

A RESPONSE TO CLIMATE CHANGE IN THE AGRICULTURE SECTOR – A FOCUS ON MOROCCO

WATER POLICY BRIEF



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1. ABSTRACT

The policy issues presented in this brief are drawn from the research study conducted by the International Water Management Institute (IWMI), the Center for Mediterranean Integration (CMI) and the Foreign, Commonwealth & Development Office (FCDO). The study showcases future high-resolution national climate data sets that cover the critical agriculture and water management areas of Morocco, providing evidence-based data, which is key to supporting decision-makers in developing strategic plans to adapt to climate change.

This policy brief recognizes the significance of climate adaptation as a key development issue in Morocco. Indeed, without addressing future climate trends and implementing long-term strategies for managing water resources and adapting climate-sensitive sectors, climate change threatens to compromise future development prospects in Morocco.

For policymakers to efficiently develop strategies to adapt to climate change, this brief sets out four key policy recommendations as follows:

- Strengthen public awareness of climate change. Awareness-raising is an important component of climate adaptation in Morocco as it helps with managing climate impacts, understanding climate variability and enhancing adaptive capacity, particularly for the agriculture and water sectors.
- Improve institutional capacity for water governance. Institutional arrangements should be made that facilitate the integration of climate adaptation into development planning and the involvement of all relevant stakeholders at all stages.
- Link scientific assessments to decision-making. Without evidence-based data on the future impacts of climate change, adaptation actions will remain informed only by previous experiences. Research efforts should enable innovative solutions and contribute to better collaboration between science, planning and policy.
- Scale up climate-smart agriculture (CSA). As a means of tackling food insecurity and climate challenges, CSA could increase productivity and enhance the resilience of livelihoods, while reducing greenhouse gas emissions.

2. INTRODUCTION

Climate change poses a major challenge to the future of development, due to its impact on natural ecosystems, food security and economic growth, making it one of the major concerns among experts and policymakers across the globe. The climatic phenomenon is not only a global environmental problem but also a regional and local issue, which raises major developmental concerns and shows variations in impact, depending on the nature and geography of each region and territorial area.

The Maghreb is considered to be one of the regions that are highly exposed to climate impacts and are expected to witness a rise in temperature above the global average and a further decrease in precipitation. Morocco, in turn, is one of the countries that will witness severe climatic changes, in a climate context characterized mainly by hot, dry summers and mild winters. The sectors that are largely dependent on climate-sensitive natural resources, such as agriculture and all those relying on the use of water, are the hardest hit by climate change.

The exploitation of natural resources is exacerbated by excessive demand due to population growth, urbanization and demand for production and consumption. Future forecasts generated from the IWMI-CMI-FCDO study indicate that temperature increase over mountain areas and plains in Morocco has important implications for crop and livestock production, mainly due to heat stress at critical times and limited water supply for irrigation as a result of evapotranspiration. Moreover, the likely changes in precipitation patterns indicate an increase in drought periods in critical agricultural areas.

Figure 1. Annual mean temperature change 2081–2100 compared with 1986–2005, as projected by the CMIP5 models for the RCP8.5 scenario

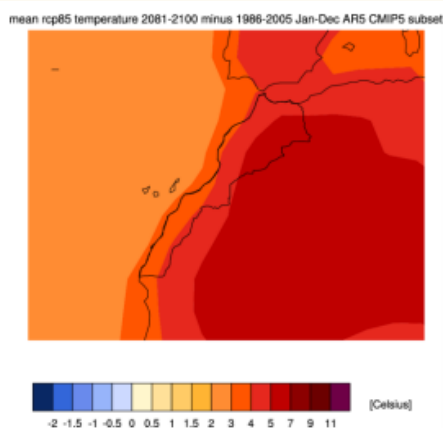
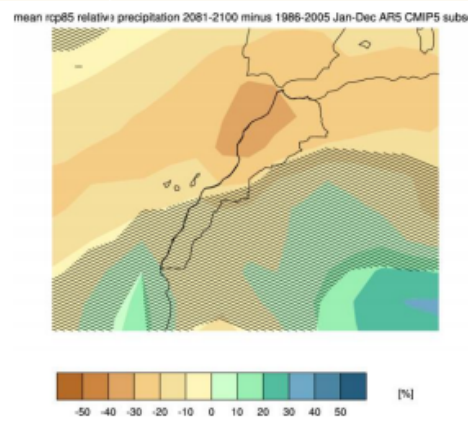


Figure 2. Annual mean relative precipitation change 2081–2100 compared with 1986–2005 as projected by the CMIP5 models for the RCP8.5 scenario



Source: KNMI Climate Explorer;
<https://climexp.knmi.nl/start.cgi>;
<https://openknowledge.worldbank.org/bitstream/handle/10986/30603/130404-WP-P159851-Morocco-WEB.pdf?sequence=1&isAllowed=y>

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Note: RCP stands for Representative Concentration Pathway. CMIP5 stands for Coupled Model Intercomparison Project, Phase 5.

3. CLIMATE CHANGE AND MOROCCO'S DEVELOPMENT

For the Maghreb region, and Morocco in particular, climate change has a clear impact on water resources, especially due to decreases in precipitation and higher temperatures, coupled with urbanization, population growth and industrial and economic development. The country's agricultural sector will be most affected, leading to a decrease in crop yields in the more humid and semi-arid areas of Morocco where agriculture is predominantly rain-fed.

The agricultural sector has always been a strategic sector for Morocco, with a disproportionate impact on the country's overall economic and social development. It still maintains its position as an essential sector for society and the economy, contributing to about 15 per cent of gross domestic product (GDP) and employing about 40 per cent of the country's workforce.¹ In rural areas, the development (or decline) of the agricultural sector is considered decisive as it accounts for three quarters of employment and women represent 42.5 per cent of workers.²

Several factors have impacted the performance of the agricultural sector in Morocco in the last few years, in particular increasing water scarcity due to climate change and the COVID-19 pandemic. In addition to increasing challenges caused by climate change, the pandemic has compounded the burden of addressing the increasing demand for water and food in a region where managing those commodities was already posing economic and political challenges.³

Climate change is putting increased pressure on water and land resources, and is likely to have severe impacts on agricultural production. Morocco has experienced significant warming trends, with mean annual temperature increasing by 0.9°C since the 1960s and observed average increases of 0.2°C per decade.⁴ As for precipitation, the IWMI-CMI-FCDO⁵ study's results show changes towards drier conditions in the future, especially in areas that currently have higher rainfall, and an increase in precipitation variability. The impact of climate change on the agricultural sector in Morocco will result in shortened growing seasons, reduced crop yields and lower productivity.

The contribution of the agricultural sector to economic growth in Morocco is likely to shrink due to climate change, with reduced rainfall and worsening drought conditions significantly affecting agricultural productivity in the country. On average, yields of wheat grains and sugar crops are

¹ Taheripour, F., Tyner, W.E., Haqiqi, I. and Sajedinia, E. (2020). *Water Scarcity in Morocco: Analysis of Key Water Challenges*. Washington, DC: World Bank.

² International Fund for Agricultural Development/International Labour Organization (2018). *Country Brief: Morocco: Young Women's Employment and Empowerment in the Rural Economy*. Geneva: ILO.

³ CMI, Growth Dialogue, 2020.

⁴ World Bank Group (2021). *Climate Risk Country Profile: Morocco*. Washington, DC: World Bank Group.

⁵ Center for Mediterranean Integration, International Water Management Institute. 2021. National Climate Change Data Sets to Support Planning and Investment in Morocco. Marseille, France and Rabat, Morocco. © CMI, IWMI. <https://www.cmimarseille.org/knowledge-library/national-climate-change-data-sets-support-planning-and-investment-morocco>. License: CC BY 3.0 IGO.

expected to decline by 10 per cent by 2050,⁶ accounting for 53 per cent of total agricultural production and 50.5 per cent of total arable land.⁷ The decrease in crop yields will significantly affect livelihoods, with greater dependence on imported food products, making Morocco more vulnerable to fluctuations in international food prices.

4. COPING WITH DROUGHT AND CLIMATE CHANGE IN MOROCCO

Climate projections from the 2013 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5)⁸ indicate that Morocco will continue to experience increasingly frequent droughts over the coming years. In response to that situation, the Government of Morocco has been implementing drought management plans and interventions at both the national and regional levels. The Green Morocco Plan (PMV by its French initials) covering the period 2008–2020 put in place several integrated sectoral strategies to deal with drought and cope with the threat of climate change by maximizing the agricultural sector's potential. Strategies in the PMV included conserving agricultural practices such as direct seeding and no tillage, using improved crop varieties more suited to drought conditions, reducing the areas dedicated to water-intensive crops and adopting more efficient irrigation practices. The PMV has been complemented by other national plans, including the National Irrigation Water Saving Programme (PNEEI in French), which aims to protect water resources and improve the livelihoods of rural populations by sustainably managing those resources.

The PNEEI has contributed to (i) modernizing irrigation farming through the development of localized irrigation to enhance network efficiency; (ii) converting conventional irrigation into localized irrigation over a total land area of 555,000 hectares at a cost of EUR 3.5 billion; (iii) developing mobilized water resources; (iv) strengthening maintenance and rehabilitation to ensure better water supply services and the durability of equipment; (v) implementing institutional reforms in the irrigation sector to improve its competitiveness; and (vi) continuing efforts to promote participatory irrigation management so as to involve and empower users in water resource management and development.⁹

Morocco has taken important measures to cope with drought risk management in recent years, which included restructuring the institutional context for agriculture and water resource management, drought monitoring and early warning systems, drought response interventions and

⁶ This projection was made before the 2022 Ukraine-Russia conflict.

⁷ Amiri, N., Lahlali, R., Amiri, S., EL Jarroudi, M., Khebiza, M.Y. and Messouli, M. (2021). Development of an integrated model to assess the impact of agricultural practices and land use on agricultural production in Morocco under climate stress over the next twenty years. *Sustainability* 13(21), 11943. <https://doi.org/10.3390/su132111943>.

⁸ Intergovernmental Panel on Climate Change (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J. et al. (eds.). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

⁹ Verner, D., Tréguer, D., Redwood, J., Christensen, J., McDonnell, R., Elbert, C. et al. (2018). *Climate Variability, Drought, and Drought Management in Morocco's Agricultural Sector*. Washington, DC: World Bank.

risk insurance. However, there is still room for further improvement in this regard. Building on the achievements of the PMV, Morocco still needs a renewed strategy for the agricultural sector with a strong focus on ensuring the sustainable management of water resources by leveraging climate-smart technologies. The effectiveness of the proposed policy actions will largely depend on the Moroccan authorities' implementation capacity and the involvement of other stakeholders.

5. POLICY RECOMMENDATIONS

5.1 Strengthen public awareness of climate change

The successful implementation of a climate adaptation policy requires strong links between public awareness, knowledge and engagement. For instance, understanding climate scenarios (past, current and future) for decision-making could increase the adaptive capacity of farmers to make use of limited water resources and increase crop productivity. Making knowledge relating to climate change more accessible would enable all stakeholders to engage with climate policy; indeed, when people have access to scientific information, they tend to change their behaviour and attitudes. In that regard, open access to scientific information and online access to educational resources, journals and scientific publications are options for making knowledge more accessible.

There is also a need to translate scientific knowledge into practice. Using indicators applied to water resources is one example, with those indicators potentially allowing the wider public to understand the situation in terms of water quality, rainfall, flooding and drought, thus helping to establish a better response. Measuring those parameters could also provide an opportunity for cross-country cooperation in a region with scarce water resources. The new data generated from the IWMI-CMI-FCDO¹⁰ study is particularly important, as it offers climate information that could support national and regional climate adaptation efforts.

5.2 Improve institutional capacity for water governance

In order to improve agricultural water management, increase crop production and optimize the use of water resources, particularly in dry seasons, institutional efficiency must be enhanced through innovative processes. This could include making use of economic and regulatory instruments that promote water efficiency through tariffs that reflect the cost of supply at the abstraction level. The subsequent revenues could finance expenditure programmes that contribute to maintaining water infrastructure. In the long term, an abstraction charge could be considered to reflect the opportunity cost for a particular kind of water use. This would benefit from a long-term inclusive approach that could help with avoiding conflicts around water and support stakeholder engagement at both the national and local levels.

Another innovative approach is smart water management, which combines information and communications technologies to manage water resources. Stakeholders involved in water management, such as government institutions, water utilities, professional associations,

¹⁰ Support Planning and Investment in Morocco. Marseille, France and Rabat, Morocco. © CMI, IWMI. <https://www.cmimarseille.org/knowledge-library/national-climate-change-data-sets-support-planning-and-investment-morocco>. License: CC BY 3.0 IGO.

non-governmental organizations and the private sector, should all be supported in enhancing water resource management and tackling key sustainability issues in the water sector, such as overexploitation and water security.

Enhancing stakeholders' capacity to understand and address the impacts of climate change is also of vital importance. Support could take the form of technical assistance related to project management, investment in equipment and associated tools, digital solutions for remote sensing and data analytics, regulation to create favourable conditions for private sector involvement and knowledge-sharing to improve the governance of water resources and adapt to increasing water scarcity.

5.3 Link scientific assessments to decision-making

The IPCC was created to provide policymakers with regular scientific assessments on climate change, its implications and potential future risks. The IWMI-CMI-FCDO report and other research studies also fall under the same category as they provide evidence-based assessment to support the decision-making process. Scientific knowledge is key for tackling climate change as it enables innovative solutions and contributes to better collaboration between data, planning and policy.

The extent to which scientific assessments are being used to inform local decision-making on climate change in Morocco is something to be explored. Furthermore, climate-change assessment reports also need to be more comprehensible to non-expert audiences. Accessibility and clarity of the language used in scientific reports sometimes remain an issue,¹¹ and it is recommended that policy concerns be flagged more clearly in final reports, which could better inform decision-making. Short summaries of the reports with key findings, statistics and facts would also be useful for policymakers, particularly at the local level.

5.4 Scale up climate-smart agriculture

Given the current and projected future impacts of climate change, the Maghreb cannot continue with business-as-usual agricultural practices. Rather, it needs to support a broader implementation of the climate-smart agriculture (CSA) approach. Moreover, the agricultural sector accounts for a large and growing share of greenhouse gas emissions, with agriculture in Morocco ranked as the second largest emitter (at 12.68 MtCO₂e) after the energy sector.¹² CSA is proposed as an integrative approach to mitigate ongoing climate change and adapt to its impacts, helping achieve food security in the context of stretched resources and reduced agricultural productivity. The CSA approach includes climate-smart technologies, improved irrigation practices, conservation of soil moisture, crop rotation and water conservation.

In 2018, Morocco developed a CSA Investment Plan (CSA-IP) with the support of the World Bank and the Food and Agriculture Organization of the United Nations (FAO). The plan will be implemented over the 2020–2030 period and includes projects that support zero tillage, irrigation modernization with more water-efficient technologies, conservation of soil and water basin, and capacity-building projects to establish a monitoring system using meteorological information and biological risk-management systems. The CSA-IP builds on previous strategies such as the PMV, which has also

¹¹ Editorial (2021). Write accessibly. *Nat Biomed Eng* 5, 1111–1112. <https://doi.org/10.1038/s41551-021-00816-8>.

¹² United States Agency for International Development (2016). *Greenhouse Gas Emissions Factsheet: Morocco*. Washington, DC: USAID.

promoted CSA, for example, through the transition from cereals to tree crops in rain-fed areas, since trees are better adapted to drought and provide a higher return to small farmers.

Morocco has embarked on a broad range of CSA approaches by paying targeted attention to small farmers, with the aim of facilitating their access to technologies and services and promoting their integration into the market.¹³ The country is making farming more rewarding and attracting private investment in the agrifood sector by lifting regulatory and financing barriers.¹⁴ This provides the Maghreb countries with a great opportunity to benefit from Morocco's experience. Implementing CSA requires creating an enabling policy environment and setting up incentive schemes to encourage farmers to adopt such practices and enable the private sector to invest in climate-smart technologies. Ideally, this should be accompanied by a valuable evidence base for CSA implementation that could be shared with all stakeholders, combining various types of knowledge on policy frameworks, national and local institutions, financing options and field-level practices.


6. CONCLUSION

In summary, climate-change adaptation has critical policy relevance for Morocco and the wider Maghreb region. Urgent policy actions are required across the key issues identified in this policy brief: (i) strengthen public awareness of climate change; (ii) improve institutional capacity for water governance; (iii) link scientific assessments to decision-making; and (iv) scale up CSA.

Those four core objectives should act as the cornerstones of a policy framework that could be followed by a clearly articulated climate and agricultural development strategy. Given the critical significance of climate change in Morocco, policymakers at the national and local levels should mainstream climate-change adaptation into rural development planning. Institutional coordination mechanisms, resource mobilization and monitoring and evaluating climate-change adaptation at all levels are likely to be the most important drivers for building resilience in Morocco.

¹³ Hou, X., Morales, X.Z., Obuya, G.A., Bobo, D. and Braimoh, A. (2016). *Climate Smart Agriculture: Successes in Africa*. Washington, DC: World Bank.

¹⁴ Soliman, A. (2021). A window of opportunity to avoid devastating climate outcomes in MENA, 20 October. <https://www.mei.edu/publications/window-opportunity-avoid-devastating-climate-outcomes-mena>. Accessed 4 July 2022.



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