: none"> • Use of a NAMA in the cement industry from 2016 onwards and access of this sector to carbon markets from 2021 onwards.

⁸⁹ <http://www.environnement.gov.tn/index.php?id=190&L=1#.WweezkiFOhM>

⁹⁰ <http://www.environnement.gov.tn/index.php?id=190&L=1#.WweezkiFOhM>

⁹¹ <http://www4.unfccc.int/ndcregistry/Pages/Party.aspx?party=TUN>

- emissions across all sectors (energy; industrial processes; agriculture, forestry and other land use; waste).
- In the specific sector of energy, Tunisia aims to reduce its carbon emissions by 46% compared to 2010 levels.
 - Tunisia is looking to reduce its carbon emissions unconditionally and through its own efforts by 13 percent compared to 2010, i.e. around 1/3 of its NDC commitment.
 - To achieve the rest of its objective, i.e. an additional decrease in carbon emissions of 28 percent in 2030 compared to 2010, Tunisia is relying on the support of the international community for funding, capacity building and technology transfer.

Financing of the implementation of the Tunisian contribution towards mitigation is an estimated USD 18 billion. The national effort required to achieve Tunisia’s unconditional contribution is estimated at around 10% of the total mitigation investment needs. The national effort exclusively concerns the energy sector which accounts for the most significant part of the investment needs.

For adaptation, Tunisia’s NDC notes:

- Tunisia is very vulnerable to climate change, in particular to the anticipated major increases in temperature, reduced precipitation and rising sea levels. The socio-economic and environmental impact will particularly affect water resources, agriculture, natural and artificial ecosystems, the coastline, health and tourism.

The cost of the necessary adaptation measures is estimated as USD 2 billion of conditional financing to be provided by the international community.

The NDC also included indicative actions for achieving its mitigation targets and increasing Tunisia’s resilience to climate change (see Table 2.)

Climate Finance

International agencies are providing climate finance, grants and loans, for the implementation of climate change projects in Tunisia. See Table 3 below for international and multilateral financed climate projects.

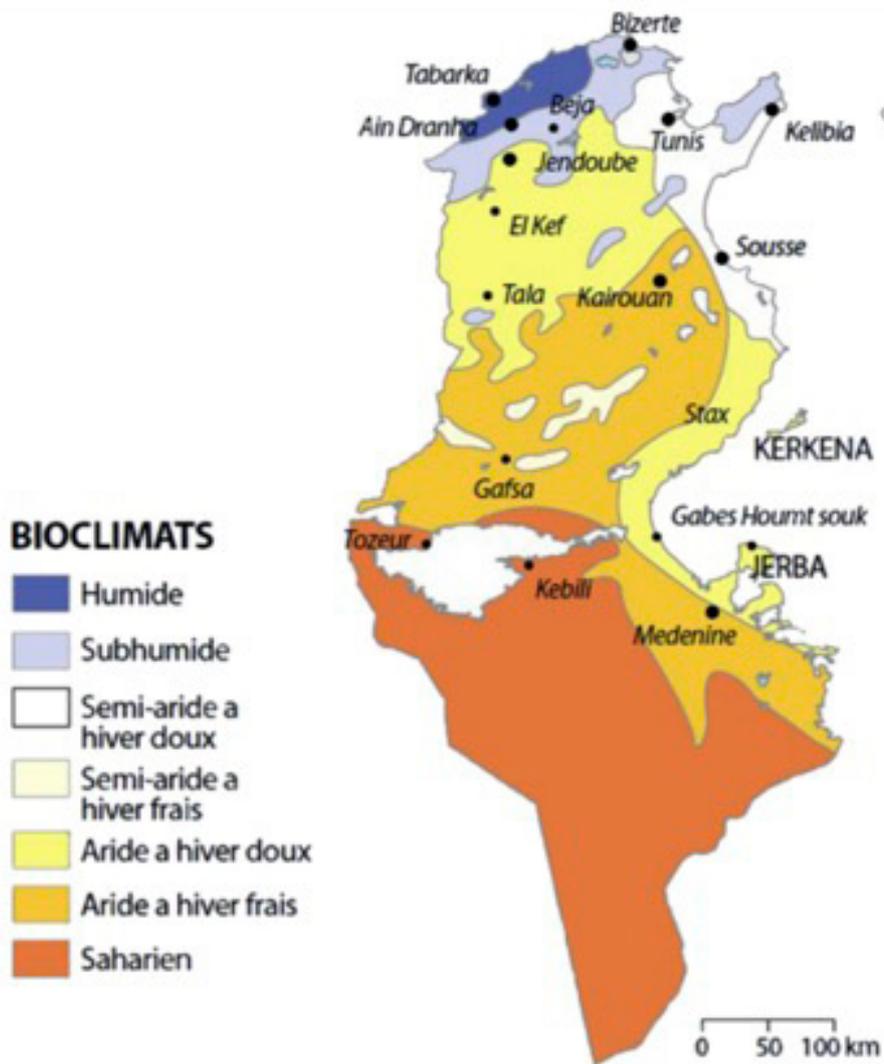
Table 3: Current Internationally Financed Climate Change Projects¹

Name of Project	Fund (implementing agency)	Amount of Funding Approved (USD millions)	Date of approval (GEF) / Implementation dates (others)
Leapfrogging Tunisia’s Lighting Market to High efficiency Technologies	GEF (UNEP)	2.4	2018
NAMA support for the Tunisian Solar Plan	GEF (UNDP)	3.55	2014
Addressing Climate Change Vulnerabilities and Risks in Vulnerable Coastal Areas of Tunisia	GEF (UNDP)	5.5	2014

¹ Climate Fund Update available at <https://climatefundupdate.org/>; GEF project information available at https://www.thegef.org/projects?field_p_focalareas:2207&field_p_latesttimelinestatus:606&field_country:164&field_country:57&field_p_focalareas:2207&field_p_latesttimelinestatus:606

Maps

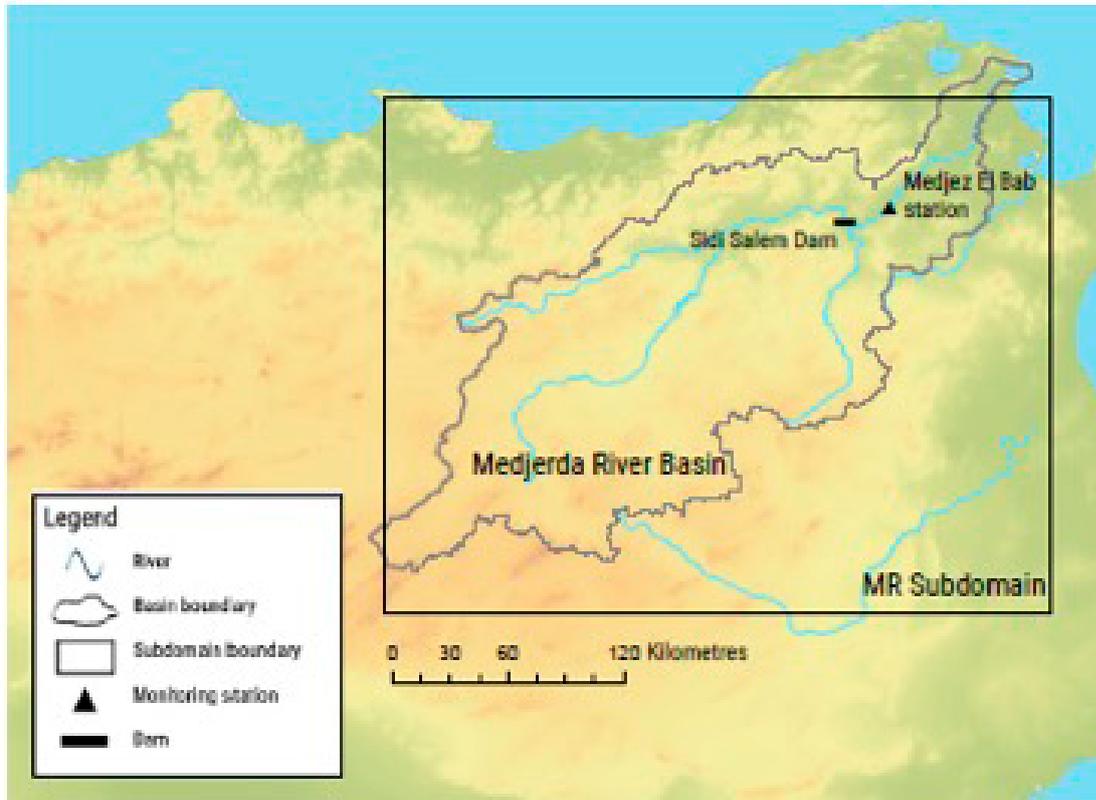
Map 1 Bioclimatic and agroecological zones in Tunisia



Source: H You et al. (2016) Plant diversity in different bioclimatic zones in Tunisia. *Journal of Asia-Pacific Biodiversity* 9 (2016), 56-62.

Available at https://ac.els-cdn.com/S2287884X16000108/1-s2.0-S2287884X16000108-main.pdf?_tid=7bb66d50-c31f-42e0-bb38-fbe9c123bba6&acdnat=1527221113_6cfcf7e9b5b6b484b5d463be7b9d891a

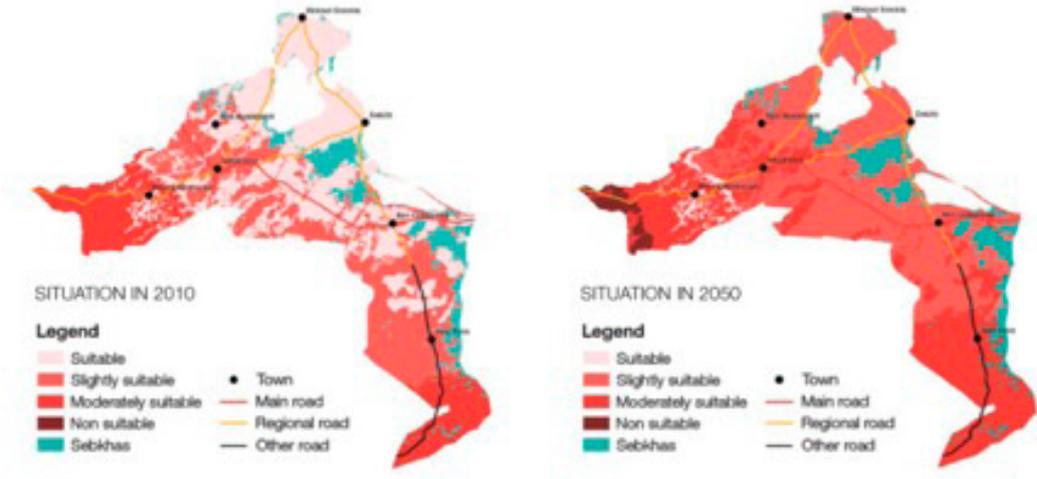
Map 2 The Medjerda River Basin



Source: 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- Main Report.

Available at <https://www.unescwa.org/publications/riccar-arab-climate-change-assessment-report>

Map 3 Land Suitable for Olive Cultivation in 2010 and 2050



Land suitable for olive cultivation in 2010 and 2050 in Medenine, a region in the south of the country.
Source: GIZ study on « L'olivierale tunisienne face au changement climatique. Méthode d'analyse et étude de cas pour le gouvernorat de Médénine »

Source: Revolve and GIZ (2013) Tunisia Report: Adapting to climate change.

Available at <http://revolve.media/adapting-to-climate-change/>

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