

# Democratic Republic of Algeria

## Policy fiche: Managing the impact of climate change on agriculture

### 1. Context of the impact of climate change

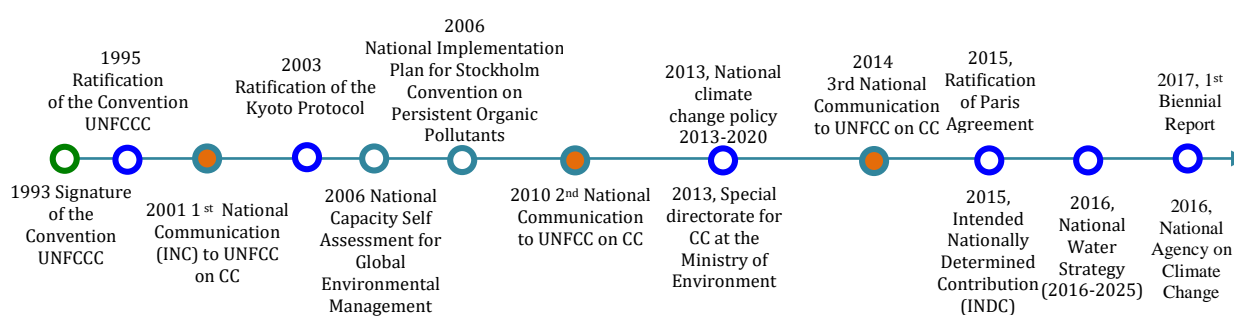
Algeria ratified in April 1993, the United Nations Framework Convention on Climate Change (UNFCCC), and fully subscribes to commitments relating to the stabilizing emissions of greenhouse gases to prevent anthropogenic interference with the climate system. By adhering to the Kyoto Protocol in 2005, Algeria has shown its determination to participate in the international effort against climate change and its potential impacts on water resources, natural ecosystems and the sustainability of economic development. All socio-economic sectors and institutions are gradually incorporating aspects related to climate change, particularly in the search for ways of adaptation and mitigation. With no historical responsibility for climate change, any national effort of mitigation should not be economically restrictive or menacing the right of Algeria to development.

Algeria has developed an initial strategy against climate change and developed numerous projects for adaptation and mitigation of changes climate. The national strategy is based primarily on four areas: institutional strengthening, adaptation to climate change, mitigation of emissions of GHG and human capacity building. Its implementation mainly concerns the sectors of energy, industry, t transport, waste, water resources, agriculture and forests. In 2007, Algeria created the National Agency for climate change and inventories of greenhouse gas (GHG) emission are carried out periodically.

The National Inter-Ministerial Dialogue on Climate Change was held in Algiers in 2009 following the ratification of the Kyoto Protocol, and with the support of a UNEP/UNDP programme.

Algeria submitted its Intended Nationally Determined Contribution (INDC) in September 2015. This INDC was adopted by the Council of Ministers which endorsed it at its meeting on May 24, 2015. On October 13, 2016, Algeria has ratified the Paris Climate Agreement of 2015 (APPC). During the process of preparing the Paris Climate Agreement, Algeria took two strong decisions in 2015, setting up the interministerial committee - INDC as well as the National Climate Committee (CNC).

Figure 1. Main milestones and dates of climate change in Algeria



#### Summary of the main characteristics of the policy and the risks in Algeria

Due to its geographical position and climatic characteristics, Algeria is highly vulnerable to climate change. Even a small rise in temperature would lead to various socio-economic problems that hinder the development of the country. The models predict that rainfall events are less frequent but more intense, while droughts are more common and longer. The spatial and temporal distribution of rainfall will also change. The analysis of climate data from 1931 to 1990 in northern Algeria reveals a rise in temperature of 0.5 °C would reach an increase of 1 °C by 2020. A temperature rise of 2 °C is expected by 2050. The decrease of water resources, declining agricultural yields, encroaching desert, the challenge of planning and the energy consumption for air conditioning are only the initial impacts to which Algeria must find answers supportable economically and socially. Thus although the contribution of Algeria on global warming is minimal (less than 0.5% of global GHG emissions), the country is very vulnerable and should integrate adaptation into its development policy.

Algeria, which is part of Mediterranean hot spot, is very vulnerable to climate change. Experts predict at the medium term an increase in temperature of 2 °C, a decrease in rainfall of 10 to 15% and more frequent droughts and more intensive. Facing this situation, and to ensure the availability of water resources, curbing soil erosion and

sustainable development, the country has implemented a strategy for adapting to climate and GHG mitigation. It covers all sectors, especially the energy sector which is responsible for the largest share of GHG emissions (74%). Much progress has been made in the mobilization of water resources for drinking and irrigation, and much remains to be done in agriculture. Regarding to ecological footprint, CO2 emissions and GDP, Algeria is among the countries that are committed to sustainable development and should preserve this position.

In the field of energy, the final development plan for renewable energy is undoubtedly a big challenge for the country. Overall this strategy will reduce up to 60% of GHG emissions. Algeria has a good chance of a successful struggle against the change climate, if certain conditions are met such as the formation of qualified human capabilities, the integration of all the possibilities, good coordination and good governance.

Forecasts are not optimistic. Models for climate change indicate that rainfall could decrease by more than 20% by 2050, which would result in even greater worsening water shortages in different basins of Algeria. The construction of 70 dams planned will provide only small additional volumes.

The particular challenge for Algeria in the coming decades will be to adapt to a decrease in renewable water resources. Country will have to manage carefully these resources. Mobilization of non-conventional water resources (desalination and wastewater reuse) will be a strategic component of future water policy.

The models predict that rainfall events are less frequent but more intense, while droughts are more common and longer. Algeria's INDC covers the 2021-2030 period. It involves mainly the sectors of energy, industry, transport, agriculture and forestry, construction and the environment. Algeria lacks the technical capacity and financial resources to overcome and cope with the anticipated changes associated with its vulnerability to climate change.

*The table below provides an overview of the main areas of challenge for agriculture due to climate change pressure expected through time.*

**Table 1. "Evaluation board" of the impact of climate change**

| <i>High impact (high impact, requiring major action and immediate action)</i>                       |   | <i>Negligible impact (the impact is limited but requires follow-up)</i>  |   |
|---|---|--|---|
| <i>Medium impact (increasing impact, requiring minor action, monitoring and medium-term action)</i> |   | <i>Uncertain impact (not enough evidence and need for further monitoring and analysis)</i>   |   |
| Areas of impact   | Currently (2017)  | Near future (2020-2030)  | Longer term (2030-2050-2100)  |
| Direct effects on costs   | Insurance against climatic hazards & Payment for environmental services   |  |   |
| Risks and insurance   |   |  |   |
| Climate variability   | Climate change will result in significant impacts on Algeria water resources and some of the effects are already visible now. Algeria is expected to be negatively affected by impacts ranging from increased frequency and intensity of floods and droughts, worse water scarcity, intensified erosion and sedimentation, sea level rise, and damage to water quality and ecosystems. Moreover, climate change impacts on water resources will have cascading effects on human health and many parts of the economy and society, as various sectors directly depend on water such as agriculture, health, and tourism—as does the environment. Adaptation to climate change is therefore a moral, economic, and social imperative. Conducted study carried out by the Algerian Government estimates that a 1°C rise in mean annual temperature would lead to decreases in precipitation by 15% and in influx of surface waters by 30%. | The analysis of climate data from 1931 to 1990 in northern Algeria reveals a rise in temperature of 0.5 °C would reach an increase of 1 °C by 2020. The spatial and temporal distribution of precipitation would change, which directly affect agriculture and water resources. Regional models with the IPCC scenarios applied to Algeria for the period 1990-2020 forecast growth of the average temperature of 0.8°C to 1.1°C, and reduced precipitation 10% with an increase in the sea level of 5 to 10 cm. Increased evaporation and | By 2050, temperature risings of 1.5–2.5 °C and a precipitation decrease of 10–50 %. An increase of 1–2 °C in temperatures can induce a reduction of 10 % in precipitations . This will have important effects on the mobilization of dam waters up to 0.64 billion m <sup>3</sup> In 2050, projections with the annual medium flow of the rivers, show an increase of 10 to 40%, with the high latitudes and a reduction of 10 to 30% in certain dry areas of the average latitudes, of which some are currently in lack of water |

|   |  |  |   |
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|   |  | decreased precipitation will accentuate the decrease of water mobilized in dams and groundwater  |   |
| <p><b>Direct effects on demand</b></p> <p>Water resources</p> | <p>In Algeria, mobilization and management of water resources is one of the most fundamental challenges of the Ministry of Water Resources. Algeria is in the poor countries in water resources under scarcity threshold set by the UNDP or the scarcity by the World Bank to 1,000 m<sup>3</sup>/person/day. The potential water of resources in Algeria is of 19.2 billion of m<sup>3</sup> (surface water 12.4 billion of m<sup>3</sup> and underground water 6.92 billion of m<sup>3</sup> mainly in the Sahara) .</p> <p>As a result, renewable available water in Algeria dropped from an average of 1,500 cubic meters per person per year (m<sup>3</sup>/p/y) in 1962 to 630 m<sup>3</sup>/p/y in 1998 and is expected to decline to 430 m<sup>3</sup>/p/y by 2020. The average availability for domestic consumption is 55 litres per inhabitant/day and the water is usually cut off in almost all the cities.</p> <p>Agricultural irrigation is the primary water consuming sector followed by the domestic and industrial sectors. Water allocated for irrigation has dropped from 80% in 1960 to around 60% in 2002.</p> <p>The impact of climatic change in Algeria during the last 25 years is expressed by a diminution of dam levels. Overflow volumes decreased in certain cases by more than 50 %</p>   | <p>The decrease of water resources, declining agricultural yields, encroaching desert, the challenge of planning and the energy consumption for air conditioning are only the initial impacts to which Algeria must find answers supportable economically and socially</p> <p>-The volume of released wastewater to the national scale is currently (2018) estimated to almost 750 million m<sup>3</sup> and to exceed 1.5 billion m<sup>3</sup> by 2020 (Billal Ameri et. al 2018)</p>                      | <p>By the year 2050, per capita water availability will fall below the 400 m<sup>3</sup>/capita/year, with serious consequences for already-stressed aquifers and natural hydrological systems.</p> <p>The reduction in pluviometry and the increase in temperatures were directly influence the groundwater recharge and generate a significant decrease of water contributions leading to a folding back of groundwater levels.</p>   |
| <p>Agriculture Production</p>                                 | <p>The climate strategy of Algeria is defined in the National Climate Plan. It aims, notably, at reinforcing water resources mobilization, controlling flood, protecting the coastline, combating drought and desertification and increasing the ecosystems and agriculture resilience and facing climate change.</p> <p>Algeria also faces the challenges related to food security, to its ecosystems and agriculture resilience, to major risks and to natural resources scarcity.</p> <p>The major vulnerability of the country is observed in the areas of water and agriculture. Algeria is a semi arid to arid north to south. Land used by agriculture, which occupy nearly 21% of the total land area, are estimated at 49 million ha distributed as follows: 8.4 million ha of agricultural area, 33 million ha used as routes, 6.6 million ha of forests and steppes of Alfa. Irrigated land accounts for 11% of the agricultural area, an area of 929.000 ha. Algeria therefore has only 3.5% of the total area of the country as arable land and irrigated. The ratio "availability / capita" of agricultural land has declined from 0.75 ha/capita in 1962 to 0.24 ha/capita in 2008. This enormous loss of farmland is not only the result of human population growth and pressures of other sectors (industrial, domestic, etc.) but also the result of desertification, soil erosion, deforestation etc.</p> | <p>- Land used by agriculture, which occupies nearly 21% of the total land area, is estimated at 49 million ha distributed as follows: 8.4 million ha of agricultural area, 33 million ha used as routes, 6.6 million ha of forests and steppes of Alfa. Irrigated land accounts for 11% of the agricultural area, an area of 929.000 ha. Algeria therefore has only 3.5% of the total area of the country as arable and irrigated land.</p> <p>- Decrease in yields of vegetables by 10 to 30% by 2030.</p> | <ul style="list-style-type: none"> <li>• Improved crop and grazing land management to carbon storage.</li> <li>• Improvements of crop yields.</li> <li>• Restoration of cultivated peaty soils and degraded lands.</li> <li>• Improved rice cultivation techniques and livestock and manure management to reduce CH<sub>4</sub> emissions.</li> <li>• Improved nitrogen fertilizer application techniques to reduce N<sub>2</sub>O emissions.</li> <li>• Dedicated energy crops to replace fossil fuel use.</li> <li>• Afforestation, reforestation, forest management, reduced deforestation.</li> <li>• Harvested wood product management.</li> <li>• Use of forestry products for bioenergy to replace fossil fuel use.</li> <li>• Enhance irrigation efficiency and/or expand irrigation</li> </ul> |
| <p>Sea level rise and Coastal erosion</p>                     | <p>The most vulnerable areas are those with the lowest slopes, which mainly consist of large sandy areas, and alluvial. The sea level rises by low speed (not more than 1.1 mm / year), and the line of the coast regressed moderately along the coast</p>   | <p>-Forecasts show an increase in the sea level of 5 to 10 cm</p>  | <p>A rise of 7–12 cm in the overall level of the Mediterranean Sea compared to the past decades is projected by 2050, he Intergovernmental Panel on Climate Change (IPCC) reports projections of SLR in the range of 10</p>   |

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|                                 |   |  |  | - 30 cm by 2050 and of 10 - 90 cm by 2100  |
| 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               | Climate change will degrade biodiversity and contribute to the weakening of the soil and reduced vegetation cover resulting in a gradual desertification. In the steppe, the effect of climate change is reflected by the change in the cyclical nature of drought from one year to three years in the 60 to two years out of five in the 70s and 80s for seven out of ten years now  |  | Dry episodes and Wet episodes : Increased frequency by 10%   | Increase in the frequency of extremes is probably the climatic hazard most influential on biodiversity. Unfortunately, it is the hazard that is the most difficult to quantify.  |
| Infrastructural issues          | impacts on coastal infrastructure   |  |  | impacts on coastal infrastructure  |
| -Greenhouse Gas (GHG) Emissions | <p>The national strategy is based primarily on four areas: institutional strengthening, adaptation to climate change, mitigation of emissions of GHG and human capacity building. Its implementation mainly concerns the sectors of energy, industry, transport, waste, water resources, agriculture and forests. In this context, there was creation in 2007 of the National Agency for climate change and inventories of greenhouse gas (GHG) emission are carried out periodically.</p> <p>In All sectors, energy use in 2008 amounted to 23.2 million Toe. in 2012, GHG emissions totalled 153 MT CO<sub>2</sub> eq. and growing at a rate of over 3%. However, there is a high potential for mitigation, especially in energy sectors, in building, transportation, as well as waste management and gas flaring.</p> |  | <p>-Reduction of greenhouse gases emissions by 7% to 22%, by 2030, compared to a business as usual -BAU- scenario, conditional on external support in terms of finance, technology development and transfer, and capacity building. The 7% GHG reduction will be achieved with national means</p> <ul style="list-style-type: none"> <li>Algeria consumes 50.02 million Toe to 2030 (average annual growth rate of 4% energy) which corresponds emissions in the order of 180 MT CO<sub>2</sub> per year by the energy sector (power plants to natural gas).</li> <li>the overall potential of CO<sub>2</sub> mitigation will rise in 2030 to about 300 MT CO<sub>2</sub> eq. A concentration of 460 ppm in 2030, an increase of around 25% compared to the year 2000 (370 ppm)</li> </ul> | <p>Algeria consumes 50.02 million Toe to 2030 (average annual growth rate of 4% energy) which corresponds emissions in the order of 180 MT CO<sub>2</sub> per year by the energy sector (power plants to natural gas).....</p> |
| Fisheries                       | There are 20 major fishing ports along the 1 280 km coastline of Algeria. The continental shelf is approximately of 13 700 km <sup>2</sup> and the fishing zone is of about 95 000 km <sup>2</sup> . In 2013 the total of recorded vessels operating from these ports was estimated at 4 569 from which 526 were trawls and 1 231 purse seiners. Aquaculture production is still marginal with the production of 2 200 tonnes in 2013, consisting 1 560 tonnes of carps grown in freshwater, 350 tonnes of gilthead seabream from brackishwater and   |  | Aquaculture development has been identified as a strategic priority by the Government which has recently launched an ambitious development programme aiming to create 10000 direct jobs in the sector in the next  | Changes will be noticed in the productivity of fisheries and fishing areas.  |

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|  | <p>a very small amount of mussels and oysters. Most of the harvest is sold fresh in local markets. Currently, Algeria is teaming up with an Asian country in an effort to develop marine shrimp seed production and grow-out culture in the country.</p> <p>In general, the fishery resources are not fully exploited. Possibilities exist in particular for the development of artisanal fisheries, especially on the rocky bottoms and of small pelagic fisheries. The fishery industry requires an important effort of modernization and investments, notably for the rehabilitation of the aging fleet (average age of the boats: 20 years) and of the processing facilities.</p> | <p>five years, and up to 50000 indirect ones by 2025, by putting 100000 hectares under cultivation for a target production of 30000 tonnes per year for export and domestic consumption.</p> <p>Particular emphasis has been given to the development of aquaculture in the desert and arid lands of the country. The main issues affecting aquaculture development are related to: feed availability; limited aquaculture experience by scientists and farmers; production and distribution of seed, and for freshwater aquaculture, high water temperature especially during summer months.</p> |  |
| <p><b>Broader indirect effects</b></p> <p>Ecosystems</p> | <p>Today, Algeria hosts 2,375 wetlands, including 50 Ramsar Sites of International Importance, composed of 2,056 wetlands of natural origin and 319 of artificial origin according to the Directorate General of Forestry (DGF). Since the ratification of the Ramsar Convention by Algeria in 1984, the DGF has carried out multiple activities, including inventories and management plans, for better management and valorization of these sites.</p>  | <p>The different axes of the strategy are also correlated with the targets of the MedWet Framework for Action 2016-2030 in the areas of the inclusion in the Ramsar List, the development and implementation of pilot restoration projects in degraded wetlands, and the integration of good practices for water management and wetland conservation into national land use plans and policies in order to avoid further damage to wetland functions and values.</p>  | <ul style="list-style-type: none"> <li>- Increase in the frequency of extremes is probably the climatic hazard most influential on biodiversity. Unfortunately, it is the hazard that is the most difficult to quantify.</li> <li>- Dry episodes and Wet episodes: increased frequency by 10%</li> </ul> |
| <p>Public health</p>                                     | <ul style="list-style-type: none"> <li>- Presence of diseases attributable to air pollution and phenomena Extreme weather: Allergies, respiratory diseases, waterborne diseases and vector-borne diseases.</li> </ul>   | <ul style="list-style-type: none"> <li>- Distribution and prevalence of disease vectors such as malaria, meningitis, and some variants of Leishmaniasis (Biskra's nail) and Onchocerciasis that infects the eye.</li> <li>- Circulatory, Respiratory and Nervous System Disorders</li> </ul>  | <ul style="list-style-type: none"> <li>- Direct contamination of sources of drinking water supply</li> <li>- Aedes mosquitoes, vectors of dengue, are also very sensitive to weather conditions may be at risk of dengue transmission by the 2080s</li> </ul>  |

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| Coastal Zone | <ul style="list-style-type: none"> <li>- Algeria, is concerned by coastal risks.</li> <li>-Essentially by Pollution (chemical, organic, bacteriological, solid waste), some fishing method</li> <li>- Silvicultural factors (fairly pronounced aging, lack of silviculture).</li> <li>-Loss of beaches is the first manifestation This is illustrated by the east coast of Algiers (beaches of Surcouf and El Kaddous, Deca Beaches).</li> <li>- sea-level rise will lead to low-lying submergence or intrusion of marine water into the aquifers.</li> </ul> |  | <ul style="list-style-type: none"> <li>-Deficits of water resources on the coastal zone will widen further by 2020 to reach deficits of 886 hm<sup>3</sup> / year.</li> </ul> | <ul style="list-style-type: none"> <li>- Rising sea level by 2100.</li> </ul> |
| Livestock    |   |  |   | Shift of grazing areas and periods for livestock                              |

### What outputs (documents) and outcomes (actions) are foreseen and by when?

| Strategic Documents  | Year & Agency  | Objectives and consistency  | How the approved measures will treat the different impacts   |
|--|--|---|--|
| National Plan of Action and Adaptation to Climate Change   | 2003 / Ministry of Environment   | <ul style="list-style-type: none"> <li>• Changing activity, Energy efficiency, Renewables, Nuclear or CCS or fuel switch, Non-energy</li> </ul>   | <ul style="list-style-type: none"> <li>• Algeria launched the National Plan of Action and Adaptation to Climate Change (PNA-ACC) (2003-2013) to honour the Kyoto Protocol commitments. Updated in 2013 through the National Climate Plan, it provides measures to limit climate change through CO2 sequestration, promotion of clean energy, reduction of the carbon footprint of industry and households, and increasing energy efficiency of processes. In parallel, it aims to adapt infrastructure to the consequences of global warming by improving the water system, promoting reforestation and adaptation of agriculture to climate change, and supporting fight against desertification</li> </ul> |
| Executive Decree No. 2005-375 Creating the National Agency on Climate Change, fixing its missions and defining terms of its organisation and operation | 2005 / Managed by an 18-member Board of Directors, composed of representatives from across the relevant Ministries and chaired by the Minister of Environment. | <ul style="list-style-type: none"> <li>• Establishes a new National Agency on Climate Change(ANCC), under the supervision of the Minister of Environment, whose primary mission is to contribute to the protection of the environment by assisting with the integration of climate change impact concerns in development plans. Additionally, the ANCC is charged with researching, synthesizing and engaging with the public regarding: (i) GHG emissions and sequestration and (ii) adaptation to and mitigation of various socio-economic climate change impacts. Following from this mission, the ANCC is responsible for: engaging in capacity building, establishing and maintaining a climate change database, aggregating weather data and preparing periodic reports, and coordinating climate change responses across different government and industry sectors.</li> </ul> | <ul style="list-style-type: none"> <li>• Creating the National Agency on Climate Change, fixing its missions and defining terms of its organisation and operation Algeria 2005</li> </ul>  |
| National Implementation Plan for Stockholm Convention on Persistent Organic Pollutants (POPs)  | 2006 / Ministry of Territorial Planning and the environment  | <ul style="list-style-type: none"> <li>• Prepare the ground for implementation of the Stockholm Convention</li> <li>• Assist Algeria in meeting its reporting and other obligations under the convention</li> </ul>   | <ul style="list-style-type: none"> <li>• Develop and formulate a National Implementation Plan (NIP) and thereby strengthen national capacity and enhance knowledge and understanding amongst decision makers, managers, the industry, and the public at large on POPs.</li> <li>• Algeria will meet the obligations of the Stockholm Convention on POPs and will be enabled to manage the elimination of POPs.</li> <li>• Allow Algeria to meet its reporting obligations under the Stockholm Convention;</li> <li>• Prepare the ground for the implementation of the Stockholm Convention;</li> <li>• Strengthen national capacity to manage</li> </ul>   |



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|   |  |   | <p>POPs and strengthen chemicals management capacity in general;</p> <ul style="list-style-type: none"> <li>Maximize government commitment and facilitate ratification of the Stockholm Convention.</li> </ul>  |
| Renewable Energy and Energy Efficiency Development Plan 2011-2030 | 2011 / Ministry of Energy and Mining   | <p>The main objective of the Renewable Energy and Energy Efficiency Development Plan is to expand usage of renewable energies and to diversify energy sources in the country\</p> <p>The Plan's renewable energy goals are:</p> <ul style="list-style-type: none"> <li>To install 22,000MW of power generating capacity from renewable sources between 2011 and 2030 (of which 12,000MW for internal usage and 10,000MW for export)</li> <li>To meet 20% of electricity generation from renewables by 2030</li> <li>For renewable energy development to drive sustainable economic development, to increase energy security supply, and to create jobs</li> </ul>   | <p>The Plan aims to increase energy efficiency through a number of avenues:</p> <ol style="list-style-type: none"> <li>improvement of heat insulation of buildings</li> <li>development of solar water heating; promotion of co-generation</li> <li>promotion of LPG and natural gas fuels</li> <li>developing solar cooling systems</li> <li>converting simply cycle power plants to combined cycle power plants, where possible</li> <li>desalinating brackish water using renewable energy</li> <li>substituting all mercury lamps with sodium lamps and promoting the use of low-energy lamps</li> </ol>  |
| The National Climate Plan   | 2013 / Ministry of the environment   | <ul style="list-style-type: none"> <li>Changing activity, Energy efficiency, Renewables, Nuclear or CCS or fuel switch, Non-energy</li> <li>Strengthening the Institutional, Legislative and Organizational Framework for Implementing a National Strategy for Climate Change Adaptation and Mitigation</li> <li>Better integration of climate change into priority sectoral policies and their local implementation</li> <li>Networking of economic actors, academics,</li> <li>public authorities and civil society to act together in the implementation of concrete actions</li> <li>Greater awareness of civil society actors as well as public and economic actors to the challenges of climate change</li> </ul> | <ul style="list-style-type: none"> <li>The National Climate Plan presents an agenda both in terms of mitigation and adaptation, aims to realize sustained economic growth and inclusive social development, while taking due account of climate change related challenges. It provides an overview of climate change vulnerabilities in Algeria and proposes over 70 action measures, including:</li> <li>adoption of cleaner energy consumption model by substituting liquid fuels by natural gas and liquefied propane; - achieving 35,000 hectares of forests and developing another 175,000 hectares; - waste recovery (13.5 million tonnes / year), - electrification of railway transport and intensification of urban public transport (including constructing the Algiers metro and tramway infrastructure in several cities). The Plan further promotes uptake of renewable energies and sets a target of installing of 22,000 MW of renewable power capacity between 2011 and 2030, divided between 12, 000 MW to be dedicated to cover the national demand for electricity and 10,000 MW for export</li> </ul> |
| Intended Nationally Determined Contribution INDC-Algeria          | 2015, A working group on the INDC was established, with the participation of representatives from 14 ministries and the National Economic and Social Council, and placed under the authority of the Minister in charge of environment. | <ul style="list-style-type: none"> <li>Changing activity</li> <li>Energy efficiency</li> <li>Renewables</li> <li>Nuclear or CCS or fuel switch</li> </ul>   | <ul style="list-style-type: none"> <li>Reduction of greenhouse gases emissions by 7% to 22%, by 2030, compared to a business as usual -BAU- scenario, conditional on external support in terms of finance, technology development and transfer, and capacity building..</li> <li>The 7% GHG reduction will be achieved with national means.</li> </ul>  |

### What are the main steps followed and what is the stage of the process?

| Strategic Documents                        | Steering                          | Process   | Associated actors   |
|--|-----------------------------------|---|---|
| National Implementation Plan for Stockholm | The Ministry of Land Planning and | - Meet the obligations of the Stockholm Convention on POPs and will be enabled to manage the elimination of POPs. | The Ministry of Land Planning and Environment (MATE)<br>United Nations Industrial Development |

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| Convention on Persistent Organic Pollutants (POPs)   | Environment (MATE)                             | <ul style="list-style-type: none"> <li>- Allow Algeria to meet its reporting obligations under the Stockholm Convention;</li> <li>- Prepare the ground for the implementation of the Stockholm Convention;</li> <li>- Strengthen national capacity to manage POPs and strengthen chemicals management capacity in general;</li> <li>- Maximize government commitment and facilitate ratification of the Stockholm Convention.</li> </ul>   | Organization  |
| National Plan of Action and Adaptation to Climate Change   | Minister in charge of environment              | <ul style="list-style-type: none"> <li>- Provide measures to limit climate change through CO2 sequestration promotion of clean energy,</li> <li>- Reduction of the carbon footprint of industry and households, and increasing energy efficiency of processes.</li> <li>- Adapt infrastructure to the consequences of global warming by improving the water system, promoting reforestation and adaptation of agriculture to climate change, and supporting fight against desertification.</li> </ul>  | Minister in charge of environment   |
| Executive Decree No. 2005-375 Creating the National Agency on Climate Change, fixing its missions and defining terms of its organisation and operation | Ministry of Environment and Renewable Energies | <ul style="list-style-type: none"> <li>- Establishing and strengthening national designated authorities or focal points</li> <li>- Strategic frameworks, including the preparation of country programmes</li> </ul>  | Ministry of Environment and Renewable Energies<br>National Agency on Climate Change |
| Executive Decree No. 2011-33 on the establishment, organization and functioning of the Algerian Institute of Renewable Energy                          | Ministry of Environment and Renewable Energies | <p>Achieve by 2030 a share of renewable energy of nearly 27% in the national balance sheet</p> <p>Photovoltaic Solar: 13,575 MW</p> <ul style="list-style-type: none"> <li>• Wind energy: 5010 MW</li> <li>• Thermal Solar: 2000 MW</li> <li>• Biomass: 1,000 MW</li> <li>• Cogeneration: 400 MW</li> <li>• Geothermal energy: 15 M</li> </ul>   | National Fund for Renewable Energies and Cogeneration (FNERC).                      |
| Intended Nationally Determined Contribution INDC- Algeria  | Minister in charge of environment.             | <ul style="list-style-type: none"> <li>- Reinforce the ecosystems resilience (flooding and drought) in order to curtail the risks of natural disasters related to climate change;</li> <li>- Fight erosion and rehabilitate its degraded lands as part of the effort s t o combat desertification ;</li> <li>- Integrate the impacts of climate change into sectorial strategies, in particular for agriculture, water management, public health and transport;</li> <li>- Integrate impacts of climate change on political stability and national security</li> </ul> | Minister in charge of environment.  |

## 2. Policy options to address such impacts

### Elaboration of the policies and measures and advancements

The Ministry of Environment and Renewable Energies (MERE) is the focal point to the UNFCCC, and has been participating in international climate change discussions as a state committed to contribute to the global efforts to reduce GHG emissions.

### What are the main steps followed and what is the stage of the process?

The process initiated by Algeria to prepare, implement and adapt its general framework for combating climate change and its adverse effects can be structured in three phases:

#### Phase 1. 1992-2000

- This phase can be considered as the initial phase where the signature was made, then the ratification of the UNFCCC convention. This phase was essentially a learning step of this new international legal instrument and its framework for discussion and negotiation



## Phase 2. 2000-2010

- This phase was intense, with the ratification of the PK (2004), the elaboration of the first National Action Plan for Environment and Sustainable Development - PNAE DD of Algeria (2002), the creation of the Agency National Climate Change (ANCC) in 2005, followed in 2006 by the designation of the National CDM Authority. It was during this second phase that the two National Communications on Climate Change (initial and second) were prepared, adopted and submitted to the UNFCC secretariat in 2001 and 2010.
- A series of actions, programs and sectoral strategies directly considering climate change have been adopted and / or implemented, notably the National Water Plan (2007), the National Program for Scientific Research (PNR), National Forest Reforestation and Adaptation Plans for Forest Policy (2010). This phase was punctuated by the adoption by the Algerian Government of the National Spatial Planning Scheme (SNAT 2030) which devotes a whole part to climate change.
- During this phase, the "SDAT 2025" Master Plan for Tourism Development has been adopted, however, this scheme has a rather economic and social orientation and does not directly consider climate change.

## Phase 3. 2010-2018

During this last phase important decisions and measures were taken: During this last phase important decisions and measures were taken:

- The preparation in 2012 of the Algerian Climate Plan, entitled "Diagnosis, strategy, action plan and governance" which aims, in particular: i) establish a diagnosis on the issue of CC in Algeria and identify the vulnerabilities of national development with regard to CC. ii) Examine the coherence of sectoral strategies and policies on the CC file. Iii) Propose a strategy to address climate change, transform it into measures by targeting priority adaptation and mitigation measures to anticipate and address risks and reduce CC vulnerabilities and identify conditions and the modalities for the implementation of the measures as well as their monitoring and evaluation.
- Preparation, adoption and transmission of the INDC from Algeria to the UNFCC secretariat
- Adoption of the National Program for the Promotion and Development of New and Renewable Energies and Energy Efficiency.
- Adoption of the national program Aquapêche 2025 and the national strategy of Integrated Coastal Zone Management - 2030).
- The establishment of the National Climate Committee in 2015.
- The ratification of the Paris Agreement on Climate 2016.

During the last two phases of 2000-2010 and 2010-2018, a training and capacity building program was conducted by different institutional actors, and demonstrative projects were carried out in this perspective, notably with the support of many foreign partners. (Examples: UNDP, UNEP, EU, UPM, German Cooperation (GIZ), Belgian Cooperation (BTC), World Bank, etc.).

### Which actors were involved, how and at what stage?

- Sustainable development and climate change mainstreaming require a continuous readjustment of strategies and measures that consider regional and local climate conditions.
- The developed strategies are focused on the short and middle terms (2020-2030); however, climate change mainstreaming should consider short, middle but also long-term planning and interventions including necessary investments for adaptation.
- There are three categories of actors of the policy of fight against the CC in Algeria, the actors of the attenuation (e.g. Energy, habitats and town planning, transport and the actors), the actors of the adaptation (e.g. resources in water, agriculture, health fisheries and aquaculture, tourism) and a third category of actors that have a transversal role, in particular the environment, local authorities, scientific research and professional training as well as economic actors.
- Throughout the process that led to the ratification of the Paris Climate Agreement, the main actors of the CC took part in the preparation, validation / adoption of the strategic documents and climate action plans of the Algeria.
- The intersectoral committee set up during the process of developing the two national communications on CCs in 2001 and 2010 played a fundamental role in this process, as it directly contributed to the improvement of awareness of the different sectors on Algeria's vulnerability to CC. It has also contributed through the various regional conferences to build the capacity of local actors, key links against the CC.

- The creation of the National Agency for Climate Change (ANCC) clarified the intentional missions in the framework of the national CC policy. The ANC appears in this process as a key player with very important missions on this issue, including:
  - i. promoting the integration of the issue of CC into development plans,
  - ii. information, education for studies and contribution to inventories of GHG emissions and sequestration, adaptation to CC, mitigation of their effects and their socio-economic impacts,
  - iii. Contribution to strengthening the national capacities of the different sectors in the field of CC,
  - iv. The production of a database on CC, v. The preparation of a periodic report on CC and business notes. vi. The creation of a directory of activities of the sectors to fight against CC,
  - o vii. Coordination of sectoral actions in the field of CC. The political will, particularly in terms of energy management, which is also an important part of climate action, was expressed during the Intersectoral Council for Energy Management held in 2005.
- During the process of preparing Algeria's INDC and its participation in COP 21 in Paris, the creation of the National Climate Committee (CNC) was instrumental in the success of this process. The CNC is chaired by the Minister of the Environment and is composed, in addition to the Ministry of Environment of Seven other ministerial departments (Foreign Affairs and International Cooperation, Interior and Local Government, Industry and Mines, Energy, Agriculture and Rural Development, National Education, Higher Education and Scientific Research as well as the National Economic and Social Council (CNES) The Committee is responsible for:
  1. Ensuring the coordination, monitoring and evaluation of policies, strategies , CC national programs and action plans
  - ii Support the development of sectoral programs required to address the effects of CC
  - iii Coordinate the work programs agreed by the relevant ministerial departments
  - CC iv) Develop the planned and nationally determined contribution "INDC" from Algeria to the Confederation of Paris on the CC COP21 The CNC was officially designated at the Interministerial Council of 07 July 2015
- During the preparation process of the NCP, a very wide national consultation was carried out, at regional conferences, with the participation of all the actors concerned by the fight against CC (ministries, technical, scientific and academic institutions, civil society, media, territorial actors, economic actors).
- Other actors no less important for action against CC in Algeria contribute directly or indirectly to this action, in particular, the National Center for Cleaner Production Technologies (CNTPP), the National Agency for the Promotion and the Rationalization of Energy Use (APRUE), under the supervision of the Ministry of Energy and Mines (MEM). As well as the National Office of Meteorology (ONM), under the supervision of the Ministry of Transport (MT). The latter plays a key role in climate watch, especially in relation to extreme weather events.
- All sectoral strategic or adaptation documents related to climate change were produced through intersectoral consultations also involving local communities, the scientific community, civil society and the media. Representatives of the National People's Congress and the Senate have also been involved in these processes.

### 3. Cross-analysis: policy options and climate impacts

The analysis of the relevance and coherence of Democratic Republic of Algeria action to fight against climate change is based on two strategic documents, the National Climate Change Policy 2013-2020 and the National Water Strategy (2016-2025).

The achievement of the main strategic documents related to the effects of climate change since 2010 has been conducted on the basis of data from three main sources: (i) Data produced by the sectors themselves (environment, industry, agriculture, tourism, etc.). Some of these data are organized in national databases (for example: forests), regional or local or covering several themes or are specific (example: meteorological observation network). (ii) Data produced by scientific research and carried out as part of research projects, end of study work (PhD thesis, MSc, etc.) (example: coastal erosion). (iii) Simulation data, particularly for climate change scenarios (temperature and precipitation, sea-level rise, energy consumption).

Table 2. Agriculture and climate change "cross analysis sheet"

| Fully considered            |  | Weakly considered  |  |
|-----------------------------|--|--|--|
| Consider the key components |  | Do not consider or no specific knowledge   |  |
| Areas of impact             | National Climate Change Policy 2013-2020   | National Water Strategy (2016-2025)  |  |
| Risks and insurance         | <ul style="list-style-type: none"> <li>• Insurance against climatic hazards &amp; Payment for environmental services</li> </ul>  | <ul style="list-style-type: none"> <li>• Maximizing the climatic potential by improving agricultural management and water resources</li> </ul>                             |  |
| Climate variability         | <ul style="list-style-type: none"> <li>• institutional strengthening, adaptation to climate change, mitigation of emissions of GHG and human capacity building. Its</li> </ul> | <ul style="list-style-type: none"> <li>• involve mainly the sectors of energy, industry, transport, agriculture and forestry, construction and the environment.</li> </ul> |  |

|                                    |   |  |  |
|------------------------------------|---|--|--|
|                                    | <p>implementation mainly concerns the sectors of energy, industry, transport, waste, water resources, agriculture and forests.</p> <ul style="list-style-type: none"> <li>Regional models with the IPCC scenarios applied to Algeria for the period 1990-2020 forecast growth of the average temperature of 0.8°C to 1.1°C, and reduced precipitation 10% with an increase in the sea level of 5 to 10 cm. Increased evaporation and decreased precipitation will accentuate the decrease of water mobilized in dams and groundwater</li> </ul> |  | <ul style="list-style-type: none"> <li>technical capacity and financial resources to overcome and cope with the anticipated changes associated with its vulnerability to climate change.</li> <li>contribute to strengthening Algerian technical and coordination capacity, with a view to enhancing its access to adequate climate financing to address these challenges.</li> <li>identified, and its institutional capacities are built to effectively fulfil its roles and responsibilities in relation to the Fund.</li> <li>facilitate the development, through a stakeholder engagement process, of a country programme, which will include programming priorities and programme/project concepts.</li> <li>National Agency on Climate Change (NACC) could achieve this coordination at the national level and capitalize on the experiences and replicate best practices across the country. It will also run multi-sectoral projects ensuring proper</li> </ul> |
| Water shortages                    | <ul style="list-style-type: none"> <li>Systematic mobilization of all exploitable water resources.</li> <li>Protection and preservation of existing resources and rehabilitation and completion of treatment systems.</li> </ul>  |  | <ul style="list-style-type: none"> <li>Reduction in the drinking and industrial distribution networks losses.</li> <li>Modernization of irrigation methods and cultivation of low water requirements crop varieties.</li> </ul>  |
| Agriculture Production             | <ul style="list-style-type: none"> <li>Standards and support for sustainable agricultural practices and use of agricultural products</li> <li>Incentives to reduce CO2 emissions from agriculture</li> <li>Incentives to reduce CH4 emissions from agriculture</li> <li>Adaptation of climate change in the fight against desertification and land degradation</li> <li>Enhanced protection against extreme rainfall events</li> <li>Adaptation of urban and interurban public transport</li> </ul>   |  | <ul style="list-style-type: none"> <li>Incentives to reduce N2O emissions from agriculture</li> <li>Incentives to reduce deforestation or support for afforestation/reforestation</li> <li>Adaptation agricultural calendars to climate change</li> <li>Selection of varieties and seeds adapted to the arid climate</li> <li>Strengthening local participation in planning, implementation and monitoring of actions relating to mitigation and adaptation to climate</li> </ul>  |
| Sea level rise and Coastal erosion | <ul style="list-style-type: none"> <li>Sea water intrusion</li> <li>Rising seawater levels</li> </ul>   |  | <ul style="list-style-type: none"> <li>Loss of coastal areas due to sea flooding</li> </ul>  |
| Vector borne-diseases              | <ul style="list-style-type: none"> <li>Encouraging development related strategies,</li> </ul>   |  | <ul style="list-style-type: none"> <li>Encouraging development related strategies</li> </ul>   |
| Energy                             | <ul style="list-style-type: none"> <li>Coordinate climate change mitigation through afforestation, rational use of fertilizers, recycling of farm wastes in to compost of energy</li> </ul>   |  | <ul style="list-style-type: none"> <li>Elaborate and implement a plan for the use of alternative energy in agriculture</li> </ul>  |
| Biodiversity loss                  | <ul style="list-style-type: none"> <li>Preservation of the efforts for strengthening and extending the productive base</li> <li>Continuation of the integrated intensification of the agricultural sector</li> <li>Adaptation of the support instruments and supervision of the national product</li> <li>Continuation of human resources and technical support strengthening</li> </ul>  |  | <ul style="list-style-type: none"> <li>The creation of a Biodiversity Observatory coupled with an alert system precocious</li> <li>The establishment of an annual national conference on biodiversity</li> <li>The development of a national ecological compensation mechanism</li> <li>The revision of the statutes of existing state structures (ex: CNDRB, Parks National, etc.)</li> <li>Experimentation with innovative financing mechanisms (Payments for Ecosystem Services, Tarification at the entrance of National Parks, etc.).</li> <li>The development of ecotourism</li> </ul>   |
| Infrastructural issues             |   |  | <ul style="list-style-type: none"> <li>Reclaim lands and construct new agricultural roads according to requests and in view of the adopted plans</li> </ul>  |
| Greenhouse Gas (GHG) Emissions     | <ul style="list-style-type: none"> <li>Growth, emissions will increase by 2020 of 40% over the year 2000.</li> <li>Production of electricity increased since 1997 by about 6% / year, accounting for 40% of CO2emissions.</li> <li>Development of photovoltaic and wind power on a large scale, Biomass (waste recovery), cogeneration and geothermal energy, and the development of solar thermal</li> <li>The spread of low consumption lamps: distribution of 10 millions lamps to 2015 and 35 million to 2020</li> </ul>                    |  | <ul style="list-style-type: none"> <li>Upgrading of low-efficiency fossil fuel-fired industrial boilers.</li> <li>Combining heat and power co-generation.</li> <li>Recovering residual and waste heat and pressure.</li> <li>Finding adapted fuel substitutes and biomass energy technologies.</li> <li>Improving energy efficient transport systems and technologies.</li> <li>Assessing potential of CO2 separation, capture and storage in geological formations.</li> <li>Using heat pumps and condensing gas furnaces.</li> <li>Interconnecting power grids.</li> <li>Preserving fossil resources, diversifying electricity production channels and contributing to sustainable development</li> </ul>  |

|                      |   |  |  |  |
|----------------------|---|--|--|--|
|                      |   |  | <ul style="list-style-type: none"> <li>• Construction of 20,000 high energy performance apartments to 2020</li> <li>• The development of solar water heater (SWH): 100,000 m2 for the individual (SWH 50,000) and 50,000 m2 for the collective to 2020</li> <li>• Labeling and promotion of household electrical equipment with low energy consumption.</li> <li>• Progressive development of solar cooling</li> </ul> |  |
| Fisheries            | <ul style="list-style-type: none"> <li>• Fishing and fisheries is an additional 'highly vulnerable' issue in Algeria</li> </ul>   |  | <ul style="list-style-type: none"> <li>• Fishing and fisheries is an additional 'highly vulnerable' issue in Algeria</li> </ul>  |  |
| Ecosystems           |   |  | <ul style="list-style-type: none"> <li>• Regarding plants genetic resources, a national strategy for the management of Genetic Resources for Food and Agriculture and a national strategy for the biodiversity are under elaboration</li> </ul>  |  |
| Health Public        | <ul style="list-style-type: none"> <li>• Provision of public health facilities with medical equipment necessary for their operation,</li> <li>• The rehabilitation of a number of health structures that date mostly from the colonial era</li> <li>• the promotion of local health for certain pathologies, including mental health</li> </ul> |  | <ul style="list-style-type: none"> <li>• Establishment of efficient operational research laboratories,</li> <li>• Creation of specialized institutes for heavy disease</li> <li>• Adaptation of the institutional and regulatory framework and implementation program of fight against climate-sensitive diseases, such as cardiology, kidney and cancer</li> </ul>  |  |
| Coastal Zone         | <ul style="list-style-type: none"> <li>• Transfer part of the dam water from the coastal zone to the Tellien Atlas zone</li> </ul>  |  | <ul style="list-style-type: none"> <li>• Implementation of the monitoring mechanism and early warning extreme weather</li> <li>• Strengthening the capacity of institutions involved in climate change</li> </ul>  |  |
| Livestock            | <ul style="list-style-type: none"> <li>• Food insecurity is already a cause of concern in Algeria</li> </ul>  |  | <ul style="list-style-type: none"> <li>• Food insecurity is already a cause of concern in Algeria</li> </ul>   |  |
| Decline of landscape |   |  | <ul style="list-style-type: none"> <li>• Promoting sustainable investment and management of pasturelands</li> </ul>  |  |

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