Climate Change, Migration, and Adaptation in the MENA Region

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Abstract

Climate change is a major source of concern in the Middle East and North Africa (MENA) region, and migration is often understood as one of several strategies used by households to respond to changes in climate and environmental conditions, including extreme weather events. Other coping and adaptation strategies include changing the household's sources of livelihood, and selling assets or taking other emergency measures in cases of losses due to extreme weather events. Yet while there is a burgeoning literature on climate change and migration and other adaptation strategies worldwide, the evidence available for the MENA region remains limited, in part because of a lack of survey and other data. This chapter is based in large part on new data collected in 2011 in Algeria, Egypt, Morocco, Syria, and Yemen. Household surveys were implemented in two climate affected areas in each country. In addition, qualitative focus groups were also implemented in both urban and rural areas. Finally, complementary work was completed using existing data sources for Morocco and Yemen. The chapter provides a summary of some of the main findings from these various sources of data, focusing on household perceptions about climate change and extreme weather events, migration, other household coping and adaptation strategies, and government and community responses. Overall, households do perceive important change in the climate, and many have been affected by extreme weather events with resulting losses in income, crops, livestock, or fish catchment. The coping and adaptation strategies used by households to deal with shocks are diverse but limited, as are the community and government programs which could help households better cope with and adapt to climate change. In terms of migration, in the areas affected by climate change and weather shocks, the analysis suggests that climate factors may account for between one tenth and one fifth of the overall level of migration observed today, but this is likely to increase as climatic conditions continue to deteriorate. While migrants appreciate the opportunities that migration offer, their living conditions and ability to be well integrated in their areas of destination is far from being guaranteed.

1. Introduction

By the next century, global mean annual temperatures may increase by 3°C to 5°C. In the MENA region this may manifest itself through reduced rainfall, greater seasonal temperature variability, and a rise in the Mediterranean sea level, all of which constitute threats to agricultural production and economic security (Verner, 2012). Agriculture employs about half of the active population in many countries, especially among the poor. Declining precipitation is likely to affect availability and usage of water, causing agricultural productivity to decrease (UNDP 2009; World Bank, 2010). Climate change is also associated with a higher likelihood of extreme temperatures, floods, and droughts, and thereby with health risks as well as risks of substantial displacement (e.g., IPCC, 2012; Elasha, 2010; McSweeney, New, and Lizcano, 2009)[1].

Estimates of the number of people likely to be affected by climate change and the extent to which they are likely to be affected are notoriously difficult to provide (Foresight, 2011). But in the MENA region as a whole, some 80 to 100 million people may be expected to experience water stress by 2025 (Warren et al., 2006). By 2050 water availability per capita is expected to decline by 50 percent. Furthermore, while the literature is mixed on this issue, aside from the economic impacts climate change may be associated with local conflict as groups compete for access to scarce natural resources (Reuveny 2007; Nordas and Gleditsch 2007). Some of the evidence in this chapter does point in that direction. Climate change also presents unique gender challenges. MENA migrants, whether internal or external, are overwhelmingly male, so that women are left to assume the burden of increased workload at the place of origin. And for those women who do migrate, job opportunities tend to be less attractive than those for their male counterparts.

This study focuses on the link between climate change and migration. Migration is considered as one of several coping and adaptation mechanisms used by households. It responds to both push and pull factors. Changes in the climate (e.g. warming temperatures, heat waves, declining rain fall, and rising water levels) are part of push factors because they lead to a deterioration of the environment. Extreme climactic conditions, such as weather shocks like severe floods or droughts, can lead to temporary migration and displacement. Climate and subsequent environmental degradation decreases agricultural crop production, livestock or water availability, which adversely affects economic activity. By contrast pull factors are those conditions that attract migrants or potential migrants, mainly to urban areas. They also shape and guide human choice. Thus the existence of economic opportunities such as employment, well-established community networks that help reduce uncertainty and risk, and available housing may all be variables that pull migrants to a particular area. Schools, health care, electricity, clean water, functioning sewage systems and other infrastructural features inform decisions as well.

While the environment generates push factors because of threats to household livelihood (Kniveton et al., 2009), the decision to migrate is filtered through household characteristics such as socio-economic status, political context, and migrant networks (Carr, 2005; Black et al., 2011). Migration can be permanent or temporary. It can be undertaken by a single individual or by an entire household, over a long or short distance. Similarly, environmental impacts can take an acute form, such as flooding or sand storms, or occur gradually via deforestation or changes in

[1] In terms of terminology, it is often suggested to use the term *environmental degradation* to describe deterioration of the quality of soil, greater pollution, and other changes that undermine quality of life related to the environment. The terms *climate change* and *weather change* are reserved for long- or medium-term changes in precipitation and temperature. *Extreme weather events* refers to droughts, earthquakes, flooding, and other rare, potentially-disruptive phenomena. The term *environmental change* refers collectively to these three phenomena.

temperature and precipitation. These various dimensions render the analysis of migration complex (Kniveton et al., 2009).

The complex temporal and spatial dimensions of migration are a challenge for data collection aiming to better understand the causes and consequences of migration. Adaptation assessment requires pre- and post- treatment data, but collecting panel survey data on migration is difficult because migration implies that respondents change their place of residence, making respondent tracking difficult. Only a handful of authors have used panel data in their analysis (Pereira and Caravajal, 2008; Gray and Mueller, 2012). One alternative involves surveying households about family members who moved to another location (Dillon et al., 2011). The caveat with this approach, however, is that the results on migration decisions by some members of the household may not generalize to the migration by the entire household. Households that decide to send only one person to a different location may be different from households that migrate together. Furthermore, migration by one or more household members is distinct from migration by the entire household as the latter harder to reverse and requires higher risk tolerance by household members (see Piguet, 2010, on alternative methodological approaches). While some studies use macro-level data on international migration (Beine and Parsons, 2012; Reuveny and Moore, 2009), this is not a panacea since international migration statistics document only cross-border migration and fail to capture movements of people within country.

Despite these challenges, the empirical literature seeking to estimate the effect of changing environment has been growing rapidly. This literature suggests that the relationship between migration and environmental change is nuanced, so that careful attention should be paid to the type of climate or weather event and the type of migration. For example, using a gravity model and census data for Yemen, Joseph and Wodon (2013) and Joseph et al. (2014) find that while climate factors do play a role in migration flows between districts, that role is much smaller than the effect of socio-economic variables. There is also a growing consensus that migration requires a minimum level of resources, and liquidity constraints impede internal migration by the poorest households leading to an "immobility paradox" (Meze-Hauseken, 2000; Foresight, 2011; Gray, 2009; Halliday, 2006; Hammer, 2004) which has gender implications[2].

Most micro-level studies measure climate change either by the incidences of extreme weather events or by variation in temperature or rainfall. The evidence is weaker on household responses to incremental environmental degradation such as pollution, soil degradation, or deforestation. Since these factors are incremental, it is harder to isolate their effects on migration from other drivers. Studies by Rappaport and Sachs (2003) and Rappaport (2007) indirectly address the issue of migration as a response to the quality of living by looking at the weather-related moves in the United States. They suggest that in countries with higher per capita income weather becomes a location amenity that affects choice of residence. Further research, however, is needed on how households in developing countries respond to the quality of environment (Findlay 2011; Findlay and Geddes 2011). Some studies that focus on international migration have also identified environment as a driver. Changes in temperature and rainfall have been found to induce out-migration from rural communities in Mexico to the United States (Feng et

[2] Gray and Mueller (2012) show that droughts in Ethiopia increased the probability of long-distance out-migration by male members of the household but reduced the probability of marriage-related migration among females because households could not finance wedding related expenses. Similarly, Dillon et al. (2011) find that *ex post* and *ex ante* weather related risk affected probability of out-migration by male household members but not by females. There is also empirical evidence that suggests that urban centers do not always serve as magnets for migration and individuals from affected rural areas migrate to other villages rather than to cities (Henry and Schoumaker, 2004).

al., 2010; Munshi, 2003; Andersen et al., 2011). Consistent with the liquidity constraint hypothesis, international migration declines immediately after extreme weather events but internal migration increases because affected households cannot afford long-distance relocation (Henry and Schoumaker, 2004; Findley, 1994, Beine and Parsons, 2012).

A few studies have found that formal and informal institutions as well as policies also affect migration. Institutions that make government more responsive to households (for example through public spending) discourage both international and domestic migration in the aftermath of extreme weather events (Anderson et al., 2011; Paul 2005; Reuveny and Moore, 2009). Qualitative studies underscore the importance of informal institutions such as social networks (McLeman and Smit, 2006) and intra-household distribution of power (Carr, 2005). But migration is often an option of last resort after vulnerable rural populations attempting to cope with new and challenging circumstances have exhausted other options such as eating less, selling assets, or removing children from school. As to remittances, they can be essential for meeting basic food and other needs, especially for households affected by extreme weather events.

Finally, in terms of a broader conceptual framework that can be used for policy discussions, the Foresight (2011) report makes several important conclusions which are worth reiterating here. First, while environmental change will affect migration, the complexity of the interactions at work in decisions made by individuals and households to migrate are such that it is typically not be feasible to identify 'pure' environmental migrants. Second, even in the absence of climate change and further environmental degradation, migration away from areas that are environmentally vulnerable today will continue. Third, at the same time, the impact of environmental change on migration will tend to increase in the future. Fourth, planning ahead and managing migration flows to the extent that this can be done will help reduce the risk of humanitarian crises. Fifth, and this is often overlooked, environmental change may make it more difficult for some groups to migrate, because of the cost of migration and the fact that weather shocks often reduce the resources available to people in order to migrate. Sixth, as a result of a lack of migration, some population groups may be trapped in vulnerable areas and these groups deserve attention as well. Finally, attempts to prevent or constrain migration are likely to also have their own substantial negative consequences in terms of impoverishment.

Therefore, the policy challenge consists in finding ways to reduce the negative impact of environmental change on communities while also planning for migration so that it can be 'transformational' by providing benefits for populations in both sending and receiving areas. In other words, the Foresight report suggests that climate induced migration may not be just part of the 'problem' but can also be part of the solution to various development challenges.

There is some emphasis in parts of the Foresight report on the risks faced by cities in low-income countries given that while being already vulnerable, these cities continue to attract migrants. The risks faced by vulnerable cities are very serious indeed. In this study however, the focus is on how vulnerable rural areas are affected today by climate change and weather shocks, on the impact that these changes and shocks have on households, and on the extent to which they are inducing migration away from these areas. Also, while the Foresight report focuses on the big picture at a global level as it emerges from a wide range of studies, some global and some local, some based on household surveys and other based on climatic and geo-physical data, the focus in this study is on somewhat narrow and detailed work using household surveys in a few specific areas affected by climate change and weather shocks.

While there is a burgeoning literature on climate change and migration, the evidence for the MENA region remains limited, in part because of a lack of access to survey data. This study

is based in large part on new data collected in 2011 in Algeria, Egypt, Morocco, Syria, and Yemen (Burger et al., 2014a, 2014b). The same household survey was implemented in two climate-affected areas in each country with only slight modifications in the survey instrument based on country-specific context. The survey took approximately two hours to administer and it was designed to elicit household perceptions of climate change and environmental degradation, self-assessed economic loss, coping strategies such as migration, and awareness of community and government assistance. The surveys were administered by in-country partners to a randomly selected set of 800 households per country. In addition, focus groups and semi-structured in-depth interviews were conducted in the five countries among both rural residents and urban migrants. Finally, existing survey and census data from Morocco and Yemen were also used.

It is important to highlight some of the limits of the study. It is sometimes said that *"Climate is what we expect. Weather is what we get."* Simply put, climate relates to the distribution of variables such as temperature and rainfall over a period of time, often 30 years at least. This distribution is characterized by its moments, including the mean and the variance of key climatic variables. Climate change is then used to refer to the change in the distribution of rainfall and temperature. However, it is more difficult to tell if the weather experienced at any point in time is due to the change in the climate (the overall mean and variance of rainfall and temperature) or is simply part of an existing distribution. As a result, it should be emphasized that this study does not provide new evidence on the direct relationship between climate change and migration, but it does contribute to the evidence on three specific issues: 1) the impact of weather shocks on migration; 2) the impact of perceptions of recent climate change on migration; and 3) the impact of climate patterns (but not directly climate change) on migration.

Another difficulty relates to the question of whether the observed behavior of households relates to ex-ante or ex-post coping and adaptation. Much of the data obtained through the surveys relate to migration following weather shocks, but this migration may result from an ex post adaptation, or an ex ante adaptation of changes in the climate to come, and this cannot be distinguished easily with the data at hand. In some cases, pro-active adaptation may be hurting welfare or productivity as households may for example trade-off lower earnings for less risk. Understanding such behaviors requires a deeper understanding of the impacts of climate change and clarity on the nature and effectiveness of the practices that have been developed historically by households and communities as a result of repeated exposures to weather shocks in the past. Assuming there is agreement that the climate is changing one may then analyze whether the old coping strategies continue to be equally or less effective as in the past. Such an analysis is however beyond the scope of the present report, in part because past data is not available.

Finally, it must be emphasized that the synthesis provided in this chapter is mostly descriptive and meant to highlight stylized facts. More detailed work relying among others on regression analysis is provided in subsequent chapters. It is also important to emphasize that neither the household survey results nor the findings from the qualitative focus groups are meant to be representative of the five countries in which the work was carried, since only a few areas were surveyed in each country. The exception to this rule is for the additional work carried using existing data for Morocco and Yemen, given that these sources of data were nationally representative (and exhaustive as well in the case of the Yemen census). It must also be recognized again that it is difficult to distinguish the separate effects of climate change, environmental change, and weather shocks on households, and to separate short-term versus long-term household responses. This is especially the case when working with cross-sectional household surveys given that shorter-term events may be consistent with, but need not

necessarily be reflective of longer-term climate change. These caveats being clear, the rest of the chapter is organized as follows. Section 2 discusses household perceptions about climate change and extreme weather events. Section 3 focuses on migration as a coping mechanisms and income diversification strategy. Section 4 examines other coping and adaptation strategies. Section 5 discusses perceptions about government and community programs. A brief conclusion follows.

2. Perceptions about Climate Change and Extreme Weather Events

Do households believe that changes in climate patterns are taking place in the five countries? While perceptions of climate change need not mean that climate change is actually occurring, they are an important entry point in trying to understand how climate events affect household livelihoods and how households respond to such events. As shown in table 1 from Adoho and Wodon (2014a), where perceptions about changes in climate have been ranked according to the share of households sharing these perceptions in the five-country sample, this seems to indeed be the case in the five country sample based on the new household surveys conducted in 2011. More than three fourths of households in the combined sample declare that rain has become more erratic, and almost three quarters say that temperatures are higher. Between half and two thirds of households declare that there is less rain today than five years ago, that the land is dryer or less fertile, that the rainy season starts later, is shorter, or ends earlier, and that droughts are more frequent. The changes in climate in turn appear to lead to more diseases in animal and livestock, more insects and pets in crops, less water in boreholes, rivers, lakes or streams, more air pollution, more frequent crop failures and livestock loss, and more soil erosion.

Some of the extreme weather events often associated with climate change, such as rain storms and floods, are not perceived as more frequent by a majority of households. In some cases, households do suggest that temperatures are becoming cooler, and that there is actually more rain, but this is often the case only for a minority of households. Thus, while there are differences between households as well as countries (for example, households in Egypt are less likely to perceive a reduction in rainfall), the overall, the patterns are clear. Furthermore, although this is not shown in table 1, differences between quintiles of well-being in perceptions of climate change tend to be minor – most households share the same perceptions.

Additional information on perceptions about the climate, weather shocks, and their impact on households is available for Morocco through special modules on climate change and shocks incorporated in a national survey implemented in 2009-10 (Nguyen and Wodon, 2014a). In the survey, as shown in table 3, 28.1 percent of households were involved in agriculture, and among those 92.1 percent declared having been affected by deteriorating climatic conditions in the last five years. The most likely shock was a reduction in agricultural yields due to inadequate rainfall, mentioned by 62.2 percent of agricultural households. In a separate part of the Morocco survey, more than one in five households declared having been affected by a recent weather shock such as a drought or flood, a proportion similar to the product of the share of households in agriculture and the share of those households affected by changing climatic conditions.

Table 1: Perceptions of Climate Change, Five Countries 2011 (%)

	Algeria	Egypt	Morocco	Syria	Yemen	All
Changes reported by a majority of households						
Rain more erratic	81.69	43.63	91.06	99.63	71.64	77.52
Temperature is hotter	82.9	40.63	69.79	100	68.53	72.37
Less Rain	81.81	20.5	48.86	100	81.59	66.57
Land is dryer	64.53	13.75	73.00	98.25	74.63	64.84
Less fertile land	52.99	12.38	79.65	94.63	71.52	62.24
Rainy season starts later	51.91	12.13	71.4	100	67.16	60.53
Rain season is shorter	55.52	13.25	64.63	100	67.79	60.24
More frequent droughts	56.24	16.5	59.26	100	63.43	59.09
More diseases in animal and livestock	52.2	23.38	58.86	91.75	61.07	57.45
More insects and pets in crops	38.47	18.5	71.36	92.38	60.82	56.31
Less water in boreholes, rivers, lakes or streams	50.07	11.38	64.64	90	64.43	56.11
More air pollution	36.07	23.25	71.15	83	64.43	55.59
More frequent crop failure	41.66	21	65.93	87	61.19	55.36
Rainy season end earlier	39.17	15.13	54.34	99.75	61.57	54.00
More frequent livestock loss	47.61	17.5	56.13	88.13	52.99	52.47
More soil erosion	29.64	12.63	75.26	91.13	53.48	52.43
Changes reported by a minority of households						
More frequent sand storms	50.68	10.25	36.72	99.5	45.77	48.58
Temperature is colder	54.07	27.75	34.54	73.75	42.79	46.58
More water pollution in rivers, lakes, sea or steams	20.14	18.75	65.53	47	41.67	38.62
Deforestation and less trees	39.62	13	37.32	68.63	34.33	38.57
Less fish is rivers, lakes or sea	1.2	12.38	38.54	36	35.07	24.65
More frequent rain storms	21.23	9.75	59.38	0.13	16.92	21.48
More rain	15.08	20.75	51.99	-	17.54	21.07
More frequent floods	17.8	3.5	58.24	-	7.59	17.42

Source: Adoho and Wodon (2014a).

Table 2: Weather Shocks and Impact on Agriculture, Morocco 2009-10 (%)

	Poorest Quintile	Wealthiest quintile	All
Household has a member involved in agriculture or related activities	70.69	5.30	28.07
Among household in agriculture, share affected by climate-related shock			
Reduction in agricultural yields due to inadequate rainfall	60.98	50.35	62.18
Reduction in agricultural yields due to too much water	39.89	19.15	38.17
Poor soil quality due to erosion reducing agricultural yields	22.91	16.51	21.80
Changing and unpredictable climate and temperatures reducing agricultural yields	34.84	22.89	34.51
Pest or locust infestation reducing agricultural yields	14.13	7.08	17.21
Reduced job opportunities in the agricultural sector	43.75	34.15	43.86
Death of livestock due to bad weather conditions	28.37	10.41	26.44
Reduction in stock of livestock due to lower availability of grazing land	37.55	10.61	31.24
At least one problem in the last five years	93.09	81.20	92.10

Source: Nguyen and Wodon (2014a).

Have households been affected by extreme weather events, and in that case which events had the largest impact? Returning to the five country sample, when asked if they have been affected by a weather-related disaster in the last five years, almost all households say that this is the case, as shown in table 3 from Adoho and Wodon (2014a). When asked which adverse event had the largest negative consequences for them, households cited drought first (30.9 percent of the overall sample), followed by excessive heat and floods, both affecting about eight percent of

households. There are differences between countries though. In Syria, all households declare having been affected by droughts, this being the adverse event considered the most damaging. In Morocco by contrast, floods were the main adverse event affecting households. There are also some differences between households according to their quintile of well-being, but these are less pronounced. The quintiles are based on an index of wealth estimated through factorial analysis, as often done in the absence of data on consumption. What the data suggest is that households in the poorer quintile are more likely to identify adverse events that affected them the most, probably because they are more vulnerable to such shocks, as discussed in more detailed below.

Table 3: Incidence of Extreme Weather Events and Impact, Five Countries, 2011 (%)

	Country					All
	Algeria	**Egypt**	**Morocco**	**Syria**	**Yemen**	
Affected by disaster						
No	0.13	29.25	-	-	0.62	5.99
Yes	99.87	70.75	100.00	100.00	99.38	94.01
Adverse event with largest impact						
Drought	10.92	2.38	14.30	99.00	27.89	30.90
Flood	1.60	0.13	34.56	-	1.38	7.54
Storms	1.72	0.25	-	-	0.38	0.47
Mudslides	8.46	-	-	-	0.25	1.74
Excessive Heat	12.67	8.88	13.21	0.75	5.28	8.16
Excessive Rain	4.56	5.63	4.19	-	2.64	3.40
Pest Infestation	10.73	0.25	-	0.13	0.25	2.27
Crops And Livestock Diseases	7.40	5.38	0.53	0.13	1.26	2.94
No Event Identified	41.93	77.13	33.21	-	60.68	42.57
	Quintiles					**All**
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	
Affected by disaster						
No	7.37	5.92	4.92	5.22	6.53	5.99
Yes	92.63	94.08	95.08	94.78	93.47	94.01
Adverse event with largest impact						
Drought	27.16	30.67	37.37	32.04	27.53	30.90
Flood	10.93	11.74	10.03	4.11	1.23	7.54
Storms	0.00	0.78	1.32	0.17	0.12	0.47
Mudslides	1.06	5.21	2.46	-	0.12	1.74
Excessive Heat	8.54	8.26	7.69	7.21	9.10	8.16
Excessive Rain	4.60	4.13	4.41	1.92	2.06	3.40
Pest Infestation	7.08	3.22	0.89	-	0.25	2.27
Crops And Livestock Diseases	3.33	3.40	4.32	2.01	1.75	2.94
No Event Identified	37.31	32.61	31.52	52.54	57.84	42.57

Source: Adoho and Wodon (2014a).

What has been the effect of climate change on households? Households were asked whether in the last five years they suffered from lost income, lost crops, lost livestock or cattle, or less fish caught as a result of weather and environment patterns. Table 4 summarizes the responses. More than half of all respondents said that environmental changes led to a loss of crops, and more than a third reported a loss of income. About a fourth reported a loss of livestock or cattle, and 8.6 percent said that they caught less fish. The results differ again between the countries, with especially high frequencies of losses of crops in Syria (remember that virtually all households in the areas surveyed reported suffering from a drought), and lower frequencies in Egypt. As expected, households belonging to lower quintiles of well-being were more likely than better off households to suffer from the various types of losses.

Table 4: Economic Impacts of Environmental Change, Five Countries, 2011 (%)

	Country					All
	Algeria	Egypt	Morocco	Syria	Yemen	
Lost income	58.11	8.25	44.90	19.50	52.11	36.59
Lost crops	58.48	28.63	38.00	87.00	60.95	54.62
Lost livestock or cattle	31.21	3.75	26.92	17.00	38.18	23.43
Less fish caught	0.00	0.88	14.77	1.50	25.75	8.60
	Quintiles					**All**
	Q1	Q2	Q3	Q4	Q5	
Lost income	46.37	44.14	43.21	29.25	20.72	36.59
Lost crops	58.12	61.96	62.13	49.42	42.10	54.62
Lost livestock or cattle	23.81	25.19	30.11	23.17	15.23	23.43
Less fish caught	9.51	10.27	8.90	9.65	4.69	8.60

Source: Adoho and Wodon (2014a).

Again, additional information on the extent to which households are able to cope with weather shocks is available for Morocco through the 2009-10 survey (Nguyen and Wodon, 2014a). It turns out that most of the households who were affected declared that they had not been able to recover from the shock, and this was especially the case among poorer households. According to regression analysis, households in the top quintile of wealth were 20 percentage points more likely to recover from weather shocks than households in the bottom quintile.

The substantial impact of climate change and extreme weather events on the livelihood of households also emerged from the qualitative focus groups (Grant et al., 2014). The majority of respondents were aware of long-term shifts in climate and they attributed declining agriculture fortunes to deteriorating environmental conditions that are caused by changing weather patterns. Conditions in rural or "sending areas" have become very difficult according to the vast majority of respondents. In Egypt for example, participants complained of fewer days of rainfall and lower irrigation levels. For key crops such as potatoes, wheat, and rice, the results may be devastating: *"Rice is burnt in some seasons, because we cannot find enough water to irrigate it"* (Male, 36-45 years old, Dakhalia). They also cited government expropriation of agricultural land as an obstacle to profitable and sustainable agriculture (this problem was not mentioned in other countries). Many former rural residents also mentioned the rising costs of seeds and other agricultural inputs, which may be related in part to climatic conditions.

For some farmers, the poor quality and quantity of crops means lower prices for their agricultural products, which reduces income. The inability to earn a stable and adequate income for crops makes it difficult to rely solely on agriculture as a source of revenue. As a focus group participant from the town of Djelfa in Algeria explained: *"The conditions [for] farming are very poor. There's drought on the one hand and the unavailability of the new equipment and poor methods we use on the other hand. Of course, this is the main problem in our life. Our life here depends on the rain, and if there is no rain, how could we survive? … The impact of poor weather conditions was disastrous to my farm's yields. My income from cereals and vegetables is not enough to feed my household. As I mentioned, the income [has] decreased to its minimum, and I cannot regain the cost of farming over the last two years. All farmers in this region have been affected by the drought and lost their yields (Male, 35-45 years old)."*

In Yemen, almost every rural resident from the area of Hudaydah emphasized the problem of warm weather and increasing heat waves. Electricity that allows for cooling functions only two to three hours per day, causing residents to lose sleep during the evening due to excessive heat. Residents therefore sleep during the day because of exhaustion, but with fewer

daytime hours dedicated to work and income generation. Agricultural productivity is further weakened by lack of governance and neglect of the sector, ineffective government policies, and corruption. Unfavorable crop prices have led growers to shift from cultivating food crops to qat which is more profitable but requires a great deal of water: *"People there [in villages] work shoulder to shoulder, but the problem lies in agriculture. They have stopped cultivating crops and coffee beans and replaced them with qat, which now [dominates] agricultural lands. … Tomatoes, now, … we import them from Syria"* (Male, 30-39 years old, Sanaa, Yemen).

3. Migration

Migration is both a coping mechanism to deal with changes in climate or environmental conditions and an income diversification strategy. Migration helps improve the employment and earnings prospects of migrants, and it may also help the family at home through remittances. What is the extent of migration in the sample? Questions are asked as to whether current members of the households (residents) and past members (non-resident) have migrated. For residents, migration can thus be considered as temporary, since the migrant came back, while for non-residents, migration is more likely to be permanent, although it may not be.

Data on both types of migration are provided at the level of households in table 5 from Adoho and Wodon (2014c). Three in every ten households (29.9 percent) have migrants, whether residents or non-residents. Having non-resident migrants is more likely than resident migrants, but this may be because non-resident migrants may include girls who may have left the household to marry. Much of the migration has been observed in the last five years. There are large differences between countries in the likelihood of migration, especially among resident members. Migration rates are highest in Syria and Yemen, and lowest in Algeria. While there are differences between quintiles, these do not appear to be systematic, although when looking at the characteristics of individual migrants and especially their places of destinations, some differences emerge (see table 5).

Table 5: Share of Households with Migrants – Household Level (%)

	Resident Migrant	Non Resident Migrant	Either type of migrant	Resident Migrant who Migrated in last 5 years	Non Resident Migrant who Migrated in last 5 years
All	13.46	21.98	29.92	10.79	16.12
Country					
Algeria	0.60	13.50	14.10	0.21	10.17
Egypt	17.88	19.13	26.25	11.75	12.38
Morocco	1.75	26.74	27.65	1.41	18.40
Syria	18.13	35.88	46.75	17.75	29.75
Yemen	28.86	14.68	34.83	22.76	9.95
Quintiles					
Q1	14.99	23.16	31.68	11.64	16.06
Q2	14.42	20.50	29.02	11.52	15.09
Q3	16.15	25.11	35.22	12.91	19.27
Q4	10.49	20.79	26.59	9.34	15.10
Q5	11.45	20.48	27.41	8.68	15.25

Source: Adoho and Wodon (2014c).

Lower migration rates are obtained when restricting migration to the last five years. At the individual level, 7.6 percent of individuals in the sample as a whole have migrated

temporarily, and the proportion over the last five years is 6.2 percent. For permanent migration, the rates are 8.0 percent in the sample as a whole, and 5.7 percent in the last five years. Looking at the areas of destination of the individuals who migrate, much of the migration is observed over the last five years. Most migration is internal, but the likelihood of migration abroad is high in Egypt, and also in general higher for individuals from higher quintiles, as expected due to the cost of international migration. For both residents and non-residents, migration to urban areas, and especially to large cities, is more likely than migration to rural areas.

To what extent are households migrating away from climate affected areas, and is climate itself a key push factor in such migration? This is a complex question for which detailed regression analysis is required. Using the combined five countries survey data set, Adoho and Wodon (2014c) suggest that changing climatic conditions and extreme weather events lead to higher out-migration. The authors estimate first through multiple correspondence analysis (MCA) two indices of how households perceive climatic changes and extreme weather events. The first factor captures the extent to which households perceive that the climate is becoming dryer and warmer, and it is associated with droughts. The second factor captures the extent to which households suffer from excess water, and it is associated with floods. Both factors are normalized and take a value between zero and one. Next, the authors estimate regression models at the level of individuals for the correlates of migration by both household residents (temporary migrants) and non-residents (permanent migrants). After controlling for other household and individual characteristics, the authors find that worsening climatic conditions, or the perceptions thereof, do lead to a higher probability of migration, both temporary and permanent.

That is, higher values for both MCA factors (i.e., worse climatic conditions) result in higher rates of resident migration, with the coefficients being statistically significant and the effects of each of the two factors of a similar order of magnitude. The effects for non-resident migration are similar, although statistically significant only for the whole period, as opposed to the last five years. The estimates suggest that a significant deterioration of climatic conditions would lead to an increase of about 1.5 percentage point for both types of migration. Given the overall migration rate, this would represent between one tenth and one fifth of the overall level of migration observed, and this magnitude is of an order of magnitude similar to that obtained when considering the reasons stated by households for the migration of some of their members.

Additional evidence for Morocco from Nguyen and Wodon (2014b) using the national survey for 2009-2010 mentioned earlier suggest that weather shocks increase the likelihood of temporary migration by slightly more than one percentage point, an order of magnitude again similar to that observed in the five country sample. While in the Morocco national survey, the impact of weather shocks on permanent migration is not statistically significant, the impact of structural changes as reduced agricultural yields due to lack of water is. Finally, using a different approach based on combining census and weather station data from Yemen, Joseph and Wodon (2013) and Joseph et al. (2014) find that climate variables do affect migration from some districts to other districts, but in a somewhat limited way, with socio-economic and cost factors playing a much more prominent role. This analysis, which is based on past data, suggest that migration flows are unlikely to increase sharply in the near term, but if conditions were to change drastically, the effect of weather variables on migration could of course become larger.

The focus groups also suggest a link between climate and migration, although again the role of socio-economic factors in determining migration is probably at least as important (Grant et al., 2014). On the climate specifically, many respondents said that they migrated from their rural homes in the countryside because of chronic droughts which lead to declining agricultural

productivity: *"There is lack of water has resulted in a failure to be able to cultivate rice and it is an important crop"* (Male, 25-35 years old, Dakhalia, Egypt). On the other hand, few mentioned flooding or being displaced as a result of natural disasters as a reason for relocation. Married urban female migrants recall having to increase their workload prior to migrating to cities. One woman who resettled in Cairo explained that women in her village have to help their husbands because it has become too expensive to hire cheap agricultural workers: *"We used to help our husbands during harvest collection instead of getting people to do this against a sum of money. Life was difficult there [in the village], so we decided to come here to Cairo as it is more comfortable"* (Female, 25-35 years old, Cairo, Egypt). Yet the factors leading to a difficulty to make ends meet in rural areas tend to be broader than climate itself, although it is difficult with the qualitative data to assess exactly what part of migration may be related directly to the changes in the climate.

Respondents appear to choose migration only after other strategies have proven unsuccessful. Most migrants describe a precarious life and hardship in the countryside, such as lacking food, water, and income for basic needs, education, and perhaps most importantly, jobs. In many households, male family members had to leave school in order to work, and families had to eat less and forego at least one meal per day. Selling assets to secure income was also a common strategy: *"My father sold mattresses, furniture, and our bed covers. We even sold our last cow during sacrifice. We had nothing"* (Female, 20-25 years old, Casablanca, Morocco); *"My father was a farmer and he could not work anymore. There was no rain, only drought and labor was soon replaced by machines. For example, my mother used to earn income milking cows. She was replaced by machines"* (Male, 18-25 years old, Casablanca, Morocco).

For older Algerian migrants however, the decision to migrate was driven primarily by violence wrought by the civil war which ravaged Algeria from 1992 to 1999. *"I left my village for two reasons. First, because of the aggravation of terrorism in Djedjel, and second, the weather conditions. The terrorists used to threaten our lives, unless we gave them food and assistance. The drought also gave us poor crops and therefore we had no income, so I decided to leave. In fact, I was working in Libya and when I came back home I found the security situation in my village was very dangerous. The terrorists [were] threatening our lives if we do not accept their ideologies, therefore I decided to relocate in Algiers and did not try to do anything there just removed my family from there."* (Male, 35-50 years old, Algiers, Algeria).

What happens to the migrants once they leave? While the information available in the five surveys is very limited in this area, focus groups were implemented in urban areas to get a feel for the conditions of migrants at their place of destination. A critical step in the integration process for migrants is finding employment. Most rural migrants say they came to urban areas in search of better job opportunities, either to support their parents' household or to improve future prospects for themselves and their own family. Many men hope to work and save enough to own their own business (a small store or shop). Finding jobs, however, is not an easy feat amid widespread joblessness found throughout the region given that unemployment levels hover around 15 percent, and a much higher 20 to 40 percent among youth 15 to 30 years old.

The types of jobs found among migrants in cities are diverse. They include housecleaning (women only), seamstress (women only), waiter, mason, doorman, gardener, baker, selling vegetables, fruits, crafts, factory worker, small shopkeeper, janitor, car parker/attendant, and driver among others. The integration process for rural migrants is also diverse. While some migrants find that urban communities are receptive to their arrival from the countryside, others say they were met with hostility. This sentiment was especially prevalent among Moroccan and

Syrian focus group participants who complained of negative stereotyping and discrimination, particularly when trying to find viable employment. *"They look at us and call us 'Berber countrymen'. They think we are invaders"* (Male, 18-25 years old, Casablanca, Morocco).

Some rural migrants said that they felt disadvantaged vis-à-vis urban dwellers because they lacked what is needed to secure proper employment, especially a degree and French-and Arabic-speaking capability, both of which tend to be needed even for jobs requiring minimal skills. *"When I go look for a job, they ask for a degree and French – this is for hairdressing, sewing or couture"* (Female, 20-25 years old, Casablanca). Syrian rural migrants, likewise, said that they feel inferior and unwelcome in large cities like Damascus. Wherever they go, they are treated like strangers and "different." This perception makes finding a good job difficult. For Yemenis, the main obstacle to finding a job may be corruption, which is deep and pervasive. Corruption was also mentioned by Yemenis as a major problem in general, and more so than in other countries. Put simply: *"You need to bribe your way into a position. That is your easy way towards a good job position – and we all love the easy way"* (Male, 30-39 years old, Sanaa).

For virtually all focus group participants, finding adequate housing was also a challenge. Urbanization has caused a shortage of housing in many cities, with resulting housing conditions for immigrants being sub-optimal. Overcrowded dwellings in poor conditions tend to be the norm for new migrants. *"I'm 39, married, with five kids and I don't have a flat of my own. I pay 300 Egyptian pounds per month and cannot have a flat. Why don't they grant me one? They say you have to rent for just one year, and then it all depends on the owner"* (Male, 36-45 years old, Cairo, Egypt). *"We live on top of each other. There's no privacy. Sometimes you get your money stolen"* (Male, 18-25 Casablanca, Morocco). Algerian rural migrants often live in slums. *"The condition of my house or slum is very bad. In winter the rain comes through the ceiling, and it is very cold, (no central heating) and in the summer it is very hot because I have no air conditioning. To be honest my slum is not even suitable to house animals"* (Male, 25-35 years old, Algiers, Algeria). For Yemenis, corruption is a problem for housing as well. As a resident of Sanaa building a house explained it: *"The house is owned but the problem is that you either build or take a random permit. Permits cost up to 60 thousand riyals of which 20-30 thousand are bribes. And paper-work takes two to three weeks, and if we don't pay the bribe they would complicate and even create problems because the Yemeni people have become accustomed to bribery. One loses the sense of this duty due to the fact that his job is underpaid and he does not consider taking another one since he allots his afternoons to qat consumption"* (Males, 35-45)

Pre-existing migrant communities make certain areas more attractive than others for migrants. Established communities that share potential migrants' lineage, tribe, or ethnic background ease the transition. Many focus group respondents spoke of relying on relatives or family friends as an intermediary for finding a job and a place to live. These individuals have resided in cities for a long time and have established networks that are critical for information gathering, and thus for reducing the risks and uncertainty associated with migration. A young Egyptian migrant attributed his success in finding a job quickly to a cousin with connections in the medical community. Another who did not enjoy the same advantage said: *"I had no family relations – and it took me a whole year to get a job"* (Male, 25-35 years old, Cairo, Egypt).

Networks also ease feelings of isolation that are common among migrants. Participants mentioned that they now have only limited interactions with their neighbors, if they are fortunate to know them at all. In the words of one Egyptian woman: *"Neighbors are close in the villages. Here [in Cairo], I don't know my neighbors, what their job is or how they live"* (Female, 36-45 years old, Cairo, Egypt). They also lamented the shift of emphasis away from family and

traditions. Crime and harassment were also mentioned, with Moroccan focus groups suggesting that female migrants are more at risk than men. *"We are always subject to problems in the street. Men harass us and they say bad words. We fell like strangers here. When they know we are strangers, they treat us worst"* (Female, 25-35 years old, Casablanca, Morocco).

Yet while life in the city is more "chaotic", it is also exciting and full of opportunity. In Morocco migration appeared to widen the options available to young immigrants. First, some young respondents expressed a greater sense of independence, belonging, and self-actualization. A married man celebrated his new life, which no longer includes working with eight brothers in the countryside. Another said that a friend returned to their village dressed in a suit and he immediately wanted to be like him. While relocating to urban areas is a challenge, it is also a chance to realize one's potential. *"I want to have a secure job, to be able travel, be able to see other places, other people. …to live my life!"* (Male, 20-25, Casablanca, Morocco). This view was however unique in Morocco, and was not found in Algeria, Yemen, Syria or Egypt.

Among young Moroccan women, moving to the city is emancipating. Some noticed that since they migrated, they have little desire to get married and have children right away. At least one said that she escaped a life of near-servitude. Another young woman explained that she left her rural home in Azilal to escape an arranged marriage. Compared to rural life, work in the city offers more autonomy for women. *"I could work, get married, have babies and have a husband who will beat me up. Marriage age in my [rural] area is 18 to 19 years old. I've worked like a slave in others' homes. No more. I wanted to come to Casablanca to live, work and maybe get married"* (Female, 20-25 years old Casablanca, Morocco). Older male participants were more likely to seek marriage and a home for a future family as marriage is seen as a source of stability. However, due to lack of steady income, marriage for most young male respondents is elusive.

Returning home once in a while is important. About a fifth of male respondents said that they do return to their village during holidays and specials occasions, about two to three times per year. But few return to help cultivate the land still held by their family or to live part time with their families. This is in part because it costs money to travel and also maintain housing in the city. *"I worked for a month or two and kept going back to my village in between. But I wasn't able to save money this way. So, I searched for a place so I could have my family with me and it took me a whole year until I found a suitable room"* (Male, 36-45 years old, Cairo, Egypt).

To conclude this review of the qualitative findings on migration at the place of destination, acquiring sustainable employment is often more difficult than respondents thought it would be, particularly for women. Some expected to find a job much sooner than they had. Others, more broadly, expected a more stable and social lifestyle. Many have had a difficult time making friends in the city and overcoming stereotypes. Long work schedules also are obstacles to making friends. Importantly, all would like in the future to have a better education.

Table 6 summarizes in a very stylized way the main results from the analysis of migration. The evidence suggests that worsening climatic conditions, or the perceptions thereof, are clearly a push factor leading to migration away from the affected (mostly rural) areas towards urban centers. It must be noted that in an analysis such as that of Joseph and Wodon (2013) or Joseph et al. (2014) which is at the level of a country as a whole, the impact of the climate on the overall patterns of migration tends to be diluted, which helps explain why the effect is qualified as smaller in table 6. By contrast, in the analysis based on the five countries sample, as well as when looking at weather shocks with the national Morocco survey, the effects are estimated mostly on those affected by these shocks, which also explains why the impacts are larger in

affected areas. In those areas, it seems fair to suggest that climatic conditions account for at least 10 to 20 percent of the current migration flows, and this could increase in the future.

Table 6: Summary Results from Regression Analysis on Weather Shocks and Migration

Variables	Country	Paper	Temporary	Permanent	Magnitude
Perceptions of climate change	5 countries	Adoho & Wodon (2014c)	+	Weak	Medium
Recall of weather shocks and structural changes in climate	Morocco	Nguyen & Wodon (2014b)	+	Weak	Medium
Actual climate variables	Yemen	Joseph & Wodon (2013) Joseph et al. (2014)	Not applicable	+	Small
Qualitative focus groups	5 countries	Grant et al. (2014b)	+	+	Substantial

Source: Authors. NA = not applicable. NS = Not statistically significant.

4. Remittances

Although remittances are not the focus of this study, the last part of the study includes two chapters looking at remittances in the case of Yemen. There is evidence in the literature that migration and remittances tend to increase in response to climate shocks, so that both may function as coping mechanisms. It is not clear however whether remittances are likely to be higher in areas that suffer from poor climate in the absence of weather shocks. The first chapter in the last part of the study by Joseph, Wodon, and Brian Blankespoor (2014) use a national household survey for Yemen combined with weather data to measure remittance flows, both domestic and international, and assess the likelihood of households receiving remittances as well as the amounts received. The question is whether households living in less favorable areas in terms of climate (as measured through higher temperatures, lower rainfalls, more variability or seasonality in both, and larger differences in a given year between extreme temperatures) are more likely to benefit from remittances. The results suggest that this is not the case in Yemen.

In the last chapter of the study, Joseph and Wodon (2014b) use matching techniques and the same household survey for Yemen combined with weather data to measure the impact of remittances, both domestic and international, on poverty and human development outcomes (school enrolment, immunization, and malnutrition). The estimations are carried both nationally and in areas with favorable and unfavorable climate. Four main results are obtained. First, remittances – which are substantial in Yemen – tend to have positive impacts on poverty measures, school enrollment, and measures of malnutrition. Second, the impact of international remittances tends to be larger than that of domestic remittances, probably because among beneficiaries, the amount of remittances received tends to be higher for international than for domestic remittances. Third, the impact of remittances – and especially international remittances – on measures of poverty and malnutrition tends to be larger in areas affected by high temperatures, and also to some extent in areas with lower levels of rainfall, which in both cases tend to be more vulnerable. Fourth, and by contrast, in areas with higher levels of rainfall or lower levels of temperatures, where issues of poverty and malnutrition may be less severe, remittances – and again especially international remittances – tend to have a larger impact on school enrollment. Thus, in areas with unfavorable climate, remittances help first for meeting basic needs in order to escape poverty and malnutrition, while in areas with more favorable climate, remittances may be used more for investments, including in the education of children.

The qualitative work (Grant et al., 2014) also suggests that remittances are important to rural households, especially in rural Yemen where there is a long-standing tradition of migration to Saudi Arabia. They allow households to enjoy a reasonably high standard of living, but

conversely consequences can be severed in their absence: *"My brother is in Saudi Arabia. He used to send me money all of the time and we were well off, even when I wasn't working. [But] we lost the house and everything we [owned] because of the discontinuity of these aids. We live at God's mercy"* (Male, 30-45 years old, Hudaydah, Yemen). By contrast, participants in focus groups from Morocco and Algeria did not depend on remittances as much, with only a few saying that they receive remittances from relatives. Similarly some Algerian rural residents received remittances from relatives who have migrated to France. In Egypt, items such as ghee, oil, bread, flour and sugar are purchased for families in addition to funds being sent directly to homes. The amounts of the transfers sent by migrants back home vary. In Morocco remittances ranged from 500 to 1000 Moroccan dirham per month, depending on the migrant's income. Male respondents tended to remit more than females. For most, providing remittances for their family was a moral obligation. *"They [our families] are in a terrible situation. Sometimes they call us to send money each month. Sometimes, I go without dinner or not spend much needed money on myself so I can send money to my family. Without money, they cannot eat. They would have no money for the souk to get food to eat"* (Female, 20-25 years old, Casablanca, Morocco).

Though urban residents in Algeria, Morocco, Syria and Egypt overwhelmingly report sending remittances back home, Yemeni urban respondents by contrast were more likely to receive remittances from family members working abroad, especially from Saudi Arabia. These remittances were critical to household survival. *"We do not rely on jobs. My mother is a government employee she gets paid 60 thousand riyals which does not cover expenses for seven days, but we rely on the income that comes from the my father who works abroad in Saudi Arabia"* (Male, 30-39 years old, Sanaa, Yemen). *"My brothers work in Saudi Arabia to provide good living for themselves and their families here in Yemen. They send me money when I need it because my work is not enough for me and my family. …wages in Saudi Arabia are good and he works one job which is sufficient for him and his family living in Yemen. We rely upon them a great deal. Employment outside Yemen is available in addition to the currency difference. If the surplus is sent to us, it is better than a month's salary here. If it weren't for them we would have nothing to eat"* (Male, 25-30 years old, Sanaa, Yemen).

5. Other Coping and Adaptation Strategies

Apart from migration, what are some of the other coping and adaptation strategies used by households to deal with difficulties to sustain their livelihood and shocks, including those brought about by climate? Table 7 from Adoho and Wodon (2014b) provides information from the surveys on how households have dealt, or might deal with shocks. Specifically, households who were affected by climate and environmental patterns and who lost income, crops, or livestock and cattle, or who caught less fish, were asked whether they used one of several coping mechanism, and if not, whether they would be likely to use such a coping mechanism if they were affected by climate patterns in the future. If the households answered yes to the question on whether they did use the coping mechanism, or if they agreed strongly or somewhat with the fact that they might use this coping mechanism in the future, they are considered as using the mechanism in table 6. In the table, the share of those using the various mechanisms as a proportion of the total population is provided (this factors in those not affected by shocks that are considered as not using the mechanism).

Some 60.6 percent of households declare that they have used or would use their savings in case of a climate shock. This is followed by 46.8 percent of respondents (household heads) who have sold or would sell their assets, 46.2 percent who have asked for a loan or would do so,

40.6 percent who have sold or would sell their livestock, and finally 36.4 percent who have withdrawn or would withdraw their children from school. The proportions of households resorting to these various strategies tend to be higher among lower quintiles (which have fewer other ways to cope), and they are also higher among households declaring that they lost income, crops, or livestock/cattle, or caught less fish, as expected. There are differences between countries, especially regarding the possibility of withdrawing children from school – in Egypt this is not considered by most households. Also, households receiving international remittances, who tend to be better off, are less likely to resort to coping strategies, except using their savings.

Table 7: Household Coping Strategies to Deal with Climate Change and Shocks (%)

	Selling livestock	Selling Assets	Withdrawing children from school	Using savings	Asking for a loan
All	40.61	46.79	36.42	60.55	46.21
Country					
Algeria	68.96	50.65	60.15	78.42	50.48
Egypt	21.00	20.25	5.13	26.88	13.75
Morocco	41.41	35.26	31.12	46.62	42.04
Syria	33.75	65.50	54.00	90.38	60.25
Yemen	37.94	62.19	31.72	60.45	64.43
Quintiles					
Q1	45.32	53.32	43.44	63.69	45.18
Q2	47.05	54.68	46.37	61.62	47.21
Q3	49.82	54.85	42.66	65.93	47.67
Q4	34.48	38.48	27.92	60.86	48.22
Q5	27.12	33.39	22.45	50.95	42.80
Losses					
Lost income	61.00	69.98	55.70	87.87	63.75
Lost crops	76.06	69.54	59.88	86.22	65.06
Lost livestock or cattle	80.35	69.16	57.01	83.99	71.40
Less fish caught	71.47	72.87	51.27	80.04	72.60
Receives remittances					
Local remittances	57.90	65.71	61.99	79.77	45.09
International remittances	34.73	58.02	47.61	78.34	53.01

Source: Adoho and Wodon (2014b).

The qualitative focus groups also reveal many different types of coping and adaptation strategies used by households, including selling assets, shifting food consumption habits (such as eating less chicken or beef or eating one less meal), and even removing children from school in order for them to work and support the household (Grant et al., 2014). Borrowing food or money from the community is also common in times of economic stress. Women, in particular, are mindful of loss of income on the ability to help their children get married. *"It affects everything. My husband passed away and my monthly income is 60 or 90 EGP, i.e. nothing. Sometimes I refuse a suitor of my daughter because I cannot afford getting her married"* (Female, 36-45 years old, Dakhalia, Egypt). Another key coping strategy is to diversify income sources. One Egyptian woman explained that poor prices turn farmers away from agriculture altogether: *"[Farmers] used to exert earnest effort in the past because the gains were equally profitable, but now it is of no use. Land [requires] a lot of money and the earnings then have to be distributed among many in the family"* (Female, 25-35 years old, Cairo, Egypt). Or as a Syrian man explained it: *"When the al-Kabour river was flowing, there was a labor force here and people*

were able to cultivate their lands, but now…" (Male, 25-45 years old, al-Hasaka, Syria). Yet traveling long distances between homes and jobs is cumbersome – and expensive, with a number of respondents in all five countries expressing frustration about the expense of transportation and lack of good roads.

Households were also asked about actions that they took or might take to cope with the loss of crops, income or livestock due to weather or environmental changes. The possibilities included: changing production technologies such as land preparation, sowing or weeding; changing crop choices, increasing crop variety, or adopting drought or flood resistant crops; changing the percentage composition of crops versus livestock; increasing the use of fertilizer or pesticides; seeking or increasing off-farm employment; and receiving occupational training for non-farm employment. Households were also asked whether compared to five years ago, they used more stored water or consumed more stored grains and stored animal products. They were asked whether they were aware of people moving out of their community as a result of weather or environmental changes, and whether in the last five years people moved into their community. Finally, they were asked if in the past 5 years they experienced conflict over agricultural land or livestock, or water for household use or cultivation due to weather or environmental changes.

The results for those questions are provided in table 8 from Adoho and Wodon (2014b). For the sample as a whole, and for most of the alternatives presented in the questionnaire, only a minority of households have implemented any single one of the adaptation strategies. This is explained in part by the fact that many of the alternatives apply mostly to farming households, and not all households are involved in farming (this is evident in the fact that the proportion of households using the various adaptation strategies are higher among households who own land, many of whom farm their land). Between one in four and one in five households have relied more on stored grains/products and stored water, have sought off-farm work, have used more fertilizers or pesticides, or have made a change in their farm production technology. The proportion of those who have received training or changed their crop mix or the varieties they use is at about 15 percent. Only nine percent of households have changed their mix of crops and livestock for their livelihood.

On the other hand, more than four in ten households say that they know people who have moved out of their community due to the climate pressures, and 14 percent declare that some people have moved in, which may at time generate conflict over water, land, or livestock. There are some large differences between countries in the use of adaptation strategies, with households in Egypt and Syria making fewer changes in their modes of livelihood than households in Algeria, Yemen, and to some extent Morocco. It also appears that households in the bottom quintiles, which tend to be affected by climate change the most and have limited means to cope with weather shocks and changing conditions, also have made more changes in their livelihood strategies. But this may also be in part because a larger share of those households is involved in farming. As before households with international remittances who tend to also be better off tend to rely less on those adaptation strategies than other households.

Table 8: Adaptive Strategies of Households to Deal with Climate Change and Shocks (%)

	Change in production technology	Change in crops mix or varieties	Change in crops vs. livestock	More fertilizers/ pesticides	Seeking non-farm work	Training for non-farm work
All	19.35	15.53	8.89	21.12	22.67	15.09
Country						
Algeria	48.61	42.45	15.25	42.16	57.04	43.30
Egypt	2.13	4.50	2.50	4.63	4.13	4.00
Morocco	21.43	16.04	8.93	31.47	25.33	1.67
Syria	5.38	4.38	3.38	5.88	1.13	2.00
Yemen	21.95	12.94	15.10	23.48	29.06	27.28
Quintiles						
Q1	31.50	27.92	10.36	22.65	27.57	24.37
Q2	25.42	17.84	11.45	22.35	24.33	18.34
Q3	20.84	19.35	13.21	22.49	24.21	17.00
Q4	10.09	7.51	5.12	22.43	20.64	9.24
Q5	8.65	4.73	4.30	15.46	16.42	6.23
Losses						
Lost income	26.19	22.24	12.55	24.02	26.63	19.86
Lost crops	41.65	34.89	17.04	38.33	39.25	29.77
Lost livestock or cattle	32.67	26.84	19.39	36.54	28.87	23.79
Less fish caught	32.58	27.03	24.48	39.63	30.60	23.55
Receives remittances						
Local remittances	40.66	35.10	15.91	27.47	40.78	35.86
International remittances	12.62	12.23	13.95	14.98	14.96	10.64
Land ownership						
Land owners	43.42	35.10	16.71	45.66	41.51	29.08
Land tenants	15.15	13.52	14.25	20.98	22.44	11.06
No land cultivated or owned	5.05	3.76	3.53	6.10	11.15	6.93

	Use of stored water	Stored grains/ products	People moving out	People moving in	Conflict over land, livestock	Conflict over water
All	20.54	28.37	40.29	13.99	12.85	8.35
Country						
Algeria	32.08	41.63	17.92	20.46	44.05	11.93
Egypt	15.00	13.00	20.38	8.13	1.00	1.13
Morocco	6.54	38.42	48.76	18.26	5.01	8.02
Syria	12.75	17.00	85.25	2.63	0.38	1.00
Yemen	37.69	33.12	26.96	21.14	16.58	20.18
Quintiles						
Q1	20.29	36.94	36.85	14.81	20.58	7.40
Q2	25.24	33.77	42.41	13.86	16.55	9.63
Q3	21.93	30.79	47.06	15.40	19.02	11.19
Q4	18.30	23.90	37.87	13.88	4.26	7.37
Q5	16.89	16.06	37.37	11.99	3.76	6.17
Losses						
Lost income	23.34	36.90	50.59	14.02	19.29	11.01
Lost crops	31.74	52.98	40.20	17.89	29.52	15.95
Lost livestock or cattle	32.28	45.32	47.93	22.72	21.85	18.91
Less fish caught	35.48	56.53	45.81	19.11	22.49	24.27
Receives remittances						
Local remittances	28.55	46.14	46.13	14.57	37.30	19.70
International remittances	19.92	23.55	68.38	14.35	6.93	13.62
Land ownership						
Land owners	29.55	49.69	37.67	17.20	29.43	15.19
Land tenants	26.79	30.26	33.67	9.37	5.09	3.45
No land cultivated or owned	14.36	15.10	42.60	12.53	3.53	4.69

Source: Adoho and Wodon (2014b).

In the absence of local organizations or government agencies that provide assistance (as discussed in the next section), residents tend to rely on each other to cope. As a rural Egyptian male explains it in the focus groups: *"Rural residents are willing to pay [give] half of what we have to help others. If I have 10 pounds [Egyptian pounds], I will pay 5. If I have 100 pounds, I will pay 50. This is how the social norms work here. We are all one family"* (Male, 36-45 years old, Dakhalia, Egypt). Yet solidarity does not always work, and conflicts over natural resources do occur due to changes in climate, as the estimates in table 7 show. In Yemen in particular, rural residents worried in the focus groups that water scarcity has led to conflict over access to wells. One Yemeni woman from Hudaydah described a complicated water distribution scheme where water is distributed to certain communities on certain days of the week. More generally, for farmers in all five countries, living in impoverished rural areas is not only difficult financially, but it also has negative impacts for health, a concern mentioned by Egyptian rural focus group respondents. Some point out that farmers are increasingly exposed to contaminated water because waste leaks into irrigation canals. Others mention being sick with illnesses such as the flu. With only limited income at their disposal, many households cannot afford quality health care and they also often cannot access health facilities because they are not in close proximity.

6. Community and Government Programs

In previous sections, information was provided about strategies used by households to cope with weather or environmental changes. What about the role of communities and governments? The survey questionnaire asked whether to cope with the loss of crops, income or livestock due to weather or environmental changes, the communities in which the household live did the following: planting trees or installing soil protection measures; building banks on rivers, streams or small check banks to reduce flooding; developing new infrastructure such as boreholes, wells, irrigation or roads; gathering and disseminating information on measures to reduce the loss of crops, income or livestock; taking measures to prepare for future disasters like floods or droughts; taking action to improve market access for agricultural products or handicrafts; and taking action to purchase seeds, animals or farm equipment.

Table 9 from Adoho and Wodon (2014b) provides the results of the analysis. To a large extent, the extent of community involvement to adapt to climate change is limited. While one in five households declares that the community has planted trees or taken soil erosion measures, and one in seven households mentioned community measures to purchase seeds, animals or farm equipment, the other actions that could be taken by communities are mentioned by only one in ten households on average. There are large differences between countries, with households in Algeria and Yemen much more likely to mention community initiatives than households in the other three countries. Households in the bottom quintiles (as well as those owning land although this is not shown in the table) are also more likely to mention initiatives, perhaps because they are more aware of these initiatives as they tend to be affected by weather shocks more. Still, many communities do not seem to implement the types of measures that might help households to cope and adapt.

Table 9: Adaptive Strategies of Communities to Deal with Climate Change and Shocks (%)

	Planting trees and soil protection	Banks against flooding	Boreholes, wells, irrigation, roads	Information on how to reduce losses	Preparation for future disasters	Market access for products	Seeds, animals, and farm equipment
All	19.06	11.41	10.19	7.90	10.15	10.47	14.58
Country							
Algeria	47.62	38.40	21.02	14.27	32.40	21.84	39.88
Egypt	4.88	1.63	2.38	8.25	3.13	7.13	8.13
Morocco	2.53	3.43	4.09	1.97	2.18	4.96	4.22
Syria	14.63	1.63	4.13	2.00	1.50	0.88	1.50
Yemen	26.72	12.98	19.73	13.23	12.36	17.98	20.10
Quintiles							
Q1	30.53	23.07	10.31	7.28	19.40	11.71	19.38
Q2	23.26	15.78	10.59	10.15	13.92	13.20	17.45
Q3	21.45	12.40	16.69	13.52	11.77	15.54	22.55
Q4	10.91	3.36	6.36	5.52	2.44	8.52	8.91
Q5	9.33	2.58	7.28	3.25	3.37	3.56	4.92
No land cultivated/owned	11.64	5.02	7.16	5.50	4.78	5.63	7.15

Source: Adoho and Wodon (2014b).

Similar questions were asked about the role of governments, albeit with slightly different modalities, including more transfers and social protection programs, such as cash or food for work programs, cash for food during floods and droughts, as well as the provision of drinking water, the provision of skills training programs, the provision of credit during crop loss, improvements in access to markets through transportation, and price support for crops when agricultural prices are low. The results are provided in table 10. Except for the provision of drinking water which is less related to climate change and shocks, the extent of government involvement in adaptation strategies or safety nets is also limited. For most types of programs, only about one in ten households declare that the government has been active. There are again differences between countries, with households in Algeria, Syria, and Yemen more likely to mention government programs than households in Egypt and Morocco. In many but not in all cases households in the bottom three quintiles are more likely to mention initiatives, as was the case for community programs. Overall, the extent of government support appears to be limited.

The fact that community and government programs to help households cope with weather shocks are the exception rather than the rule was also a conclusion of the qualitative work. When asked about government and community programs, focus group respondents said that they were aware of few programs and organizations geared towards assisting the rural poor affected by climate change. Some Yemeni residents mentioned the Saleh Organization, but concluded that it only provides temporary help or relief. Rural Algerians knew about government assistance for the agricultural sector, including low interest loans and government extension workers travelling to villages to advise farmers on growing methods. Yet they suggested that the impact of these services was uneven, that isolated locales were far from their reach, and that bureaucracy and corruption made loan acquisition from formal institutions such as banks a lengthy and frustrating process, so much so that most farmers avoid this option altogether.

Table 10: Government Programs to Deal with Climate Change and Shocks (%)

	Planting trees and soil protection	Banks against flooding	Boreholes, wells, irrigation, roads	Seeds, fertilizers, or fodder for livestock	Storage facility for crops	Cash or food for work programs
All	12.36	10.57	14.98	13.35	10.41	9.93
Country						
Algeria	19.30	16.46	19.78	19.19	17.17	14.69
Egypt	8.25	5.00	4.63	6.38	4.88	7.38
Morocco	6.00	5.00	6.19	8.31	2.04	1.13
Syria	10.75	10.88	21.88	23.88	21.38	18.13
Yemen	17.75	15.75	22.60	9.24	6.87	8.49
Quintiles						
Q1	13.32	11.79	15.18	14.62	9.71	8.48
Q2	12.99	11.41	13.17	13.19	12.33	14.73
Q3	15.27	13.94	19.79	20.30	17.26	11.66
Q4	9.25	7.66	12.76	10.58	7.34	7.65
Q5	11.12	8.23	14.20	8.33	5.71	7.23

	Cash for food during floods and droughts	Provision of drinking water	Provision of skills training programs	Provision of credit during crop loss	Improved access to markets, transport	Price support prices when agricultural prices are low
All	10.08	24.67	6.65	11.98	10.33	10.10
Country						
Algeria	16.67	27.82	11.12	38.21	14.90	18.80
Egypt	7.38	7.38	4.38	5.75	6.63	8.00
Morocco	2.37	29.31	0.70	4.67	4.80	1.94
Syria	13.88	30.75	2.88	4.38	10.75	15.38
Yemen	10.36	28.21	14.36	7.87	14.73	6.74
Quintiles						
Q1	10.41	19.93	7.03	23.61	10.81	12.49
Q2	13.27	22.32	8.16	17.26	11.09	8.54
Q3	14.73	26.91	8.48	11.87	15.91	17.25
Q4	5.69	25.57	5.36	4.55	8.15	7.54
Q5	6.55	28.72	4.31	2.68	5.90	4.95

Source: Adoho and Wodon (2014b).

In the focus groups, rural participants suggested a number of areas where government initiatives could help farmers better adapt to their changing environment (Grant et al., 2014). Egyptian respondents mentioned the importance of strengthening agricultural unions. In one focus group, rural participants recalled that in the past these unions were stronger and benefitted from linkages to the Egyptian parliament, so that they were in a much better position to serve agricultural interests. Government provision of agricultural inputs such as seeds and fertilizers was also suggested in addition to the provision of loans to purchase machinery or for livestock breeding. *"We need machinery that would help us collect rice ashes instead of burning it and to press wood automatically. Livestock breeding … are also projects that are of low cost to the government"* (Male 36-45 years old, Dakhalia, Egypt). However, participants were not convinced that real change would materialize due to pervasive patronage constraining progress in the countryside. Syrians in al-Hasakeh recommended removing the dam at the al-Kabhour river to allow greater access to water, in addition to encouraging the government to keep its promises to improve rural infrastructure. Assistance with navigating the process to obtain loans was also suggested.

Job training and improved employment opportunities for both rural men and women were also mentioned as helpful. Men and women said that although local norms may frown upon women working, particularly in public spaces typically reserved for men, training for employment that is discreet and suitable in or near the home would be welcome. Moroccan participants, though, were virtually unanimous in their objection to rural women working in positions deemed unacceptable according to community norms (such as sales and teaching). Some Yemenis were doubtful that any government program would bear fruit, citing corruption and distrust of Yemeni institutions as the reason for their lack of confidence.

In urban areas, access to health care, education and job training, credit for housing and rental assistance were all seen as vital for advancing the integration of rural migrants into urban communities. Some suggestions were country-specific. In Morocco respondents complained of not having the appropriate official documents that enable them to work and receive credit: *"Our life is in crisis. When you don't have official documents, what else can you do?"* (Male, 35-45 years old, Casablanca, Morocco). French-speaking capability was also mentioned in Morocco for being able to fully function in the labor force, with suggestions for government-funded language training (this was not suggested in the other countries). By contrast, Egyptians emphasized the need for government assistance with agricultural inputs such as seeds and fertilizer, as well as no-interest loans and credit. In Yemen, as was the case for rural residents, the respondents' faith in their domestic institutions was low: *"I heard about [various programs] and [people] did not get their help because those responsible for these institutions are taking the money which they promise to help the citizen with. Also, with institutions of disabled people we hear that they are funded with millions, but the money is being divided in between government officials. The disabled person is supposed to receive a monthly salary receives 3000 riyals every three months, and the 1000 riyals doesn't even suffice him for a day, and all the equipment is ancient. So where is the money going?"* (Male, 25-30 years old, Sanaa, Yemen). It is also worth noting that focus groups participants from all countries did not look to mosques for solace or assistance, and respondents were united in their reprehension towards using children to peddle.

7. Conclusion

The goal of the study was to contribute to a better understanding of perceptions of climate change, environmental degradation, and extreme weather events and their relationship to migration and other coping strategies in the MENA region. Quantitative and qualitative data collection activities were implemented in climate-affected areas in five countries, and existing census and survey data for Morocco and Yemen were used as well. The analysis suggests that a majority of households do perceive important changes in the climate, such as more erratic rain, higher temperatures, less rain, dryer and less fertile land and more frequent droughts.

These changes have led to a range of negative consequences for agriculture and livestock production, and extreme weather events have been associated with losses in incomes, crops, and livestock. The coping and adaptation strategies used by households to deal with shocks are diverse, including migration, selling various assets and taking other emergency measures to get by, as well as changing the household's sources of livelihoods in terms of crops, livestock production, and off-farm work among others. Yet many households do not appear to use these strategies, and in addition the extent to which they benefit from community and government programs and initiatives to help them cope with weather or environmental changes is limited.

In terms of migration, the study suggests that the impact of weather shocks and deteriorating conditions on migration is positive, leading to higher temporary and permanent

migration. In the areas most affected by climate change, the analysis suggests that climate factors may account for between one tenth and one fifth of the overall level of migration observed today, but this is likely to increase as climatic conditions continue to deteriorate. Furthermore, while many migrants appreciate the opportunities that migration offer, their living conditions and their ability to be well integrated in their areas of destination is far from being guaranteed, especially given intense competition for relatively few good job opportunities.

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