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Proceedings from the Regional Workshop on
Climate-Smart Agriculture
in the Near East and North Africa

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A framer harvesting crops from the field

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Cattle grazing in Sudan

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Proceedings from the Regional Workshop on

Climate-Smart Agriculture in the Near East and North Africa

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FOREWORD

Climate change poses an existential threat to many populations in the Near East and North Africa (NENA) region and across the world, and the international community is responding with increasing focus to this challenge. This is exemplified by the leadership shown by governments during the 21st Conference of the Parties (COP), held in 2015, where 192 parties signed the Paris Agreement, committing to keep the rise in global temperatures to below 2 °C. This landmark agreement marked the beginning of concerted national actions to mitigate climate change and adapt to its impacts. The countries' commitments are manifested in their Intended Nationally Determined Contributions (INDCs).

As part of these commitments, governments recognized the essential role of the agricultural sectors in addressing climate change. Agriculture is a significant contributor to global climate change. At the same time, those who depend directly on agriculture for their livelihoods are amongst the most vulnerable to climate change impacts. In the Near East and North Africa region, the contribution of greenhouse gas emissions to climate change is negligible. However, climate change is expected to have significant negative impacts on crops, livestock, forestry and aquaculture in the region, with a 10–20 percent reduction in crop yields by 2050. For this reason, the region's priority is to ensure that people, especially smallholder farmers, are equipped to adapt to the impacts of climate change.

In October 2018, FAO published the seminal report, "Impacts of climate change on farming systems and livelihoods in the Near East and North Africa". This report served as the baseline assessment for understanding the challenges that smallholder farmers in the NENA region face due to climate change. The report focuses on smallholder farmers because they are often the most vulnerable to the impacts of climate change. Furthermore, they generate 80 percent of domestic agricultural production in the region. Thus, any impact on their livelihoods affects the food security of the entire region.

With this report, programmatic work to determine how to effectively support the smallholder farmers across the region could begin. The Islamic Development Bank and the Regional Office for the Near East and North Africa of the Food and Agriculture Organization of the United Nations (FAO) hosted the Regional Workshop on Climate-Smart Agriculture (CSA) in the Near East and North Africa on 8–10 October 2018. This was the first workshop of its kind in the region, bringing together stakeholders from

15 Islamic Development Bank (IsDB) member countries from the NENA region.

The workshop aimed to highlight the impact of climate change on farming systems and livelihoods in the region and the potential of CSA to mitigate negative impacts and achieve the INDCs. The workshop built a common understanding of the concept and importance of climate-smart agriculture amongst key decision makers in the ministries of agriculture, water resources and environment. It also enabled the participants to align national priorities with potential future courses of action in mainstreaming CSA at national levels. These priorities and plans were documented in country-specific roadmaps that can guide the scaling up of CSA work in the region.

Effective programming on climate-smart agriculture requires that it be applied from the community level up to policy level through a coordinated approach. Partnerships, such as the one that has been fostered between the IsDB and FAO, are key to the coordination and alignment that will ensure effective and systematic expansion of CSA initiatives to build resilience.

This report of the workshop proceedings will help document the first steps to expanding regional, programmatic work for CSA adoption that will ensure the food security of this region in a changing climate.

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ACRONYMS

BRAC	Building Resilience of the Agriculture Sector to Climate Change
COP21	21st Conference of the Parties to the UNFCCC
CSA	Climate-smart agriculture
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse gas
GMP	Green Morocco Plan
INDC	Intended Nationally Determined Contributions
IsDB	Islamic Development Bank
LDC	Least Developed Countries
LULUC	Land use and land use change
NDC	Nationally Determined Contributions

EXECUTIVE SUMMARY

This document provides an overview of the purpose, context and content of the Regional Workshop on Climate-Smart Agriculture in the Near East and North Africa, held 8–10 October 2018. The aim of the workshop was to build the capacity of the countries in the region mainly ministries of agriculture and the environment) in to understand and potentially use climate-smart agriculture (CSA). This was a timely workshop as CSA becoming more important as all countries will need to revise and update their Nationally Determined Contributions to be submitted to FCCC in the coming year. Therefore, building a common understanding of priorities and options for adapting the agricultural sector to climate change is of great importance.

The workshop included an overview of regional climate change trends, the impact these will have on farmers' livelihoods and the concept of climate-smart agriculture. Climate change is likely to make the region hotter and drier and to increase the frequency and intensity of extreme events. The most extreme changes in temperature will occur in Iran (Islamic Republic of), Mauritania and the Sudan. The most extreme changes in precipitation will occur in Iran (Islamic Republic of) and along the entire coast of the Maghreb, especially in northern Morocco.

The impacts on smallholder farmers will vary depending on their farming system, their vulnerability and exposure to climate change as well as their adaptive capacity. However, impacts will generally include reduced agricultural production and productivity, which will impede sustainable rural livelihoods. On and off-farm diversification will become necessary. Part of this diversification and resilience building can be achieved by implementing climate-smart agricultural practices appropriate for each particular farming system. CSA practices that focus on the sustainable use of soil and water resources will be of particular importance in the semi-arid to arid NENA region.

The countries that participated in the workshop were Egypt, Iran (Islamic Republic of), Iraq, Jordan, Lebanon, Mauritania, Morocco, Saudi Arabia, the Sudan, Tunisia, the United Arab Emirates (UAE), and Yemen. Each country was given the opportunity to present the status of climate change, national policies related to climate and agriculture (in some cases including NDCs) and smallholder farming in their country.

In addition, the countries worked in groups, according to major farming systems, to identify roadmaps for implementing CSA actions. The common priorities amongst all countries were: (1) the development of early warning systems, (2) the development of crop varieties that are resistant to heat, drought and salt and (3) the farmer capacity development through various extension services. These roadmaps will guide the next steps, in accordance with the needs of the countries in this region.

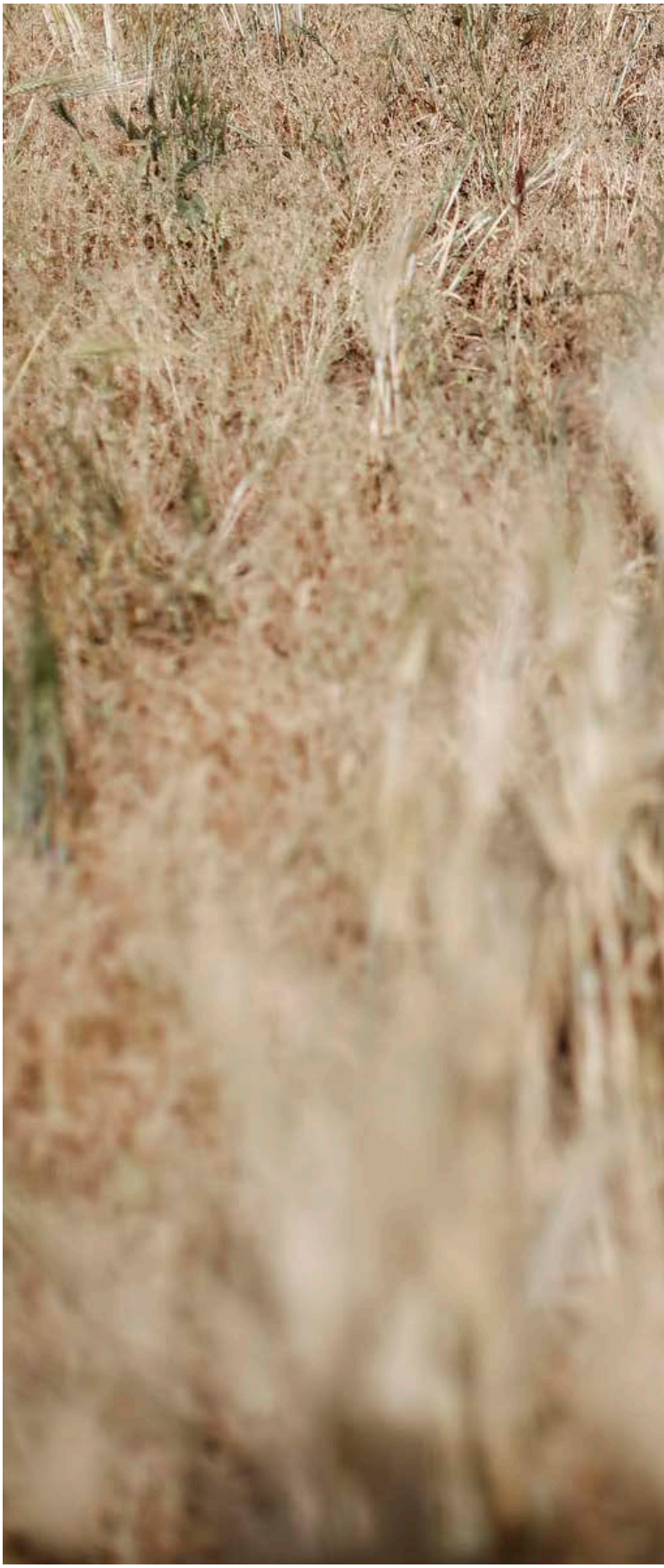
Seasonal workers harvesting cucumbers.
©FAO/Marco Longari

PART 1
Introduction and context

Karsaneh Harvesting.
©FAO/Omar Sanadiki

Background

Agriculture is often the first sector to be affected by climate change. In the Near East and North Africa, where farmers are already living on the margin of agricultural production due to the limited land resources and water scarcity in the region. Climate change is likely to push them over the edge. Smallholder farmers bear the brunt of climate change challenges given their direct dependence on natural resources and their disconnect from social protection support systems. Therefore, it is imperative to build their resilience to the impacts of climate change through various adaptation measures, key among these being climate-smart agricultural practices and policies. In order to respond to this challenge, the Food and Agriculture Organization of the United Nations (FAO) and the Islamic Development Bank (IsDB) organized the first Regional Workshop on Climate-Smart Agriculture in the Near East and North Africa. This event brought together over 40 stakeholders from ministries of agriculture and environment of 15 countries, thus facilitating collaboration between the two sectors and ensuring effective mainstreaming of CSA into ministerial action (Figure 1). The workshop provided capacity building on CSA and its application to the region. It also provided an opportunity for the stakeholders to use the information provided to develop roadmaps for implementing CSA based on their local conditions and farming system typologies.

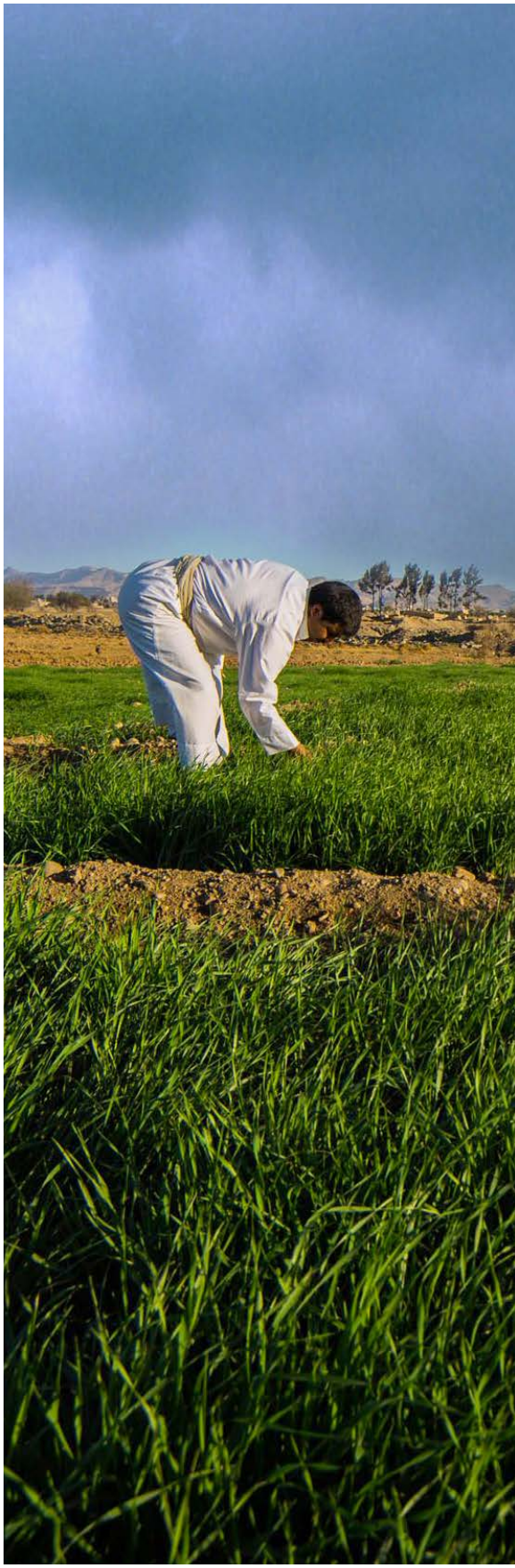


Climate change trends in the region

This session provided an overview of the climate change trends in the region based on the research from the first climate change modelling, downscaled specifically to the NENA region. This was generated by the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR). This initiative aims to provide a common platform for assessing, addressing and informing responses to climate change impacts in the region by serving as the basis for dialogue, priority setting and policy formulation on climate change at the regional level. Given the relatively limited emissions from agriculture and forestry in the region, the initiative focuses primarily on climate change adaptation.

In all scenarios discussed in the RICCAR process, temperatures in the region are increasing and are expected to continue to increase until the end of the century. Temperature rises of between 1.2 and 1.8 °C are expected by mid-century (2046-2065) in a moderate case scenario. In a worst-case scenario (also known as business-as-usual), these increases are likely to be between 1.7 and 2.6 °C by the same time-period. The most extreme temperature rises will be seen in Iran (Islamic Republic of), Mauritania and Sudan (Figure 2). Precipitation patterns are more varied (Figure 3). Precipitation will increase in some areas and decrease in others. However, in the areas where precipitation increases, there is also likely to be an increase in the intensity of precipitation, which could result in soil erosion and flash flooding. Between 64 and 88 percent of the region will be moderately exposed to precipitation changes by mid-century. The Maghreb, in particular, will observe a dramatic decrease in precipitation, especially in the Tingitana Peninsula in Northern Morocco (ESCWA *et al*., 2017).

Furthermore, extreme events are also likely to increase throughout the century. Extreme climate indices and seasonal projections provide valuable insights into climate change impacts, particularly at smaller scales of analysis. Warm spells are likely to become much longer, shifting from an average of 16 days per year between 1986 and 2005 to 83–118 days per year by 2046-2065. Dry spells are also projected to last longer.



A farmer working in a wheat field in the targeted area supported by FAO.
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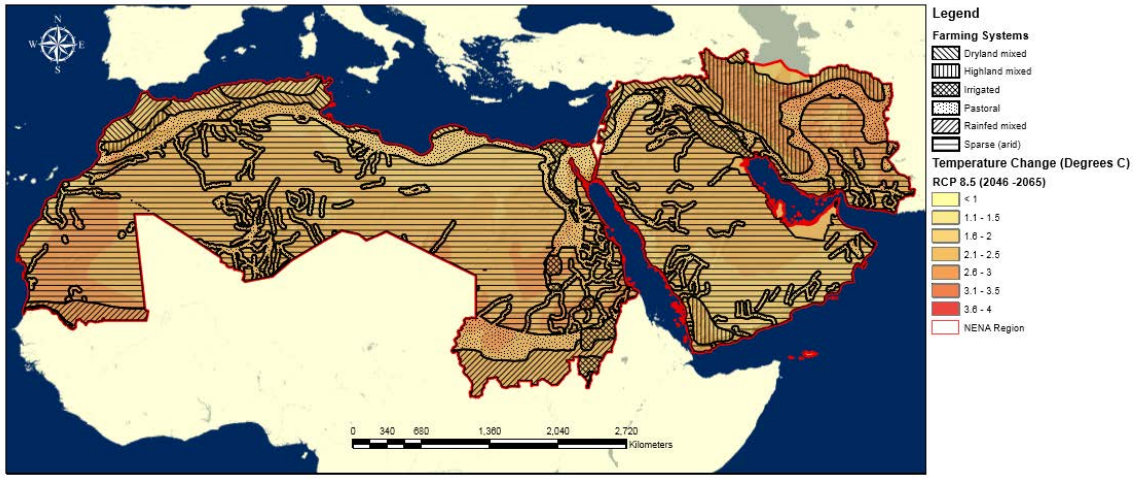


Figure 1. Temperature change by 2046-2065 in NENA under RCP 8.5 (Lewis *et al*., 2018)

***Source**: Lewis, P., Monem, M.A. and Impiglia, A. 2018. Impacts of climate change on farming systems and livelihoods in the near east and North Africa.*

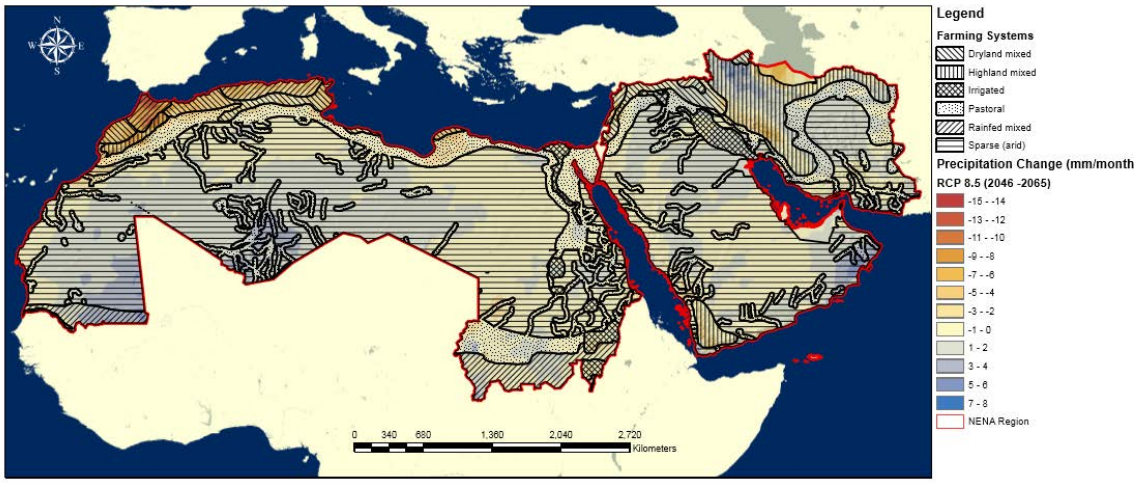


Figure 2. Temperature change by 2046-2065 in NENA under RCP 8.5 (Lewis *et al*., 2018)

***Source**: Lewis, P., Monem, M.A. and Impiglia, A. 2018. Impacts of climate change on farming systems and livelihoods in the near east and North Africa.*

As a consequence, over 50 percent of the surface area of the region's major cropland systems (including wheat, maize, sorghum, potatoes, vegetables and olives) are exposed to the two highest classes of vulnerability, as defined by the RICCAR process. Climate change will also shorten crop growing seasons in certain parts of the region leading to changes in the agriculture calendar . The impact of climate change on livestock is related to declining water and feed resources due to recurrent droughts, degradation of rangelands and desertification. Cattle are the most affected by climate change, followed by goats and sheep. Climate change will also impact forest productivity and possibly result in shifts in species composition (ESCWA *et al*. 2017).

Climate change and farmers' livelihoods

To better understand the vulnerability of farmers, there are multiple components to consider. Vulnerability to the impacts of climate change is dependent on the potential impacts of climate change and on the ability of communities to adapt to those impacts. In turn, the potential impact is influenced by exposure and sensitivity. Therefore, , it is important to consider that the locations of the most extreme changes in climate do not necessarily indicate which farmers will be most severely impacted. This understanding of vulnerability is taken into account when assessing the effect that climate change will have on smallholder farmers throughout the region.

The direct impacts of climate change on farmers will vary based on their farming system. Five major farming systems have been identified in the region: rain-fed mixed, dryland mixed, highland mixed, pastoral and irrigated. Using these farming systems and the climate change data available for the region, five hotspots were identified (FAO 2018) in the region: the Maghreb, the Mashreq, the Nile Valley, North and West Iran (Islamic Republic of), and Yemen (Figure 4). The impacts vary by farming system, but across the region, there will be a general decline in agricultural production and productivity. This will necessitate diversification both on and off the farm. In some cases, farmers might be pushed beyond their limits with shifting agricultural zones.

Some farmers are already diversifying their livelihoods, thus increasing their climate resilience. However, supportive policies, financial mechanisms and programs are needed to facilitate this and ensure that the farmer resilience is built to some of the projected changes. Supporting farmers through these policies and mechanisms is essential not only to safeguard their livelihoods , but also for the food security of each country as a whole since these farmers produce around 80 percent of the region's agricultural produce (FAO, CIHEAM-IAMM and CIRAD, 2017). Furthermore, a comprehensive approach to climate change in the NENA region cannot solely address domestic production as the region is highly dependent on food imports. Therefore, policies and approaches for climate proofing the international food supply chain

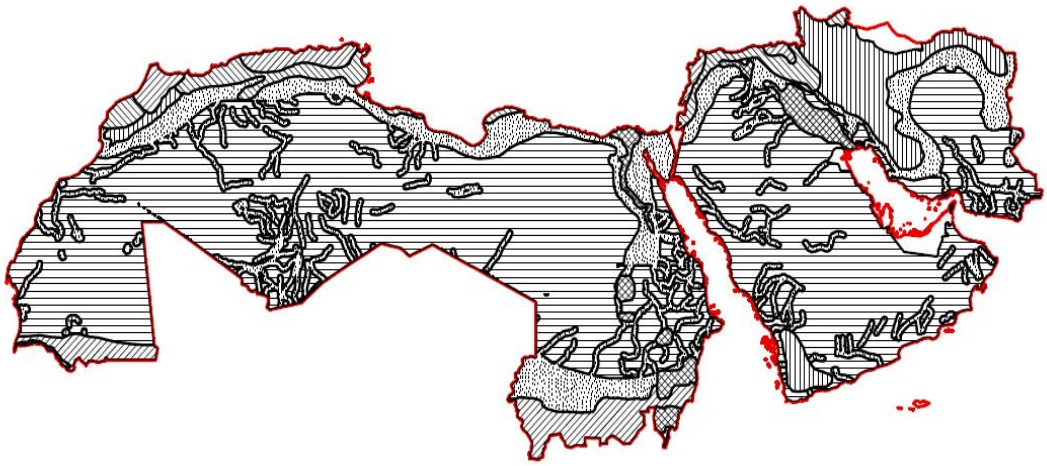
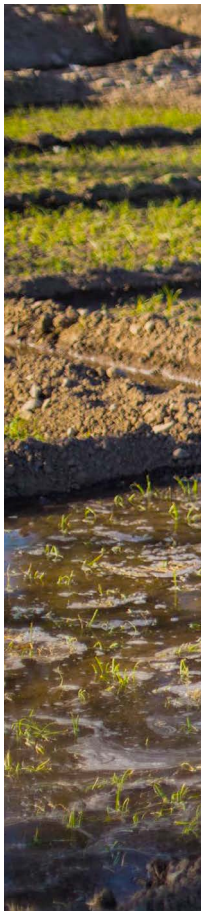


Figure 3. Hotspots identified in Lewis *et al*., 2018.

***Source**: Lewis, P., Monem, M.A. and Impiglia, A. 2018. Impacts of climate change on farming systems and livelihoods in the near east and North Africa.*



are also necessary. This will involve looking at international trade agreements and potential trade chokepoints.

Islamic Development Bank Policies

The Islamic Development Bank (IsDB) has developed two policies to support the agriculture sector in adapting to the impacts of climate change, one focused on agriculture (Agriculture and Rural Development Policy 2018-2023) and the other on climate change (Climate Change Policy 2018-2023) (Figure 5). The agriculture policy focuses on guiding investment in agriculture and rural development in the IsDB's member countries. It aims to realise higher degrees of food security through real and effective sustainable rural and agricultural development that reduces poverty and improves natural resource utilization based on a regionally differentiated approach. The policies cover the 19 IsDB-member countries in the NENA region. Priority will be given to managing water management efficiency, food and nutrition security, and the high dependency on imports. The IsDB will also work to improve the investment environment to ensure that the private sector assumes a greater role in improving food systems and market access.

The climate change policy focuses on supporting the IsDB-member countries in developing climate-resilient and sustainable investment, and providing the IsDB with a referential climate-policy framework. These aims are reinforced by the Bank's five principles. First, to maintain the IsDB's member countries' climate action plans; second, to promote climate change resilience; third, to support

A farmer watering crops in the targeted area supported by FAO.
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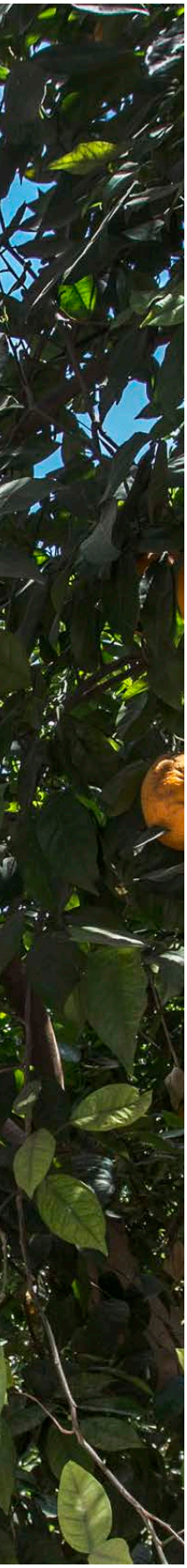
PART 2

Nationally Determined Contributions to the United Nations Framework Convention on Climate Change

Local Employers working at "Domaine Elboura" citrus orchard.
©FAO/Alessandra Benedetti



the transition to a green economy; fourth, to leverage resources; and finally, to manage the climate change facility that it has developed.

The Paris Agreement and the Nationally Determined Contributions

At the 21st Conference of the Parties (COP21), held in Paris in 2015, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to promote climate change adaptation as one of the key goals for enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development. The agreement is centred on the commitment of 195 parties to limit the increase in global average temperature to below 2 °C. The Paris Agreement considers the different needs of developing countries, which are especially vulnerable to the adverse effects of climate change.

In the climate change agenda put forward by the Paris Agreement, agriculture is of central importance given its direct exposure to the impacts. Policies around agriculture must marry science with the knowledge of indigenous peoples and traditional practices. The policies must be mainstreamed into sectoral and cross-sectoral policymaking so that effective and comprehensive change can be achieved.

In the lead up to the signing of the Paris Agreement at COP21, the Parties to the UNFCCC submitted their Intended Nationally Determined Contributions (INDCs). These INDCs outlined each party's planned contributions and commitments towards reducing greenhouse gas emissions. The INDCs then became each party's first Nationally Determined Contribution (NDC), upon submission of its instrument of ratification for the Paris Agreement. These NDCs are the primarily mechanism for governments to communicate to the international community the steps they will take to mitigate and adapt to climate change. They reflect each country's ambitions and plans for reducing emissions, considering domestic circumstances. Subsequent to the first submission of an INDC, the Paris Agreement (Article 4, Paragraph 2) requires each party to prepare, communicate and maintain successive NDCs. All Parties are requested to submit the latest round of NDCs (new or updated NDCs) by 2020 and every five years thereafter (by 2020, 2025, 2030 and so on) irrespective of their individual implementation

Agricultural sectors reflected in the NDCs

Analysis of the NDCs submitted show that the agriculture sectors (crops, livestock, fisheries, aquaculture and forestry) feature prominently in meeting national mitigation and adaptation targets (FAO, 2016). This is a clear indication of the central role of the agriculture sectors in responding to climate change. In fact, a FAO (2016) analysis shows that 90 percent of the countries highlighted the vulnerability of the agriculture sectors to climate change and 60 percent referenced freshwater resources. The discussion around vulnerability does, however, very much depend on the level of socio-economic development. All of the Least Developed Countries (LDCs) and 90 percent of the other developing countries made reference to vulnerability. By contrast, the same analysis shows that 73 percent of emerging countries and only seven percent of developed countries refer to vulnerability. Most of the countries discussing vulnerabilities point to extreme events (such as droughts and floods) as the primary threats to environmental and socioeconomic development, while around half the countries point to changes in weather patterns. Countries also point to the importance of disaster risk reduction in the agriculture sectors. Around 30 percent of the countries that include adaptation measures also make reference to disaster risk management in the agriculture sectors.

This same analysis identified that 94 percent of developing countries have included adaptation in their NDCs. This ranges from 100 percent in Sub-Saharan African, Eastern Asia and South-Eastern Asia to 79 percent in Oceania. However, none of the NDCs submitted by developed countries included any adaptation measures. Nevertheless, the agriculture sectors are the foremost priority for adaptation. Of the 130 countries that included adaptation in their INCDs, 95 percent refer to crops and livestock, 83 percent to forests, and 46 percent to fisheries and aquaculture (FAO, 2016).

Countries indicated the importance of disaster risk reduction in the agriculture sectors. Thirty percent of the countries that included adaptation measures refer to disaster risk management in the agriculture sectors. These measures are specified most often by least-developed countries (LDCs) (37 percent). The most common measures include

Local Employers working at "Domaine Elboura" citrus orchard.
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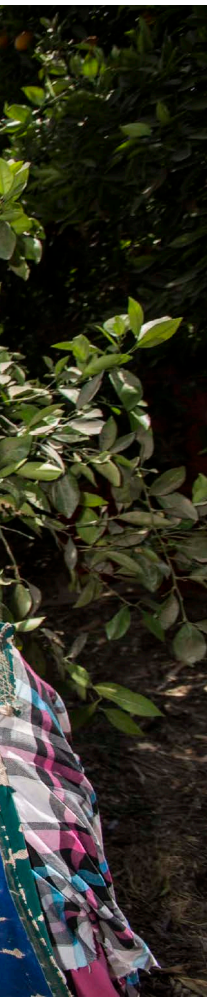
Analysis of NDCs of the Near East and North Africa region

Given the limited natural resource base and inherent water scarcity, adaptation to climate change is the main priority of the countries of the NENA region, as reflected in their NDCs. The FAO (2016) analysis indicates that adaptation was included in 93 percent of the NDCs from the NENA countries, of which around 75 percent refer to crops and livestock, 56 percent to forestry, and 44 percent to fisheries and aquaculture. Most of the NENA region's NDCs highlight the impact of climate change on water resources, since adapting agriculture to climate change is closely linked to water management in this semi-arid to arid region. Many countries also note the need to undertake vulnerability and impact assessments, especially around desertification. In fact, 70 percent of all NENA countries discuss vulnerability and connect it with combating desertification. Most of the countries identified innovative and sustainable water management technologies that, combined with appropriate policies and strategies, would enhance climate change adaptation.



It is important to consider ecosystem resilience, including coastal zones, wetlands and terrestrial ecosystems, in the context of climate change. Almost one-third of the countries refer to agriculture in the context of disaster risk management in their NDCs. The most common activities suggested centre on understanding disaster risks by assessing national circumstances and on strengthening disaster resilience. By contrast, disaster risk governance is rarely addressed at the sectorial level. Despite the strong regional focus on adaptation in agriculture, a number of countries in the NENA region refer to land use and land use change (LULUC). These are considered part of an economy-wide approach. In particular, mitigating forestry emissions is mentioned in a number of NDCs, including those of Algeria, Lebanon, Morocco and the Sudan. With regard to mitigation actions in agriculture, these largely

A man digging in the earth to plant a tree in an effort to reforest degraded land.

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PART 3
Climate-smart agriculture in NENA

Cattle grazing in Sudan.
©FAO/Raphy Favre

Climate-smart agriculture

Strong adaptation measures and the use of new practices and technologies, along with policies and financing that support them, are imperative for poverty reduction and food security. Farmers and other actors along the food production value chain can make key contributions to sustainable food and water security, so long as they have access to technologies and support to help them adjust their practices to changing weather patterns. Climate initiatives and climate-smart technologies can help increase food production for a growing population, while safeguarding precious natural resources.

In response to this need for agricultural adaptation, FAO developed the concept of climate-smart agriculture (CSA), an approach that helps guide the actions that are needed to transform and reorient agricultural systems to effectively support development initiatives and ensure food security in a changing climate (Table 1). CSA is based on three main objectives: sustainably increasing agricultural productivity and income, adapting and building resilience to climate change, and reducing or removing greenhouse gas (GHG) emissions, where possible. CSA provides the means to help local, national and international stakeholders identify agricultural strategies suitable to their local conditions. Developed by FAO, CSA is one of the Organization's 11 Corporate Areas for Resource Mobilization under its Strategic Objectives. It is in line with the FAO vision for Sustainable Food and Agriculture and supports the Organization's goal to make agriculture, forestry and fisheries more productive and more sustainable (FAO, 2013).

Table 1: Examples of climate-smart practices

	Contribution to CSA goals			Gender impact	
CSA option/practice	**Climate change adaptation**	**Climate change mitigation**	**Potential household food security and nutrition impact**	**Women's control of income from practice**	**Relative amount of time until benefits are realized**
Stress-tolerant varieties	High	Low	High	Low	Low
Conservation agriculture	High	Medium	High	Low	High
Improved home gardens	High	Medium	High	High	Low
On-farm tree planting	High	High	Low-Medium	Low	High
Composting	Medium	Medium	Medium	Medium	Low
Small-scale irrigation	High	Low	High	Low-Medium	Low
Fodder shrubs	High	Medium-High	High	High	Medium
Herbaceous legumes	High	Medium	High	High	Medium
Improved grasses	High	Medium	High	High	Low
Livestock genetic improvement	High	Medium	Medium-High	Low-High	High
Restoration of degraded rangeland	High	High	Medium	Low	High

CSA seeks to increase agricultural productivity in a sustainable manner, support the adaptation of small-scale farming to climate change by building the resilience of agricultural livelihoods and ecosystems, and, where possible, contribute to reducing GHG emissions from the agricultural sector. CSA must be productive. It is not a low input, low output approach. The use of yield-enhancing technologies, including improved seeds and fertilizers, are part of good CSA practices. The CSA approach also entails agricultural practices, policies, institutions and financing to bring concrete benefits to smallholder farmers and to make their livelihoods sustainable (FAO, 2017). Practically, CSA is based on a combination of climate-resilient technologies and integrated

farming systems and landscape management. The evidence base to identify the practices that work best in a given context continues to be expanded through the testing and implementation of a broad range of practices (FAO, 2017)

CSA is not a prescribed practice or a specific technology that can be universally applied. It is an approach that requires site-specific assessment of the social, economic and environmental conditions to identify appropriate agricultural production technologies and practices. A key component of CSA is an integrated landscape approach that follows the principles of ecosystem management and sustainable land and water use (Partey *et al*., 2015). On the production side, some CSA practices include conservation agriculture (including no-tillage or minimum tillage).

It is an approach to developing the technical, policy and investment conditions necessary to achieve sustainable agricultural development for food security under climate change. The magnitude, immediacy and broad scope of the effects of climate change on agricultural systems create a compelling need to ensure comprehensive consideration of these effects in national agricultural planning, investments and programs. The CSA approach is designed to identify and operationalize sustainable agricultural development within the explicit parameters of climate change (FAO, 2013).

CGIAR Research Program on Climate Change, Agriculture and Food Security (2017) indicated that to maximize benefits and minimize trade-offs, CSA takes into consideration the social, economic, and environmental context where it will be applied. Repercussions on energy and local resources are also assessed. Different elements which can be integrated in climate-smart agricultural approaches include:

- The management of farms, crops, livestock, aquaculture and capture fisheries to manage resources better and produce more with less, while increasing resilience;
- Ecosystem and landscape management to conserve ecosystem services that are key to increasingresource efficiency and resilience simultaneously;
- Services for farmers and land managers to enable them to implement the necessary changes.

Governments and partners seeking to facilitate the implementation of CSA can undertake a range of actions to provide the foundation for effective CSA across agricultural systems, landscapes and food systems. CSA approaches include five major types of actions:

- Expanding the evidence base and assessment tools to identify agricultural growth strategies for food security that integrate necessary adaptation and potential mitigation;
- Building policy frameworks and consensus to support implementation at scale;
- Strengthening national and local institutions to enable farmer management of climate risks and adoption of context-suitable agricultural practices, technologies and systems;
- Enhancing financing options to support implementation, linking climate and agricultural finance;
- Implementing locally suited and context-specific practices and technology for CSA in the field.

Climate-smart agriculture has been highlighted as a potential contributor to both adaptation and mitigation at the global level. Thirty-one countries, including 40 percent of Least Development Countries (LDCs), specifically refer to CSA in their NDCs. About one-third of these countries – all in Sub-Saharan Africa – highlight CSA as an approach to pursue both adaptation and mitigation goals. About 19 percent of these countries refer to CSA only in relation to mitigation and 50 percent refer to it in relation to adaptation as well.

One member of the team is informing the farmers on how to plant almond trees using modern methods in the targeted area supported by FAO.

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Climate-smart agriculture and gender

While climate change affects everyone, it is not gender neutral. There are significant social impacts that magnify existing inequalities, vulnerabilities and adaptive capacities. In particular, it is crucial to recognize the role of women as agents of change and contributors to building resilience. This is especially important in the NENA region where an increasing proportion of the labour burden in agriculture falls to women.

Mainstreaming gender in the CSA projects, programs, and policies is very crucial for a successful implementation of CSA. Several studies showed when women's awareness, knowledge, and access to information about climate change impact and CSA practices increases, more female and male farmers adopt technologies and practices of climate smart agriculture and contribute to strengthen the resilience of communities and households, exposed to climate-related shocks and climate change (World Bank Group, FAO and IFAD, 2015).

Closing the gender gap in terms of access to productive resources, services and inputs could reduce the number of hungry people in the world by around 150 million (SOFA, 2011). Women's asset ownership is positively linked to the uptake of some climate-smart practices and soil conservation techniques. Where women have secure land rights, there is evidence of greater yields and increased food security. Large-scale climate change mitigation interventions are more effective as well when they fully recognize women as stakeholders and compensate them for "secondary" services such as gathering fuelwood and non-timber products.

There are five key components to mainstreaming gender in CSA approaches:

Conduct a gender analysis.

Ensure the participation and engagement of both men and women.

Reduce the constraints placed on women that impede their participation in CSA.

Note the immediate benefits for men and women if there is effective mainstreaming (such as reduced labour time).

Note the long-term benefits for men and women if there is effective mainstreaming (such as increased resilience).

The effective mainstreaming of gender into climate change work is supported at the policy level through actions such as the UNFCCC's Paris Agreement that mandates gender-responsive adaptation and mitigation actions. In addition, the UNFCCC Gender Action Plan was adopted in November 2017 at the 23rd Conference of the Parties to the UNFCCC (COP23). The Global Environment Facility and the Green Climate Fund are also gender-responsive funding mechanisms.

Overview of CSA in the NENA region

Forty percent of the countries of the NENA region specifically refer to CSA in their NDCs, and about one-third of these countries highlight CSA as an approach to pursue both adaptation and mitigation goals. Approximately 19 percent of these countries refer to CSA only in relation to mitigation, and about 50 percent do so in relation to adaptation (FAO, 2016).

Opportunities exist for employing CSA approaches in the NENA region, which centre on resource-conserving technologies and management practices that enhance the efficiency of the already limited key resources such as land, water, labour and nutrients.

Climate-smart farming innovations, based on agricultural research, can support long-term agricultural growth in the drylands of the NENA region. These innovations provide practical adaptation measures to climate change that will improve the livelihoods of rural populations under the present and the future changing climate. New technologies, practices and policy options had been developed and tested in partnership with the major stakeholders in the region. These practices include:

- Assessing climate change at the country and community levels: Providing technical tools for 'climate downscaling techniques' in cooperation with several countries of the NENA region to assess village-level impacts of climate shifts, contributing to the development of national plans targeting specific parts of the population.
- Enhancing development of new crop varieties that are tolerant to drought, heat and disease: developing breeding programs for drought, heat and salinity tolerant crop varieties, using the wealth of dryland plant genetic resources from the available gene bans in the region.. Hundereds of new varieties of bread and durum wheat, barley, chickpea, lentil, fava bean and grass pea has been developed using the existing genatic materials.
- Promotion of conservation agriculture to protect fragile soils and preserve their fertility, helping drylands farmers to produce better yields under harsh environments. Dryland conservation approaches for low-income and marginal areas were tested with farmers in Iraq, Jordan, Morocco and Syria using locally produced machinery for planting (seeders).
- Soil and water practices to combat salinity: A package for cultivating saline soils had been developed for dryland agriculture in the NENA region threatened by salinity problems. The package includes the introduction of salt-tolerant crop varieties; new food production value chains; options for efficient irrigation management systems and salt-tolerant forage crops (to introduce new livestock systems that are not based on traditional crops). New cultivation practices, such as the raised bed farming technique, increased wheat yield by 25 percent, using 30 percent less water and 50 percent less seeds.
- Crop-livestock integration packages to fight climate change: A national crop-livestock strategy has been developed to increase the climate-change resilience of millions of dryland smallholder farmers and ensure their food security.

Potential use of CSA in farming systems in the NENA region

It is important to consider the various types of farming systems to understand what the key vulnerabilities are and, thus, what the most appropriate responses are. The main types of farming systems in the NENA region are rain-fed mixed, highland mixed, dryland mixed, irrigated and pastoral systems. These farming systems occur across the five identified "Climate-Impacted Farming Systems" or hotspots in the region: the Maghreb, the Mashreq, the Nile Valley, North and West Iran (Islamic Republic of), and Yemen.

In the Maghreb, citrus and dates are vulnerable to climate change in the rain-fed farming systems along the coast. Potential CSA responses are on-farm diversification (including crop diversification), the development of heat-tolerant varieties, and the modification of crop rotation and planting times. Wheat, olives and maize are vulnerable in both the rain-fed and highland mixed farming systems. Given the importance of wheat, considering new heat-tolerant varieties is important. Considering a transition to increased barley use, instead of wheat, might be appropriate in some cases as barley requires less water. Off-farm diversification also needs to be considered. In Mauritania in particular, sorghum, maize and millet are vulnerable. Similar CSA approaches apply to these crops. In the pastoral lands of the Maghreb, milk yield relative to feed will decrease for both goats and sheep. Adapting traditional management and mobile grazing strategies will therefore become necessary.
In the Mashreq, rain-fed mixed, highland mixed, dryland mixed, and irrigated farming systems exist. In the rain-fed and highland mixed lands, pome fruits, grapes and citrus are vulnerable to the impacts of climate change.

Farmer tending sheep in his garden where date palms are growing.
©FAO/Rosetta Messori

The introduction of supplemental (especially drip) irrigation will be important. This is especially the case for olive trees that are a key component of the agricultural economy. It will also be necessary to change crop planting times. In the dryland mixed systems, wheat and vegetables will be vulnerable, especially in Jordan and Syria. Continued crop diversification will be important, especially for cucumbers, tomatoes and eggplants. Promoting high-yield wheat varieties will also be important. In the irrigated lands, where fruits, vegetables and maize are grown, optimizing irrigation patterns will be necessary. Another important key will be to continue to diversify into off-farm jobs, especially around urban centres. Finally, diversifying both crops and livestock will be important. Such diversification will be important for mountain and Shami goats in the region.

In the Nile Valley, there are some rain-fed and pastoral lands, but the major farming system is irrigation. In the rain-fed lands, millet, potatoes and tomatoes are vulnerable. Increasing sorghum cultivation could be a helpful CSA approach in these lands, given its lower vulnerability to climate change and shorter growing period. In the pastoral lands, there are cattle (especially in the Sudanese grasslands) and camels (especially further north). Supporting pastoralists with supplemental feeding using crop residues and stubble will be important. In addition, developing early warning systems that enable pastoralists to plan their movement, manage animal maintenance and sell their assets more efficiently will be key. Finally, herders will need to diversify into small ruminants. For irrigated lands, a variety of crops, including wheat, are grown along the Nile River. Horticultural crops dominate, especially in Egypt. In these lands, promoting new wheat genotypes, crop rotation, and alternatives to flood irrigation are essential. Finally, in the Nile

Farmers harvesting grapes from the farm crates to their wholesaler crates.
©FAO/Heba Khamis

Delta, which is vulnerable to sea level rise and where a large proportion of Egyptian farmers are concentrated, the adoption of salt-tolerant varieties, the use of precise land levelling and crop cultivation on raised beds will also be important.

In North and West Iran (Islamic Republic of), highland mixed farming systems dominate and there is some pastoral land. Tea and rice, cultivated in the Alborz Mountains in the north, are especially vulnerable as is saffron, which is cultivated in the north-east of the country. Adapting planting times and cropping patterns is important for all these crops. For tea, applying mulch is a potential solution. For rice, breeding heat-tolerant varieties has been suggested. Adapting planting times for saffron and barberries, which are often grown together, is also suggested. Wheat is especially vulnerable in the Zagros Mountains. A potential transition from wheat to barley in some areas may be necessary. It might be necessary to adapt planting times or cropping patterns for wheat. For the pastoralists in Iran (Islamic Republic of), sheep are especially vulnerable. Pastoralists will need to diversity their herds and breed for drought and heat tolerant conditions. Many of these pastoralists are diversifying into non-agricultural livelihoods already.

In Yemen, the predominant farming system is highland mixed farming, where most crops – including sorghum – are vulnerable. In terms of livestock, milk yields will drop (for goats and sheep), reduced animal food supply, while animal heat stress and the risk of disease and infection will increase. Crop calendars can be optimized in order to mitigate these effects of climate change. For the region in general, but Yemen especially, effectively managing agricultural water supplies is key. For livestock, small ruminants should be preferred over cattle since they are more resilient to the impacts of climate change.

PART 4

Climate-smart agriculture: views from the countries (Country's presentation)

Fostering rural diversification through enhanced youth employment and better labour mobility (RYM).
©Nikos Economopoulos/Magnum Phot

CSA has been developed in multiple countries and regions throughout the world. While CSA practices already exist in the NENA region (even if they are not officially termed as such), the concept of developing the CSA approach with the explicit aim of addressing climate change has not yet been undertaken in the Near East and North Africa. The aim of this workshop was to initiate the conversation regarding CSA as an approach to address climate change impact in the region, and to develop national roadmaps to implement CSA modules and practices. Prior to doing this, it was important to understand the situation from each country's perspective. The following section provides an overview of the countries' perspectives. The countries have been grouped into sub-sections according the hotspots identified in the "Impacts of climate change on farming systems in the Near East and North Africa" report (FAO 2018). Not all the countries listed under the various "Climate-Impacted Farming Systems" (CIFS), which are considered hotspots, attended the workshop. As such, only those countries that did participate are included in this section. Finally, the section also includes some countries that are not part of the CIFS listed here, but that are highly important in the context of climate change adaptation in the region.

The following is an summary of the presentations made by the country representatives and the follow up discussions. The representatives provided a summary of the agricultural production, climate-change impacts and required adaptation measures in their respective countries.

Climate-impacted farming system 1: Maghreb

Mauritania

Climate change has major effects on agriculture in Mauritania through expanding land degradation and erosion, , reducing arable land and water resources. Most of the smallholder farmers in areas of rain-fed agriculture are elderly women; while farmers in areas of irrigated agricultural along the river and in some of the wetlands are men, many of whom are struggling to find employment. All the farmers are vulnerable to the adverse effects of climate change and poor agricultural production.

Different institutions in Mauritania support smallholder farmers in issues related to climate change with projects and activities covering agricultural extension, agricultural inputs, various means of production, protection against agricultural pests, water control and adaptation projects. One major project, running from 2014 through 2018, aims to improve the capacities of local communities and their food security to counter the negative effects of climate change. The institutions involved include the Ministry of Environment and Sustainable Development, through the National Program for the Climate Change Coordination Unit the Ministry of Agriculture, through the National Center for Agricultural Research and Development; the Agricultural Meteorology Department and the Ministry of Equipment and Transport.

The country's NDCs aim to reduce the fragility of the natural, social and economic system and deal with climate change through the formulation of 19 priorities for adaptation, such as covering food needs.

Desert Locusts cause severe crop damage in Mauritania.
©FAO/Giampiero Diana

Morocco

Agriculture in Morocco is a significant economic sector, accounting for around 43 percent of jobs and 14–20 percent of GDP. Agriculture has multiple functions, including having a key role to play in rural poverty reduction and environmental management. The vast majority of agricultural land is dedicated to cereal production (52 percent), followed by fallow (20 percent), fruit trees (15 percent), fodder (5 percent), legumes (4 percent) and cash crops (around 3 percent). The main risks facing agriculture in Morocco are meteorological drought, pests and diseases, hot winds, and high temperatures. However, water stress, frost, floods and hail also challenge production and productivity. In the context of climate change, Morocco is especially concerned about the production of wheat, given its vulnerability and its key role in the economy.

In response, the country has developed the Green Morocco Plan (GMP), which asserts that agriculture can be a positive driver of socio-economic development and environmental sustainability. The plan looks at both commercial farming and smallholder farming as forms of business that enable a holistic and transactional approach. The following cross-cutting reforms feature in the plan: land tenure, water, trade, domestic markets, business, value chains and administration. Pillar 1 of this plan focuses on developing a high-value and highly productive agricultural sector. Seven to nine hundred investment projects are being implemented across the country to this aim. The plan aims to attract private investors while protecting social interests. Pillar 2 focuses on promoting the businesses of smallholder farmers in order that they might transition out of poverty. This pillar features 300 to 400 projects, including reconversion, intensification and diversification projects. It looks to strengthen the capacities of social institutions for proper project implementation on the ground.

In addition, as part of its general support to smallholder farmers, Morocco has developed the following programmes:

Olive oil programme to 2020;

Fruit tree programme (excluding citrus and non-olive) by 2020;

Citrus planting programme to 2020;

Cactus planting programme to 2020;

Date palm plantation programme to 2020;

National programme for the development of rangelands to 2020 (for Phase I).

These programmes involve smallholder farmers in general and there are no conditions or requirements for them to participate. The government has made other commitments as well, , but access to these is based on certain conditions being met. The government is keen to foster public–private partnerships to support the farmers in the context of climate change. It has also established connections and interacts with key institutions, including the Agency for the Agricultural Development of Morocco, the National Agriculture Research Institute, the National Meteorological Direction and several universities and think tanks. The key ministries working on climate change are the Ministries of Agriculture, Fisheries, Rural development, Water and Forests.

Tunisia

Tunisia understands the vital role of agriculture in ensuring national food security, social stability and economic development. Agriculture in Tunisia contributes around 20 percent of national GHG emissions, making it the second largest contributor after the energy sector. However, it is also of great socio-economic importance, accounting for around 28 percent of jobs and around 12 percent of GDP. Around 92 percent of the land is rain-fed and only 8 percent is irrigated. The impacts of climate change can already be seen in the agricultural sector. Specifically, there is more erosion, resulting from increased extreme rain and flood events that reduce the vegetation cover. Further, there is less surface water and underground water in a country that is already water scarce. It is understood that smallholder farmers will be disproportionately impacted by the impacts of climate change.

With regard to the various agricultural subsectors, Tunisia projects that the area of major crops will decrease by around 200 hectares by 2030. Olive productivity is expected to decrease by around 50 percent by 2040. Livestock will decrease in productivity by around 80 percent by 2030. There will be a reduction in water resources of around 28 percent by 2030. In addition, Tunisia expects a reduction in many naturally productive systems, including protected areas, forests, soils and biodiverse systems.

In response to these challenges, the government has developed a National Adaptation Strategy for Tunisian Agriculture and Ecosystems to Climate Change (2007). The objective is to contribute to the sustainable development of Tunisian agriculture by developing and implementing a set of mechanisms for the continuous adaptation of the agricultural sector to climate change. They have also developed the Action Plan for Adapting Coastal Systems to Expected Rise in Sea Level (2008, updated in 2012) as well as the Plan of Action to Adapt the Tourism Sector to Climate Change (2011), the Plan of Action for the Adaptation of the Heath Sector to Climate Change (2011), and a plan for developing work on early warning systems. In addition, they are implementing the measures as per their commitments to the NDC process in terms of both adaptation and mitigation. In terms of adaptation, the country is focusing on preserving the environment, protecting national water and soil resources, sustainably managing other natural resources, and ensuring a decent income for farmers. Going forward, the country will prioritise water resource management, the development of rural territories and the integration of climate change into development planning.

Chaker Sleymi (centre) launched an initiative to grow and distillate aromatic and medicinal plants for marketing.

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Climate-impacted farming system 2: Mashreq

Iraq

Among Iraq's main challenges are the increasing impacts of climate change and the extent of the country's readiness to deal with it. These challenges are resulting in irregular water supply, the deterioration of agricultural land affected by drought and the inability to store rainwater efficiently. This is coupled with a number of related issues: decreasing discharge rates in Iraq's permanent rivers, lower water levels in marshlands, reduced soil fertility, increased salinity of the Shatt al-Arab, lower surface water flow rates, decreased groundwater levels, hydrological droughts due to low levels of surface water, and increased sand and dust storms.

Iraq is currently losing a lot of agricultural land through desertification and soil salinization. Desertification and water scarcity , in turn, are associated with a loss of biodiversity and the reduction of the water levels of the Tigris River into Iraq. The agricultural systems in Iraq are divided into agricultural lands belonging to the state, those leased to farmers according to the laws enacted by the Ministry of Agriculture, and lands belonging to the farmers themselves. There are three categories of farmers: (1) major farmers who cultivate strategic crops, (2) small and medium-sized farmers who grow grain and vegetable crops as well as livestock, and (3) farmers who raise poultry and fish, including using floating cages.

One of the most important projects to improve climate change adaptation is the Building Resilience of the Agriculture Sector to Climate Change in Iraq (BRAC) project, funded by the Adaptation Fund.

Iraq submitted a preparatory document for funding for national climate change mitigation and adaptation projects to the Green Climate Fund. A preliminary project document on climate change and its relationship with the agriculture and biodiversity sectors is being prepared in cooperation with FAO as an executing agency for funding from the Green Climate Fund. This project targets the poorest provinces in Iraq. A number of ministries will support the project, including the Ministry of Health and Environment, the Ministry of Agriculture and the Ministry of Water Resources.

a participant in FAO's cash for work project, cleans the main Al Jazeera irrigation canal as part of a project to resupply water for agricultural production for the first time since the Islamic .

©FAO/Cengiz Yar

Jordan

Increasing temperatures and changing precipitation patterns are expected to impact the agriculture sector in Jordan. Jordan has identified the following major climate risks: temperature increase, rainfall decrease, drought increase, and shifting rainy seasons. It is anticipated that this will affect the cropping systems, livestock production, livelihoods and food security of the country. The overall objective of climate change efforts is to assess the vulnerability of priority areas and identify adaptation options for the agriculture sector. These issues are of particular concern in the parts of Jordan that receive less than 200 mm of rainfall per year, which is most of the country, apart from the Jordan Valley. This is especially important in rural areas where inefficient agricultural practices result in the overconsumption of water. Around 25 percent of Jordan's poor live in the rural areas that are most dependent on agriculture.

In response to the challenges that these farmers face, Jordan proposes the establishment and implementation of a policy on sustainable agriculture. This includes supporting water-saving technologies and water harvesting, and promoting plant varieties that are resistant to climate change. These actions focus directly on smallholder farmers. These farmers are able to reschedule debts through the Agricultural Credit Corporation, access a climate awareness database network, and participate in permaculture pilot projects. In addition to this disaggregated support, there are a series of institutions working on climate change in agriculture. These include the Ministry of the Environment, the Climate Change Directorate and the National Climate Change Committee. In addition, these institutions and other act on the country's NDCs, which include77 measures with agriculture featuring in both mitigation and adaptation.

Farmers harvesting onions in a field in Dear Alla.
©FAO/Khalil Mazraawi

Lebanon

Lebanon is vulnerable to the impacts of climate change in both its agricultural and water resources sectors. As a result of the changing climate, crop yields are likely to drop, soil moisture will decrease, aridity will increase, as will desertification, and livestock numbers will drop. Crop productivity is also anticipated to drop, specifically for wheat, tomatoes, cherries, apples, olives and grapes. A reduction in the quantity and quality of both surface and groundwater is anticipated, along with hydrological droughts and the intrusion of seawater into coastal aquifers.

In the rain-fed farming systems in Lebanon, where olives, tobacco, cereals and legumes are grown, there are a series of challenges. These include soil erosion, increased farming mechanization, poor access to high-quality land and increasing numbers of smallholder farmers. Soil contouring, watershed management and improved access to markets are some of the solutions to these issues. In the irrigated farming systems, where fruit trees and vegetables are grown, water misuse and mismanagement are major challenges. Increased salinity and soil degradation also present problems. In response, the government proposes the implementation of water demand management strategies that optimize water use efficiency. Methods for restoring soil fertility are also a priority.

The majority of the farmers in Lebanon work in Baalbek-Hermel (around 25 percent of the workforce), followed by Bekaa (with 18 percent), Akkar (with 16 percent), Nabatiyeh (with 11 percent), South (with 11 percent), North (with 10 percent), and Mount Lebanon (with 9 percent). Most of the farmers in all areas are seasonal family labourers. This is especially the case in Akkar and North. The rest of the labour force is made up of permanent family labourers and permanent non-family labourers. All these farmers are highly vulnerable, but the government is working to provide services for them. For instance, it is providing extension services and training on sustainable irrigation through the Ministry of Agriculture. It also provides free irrigation equipment and crop protection products. Around 30 percent of the beneficiaries of such projects have switched from surface to pressurized irrigation networks. Finally, the government provides agro-meteorological information to farmers via SMS and smartphone applications.

At the macro level, Lebanon is committed to its contributions to the NDC process. It has committed to adopt more drought and heat-tolerant species, change planting dates and cropping patterns, protect groundwater from salinization in coastal areas, manage water demand, and restore degraded land. It has also committed to reduce GHG emissions from agricultural soils, which account for around 55 percent of the emissions from the sector.

Volunteers of the Association for Forests, Development and Conservation (AFDC) preparing pine seedlings for planting as part of a reforestation project following forest fires, Ramlieh, Chouf Mountains, Lebanon.

©FAO/Kai Wiedenhoefer

Palestine

Around 90 percent of the agricultural land of Palestine is located in the West Bank, with only ten percent in the Gaza Strip. The majority of agricultural land in the West Bank is under Area C, which is under full Israeli control. There are around 111 310 agricultural holdings in Palestine in which most farmers are between 40 and 49 years of age. Rain-fed farming systems dominate Palestinian agriculture, occupying nearly 81 percent of the total agricultural land area while irrigated agriculture accounts for only 19 percent. Irrigated agriculture is located primarily in the Gaza Strip and Jordan Valley governorates. Low soil fertility, limited agricultural land investment, water scarcity and limited financial resources are underlying issues that impede agriculture. In addition, there is limited amount of land permitted for the grazing of ruminants, which results in overgrazing and the associated land degradation.

The impacts of climate change will be felt across the agricultural holdings in Palestine. In the West Bank, olive, grape, stone fruit, rain-fed and irrigated vegetables, and field crops are all considered highly vulnerable to the effects of climate change. In the Gaza Strip, olive, vegetable and citrus production are considered highly vulnerable. In both areas, livestock and grazing land are also vulnerable. To respond to these vulnerabilities, the Palestinian Authorities have signed and ratified the Paris Agreement (22 April 2016) andsubmitted their Initial National Communication Report and National Adaptation Plan to the UNFCCC (12 November 2016), their Nationally Determined Contribution and their Initial NDC Implementation Roadmap to the UNFCCC (August 2017).

In accordance with its National Adaptation Plan, Palestine is implementing sustainable community-level irrigation schemes and infrastructure, climate-smart agriculture, improved water-use efficiency, agricultural disaster risk reduction and management strategies and methods of increasing the availability of animal feed in the West Bank. Gaza Strip is implementing similar activities as well as establishing subsidies and raising awareness among farmers through training. The improvement of livestock production pens has also been planned in Palestine. Palestine is also responding to the mitigation agenda by implementing afforestation projects. There are a series of institutions supporting this work, including international organisations, local NGOs, various ministries and universities.

Workers harvesting greenhouse tomatoes and cucumbers.
©FAO/Marco Longari

Syria

Around 32.8 percent of the land in Syria is arable. Strategic crops are cultivated in irrigated lands while subsistence crops such as barley and wheat are cultivated in the rain-fed lands. Fruit is grown in both farming systems. However, the farming systems of Syria are not divided into these two classes alone. Syria has (1) intensive irrigated coastal farming systems (with fruit trees production), (2) hilly and mountainous systems (with olive, apple, wheat, tobacco and livestock production), (3) dry north and north-eastern plains (with wheat, barley, cotton and livestock production), (4) central rain-fed and irrigated plains (with wheat, barley, sugar beet, potato, pistachio, almond and grape production), (5) southern semi-arid plains and mountains (with wheat, chickpea, barley, apple, grape and olive production), and (6) pastoral and agro-pastoral farming systems that cover around 55 percent of the country.

There are a variety of farmers who manage these lands, including landed holders, landless holders, sharecroppers and tenants, land reform beneficiaries, squatters, and labourers on state farms. According to Syrian law, women are equal to men. In practice, however, their brothers (or other male family members) can often renounce the women's share or simply become squatters on the women's land.

Frequent droughts, reduced annual rainfall, unpredictable distribution of rainfall, and rising temperatures are all threatening Syrian agriculture; this in a country where over half of the land already receives less than 220 mm of rain per year. This has resulted in noticeable declines in crop production. Fruit tree production also oscillates depending on the climate conditions. There has also been a decline in the productivity of natural pastures. These conditions will increasethe food gap that already exists in the country.

To respond to these challenges, Syria ratified the UNFCCC in 1996 as a non-Annex I party. Syria does not have any quantitative commitments to reduce its GHG emissions, but under Article 12 of the UNFCCC, it has to prepare national communications to the UNFCCC on its actions. Currently, it has a series of national policies and programs, including the development of drought-tolerate breeding programs for wheat, barley and fruits. Syria is also identifying crop coefficients in the rain-fed areas using remote sensing techniques. Farmers are transitioning to efficient irrigation techniques and rainwater harvesting and conservation agriculture are growing. There are a series of national institutions working on climate change in Syria, including the Ministry of Agriculture and Agrarian Reform, the Ministry of Local Administration and Environment, the Ministry of Water Resources, and the General Organization of Remote Sensing.

Strengthening Resilience of Vulnerable Crisis Affected Households through Women Empowerment and Livelihood Improvement.

©FAO/Jawdat Tabaa

Climate-impacted farming system 3: Nile Valley

Egypt

Climate change will have a severe impact on Egypt's water and agricultural activities. This is especially so given that agriculture already consumes more than 80 percent of the country's water supply. Egyptian agriculture is entirely reliant on irrigation, except for a few places along the Mediterranean coast. Egypt has already projected the change in yield of certain key crops as a result of climate change. The most dramatic declines are forecast for summer vegetables, tomatoes, soybeans and lentils, which are expected to drop28 percent in yield. Other key crops, such as wheat, sugarcane, sorghum, maize and citrus trees will also be impacted with an anticipated drop in yield of at least 15 percent.

In response, Egypt proposes to develop new water supplies, through the desalinization and reuse of water and implement management techniques that increase water supplies. For the areas that are more reliant on rain-fed agriculture, rainwater harvesting needs to be encouraged. This is especially relevant in the Mediterranean area where most of the country's rain falls. Irrigated areas will require more efficient irrigation techniques, crops that demand less water, and water-efficient technologies. Egypt also proposes to develop heat, drought and salt-resistant crops. Developing varieties that can maintain yields under higher temperatures is the key. Because of the farming system characterization of Egypt, the focus remains on irrigation. Around 76 percent of irrigation in Egypt is surface irrigation while 24 percent is pressurized irrigation. Of special concern to Egypt, sea level raise is expected to be serious threat to the agricultural land in the North Delta of Egypt. It is projected that Egypt will lose hundred thousands of hectares due to the sea level raise leading to significant decrease of the already limited agricultural land and increasing soil salinity in the Delta.

Smallholder farmers have received support in a variety of ways, including lining canals, raising awareness and providing guidance on production. For instance, a project was conducted in conjunction with FAO that taught women farmers to dry tomatoes to reduce food loss and waste, which is essential in a changing climate.

Labourers are harvesting tomatoes.
©FAO/Heba Khamis

The Sudan

Climate change poses a serious challenge to agriculture in the Sudan, driving recurrent drought, desertification, food insecurity and the movement of people. The Sudan has been aware of the threat posed by climate change for some time now, notingchanges in temperature and precipitation in the various ecological zones. Given that a large part of the country is semi-arid to arid, the changes in temperature and precipitation are leading to desertification. This is especially challenging since the country's food security is dependent on consistent rainfall, especially in the rural areas where around 70 percent of the total population lives. An estimated 90 percent of cultivated land is dependent on rainfall that is being affected by climate change. More than 70 percent of the Sudan's population depends on agriculture as a source of livelihood. Most of these farmers are smallholders.

In response to these challenges, the Sudan focuses its adaptation primarily on agriculture and water. In 2007, the National Adaptation Program of Action identified 32 interventions to implement an urgent set of measures that would minimize the adverse effect of climate change on agriculture and improve the sector's resilience, thereby improving the country's overall food security. The Sudan prepared the Intended Adaptation Contributions for the agriculture sector, including crop production, livestock and rangelands. Further, it prepared the National Climate Change Policies and Measures document that will be approved shortly by the Council of Ministers. This document signifies the government's sincere efforts to prepare responses to climate change impacts in the country. The policy measures would mainstream climate change into national development policies. Various Sudanese institutions, including the Ministry of Agriculture's General Administration of Agricultural Natural Resources, will support the implementation of such policies.

In particular, smallholder farmers are being supported through various resilience building projects that increase their ability to adapt to climate change. They are being supported to use resistant breeds and crop varieties and to introduce new farming practices. For instance, conservation agriculture, zero tillage agriculture, water harvesting, and complementary irrigation are all being employed in parts of the country. There are also initiatives to increase the uptake of renewable energy to reduce deforestation and increase resilience to droughts.

Harvested beans in Sudan.
©FAO/Mario Zappacosta

Climate-impacted farming system 4: Northern and Western Iran (Islamic Republic of)

Iranians. Around 53 percent of seasonal crops are produced in rain-fed areas and 36 percent are produced in irrigated areas. Around 10 percent of permanent crops are produced in irrigated areas and one percent are produced in rain-fed areas. There are various types of agricultural holdings in the country, namely agro-industries, rural production cooperatives, farming corporations and family holdings. More than 99 percent of agricultural holdings in Iran (Islamic Republic of) are family holdings.

Climate change will impact all forms of agriculture in Iran (Islamic Republic of), with changes projected in both temperature and precipitation. Surface runoff, groundwater, total renewable water and, especially, snow fall and snowmelt time are already changing and expected to continue to change. Evapotranspiration has increased over the past 30 years, which is also impacting agricultural production. There have also been extreme drought trends throughout the country over the past 30 years. Flood occurrence by around 52 percent over the same period. Added to these challenges, Iran (Islamic Republic of) is witnessing an increase in sand and dust storms. originating both from within and outside the country. These result mostly from poor natural resource management practices and the damming of rivers in the lands to the west of Iran (Islamic Republic of).

In response to these challenges, Iran (Islamic Republic of) is considering both mitigation and adaptation measures through its NDCs. It will take conditional mitigation actions to conserve and develop its forests and implement sustainable agriculture to mitigate greenhouse gas emissions. To take action on adaptation, Iran (Islamic Republic of) indicated the need to use environmentally-friendly technologies, develop online climate and weather monitoring systems, and develop early warning and monitoring systems for climate and sand and dust storms. This, however, requires access to global satellite data.

In terms of current activities, Iran (Islamic Republic of) is focusing on increasing its water productivity, limiting rice planting to Northern Iran (Islamic Republic of) only, replacing water-intensive crops such as melon and watermelon with water-efficient crops, establishing water meters on agricultural wells, and shifting to growing certain vegetables such as tomatoes and cucumbers in greenhouses. The institutions responsible for implementing climate change work in agriculture are primarily those under the Ministry of Agriculture and Jihad, especially the Office of Environment and Food Safety, the Organization of Forests and Pastures, the Agricultural Planning Economic and Rural Development Research Unit and the Deputy of Watershed Management, Rangeland and Desert Affairs. The Ministry of the Environment focuses on this work as well, particularly the Deputy of Human Environment and the Water and Soil Office, the Dust Office, the Climate Change Center and the Air Quality Monitoring Unit.

Climate-impacted farming system 5: Yemen

Agriculture in Yemen is still dominated by smallholder farms that are typically less than one hectare in size. Rain-fed agriculture predominates, accounting for around 47 percent of the cultivated land. Annual precipitation in Yemen is very low and characterized by seasonally intense and short-lived heavy storms that produce flash floods. During the rest of the year there are, with long dry spells that lead to widespread drought.

Several studies have been conducted to assess the impact of climate change in Yemen. All found that agriculture, water and coastal zones are most vulnerable to climate change. This is a vast challenge given that agriculture sustains the rural poor and employs more than 50 percent of the total labour force.Specifically, climate change is expected to increase water scarcity, reduce water quality, increase drought frequency, change precipitation patterns, increase temperatures, and reduce agricultural productivity. All of these will then impact the country's food security.

In response to the challenges posed by climate change, Yemen has put forth a wide range of measures, including promoting rainwater harvesting and drought management, developing livelihood approaches that integrate natural resource management, ensuring disaster risk management (especially for floods and droughts), and building the capacity of farmers to adapt to climate change. To support these efforts, the Ministry of Agriculture and Irrigation, the Ministry of Water and Environment, the Yemen's Farmers Association, and the Water Users' Association lead much of the work.

The beneficiary feeding her animals in the targeted area supported by FAO.
©FAO/Abdulhakim

Other Climate-impacted farming systems

Oman

There are smallholder farmers throughout all of Oman's governorates. Most of them are located in Ad Dakhiliyah, Ash Sharqiyah North, Al Batinah North and Al Batinah South. The two major farming types are mixed (crops and livestock) and pastoral. It is very commonly kept to raise chickens. Farmers are already feeling the impacts of climate change, primarily from the lack of rainfall reducing freshwater supplies, as well as increased desertification, land degradation and sea-level rise and the consequent salt-water creep into aquifers. Further to this, livestock are also being affected by the impact that increased temperatures have on their health as well as the promulgation of diseases, insects and weeds throughout all agricultural practices.

A particular challenge that Oman faces is the occurrence of extreme weather events, especially cyclones coming from the Indian Ocean. There has also been a general increase in the average annual temperature where some areas have noted a 1 °C temperature rise from 1980 to 2008. Some areas have also seen a reduction in rainfall of 70 mm per annum over the same time frame.

In response to this, Oman's NDC prioritizes coastal areas, fisheries, flooding, and sea-level-rise management. Oman is conducting research into forage crops that are drought and salt tolerant as well as into the use of *siwawe* water for forage crops. Further, they are exploring integrated pest and disease management, protected agriculture schemes, and the expansion of tree planting (especially of date palms, coconuts and various fruit trees). Support to smallholder farmers is channelled through various development banks, the Marketing Authority and the Agriculture Society. Farmers received subsidies for the use of irrigation systems and greenhouses.

Bedouin woman farmer raising goats.
©FAO/Rosetta Messori

Saudi Arabia

According to a study by the Prince Sultan Institute for Environmental, Water and Desert Research, all regions of Saudia Arabia will be affected by climate change in the period 2025-2084, specifically by high temperature and significant changes in precipitation. In addition, water consumption in different areas such as households, industry and agriculture is likely to be affected by climate change, which will increase the costs of desalination.

There are many farming systems in Saudi Arabia; the main ones are based on irrigation. Farmers in Saudi Arabia are divided into several categories: farmers with lands, farmers who are land investors and tenant farmers. Most of the smallholder farmers are tenant farmers. They cultivate vegetables in protected systems (such as greenhouses), as well as cultivating vegetables and feed under irrigated systems, drip irrigation, and nurseries. The Saudi Arabian government aims to provide water for agriculture and reduce the use of chemicals as much as possible, through several programs being implemented and by encouraging farmers to switch to techniques such as aquaculture and organic agriculture and to shift away from fodder farming.

These efforts are implemented by several national institutes that work on climate change, including the Prince Sultan Institute for Environmental, Water and Desert Research at King Saud University; the Department of Civil and Environmental Engineering at King Fahd University of Petroleum and Minerals; and King Abdulaziz City for Science and Technology.

They country's NDCs recommend focusing on economic diversification and the export revenues of oil and its derivatives in order to exploit profits in important sectors such as agriculture, financial and medical services, tourism, education and renewable energy, and to invest considerable efforts and resources in activities that help protect and renew the natural environment, including conserving biodiversity.

Crop production and protection at Hakma Research Station.
©FAO/Franco Mattioli

PART 5
Climate-smart agriculture roadmaps

A farmer cultivating the land in the targeted area supported by FAO.
©FAO/Soliman Ahmed

The workshop enabled the countries represented to provide an optic on the status of climate change and its impact on agriculture in their country and to discuss potential ways forward. Working groups were assembled that grouped countries whose farming systems were similar (Figure 6). In these groups, countries shared their experiences of the most relevant CSA solutions for their country based on their farming system type and local specificities. The findings from each of these groups were then shared with the entire workshop. Iit was evident that there were themes and priorities that were common to the entire region.

After all the working groups reconvened, it was evident that there were several actions that needed to be prioritized throughout the region. First, all countries noted the need to develop early warning systems for changes in temperature and rainfall, extreme events (such as heat waves, droughts and flooding) and for sand and dust storms in certain parts of the region. However, this effort should not end with the creation of these systems as they already exist or are being developed in some countries. Rather, once these systems are in place, farmers must be able to effectively access the systems and receive recommendations on what actions they should take. Second, all countries noted the need to develop heat, drought and salt-resistant crop varieties. Third, countries emphasized the need to build farmers' capacities through various extension services. This reflected the sentiment that farmers were often systematically detached from socio-economic systems.

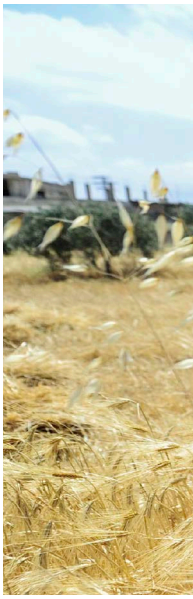
In addition to these common priorities, specific priorities were observed in each of the working groups. The groups focusing on rain-fed mixed farming systems identified the establishment of climate change centres and the rehabilitation of forest and degraded lands as priority actions under CSA. The groups focused on highland mixed farming systems identified food loss and waste management and sand and dust storm management as priorities. The groups focused on irrigated farming systems, prioritized the use of geo-information systems and the wastewater management. Finally, the groups focused on pastoral systems emphasized the need to develop capacity on quarantine services and to optimize animal genetic varieties.

For the **Maghreb rain-fed** working group, both members (Mauritania and Tunisia) strongly prioritized the livestock sector, noting that better herd management, reduced herd size, and improved and more inclusive milk value chains were key. Livestock management requires addressing both production and post-production losses. In terms of crops, the sub-region prioritized olives and wheat, where the anticipated yield reduction under climate change is likely to be extreme. In response to this, the countries suggested (1) investing in research to developvarieties adapted to climate change, (2) fostering the sharing of research with smallholder farmers, and (3) Studies on the impact of climate change om olive production and exploring alternatives to olives for the oil production. This last suggestion would also entail a study how an increase olive oil prices would impact consumer demand.

Mauritania emphasized managing the risk of declines in maize production by developing resilient varieties and reviewing planting calendars. Increased production of sorghum, which is more resilient to climate change, would partially address this issue. Mauritania also suggested developing appropriate policies for the maintenance of forests as barriers to desertification. In Tunisia, there is a desire to build CSA capacity through the development of a strategy on innovative extension and communication services.

The **Mashreq rain-fed** working group coalesced over the sub-region's priorities. First, assessments are needed to determine the impacts of climate change on agriculture at the national level. The assessments should include both modelling and field surveys. Second, climate change centres for agriculture are needed. This would require creating databases and training staff. Finally, the group noted the need to use different Levantine species that are drought, heat and salt tolerant. This would entail an assessment of the existing species, starting a breeding program, increasing public awareness and improving extension services. A strong emphasis should be placed on olive production, given its economic importance in the region.

The **highland mixed** farming system group had country-specific recommendations. Iran (Islamic Republic of) identified three priorities. First, they need to prepare a new cropping pattern, with a reduction in water-intensive crops, the development of greenhouses for vegetables, and the uptake of smart water meters. Second, the country prioritized a reduction in food loss and waste, including reviewing and enforcing the green tax law and determining the economic value of the ecosystem of biological resources. Third, the country intends to reduce natural disaster impacts by developing forests to reduce erosion and flooding. The country will also identify causes of internal sand and dust storms and assess their impacts, especially in Khuzestan and Kerman. The protection of lagoons and aquatic systems is considered part of this.



In Lebanon, a series of priorities were identified. First, improving the Committee on Climate Change's fulfilment of its duties, including more frequent meetings with all stakeholders present. Second, adoptiing a new and common approach to extension services. Third, increasing early warning systems that message farmers about the trends and provide them with advice on how to respond. Lebanon also suggested the implementation of a “green corridor” at land and sea crossings. This would effectively develop a fast lane at border crossings for vehicles transporting

food so they do not have to wait at borders, thereby reducing food loss and waste. Finally, using or reusing more drought and heat resistant species is also a priority.

In Yemen, the development of solar photovoltaic water pumping systems for irrigation was noted. For these to be effectively and efficiently used in a water-scarce environment, Yemen noted that they would need to be accompanied by the use of meters for measuring water use. Rolling out the systems would involve assessing target areas, identifying a number of smallholders in each area, determining the specifications of the systems, and purchasing and installing the systems. Yemen also identified the need for early warning systems. This would entailestablishing a system for data exchange. Finally, building the capacity of extension service providers and raising awareness about the impacts of climate change on agriculture are key aspects as well..

The United Arab Emirates identified a series of priorities that were different from other countries. This is due to their different geography and prioritisation of imports. Priority was given to minimizing food loss and waste. However, for the smallholder farmers in the country, ensuring their access to early warning systems is key. Such systems exist in the governorates of the country, but extending access to them on the part of farmers still needs to happen more systematically.

For the **irrigated** farming systems, each county identified different priorities. Egypt emphasized the need to support capacity building for installing early warning systems as well for implementing activities to eliminate post-harvest crop loss and waste. Egypt also noted the need to treat wastewater and use it in planting trees in the desert area. Iraq listed a series of priorities, including installing soil-monitoring stations, introducing genetically modified crops, installing water harvesting projects, raising farmers' awareness of the issues, and managing dams. In the Sudan, three priorities were identified. First, value chains for eight main crops should be enhanced. This would involve capacity building and reviewing existing measures. Second, geo-information technology needs to be better integrated into different sectors. Third, water-resource infrastructure should be improved. In the context of climate change, this could include water harvesting, transfer irrigation and new technology.

Abu Suliamn farms & livestock at Tal Kalakh area, al Quryyat, Homs Fields.
©FAO/Omar Sanadiki

PART 6
Future directions

A couple caring for their livestock in Lebanon.
©FAO/Kai Wiedenhoefer

Under the auspices of the Regional Initiative on Small-Scale Family Farming, the Regional Workshop on Climate-Smart Agriculture in the Near East and North Africa allowed key stakeholders to gather for the first time to discuss solutions to the impact of climate change on agriculture. The aimed of the organizers was that a representative from the ministry of agriculture and another from the ministry of the environment of each country participate in the workshop in order to foster the nexus thinking that is essential to effectively building smallholder farmers' resilience to the impacts of climate change.

This workshop was of central importance to addressing this very issue of the ability of farmers and food systems to manage and adapt to the impacts of climate change - one of the major challenges faced in the NENA region.. There are a myriad of options for addressing this challenge. Key among them is the climate-smart agriculture approach. The regional workshop enabled a dialogue on CSA for the first time in NENA. In so doing, it facilitated the sharing of knowledge from technical experts and the exchange of expertise and experience among the countries.

The workshop demonstrated that there are a number of common challenges in the region, including increasing temperatures, increasingly erratic precipitation and increasing frequency of extreme events. There are also a number of common priorities in response to these challenges. These include the development of early warning systems, the provision of effective extension services, and the development and use of enhanced crop varieties that are drought, heat and salt tolerant. While there were a series of common trends between countries, some challenges and priorities were state-specific. The roadmaps that each of the countries developed to respond to these challenges were discussed in working groups where other members had similar farming systems.

These roadmaps serve as a basis for future action. They have been communicated to the country offices so that dialogue can commence towards the country-specific measures to be adopted to ensure that the resilience of smallholder farmers to the impacts of climate change is built. In addition to these national-level actions, the Regional Initiative on Small-Scale Family Farming aims to draw out regional themes to study and act on. There are, for instance, certain key crops and livestock that will be especially impacted by climate change. Identifying the economic importance of these to NENA countries, as well as the impacts and potential solutions, is essential. In addition, a comprehensive, region-wide analysis of the economic cost of adaptation of agriculture sectors to climate change is key to informing policy decisions. These recommendations, and others, will be discussed and explored between the IsDB and FAO as a direct consequence of this workshop.

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ANNEX 1:
WORKSHOP AGENDA

REGIONAL WORKSHOP ON CLIMATE-SMART AGRICULTURE

8-10 OCTOBER 2018
KHARTOUM, SUDAN

AGENDA

DAY 1	
8:00 – 9:00	**Registration**
9:00 - 10:00	**Opening Ceremony, remarks by:** » Mr. Badreldin Elsheikh, Undersecretary of the Ministry of Agriculture and Forests » Mr. Ahmed Al Qabany, Manager – Climate Change Division, IsDB » Mr. Babagana Ahmadu, FAO Representative in Sudan » Mr. Busara Jumaa Aror, Federal Minister of Communications and Information Technology. » Mr. Hassabelnabi Musa Mohamed, Federal Minister of Agriculture and Forests **Establishment of Workshop Objectives** » Mr. Alfredo Impiglia, Delivery Manager, FAO
10:00-11.15	**The Challenge: Climate change in the NENA region** **Special themes: drought, soil and forestry** » Mohamed Abdel Monem, Senior Advisor, FAO RNE
11.15-11.30	*Tea and Coffee Break*

11.30-12.15	**The Challenge: Impacts of climate change on farming systems and livelihoods in NENA** » Phoebe Lewis, Agronomist, FAO RNE
12.15-13.00	**A regional framework for climate-smart agriculture and early warning systems** » Phoebe Lewis, Agronomist, FAO RNE
13.00-14.00	*Lunch*
14.00-15.00	**The Solutions: Climate-Smart Agricultural Barriers and Solutions** » Rima Al Azar, Senior Natural Resources Officer, FAO HQ
15.00-15.15	*Tea and Coffee Break*
15.15-16.00	**IsDB Policy Review and Application** » Climate Change Policy
16.00-17.00	**IsDB Policy Review and Application** » Agriculture and Rural Development Policy
DAY 2	
09.00-09.15	**Recap**
9:15 - 10:00	**Climate-Smart Agriculture: Practical Applications** » Mohamed Abdel Monem, Senior Advisor, FAO RNE
10:00-11.00	*The Solutions (cont.)* **Part 2: Climate-Smart Agricultural Post-Production Stage** » Mohamad Abiad, Associate Professor, American University of Beirut
11.00-11.15	*Tea and Coffee Break*
11.15-13.00	**Country Presentations: Progress and Plans (10 mins each)** » Egypt, Iran (Islamic Republic of), Iraq, Jordan, Lebanon

13.00-14.00	*Lunch*
14.00-15.30	**Country Presentations: Progress and Plans (10 mins each)** » Mauritania, Morocco, Oman, Saudi Arabia, Sudan
15.30-15.45	*Tea and Coffee Break*
15.45-17.00	**Country Presentations: Progress and Plans (10 mins each)** » Syria, Tunisia, United Arab Emirates, Palestine, Yemen
DAY 3	
09.00-09.15	**Recap**
9:15-11.00	**Working Groups** **There will be three working groups, each with a facilitator.** *WG 1: Maghreb; WG 2: Mashreq; WG 3: GCC Facilitators will be Alfredo Impiglia, Mohamed Abdel Monem, and Phoebe Lewis.* » Identification of pertinent outputs » Design of the roadmap to implement activities » Align with NDC planning **Assignment of timeline and accountability**
11.00-11.15	*Tea and Coffee Break*
11.15-13.00	**Presentation of Roadmaps** » 5 min outline of roadmap per country » Follow up actions
13.00-14.00	*Lunch*
14.00-16.00	**Presentation of Roadmaps** » 5 min outline of roadmap per country » Follow up actions **Closing Remarks**

ANNEX II:

COUNTRY ROADMAPS ON CLIMATE-SMART AGRICULTURE PROGRAMMING

Country	CSA Priority Policy or Programme	Activity (include location if possible)	Indicator	Modality	Responsibility
Egypt	Support capacity building activities for install early warning system	» The activities will include establishment of agriculture monitoring stations and data base, and it will covers 3 areas; Delta, Middle Egypt, and Upper Egypt.	» Number of trained, staff , and systems installed. » validate scope of work » Assessment of crop loss and waste. » Number of trained farmers (Males and females)	N/A	Ministry of agriculture Meteorological Authority
	Support capacity building activities to eliminate crops' loss and waste after harvesting and industrialization processes	**The actives will cover upper Egypt area, and including:** » Provide well trained external agents. » Implement small –scale agro processing industries; such as drying units, units for extracting oils, and small pickling factories.	» Number of trained external agents (especially women) » Number of trained farm-ers(especially women) » Measure the percentage of crops' waste after awareness sessions; by measuring of increase farmers' income, and decrease unemployment's percentage		Ministry of Agriculture Ministry of Industry
	Treatment of waste water and use it in planting forest trees in the desert areas	**The activities will cover Delta area, and will include:** » Installment of waste water treatment plants. » Provide seedlings and trained people who are able to plant and maintained the trees.	The amount of treated waste water. Number of seedlings, the area covered, and follow up grow of the trees.		Ministry of Agriculture Ministry of Environment Ministry of Irrigation

Iran (Islamic Republic of)	Preparing a new pattern for cropping.	» Develop greenhouse system vegetables (such as tomatoes, cucumbers etc.) in Kerman and Kazavi Khorasan. » Water-intensive crops will be limited (such as rice) wlll be limited in places like Isfahan and Shiraz. » Setting up smart water meters on agricultural wells in the central parts of Iran (Islamic Republic of).	» Greenhouse cropping versus the total cultivated land. » Proportion of wells with smart meters versus all agricultural wells in Iran (Islamic Republic of).		Ministry of Agriculture and Jihad in partnership with the Ministry of Power.
	Reduction of food loss and waste	» Review and enforce the green tax law. » Determine the economic value of the ecosystem of biological resources and the cost of its environmental damage. » Upgrade from accounts GDP to GGDP.	» Green tax collected versus total country tax. » Green accounts versus total gross national GDD.	Mathematical and statistical method.	Department of Environment in partnership with Central Bank.
	Reduction of natural disasters impact.	» Development and maintenance of forests with emphasis on erosion and flood areas managing and reducing agriculture at step levels. » Identification and consolidation of causes of internal dust with emphasis on Khuzestan and Kerman. » Change the pattern of agricultural cultivation with adaptation to the climate. » Protection of lagoons and aquatic ecosystems.	» Number of managed wetlands versus total wetlands » Total area fixed dust versus total area of dust (internal only) » Total area fixed dust versus total area of dust (external)		Department of Environment in partnership with (1) Jahad (2) Interior and (3) Foreign Affairs.

Iraq	Installing soil monitoring stations using new CIS techniques as well as development of staff capacity in this field	Provide the ministry of environment (Baghdad) with required equipment and technical assistance as well.	» Upgrading the capacity of Rabinah station (existed). » With other 4 substation		Ministry of environment Ministry of agriculture
	Fill the food gap by Produce a new genetically modified crops	Provide Agriculture research center in (Aboughreeb) with the tools and technical assistance.	Number of trained people (males and females)		Ministry of environment Ministry of agriculture
	Land reclamation projects	Middle and south Iraq (Basra, Emara, waset, Theecar)	100 thousand Donnom		Ministry of agriculture
	Water harvesting projects	Dialy, Mosal and Alanbar areas	Establish 7 oases; with total area from 200 to 800 Donnom each.		Ministry of agriculture
	Reconstruction of Elahowar's area	Basra, Emara, and Theecar areas	Provide about 12 billion square meter of water for reconstruction of Elahwar area		Ministry of environment Ministry of water resources
	Fisheries projects	In Tigris and Euphrates rivers and also in the perennial surface water resource.	Increase the percentage of domestic production by 15%		Ministry of agriculture
	Wastewater treatment projects	Close to the Tigris river (Baghdad; nearby Madentatelteb)	Decrease water pollution		Ministry of municipality
	Raising farmers' awareness	The project will covers fifteen governorates.	Increase the number of beneficiaries from 500-1100 farmers		Ministry of environment Ministry of agriculture
	Mainstreaming gender equality issue	Cover different governorates such as; Babel,Basra, Emara, Theecar, Waset, Karbalaa, Nagaf, and Mosel	Increase farmers' income and productivity		Ministry of environment Ministry of agriculture
	Install dams » Establishment of new of grazing and protected areas » Vegetation improvement and exploitation of rainwater. » Genetic improvement of animals. » Provide comparative advantage for small producers and marketing instruments to increase domestic production.	**Dams in Mesan, Anbar, Karkook, Dialy, and Waset ares.** » Anbar, Dialy, Salaheldeen, and Tenoy areas » Elanbar area » Fifteen governorates in Iraq » Middel and South governorates.	**Increasing storage capacity into 124 billion cubic meter** » Establishment of 150 stations. » Protection of 1000 Donnom of forests. » Establish 10 stations » Establish 10 food processing factories		1,2,3 -Ministry of agriculture 4-Ministry of trade

Jordan	Assessment of climate change on agriculture at the national level.	» National studies. » Modeling of climate change. » Field surveys.	The report of the study.	» Using global, regional and local results of the study on agriculture. » Apply the models and verify by field studies.	National research centres National organizations.
	Establishment of a climate change centre for agriculture.	» Establish database » Conduct capacity building	Variable information.	» Collecting data and information.	Ministry of Agriculture.
	Use different Levantine species for drought, heat and saline conditions, focusing on olives.	» Assessment of the existing species. » Start a breeding programme. » Public awareness and extension service.	New varieties.	» Research programme » Introduce the new varieties.	» National research institutes. » International organizations.

Lebanon	Increase or develop the duties of the Committee on Climate Change.	» Meeting every other month instead of current rate of four times per year and with the presence of all stakeholders.	» More coordination. » Decreasing the duplication. » Good exchange between the concerned authorities.	Already implemented, the need is to increase their activity.	Develop a roadmap between concerned ministries or research centres.
	Adoption of new and common approach in the promotion	» Train the trainers in the Ministry of Agriculture » Increase the activity of extension offices or centers in each governorate. There are 28 in Lebanon. For example, create a green line telephone for early warning systems.	» Same method and work between all extension services.	By training	A roadmap between stakeholders.
	Increasing the early warning system	Send messages or WhatsApps for farmers with (1) the warning and (2) what they can do about it.	Number of farmers who execute and respond to this warning.	Contract with telecommunication companies to make this activity free of charge.	Coordination between the research centre and ministries.
	Use or implement a "green corridor" between all borders/ countries.	Develop a fast lane at sea and land borders to be used for vehicles transporting food so that they are not waiting for long periods of time (thereby increasing food loss and waste potential).	Decreasing time for entry and waiting time at borders.	Create a place or checkpoint between the countries.	Decrease the waiting time for agricultural products.
	Use or reuse more drought and heat resistant species.				

Mauritania	The risk of decline in maize production in Mauritania should be addressed first by developing resilient varieties and also reviewing the planting calendar if possible	The production of sorghum should be supported by adequate policies as this cereal is more resilient to heat.			
	Another commodity that deserves special emphasis, especially in Mauritania, is milk.	» Better management of herds and a better control of risks (diseases) will help reducing herd size while maintaining or even increasing production. » Reducing herd size will reduce the pressure on natural resources. » Improved and more inclusive milk value chains, in which both production and post-production losses are controlled, quality and hygiene is improved, will reduce the need to import food and will also have an impact on the country's efforts to mitigate climate change by better integrating Dairy and beef production (i.e. generate a higher protein and nutritional outputs per unit of natural resource used) » This also requires improved management of pastures and control of the number of livestock units per hectare of pasture.			
	The expected reduction in productivity in olives and wheat should be addressed.	» Investing in research for the development of varieties adapted to the climate that will prevail in 2030 » Foster the sharing of results of research within the region and develop measures to accelerate adoption by small-scale producers with adequate incentives. » Explore alternatives to olives for the production of oil and study what will be the impact of an increase of the price of olive oil on consumers demand for olive oil and for alternative products in order to reorient agricultural policies accordingly.			
	In Mauritania, there is a lack of recent data on the status of forests. This gap needs to be filled in order to develop appropriate policies for the maintenance of forests as barriers to desertification.				

Oman	» Improvement of external agents' system and Agricultural Quarantine Procedures and list. » Periodic inspection on sea species; especially nearby the industrial areas. » Rang land management	» Establishment of database and elaborate research tools and techniques in the agricultural laboratories. » Periodic inspection on sea species (sea mollusks, clams,.....); especially nearby the industrial areas. » Rehabilitation of the range land, grazing capacity restoration and management, and	» Number of agents who are able to transfer the technology to the farmers, » Number of staff that are able to identify the plant pathogen. » Dissection of marine mollusks for research purpose. » Range land assessment and define grazing activity.	Expert committee to update agricultural Quarantine list.	1,2 Ministry of agriculture 3 Ministry of agriculture and Ministry of environment
Palestine	Assessment of climate change on agriculture at the national level.	» National studies. » Modeling of climate change. » Field surveys.	The report of the study.	» Using global, regional and local results of the study on agriculture. » Apply the models and verify by field studies.	National research centres National organizations.
	Establishment of a climate change centre for agriculture.	» Establish database » Conduct capacity building	Variable information.	Collecting data and information.	Ministry of Agriculture.
	Use different Levantine species for drought, heat and saline conditions, focusing on olives.	» Assessment of the existing species. » Start a breeding programme. » Public awareness and extension service.	New varieties.	» Research programme » Introduce the new varieties.	» National research institutes. » International organizations.
Saudi Arabia	Assessment of climate change on agriculture at the national level.	» National studies. » Modeling of climate change. » Field surveys.	The report of the study.	» Using global, regional and local results of the study on agriculture. » Apply the models and verify by field studies.	» National research centres » National organizations.
	Establishment of a climate change centre for agriculture.	» Establish database » Conduct capacity building	Variable information.	Collecting data and information.	Ministry of Agriculture.
	Use different Levantine species for drought, heat and saline conditions, focusing on olives.	» Assessment of the existing species. » Start a breeding programme. » Public awareness and extension service.	New varieties.	» Research programme » Introduce the new varieties.	» National research institutes. » International organizations.

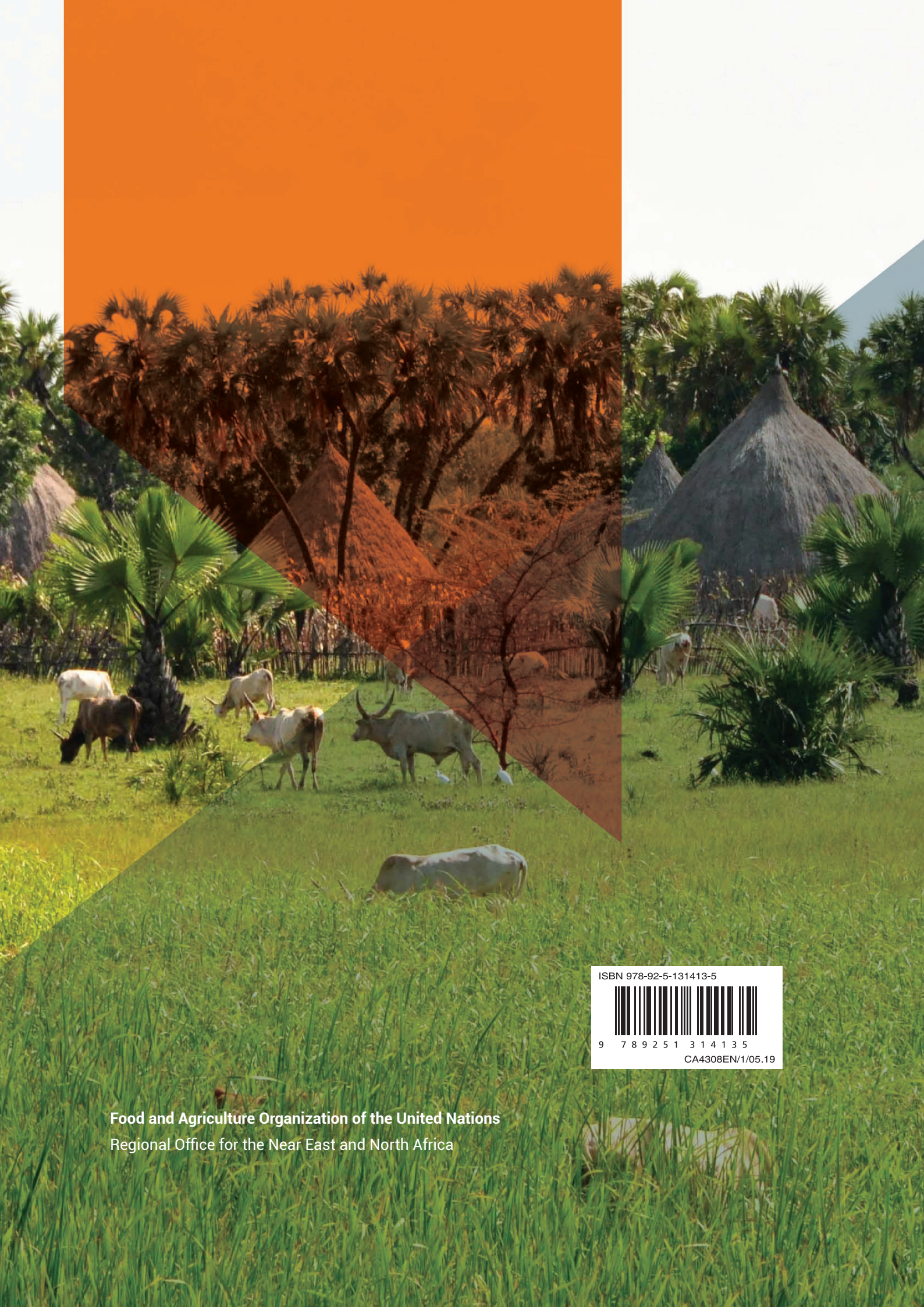
Sudan	Fostering value chains for eight main crops.	» Capacity building for farmers and SMS. » Reviewing market policy related to crop.	» Training of trainers conducted. » Policy updating.		» Ministry of agriculture » Research institutes » Finance » NGOs
	Integrate geo-information technology for different sectors.	» Capacity building » Human resources » Seasonal prediction and monitoring	» Qualitative indicators » Mapping		» Ministry of agriculture » Ministry of meteorology » Ministry of environment and energy » Ministry of food security and livelihoods
	Improve water resources infrastructure.	» Water harvesting » Transfer irrigation » New technology	» Covered area by water harvest » Improve efficiency of water quantity.		» Ministry of agriculture » Ministry of water resources » Ministry of environment and energy » NGOs
Syria	Assessment of climate change on agriculture at the national level.	» National studies. » Modeling of climate change. » Field surveys.	The report of the study.	» Using global, regional and local results of the study on agriculture. » Apply the models and verify by field studies.	» National research centres » National organizations.
	Establishment of a climate change centre for agriculture.	» Establish database » Conduct capacity building	Variable information.	Collecting data and information.	Ministry of Agriculture.
	Use different Levantine species for drought, heat and saline conditions, focusing on olives.	» Assessment of the existing species. » Start a breeding programme. » Public awareness and extension service.	New varieties.	» Research programme » Introduce the new varieties.	» National research institutes. » International organizations.

Tunisia	Enhancing skills in climate-smart agriculture (capacity-building)	» Training and knowledge exchange to share successful experiences in climate-smart agriculture » Development of a strategy on innovative extension and communication services, with stronger emphasis on the impact of climate change			
	Another commodity that deserves special emphasis, especially in Mauritania, is milk.	» Better management of herds and a better control of risks (diseases) will help reducing herd size while maintaining or even increasing production. » Reducing herd size will reduce the pressure on natural resources. » Improved and more inclusive milk value chains, in which both production and post-production losses are controlled, quality and hygiene is improved, will reduce the need to import food and will also have an impact on the country's efforts to mitigate climate change by better integrating Dairy and beef production (i.e. generate a higher protein and nutritional outputs per unit of natural resource used) » This also requires improved management of pastures and control of the number of livestock units per hectare of pasture.			
	The expected reduction in productivity in olives and wheat should be addressed.	» Investing in research for the development of varieties adapted to the climate that will prevail in 2030 » Foster the sharing of results of research within the region and develop measures to accelerate adoption by small-scale producers with adequate incentives. » Explore alternatives to olives for the production of oil and study what will be the impact of an increase of the price of olive oil on consumers demand for olive oil and for alternative products in order to reorient agricultural policies accordingly.			

United Arab Emirates	Minimize food loss and waste.	Monitor the whole process of incoming shipments to ensure that there is a fast release.	Minimized time of release.	Gather the importers to see if they have any suggestions or points. Discuss implementation with the ministry and customer.	
	Develop early warning systems.	» Register farmers in the system with their contact numbers. Systems are available, but the access to farmers needs to be provided. » Enable farmers to access a database full of the data and information they might need to help them predict ad prepare for climate change. » Provide farmers with suggestions to solve any problem they might come to face.			
Yemen	Development of solar PV water pumping for irrigation, ensuring the use of a meter for measuring use.	» Assessment to identify target areas. » Identification of number of smallholders in each area. » Specifications of the system. » Purchasing and installment of systems.	Number of systems installed.		» Ministry of Agriculture and Irrigation » Irrigation Department
	Develop early warning systems.	» Establishment of a coordination mechanism between (1) CAMA, (2) agriculture offices, and (3) EPA. » Establishment of a system for data exchange.	Number of help desks in different districts.		» CAMA » MAI » EPA
	Capacity building of extension services and awareness.				

ANNEX III:
WORKSHOP ATTENDEES

- Government of Iran
- Government of Iraq
- Government of Jordan
- Government of Lebanon
- Government of Mauritania
- Government of Morocco
- Government of Oman
- Government of Saudi Arabia
- Government of Sudan
- Government of Syria
- Government of United Arab Emirates
- Government of West Bank and Gaza Strip
- Government of Yemen
- Islamic Development Bank
- FAO Sudan
- FAO Regional Office for the Near East and North Africa
- FAO Headquarters



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