

# Kingdom of Morocco

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

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

Since its ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol, Morocco's ratification of the Climate Convention in 1995, as well as its efforts deployed to abide by the provisions spelt out in the National Initial Communication, demonstrates our willingness to contribute efficiently to the world's struggle to control global warming. The fact that Morocco hosts the Seventh Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC), the first of its kind in Africa, testifies our resolution to draw the world's attention to the specific problems of the African continent.

Morocco signed the United Nations Framework Convention on Climate Change (UNFCCC) during the Earth Summit held in Rio de Janeiro in June 1992 and ratified it in December 1995. As a Non Annex I Party to the Convention, Morocco has to deliver to the Conference of the Parties a Communication in compliance with Articles 4 and 12 of the Convention.

In 2001 Morocco hosted COP 7 in Marrakech. In the same year, a National Committee for Climate Change was set up. The National Committee is chaired by the Department for the Environment, the national focal point for the UNFCCC, and includes nominated contacts from other ministries. The National Committee's main role has been to draft Morocco's national communications to UNFCCC. Morocco's first and second national communications were submitted in 2001 and 2010 respectively.

Following the ratification of the Kyoto Protocol, and with the support of a UNEP/UNDP programme, Morocco established the institutional set-up for the CDM in Morocco (2003–2005). CDM projects are dominated by renewable energy, especially wind. Of the 14 projects currently under way, nearly half are wind projects, with one solar project.

In 2009 Morocco adopted a National Plan of Action on Climate Change (*Plan National de Lutte Contre le Réchauffement Climatique* PNRC), presented at COP15, in Copenhagen, alongside with the Second National Communication. The PNRC focuses on developing renewable sources of electricity generation, particularly solar, and investing in energy efficiency. The plan includes a summary of current emissions and projections of climate impacts, and it picks up the plans of individual ministries. The plan comprises a portfolio of governmental actions to adapt to and mitigate climate change, but with more of a focus on the latter. It confirms the target established by the National Energy Strategy of Morocco and the related National Priority Action Plan (PNAP), both launched in 2008, to meet 10–12% of the country's primary energy demand by 2020 and 15–20% by 2030 from renewable energy sources. A range of sectoral strategies, including the "Plan Maroc Vert" for agriculture complement the Climate Change Plan.

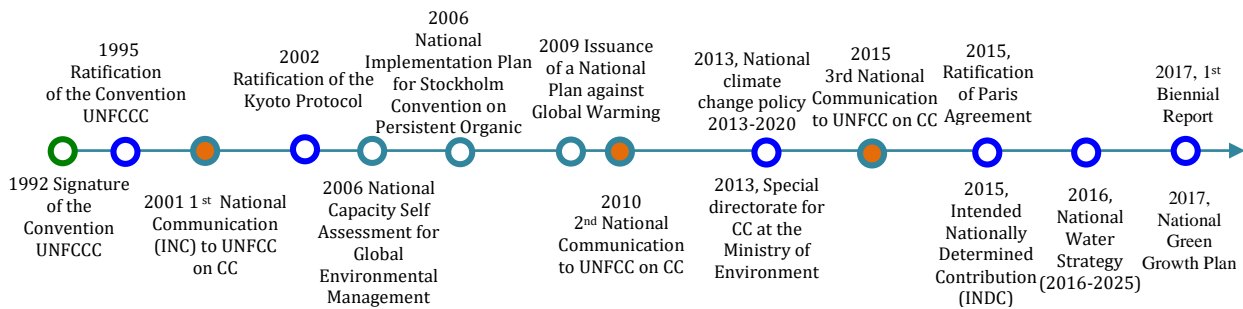
In addition, Morocco has a number of environmental laws, norms and policies addressing water and waste management, air and soil pollution, protection of biodiversity and coastal areas. The most relevant are the National Strategy for the Environment, established in 1995, which was put into effect by the 2003 National Environmental Action Plan. The National Environmental Action Plan prioritises the protection and sustainable management of water, soil and natural resources, the protection of air quality and promotion of renewable energies, preventing major natural and man-made disasters, improving the urban environment, and environmental management. Other relevant laws are the laws on protected areas (2010) and on the protection of wild species of fauna and flora (2011). In 2011 a National Charter for Environment and Sustainable Development was presented. The charter was voted on by the chamber of representatives, on January 8, 2014. The charter forms the framework for national environmental laws as well as for future environmental policy.

Morocco has developed a National Plan against Global Warming (PNRC) that was presented at the COP 15 held in Copenhagen in 2009. The Plan provides for reducing greenhouse gas emissions through the development and diversification of clean energy sources and the implementation of adaptation measures that rely mainly on the water strategy and Green Morocco Plan for Agriculture, also launched in 2009.

The Plan includes mitigation, adaptation and cross-sectoral measures and is based on two strategic pillars: mitigation of greenhouse gases emissions via the implementation of a low Carbon development policy, in particular through the very ambitious "solar project of 2000 MW in the Moroccan desert"; and

the evaluation of the vulnerability and adaptation to climate change impacts. With the National Plan against global warming, Morocco has set up a permanent process for managing these policies which enables making significant progress and ensuring effective monitoring and governance.

Figure 1. Main milestones and dates of climate change in Kingdom of Morocco



**Summary of the main characteristics of the policy and the risks in Kingdom of Morocco**

The National Plan presents the mitigation and adaptation actions taken by the government to combat climate change. It consolidates within the Department for the Environment a number of initiatives related to climate change established by other ministries.

The Plan includes a summary of current emissions and projections of climate impacts. The mitigation measures draw upon the 2008 National Energy Strategy and are mainly related to energy efficiency and the production of renewable energy. They comprise seven areas: energy demand and supply, transportation, industry, waste management, agriculture, forestry and construction. In order to promote mitigation measures, the Department for the Environment should: promote CDM projects; elaborate GHG inventories, particularly aiming at establishing carbon pricing; and establish green taxes for electric equipment and energy efficiency improvement in existing buildings. Adaptation measures are proposed within the areas of weather forecast, water resources, agriculture, forestry, desertification, fisheries, public health, and tourism. Renewables to represent 10-12% of primary energy by 2020 and 15-20% by 2030. Energy efficiency improvements of 15 % by 2020 and 20 % by 2030.

So far no assessment has been conducted on the potential benefits of adaptation to climate change in Morocco. The National Plan against Climate Change identifies a number of adaptation priorities in agriculture, coastal areas and water scarcity.

For agriculture, measures include developing the adaptive capacity of rural populations; developing a national forecast system for agricultural production; creating resistant varieties of wheat; improving the productivity and durability of farming systems through planting techniques; changing agricultural practices; optimising irrigation; improving tenure of agricultural land; incentives and subsidies for training farmers in sustainable farming; and establishing water pricing based on volumetric counting. For coastal areas, legislation will enable the implementation of integrated management of coastal zones and their adaptation to rising sea level by building dykes or other protective structures.

Measures to tackle water scarcity include education and public awareness about water conservation; installation of individual meters; revising tariff systems; investing in water saving and water recycling measures; and investing in new dams and drilling of deep wells.

Established the Moroccan Agency for Solar Energy (MASEN) as a Public Private Partnership. MASEN was established to ensure the implementation of the Moroccan solar programme. The MASEN aims to achieve the development of integrated production of electricity from solar energy, with a minimum total capacity of 2,000 MW. MASEN ensures the management of the projects and is liable for the decisions taken within the projects. Targets Launch of Solar Programme of 2000 MW by 2020.

In addition, Morocco receives technical and financial assistance from a number of international organisations to develop and implement climate policies.

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

High impact (high impact, requiring major action and immediate action)			Negligible impact (the impact is limited but requires follow-up)		
Medium impact (increasing impact, requiring minor action, monitoring and medium-term action)			Uncertain impact (not enough evidence and need for further monitoring and analysis)		
Areas of impact	Currently (2017)		Near future (2020-2030)		Longer term (2030-2050-2100)
<b>Direct effects on costs</b>	Maximizing the climatic potential by improving agricultural management and water resources				
Risks and insurance					
Climate variability	<p>Since the 1960s, climate trends include:</p> <ul style="list-style-type: none"> <li>-An average temperatures rise of 1°C, with rate of increase most rapid from April-June.</li> <li>-Increase in the annual number of days (21) and nights (40) classified as "hot."</li> <li>-More erratic and overall declining precipitation.</li> <li>- Shift in seasonal rainfall patterns -longer and more intense rain events in October and November (often causing floods ) and substantial reductions during the rest of the year</li> <li>- Increase in the frequency and intensity of extreme events ( droughts, floods, heat waves)</li> </ul>		<ul style="list-style-type: none"> <li>- Increase in temperature from 1.1 to 1.6 ° C in 2030</li> <li>- Decrease in rainfall by 14% in 2030</li> <li>-Precipitation would diminish by about 15% and would result in a reduction in water supplies in the region of 30%.</li> <li>- The impact of climate change can be estimated from the regulated volumes calculated in hydraulic simulations performed on the basis of the observed series 1939-2006, reduced by approximately 22%.</li> <li>- Rising temperatures of 1–1.5°C by 2020 (rate of warming faster in the interior).</li> <li>- Reduced snowpack in the Atlas Mountains.</li> <li>- Continued increase in the number of days and nights classified as "hot"</li> <li>- Increased incidence of drought conditions.</li> </ul>		<ul style="list-style-type: none"> <li>- Increase in temperature from 2.3 to 2.9 ° C in 2050, and from 3.2 to 4.1 ° C in 2080</li> <li>- Decrease of precipitation from 13 to 30% in 2050 and from 21 to 36% in 2080</li> <li>-Rise in sea levels between 18–59 cm by 2100.</li> <li>-Sea level may rise between 18 and 59 cm before the end of the century</li> <li>-Decrease in average precipitation by 10 –20 percent across the country; 30 percent decrease for the Saharan region by 2050</li> <li>-Precipitation would diminish by about 20% and would result in a reduction in water supplies in the region of 40%.</li> <li>-The impact of climate change can be estimated from the simulations on the 1939-2006 observed series, with a reduction of around 35%.</li> <li>-The reduction in water resources at all dams, whether built or planned.</li> <li>-Increased evaporation from all dams, whether built or planned</li> <li>-Decrease of average precipitations of 10 to 20% across the country, with a 30% decrease for the Saharan region by 2100.</li> <li>-Dry periods will also extend of 5 days by 2100</li> <li>-Heat waves will last 26 days longer in 2100</li> </ul>
<b>Direct effects on demand</b>	Water is something of a rare commodity in Morocco. Renewable natural water resources are estimated at approximately 22 billion m <sup>3</sup> per year, that is approximately 700 m <sup>3</sup> per capita per year, near the threshold of 500 m <sup>3</sup> per capita per year, which is widely recognised as the scarcity threshold that indicates developing scarcity and underlying crises. Morocco's water resources are unevenly distributed across the region; the coastal plains are flooded consistently while the south suffers from water shortages year-round. Renewable water resources per person have declined by almost 60 percent since 1960 due to non-climate stressors such as population growth in the north, irrigation expansion, and urban, industrial and tourism development. At the same time, rising temperatures and more erratic		<ul style="list-style-type: none"> <li>- An increase in the needs for the water necessary for irrigated crops (somewhere between 7 and 12%).</li> <li>Reduction of energy production from dams and thus the expected performance of hydroelectric plants planned.</li> <li>- Precipitation would diminish by about 15% and would result in a</li> </ul>		<ul style="list-style-type: none"> <li>-Precipitation would diminish by about 20% and would result in a reduction in water supplies in the region of 40%. (2050)</li> <li>-Accelerated siltation of dams from heavy rainfall</li> <li>-Increased reliance on groundwater resources; risk of overexploitation and insufficient recharge</li> <li>-Reduced surface water quality due to concentration of pollutants</li> <li>- Surface and ground water sources, are projected to decrease between 7–40% by 2080.</li> </ul>
Water resources					

	rainfall have reduced river flows and increased evaporation and siltation of storage dams, leading to a 20 percent reduction in overall water resources in the last 30 years.		reduction in water supplies in the region of 30%	
Agriculture Production	<p>Agriculture accounts on average for 16 percent of GDP but employs about 40 percent of the country's workforce. Morocco's agriculture depends heavily on the weather, a typical characteristic of third-world countries. In 2008 the Moroccan government released a new agricultural strategy, called "Plan Maroc Vert (PMV)". Beside the objective of promoting "aggressively" the productivity of the agriculture, the PMV addresses as well climate change, overexploitation of groundwater, and alleviation of poverty. Agriculture is critical to the Moroccan economy and rural livelihoods, but has suffered as population pressure and erratic rainfall have pushed production into fragile and degraded land. Crop production is primarily rainfed (87 percent) and is highly vulnerable to increased rainfall variability (particularly barley and wheat). The recent 2016 winter grain harvest is a striking example: harvested yields were 70 percent lower than in 2015 due to widespread drought. Hotter, drier conditions will increase crops' water requirements by up to 12 percent, increasing demand for irrigation and further stressing limited water resources. Drought also promotes proliferation of the Hessian fly (midge), increasing risk of damage to wheat yields.</p>		<p>-A decrease in cereal yields by 50% in dry years and 10% in normal years. In the two cases, the result of the projections made for cereal production in 2020 points to a deficit, in comparison with the 60 million quintals security food program set by the Department of Agriculture. In fact, this production would be in the order of 14 million quintals in dry years and 51 million quintals in normal years. But the need for cereals in 2020 would be in the order of 130 million quintals (85 million of which for human consumption). -Reduced yields (50-75 percent) of rainfed crops during dry years</p>	<ul style="list-style-type: none"> <li>- the rate of increase of average water needs at around 5% by 2030, 10-15% by 2050 and 20-40% by 2080.</li> <li>- Shortened growing season; reduced yields and/or lowered productivity</li> <li>- Decreased water availability for irrigation, reducing profitability of irrigated agriculture (need to pump groundwater).</li> <li>- The reduction in crop cycles.</li> <li>- The shift and reduction of the growth period.</li> <li>- The increase in risks of dry periods at the beginning, middle and end of the annual crop cycle.</li> <li>- Migration towards the north of the arid zone</li> <li>- The extinction of some crops (such as the Alpist) and some tree species (such as the Argan)</li> </ul>
Sea level rise and Coastal erosion	<ul style="list-style-type: none"> <li>• Coastal erosion sensed, due to an increase in the frequency/intensity of episodic weather events, sea-level rise and/or alteration of coastal circulation patterns</li> </ul>			Coastal erosion and structural damage to the national archaeological heritage
Vector borne-diseases			Uncontrolled sewage disposal and no monitoring of septic tanks	Increased risk of death/malnutrition, diarrhoea, floods, malaria, cardiovascular disease
Energy				Considered a discrete set of measures feeding into the transition to a low-emission development
Biodiversity loss	Temperature-induced changes or declines in marine fish stock and marine biodiversity			Temperature-induced changes or declines in marine fish and biodiversity
Infrastructural issues			Coastal flooding and inundation during high sea level conditions	Higher costs to protect and maintain waterfronts
Greenhouse Gas (GHG) Emissions	Morocco's total GHG emissions in 2012 (the most recent year with complete data), were 72.51MtCO <sub>2e</sub> , totaling 16% of global GHG emissions. The energy sector serves as the predominant source of GHG emissions in Morocco, at 54.84MtCO <sub>2e</sub> , with the subsectors of electricity/heat, transportation, and other fuel combustion constituting the majority of energy emissions. The agriculture sector is the next largest emitter at 12.68MtCO <sub>2e</sub> . The waste, bunker fuels, and land-use change and forestry (LUCF) sectors were relatively		In the longer-term, the government is employing an energy efficiency program covering the residential, commercial, industrial, transportation, and public administration sectors, in order to significantly reduce	-A CO <sub>2</sub> emissions market of approximately US\$ 233 billion in 2050 (compared to US\$ 60 billion in 2007)..

	<p>minor emitters, at 3.63, 2.02, and 1.07MtCO<sub>2</sub>e, respectively.</p> <p>Programs for wind, hydro, and solar development are expected to raise the share of renewable energy in the installed electric capacity. The goal is to install 2 GW of wind and 2 GW of solar energy by 2020, which would equate to 42% of installed power capacity. To help achieve this goal, Morocco is building the Ouarzazate solar plant which, when complete in 2018, will be the world's largest solar plant with a capacity of 580 MW.</p>		<p>GHG emissions by 2020.</p> <p>- Investment forecasts for the production of electricity will require the equivalent of the water consumed by a population of about 3 to 4 million inhabitants in order to meet the cooling needs of inland thermal power stations by 2030.</p>	
Fisheries	<p>Morocco's thriving fisheries sector produces an estimated 1 million tons annually (mainly sardine and mackerel) and constitutes an important source of foreign currency inflows, valued at \$1 billion. The sector is an important employer for coastal and rural communities, but is under growing threat from non-climate stressors such as illegal and unregulated fishing practices and pollution. Climate change will further aggravate these issues as increased temperatures induce migration of fish species, particularly plankton, and open the way for invasive species to outcompete those upon which the industry relies. Fish habitats are impacted by rising sea levels and by toxic algae blooms caused by warmer Mediterranean waters</p>		<p>-Temperature-induced migration of plankton and/or changes in composition and hatching</p> <p>-Decreased productivity of crustaceans, corals and echinoderms</p> <p>Loss of habitat and spawning grounds</p> <p>-Increasing the consumption of fish in Morocco to reach 16 kg / inhabitant / year in 2020 against 10 kg currently</p>	<p>-Increased upwelling and changes to ocean circulation, decreasing productivity</p> <p>- Increased risk of toxic algae blooms, impacting shellfish</p> <p>- Loss of livelihoods for coastal populations</p>
<p><b>Broader indirect effects</b></p> <p>Ecosystems</p>	<p>Morocco hosts a remarkable diversity of climate zones; the High Atlas Mountains are considered a biodiversity hotspot in the Mediterranean region.</p> <p>In addition to their natural and social value, Morocco's ecosystems have economic potential (ecotourism, for example) that is vulnerable to a changing climate. Of particular concern are cedar and forests, which are already under pressure due to population growth and continued use of firewood for fuel. Forest dieback has been observed in the Rif, Middle and High Atlas Mountains, where native trees are being replaced by more drought tolerant species. Coastal erosion and sea level rise threaten habitats of rare and endemic species in wetlands and estuaries in places like the Moulouya River delta.</p> <p>The oasis in Sous-Massa suffers from land degradation and biodiversity loss associated with higher temperatures and drier conditions.</p>		<p>-Biodiversity loss and/or migration of species to cooler, more humid climates</p> <p>-Increased forest dieback and lack of regeneration (particularly Sapin de Talasemtante, Tizilfri Cedar, Rif Ketama, Rif Cedar and Spanish Juniper)</p> <p>-Increased risk of forest fires (particularly in the Rif Mountains )</p>	<p>Habitat loss due to coastal erosion; disturbance to important migratory sites for birds</p> <p>Increased land degradation and lower water levels in oases and wetlands</p>
Public Health	<p>The vulnerability of health to climate change in Morocco can be explained by the presence of endemic foci of diseases that may be aggravated by climate change, including malaria, schistosomiasis, typhoid and cholera. Although efforts to control these diseases are being made, the risk of their reactivation under the effect of climate change is still possible</p> <p>In addition to deaths from drowning, flooding causes extensive indirect health effects, including impacts on food production, water provision, ecosystem disruption, infectious disease outbreak and vector distribution. Longer term effects of flooding may include post-traumatic stress and population displacement.</p> <p>In Morocco, the prevalence of stunting in</p>		<p>-Proliferation of Hessian fly populations and emergence of new pests and diseases</p>	<p>-Under a high emissions scenario heat-related deaths in the elderly (65+ years) are projected to increase to almost 50 deaths per 100,000 by 2080</p> <p>- A rapid reduction in emissions could limit heat-related deaths in the elderly to just over 14 deaths per 100,000 in 2080.</p>

	children under age 5 was 14.9% in 2011; the prevalence of underweight children and wasting in children under 5 was 3.1% and 2.3%, respectively, in 2011.			
Coastal Zone	<p>The coastal zone is home to the country's major agglomerations, the highest rural population densities, the densest infrastructure and communications networks, and the main economic activities. The area also benefits from an important hydrographic network which has allowed the development of several irrigated perimeters.</p> <p>The coastal fringe also has abundant fish resources, diverse landscapes, and natural sites that allow it to provide a very attractive environment.</p> <p>The advantage that Morocco derives from its privileged position and its coastline of 3,446 km, can become a handicap because of the risks of the rise of the level of the sea. These risks on the coastal spaces are numerous and varied but the most significant are generally: submersion of low coasts, coastal erosion and salinization of estuaries and coastal aquifers.</p> <p>A preliminary assessment of the degree of vulnerability of the Moroccan coastal zones made it possible to establish a vulnerability analysis of the paralic environments which identified the Nador lagoon and the Oualidia-Sidi Moussa lagoon and the Sebou estuary as the most vulnerable systems. As for that of large coastal cities, it highlights Tangier, Casablanca, Mohammedia and Agadir as the most vulnerable urban agglomerations.</p> <p>Sea level rise will have consequences on the environment but also on different sectors of the economy, especially tourism and will require interventions (protection, rehabilitation.) that will not always be easy, nor even possible sometimes.</p>		<p>- an overall sea level rise of 20 cm by 2030</p>	<ul style="list-style-type: none"> <li>- a sea level rise of 17.1 cm by 2050 and 32.1 cm by 2100</li> <li>- The flood area could reach 43 km<sup>2</sup> by 2100</li> <li>- By 2050, the losses of the current area of the beaches, due to the rise of the sea level (about 9% for the low hypothesis and 26% for the average hypothesis).</li> <li>- By 2100, losses could affect 72% of the current area.</li> <li>- a relatively large exposure of the west coast of Morocco to the risk of tsunami the return period is of the order of 200 years.</li> <li>- Seawater intrusion would affect up to half of the coastal aquifer area by 2100</li> </ul>
Livestock				Shift of grazing areas and periods for livestock

**How do the measures identified intend to address each specific impact?  
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 Implementation Plan for Stockholm Convention on Persistent Organic Pollutants (POPs)	2006 MEMEE	<ul style="list-style-type: none"> <li>• Prepare the ground for implementation of the Stockholm Convention</li> <li>• Assist Morocco in meeting its reporting and other obligations under the convention</li> <li>• Strengthen Morocco's national capacity to manage POPs and chemicals generally</li> </ul>	<ul style="list-style-type: none"> <li>• Enabling Activity (EA) is to create sustainable capacity and ownership in Morocco to meet the country's obligations under the Stockholm Convention, including initial preparation of a POPs National Implementation Plan (NIP).</li> <li>• Describe how Morocco will meet its obligations under the Convention to phase-out POPs sources and remediate POPs contaminated sites in the country. By facilitating dialogue, information exchange and co-operation between relevant stakeholders - including the governmental, non-governmental, academic and private sectors - the EA will help to raise awareness and knowledge of POPs related issues in Morocco. As a result, these issues will be better taken into account in planning and strategy formulation for different economic and technical sectors.</li> <li>• The EA will strengthen Morocco's role in international scientific forums and the negotiation process related to POPs.</li> </ul>
National Plan	2008	<ul style="list-style-type: none"> <li>• Changing activity</li> </ul>	<ul style="list-style-type: none"> <li>• The National Plan presents the mitigation</li> </ul>



Against Climate Change	MEMEE	<ul style="list-style-type: none"> <li>• Energy efficiency</li> <li>• Renewables</li> <li>• Nuclear or CCS or fuel switch</li> <li>• Non-energy5</li> </ul>	and adaptation actions taken to combat climate change. It consolidates within the Department for the Environment a number of initiatives related to climate change established by other ministries. It presents a summary of current emissions and projections of climate impacts, and it integrates the plans of individual ministry
National Green Morocco Plan	2008 Ministry of Agriculture and Maritime Fishing	<ul style="list-style-type: none"> <li>• The strategy of the Green Morocco Plan for a sector that contributes 19% to the national GDP, 15% in agriculture and 4% in agribusiness.</li> <li>• the Plan Maroc Vert seeks to increase value added in the sector and create jobs while making agriculture more sustainable, inclusive, and resilient.</li> <li>• The Plan Maroc Vert includes support for climate-smart practices in both rainfed and irrigated agriculture.</li> <li>• In rainfed agriculture, direct seeding is a technique which conserves soil moisture and topsoil and helps stabilize cereal yields in times of drought.</li> <li>• In irrigated agriculture, the introduction of drip irrigation seeks to address growing water constraints.</li> </ul>	<ul style="list-style-type: none"> <li>• Morocco's vision of inclusive green growth is based on better management of natural resources to generate more jobs, value and wellbeing from existing assets.</li> <li>• The end of fossil fuel subsidies has favored an increase in renewable energy investments and allowed government spending on social programs to go up.</li> <li>• Strategies for agriculture and fisheries seek to make the most of limited water and fish resources.</li> </ul>
The National Agency for Energy Efficiency and the Development of Renewable Energy (ADEREE)	2010 MEMEE	<ul style="list-style-type: none"> <li>• promote Renewable Energy and Energetic Efficiency and contribute to the implementation of national policy aimed at reducing energy dependence and preserving the environment. It also works on widespreading the use of Energy Efficiency and Renewable Energy to contribute to the Sustainability of Development of the country, in accordance with the principles of good governance.</li> </ul>	<ul style="list-style-type: none"> <li>• The ADEREE aims to contribute to the implementation of the national policy on renewable energy and energy efficiency. It proposes national, regional and sectoral plans for the development of renewable energy and energy efficiency. The ADEREE is also competent to design and implement development programmes in the areas of renewable energy and energy efficiency.</li> </ul>
Framework Law 99-12 on the National Charter for the Environment and Sustainable Development Morocco 2014	2014 MEMEE.	<ul style="list-style-type: none"> <li>• The most significant are the National Charter for the Environment and Sustainable Development, the 2015-2030 National Strategy for Sustainable Development and the intended nationally determined contribution (INDC) commitments through which Morocco is committed to reduce 32 per cent of its greenhouse gas emissions by 2030. The integration of sustainable development principles in various sectoral policies - including the industrial sector - remains a challenge, while the potential for job creation through the green economy needs to be further harnessed</li> </ul>	<ul style="list-style-type: none"> <li>• Enhanced institutional capacities to mitigate and reduce vulnerabilities related to climate change and natural disasters</li> <li>• Improved management of natural resources and ecosystem services</li> <li>• Measures related to energy efficiency and renewable energies in place</li> </ul>
Nationally Determined Contribution (NDC) to the Paris Agreement: Morocco	2016 MEMEE	<ul style="list-style-type: none"> <li>• Morocco's first NDC, submitted 19 September 2016, is an update of its intended nationally determined contribution of 5 June 2015. The NDC includes a commitment to reduce GHG emissions by 42% below business as-usual (BAU) levels by 2030, conditional on international support. Its unconditional target is 17% below BAU levels by 2030.</li> <li>• According to the NDC, Morocco's GHG mitigation goals rely in large part on an important transformation of the country's energy sector. It aims to reduce the country's heavy reliance on foreign energy sources and increase the share of renewable energy, while responding to growing demand for energy to ensure the socioeconomic development and well-being of its citizens. The primary</li> </ul>	<ul style="list-style-type: none"> <li>• Reaching over 52% of installed electricity production capacity from renewable sources by 2030</li> <li>• Reducing energy consumption by 15% by 2030</li> <li>• Substantially reducing public fossil fuel subsidies, building on reforms already undertaken in recent years</li> <li>• Substantially increasing the use of natural gas, through infrastructure projects allowing liquefied natural gas imports.</li> </ul>

		goals that underlie this energy transition are the following: Reaching over 52% of installed electricity production capacity from renewable sources by 2030. Reducing energy consumption by 15% by 2030. Substantially reducing public fossil fuel subsidies, building on reforms already undertaken in recent years. Substantially increasing the use of natural gas, through infrastructure projects allowing liquefied natural gas imports	
Water National Strategy	2016 Delegate Ministry in Charge of Water	<ul style="list-style-type: none"> <li>• Demand management and water valuation: <ul style="list-style-type: none"> <li>- Efficiency of irrigation: Conversion to localized irrigation of 50 000 ha / year</li> <li>- Better match between hydraulic and hydro-agricultural equipment</li> <li>- Drinking water, industrial and tourism saving program</li> </ul> </li> <li>• Supply management and development of the water offer: <ul style="list-style-type: none"> <li>- Continued mobilization of surface water</li> <li>- Desalination of seawater: 500 Mm<sup>3</sup> / year by 2030.</li> <li>- Reuse of treated wastewater: 300 Mm<sup>3</sup> / year by 2030.</li> </ul> </li> <li>• Water resources preservation, natural environment protection and climate change adaptation: <ul style="list-style-type: none"> <li>- Protection of underground water resources by adopting a new mode of governance: groundwater contracts.</li> <li>- Protection of the quality of RE and fight against pollution: National programs of sanitation and fight against Pollution</li> <li>- Safeguarding watersheds, oases, and wetlands</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Rarefication of water resources accentuated by climate change Increased pressure on water resources.</li> <li>• Degradation of water quality (Pollution).</li> <li>• Low level of efficiency and value of water use.</li> <li>• Reduce vulnerability to naturel water risk and adaptation to climate change</li> </ul>
1st biennial report of Marroco-United Nations framework Convention on climate change	2016 MEMEE	<ul style="list-style-type: none"> <li>• Establishment of an Interministerial Monitoring Committee (ISC) responsible for guidance, monitoring, approval of annual work plans and validation of work on the different phases of the development of the Third National Communication (TCN) and the first biennial report. It is composed of representatives of the main partners (ministerial departments, UNDP, agencies, offices, ...) concerned by the problem of mitigation and adaptation in Morocco.</li> <li>• Establishment of a Project Management Unit (PMU) responsible for regular monitoring of TCN and BUR project activities. It is composed of the National Coordinator, a technical assistant, the MoE representative, the UNDP representative and any other partner as needed.</li> </ul>	<ul style="list-style-type: none"> <li>• Contribute to the efforts of the international community to combat climate change in a context of sustainable development.</li> </ul>

## 2. Policy options to address such impacts

### Elaboration of the policies and measures and advancements

The Secretary General of the Environment (SGE) 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.

The implementation of the various projects and measures planned at the national level in the fight against global warming (mitigation and adaptation) is confronted with the insufficiency of financial resources. Support for international cooperation (eg from the United Nations Environment Program (UNEP) and / or the United Nations



Development Program (UNDP)) and the mobilization of additional resources are crucial for implementation of the CC Policy in Morocco

### 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 Convention on Persistent Organic Pollutants (POPs)	Ministry of Land Planning, Urbanism, Housing and Environment	Create sustainable capacity and ownership in Morocco to meet the country's obligations under the Stockholm Convention, including initial preparation of a POPs National Implementation Plan (NIP)	Ministry of Land Planning, Urbanism, Housing; Environment Sectoral stakeholders (Most of the Ministries engaged)
National Plan Against Climate Change	Ministry of Land Planning, Urbanism, Housing and Environment	Supports the application of Morocco's vision in terms of climate change. Offers a coordinated approach to the different strategies and plans already initiated, as well as an operational framework until 2040.	Ministry of Land Planning, Urbanism, Housing & Environment Sectoral stakeholders (Most of the Ministries engaged)
The National Agency for Energy Efficiency and the Development of Renewable Energy (ADEREE)	Ministry of Energy, Mines and Sustainable Development	a leading energy efficiency agency, a hub of excellence and a crossroads between institutional, civil society, private sector and national and international cooperation.	Ministry of Energy, Mines and Sustainable Development National Agency
Framework Law 99-12 on the National Charter for the Environment and Sustainable Development Morocco 2014	Ministry of Energy, Mines and Sustainable Development	recognize environmental rights that should be protected and respected. It focuses on the duties of the State, local authorities, public institutions and companies concerning sustainable development; strengthen the legal protection of resources and ecosystems by listing the types of actions or steps that the State proposes to take in order to fight against all forms of pollution; establish sustainable development as a core value shared by all segments of society and as a process followed by the public policy development; create a coherent and efficient system to implement the contemplated measures; lay down the groundwork for a system of environmental responsibility with a mechanism of financial compensation for damage to the environment; establish environmental police that ensures respect for these rules.	Ministry of Energy, Mines and Sustainable Development National Agency
Nationally Determined Contribution (NDC) to the Paris Agreement: Morocco	Ministry of Energy, Mines and Sustainable Development	Reaching over 52% of installed electricity production capacity from renewable sources by 2030. Reducing energy consumption by 15% by 2030. Substantially reducing public fossil fuel subsidies, building on reforms already undertaken in recent years. Substantially increasing the use of natural gas, through infrastructure projects allowing liquefied natural gas imports	Ministry of Energy, Mines and Sustainable Development
National Green Growth Plan	Ministry of Agriculture and Maritime Fishing	contributes 19% to the national GDP, 15% in agriculture and 4% in agribusiness. This sector employs over 4 million rural and creates about 100 thousand jobs in the field of food.	Ministry of Agriculture and Maritime Fishing

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

Morocco has an institutional mechanism for national climate governance favorable to consultation and action, comprising a set of entities responsible for the different aspects of climate policy; the country also has several bodies responsible for research into the observation and analysis of the effects of global warming.

• **State Secretariat to the Minister of Energy, Mines and Sustainable Development, responsible for sustainable development (before, Ministry of Energy, Mines, Water and Environment (MoE)):**

National Focal Point of the UNFCCC, the State Secretariat is responsible for coordinating the national implementation of the Convention.

The national framework opens up to civil society and economic operators through Interministerial Committees:

- **A National Committee on Climate Change (CNCC)**

Grouping the representatives of the main public actors involved in the problem of CC in Morocco, in addition to representatives of the private sector and civil society.

- **National Scientific and Technical Committee - Climate Change (CNST-CC)**

Composed of national experts (public institutions, universities, consulting firms) and covering the main themes of climate change.

- **Interministerial Committee for Follow-up (CIS)**

In charge of the follow-up and validation of the technical studies carried out by Morocco in the framework of the respect of its commitments vis-à-vis the UNFCCC (National Communications, INDCs, NAMAs, etc.)

- **Climate Change Competence Center of Morocco (4C Morocco):**

Platform aimed at mobilizing the actors of Moroccan society and international financial partners, by strengthening the skills of the various actors and exchanging information on CC. Morocco 4C will also be responsible for developing a national GHG emissions inventory system;

- **National Authority Designated CDM**

Responsible for reviewing and approving the national projects of the Clean Development Mechanism under the Kyoto Protocol.

- **National Committee for Monitoring and Monitoring Air Quality**

Regional Committees for monitoring and monitoring Air Quality.

- **Designated National Authority responsible for the Green Climate Fund**

The purpose of which is to review projects submitted for GCF funding.

- **Directorate of National Meteorology (DMN)**

Provides technical support and is the focal point of the Intergovernmental Panel on Climate Change (IPCC).

- **Royal Center for Remote Sensing Spatial (CRTS)**

Responsible for the collection, production and analysis of Earth Observation data and develops applications and methodologies in the field of space techniques and related disciplines. It also carries out the national program in the field of remote sensing space in partnership with the various ministerial departments concerned, private operators and universities.

The CRTS conducts various projects / studies that have a direct or indirect relationship with CC, based mainly on the use of spatial observation in different economic sectors: forest evolution, desertification, oceanography and fisheries resource management, land use etc.

- **National Observatory of the Environment of Morocco (ONEM) and regional variation (Regional Observatories of the Environment and Sustainable Development (OREDD))**

The National Observatory for the Environment of Morocco has the following missions:

- Assess the state of the environment at both national and regional levels;
- Define and update the Sustainable Development Indicators (SDIs);
- Implement tools and systems for environmental information management;
- Evaluate the performance of public policies in the field of environmental management;
- Disseminate environmental data and share it as part of the national network or regional environmental networks.

- **Ministry of Agriculture and Fisheries**

Ministry of Agriculture and Fisheries - Department of Agriculture - is responsible for developing and implementing the Government policy concerning Agriculture and Rural Development.

To this end, it is in charge of the following assignments, taking into account the attributions of the other government departments:

- Define and implement the agricultural fitting out Government Policy ;
- Examine and develop an intervention strategy to improve and restructure the organization of the agricultural sector ;
- Take the main arrangements to rationalize the use of water resources for irrigation ;
- Develop and implement the Government policy to promote the agricultural production and ensure the upgrading of professional agricultural organizations in production chains ;
- Take all measures to encourage investment in the agricultural sector ;
- Perform studies and research for the development of agriculture at regional and national levels ;
- Develop juridical and regulation texts related to agricultural activities ;
- Collect, analyze and distribute the statistics and agricultural information ;
- Define and implement the strategy in the higher agricultural education, agronomic research and agricultural technical and vocational training ;
- Participate in the negotiations related to the free trade in agriculture and the management of the agreements in this field ;
- Lead all the prospective studies related to research of remunerative outlets for plant and animal production;

- Develop and participate in transformation and industry upgrading of plant and animal production studies and projects ;
- Examine and follow the evolution of national and international markets and prices of agricultural products, as well as production costs and to suggest suitable measures of intervention ;
- Develop government policy for the plants, animals and food products safety throughout the national territory and at border posts ;
- Propose and implement the Government policy in the field of rural development, in coordination with the concerned government authorities ;
- Ensure the Secretariat of the Permanent Interdepartmental Commission of the Rural Spaces and Mountain Areas Development.

• **Ministry of Energy, Mines and Sustainable Development**

Decree No. 2-14-541 of 11 Chaoual 1435 (August 8, 2014) setting out the attributions and organization of the Ministry of Energy, Mines, Water and Environment -Department of Energy and mines-

- Text published in Arabic B.O No. 6289 of 8 September 2014.
- Text published in French B.O No. 6326 of 15 January 2015.

The central directorates of the Ministry of Energy, Mines and Sustainable Development of Morocco are:

Direction of Geology;

Directorate of Mines and Hydrocarbons;

Fuels Department;

Renewable Energies and Energy Efficiency Department;

Direction of Electricity;

Directorate of Control and Risk Prevention;

Directorate of Observation, Cooperation and Communication;

Directorate of Resources, General Affairs and Information Systems;

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

The analysis of the relevance and coherence Kingdom of Morocco’s 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).

Due to the variety of plans, strategies and programs that conform to the national framework for action against CC in Morocco, the analysis of provisions and / or considerations that directly / indirectly concern CC and / or sustainable development is based on the consideration of three documents: the National Strategy (NTS) and the National Plan for the Fight against Global Warming (PNRC, 2009), the CC Policy in Morocco (MCCP, 2014).

The production of the main documents produced in Morocco in relation to the requirements of the UNFCCC in terms of the impacts of CC was conducted on the basis of data, information and resources from the following sources:

- Data from national agencies and government / public bodies:
- Ministries (particularly, the Ministry Delegate in charge of the Environment of Morocco), the Office of the High Commissioner for Planning (HCP, Moroccan institution of prospective, analysis and economic forecast, in charge of the national system of statistical production); the Statistics Directorate; the Office of the High Commissioner for Water and Forests and Combating Desertification (HCEFLCD); the State Secretariat in Charge of Water; the National Agency for the Development of Oasis Zones and the Argan Tree (ANDZOA); the National Office of Electricity and Drinking Water (ONEE); Agency for Agricultural Development (ADA); Moroccan Agency for Energy Efficiency (AMEE); Agency for Development of Renewable Energies and Energy Efficiency (ADEREE); Morocco Energies (MEMEE); National Portal of Local Authorities (CTFN); Directorate of National Meteorology (DMN);
- The data produced within the projects carried out under the Mechanism for a Clean Development in Morocco (CDM);
- Data produced by the academic sector and scientific research, national and international;
- Data produced by the private sector (e.g. consulting firms and / or technical assistance firms);
- Resources from international cooperation organizations (CCUNCC, UNDP, UNEP, FAO, World Bank, GIZ, AFD, OECD, CIHEAM, Blue Plan, etc.) and projects carried out under international agreements (eg projects / national actions or NAMAs to mitigate GHG emissions);
- Simulation and model data, particularly for climate change scenarios and GHG mitigation estimates in different scenarios;
- Data and resources from non-governmental organizations (NGOs) including Enda Maghreb Morocco.

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>Morocco's engagement regarding the international climate change regime</li> </ul>		<ul style="list-style-type: none"> <li>Contribution to sustainable development in Morocco through a strategic dimension : the MCCP</li> </ul>
Water shortages	<ul style="list-style-type: none"> <li>worsening the desertification phenomenon and impacting water resources.</li> <li>The demand management and water efficiency by: the water saving irrigation program; drinking, industrial and touristic water saving, with incentives to use efficient practices.</li> <li>The preservation and protection of water resources, natural habitats and sensitive areas;</li> <li>Reducing vulnerability to floods and droughts through: the Works of protection against flooding (PNI); the drought management by river basin Plan; improved hydrometeorological forecasting.</li> </ul>		<ul style="list-style-type: none"> <li>Management and supply development through: <ul style="list-style-type: none"> <li>the construction of 60 large dams to mobilize 1.7 billion m<sup>3</sup>/year and several small dams;</li> <li>the transfer of raw water resources in the basins of the North to the South (800 Mm<sup>3</sup>/year);</li> <li>the mobilization of unconventional resources through the reuse of treated wastewater, capture rainwater, desalination of seawater and brackish water desalination.</li> </ul> </li> <li>The demand management and water efficiency by: <ul style="list-style-type: none"> <li>the water saving irrigation program;</li> <li>drinking, industrial and touristic water saving, with incentives to use efficient practices.</li> </ul> </li> <li>The preservation and protection of water resources, natural habitats and sensitive areas;</li> <li>Reducing vulnerability to floods and droughts through: <ul style="list-style-type: none"> <li>the Works of protection against flooding (PNI);</li> <li>the drought management by river basin Plan;</li> <li>improved hydrometeorological forecasting</li> </ul> </li> </ul>
Agriculture Production	<ul style="list-style-type: none"> <li>The National Irrigation Water Saving Programme targeting the alleviation of water stress and a protective and sustainable management of water resources for irrigated agriculture. In order to do this, it is planned to move to drip irrigation over an area of 555,000 ha, which would make a considerable saving of water resources of about 1.4 billion m<sup>3</sup>/year, in 2020;</li> </ul>		<ul style="list-style-type: none"> <li>strengthening the integration of CC by the institutions concerned. The achievement of this component is assigned to ADA;</li> <li>promotion of CC resilient technologies to farmers benefiting from Pillar II projects. This will be done by the Regional Directorates of Agriculture with the assistance of ADA.</li> </ul>
Sea level rise and Coastal erosion	<ul style="list-style-type: none"> <li>Sea water intrusion</li> </ul>		<ul style="list-style-type: none"> <li>Sea water intrusion</li> <li>Loss of coastal areas due to sea flooding</li> </ul>
Vector borne-diseases	<ul style="list-style-type: none"> <li>Strengthen institutions responsible for preparing for and responding to the effects of CC on public health</li> </ul>		<ul style="list-style-type: none"> <li>Implement adaptive strategies at local &amp; national level to minimize impacts of CC on population's health</li> </ul>
Energy	<ul style="list-style-type: none"> <li>Modernizing the irrigation system in Lebanon and promoting the use of alternative sources of water and energy in agriculture</li> <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>the preservation of marine biodiversity and endangered species</li> <li>The protection of this biodiversity is a country priority resulted in the National Strategy for the Conservation and Sustainable Use of Biological Diversity</li> </ul>		<ul style="list-style-type: none"> <li>the conservation and sustainable use of biodiversity;</li> <li>improving the knowledge and the promotion of scientific research;</li> <li>the awareness and education through the development of specific and intended programs designed for target populations.</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>The rehabilitation of uncontrolled waste sites</li> <li>The recovery of methane gas from controlled and uncontrolled landfills;</li> <li>The establishment of recycling and recovery of waste.</li> <li>develop capacity to produce renewable energy</li> </ul>		<ul style="list-style-type: none"> <li>Concerning the GHG emissions mitigation, and through the implementation of land use change and management projects in the PMV, the baseline is estimated at 61,773,196 TeqCO<sub>2</sub> with a potential reduction estimated between 16,439,680 (pessimistic scenario) and 117,000,000 TeqCO<sub>2</sub> (ultimate scenario).</li> <li>dependency on foreign energy imports is almost total</li> <li>rational use of energy especially through energy efficiency measures and the use of renewable energies.</li> </ul>
Fisheries	<ul style="list-style-type: none"> <li>Fishing and fisheries is an additional 'highly vulnerable' issue in Morocco</li> </ul>		<ul style="list-style-type: none"> <li>Fishing and fisheries is an additional 'highly vulnerable' issue in Morocco</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>the protection of population health towards the impacts of climate change and the reduction of health risks inequalities;</li> <li>improved epidemiological surveillance</li> </ul>		<ul style="list-style-type: none"> <li>the emergency and response plans preparation;</li> <li>the reinforcement of professionals abilities concerning CC;</li> <li>the research promotion on the impacts of climate</li> </ul>

	<ul style="list-style-type: none"> <li>system;</li> <li>strengthening the health facilities resilience towards extreme events;</li> <li>Conduct an updated assessment of the consequences of climate change, vulnerability and adaptation of the health sector.</li> <li>Implement measures to strengthen institutional capacity and technical capacity to work on climate change and health.</li> <li>Develop an integrated disease surveillance and response system including climate information.</li> <li>Estimate the costs of implementing health sector resilience to climate change.</li> </ul>		<ul style="list-style-type: none"> <li>change on health;</li> <li>the information and effective awareness of the various populations: makers vulnerable persons,</li> </ul>
Costal Zone	<ul style="list-style-type: none"> <li>Selective protection of different coastal zones according to the level of their vulnerability to climate change and their more or less valuable (heritage) or useful (socio-economic) nature;</li> <li>The choice to combine the continuation of traditional activities - while reforming them - and the launch of other innovative and protective, to develop the economic and social value of coastal areas and their value in monetary terms, to prevent a too fast consumption of available land;</li> <li>The taking into account of the future, even distant (sustainable development) at the social, economic, environmental and educational levels, and this by anticipating from now on prospects that will only be realized in the long term</li> </ul>		<ul style="list-style-type: none"> <li>The development of an integrated coastal development strategy and its resources</li> <li>The valorization of coastal biological and landscape resources</li> <li>The preservation of the marine environment and the quality of the coast</li> <li>The establishment of specific legal and institutional instruments for coastal space and resources</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>Food insecurity is already a cause of concern in Morocco</li> </ul>		<ul style="list-style-type: none"> <li>Food insecurity is already a cause of concern in Morocco</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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