



Investing in resilience: addressing climate-induced displacement in the MENA region

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Executive summary

Climate change threatens the viability of agriculture, ecosystems, and rural livelihoods in the Middle East and North Africa (MENA). In a region where agriculture is a critical source of employment and income, environmental degradation, and declining and more variable productivity, could potentially cause significant displacements, posing challenges in a region already beset by instability.

There is evidence that environmental factors are now influencing migration flows, and this influence is expected to grow as climate change intensifies and conditions become progressively hotter and drier. Investments are needed now to strengthen resilience and maintain rural livelihoods, helping communities to prepare for and recover from immediate weather shocks such as drought, and also adapt to shifting climatic conditions over the medium to longer term. The costs of our inaction will only grow as adaptation needs escalate.

The resilience strategy outlined in this discussion paper strategically targets regional priorities and challenges. It has three main components: (1) the improved collection of migration-related data to better understand the relationship between climate change, migration, and displacement, and help decision-makers devise more strategic responses; (2) proven adaptation measures to help rural communities adjust to both short- and longer-term climate threats; and (3) promoting migration as a form of climate change adaptation.

Given North–South inequalities, the existence of migration networks, and the fact that many rural households already use migration to diversify their incomes, the strategy is not designed to stop migration altogether. Instead, it offers a more practical approach: limiting involuntary displacement and, where possible, giving people the option of remaining where they are to build resilient and productive lives.

1. Climate change, migration, and displacement

Climate-induced migration is receiving significant and growing attention. Given its multi-causal nature, attributing migration to a single factor can often be extremely difficult (Box 1.1), and while environmental factors may be influential, their impact on migration is often more complex and nuanced than a simple cause–effect relationship. Environmental degradation and climate change tend to intensify existing economic, demographic, and political drivers, and the influence of these drivers is also controlled by personal and household characteristics, the costs of moving, and proximity to migrant networks (Foresight 2011; IPCC 2014; World Bank 2018). In some cases, an increasing focus on climate-induced migration can overlook a long history of mobility among affected populations (Farbutko and Lazrus 2012).

However, the influence of climate change on migration flows is expected to grow as climate change intensifies (Wodon et al. 2014) and people are forced to abandon climate-vulnerable areas or escape extreme weather events and conflicts initiated by competition over increasingly scarce resources (IPCC 2014). Countries and regions that are dependent on the agricultural sector are particularly vulnerable; in fact, several studies using extensive and comprehensive datasets on mobility and adverse climatic conditions suggest that rising temperatures and declining productivity are already contributing to rising rates of out-migration in many agriculture-dependent countries (Cai et al. 2014; Cattaneo and Peri 2015; Falco et al. 2018).

In the Middle East and North Africa (MENA) region, where conditions are expected to become significantly hotter and drier, projections suggest that higher temperatures, increasing water scarcity, and rising sea levels will compound production challenges in the region's critically important agricultural sector, which employs over 50 percent of the active population in many countries and generates some 40 percent of the region's GDP (Wodon et al. 2014). Deteriorating environmental conditions could therefore become devastating for rural economies, exacerbating regional

Box 1.1 Defining environmental migrants

The International Organization for Migration (IOM) uses a broad definition to describe environmental migrants as “persons or groups of persons who predominantly for reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad” (IOM 2014).

However, efforts to define environmental migrants, or similar definitions such as climate refugees, have been criticized. Some have suggested these definitions may be unhelpful given the multi-causal nature of migration flows (Foresight 2011).

There are three main components. First, it calls for improved and more coordinated efforts to gather and disseminate migration-related data, therefore enhancing understanding of the climate change–migration nexus, informing decision-making processes, and helping to devise policies that strategically target climate-vulnerable and migration-sensitive sectors and communities. Second, it adopts a series of proven adaptation measures and an integrated approach to adaptation that combines, for instance, the more efficient use of scarce water resources; the conservation, collection and utilization of biodiversity; integrated crop–livestock farming systems; more sustainable value chains and off-farm activities; and the delivery of new technologies to farmers. Finally, the resilience strategy embraces migration as a form of climate change adaptation, where appropriate, to help reduce pressures in climate-vulnerable areas.

The discussion paper is divided into three main sections. Sections 2 and 3 provide context and an overview of migration in the MENA region, the MENA region's vulnerability to climate change, and implications for agricultural production and food security. Section 4 outlines the three main components of the resilience strategy and explains how countries can embed the strategy in national adaptation plans and mobilize financial resources to facilitate its implementation.

socioeconomic challenges and forcing many to abandon unproductive lands and economically depressed communities (Lelieveld et al. 2016).

Strengthening resilience

The MENA region requires investments now to strengthen the resilience of its agricultural sectors and avoid the challenges posed by human displacements. The costs of inaction will only grow as adaptation needs escalate. This discussion paper outlines a strategic response to the threat posed by climate-induced displacements. Given the existence of migrant networks and the fact that migration is already an important income diversification strategy for rural households, the resilience strategy is not designed to prevent migration but instead to give people the option, where possible, of remaining where they are to build productive livelihoods. The strategy reflects national and regional priorities, and is based on extensive consultations with national governments and other relevant stakeholders. It is also consistent with the UN's Sustainable Development Goals Agenda for 2030 and the Global Compact on Safe, Orderly and Regular Migration.

2. Migration in the MENA region

Although migration is multi-causal, the influence of climate change on migration flows and displacement in the MENA region is already apparent and is expected to grow as conditions become significantly hotter and drier.

The MENA region has a large and growing migrant population, with emigrants from MENA countries accounting for approximately 10 percent of migrant stocks globally (IOM 2016). In recent years, in response to conflict and instability, significant attention has been paid to the region's growing numbers of refugees and Internally Displaced People (IDP). By 2015, over 6 million refugees worldwide originated in MENA countries – some 4.9 million from Syria alone – and the region's 16 million IDP account for around 40 percent of the world's IDP (IOM 2016). In fact, the region now has the world's largest refugee and IDP populations (UNDP 2018).

The MENA region is host to well-established labor migrant networks. Some 74 percent of the region's international migrants are in Gulf Cooperation Council Countries, including 10 million in Saudi Arabia and 8 million in the United Arab Emirates (IOM 2015). An estimated 36 percent of international migrants in the region are from other MENA countries, with the top countries of origin being Palestine, Syria, and Egypt (IOM 2015). Long-established labor networks also facilitate movements from North Africa to Europe (IOM 2015).

Understanding the climate–migration nexus

The influence of environmental factors on migration and displacement remains poorly understood in the MENA region (Wodon et al. 2014), as elsewhere (Falco, Galeotti, and Olper 2018). However, climate-induced movements are beginning to receive more attention. Climate change has been identified as a potential contributing factor to the conflict in Syria and the subsequent movements of refugees and IDP, for example (Box 2.1).

The IOM also identified drought as a cause of mass displacement in Somalia and Sudan in 2014 (IOM 2015), and estimates suggest that up to four million people were displaced by a prolonged drought in Somalia

Box 2.1 Syria: climate change and the migration crisis

A 2015 paper (Kelley et al. 2015) argued that severe drought in 2007–2008, and the rural–urban migration that followed, exacerbated unemployment, economic insecurity, and inequality, which in turn contributed to the unrest that precipitated the Syrian conflict. This paper was subsequently cited in media reports, which suggested that climate change was a direct cause of migrant flows heading towards Europe. However, attributing causality is difficult, and given the multi-causal nature of migration, this narrative also needs to recognize the significant political and socioeconomic drivers of migration.

between 2006 and 2011 (UNDP 2018). An analysis of national household surveys in Morocco by Nguyen and Wodon (2014) found that water scarcity and decreasing agricultural yields are influencing the decision to migrate.

However, this study, and others, also suggest that climate or environmental factors may be less influential than socioeconomic drivers (Wodon et al. 2014; Joseph and Wodon 2014) or the effects of conflict, violence, and persecution (IOM 2015).

In addition, efforts to quantify the size of future displacements have been criticized as methodologically unsound, overly deterministic, and neglectful of human agency and the possibility of adaptation (Foresight 2011).

Nonetheless, it is generally agreed that climate-induced migration will increase in the years and decades ahead as climate change intensifies and rural communities begin to feel the worsening impacts of climate change (Wodon et al. 2014). As conditions become progressively hotter and drier it is not unreasonable to assume that falls in productivity and the collapse of rural economies could potentially force significant numbers of people off degraded lands in search of opportunities elsewhere (Lelieveld et al. 2016), particularly if investments in resilience and climate-smart technologies and practices are insufficient. While data for the MENA region are limited, global analyses of mobility patterns and climatic

data have identified a relationship between rising temperatures, declining productivity, and out-migration in several agriculture-dependent countries (Cai et al. 2014; Cattaneo and Peri 2015; Falco et al. 2018).

3. Climate change and implications for agriculture

As climate change intensifies, the MENA region's agricultural sector – a critical source of income and employment – will struggle to maintain productivity, potentially devastating rural economies and endangering livelihoods.

The MENA region is already dealing with the effects of climate change and conditions are expected to become significantly hotter and drier over the course of this century, threatening the ability to irrigate crops, support adequate food production, sustain industry, or provide sufficient drinking water for growing populations (Verner 2012; IPCC 2014). Vulnerability to extreme weather shocks is also a worry, and the devastation caused by sudden droughts, floods, or storms could undermine the long-term adaptation capacities of rural communities and households.

Exposure to increased climate variability and extreme events

The MENA region is already exposed to the impacts of climate variability and extreme weather events (Verner 2012; Waha et al. 2017). Observational records since the 1960s, for instance, demonstrate a significant increase in the heat wave intensity index ($+1.33 \pm 0.06^{\circ}\text{C}$ per decade) (Kuglitsch et al. 2010). Global temperatures in 2010 were also the warmest since systematic data collection began in the late 1800s: 19 countries set new national records for daily temperature highs and 5 of these were in the MENA region. Moreover, MENA countries have to contend with more intense rainfall events, flash floods, and frequent droughts (Verner 2012; Donat et al. 2014). Droughts in Jordan and Syria in 2007–2010 were particularly devastating for agriculture, and floods in Yemen in 2008 increased the poverty rate and brought a 15 percent rise in the number of hungry people (Verner 2012).

Rural communities are increasingly aware of the threats posed by a changing climate. A World Bank analysis of household surveys in climate-vulnerable areas of Algeria, Egypt, Morocco, Syria, and Yemen revealed a widespread

acknowledgement of changing climatic conditions: less and more erratic rainfall, higher temperatures, and the increased occurrence of droughts (Wodon et al. 2014). Households reported that these conditions brought declining agricultural yields and contributed to higher rates of out-migration.

Climate variability and extreme weather events are not only an immediate threat. Their effects are long lasting: by destroying the productive assets of a rural household or community, they erode the possibility of long-term recovery and the ability to strengthen resilience against future shocks and the progressive deterioration of environmental conditions.

Rising temperatures

Temperatures in the MENA region are projected to increase throughout this century. Using five global climate models, Waha et al. (2017) found that by 2100 in a 2°C warming (optimistic) scenario, unusual heat extremes could occur in about 30 percent of summer months almost everywhere in the MENA region. With 4°C global warming, however, mean summer temperatures could be 8°C warmer in parts of Algeria, Saudi Arabia, and Iraq (Figure 3.1).

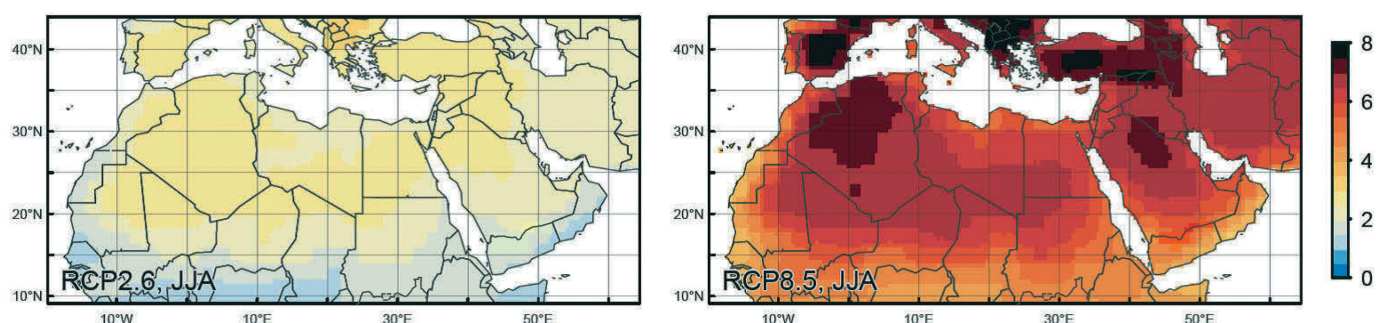
These changes will impact both crop and livestock production, and farming will have to move geographical location, requiring significant transformations and restructuring of the agricultural sector. Although rising temperatures may increase yields at higher latitudes where low temperatures are a limiting factor on growth (Müller et al. 2009), temperature increases at lower latitudes, including the MENA region, are expected to

reduce grain yields because grain crops mature earlier at higher temperatures, therefore shortening the critical growth periods. While studies show that CO₂ levels can benefit plant growth, any positive benefits are expected to be outweighed by soil moisture deficiencies and rising temperatures (Sneed 2018). One study, which analyzed warming levels of between 1.8°C and 2.8°C up to 2050, projected worldwide yield decreases of 14–25 percent for wheat, 19–34 percent for maize, and 15–30 percent for soybean (Deryng et al. 2011). The IPCC (2018) has also warned of net reductions in the yields of staple crops such as maize, rice, and wheat as temperatures increase by 1.5–2.0°C above pre-industrial levels.

There are also worrying implications for human nutrition. Atmospheric CO₂ is expected to surpass 550 parts per million by the middle of this century, resulting in a 3–17 percent reduction in the protein, zinc, and iron content of staple food crops (Myers et al. 2014; Medek, Schwartz, and Myers 2017). As a result, an additional 173 million people could become zinc-deficient, an additional 122 million people could become protein-deficient, and 1.4 billion women of child-bearing age and children under the age of 5 would lose more than 4 percent of their dietary iron intake in countries where anemia affects more than 20 percent of the population (Smith and Myers 2018). The Middle East is one of the regions most at risk.

Rising temperatures and heat stress will reduce the dry matter intake of livestock as a result of slower feed transit in the digestive tract, which leads to weight loss, less meat, and lower milk production (Ben Salem et al. 2011; Verner et al. 2013). High temperatures also threaten reproductive efficiency: changes in the uterine

Figure 3.1 Temperature projections (in °C) for scenarios RCP2.6 (2°C World) and RCP8.5 (4°C World), and the summer months of June–August (JJA) in 2071–2099 per grid cell



Source: World Bank 2014.

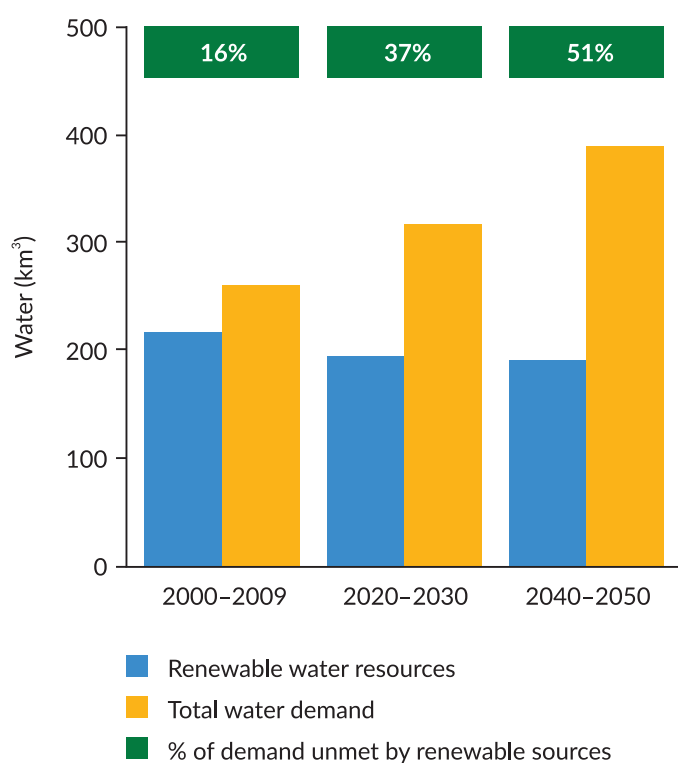
Note: RCP refers to Representative Concentration Pathways.

environment reduce embryo cell numbers and the size of the placenta, which results in significantly smaller lambs (Ben Salem et al. 2011). Furthermore, dry periods could initiate mammary gland involution and affect endocrine responses, which may increase abortions, shorten gestation lengths, lower calf birth weight, and reduce follicle and oocyte maturation. High temperatures have also been shown to be associated with longer postpartum periods in female sheep and goats (Ben Salem et al. 2011).

Increasing water scarcity

Rainfall levels are expected to decline across North Africa and West Asia, and Morocco, Algeria, Tunisia, and countries of the Middle East are projected to become global hot spots for drought (Orlowsky and Seneviratne 2013; Sillmann et al. 2013; Prudhomme et al. 2014). All but four of the region's countries – Egypt, Iraq, Saudi Arabia and Sudan – already suffer from chronic water scarcity and over half fall below the absolute water scarcity threshold (Verner 2012).

Figure 3.2 Renewable water resources and associated demand for the MENA region up to 2050



Source: Verner 2012.

Some 70 percent of the region's agricultural production takes place under rainfed conditions and, as climate patterns shift, the 200 mm isohyet – the threshold for viable rainfed agriculture – is predicted to move northward by some 75 km by the end of the century. This would result in the loss of 170,000 km² of rainfed agricultural land over an area covering Iran, Iraq, Lebanon, Syria, and the West Bank and Gaza (Evans 2009). Rainfed grazing systems are particularly vulnerable to drought and water scarcity, leading to changes in biomass production and species composition, which, in turn, influence the quantity and quality of livestock feed (Thornton et al. 2009).

Across the region as a whole, demand for renewable water surpasses supply, and demand is projected to increase even further (Figure 3.2). The availability of renewable water resources in most countries is below 1000 m³/capita/year (Sowers, Vengosh, and Weinthal 2011; Selvaraju 2013), and withdrawal availability ratios exceed a critical threshold of 40 percent in all MENA countries except Lebanon; they exceed 100 percent in Jordan, Yemen, Libya, and most Arab peninsula countries (FAO 2013).

Annual freshwater withdrawals are 94 percent of actual renewable water resources in Egypt, 609 percent in Libya, and 936 percent in Saudi Arabia (Michel et al. 2012). Agriculture is the most significant user of water, and consumes over 80 percent of the MENA region's resources (IFAD 2009; Waterbury 2013), and the introduction of intensive agriculture in some locations has accelerated the depletion of groundwater resources (UNDP 2018).

Innovations that are proven to enhance water-use efficiency, such as drip irrigation, are infrequently implemented or are used inappropriately (Haddad et al. 2011). There are few incentives or regulations to rationalize usage, and water policies that do exist tend to be enforced only rarely or inadequately (Abou-Hadid 2010; Molle and Closas 2016). In some contexts, the power of the state to act may be severely limited by financial costs, popular opposition to restrictive policies, and a lack of data and limited understanding of hydrogeology (Molle and Closas 2016).

Pests and diseases

As the region's climate changes, the types and severity of pests and diseases will also change. Insects are cold-blooded and higher temperatures could increase the number of insect generations that are possible in a year as a result of longer growing seasons and accelerated development (Harvell et al. 2002; Verner et al. 2013). A recent study by Deutsch et al. (2018) estimated that growing pest pressures resulting from a 2°C increase in average global surface temperatures could cause yield losses of 46, 19, and 31 percent for wheat, rice, and maize, respectively.

Extreme events such as droughts and floods could also cause a sudden outbreak of pests (Fuhrer 2003), and prolonged leaf wetness could encourage the presence and spread of leaf diseases (Juroszek and von Tiedemann 2011). Additionally, the effectiveness of herbicides, insecticides, and fungicides will decline as temperatures and CO₂ levels rise (Verner et al. 2013).

For livestock, too, higher temperatures and shifting rainfall patterns could cause the spread of vector-borne diseases, ticks, and macro-parasites, as well as the emergence of new diseases (IFAD 2009). The increased frequency of drought could enhance the more rapid spread of livestock diseases since livestock and wild animals could be forced to congregate in smaller areas or around fewer water sources (Descheemaeker et al. 2016). Less feed and crop residue, particularly during dry periods, will cause livestock to lose weight, resulting in them becoming more susceptible to diseases (Descheemaeker et al. 2016).

Sea level rises

Predicted sea level rises pose significant risks to the MENA region's population and agricultural, industrial, and other economic activities, which tend to be concentrated in coastal zones. Projections for the MENA region indicate progressive median sea level rises, although projections for the Mediterranean are lower than those for the Arabian Sea. Tunisia, for example, is projected to experience a 0.56 m sea-level rise by the end of the century (2081–2100) compared to 1986–2005 in a 4°C world, which is 8 cm less than in Muscat where 0.64 m is projected (World Bank 2014).

To give an indication of potential impacts, a 1 m sea level rise would affect 3.2 percent of the MENA region's population, compared to 1.3 percent worldwide. It would also affect 1.49 percent of the region's GDP compared to 1.30 percent worldwide, and 1.15 percent of its agricultural area (Dasgupta et al. 2009). Coastal communities would be exposed to more floods, extreme weather events, enhanced erosion, and saltwater intrusion into coastal aquifers (Hunt and Watkiss 2011; Brecht et al. 2012; Haddad and Shideed 2013; Malm and Esmailian 2013).

Increasing dependence on costly food imports

Lower agricultural productivity will cause many dryland countries to become even more dependent on costly food imports (FAO 2015). The MENA region is already the most food import-dependent region in the world (UNDP 2018) and imports some 50 percent of its domestic wheat and barley supply, 70 percent of its rice consumption, and 60 percent of its corn consumption (Verner 2012). Rising populations and incomes are also driving an increased demand for meat imports. The MENA region, for instance, is now the largest regional importer of poultry products in the world (Nigatu and Motamed 2015).

This dependence on international markets will continue to intensify with population growth (Fader et al. 2013) and risks exposing ordinary people to the vagaries of international commodity markets (Jobbins and Henley 2015). International markets are expected to become tighter and significantly more volatile as a result of climate change (Bailey and Wellesley 2017) and there is a risk of a repeat of the food crisis of 2008 when prices for basic foods rapidly escalated, resulting in riots and unrest throughout the region.

4. Strengthening resilience: a strategy for MENA countries

Investing in resilience will help to limit involuntary climate-induced displacement and give people the option of remaining where they are to build productive livelihoods.

The strategy presented in this section provides a general framework for strengthening the resilience of rural communities across the MENA region, addressing their immediate vulnerability to climate variability and extreme weather events, and enhancing their long-term adaptation to hotter and drier conditions over the course of this century. It targets the region's climate-vulnerable yet critical agricultural sector, which remains a significant employer and generator of income (Wodon et al. 2014), and a potentially important source of migrants and displaced people (Cai et al. 2014; Cattaneo and Peri 2015; Falco et al. 2015).

The strategy is an attempt to initiate a discussion on the implications of climate change for agriculture and migration in a region where preparedness is limited and climate-induced displacement is rarely factored into national development planning (UNDP 2018; World Bank 2018). It is consistent with the United Nations (UN) Global Compact for Safe, Orderly and Regular Migration (UN 2018) and its emphasis, in particular, on collecting and utilizing accurate migration-related data (Objective 1), addressing the adverse drivers and structural factors that compel people to migrate (Objective 2), and enhancing the availability and flexibility of pathways for regular migration, including in response to environmental degradation and the adverse impacts of climate change (Objective 5).

It also reflects national and regional priorities and is based on extensive consultations with national governments and other relevant stakeholders. These include national agricultural research systems and international agricultural organizations such as the Global Conference on Agricultural Research for Development and the Association of Agricultural Research Institutions in the Near East and North Africa. In addition to complementing the national development priorities of MENA countries,

Box 4. 1 A resilience strategy for the MENA region

- **Address knowledge gaps to facilitate appropriate strategies and policies:** the MENA region's ability to respond to issues related to climate-induced displacement with effective policies and strategies is held back by a lack of comprehensive data; such data as are available are often patchy and unreliable, and rarely disaggregated.
- **Introduce adaptation measures:** proven interventions that help MENA countries prepare for hotter and drier conditions will prevent or slow displacement in climate-vulnerable sectors, production systems, and regions.
- **Promote migration as a form of adaptation and income diversification:** in some circumstances, migration could be harnessed as a form of climate change adaptation. Planned and coordinated movements could generate positive benefits for both areas of origin and destination.

the strategy also reflects the wider Sustainable Development Goals (SDGs) Agenda for 2030, and thereby supports the implementation of a more sustainable and equitable development model for the MENA region.

The main elements of the strategy are: (1) Addressing knowledge gaps to facilitate appropriate strategies and policies; (2) Implementing proven adaptation measures; and (3) Promoting migration as a form of adaptation and income diversification (Box 4.1). It is designed to limit involuntary climate-induced displacement and where possible give people the option of remaining where they are, helping them to live in dignity and build resilient and productive livelihoods, while also recognizing that migration can be a valid adaptation strategy and crucial to income diversification for rural households.

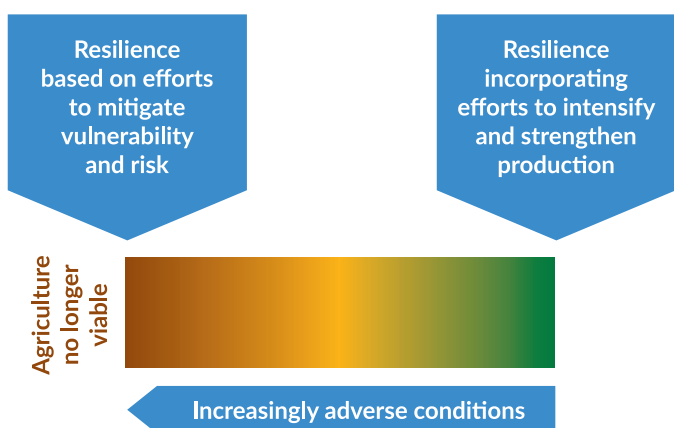
Implementing a resilience strategy

Given that impacts will be context-specific, the strategy is not designed to give an exact prescription for every scenario, but rather is a broad framework of potential

actions that countries can adopt and tailor to their own situations. The heterogeneous nature of socioeconomic, political, and bio-physical realities across the MENA region will require distinct approaches and ‘packages’ of technologies, institutions, and policies tailored to specific challenges.

Application can be understood as a process tailored to a gradient of conditions (Figure 4.1): at one end of this gradient are conditions where agriculture is no longer feasible, followed by agricultural production systems where the key challenge is to mitigate vulnerability and risk, and finally at the other end of the gradient, systems where, although risk is still a factor, there may be opportunities for intensifying and strengthening production. Within this framework, efforts to strengthen resilience and improve food security, poverty reduction, and natural resource management are important everywhere, but they are given different priorities or addressed differently according to context.

Figure 4.1: Targeting resilience strategies across the MENA region



Embedding resilience in national climate planning

Countries already have several planning mechanisms they can utilize to embed resilience-strengthening measures into their climate adaptation strategies, including Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). Although principally focused on mitigation and efforts to reduce emissions, several countries have included adaptation targets in their NDCs. Submitted every five years to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, NDCs provide

a convenient planning framework that helps countries progressively respond to shifting climatic conditions while taking into account national circumstances and capacities.

NAPs are designed to help countries identify medium- to long-term adaptation needs and the efforts required to address these needs. NAPs, the main vehicles through which countries can outline their adaptation strategies and communicate support needs to the UNFCCC, are country-led and aim for enhanced coordination at national, sectoral, and sub-national levels.

A major challenge, however, will be accessing the necessary funds to finance resilience strengthening. Although knowledge gaps and insufficient data make it difficult to estimate the costs of resilience (IPCC 2018), it is widely agreed that there is a significant gap between adaptation needs and available climate financing (UNEP 2016). Efforts to strengthen the resilience of the agricultural sector could also be held back by declining donor investments in agricultural research (Arkin 2016) and a failure to prioritize agricultural research for development at the national level – investments remain below 1 percent of GDP in every MENA country (Stads 2015).

Given ongoing financial constraints in the development sector, it is imperative that MENA countries adopt practical and strategic financial outreach plans that effectively target diverse sources of funding, whether domestic, private, bilateral, or multilateral (Appendix 3). The NAP process could potentially help to unlock funding to support resilience strengthening in the MENA region, but governments first need to develop financial outreach plans that estimate funding gaps and the costs of adaptation. They also need to identify suitable funding sources based on existing relationships or donor mandates and interests, and mobilize efforts to target potential donors – for instance, increasing engagement with donors, building institutional fundraising capacities, and preparing ‘bankable’ proposals (Parry et al. 2017).

Additional efforts are required to engage the private sector. The Business and Sustainable Development Commission (2017) has suggested that achieving the SDGs could open up an estimated US\$12 trillion in market opportunities across four economic systems:

food and agriculture; cities; energy and materials; and health and wellbeing. The Commission proposes new business models based on social and environmental sustainability. However, evidence suggests the MENA region could find it difficult to attract private sector finance since national governments have largely failed to prioritize climate resilience or create enabling environments that facilitate private sector investments (UNDP 2018). Developing countries, including those in the MENA region, have been encouraged to lower the risk of adaptation investments (IPCC 2018), understand private sector interests, and identify how investments can serve resilience priorities more effectively (Parry et al. 2017).

Finally, there may be opportunities to increase domestic public finances to fund adaptation and resilience. National governments can examine their budgets, analyze existing financial flows that support climate resilience, and identify any necessary adjustments based on this analysis (Tirpak and Parry 2009). Options to finance adaptation include fiscal instruments such as the imposition of taxes or debt conversions; redistributing existing finances through subsidies and subsidy reform; and creating national and sub-national climate funds (World Bank 2010; Parry et al. 2017).

Strengthening capacities

Implementing the resilience strategy outlined in the following sections will also require efforts to strengthen the capacities of public institutions (IPCC 2018). Government agencies, ministries, and national agricultural research systems need support to undertake and utilize research more effectively, and ensure this research is packaged and disseminated so that it can inform decision-making and lead to the creation of appropriate policies.

Improving technical skills will be critical so that countries have sufficient expertise to embrace technological advances and utilize innovations such as geo-informatics and climate modeling. Given that many of the region's best agricultural scientists were trained decades ago and are nearing retirement age, there is a desperate need to target younger researchers with capacity development opportunities, and equip them with the knowledge and skills they will need to strengthen production systems against a backdrop of new and emerging climate challenges (Alwang 2016).

International development organizations, including CGIAR centers, can play a critical role by improving the collection and dissemination of relevant data, thus helping national governments to more effectively understand, anticipate, and respond to risks. Other roles for international development organizations include developing and promoting proven and appropriate climate-smart technologies and practices; raising national capacities so that government agencies and rural communities can better adapt to changing climate scenarios; and helping governments to measure their progress towards NAP and NDC targets – something that is relatively straightforward for mitigation but more difficult for adaptation, given that there is still no practical and coherent set of easily measurable adaptation indicators.

In terms of improving planning processes, countries can access support through various UN agencies. The UN Global Support Programme offers institutional and technical support and knowledge sharing to advance the NAP process: Less Developed Countries (LDCs) can submit their plans to a LDC Expert Group for technical feedback and advice, and both the Global Environment Facility and the Green Climate Fund provide guidance to strengthen NAP submissions. Raising national capacities so that governments can effectively target and extract funds from existing financial mechanism needs to be addressed quickly (UNDP 2018).

Having discussed the enabling environment required to implement a resilience strategy, the following sections describe in more detail the three main components of this strategy, namely: addressing knowledge gaps to facilitate the development of appropriate policies and strategies in response to the threat of displacement; climate adaptation measures to address the threat of displacement; and efforts to promote migration as a form of climate change adaptation and source of income diversification.

Addressing knowledge gaps to facilitate appropriate policies and strategies

Although the empirical literature on climate change and migration is increasing, and there is a growing consensus that environmental change can influence the decision to migrate, it is often difficult to separate environmental factors from alternative social, economic, and political drivers of migration (Foresight 2011; Wodon et al. 2014).

Unfortunately, our understanding is held back by a lack of comprehensive data (Foresight 2011; World Bank 2018), including in the MENA region (Wodon et al. 2014).

Migration data are often patchy and unreliable, rarely disaggregated by sex, age or other indicators, and there are few comparative studies across countries (Tacoli 2009; Global Migration Group 2017; Knoll et al. 2017; Clemens and Postel 2018; Fratzke and Salant 2018). Development initiatives that are designed to address the 'root causes' of migration and displacement also rarely monitor migration outcomes (Knoll et al. 2017; Clemens and Postel 2018; Fratzke and Salant 2018). The result is limited knowledge of the climate change–migration nexus and difficulty devising sound policies that strategically target the drivers of displacement or the adaptation potential of migration (McLeman and Hunter 2010; Barnett and Webber 2010; World Bank 2018; Foresight 2011; Global Migration Group 2017).

Time for a data revolution

These limitations have prompted calls for more accurate, relevant, and timely statistics, including at the UN level (Global Migration Group 2017). The Global Compact on Safe, Orderly and Regular Migration (Appendix 2), for instance, calls for the collection and utilization of accurate migration-related data (Objective 1). This includes efforts to improve the international comparability and compatibility of migration statistics; strengthen national capacities for the collection, analysis, and dissemination of data; and integrate migration-related data into national censuses and household surveys.

In the MENA region the collection of accurate, comprehensive, and timely information is critical. Here, and elsewhere, a knowledge agenda needs to be developed, supported, and disseminated so that a more in-depth evidence base is created and a more informed debate emerges and is ultimately reflected in sound and effective policies at the national, regional, and global levels.

The Global Migration Group (2017), an inter-agency group established by the UN Secretary General, recommends several steps to improve the collection, accuracy, and usefulness of migration data and enhance understanding of the climate change–migration nexus (Box 4.2). The Group has also provided a comprehensive review of existing data and information repositories that countries and development agencies can use to enhance

their understanding of the climate change–migration nexus and improve their research and analyses (Appendix 1).

Adaptation measures to address climate displacement

The adaptation measures outlined below form part of an integrated response to climate vulnerability and the threat of climate displacement. They reflect regional priorities and combine the more efficient use of scarce water resources; the conservation, collection, and utilization of

Box 4.2 Global Migration Group recommendations for improving migration data

- **Prepare national assessments:** review existing evidence and identify knowledge gaps. By consulting existing databases and sources of evidence (see list in Appendix 1) it may be possible to more closely identify needs.
- **Identify vulnerable groups:** linking census data with climatic information could help identify environmental and climatic hotspots in areas of high population density.
- **Improve the collection of migration data:** adopt more effective household surveys and include environmental indicators in these surveys.
- **Adopt innovative means of collecting data:** such as unmanned aerial vehicles to provide images of settlements affected by environmental disasters.
- **Continually track movements:** to understand changes in movements and help national governments and other agencies become more responsive to needs and enhance preparedness. The Displacement Tracking Matrix developed by the International Organization for Migration (IOM) offers the continuous collection of information on communities, solutions, resilience, and vulnerability.

Source: Global Migration Group (2017).

biodiversity; integrated crop–livestock farming systems; more sustainable value chains and off-farm activities; and the enhanced dissemination of improved crop varieties, livestock, and technologies. Adaptation measures target both short-term threats – climate variability and exposure to climate shocks – and progressive medium- to longer-term climate changes.

Reducing vulnerability to climate shocks

Extreme weather events strip away the productive assets of poor and vulnerable people, reducing their capacity to recover and weakening their long-term resilience. Early interventions are therefore needed so that communities can anticipate shocks, make necessary preparations, and protect their livelihoods. Utilizing new tools and technologies can help countries monitor risks more effectively, intervening and mobilizing resources in response to predefined environmental triggers so that any damage is limited and communities have an improved chance of recovering to build productive and climate-resilient livelihoods over the long term.

FAO's 'Early Warning, Early Action' approach combines accurate forecasting, a flexible financial system that allows the rapid procurement of resources and supplies, and shock-responsive interventions that quickly reach vulnerable communities, including cash transfers, food supplies, improved and resilient seed, veterinary support for livestock, or rapidly constructed flood defenses. In Somalia in 2016, for instance, FAO assistance reached over 7 million people: 1.3 million people received cash transfers and 5.7 million people received veterinary care for their livestock before the drought peaked (FAO 2018). Defenses can also be strengthened by the strategic placement of critical reserves such as water, seeds, and other agricultural inputs, which can be mobilized easily and efficiently when disaster strikes.

Farmers can prepare more effectively and limit the destruction caused by weather-related shocks when they have access to climate advisory services. Tailored to their needs and disseminated through SMS technology and rural radio broadcasts to maximize coverage, climatic information can help farmers make preparations in advance of a shock to protect their assets. Equally, seasonal forecasts could provide information on longer-term climatic trends that could influence farmers to make adjustments to their farming practices, benefiting crop and livestock performance. The UN's Global Framework for Climate Services provides support to

improve the quality and application of advisory services, particularly in developing countries.

Given their acute vulnerability to climate shocks, MENA farmers would also benefit from shock-responsive social safety nets. Weather-based insurance schemes enhance farmer resilience when climate shocks occur and also help to overcome the risk of investing in climate-smart technologies and strengthening long-term adaptation to worsening climatic conditions. Weather-based insurance schemes were not previously viable in many developing countries because of the high costs associated with verifying losses across a large number of smallholdings. However, advances in satellite technology and data analysis avoid these high costs and expand the reach of insurance policies. Pegging insurance payments to easily measured environmental conditions, or to an index closely related to agricultural production losses, has shown significant potential. When an index exceeds a certain threshold, farmers can receive an efficient payment, for instance via a mobile phone. Interest in providing climate-linked insurance schemes is growing, and gaining support at the global policy level. The G7 Initiative on Climate Risk Insurance, for instance, aims to extend insurance coverage to 400 million people by 2020.

The Sendai Framework for Disaster Risk Reduction, a voluntary and non-binding agreement adopted by UN member states in 2015, provides a set of guiding principles that MENA countries can adopt to better anticipate, endure, and recover from extreme weather events (United Nations Office for Disaster Risk Reduction 2015). Among the Framework's recommended actions are efforts to enhance the governance of disaster risk and clarify responsibilities, mobilize risk-sensitive investments, strengthen the resilience of critical infrastructure, build and maintain early warning systems, and build capacity to improve the effectiveness of shock responses.

Unfortunately, indications suggest disaster response capacities across the MENA region are weak. Countries have limited access to relevant data and environmental indicators, and they struggle to contextualize the data they can access, complicating the development of appropriate policies. Investments in resilience-strengthening innovations, technologies, social safety nets, and early warning systems are among the lowest in the world. Participatory approaches to risk governance are rare, meaning that decisions

may not reflect the interests and needs of all sectors and demographic groups. Government coordination between ministries and with local-level agencies and community groups is poor, and the capacity to assess financial and technological needs, and to mainstream disaster risk assessments into land-use policies and rural development strategies, is limited (Hamdan, n.d.).

Given the region's vulnerability to extreme weather events and the adverse impacts of climate change, this needs to change quickly. Attending to these weaknesses in disaster response capacities will help ensure that extreme weather events do not impede or delay the medium- to longer-term adaptations that countries need to adopt in order to deal with the progressive impacts of climate change. These adaptation measures are listed in Box 4.3 and discussed in the following sections.

Enhancing water-use efficiency

Water is the most limiting and critical factor in the MENA region. Significant efforts are needed to develop and implement more efficient irrigation systems, improve

water storage through managed aquifer recharge, enhance water harvesting through effective landscape modification, and safely utilize wastewater.

More efficient irrigation systems: High evapotranspiration and soil infiltration rates in arid regions reduce soil moisture and consequently increase irrigation requirements, which typically surpass 80 percent of total water withdrawals in most MENA countries. With climate change, the predicted increases in evapotranspiration rates will lead to even higher irrigation requirements – despite water tables being severely depressed in many areas. Research and experience shows that supplemental irrigation, which allows farmers to plant and manage crops at the optimal time, regardless of climate vagaries, can improve water productivity. Supplemental irrigation allows farmers to plant their crops early, increasing yields and preventing exposure to terminal heat and drought stress. Reserving irrigation for high-value crops such as fruit and vegetables could also enhance the economic efficiency of water usage.

Improved water storage through managed aquifer recharge: In an attempt to meet rising demand for water, many MENA countries have over-used their groundwater and non-renewable aquifer water reserves. Given the significant evaporation and seepage that arid and semi-arid regions sustain as a result of flat terrain, permeable geological formations, and long, hot summers (Sivapragasam et al. 2009), MENA countries should be encouraged to use their vast natural aquifer storage capacity to store and improve water quality. Aquifer storage can be used for excess winter runoff and treated wastewater. Abu Dhabi has already embarked on a massive US\$5 billion program, based on the aquifer storage and recovery approach, to use local aquifers as strategic reserves for desalinated water. However, there is a trade off between climate change adaptation and mitigation given that desalinization consumes a significant amount of energy.

Landscape modification to improve water harvesting: Water harvesting is an effective low-cost technology to conserve every last drop of available moisture and prevent soil erosion. In many MENA countries there is considerable scope for harnessing traditional knowledge developed over generations by rural communities. Examples include underground cisterns, flood harvesting

Box 4.3 Adaptation priorities for the MENA region's agricultural sectors

- **Enhancing water-use efficiency:** more efficient irrigation, managed aquifer recharge, landscape modification for enhanced water harvesting, and the safe utilization of wastewater.
- **Collecting, conserving, and using biodiversity:** tapping advanced science to breed climate-resilient crops and livestock.
- **Building resilient, integrated crop–livestock farming systems:** environmentally friendly agronomic practices and sustainable feed options for livestock.
- **Promoting sustainable value chains and off-farm activities:** diversifying production, promoting value-added products, and supporting the viability of alternative livelihoods.
- **Scaling-up proven technology packages:** ensuring that farmers have access to climate-smart technologies.

systems, and basins for collecting and channeling water. To enhance the effectiveness of water harvesting, new strategies are emerging to precisely locate potential micro-catchments. A combination of satellite remote sensing and observation on the ground can identify new water sources. Using this approach, countries can pinpoint where new sources exist and install appropriate structures to capture water for home use, animals, or irrigation. In Jordan, ICARDA has adopted a contour measuring laser system to enhance the accuracy of bunds and ridges.

Safe utilization of wastewater: Wastewater offers an alternative and readily available – though unconventional and undervalued – source of irrigation water. Already a reality in many countries, UN-Water argues that wastewater use will increase in the future as the global population grows and urbanization continues apace. Given the health risks associated with the use of wastewater, governments should invest in protective measures such as: withholding periods to allow pathogens to die off; techniques, including drip irrigation, which minimize crop contamination; and offering medication, immunization, and protective clothing for agricultural workers. These measures should be supported by appropriate policies, legislation, institutional frameworks, and regulations at the international, national, and local level. This will include legal instruments that govern safe usage, establish access rights, and raise awareness about safety issues.

Collecting, conserving, and using biodiversity

Wild species are a genetic resource with the potential to increase water-use efficiency and enhance tolerance to drought and disease. Their value as a source of adaptive traits is even greater under climate change as they provide the genetic material that scientists can utilize to develop climate-resilient crops and livestock. Scientific advances such as phenotyping and genotyping can help to efficiently identify critical traits of resistance that can help breeding programs develop resilient crop varieties and ensure production systems become less vulnerable to pressure from drought, extremes of cold and heat, unpredictable rainfall, and new pests and diseases. ICARDA and national partners in Sudan, for instance, developed wheat varieties that can thrive in temperatures that often exceed 40°C. The varieties have been promoted across sub-Saharan Africa where they have raised yields and convinced policymakers that wheat production could be a viable alternative to reliance on costly wheat imports. In Nigeria, they are

generating yields of up to 6 tons per hectare. Efforts are also needed to match genetic resources with livestock production systems, targeting locally thriving breeds that demonstrate great adaptation to the prevailing environment, including extreme climatic events.

Climate change threatens the genetic diversity that crop science and livestock breeders depend upon, so more research is urgently needed to investigate impacts such as the fragmentation of habitats, and to identify wild species threatened by extinction. Maintaining and protecting national and international gene banks, and enhancing the distribution of germplasm and seeds, will also be critical. More research and funding could also target the development of ‘hardy’ livestock species and crops such as legumes and barley, which are naturally adapted to the hotter and drier conditions expected to emerge with climate change across the MENA region. Finally, defenses against the spread of new pests and diseases will need to combine new resistant crop varieties with effective monitoring systems.

Building climate-resilient, integrated crop–livestock farming systems

Integrating crop–livestock systems can be a highly effective way of cushioning each sector from external pressures and getting maximum effects from a symbiosis of both. Agriculture will also need to balance the need for intensification with ecological fragility, prioritizing sustainable agronomic practices, sustainable feed options for livestock, and the restoration of soil health.

Sustainable agronomic practices: Agronomic practices that sustain production without damaging the environment include conservation agriculture. This technique is highly suited to dryland farming, particularly in rainfed areas, and involves retaining crop stubble and avoiding the tilling of soil for enhanced nutrient and water conservation. Crop rotation is an important part of this approach, which produces significant benefits through lower production costs, higher yields, and improved soil health and nutrient recycling. Under conservation agriculture, soil carbon is also retained and increased, contributing to climate change mitigation. However, its application should be targeted and applied in areas where there is sufficient biomass production and mineral nitrogen in soils to allow bacteria to transform the carbon into stable humus. This may be dependent on the use of nitrogen fertilizers, which, in turn, may lead to trade offs between climate change adaptation

and mitigation given that fertilizer production consumes significant amounts of energy.

Sustainable feed for livestock: As demand for livestock products increases, more sustainable feed options are needed to reduce the environmental costs of livestock while enhancing the quality and quantity of the food they produce. Less thirsty forage crops should be targeted, such as legumes or indigenous grass species that are better adapted to dry conditions. One promising alternative to conventional feed sources in the driest regions is cactus. This high-energy, nutrient-rich plant can reduce pressure on already depleted natural resources and provide farmers with a guaranteed source of water during the dry season. As knowledge of these benefits spreads, cactus-producing countries are already refining the cultivation, harvesting and processing of this valuable resource. Additional options include replacing roughage with concentrates and using ensiled forage. More sustainable and efficient governance of rangeland management practices and the avoidance of heavy grazing are also beneficial.

Promoting sustainable value chains, off-farm activities, and enabling policies

Enabling policies and sustainable markets help the agricultural sector generate more income for poor households and stimulate wider economic activities in rural communities. In some situations, when agriculture may no longer be viable because of climate change, alternative livelihood strategies may need to be explored.

Diversifying agricultural systems can be an effective means of mitigating risk and increasing income and should be developed and promoted more broadly across the MENA region. Herders in rangeland areas, for instance, should be encouraged to produce value-added products such as yoghurt and cheese from their sheep and goats. The Awassi sheep, a hardy native breed, brings resilience to rural communities throughout the Middle East. With good resistance to high temperatures and low rainfall, this is one of several indigenous breeds that have considerable potential for use across marginal lands, providing meat, milk, and wool for farmers.

Where possible, production systems could also adopt high-value export crops such as fruits, vegetables, medicinal plants, and oils for export to lucrative markets in Europe, North America, and elsewhere. One potential model in the MENA region is the Green Morocco Plan,

a strategic new direction for the country's agricultural sector that prioritizes integration with international markets. The Plan has two main pillars: a focus on high-yield, intensive and market-related agriculture; and improving the livelihoods of smallholder farmers through improved technologies and environmentally adapted crops. Its holistic system-wide approach incorporates technological innovation, private sector involvement, and value chains that reflect consumer demand, resulting in a shift away from wheat production in marginal areas and an increase in cash cropping and farmer incomes in irrigated areas (Alwang 2016).

Policies that support resilience in rural areas are also required. Subsidies related to agricultural production often require reform: fertilizer, pesticide, fuel, and irrigation subsidies are often poorly targeted, expensive, and create disincentives for efficient farming, which can lead to the overuse of scarce resources, including water (Alwang 2016).

In areas where agriculture is no longer viable or can no longer support current population levels, alternative livelihood opportunities should be explored. Decision-makers could take advantage of the growing number of tourists worldwide, for instance, and invest in more lucrative forms of travel such as educational, cultural, and natural tourism. Investments will need to strengthen the sector's long-term adaptation capacity, including efforts to improve the management of scarce water resources, protect natural and cultural environments, and reinforce critical infrastructure to withstand extreme weather events (Verner 2012). Governments in the MENA region could also take advantage of the region's ample sunshine to invest in solar power and pursue green economic growth strategies (Walters 2015).

Scaling-up proven technology packages

Although the technologies and practices required to strengthen resilience are known and have been tested and verified, change will only come when these are adopted by farmers. Even when farmers do opt to use new innovations and technologies, they are often selective and choose to adopt only part of the recommended packages.

Efforts are therefore required to enhance delivery mechanisms and ensure innovations reach areas where they are most needed (Haddad et al. 2011). This requires new partnerships with a broad network of partners,

including advanced research institutions, private sector actors, NGOs, development agencies, and financial institutions. More South–South cooperation is also needed, and decision-makers should be better engaged through dialogue, advocacy, and regional fora.

Given the disproportionate impacts of climate change (IPCC 2014), dissemination strategies also need to target poor people and other disadvantaged groups. Improving women's access to agricultural innovations, credit, and extension services is particularly important in the MENA region where women are increasingly being left behind to take responsibility for farms after men migrate in search of alternative opportunities. This feminization of agriculture requires a shift in agricultural extension and improved targeting of women by service providers (Abdelali-Martini et al. 2003; Najjar 2015).

Youth, like women, represent a disenfranchised group facing high levels of unemployment, and efforts are needed to make the agricultural sector more attractive to young people. This may be achieved through the use of new technologies and mechanization to reduce labor burdens, and strengthening the value chains of key commodities to encourage entrepreneurial activities. The fact that 6 out of 10 people in the MENA region are aged under 30 (UNDP 2018) underlines the scale of this challenge.

Migration as adaptation and for income diversification

Intervening early to facilitate planned and coordinated movements from climate-vulnerable areas could help avoid the negative challenges and hardships of climate-induced displacement and irregular migration flows (Foresight 2011; IPCC 2014; World Bank 2018). It could also generate positive benefits for both areas of origin and destination by easing pressures in fragile, climate-vulnerable areas, providing a new source of income for rural households (Wodon et al. 2014), and encouraging the circulation of new skills, resources, and knowledge (Barnett and Webber 2010). Migration as a form of climate change adaptation also makes practical sense given that migration is already a critical income diversification strategy for many rural households.

When should national resilience strategies harness migration as a form of adaptation? In reality there can be no single 'tipping point' because facilitated migration

will depend on a range of factors, including population pressures, resource levels, or the availability and viability of alternative economic activities. Decision-makers could define certain thresholds beyond which efforts and resources could be mobilized, but the more critical issue is prior planning; that is, monitoring conditions, identifying climate-vulnerable areas, and easing mobility constraints in advance.

Planning and coordination

The focus on the 'migration crisis' affecting the Mediterranean basin gives a somewhat misleading perception of contemporary migration flows. Rather than moving across borders, most migrants tend to stay within the same countries or regions (Tacoli 2009). The areas they migrate to are often environmentally vulnerable themselves, requiring support to cope with the additional burden of a larger population (Foresight 2011).

Planned and coordinated movements could include employment schemes or relocations that strategically target areas with labor and skills shortages (Barnett and Webber 2010). Countries could also remove existing restrictions that limit mobility (Foresight 2011) and support integration efforts in destination areas. Migrants can contribute more to destination areas if their rights are protected and they enjoy economic and political freedoms, and have access to education, health, and financial services (Barnett and Webber 2010; McLeman and Hunter 2011). The World Bank (2018) recommends that social protection programs respond to changes in human mobility and become portable so migrants can access services in destination areas.

Treating migrant and non-migrant households equitably can help to avoid tensions. External development and humanitarian agencies assisting migrants, for instance, could also deliver assistance to non-migrants in targeted areas (Box 4.4) (Barnett and Webber 2010). In cases of involuntary mass displacements, camps can be carefully sited to avoid environmental degradation, and migrants should be offered livelihood opportunities that do not overexploit local resources (Barnett and Webber 2010).

To facilitate international movements, some have suggested that regional trading blocs extend the free movement of goods and services to include people (for example, Foresight 2011), and others have called for an immigrant status that allows people to move

freely between countries of origin and destination (Barnett and Webber 2010). This all depends on political support, however. Decision-makers and donors continue to view migration negatively (Agrawal and Perrin 2009; Tacoli 2009; World Bank 2018; Sward and Codjoe 2012; Ober 2014), and implementation of 'migration as adaptation' strategies is further constrained by a lack of joined-up thinking at the policy level: agriculture, disaster prevention, economic development, and migration all tend to be considered separately (McLeman and Hunter 2010).

As the world's only global organization the UN could play an important role advocating for and developing conducive frameworks (Malouche, Plaza, and Salsac 2016). The UN's Global Compact for Safe, Orderly and Regular Migration, for instance, lends support to 'migration as adaptation' strategies. The Compact calls for measures that: support regular migration flows (Objective 5), including the removal of restrictions that limit mobility; address and reduce migrant vulnerabilities (Objective 7), such as assisting migrants and protecting their rights under international law; provide access to basic services (Objective 15); and establish mechanisms for the portability of social security entitlements and earned benefits (Objective 22).

Migration as development

There is strong evidence that migration can enhance rural development and climate change adaptation, helping to transfer new innovations, knowledge, and finance (Barnett and Webber 2010; Scheffran, Marmer, and Sow 2012), and enabling rural households to diversify their incomes (Foresight 2011; Ober 2014). Money sent home by migrants provides a lifeline for poor households and facilitates increased spending on shelter, nutritious food, education, and health (de Haas 2005; Duryea, Lopez Cordova, and Olmedo 2005; Jennings and Clarke 2005). It also offers an additional source of income that can be invested in the purchase of new agricultural technologies and inputs, and a safety net so that farmers can better manage the risks associated with adopting new and unconventional practices (Tacoli 2009; Barnett and Webber 2010). Migrant remittances to the MENA region grew by 9 percent in 2017 and represent a significant proportion of GDP in some countries (KNOMAD 2018).

Migrant investments also offer several advantages: migrants can judge investment opportunities and risk more effectively in their countries and communities of origin (Gillespie et al. 1999); their contributions are often guided by altruism rather than profit maximization (Lubkemann 2008); and they are often the first to invest in post-disaster or post-conflict situations (Brinkerhoff 2006).

This potential is recognized by the Global Compact for Safe, Orderly and Regular Migration which encourages member states to create conditions that help facilitate migrant and diaspora contributions to sustainable development in their countries of origin (Objective 19). Recommended measures include flexible and barrier-free travel, work, and investment arrangements; partnerships with diaspora organizations to promote knowledge and skills transfer; and integrating migration into development planning at local, regional, national, and global levels.

In response to the relatively high fees that migrants incur to send money (Barnett and Webber 2010), which limits the development potential of remittances and encourages migrants to opt for informal services, the Compact also calls for faster, safer, and cheaper transfer options (Objective 20). It supports efforts to cap transaction costs at 3 percent, promote competitive remittance markets, and ease transfer payments through innovative technologies such as mobile payments and e-banking.

Box 4.4 Protecting 'trapped' people and communities

Many advocating 'migration as adaptation' suggest that help also needs to be delivered to those who are unable to migrate – such as the elderly, the poor, and the infirm (Barnett and Webber 2010; Ober 2014; World Bank 2018). In this situation governments are encouraged to proactively address the needs of these 'trapped' individuals and populations (Ober 2014), including through the development of early warning systems and emergency evacuation plans that minimize vulnerability to extreme weather events (Foresight 2011).

Leveraging migration for development requires sound diaspora strategies that maintain a clear line of communication with migrants, acknowledge their concerns and interests, and extend incentives and economic and political rights (de Haas 2005). Although surveys of MENA diaspora groups demonstrate interest in the development of their communities and countries of origin, most countries have yet to mobilize institutional support or develop plans to tap diaspora networks effectively (Malouche, Plaza, and Salsac 2016). This represents another missed opportunity to mobilize financial resources and fund the implementation of a resilience strategy aimed at preventing or limiting displacement.

5. Conclusion

Agriculture and food production in the MENA region are vulnerable to the effects of climate change. The combination of higher temperatures, increasing water scarcity, environmental degradation, and increased exposure to extreme weather events threaten the viability of rural livelihoods and economies. Although it is extremely difficult to estimate the numbers involved, deteriorating conditions in an already hot and dry region could conceivably lead to substantial displacements as people are forced to leave degraded and unproductive land. Given the critical importance of the region's agricultural sector as a major source of income and employment, it makes strategic sense to invest in the sector's resilience, enhance its climate change adaptation and give people the option of remaining where they are to build productive lives.

The resilience strategy presented in this discussion paper adopts an integrated response to the threat of climate-induced displacement in the MENA region. It recommends the improved collection and utilization of migration-related data to inform decision-making processes and help devise policies that strategically target climate-vulnerable and migration-sensitive sectors and communities. It also recommends the implementation of proven adaptation measures that strengthen the resilience of agricultural sectors against short- and longer-term climate threats, and the use of migration as a form of climate change adaptation to help alleviate pressures on degraded or vulnerable land and leverage the human capital and financial resources of migrants for development and resilience-building efforts.

Implementation of the resilience strategy will require government action in several areas. To mobilize financial resources MENA countries will need to invest in financial outreach plans and more effectively target climate finance mechanisms. They will also need to raise money domestically through fiscal instruments such as the imposition of new taxes, or create enabling environments that encourage private sector investments in adaptation. For countries with large expatriate populations, leveraging the skills, knowledge, and financial resources of migrants will also depend on effective diaspora engagement strategies.

Governments can embed resilience in established climate planning mechanisms such as NDCs and NAPs. They will also need to establish and maintain strong partnerships with international organizations and UN agencies to do so effectively. International development agencies like the CGIAR network, for instance, can help improve the collection and dissemination of relevant data; develop and promote relevant climate-smart technologies and practices; enhance national research and policy capacities; and help governments to measure progress towards adaptation targets.

Inaction is no longer an option. MENA countries are already experiencing climate-induced displacements, and in a region susceptible to instability they cannot afford to ignore the potential for more. As climate change intensifies, national governments will need to find ways to counter this threat and enhance resilience to short- and longer-term climate challenges either by strengthening the resilience of existing livelihoods or by helping rural communities pursue alternative opportunities in the same or different locations.

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Appendix 1: Existing migration-related repositories

The following list compiled by the Global Migration Group provides a comprehensive review of existing data and information repositories that countries and development agencies can build upon to enhance their understanding of the climate change–migration nexus and utilize as models or frameworks to inform their own analyses and research. The list is taken from the ‘Handbook for Improving the Production and Use of Migration Data for Development’ (Global Migration Group 2017).

- The University of Neuchatel has compiled ‘CLMIG’ – a database of existing quantitative and qualitative studies on the climate change–migration nexus.
- The Environmental Change and Migration working group within the Global Knowledge Partnership on Migration and Development has published an annotated bibliography of studies in the Environmental Migration Portal.
- The Internal Displacement Monitoring Centre publishes annual reports on people displaced by disasters.
- The Climate Impacts and Extremes project provides research on climate impacts in relation to varying global warming scenarios.
- The IOM’s Displacement Tracking Matrix is a system that tracks and monitors displacement and population mobility.
- The Environmental Change and Forced Migration project has developed standard questionnaires that can be applied to other analyses.
- The United Nations University’s Institute for Environment and Human Security has developed household surveys as part of its ‘Where the Rain Falls’ initiative.
- A research consortium of six universities led by the IOM has developed a survey approach focusing on how different forms of mobility such as migration, displacement, and planned relocation could benefit or pose challenges to environmental and climate change adaptation.
- ‘Migration, Environment, and Climate Change: Evidence for Policy,’ a project funded by the European Union has developed a cross-country comparative analysis of five pilot countries, the questionnaire for which could be replicated elsewhere.
- The Internal Displacement Monitoring System has developed a model to simulate drought-induced displacement in the Horn of Africa. The tool analyses existing data to demonstrate how environmental changes, demographic trends, and different policy options impact target populations. A key challenge, however, remains accessing reliable data to make robust forecasts.
- The United Nations Plan of Action on Disaster Risk Reduction for Resilience (UNISDR 2016) included a set of concrete indicators that aimed to collect data on the following: relative percentage of out-migration from areas affected by disaster or environmental degradation; demographic trends in high-risk areas; the percentage of at-risk households with access to outsourced resources; and the in-flow of remittances and other migrant resources following a disaster.

Appendix 2: The Global Compact on Safe, Orderly, and Regular Migration

The Global Compact on Safe, Orderly, and Regular Migration, published in July 2018, is a non-legally binding comprehensive framework negotiated within the United Nations system to improve the international management of migration. In addition to commitments targeting human rights, international governance regimes, and irregular movements and trafficking, the Compact addresses climate-induced migration and the migration–development nexus, and lends support to the three main thrusts of the resilience strategy presented in this discussion paper: improving the quantity and quality of migration-related data; enhancing climate change adaptation in agricultural sectors; and harnessing migration as a form of climate change adaptation.

Compact objectives that are consistent with the MENA resilience agenda are listed below:

Objective 1. Collecting and utilizing accurate migration-related data: including comprehensive strategies for improving migration data at local, national, regional, and global levels; improving international comparability and compatibility of migration statistics; building national capacities on the collection, analysis, and dissemination of data; and integrating migration-related data into national censuses and household surveys.

Objective 2. Addressing the adverse drivers and structural factors that compel people to migrate: including efforts to promote the Sustainable Development Goals and help national governments implement the goals; monitor and anticipate risks that trigger migration; invest in sustainable development and help people improve their livelihoods through inclusive and sustainable economic growth, entrepreneurship, capacity strengthening, and job creation; and strengthen analyses to better map, predict, and address movements; strengthen resilience and adaptation strategies to sudden-onset and slow-onset natural disasters.

Objective 5. Enhancing the availability and flexibility of pathways for regular migration, including in response to environmental degradation and the adverse impacts of climate change: including efforts to develop bilateral, regional, and multilateral labor mobility agreements; promote effective skills-matching in the national economy; reduce visa- and permit-processing timeframes; identify, develop, and strengthen solutions for migrants compelled to leave their countries of origin; and facilitate family reunification for migrants at all skill levels.

Objective 7. Assisting migrants and protecting their rights under international law: including moves to review relevant policies and practices to ensure they do not increase the vulnerability of migrants; establish comprehensive policies and develop partnerships that provide the necessary support at all stages of migration through identification, assistance, and human rights protection; and review existing labor laws and work conditions to identify and address workplace-related vulnerabilities.

Objective 15. Providing migrants with enhanced access to basic services: including efforts to establish and strengthen holistic and easily accessible service points at local levels that are migrant inclusive; incorporate the health needs of migrants in national and local healthcare policies and plans; and provide inclusive and equitable quality education to migrant children and youth and facilitate access to lifelong learning.

Objective 22. Establishing mechanisms for the portability of social security entitlements and earned benefits: including efforts to establish or maintain non-discriminatory national social protection systems for migrants; conclude reciprocal bilateral, regional, or multilateral social security agreements on the portability of earned benefits for migrant workers; integrate provisions on the portability of entitlements and earned benefits into national social security frameworks; and designate focal points that respond to requests from migrants.

Appendix 3: Major regional and global climate finance mechanisms

Regional mechanisms

MENA Climate Action Plan (World Bank): provides funding of US\$1.5 billion to support adaptation. Target areas include water and food security; climate-smart agricultural practices; policy reforms; and the improved management of natural resources.

Arab Climate Resilience Initiative (United Nations Development Programme [UNDP]): has a mandate to help developing countries to access climate finance and formulate new climate resilience project submissions to the Green Climate Fund.

Islamic Development Bank/UNDP Partnership: supports governments to achieve transformational change for risk-informed resilient development in agriculture, water, and infrastructure sectors.

Arab Fund for Economic and Social Development: finances projects covering healthcare, education, drinking water, rural development, and social welfare, paying special attention to the least-developed Arab countries.

Kuwait Fund for Arab Economic Development: funds initiatives that include agriculture, irrigation, and water.

Global mechanisms

Green Climate Fund: established by the United Nations Framework Convention on Climate Change (UNFCCC) and the main vehicle through which developing countries can access financing to build their resilience to the threats posed by climate change.

V20 Group: brings together finance ministers to mobilize climate funding and identifies migration as a key challenge.

International Organization for Migration Development Fund: provides financing for pilot projects that address migration within the context of climate change.

Global Environment Facility (GEF): the operating entity of the financial mechanism to the UNFCCC which prioritizes agriculture and food security, water resource management, natural resources management, and climate information services. Since 2001 GEF has provided US\$1.5 billion in grant financing and mobilized an additional US\$7 billion from other sources.

Adaptation for Smallholder Agriculture Programme (International Fund for Agricultural Development [IFAD]): channels climate and environmental finance to smallholder farmers, scales-up climate change adaptation in rural development programs, and mainstreams climate adaptation into IFAD's work.

Adaptation Fund: financial investment under the UNFCCC and Kyoto Protocol to reduce the adverse effects of climate change, focusing on water resources, land management, agriculture, health, infrastructure development, and fragile ecosystems.

Global Climate Change Alliance: launched by the European Commission to strengthen dialogue and cooperation with climate-vulnerable developing countries, the Alliance also helps integrate climate change into development policies and budgets.

Funds targeting displacement: the UN's Taskforce on Displacement has pressed developed nations to donate more funds to support developing countries and their efforts to avert, minimize, and address climate-induced movements. The Global Compact on Safe, Orderly and Regular Migration also includes reference to a start-up fund that will provide initial financing for migration-related initiatives.

Bilateral donors with MENA interest: United Kingdom, United States of America, Germany, European Union.



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