A WORLD BANK STUDY

Climate Change and Migration

EVIDENCE FROM THE MIDDLE EAST AND NORTH AFRICA

Quentin Wodon, Andrea Liverani,
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Editors

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Overview

Quentin Wodon and Andrea Liverani

Climate change and migration are major concerns in the MENA region, yet the empirical evidence on the impact of climate change and extreme weather events on migration remains limited. Information is broadly lacking on how households in vulnerable areas perceive changes in the climate, how they are affected by extreme weather events, whether they benefit from community and government programs to help them cope with and adapt to a changing climate, and how these conditions influence the decision of household members to migrate, either temporarily or permanently. This introductory chapter summarizes briefly the main results of the study which relied on existing data as well as focus groups and new household surveys collected in 2011 in Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of Yemen. The results suggest that households do perceive important changes in the climate, and that many households are being affected by extreme weather events resulting in losses in income, crops, and livestock. The coping and adaptation strategies used by households to deal with weather shocks are diverse, but also limited, with most households not able to recover from the negative impact of weather shocks. The ability of community-level responses and government programs to support households is also very limited. Finally, while climate change is not today the main driver of migration flows, it does appear to contribute to these flows, and worsening climatic conditions are likely to exacerbate future migration flows.

Introduction

Do households living in climate-affected areas in the Middle East and North Africa (MENA) region believe that changes in climate patterns and their environment are taking place? Have households been affected by extreme weather events, and in that case to what extent and which events have had the largest impact? What are the coping strategies that households declare having used, or could be using to cope with climate change and weather shocks? To what extent are perceived and actual changes in weather patterns and the environment driving temporary and permanent migration flows in MENA countries? Finally, to what extent do remittances reach households living in climate poor areas, and what is the impact of such remittances on poverty and human development indicators?

It is widely acknowledged that the MENA region will be strongly affected by climate change, and yet the current evidence on the relationship between climate change and migration in the MENA region is weaker than in most other regions (see Foresight 2011). This study is not meant to review the limited evidence on climate change in the MENA region, nor does it provide specific policy recommendations (for a recent study doing just that, see Verner 2012; on the evidence and policies related to climate change worldwide, see World Bank 2010; and on migration, see Foresight 2011). The aim of the study is more modest: it is to provide new empirical evidence on the relationship between weather patterns, perceptions of climate change, and migration so that at least partial answers can be provided to the questions asked above.

This introductory overview chapter summarizes the main results of the study. A more detailed synthesis is provided in chapter 1 (Wodon et al. 2013). The study is based in part on new household surveys collected in 2011 in climate-affected areas in Algeria, Egypt, Morocco, Syria, and the Republic of Yemen. On purpose, in order to achieve variability in the data collected, the selection of the countries and areas sampled within countries included some countries and areas highly vulnerable to droughts, as is the case in Syria, and others much less vulnerable, as is the case in Egypt (given that Egypt's agriculture is mostly irrigated). The sample of countries also included low income countries such as the Republic of Yemen, and higher-income countries such as Algeria, Egypt, Moroco, and Syria. Finally, the sample included countries and areas affected by diverse types of extreme weather events, including both droughts and floods (for example in some areas of Morocco).

Beyond survey data collection generating quantitative data, the study also relies in part on qualitative focus groups implemented in both urban and rural areas in the five countries in 2011. In addition, some of the analysis is based on previously existing survey data for Morocco, as well as survey and census data for the Republic of Yemen. The context that led to the study and the literature to which it contributes, as well as the approach used for both quantitative and qualitative data collection are discussed in chapters 2 and 3. This introduction focuses on the main empirical results which are provided in a series of technical papers in chapters 4 through 12.

One important caveat is required before presenting the main results. 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 difficult to tell if the weather experienced at any point in time is due to a change in climate (the overall mean and variance of rainfall and temperature) or is simply part of an existing distribution. The implication for this study is that our results do not provide clear new evidence on the direct relationship between climate change and migration *per se*, but the results do contribute to the evidence on three specific related 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.

Perceptions and Impacts of Weather Shocks on Households

Do households living in rural areas susceptible of being affected by climate change believe that changes in climate patterns are taking place? Questions on perceptions of climate change and migration were asked with a focus on events and changes that took place in the last five years, bur the analysis of migration is done both for the last five years and for longer periods.

Table O.1 from Adoho and Wodon (2014a) suggests that indeed households do believe that the climate has been changing in recent years. In the combined sample for the five countries where new household surveys were implemented, more than three fourths of households declare that rain has become more erratic, and almost three quarters say that temperatures are higher. Between half and two thirds 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 animals 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 associated with climate change such as rainstorms and floods are not perceived as more frequent by a majority of households, and in some cases, households do suggest that temperatures are becoming cooler, and that there is more rain, but this is a minority of households. But overall, while there are differences between households and areas or countries, there is a clear perception that the climate is worsening.

In focus groups as well the majority of respondents mentioned long-term shifts in climate and they attributed declining agriculture fortunes to deteriorating environmental conditions caused by changing weather patterns (Grant et al. 2014). For 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,

Table O.1 Perceptions of Climate Change, Last Five Years, Five Countries Sample, 2011
Percent

Perception	*Percent*	*Perception*	*Percent*
Rain more erratic	77.52	More diseases in animal and livestock	57.45
Temperature is hotter	72.37	More insects and pets in crops	56.31
Less rain	66.57	Less water in boreholes, rivers, lakes or streams	56.11
Land is dryer	64.84	More air pollution	55.59
Less fertile land	62.24	More frequent crop failure	55.36
Rainy season starts later	60.53	Rainy season end earlier	54.00
Rain season is shorter	60.24	More frequent livestock loss	52.47
More frequent droughts	59.09	More soil erosion	52.43

Source: Adoho and Wodon 2014a.

36–45 years old, Egypt[1]). The inability to earn a stable income for crops makes it difficult to rely solely on agriculture as a source of revenue. "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. … All farmers in this region have been affected by the drought and lost their yields" (Male, 35–45 years old, Algeria). In the Republic of Yemen, residents from Hudaydah emphasized the problems of warm weather and increasing heat waves. Furthermore, unfavorable crop prices have led some 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 replaced them with qat" (Male, 30–39 years old, the Republic of Yemen). Importantly, as shown in table O.2, many households are affected by weather shocks, especially in terms of crop and income losses, but also in terms of losses in livestock and less fish caught.

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 O.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 survey, more than one in five households declared having been affected by a recent weather shock such as a drought or flood. Most of the households that 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.

Coping and Adaptation Strategies

What are the coping strategies that households declare having used, or could be using to cope with climate change and weather shocks? In the five country sample, 60.6 percent of households declare that they have used or would use their savings, 46.8 have sold or would sell their assets, 46.2 percent have asked

Table O.2 Economic Impacts of Weather Shocks, Five Countries Sample, 2011
Percent

	Quintiles					
	Poorest	*Q2*	*Q3*	*Q4*	*Richest*	*All*
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.

Table O.3 Weather Shocks and Impact on Agriculture, Morocco, 2009/10
Percent

	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.

for a loan or would do so, 40.6 percent have sold or would sell their livestock, and 36.4 percent have withdrawn or would withdraw their children from school (Adoho and Wodon 2014b). The proportions of households resorting to these coping strategies are higher among lower quintiles which have fewer other means to cope. There are differences between countries, especially regarding the possibility of withdrawing children from school—in Egypt this is not being considered by most households. Also, households receiving international remittances, which tend to be better off, are less likely to resort to these various coping strategies, except using their savings. The qualitative focus groups also reveal different coping strategies, including selling assets, shifting food consumption habits, and removing children from school to have them support the household (Grant et al. 2014).

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. As shown in table O.4 from Adoho and Wodon (2014b), between one in four and one in five households have relied or would rely more on stored grains/products and stored water, have sought or would seek off-farm work, have used or would use more fertilizers or pesticides, or have made or would make a change in their farm production technology. Undertaking training for nonfarmwork or changing crop mixes and varieties is mentioned by about 15 percent of households, versus only 9 percent for changing the crops versus livestock mix. Thus most households do not implement many adaptation strategies. However more than 4 in 10 households say that they know people who have moved out of the community due to climate pressures, and 14 percent say that some people have moved in, which may generate conflict over water, land, or livestock.

Table O.4 Adaptive Strategies of Households to Deal with Climate Change and Shocks
Percent

	Change in production technology	*Change in crops mix or varieties*	*Change in crops vs. livestock*	*More fertilizers/ pesticides*	*Seeking nonfarm work*	*Training for nonfarmwork*
Share of households	19.35	15.53	8.89	21.12	22.67	15.09
	Use of stored water	Stored grains/ products	People moving out	People moving in	Conflict over land, livestock	Conflict over water
Share of households	20.54	28.37	40.29	13.99	12.85	8.35

Source: Adoho and Wodon 2014b.

The qualitative work suggests that residents often rely on each other to cope and adapt: "Rural residents are willing to pay [give] half of what we have to help others. If I have 10 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, Egypt). Yet solidarity does not always work, and conflicts over natural resources do occur due to changes in climate, as the estimates in table O.3 show. In the Republic of Yemen in particular, rural residents worried in the focus groups that water scarcity has led to conflict over access to wells. One woman described a water distribution scheme where water is distributed to certain communities on certain days of the week. 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 in Egyptian focus groups. Farmers may be increasingly exposed to contaminated water because waste leaks into irrigation canals. Others mention being sick. With only limited income at their disposal, many households cannot afford quality health care and they also often cannot access health facilities (Grant et al. 2013).

What about community-level responses? Households were asked whether to cope with the loss of crops, income, or livestock due to weather or environmental changes, the communities in which they live did any of 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. In most cases community action is limited. As shown by Adoho and Wodon (2014b), only one in five households declare that the community has planted trees or taken soil erosion measures, and one in seven mentioned measures to purchase seeds, animals, or farm equipment. The other actions are mentioned by only one in ten households or less.

Similar questions were asked about 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. Except for the provision of drinking water which is probably less related to climate change and shocks, government involvement in adaptation strategies and safety nets is also limited. For most programs, only about one in ten households declared that the government has been active.

The fact that community and government programs to help households cope with weather shocks and adapt to climate change are the exception rather than the rule was also a conclusion of the qualitative work. When asked about such programs, respondents said that they were aware of few programs and organizations geared toward assisting the rural poor affected by climate change. Participants suggested areas where government initiatives could help, such as the provision of agricultural inputs or loans to purchase machinery. Job training and improved employment opportunities were also mentioned. Yet some respondents, especially in the Republic of Yemen, were doubtful that government program would bear fruit, due to corruption and distrust.

Migration

Migration is also a widespread strategy to cope with and adapt to changes in climatic and environmental conditions. In the five country sample, the data suggest that three in every 10 households (29.9 percent) have migrants, whether residents (current members of the households) or nonresidents (former members of the household). Lower 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 (Adoho and Wodon 2014c). 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 nonresidents, migration to urban areas, and especially to large cities, is much 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. Regression results suggest that poor climate and extreme weather events lead to a higher probability of migration, but the role of climate is smaller than that of socioeconomic characteristics and job prospects in cities. More precisely, data from the five country sample are used by Adoho and Wodon (2014c) to construct two indices or factors that summarize household perceptions regarding changes in weather patterns and the environment. 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.

In the regression analysis with the five country sample, higher values for both factors (that is, worse climatic conditions) result in higher rates of resident or temporary 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 nonresident or permanent migration are similar, although statistically significant only for the whole period, as opposed to the last five years. Thus overall higher values for both factors result in higher rates of both temporary and permanent migration, but with weaker evidence for permanent migration. The regression 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 increase would represent between one tenth and one fifth of the overall level of migration observed, and its 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 2009/10 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 changing structural conditions such as reduced agricultural yields due to lack of water is, and it does contribute to higher permanent migration away from the affected areas. Finally, using a different approach based on combining census and weather station data from the Republic of Yemen, Joseph and Wodon (2014a) find that climate variables do affect migration from some districts to other districts, but in a somewhat limited way, with socioeconomic 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 become much larger (Joseph, Wodon, and Blankespoor 2014).

The focus groups data reported in Grant et al. (2013) also suggest a link between climate and migration, although again the role of socioeconomic factors is probably at least as important as that of climatic conditions. Respondents linked migration to chronic droughts which lead to declining agricultural productivity: *"The 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. Respondents appear to choose migration after other strategies have proven unsuccessful. The qualitative work also suggests that remittances are important, especially in the Republic of Yemen where there is a long-standing tradition of migration to Saudi Arabia. But conversely consequences can be severed in the absence of remittances: "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, the

Republic of Yemen). Participants in focus groups from Morocco and Algeria did not depend on remittances as much. Though urban residents in Algeria, Morocco, Syria, and Egypt overwhelmingly report sending remittances back home, the Republic of Yemeni urban respondents by contrast were more likely to receive remittances from family members working abroad, especially again from Saudi Arabia.

What happens to the migrants once they leave? Many migrants 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 20–40 percent among youth 15–30 years old. While some migrants find urban communities receptive, others say they were met with hostility: "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. For the Republic of Yemenis, the main obstacle to finding a job may be corruption, which appears to be deep and pervasive: "You need to bribe your way into a position" (Male, 30–39 years old, Sanaa). Finding adequate housing was also a challenge: "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).

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. Networks also ease feelings of isolation. 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. Yet while life in the city is more "chaotic," it is also exciting and full of opportunity. In Morocco, for example, migration appeared to widen the options available to young immigrants as young respondents expressed a greater sense of independence, belonging, and self-actualization.

Table O.5 summarizes in a very stylized way the main results from the analysis. The evidence suggests that worsening climatic conditions, or the perceptions thereof, are clearly a push factor leading to temporary migration away from the affected (mostly rural), but the evidence is a bit weaker for permanent migration. It must be noted that in an analysis such as that of Joseph and Wodon (2014a), which is at the level of a country as a whole, the impact of the climate on the

Table O.5 Summary Results from Regression Analysis on Weather Shocks and Migration

Variables	*Country*	*Paper*	*Temporary*	*Permanent*	*Magnitude*
Perceptions of climate change	5 countries	Adoho and Wodon (2014c)	+	Weak	Medium
Recall of weather shocks and structural changes in climate	Morocco	Nguyen and Wodon (2014b)	+	Weak	Medium
Actual climate variables	Yemen, Rep.	Joseph and Wodon (2014a) Joseph, Wodon, and Blankespoor (2014)	n.a.	+	Small
Qualitative focus groups	5 countries	Grant, Burger, and Wodon (2014)	+	+	Substantial

Source: World Bank.
Note: n.a. = not applicable.

overall patterns of migration tends to be diluted. 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 10–20 percent of the current migration flows, and this could increase in the future.

Remittances

The last part of the study includes two chapters looking at remittances in the case of the Republic 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 Blankespoor (2014) use a national household survey for the Republic of 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 the Republic of Yemen.

In the last chapter of the study, Joseph and Wodon (2014b) use matching techniques and the same household survey for the Republic of 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 the Republic of 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.

Conclusion and Policy Implications

A solid foundation for decision making related to climate change adaptation involves four iterative steps: (1) Assessing climate risks, impacts, and opportunities for action; (2) Prioritizing policy and project options; (3) Implementing responses in sectors and regions; and (4) Monitoring and evaluating implementation, then reassessing the climate risks, impacts, and opportunities (Verner 2012). Our work falls squarely within the first of these four steps. As mentioned in the introduction, the aim of this 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 the Republic of 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.

Beyond addressing an existing research gap though, the findings provide much ground for policy development. Five broad areas of implications for policy are highlighted below.

First, affected communities call for more government action to help with adaptation. In line with the conclusions reached in the recent study led by Verner (2012) on adaptation in the MENA region, we have shown the extent to which households in vulnerable rural areas are affected by climate change and weather shocks, and how their ability to cope and adapt to these shocks is limited. The cost of climate change and weather shocks is already felt today by many rural households, which are essentially left on their own in the absence of strong community responses and government programs in the geographic areas studied. While we have not conducted any cost-benefit analysis to assess which types of programs might help households the most in rural sending areas—such analysis would need to take local conditions into account, we have demonstrated the need for more assistance in order to help households cope and adapt, given the substantial damage already caused to livelihoods by changing weather patterns. The populations sampled in this study perceive a lack of effective government interventions to address the impacts of climate change and the migration it generates, and collective action solutions do not seem to work. The gap in the public provision and financing of adaption interventions leaves individuals and communities alone in making choices and decisions, including through migration. Although this leaves space for private initiatives, it also leaves the space vulnerable to forms of uncoordinated action that may lead to conflict and maladaptation.

The role of safety nets and broader social protection programs is especially important in this context, both for migrants and their families in sending areas. MENA governments should be encouraged to adopt and expand the coverage of their social protection and safety net programs. The coverage of those programs appears very thin in the areas surveyed for this study. Investments in safety net systems could have immediate pay-offs in the short run as well as in the long run when the consequences of climatic change may become more obvious. In addition, it would be important to highlight the fact that the design, coverage, and placement of safety net programs would not be just for the purpose of minimizing the future impacts of climate change; instead safety nets should be seen as an integral part of the governments' broader strategy toward poverty reduction and urbanization and they should provide portable skills and human capital to the segments of the population that need it the most (we come back to this below).

Second, migration policy needs to understand and address climate-induced migration in the context of other push and pull factors. The study has shown that while environmental and climatic factors do play a role in driving migration, a range of other socioeconomic factors are at play. Although uncertainties remain as to the magnitude of future climate change and its effects on migration, focusing on environmental degradation alone as the dominant driver of migration would be misleading. Similarly, characterizing environmental degradation as key driver of transborder migration is also potentially misleading: in the countries studies, when environmental factors play a role, migration is mostly internal. These findings run somewhat against the received wisdom behind much of the recent global hype around climate migration, but they are in line with the results of other assessments, including the recently released Foresight report on environmental change and migration (Foresight 2011). Identifying climate migration more squarely as a domestic policy issue will lead to a different type of attention to the problem for both domestic policy makers in MENA countries and donors alike.

Third, migration can be conceived of as a form of adaptation, but it is often seen as a solution of last resort by households, especially in the qualitative work presented in this study. One reason for this is that migration may be perceived as more costly than other strategies such as using savings, selling assets, getting into debt, or withdrawing children from school. In addition to material costs (travelling and relodging), migration implies substantial risks due to unknown outcomes (finding other forms of livelihood) in addition to immaterial costs such those as stemming from the uprooting of individuals, households, and sometimes even communities. In some cases, those left behind, whether at the level of the household or the community may be precluded from reaping the benefits from migration, especially when remittances are hampered by the high cost of remitting or by the fact that migrants have a hard time finding jobs.

At the same time policy responses and development interventions need to recognize that migration represents a viable and legitimate mechanism through which people can address risks to their livelihoods and wider well-being, and a means of adapting to climate change and its impacts. A key question for migration policy is therefore where migration should be treated as a risk to be managed and mitigated, and where it should be treated as an opportunity to be facilitated or even encouraged. Enabling communities in sending areas to better leverage the potential benefits of migration and increase their adaptive capacity is often a better alternative than their progressive displacement. The effective economic insertion of migrants in urban areas leads to opportunities for the sending communities, particularly thanks to the transfer of remittances. For example, the evidence from the surveys and the qualitative work suggests a positive impact of remittances in areas affected by climate shocks, especially in terms of human development outcomes. Without a facilitating environment though, remittances are too often turned into pure consumption and the accumulation of nonproductive assets. This type of assets can be of little value both in terms of preventive and ex-post adaptation, as their investment contribution is limited and they are not liquid enough to be used when climate impacts strike, at which point their value

can drop. Policy should focus on leveraging the impacts of remittances by encouraging their productive use, for instance by subsidizing forms of defiscalization for remittance-funded investments and community saving schemes which also facilitate financial integration and increase liquidity.

Fourth, urban development policy is a fundamental component of the policy package to address climate induced migration. Most of the study focuses on sending areas, but the qualitative work conducted in urban areas suggests that the integration of migrants into major destination cities is not working as well as it should. The study shows that climate-induced migration tends to be toward cities, mostly large ones. The policy responses to climate shocks and migration are therefore to be found in cities as much as in sending areas. Concerns about employment and housing abound among migrants, with migration simply adding to existing pressures that can be dealt with only through broad-based economic development not necessarily focused on migration per se. The climate induced migration problem should be part of a broader policy debate about urbanization. Most MENA countries are rapidly urbanizing. While the share of the urban population in the region was at 48 percent in 1980, it almost reached 60 percent in 2000 and is expected to reach 70 percent by 2015. The way MENA policy makers will address the challenges posed by climate-induced migration is related to how they will manage to promote an urbanization model that welcomes the contribution of migrants to the development of cities.

Fifth, policy should focus on providing migrants with the portable skills and capabilities they need to fully exploit the adaptation potential of migration. All too often the policy debate focuses on whether migration should be encouraged or not. The study has shown that climate-induced migration is already taking place. It must therefore be accompanied. The provision of education and training can help potential migrants better grasp labor market opportunities both in sending and receiving areas, adapt to new living conditions, and shift more easily among jobs in different sectors. An emphasis on basic and portable skills would be effective regardless of the causes, timing, and destination of the migration decisions involved. And it would benefit not only those that leave, but also those that decide to stay or eventually return.

Sixth, while dealing with climate-induced migration will require some interventions specifically aimed at migrants, the policy package needed to deal with both climate change and migration is much broader. This is both a challenge and an opportunity. This is an opportunity because several levers can be applied to better leverage migration's potential for adaptation and development. But this is also a challenge because an integrated policy response will require a level of coordination and commitment that is likely to arise only through broader governance reforms and strong political leadership in MENA countries.

Finally, it is worth investigating how safeguards could play a role in reducing the risk that development initiatives result in negative impacts. For example, could inadvertent increases in the vulnerability of certain groups take place as a by-product of policies and projects that may or may not address climate change directly, such as adaptation initiatives involving resettlement and relocation? Is

there a risk of maladaptation associated with interventions that are founded on unjustified assumptions about future climatic conditions and may thereby increase dependence or pressure on resources threatened by climate change? How to design safeguard mechanisms is a complex issue, if only because policy responses related to migration differ depending on whether one considers sudden-onset climate-related disasters or long-term climate-related environmental changes. But the fact that such safeguard mechanisms are needed is not itself in question.

Note

1. In the case of Egypt, the fact that much of the agriculture is irrigated means that results, including quotes from the qualitatiuve work, must be interpreted with care. When farmers are faced with lack of water, as this quote suggests, this may be related to shortages in the allocation of irrigation water which can themselves be due to any number of problems that need not be related to climate change, such as the upstream use of the Nile water by others.

Bibliography

Adoho, F., and Q. Wodon. 2014a. "Perceptions of Climate Change, Weather Shocks, and Impacts on Households." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 4 in this study.

———. 2014b. "How Do Households Cope with and Adapt to Climate Change?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 6 in this study.

———. 2014c. "Do Changes in Weather Patterns and the Environment Lead to Migration?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 7 in this study.

Foresight. 2011. *Migration and Global Environmental Change*. London: The Government Office for Science.

Grant, A., N. Burger, and Q. Wodon. 2014. "Climate-Induced Migration in the MENA Region: Results from Qualitative Fieldwork." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 8 in this study.

Joseph, G., and Q. Wodon. 2014a. "Is Internal Migration in Yemen Driven by Climate or Socio-Economic Factors?" *Review of International Economics* 21 (2): 295–310.

———. 2014b. "Does the Impact of Remittances on Poverty and Human Development Depend on the Climate of Receiving Areas?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 12 in this study.

Joseph, G., Q. Wodon, and B. Blankespoor. 2014. "Do Remittances Reach Households Living in Unfavorable Climate Areas? Evidence from the Republic of Yemen." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 11 in this study.

Joseph, G., Q. Wodon, A. Liverani, and B. Blankespoor. 2014. "Is Climate Change Likely to Lead to Higher Net Internal Migration? The Republic of Yemen's Case." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 9 in this study.

Nguyen, M. C., and Q. Wodon. 2014a. "Weather Shocks, Impacts, and Households' Ability to Recover in Morocco." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 5 in this study.

———. 2014b. "Extreme Weather Events and Migration: The Case of Morocco." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 10 in this study.

Verner, D., ed. 2012. *Adaptation to a Changing Climate in the Arab Countries*. Directions in Development. Washington, DC: World Bank.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

PART 1

Synthesis

CHAPTER 1

Climate Change, Migration, and Adaptation in the MENA Region

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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, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of 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 the Republic of 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 changes 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.

Introduction

By the next century, global mean annual temperatures may increase by 3°C to 5°C. In the Middle East and North Africa (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 (for example, Elasha 2010; IPCC 2012; 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 80–100 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 (Nordas and Gleditsch 2007; Reuveny 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 (for example, 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 socioeconomic status, political context, and migrant networks (Black et al. 2011; Carr 2005). 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 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 posttreatment 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 (Gray and Mueller 2012; Pereira and Caravajal 2008). One alternative involves surveying households about family members who moved to another location (Dillon, Mueller, and Salau 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 the Republic of Yemen, Joseph and Wodon (2013, 2014) find that while climate factors do play a role in migration flows between districts, that role is much smaller than the effect of socioeconomic 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" (Foresight 2011; Gray 2009; Halliday 2006; Hammer 2004; Meze-Hausken 2000) 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 (Andersen, Lund, and Verner 2011; Feng, Kruegera, and Oppenheimer 2010; Munshi 2003). 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 (Beine and Parsons 2012; Findley 1994; Henry and Schoumaker 2004).

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 (Andersen, Lund, and Verner 2011; Paul 2005; Reuveny and Moore 2009). Qualitative studies underscore the importance of informal institutions such as social networks (McLeman and Smit 2006) and intrahousehold 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 geophysical 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 the Republic of 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 the Republic of 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, proactive 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 the Republic of Yemen, given that these sources of data were nationally representative (and exhaustive as well in the case of the the Republic of 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 two discusses household perceptions about climate change and extreme weather events. Section three focuses on migration as a coping mechanisms and income diversification strategy. Section four examines other coping and adaptation strategies. Section five discusses perceptions about government and community programs. A brief conclusion follows.

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 1.1 from Adoho and Wodon (2014a), where perceptions about changes in climate have been ranked according to the

Table 1.1 Perceptions of Climate Change, Five Countries, 2011
Percent

	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*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	82.90	40.63	69.79	100.00	68.53	72.37
Less rain	81.81	20.50	48.86	100.00	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	71.40	100.00	67.16	60.53
Rain season is shorter	55.52	13.25	64.63	100.00	67.79	60.24
More frequent droughts	56.24	16.50	59.26	100.00	63.43	59.09
More diseases in animal and livestock	52.20	23.38	58.86	91.75	61.07	57.45
More insects and pets in crops	38.47	18.50	71.36	92.38	60.82	56.31
Less water in boreholes, rivers, lakes, or streams	50.07	11.38	64.64	90.00	64.43	56.11
More air pollution	36.07	23.25	71.15	83.00	64.43	55.59
More frequent crop failure	41.66	21.00	65.93	87.00	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	17.50	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	99.50	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	47.00	41.67	38.62
Deforestation and less trees	39.62	13.00	37.32	68.63	34.33	38.57
Less fish is rivers, lakes, or sea	1.20	12.38	38.54	36.00	35.07	24.65
More frequent rainstorms	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	17.80	3.50	58.24	—	7.59	17.42

Source: Adoho and Wodon 2014a.
Note: — = not available.

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 rainstorms 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 between countries (for example, households in Egypt are less likely to perceive a reduction in rainfall), overall the patterns are clear. Furthermore, although this is not shown in table 1.1, 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 1.2, 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.

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 1.3 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 8 percent of households. There are differences between

Table 1.2 Weather Shocks and Impact on Agriculture, Morocco, 2009/10
Percent

	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.

Table 1.3 Incidence of Extreme Weather Events and Impact, Five Countries, 2011
Percent

	Country					
	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*All*
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					
	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*All*
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.
Note: — = not available.

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.

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 1.4 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.

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 that 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. 2013). 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

Table 1.4 Economic Impacts of Environmental Change, Five Countries, 2011
Percent

	Country					
	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*All*
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					
	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*All*
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.

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 the Republic of 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, the Republic of Yemen).

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 (nonresident) have migrated. For residents, migration can thus be considered as temporary, since the migrant came back,

while for nonresidents, 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 1.5 from Adoho and Wodon (2014c). Three in every 10 households (29.9 percent) have migrants, whether residents or nonresidents. Having nonresident migrants is more likely than resident migrants, but this may be because nonresident 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 the Republic of 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 1.5).

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 nonresidents, migration to urban areas, and especially to large cities, is more likely than migration to rural areas.

Table 1.5 Share of Households with Migrants—Household Level
Percent

	Resident migrant	*Nonresident migrant*	*Either type of migrant*	*Resident migrant who migrated in last five years*	*Nonresident migrant who migrated in last five 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, Arab Rep.	17.88	19.13	26.25	11.75	12.38
Morocco	1.75	26.74	27.65	1.41	18.40
Syrian Arab Republic	18.13	35.88	46.75	17.75	29.75
Yemen, Rep.	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.

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 nonresidents (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 (that is, 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 nonresident 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 2009/10 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 the Republic of Yemen, Joseph and Wodon (2014) 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 socioeconomic and cost factors playing a much more prominent role. This analysis, which is based on past data, suggests 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 socioeconomic 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 20–40 percent among youth 15–30 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 the Republic of Yemenis, the main obstacle to finding a job may be corruption, which is deep and pervasive. Corruption was also mentioned by the Republic of 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 suboptimal. 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 the Republic of 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).

Preexisting 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, the Republic of 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 1.6 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 toward urban centers. It must be noted that in an analysis such as that of Joseph and Wodon (2013a) or Joseph et al. (2013a) which is at the level of a country as a whole, the impact of the climate on the

Table 1.6 Summary Results from Regression Analysis on Weather Shocks and Migration

Variables	*Country*	*Paper*	*Temporary*	*Permanent*	*Magnitude*
Perceptions of climate change	5 countries	Adoho and Wodon (2013c)	+	Weak	Medium
Recall of weather shocks and structural changes in climate	Morocco	Nguyen and Wodon (2013b)	+	Weak	Medium
Actual climate variables	Yemen, Rep.	Joseph and Wodon (2013) Joseph et al. (2014)	n.a.	+	Small
Qualitative focus groups	5 countries	Grant, Burger, and Wodon (2013)	+	+	Substantial

Source: World Bank data.
Note: n.a. = not applicable

overall patterns of migration tends to be diluted, which helps explain why the effect is qualified as smaller in table 1.6. 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 10–20 percent of the current migration flows, and this could increase in the future.

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 the Republic 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 et al. (2014a) use a national household survey for the Republic of 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 the Republic of Yemen.

In the last chapter of the study, Joseph and Wodon (2014b) use matching techniques and the same household survey for the Republic of 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 the Republic of 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 the Republic of 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, the Republic of 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 1,000 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, the Republic of 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, the Republic of 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, the Republic of Yemen).

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 1.7 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 1.6. 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

Table 1.7 Household Coping Strategies to Deal with Climate Change and Shocks
Percent

	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, Arab Rep.	21.00	20.25	5.13	26.88	13.75
Morocco	41.41	35.26	31.12	46.62	42.04
Syrian Arab Republic	33.75	65.50	54.00	90.38	60.25
Yemen, Rep.	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.

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.

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 nonfarm 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 five 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 1.8 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 9 percent of households have changed their mix of crops and livestock for their livelihood.

On the other hand, more than 4 in 10 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, the Republic of 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.

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 1.7 show. In the Republic of Yemen in particular, rural residents worried in the focus groups that water scarcity has led to conflict over access to wells. One the Republic of 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

Table 1.8 Adaptive Strategies of Households to Deal with Climate Change and Shocks

Percent

	Change in production technology	*Change in crops mix or varieties*	*Change in crops vs. livestock*	*More fertilizers/ pesticides*	*Seeking nonfarmwork*	*Training for nonfarmwork*
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, Arab Rep.	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
Syrian Arab Republic	5.38	4.38	3.38	5.88	1.13	2.00
Yemen, Rep.	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

table continues next page

Table 1.8 Adaptive Strategies of Households to Deal with Climate Change and Shocks (*continued*)
Percent

	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, Arab Rep.	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
Syrian Arab Republic	12.75	17.00	85.25	2.63	0.38	1.00
Yemen, Rep.	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.

households cannot afford quality health care and they also often cannot access health facilities because they are not in close proximity.

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 1.9 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 1 in 5 households declares that the community has planted trees or taken soil erosion measures, and 1 in7 households mentioned

Table 1.9 Adaptive Strategies of Communities to Deal with Climate Change and Shocks
Percent

	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, Arab Rep.	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
Syrian Arab Republic	14.63	1.63	4.13	2.00	1.50	0.88	1.50
Yemen, Rep.	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.

community measures to purchase seeds, animals, or farm equipment, the other actions that could be taken by communities are mentioned by only 1 in 10 households on average. There are large differences between countries, with households in Algeria and the Republic of 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.

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 1.10. 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 1 in 10 households declare that the government has been active. There are again differences between countries, with households in Algeria, Syria, and the Republic of 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 toward assisting the rural poor affected by climate change. Some the Republic of 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.

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

Table 1.10 Government Programs to Deal with Climate Change and Shocks
Percent

	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, Arab Rep.	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
Syrian Arab Republic	10.75	10.88	21.88	23.88	21.38	18.13
Yemen, Rep.	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, Arab Rep.	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
Syrian Arab Republic	13.88	30.75	2.88	4.38	10.75	15.38
Yemen, Rep.	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.

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 the Republic of Yemenis were doubtful that any government program would bear fruit, citing corruption and distrust of the Republic 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 the Republic of 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, the Republic of 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 toward using children to peddle.

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 the Republic of 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 climatic 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 climate 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.

Notes

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.
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, Mueller, and Salau (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).

Bibliography

Adoho, F., and Q. Wodon. 2014a. "Perceptions of Climate Change, Weather Shocks, and Impacts on Households." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 4 in this study.

———. 2014b. "How Do Households Cope with and Adapt to Climate Change?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 6 in this study.

———. 2014c. "Do Changes in Weather Patterns and the Environment Lead to Migration?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 7 in this study.

Afifi, T. 2009. "Environmental Change and Forced Migration: Egypt Case Study Report." EACH-FOR, D2.5.2.1. UNU-EHS, Germany.

Agrawala, S., A. Moehner, M. El Raey, D. Conway, M. van Aalst, M. Hagenstad, and J. Smith. 2004. *Development and Climate Change in Egypt: Focus on Coastal Resources and the Nile*. Paris: OECD.

Andersen, L., L. Lund, and D. Verner. 2011. "Migration and Climate Change." In *Reducing Poverty Protecting Livelihoods, and Building Assets in a Changing Climate: Social Implications of Climate Change of Latin America and Caribbean*, edited by D. Verner. Washington, DC: World Bank.

Asian Development Bank. 2012. *Addressing Climate Change and Migration in Asia and the Pacific*. Mandaluyong City, Philippines: Asian Development Bank.

Beine, M. A. R., and C. R. Parsons. 2012. "Climatic Factors as Determinants of International Migration." CESifo Working Paper Series No. 3747, CESifo, Germany.

Black, R., D. Kniveton, and K. Schmidt-Verkerk. 2011. "Migration and Climate Change: Towards an Integrated Assessment of Sensitivity." *Environment and Planning* 43 (2): 431–50.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014a. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Burger, N., B. Ghosh-Dastidar, A. Grant, T. Ruder, O. Tchakeva, and Q. Wodon. 2014b. "Data Collection." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 3 in this study.

Carr, E. R. 2005. "Placing the Environment in Migration Environment, Economy, and Power in Ghana's Central Region." *Environment and Planning* 37 (5): 925–46.

Darwish, K. M., and W. A. Abdel Kawy. 2008. "Quantitative Assessment of Soil Degradation in Some Areas North Nile Delta, Egypt." *National Journal of Geology* 2 (2): 17–22.

Dillon, A., V. Mueller, and S. Salau. 2011. "Migratory Responses to Agricultural Risk in Northern Nigeria." *American Journal of Agricultural Economics* 93 (4): 1048–61.

Elasha, B. O. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

El Raey, M., K. Dewidar, and M. El Hattab. 2009. "Adaptation to the Impacts of Sea Level Rise in Egypt." *Climate Research* 12 (27): 117–28.

Feng, S., A. B. Kruegera, and M. Oppenheimer. 2010. "Linkages among Climate Change, Crop Yields, and Mexico-U.S. Cross-Border Migration." *Proceedings of the National Academy of Sciences* 108 (33): 14257–62.

Findlay, A. M. 2011. "Migrant Destinations in an Era of Environmental Change." *Global Environmental Change* 21 (Supplement 1): S50–8.

Findlay, A., and A. Geddes. 2011. "Critical Views on the Relationship between Climate Change and Migration: Some Insights from the Experience in Bangladesh." In *Migration and Climate Change*, edited by E. Piguet, A. Pecoud, and P. de Guchteneire. New York: Cambridge University Press.

Findley, S. E. 1994. "Does Drought Increase Migration? A Study of Migration from Rural Mali During the 1983–1985 Drought." *International Migration Review* 28 (3): 539–53.

Foresight. 2011. *Migration and Global Environmental Change.* London: The Government Office for Science.

Grant, A., N. Burger, and Q. Wodon. 2014. "Climate-Induced Migration in the MENA Region: Results from Qualitative Fieldwork." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 8 in this study.

Gray, C. L. 2009. "Environment, Land, and Rural Out-Migration in the Southern Ecuadorian Andes." *World Development* 37 (2): 457–68.

Gray, C. L., and Valerie Mueller. 2012. "Drought and Population Mobility in Rural Ethiopia." *World Development* 40 (1): 134–45.

Halliday, T. 2006. "Migration, Risk, and Liquidity Constraints in El Salvador." *Economic Development and Cultural Change* 54 (4): 893–925.

Hammer, T. 2004. "Desertification and Migration: A Political Ecology of Environmental Migration in West Africa." In *Advances in Global Research: Environmental Change and Its Implications for Population Migration*, edited by Jon D. Unruh, Maarten S. Krol, and Nurit Kliot. The Netherlands: Kluwer Academic Publishers.

Henry, S., and B. Schoumaker. 2004. "The Impact of Rainfall on the First Out-Migration: A Multilevel Event-History Analysis in Burkina Faso." *Population and Environment* 25 (5): 423–60.

IPCC (Intergovernmental Panel on Climate Change). 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, G. -K. P. K. J. Mach, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge, UK, and New York: Cambridge University Press.

Jager, J., J. Frühmann, S. Grünberger, and A. Vag. 2009. "Environmental Change and Forced Migration Scenarios, D.3.4." Synthesis Report. ATLAS Innoglobe Ltd., Hungary.

Joseph, G., and Q. Wodon. 2013. "Is Internal Migration in Yemen Driven by Climate or Socio-Economic Factors?" *Review of International Economics* 21 (2): 295–310.

———. 2014. "Does the Impact of Remittances on Poverty and Human Development Depend on the Climate of Receiving Areas?" In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 12 in this study.

Joseph, G., Q. Wodon, and B. Blankespoor. 2013a. "Do Remittances Reach Households Living in Unfavorable Climate Areas? Evidence from the Republic of Yemen." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 11 in this study.

Joseph, G., Q. Wodon, A. Liverani, and B. Blankespoor. 2014b. "Is Climate Change Likely to Lead to Higher Net Internal Migration? The Republic of Yemen's Case." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 9 in this study.

Kniveton, D., C. Smith, R. Black, and K. Schmidt-Verkerk. 2009. "Challenges and Approaches to Measuring the Migration and Environment Nexus." In *Migration, Environment and Climate Change: Assessing the Evidence*, edited by F. Laczko and C. Aghazarm. Geneva, Switzerland: International Organization for Migration.

McLeman, R., and B. Smit. 2006. "Migration as an Adaptation to Climate Change." *Climate Change* 76: 31–53.

McSweeney, C., M. New, and G. Lizcano. 2009. "UNDP Climate Change Profiles: Documentation." Mimeo, United Nations Development Program, New York.

Meze-Hausken, E. 2000. "Migration Caused by Climate Change: How Vulnerable Are People in Dryland Areas? A Case Study in Northern Ethiopia." *Migration and Adaptation Strategies for Global Change* 5: 379–406.

Munshi, K. 2003. "Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market." *Quarterly Journal of Economics* 118 (2): 549–99.

Nguyen, M. C., and Q. Wodon. 2014a. "Weather Shocks, Impacts, and Households" Ability to Recover in Morocco." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 5 in this study.

———. 2014b. "Extreme Weather Events and Migration: The Case of Morocco." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 10 in this study.

Paul, B. K. 2005. "Evidence against Disaster-Induced Migration: The 2004 Tornado in North-Central Bangladesh." *Disasters* 29 (4): 370–85.

Pereira, I., and L. Caravajal. 2008. "Evidence on the Link between Migration, Climate Disasters and Human Development." Paper presented at the Environment, Forced Migration and Social Vulnerability International Conference, Bonn, Germany, October 9–11.

Piguet, E. 2010. "Linking Climate Change, Environmental Degradation, and Migration: A Methodological Overview." *Climate Change* 1 (4): 517–24.

Ragnhild, N., and N. P. Gleditsch. 2007. "Climate Change and Conflict." *Political Geography* 26 (6): 627–38.

Rappaport, J. 2007. "Moving to Nice Weather." *Regional Science and Urban Economics* 37 (3): 375–98.

Rappaport, J., and J. Sachs. 2003. "The United States as a Coastal Nation." *Journal of Economic Growth* 8 (1): 5–46.

Reuveny, R. 2007. "Climate Change-Induced Migration and Violent Conflict." *Political Geography* 26 (6): 656–73.

Reuveny, R., and W. H. Moore. 2009. "Does Environmental Degradation Influence Migration? Emigration to Developed Countries in the Late 1980s and 1990s." *Social Science Quarterly* 90 (3): 461–79.

Sowers, J., and E. Weinthal. 2010. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Dubai School of Government, Dubai.

UNDP (United Nations Development Programme and Arab Fund for Economic and Social Development). 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Verner, D., ed. 2012. *Adaptation to a Changing Climate in the Arab Countries*. Directions in Development. Washington, DC: World Bank.

Warner, K., T. Afifi, O. Dun, M. Stal, and S. Schmidl. 2008. *Human Security, Climate Change and Environmentally Induced Migration*. Germany: United Nations University—Institute for Environment and Human Security.

Warner, K., C. Ehrhart, A. de Sherbinin, S. Adamo, and T. Chai-Onn. 2009. "In Search of Shelter: Mapping the Effects of Climate Change on Human Migration and Displacement." Mimeo, UNU and UNHCR, Brussels.

Warren, R., N. Nicholls, R. Levy, and P. Price. 2006. "Understanding the Regional Impacts of Climate Change: Research Report Prepared for the Stern Review on the Economics of Climate Change." Tyndall Centre for Climate Change, Research Working Paper 90, Tyndall Centre, Norwich, UK.

World Bank. 2007. *World Bank Development Report 2008. Agriculture for Development. World* Washington, DC: World Bank.

———. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

PART 2

Focus Countries and Data

CHAPTER 2

Focus Countries

Nicholas Burger, Audra Grant, Sarah Kups, Yashodhara Rana, and Quentin Wodon

This study aims to be relevant for the Middle East and North Africa (MENA) region as a whole, but it focuses on five countries—Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic and the Republic of Yemen, and in many (but not all) cases on specific geographic areas within each of the five countries. After a brief introduction, this chapter outlines the reasons that led to the choice of the five focus countries. Next, to provide contextual background for the study, the chapter provides an introductory discussion of climate and migration patterns in each of the five countries, and of the policy and institutional context in which discussions on climate change take place.

Introduction

This study is about the impact of climate change on households, their coping mechanisms and their adaptation strategies, and especially migration. Migration decisions are influenced by a wide range of considerations related to climate change, including the risks of extreme weather events such as floods and droughts and the destruction they may cause, as well as the indirect effects of these and other events, such as lower agricultural yields, lack of water, and the health effects of excess temperatures. Understanding how climate change may impact migration is important to inform not only government and other programs to help households cope with and adapt to climate change but also a wide range of investment decisions which must anticipate future patterns of mobility and settlements. Yet to-date relatively little is known about the extent to which households are affected by climate change in the Middle East and North Africa (MENA) region, and whether climate change and extreme weather events have a large impact on migration decisions.

While this study aims to be relevant for the MENA region as a whole, it focuses on five countries—Algeria, Egypt, Morocco, Syria, and the Republic of Yemen. In that context, the objective of this chapter is twofold. First, the chapter lays out the reasons that led to the choice of the five focus countries. The aim was to select countries which (1) had a large population to ensure that findings from the study to be illustrative (but not representative) of the relationships

between climate change and migration for a large share of the MENA population; (2) were affected by changes in weather patterns and the environment, especially in terms of the frequency of droughts; (3) represented a wide array of socioeconomic contexts in terms of the countries' levels of development, but with an emphasis on some of the poorer countries where the impact of climate change on households may be largest; (4) had other available data sources such as other household surveys or census data which could be used for complementary analysis.[1]

Second, the chapter provides contextual background information on each of the five countries selected for the study. Information is provided first on traditional patterns of international and domestic migration in each country, and next on some of the challenges that the country is facing regarding climate change as well as the institutional framework in which policies related to climate change are being considered, and some of the programs and policies that have been adopted by the government as well as by nongovernmental actors in this area.

The structure of the chapter is as follows. Section two outlines the reasons that led to the choice of the five focus countries. The next five sections provide contextual background for the study on each of the five focus countries. A brief conclusion follows.

Criteria for the Choice of Focus Countries

As mentioned in the introduction, four criteria guided the choice of the focus countries in which new data were collected. This section explains and reviews each of these four criteria.

Consider first population size. Table 2.1 provides population data for the top 10 Arab countries by population size as of July 2012 according to UN estimates, as well as other variables such as population growth. Egypt, Algeria, and Morocco are the three most populated countries in the region, and are part of our sample

Table 2.1 Population Data for the Most Populated Arab Countries, 2012

Rank	*Country*	*Population in 2012*	*Regional share (%)*	*Growth (%)*	*Annual increase*	*Doubling time (years)*
1	Egypt, Arab Rep.	83,958,000	22.55	1.72	1,444,000	41
2	Algeria	36,486,000	9.80	1.41	514,000	50
3	Morocco	32,599,000	8.75	1.01	329,000	69
4	Iraq	31,129,225	9.05	3.18	1,072,000	22
5	Sudan	30,894,000	12.28	2.44	1,116,000	29
6	Saudi Arabia	28,705,000	7.71	2.21	634,000	32
7	Yemen, Rep.	25,569,000	6.87	3.10	793,000	23
8	Syrian Arab Republic	21,118,000	5.67	1.70	359,000	41
9	Tunisia	10,705,000	2.87	1.05	112,000	66
10	Somalia	9,797,000	2.63	2.51	246,000	28
Arab world	Total	372,370,000	100.00	2.02	7,534,000	35

Source: United Nations population estimates.

of focus countries. The Republic of Yemen and Syria rank seventh and eighth on the list. We did not choose Iraq because of the ongoing tensions within the country. Sudan was not selected because administratively, it belongs to the Sub-Saharan Africa region of the World Bank, and not to the Middle East and North Africa Region. Saudi Arabia was not considered because it is much wealthier (and less agrarian) than the other countries, and thereby has much more resources at its disposal to cope with and adapt to climate change. The Islamic Republic of Iran is not listed in table 2.1 because it is usually not considered as an Arab country.[2]

Consider next vulnerability to climate change. As will be clear in subsequent chapters, while some households in the areas of focus of the study have been or are likely to be affected by floods, many more are affected by droughts. Without downplaying the threat of floods, the population affected by droughts is much larger. An analysis of vulnerability to droughts with a special focus on Syria, but with comparative data for other MENA countries was recently conducted by the Arab Center for the Studies of Arid Zones and Dry Lands and the United Nations Secretariat of the International Strategy for Disaster Reduction Regional Office for Arab States (ACSAD and ISDR 2011). On the basis of data on drought frequency and consecutive droughts, the authors estimate that 69.1 percent of the area of the Arab region is not vulnerable to droughts, 14.45 percent has a low level of vulnerability, 10.98 percent is moderately vulnerable and 5.47 percent is highly vulnerable.

As shown in table 2.2, some of the countries most vulnerable to droughts are Syria (especially the north eastern area), Sudan (southern area), Tunisia (northern area), Algeria (northern area), Morocco (northern area), Somalia (north eastern area), Iraq (north eastern area), Saudi Arabia (north eastern area), and the Republic of Yemen. The focus countries were chosen in part in order to represent conditions in different parts of the region, with Algeria and Morocco being part of the Maghreb, Egypt belonging to the Central Region, Syria located in the Mashreq and the Republic of Yemen located in the Arabian Peninsula. Four of the five countries are among the most vulnerable to droughts in the region, and Egypt was chosen as the largest country in the Central Region and more generally in the Arab world, as discussed earlier. The ACSAD-ISDR study also emphasizes the fact that the drought vulnerable areas tend to be highly populated, with an estimated 54.69 million people living in areas under high stress from drought vulnerability, and another 91.3 million in areas moderately vulnerable to droughts.

Consider third levels of socioeconomic development. The principle guiding the choice of countries was to focus on middle- and low-income countries, because these countries tend to have fewer means at their disposal than high-income countries to be able to cope with and adapt to climate change (higher-income countries are also of course affected by climate change, and often in dramatic ways, but their resources make it easier to protect the population from some of the damaging effects of extreme weather shocks). Also, middle- and low-income countries are more likely than high-income countries to have net emigration flows internationally.

Table 2.2 Areas within Arab Countries Vulnerable to Droughts

Country	*Area in squared kilometers*	*High vulnerability (%)*	*Medium vulnerability (%)*	*Low vulnerability (%)*	*No vulnerability (%)*
Algeria	2,381,741	4.53	7.11	9.62	78.74
Libya	1,759,540	0.55	1.66	6.07	91.72
Mauritania	1,030,700	1.42	5.41	13.27	79.90
Morocco	712,550	7.79	17.51	29.75	44.95
Tunisia	163,610	9.82	27.52	14.55	48.10
Maghreb	6,048,141	3.37	7.01	11.71	77.90
Djibouti	23,200	11.73	14.58	23.97	49.72
Egypt, Arab Rep.	1,001,450	0.43	1.61	7.71	90.24
Somalia	637,657	7.37	47.28	25.14	20.21
Sudan	2,505,813	10.02	11.70	17.72	60.56
Central Region	4,168,120	7.32	14.73	16.49	61.46
Iraq	438317	21.00	31.47	20.86	26.68
Jordan	89,342	2.69	8.56	14.15	74.60
Lebanon	10,400	17.13	25.67	16.45	40.75
Syrian Arab Republic	185,180	26.69	36.96	14.58	21.76
Palestine	6,220	8.72	36.85	14.69	39.74
Mashreq	729,459	20.04	30.02	18.33	31.61
Bahrain	741	—	—	—	—
Kuwait	17,818	11.46	43.03	27.79	17.72
Oman	309,500	0.68	2.67	11.92	84.73
Qatar	11,586	0.00	40.48	27.00	32.52
Saudi Arabia	2,149,690	2.91	7.85	17.13	72.11
UAE	83,600	0.99	2.75	11.75	84.51
Yemen, Rep.	527,968	5.24	9.73	13.52	71.51
Arabian Peninsula	3,100,903	3.07	7.84	15.95	73.14
Total	14,046,623 5	0.34	10.68	14.41	69.57

Source: ACSAD and ISDR 2011.
Note: — = not available.

Our five focus countries include four middle-income countries—Algeria (with a per capita GDP of US$7,643 in 2011 in US$[3]), Egypt (per capita GDP US$5,547 in 2011), Syria (per capita GDP of US$4,741 in 2010), and Morocco (per capita GDP of US$4,373 in 2011), but they also include a much poorer country—the Republic of Yemen, with a per capita GDP of only US$2,060 in 2011 (all figures are from the World Bank's World Development Indicators). Differences in standards of living can also be illustrated through the under-five mortality rate in the various countries. The lowest rate is for Syria, at 15.3 per 1,000 live births, followed by Egypt (21.1 per 1,000 live births), Morocco (35.5 per 1,000 live births), and Algeria (36 per 1,000 live births). The rate is much higher in the Republic of Yemen, at 76.5 per 1,000 live births.

Consider finally the availability of other data sources. Much of the work conducted for this study is based on data newly collected, but where feasible we also relied on existing data. Two of the five countries presented an opportunity of using existing data. First, Morocco had just implemented a national Household

and Youth Survey between December 2009 and March 2010. The survey included data on migration as well as on various shocks affecting households and their ability to cope with these shocks. Fortunately, just before the survey went to the field, we were able to add a few questions to guide the analysis of climate change and migration. Second, we had at our disposal the latest census and the latest national integrated household survey for the Republic of Yemen. These national datasets for Morocco and the Republic of Yemen made it feasible to conduct analysis for the countries as a whole, thereby complementing the analysis of specific areas within the five countries on the basis of the data collected specifically for this study.

Overall, the combination of these four considerations together with information on the ongoing dialogue between the World Bank, the Agence Française de Développement, and the various country governments, led to the choice of these five specific countries for the study. In what follows, we provide an introductory discussion of climate change and migration in each of the countries.

Algerian Context

As mentioned in the introduction, this section and the four sections that follow provide a brief discussion of migration and climate related topics in each of the five countries of focus. Starting with Algeria, consider first international migration. France has long been the primary external destination for Algerian emigrants. This continued to be true throughout the 1954–62 War of Independence, and after the war, over 1 million Algerians who had fought on the French side moved to France. In 1973, the Algerian government formally suspended migration to France. The government viewed migration as a form of postcolonial dependence and anticipated sufficient labor demand from the petroleum sector (de Haas 2007). Under this policy, mass labor migration was terminated but family reunification migration continued. Over the last decade, more Algerians, in particular highly skilled individuals, have moved to a more diverse set of destination countries, in particular to Spain (Di Bartolomeo, Jaulin, and Perrin 2010). In 2002, it was estimated that 1.3 million individuals (4.2 percent of the population) were living outside of the country. Approximately 85 percent of these emigrants were living in France and an additional 8 percent in other European Union countries. By 2008, the number of emigrants has fallen to below 900,000 however. Since emigration flows increased over the same time period, this seems to imply that many Algerians chose to return to their home country.

Algeria has also become a destination for immigrants from Sub-Saharan Africa (Sekkai 2008), and special immigrant groups, such as Chinese workers working for Chinese companies (Temlali 2010). Overall, there were around 100,000 foreigners living legally in the country in 2008 and probably three times as many illegal immigrants and refugees, most of them Sahrawis who fled from West Sahara in 1975 and 1976. Probably around 40 percent of foreign migrants see Algeria as their final destination, another 40 percent see it as a transit station on their way to Europe, and the remainder are refugees or immigrants who would

like to return to their home country but currently don't have the means to do so (Temlali 2010).

Internal migration within Algeria takes place primarily between rural areas and midsized towns, rather than toward large urban areas (Gubert and Nordman 2009). In 2010, 66 percent of the population was living in urban areas, up from 60 percent in 2000. Urban areas have been growing at around 2.5 percent over that period, while the number of people living in rural areas has been declining (World Bank 2011). In addition to voluntary moves, during the Algerian Civil War from 1992 to 2002, at least 1 million Algerians were forced to move within the country. Many of these refugees have not yet been able to return home (EACH-FOR 2008).

As in other countries, unemployment is a key driver of migration flows, including for the case of highly skilled individuals (de Haas 2007; Di Bartolomeo, Jaulin, and Perrin 2010). Although unemployment declined from 29.3 percent in 1999 to 10.2 percent in 2009, rates among under-30-year-olds are typically twice as high as the national and even higher among young highly educated individuals (Ministry of Territorial Management and Environment [MATE] 2010). It is worth noting, however, that unemployment is on average higher among Algerian-born individuals residing abroad than in Algeria itself (European Commission 2010).

Consider next the question of environmental degradation and climate change. The Algerian territory encompasses three main geographic regions: the Tell in the north, the high planes in the center, and the Sahara in the South of the country. The littoral region of the north is the most densely populated, with 63 percent of the population on four percent of the territory. One tenth of the population lives in the Sahara, which represents 85 percent of the territory. The majority of arable land (3 percent of the territory) as well as the majority of industry are located in the coastal region, while the region of the High Plains dominated by semi-nomadic pastoral cultures. The coast and the Tellian Atlas are in a temperate climate zone, with warm summers and mild and rainy winters; the High Plaines and the Saharian Atlas have an arid climate, with low and irregular rainfall, cold winters, and very hot summers; and the Sahara has a desert climate (MATE 2010). Slow-onset environmental degradation is an issue throughout Algeria and the country is already subjected to water stress. Mean annual precipitation ranges from 800 to 1,000 millimeters in the East of the Tellian Atlas to 20–150 millimeters in the Sahara. Since 1975, precipitation has gradually decreased, with currently only 600 cubic meters of fresh water per habitant and year, a level below the U.N. defined scarcity threshold of 1,000 cubic meters (MATE 2010). Based on Food and Agriculture Organization (FAO) data and World Population Prospects data, Fargues (2008) estimates that this amount will not drastically decrease until 2030, but it may decline after that.

Apart from water scarcity, another environmental problem affecting Algerian agriculture is soil erosion and desertification. In the Algerian steppes 3.5 percent of the land is already subject to desertification or being irreparably damaged, and more than 50 percent of the territory is either highly sensitive or sensitive to

desertification (MATE 2010). For the future, Cline (2007) estimates shortfalls in agricultural yields by 2080 ranging between 28 percent and 36 percent versus the baseline of 2003, while Rousset and Arrus (2006, cited in Gubert and Nordman 2009) predict that by 2020, agricultural yields could decrease from 5 percent to 14 percent as a result of environmental problems exacerbated by climate change.

Extreme climate events are also frequent, with parts of the northern region of the country highly vulnerable to droughts (such as the several-year long drought of the early 1990s), cold waves (January 2005), flash floods (possibly associated with mud slides) due to heavy rainfall (in November 2001, October 2002, and October 2008), and heat waves (summer 2003). The consequences of these events range from large harvest losses and destruction of homes to deaths. For instance, in November 2001 the municipality of Bal El Oud in the region of Algier registered a rainfall of 290 millimeters, 40 percent of the mean annual precipitation, in less than 17 hours. In the wake of this event, in this municipality alone, 712 people died, 115 had disappeared, 311 were injured, and 1,454 families lost their home. Since 1975, both droughts and flooding have become more common, and there are concerns that this trend will continue in the future (MATE 2010). On the other hand, forest fires, which are only partly a result from the climate, have become less common and severe since 2001, due in part to increased surveillance and the implementation of an early warning and intervention system (MATE 2010). Despite being predicted to have the highest rise in sea levels in North Africa by 2030 (NIC 2009) less than 1 percent of the population may be affected by sea level rises (Sowers and Weinthal 2010).

Consider finally the link between environmental degradation, climate change, and migration. To our knowledge, no studies are available on how past environmental shocks have affected migratory movements in Algeria, or how they may be related in the future. A conference hosted by the National Intelligence Council concluded that Algeria is less economically vulnerable to climate change because a large percentage of its GDP (30 percent) is derived from oil and natural gas and because agriculture and tourism play a limited role for the country's economy (NIC 2009), both in terms of GDP and labor force share (only 14 percent of the labor force is employed in the agricultural sector according to the CIA 2011). This may suggest that climate-induced out-migration will not drastically increase due to climate stress. However, Algeria already has to import 45 percent of its food, a percentage that may increase in the future due to increasing desertification, soil erosion, and water shortages, so that climate change may exacerbate the food security situation, leading to refugee flows (Brown and Crawford 2009).

In terms of the policy framework, Algeria has been party to the United Nations Framework Convention on Climate Change (UNFCC) since 1993, and it ratified the Kyoto Protocol in 2005 as a non-Annex I party country. In 1996, Algeria also ratified the Convention on the Fight against Desertification. Key government agencies include the High Council on Environment and Sustainable Development (Haut Conseil de l'Environnement et du Développement Durable) created

in 1994 and charged with evaluating the environmental situation, develop strategies, and follow international policy. The Ministry of Territorial Planning and Environment (Ministère de l'Aménagement du Territoire et de l'Environnement) was created in 2000 and charged with implementing environmental policy. In particular, the ministry is tasked with preventing pollution, protecting biodiversity and natural spaces, promoting environmental education, and managing the National Environmental Fund, which provides funding for environmental protection projects. The General Environmental Inspection (Inspection Générale de l'Environnement) was created in 1996 to oversee the implementation of environmental policy. Other governmental agencies have related mandates, including the Agricultural Ministry and the Ministry for Water Resources. A Law for the Protection of the Environment and Sustainable Development has been adopted, as well as a National Action Plan for the Environment and Sustainable Development (Plan National d'Actions pour l'Environnement et le Développement Durable). The National Scheme of Territorial Management (Schema National d'Aménagement du Territoire) 2030 was approved in 2009.

In terms of projects, one traditional area of focus has been to implement a "green barrier" (barrage vert) to reduce desertification and erosion through reforestation in the Saharian Atlas. A project was started in 1996 but halted in the late 1980s. Today, an important initiative is the National Program on Agricultural Development (Programme National de Développement de l'Agriculture) which aims to ensure food security, increase incomes and living standards in the rural regions, and manage scarce natural resources. For 2009 to 2014, 12,000 projects potentially benefiting 12 million people were planned (MATE 2010). Initiatives to secure water supply include the building of 15 new dams between 2004 and 2009 and the planning of 13 additional ones, a pilot desalinization plant in Algier and plans to build 13 such plants across the coast, water recuperation, the building of channels, and a 65 percent increase in irrigated surfaces from 2000 to 2009 (MATE 2010). The National Environmental Strategy (Stratégie Nationale de l'Environment) for the 2001–10 period includes an educational component, targeting for instance teachers and television stations as multipliers. A pilot project launched in 2002 with United Nations Industrial Development Organization (UNIDO) funded environmental education in 50 schools, and since 2005, environmental education has become part of the school curriculum at the primary and secondary level at 1,000 schools.

Nongovernmental efforts are also underway with funding or technical assistance from donors. For example, in partnership with the government and the United Nations Office for Project Services (UNOPS) and with funding from International Fund for Agricultural Development (IFAD), local actors have defined a development plan for their mountainous region with the aim of reducing rural poverty. Canada's International Development Research Center (IDRC) has funded a project on environmental and natural resources management capacity building to support local researchers through hosting a workshop and through a small grants program from 2003 to 2006. The International Organization for Migration (IOM) is planning a number of projects whose goals are to build local

capacity for planning rural development and sustainable management of natural resources (including water and land), and to create stable and diversified income for rural populations. At the request of the national government, United Nations Development Programme (UNDP) carried out a program formulation mission that sought to communicate with local and national private and public actors, and to define common guidelines by which these actors could manage their climate change-related projects. And the FAO has been running a Special Program for Food Security since 2005, with around 60 projects and covering around 5,300 households.

Egyptian Context

It is estimated that 2.7 million Egyptians reside abroad (IOM 2010), 70 percent of whom are in other Arab countries, and especially Saudi Arabia (with 0.92 million Egyptians), followed by Libya, Jordan, and Kuwait. Among non-Arab countries, the United States is the most common emigrant destination, with 0.3 million Egyptian immigrants. Highly educated individuals, such as doctors and engineers, are most likely to emigrate permanently (EACH-FOR 2009a). In total, around 5 percent of the tertiary educated were living abroad in 2000 (World Bank 2010). There are no reliable estimates of the extent of illegal emigration, but the Environmental Change and Forced Migration Scenarios (EACH-FOR) report states that "there are tens—if not hundreds—of Egyptians who have been caught illegally attempting to cross the Mediterranean," and the 2007 EU-Egypt Action Plan contains some general clauses on cooperation on migration control (European Union 2007). From 2000 to 2010, the number of foreign-born individuals living in Egypt increased from 170,000 to 245,000 (World Bank 2011). However, these figures are likely to be underestimates. Immigrants include labor migrants from Arab and African countries, Europe and the United States, and refugees from Palestinian, Somali, Ethiopian and Eritrean nationalities.

The most important internal migration flows are from the south to the north, from both south and north to the Canal Zone, and from rural areas to Cairo and Alexandria (Zohry 2005). Over the past decade the urban population growth was at 1.9 percent, which is similar to the national average, so that urbanization remains just below 43 percent. Reasons cited for historic migration include rising population density in areas where agriculture could not be expanded further geographically, decreasing economic opportunities, and unemployment. In addition, involuntary migration occurred in response to the 1967 Arab-Israeli war, which displaced 750,000 people, and to the construction of the Aswan Dam, which displaced 100,000 people, primarily of the Nubian ethnicity. While temporary and circular migration– traditionally very important– continues to occur, it used to be driven by seasonality, with primarily agricultural workers moving to cities when there was no work for them in rural areas. Today, the seasons appear to have much less of an influence on these circular moves (Zohry 2005).

Egypt has a primarily desert climate. During the winter there are some rains and mild temperatures in the coastal areas of lower Egypt, while upper Egypt is

dry with warm weather. In the summer, the entire country experiences hot and dry weather (EEAA 2010). From 1961 to 2000, mean temperatures were steadily rising, and in Upper Egypt and the Western Desert, the number of days on which temperatures equaled or exceeded 45 degrees Celsius (113 Fahrenheit) increased. The severity and frequency of extreme weather events—including sand storms, dense haze, and flooding—have also been increasing over the 1972 to 2002 period.

Some 80 percent of the water is used in the agriculture sector, which accounted for 13.8 percent of GDP in 2006/07 and employed 55 percent of the Egyptian labor force (EEAA 2010). Because 95 percent of Egyptian agriculture is irrigated and all but 5 percent of Egypt's water supply comes from the Nile River, the impacts of climate change on temperature and precipitation levels and on Nile flows are of vital importance. Under three global circulation models, it is estimated that Nile flows could either decrease by between 10 percent and 75 percent or increase by one third relative to the 1996 level of 84 billion cubic meters (EEAA 2010). In another paper, scenarios predicted losses from 5 percent to 50 percent in 2020; and nine of ten scenarios predicted long-term decreases between 10 percent and 90 percent by 2095 (Strezpek et al. 2001, cited in EEAA 2010). While Egypt is relatively well equipped to deal with one-year droughts through the water stored by the High Aswan Dam, long-term decreases in Nile flows would be a major problem. In addition, it is estimated that solely through the expected rise in temperature the production of major crops will decrease—for instance for rice by 15 percent by 2050 and by 36 percent in 2100 (Abou-Hadid 2006, in EEAA 2010). Land degradation through pollution and salinization may further negatively affect agricultural output (EACH-FOR 2009c).

With a 3,500 kilometers coastline and much of the economy and population being concentrated in these areas, sea-level rises will also have an impact. For instance, El-Raey et al. (1999, in EACH-For 2008) estimates that a 0.18 meter rise would lead to a loss of employment of 32,000 and a rise in half a meter would lead to a loss of 195,000 jobs in Alexandria; and in a recent presentation by Shalaby (2010), it is argued that sea level rises may reduce the Egyptian agricultural area in the Nile delta by 12–15 percent. An environmental factor that is already displacing people today—and which is likely to become more severe in the future—is desertification. Advancing sand dunes in the Western desert are swallowing entire villages, forcing their inhabitants to move (Warner et al. 2008). Thus, Warner et al. found that more than 70 percent of internal migrants that they interviewed in the Nile Delta and Valley, newly reclaimed desert and slums in Old Cairo named land degradation and water shortages as root causes in their migration decision. Another environment factor that may cause future migratory movements is a rise of the sea level. Dasgupta et al. (2007, in EACH-FOR 2009b) predict that a one-meter sea-level rise would displace around 10 percent of the Egyptian population.

Demographic pressures may further influence future migration flows. It is projected that that Egypt's population, which in 2006 was approximately 77 million, will increase to 92–100 million by 2020 and 104–119 million by 2030 (EEAA 2010). This population growth will put strains on the environment, for

instance reducing the available water per capita from 1,000 cubic meters in the early 1990s to 468 cubic meters in 2030, assuming that Egypt will continue to be able to get its current fixed share of Nile water as was laid out in a water sharing agreement in 1959 (EEAA 2010).

The policy framework regulating the use of water from the Nile dates back to a 1959 agreement between the Nile states establishing fixed water quotas. In addition, the Nile Basin Initiative was launched in 1999 with the aim to "achieve sustainable socioeconomic development through the equitable utilization of, and benefit from, the common Nile basin water resources," such as planning projects on the efficient use of water (EACH-FOR 2009b). Egypt ratified the United Nations Convention to Combat Desertification in 1995 as one of the first four countries to do so. The main obligation under the Convention is the formulation of National Action Programs, which Egypt has done in 2005. Egypt signed the UN Framework Convention on Climate Change in 1992 and ratified the Kyoto protocol in 2005. As a non-Annex I party country, Egypt is required to submit national communications. A climate change unit was established in 1992 within the Egyptian Environmental Affairs Agency (EEAA), the executive arm of Egypt's First Minister of State for Environmental Affairs. Its goal is to coordinate all national and international activities related to climate change. The National Committee on Climate Change headed by the Minister of State for Environmental Affairs was established in 1997. It oversees national policies regarding climate change. A variety of other bodies, such as a National Authority for the Clean Development Mechanism, ministerial committees for climate change within the ministries of Agriculture and of Water Resources also exist (EEAA 2010).

An important project under implementation for some time is the New Valley Project with four five-year development plans laid out from 1996 to 2017. Under the project the Ministry of Housing, Utilities and Urban Communities was to construct new cities in the Western desert, and millions of Egyptians were to be resettled. This would have extended the populated area from 4 percent to 25 percent of the territory. Five cities were constructed from 1996 to 2006 and other cities were restructured and extended (EEAA 2010). However, even though soil quality in the region is very good, it is one of the hottest places in Africa, and water evaporation and soil salinization are threats (EACH-FOR 2009b). Individuals who have already moved to the region have noted these issues, and also complained about a lack of key infrastructure. Another project is led by the Ministry of Agriculture and Land Reclamation and the Ministry of Water Resources and Irrigation. The two ministries have developed a plan to reclaim 3.7 million acres of land by 2017, with the required water being procured through a more efficient water use and increasing the use of nonconventional water resources (EEAA 2010). The Ministry of Agriculture and Land Reclamation, in collaboration with the IFAD and FAO, also develops stress resistant crops and disseminates information in response to climate change.

Due to a growing population, per capita fresh water resources are likely to decline even without decreases in Nile water flows. In response, the 2005 Water Resource Plan by the Ministry of Water Resources aims to improve the irrigation

system, change cropping patterns, and support weed control, rainwater harvesting, desalinization, and so on. (EEAA 2010). The plan, if successful, could increase irrigation by 50–75 percent, and the ministry collaborates with United Nations Educational, Scientific, and Cultural Organization (UNESCO) in the forecasting of climate change impacts on the Nile flow. Also, compared to other developing countries, Egypt is very engaged in coastal vulnerability assessments, and in carrying out adaptation procedures that respond to current threats, such as beach nourishment projects in Alexandria and the reinforcement of a sea wall. However, relative to the magnitude of changes that may be expected in the future, these projects are not yet sufficient (Agrawala et al. 2004). Finally, in its second national communication under the UNFCC, the EEAA outlines further adaptation, project and research needs and the need to establish a Ministerial Committee headed by the prime minister that would review literature, develop a draft policy for addressing climate change, and develop four five-year plans (EEAA 2010).

Many international organizations are supporting governmental and nongovernmental efforts in various ways. As done for Algeria earlier, a few examples include support the UNDP Global Environmental Facility Small Grants programme, with 60 percent of the 175 grants that were allocated carried out by nongovernmental organizations (EEAA 2010). UNDP also provides expertise to various Egyptian governmental agencies for instance on renewable energy and energy efficiency and on the financing of environmental projects, and on crisis and risk management. The United Nations High Commissioner for Refugees (UNHCR) carries out activities related to refugees in Egypt, on the basis of a 1954 framework agreement between the organization and the Egyptian government (UNHCR 2011). Current FAO projects in Egypt include an assessment of the risks from a sea level rise for groundwater and agriculture in the Nile Delta, the establishment of a monitoring system of the implementation of the sustainable agriculture strategy in 2030, or address income generation activities in rural areas, such as breeding goats or rabbits, for women and youths.

Moroccan Context

International migration by Moroccans has traditionally been and remains primarily directed toward Western Europe. It is estimated that 2 million Moroccans, 85 percent of all emigrants, are currently living in Europe. During the 1960s and 1970s, emigrants were mainly guest workers; from the 1970s to the 1990s, family reunification was the main form of migration. Since then, the share of illegal emigration in migration flows has been on the rise, partly driven by increasing activities in the agricultural and construction sectors in Southern Europe (EACH-FOR 2008). The majority of emigrants are unskilled; but in 2000, nearly 20 percent of tertiary-educated individuals were living abroad (Gubert and Nordman 2009; World Bank 2011). For decades the Moroccan government encouraged emigration for economic and political reasons. More recently, the government has started cooperating with the European Union on the prevention of illegal migration of Moroccans and Sub-Saharan Africans, for whom Morocco

is an important transit country on their way to Europe. For instance, Morocco participates in joint navy patrols, and takes in both Moroccans and other nationals who are apprehended by border forces. In return, the country receives development assistance. It is estimated that there are 10–20,000 illegal immigrants in Morocco (IOM undated).

Internal migration flows are larger than international flows. These movements are predominately rural to urban, which explains why cities have been growing at more than four times the rate as rural areas over the 2000 to 2010 period. During that time, the urbanization rate increased from 53 percent to 56 percent. However, as rural areas and small and medium-sized towns have become more developed partly due to remittances from international migrants, they have become more attractive as destinations in their own right (GCIM 2005).

Morocco's inhabitants are already experiencing deteriorating environmental conditions and shocks that may put their livelihoods at risk, and it is expected that climate change will exacerbate this trend. Shifts include a decrease in precipitation, increasing risks of droughts, more dry areas toward the North of the country, and less ground water. Despite a low per-capita water usage of 500 cubic meters, Morocco is experiencing water stress. These water shortages are predominantly caused by climatic factors in the south and the pressure of population growth in the northern parts of the country (EACH-FOR 2008). More than 80 percent of water is used in agriculture, even though only 13 percent of cropped land is irrigated. The Moroccan government estimates that at least until 2020, subject to sufficient investments in infrastructure, water needs will be met (Kingdom of Morocco et al. 2001). However, the EACH-FOR study (2008) suggests that by 2025, per capita available water resources will have decreased by 30 percent. Under different climate scenarios developed by a consortium of international (World Bank, Food and Agriculture Organization) and national organizations (such as the National Institute for Agricultural Research [INRA]), it is expected that agricultural output will not be drastically affected by climate change until 2030. Subsequently, however, there may be a strong decrease in agricultural output particularly in the northern and center-west parts of the country, where rainwater-based agriculture is currently predominant. The study also points out that the country faces uncertain declines in revenues from irrigation-based agriculture.

In a country where 40 percent of the population is employed in agriculture, and where nearly 70 percent of the poor live in rural areas (World Bank and Agence Française de Développement, undated), environmental shocks and resultant decreases in agricultural output are likely to negatively affect the livelihood of many individuals, and this creates the potential for migration movements. In addition, Morocco has 3,500 kilometers of coastline, so that an increasing number of floods and as well as a rising sea level may also induce future migration movements.

While as for the other countries, there is currently no study that we know of that systematically evaluates how past environment changes influenced migration movements in Morocco, or how it might be expected to do so in the future, a recent report prepared for the U.S. National Intelligence Council (CENTRA

Technology and Scitor Corporation 2009) suggests that "climatic stress will add to the already substantial movement of population from rural areas into cities" in Northern Africa, and speculates that the cyclical movements in agricultural output that have been accompanied by cyclical movements of population between rural and urban areas in Morocco in the past might be replicated in the future. Another study points out that following a severe drought in 2007, two thirds of the illegal migrants arrested in Spain were from the farming and mining region of Khouribga (EACH-FOR 2008). This suggests a link between environmental shocks and migration exists, and that at least some of the induced migration will be international. A case study by Hamza, El, and Fermin (Ait Hamza, El Faskaoui, and Fermin 2009) based on a survey of 30 households in two oasis villages in the Middle Draa Valley of Southern Morocco found that environmental degradation was a major factor for either past or intended migration, with lack of access to services and opportunities also being major contributing factors.

In terms of policy framework, Morocco ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and the Kyoto protocol in 2002. As for the other countries, as non-Annex I party country, Morocco is required to submit national communications. Morocco also ratified the United Nations Convention to Combat Desertification in 1996 and it submitted a National Action Plan in 2002. Under the National Action Plan against Climate Change adopted in 2009 plan, the Ministry for Agriculture is responsible for projects including the development of wheat varieties resistant to drought periods and parasites, the creation of systems of irrigation supplemental to present rain-fed cultures and an evaluation the expected impact of climate change on the fish population (Kingdom of Morocco 2009). In addition, the second pillar of the 2008 "Plan Marco Vert" (Moroccan Green plan) is specifically aimed at reducing poverty. The more than 300 projects outlined in the plan are expected to target 500,000–600,000 farmers, representing 40 percent of all Moroccan farmers, and to cost 15–16 million dirhams (US$2 million). The aim is to allow farmers to switch to crops that are less sensitive to variations in rainfall, such as olive and almond trees and cacti, to diversify their crop, and to improve agricultural techniques (Aujourd'hui 2008; Ministry of Agriculture and Fishery 2008).

The High Commission for Water, Forests and the Fight against Desertification is responsible for the National Action Plan for the fight against Desertification adopted in 2001. Implementation by 2020 is to include the development of an early warning system against droughts. The Water Department of the State Secretary for Water and Environment is planning a variety of adaptive measures for the 2010–30 period, including building protective structures against floods, developing a plan as well as hydraulic basins for drought periods, educating the public and farmers against water wastage, changing the water pricing system for irrigated agriculture, and so on. The population living at sites with extremely high flood risk is to be relocated, with the Ministry for Housing, Urbanism and Regional Planning charged with such relocations (Kingdom of Morocco 2009). The Department of Environment, following the ratification of the UNFCCC and of the Kyoto protocol, has set up a number of administrative units and committees

that are concerned primarily with developing mitigating rather than adaptive strategies. In addition, the Department of the Environment decided in 2011 to prepare a national strategy on climate change with a national plan including a large number of new activities in the area, especially for water management.

Examples of support provided by donors include four projects financed by Canada's IDRC and the United Kingdom's U.K. Department for International Development (DFID). The projects aim to increase the adaptive capabilities to climate changes of two villages in plane and mountainous regions, address water scarcity and water management in the Saiss Bassin in Northern Morocco, hold workshops for community-based adaptation to desertification and reduction of water resources, and prepare coastal communities to be able to adapt to phenomenon linked to climate change. They are carried out with nongovernmental national partners including INRA, ENFI (National School for Forestry Engineers), and the University Al Akhawayn, and the *Réseau marocain des associations en lutte contre la desertification* (RIOD Maroc), a Moroccan network of nongovernmental and community-based organizations.

As an example, the project in the coastal areas combined efforts to collect rainwater and to develop new farming and soil preservation techniques in conjunction with the villagers with training efforts for women, such as literacy classes, since women cannot move as easily in response to environmental shocks as men (EMWIS 2010). The IOM has an office in Morocco since 2007, and is principally concerned with voluntary return projects for irregular migrants in the country. An example of a currently ongoing UNDP program is a program intended to increase the adaptability of oases to climate change. It aims to strengthen local long-term planning mechanisms and explore financing options for adaptive measures. The World Bank is currently financing a project on Integrating Climate Change into the Plan Marco Vert. It aims to strengthen the capacity of public and private institutions to integrate climate change adaptations into projects aimed at small farmers in five target regions (World Bank 2011).

Syrian Context

International out-migration is high in Syria, although estimates of its extent vary. According to Kawakibi (2009), 18 percent of Syrians have migrated abroad, and a study by the Syrian Commission for Family Affairs estimated that in 2007, 3.4 million people (15 percent of the total population) lived abroad (Marzouk 2010). But another report by the United Nations stated that in 2005, less than 750,000 Syrians were living abroad (Marzouk 2010). Still, it appears that throughout the 2000s, emigration has increased. While the majority of emigrants during the 1960s and 1970s moved to the Persian Gulf, circular migration with Lebanon, Jordan, and the Gulf states became more common in recent decades. There is also some evidence of brain drain: while only 0.9 percent of Syrians live in Organisation for Economic Co-operation and Development (OECD) countries, the emigration rate of individuals with tertiary education to these countries in 2000 was 3.7 percent (Dumont 2006).

Syria is also a receiving country for migrants and especially refugees, including Iraqis since 2003 and Lebanese in 2006 (Kawakibi 2009). As a result, while in 2000 5.6 percent of the population was made of immigrants, this had increased to 10.2 percent by 2010 (World Bank 2011). In addition, Khawaja (2002) found that 14 percent of the Syrian population migrated internally from one administrative unit to another at some point during their life, and that around 5 percent migrated during the previous five years. The most common moves are from rural to urban areas, which in 2010 were home to 55 percent of the population, up from 52 percent in 2010 (World Bank 2010). Khawaja sees this as a lower than expected internal migration rate, and suggests that the main reasons for this are the high percentage of people who own their apartment or houses, and the relative equal distribution of access to social services and even wages throughout the country. Surveys indicate that moves for family reasons are more common than those for work-related motives, but internal migration may have recently increased.

Syria is an arid to semi-arid country. A third (32 percent) of the land is cultivated, of which 75 percent is rainfed and 45 percent is pastures. Since the 1980s, the country has been able to meet its own food needs and even export food. However, today the country is witnessing a deteriorating environment and a more adverse climate. Between 1980 and 2006, 13 percent of agricultural land was downgraded because of human activity. Rainfall decreased by 10 millimeters per year (with an annual average of 300 millimeters per year) from 1956 to 2006 (El-Atrache 2009), with large regional variation. For example, the northern and northeastern parts of the country have experienced decreasing precipitation in winter, while the northern and central regions have experienced more rain in autumn (Ministry of State for Environmental Affairs [MSEA] 2010). Summer temperatures have risen significantly, particularly in the coastal zones (MSEA 2010; Qabbani 2010). From 2006 to 2009, Syria experienced a severe drought (Sowers and Weinthal 2010), and droughts may become more common in the future (MSEA 2010). Rises in the sea level will be another potential consequence of climate change, with an estimated 3.8 percent of the coastal population potentially being affected. Among those affected, 2–6,000 farming families may lose their livelihoods and homes (MSEA 2010).

Syria uses 18 billion cubic meters of water per year, in excess of the estimated 15 billion cubic meters of renewable resources. The agricultural sector is responsible for 90 percent of water usage. With an available 1,000 cubic meters of water per capita and year, Syria is on the threshold of water poverty (MSEA 2010). Population growth, decreases in precipitation, pollution, and increased demand due to development are likely to decrease consumption, possibly to 500 cubic meters per person per year in 2025. Syria's first National Communication to the United Nations Framework Convention on Climate Change reports that between 2010 and 2100, annual precipitation could decrease between 34 and 75 millimeters, and temperatures could rise by 2.8–7 percent (Qabbani 2010). Based on the CROPWAT irrigation management model of the FAO, it was estimated that under these scenarios, irrigated wheat agriculture in the Hassakeh governorate could experience a reduction in yield of 16 percent by the end of

the century, while yields from nonirrigated land could drop by more than 20 percent if no additional irrigation be provided (MSEA 2010).

To the best of our knowledge there are very few systematic studies on how past environmental changes have impacted migration in Syria. Khawaja (2002) did explicitly ask whether environmental problems were related to the decision to move, but the low incidence of individuals naming work or income as reasons for migration may suggest that at least in the late 1990s and early 2000s, climate factors were not a prime motive for migration. However, in a country where 45 percent of the rural population work in agriculture, and 75 percent of the cultivated land is not irrigated, as temperatures rise and precipitation falls, this may change in the future, especially in periods of droughts (Qabbani 2010).

Past experience suggests that migratory movements in response to large-scale environmental shocks may be substantial. For instance, a study by the Canadian International Institute for Sustainable Development suggests that 160 villages in the north-east of the country were entirely abandoned during the 2007/08 period of the current drought that has lasted since 2006 (El-Atrache 2009; Sowers and Weinthal 2010). An assessment mission of the Syrian government and the UN estimated that the drought has affected 1.3 million inhabitants of Eastern Syria. More than 800,000 persons lost their entire livelihood, with small-scale farmers and herders being particularly affected. Many initially tried to react to the drought by selling livestock below prices, reducing food intake, and selling assets (Alqusairi undated), but eventually, an estimated 40,000–60,000 households migrated in response to the drought (DREF 2009). Among these, 200,000–300,000 people were from the Al-Hasakeh governorate, representing 13–20 percent of the total previous population and 41–62 percent of the affected population (DREF 2009). Such massive moves put pressure on urban infrastructure, reduce economic growth, and lead to worsening educational and health outcomes among migrants. Unusually, migration was predominantly by entire families, rather than just men.

In terms of policy framework, Syria ratified the UNFCCC in 1996 and signed the Kyoto Protocol in 2005. As the other four countries, it is required to submit national communications. The country ratified the International Convention to Combat Desertification in 1997, and it fulfilled its obligation to submit a National Action Plan in 2002. MSEA was established as the first one in the Arab World. It is primarily engaged in the research into and establishment of mitigation strategies, and is less focused on adaptation (Eido 2006). It is also responsible for applying environmental law (MSEA 2010). The Council for the Protection of the Environment is an interministerial body tasked to set policy and coordinate environmental activities between different ministries (MSEA 2010).

Syria has not yet developed and implemented wide-ranging adaptation policies with regards to climate change. The objectives of the Syrian Agricultural Strategy for 2001–10 did not define sustainability, or adaptation to climate change, as a policy objective (NAPC 2006). The focus was on increasing producers' income, introducing modern technologies and increasing the contribution of the agricultural sector to the country's GDP. The midterm assessment of the strategy showed

increased agricultural productivity, but it appears that aspects of the policy that would lead to a more sustainable agriculture, such as switching to more suitable crops and making the use of modern irrigation techniques more widespread, were still facing difficulties. Nevertheless, in its first National Communication to the UNFCCC, a number of possible future adaptation measures are discussed. These include preparing a national water master plan, enforcing water-related laws and regulations, improving irrigation efficiency and rain collection techniques, rationalizing water use, rehabilitating dams, reviewing agricultural policy under the changed conditions of climate change, further pursuing agricultural research, developing suitable land use policies, and modernizing farm management and farming technology (MSEA 2010). And in response to the most recent drought, the Syrian government and the UN Country Team developed a Drought Response Plan. The government handed out emergency aid, veterinary services, vaccinations, and food assistance (Alqusairi undated; FAO 2009).

In areas with 250–350 millimeters of rainfall per year, as well as in hilly and mountainous areas, the government has implemented a number of policies and projects aimed at improving living conditions, for instance through improving road infrastructure, increasing agricultural productivity, land reclamation, and giving women access to income-generating activities. From 2002 to 2007, the government also implemented a project of unemployment alleviation loans that provided loans to small, intermediate, and large enterprises, as well as household and small project grants. The project was extended and further institutionalized in 2006 (National Agricultural Policy Center [NAPC] 2008). A preliminary evaluation of these policies based on a pilot study concluded that improvements in rural infrastructure and agricultural employment opportunities may have led to increased migration to rural areas, though these are not by any means large enough to offset the large rural-to-urban migration flows (NAPC 2008).

Support by donors for coping with and adaptation to climate change may also be less extensive in Syria than in the four other countries of focus of this study. Examples of such support include the delivery by the Syrian Arab Red Crescent of food parcels to 8,000 families during the recent drought (DREF 2009), and assistance provided by the IOM for the re-settlement of foreign refugees and migration management. The United Nations High Commissioner for refugees also provides various services to Iraqi refugees in Syria.

Yemeni Context

The Republic of Yemenis have been migrating out of the country to oil-producing Arab Gulf States, North America, and Europe for several decades. The current stock of the Republic of Yemeni emigrants is estimated at 1,134,700, or 4.7 percent of the population. Migrants constitute 6 percent of the tertiary-educated population. The main destination countries for migrants remain Saudi Arabia, the UAE, and the United States (Ratha, Mohapatra, and Silwal 2010). The Republic of Yemen is also a country of passage for migrants from Sub-Saharan Africa (Fargues and Bensaad 2007) and a destination for an increasing number of

refugees (UNHCR 2011). Some 60 percent of immigrants are Somali, 30 percent Ethiopian, and 10 percent Eritrean and from other nationalities (Al-Ariqi 2010). Currently, immigrations constitute 2.1 percent of the population.

Internal migration is primarily directed toward urban areas, which constitute an increasing share of total population and are experiencing faster population growth than rural areas. In 2010, urban areas constituted 31 percent of the total population, up from 26 percent in 2000 (World Bank 2011). Although urban population growth rates have fallen slightly between 2000 and 2010 from 4.9 percent per year to 4.7 percent per year, urban population growth is more than twice that of the rural population, at 2.0 percent per year. In addition to voluntary migration, 350,000 individuals have been displaced since 2004 by a violent conflict between insurgents and the government in Northern the Republic of Yemen (IOM 2010).

Although weather data for the Republic of Yemen may be less accurate than for other countries, making it more difficult to construct future climate change scenarios (Al-Tholaya 2010), annual mean temperature appears to have increased by 1.8 degrees Celsius since 1960. Temperatures are expected to increase by 1.2–3.3 degrees Celsius by 2060 and 1.6–5.4 by 2090. Monthly rainfall has fallen by 1.2 millimeters since 1960, a decrease of 9 percent. In the future, sea-level rises may also threaten the coastal cities, in particular Aden (Al-Tholaya 2010).

Predictions about future rainfall trends vary by climatological model, with some models predicting increased rainfall while others predict decreased rainfall (McSweeney, New, and Lizcano 2009). Decreased rainfall has the potential to harm rainfed agriculture, which constitutes an important fraction of the Republic of Yemen's cereal production (FAOUN 2009). Even without decreases in rainfall, water scarcity will be a challenge due to limited water resources, population growth, and the water use for the production of khat. In 1955, per capita water availability was 1,098 cubic meters, but by 1990 it had fallen to 460 cubic meters per capita (Republic of Yemen 2008). Moreover, projections suggest that under business-as-usual scenarios per capita water availability will fall further to 150 cubic feet (Republic of Yemen 2008).

A study by McKinsey suggests that water shortages could lead to the loss of 750,000 jobs and a decrease in income of 25 percent (Rudolf 2010). In the capital Sanaa in particular, water is currently being extracted at four times the replenishment rate. According to reports based on a World Bank-funded assessment of the Sanaa basin, the capital city's water resources are being depleted by a fast-growing population (IRIN 2010b), and the expanding urban population is due in part to migration from rural to urban areas (Boucek 2009). Projections suggest Sanaa may deplete is economically viable water supplies—primarily groundwater—in a decade (IRIN 2010b; see also Rudolf 2010; Sowers and Weinthal 2010). Extreme weather events are also becoming more common. For instance, Wynter (2009) reports that flash floods are becoming increasingly more common, endangering the life of villagers that live close by.

There is little systematic research into how past environmental change has impacted migration in the Republic of Yemen, but the Republic of Yemen's

population is quite vulnerable to climate shocks. While agriculture generates only 15 percent of GDP, it employs more than 55 percent of the active population. Decreases in agricultural yields are expected in the future, which would impact livelihoods. Some 84 percent of the rural poor are dependent on rainfed subsistence agriculture, a form of agriculture that is highly vulnerable to the impact of climate change (World Bank 2010). Environmental changes affecting the agricultural sector could increase rural to urban migration.

The Republic of Yemen became party to the UNFCCC in 1992, and signed the Kyoto protocol in 2004. As a non-Annex I party country, it is required to submit national communications. The Republic of Yemen is also party to the UN Convention to Combat Desertification. In 2008, the government adopted a plan by the Ministry of Water and Environment to increase available water resources. The plan calls for assessing climate change impacts on water resources and improving climate monitoring. The plan first targeted Sanaa, calling for the city to gather and harvest 70 percent of its rainwater in by 2012. By 2020, the plan calls for 40 percent rainwater to be harvested in the rest of the country (Sorel 2010). However, there has been little visible progress toward these goals (IRIN 2010a). In 2009, the Environmental Protection Authority outlined 22 adaptation projects that were identified as the most urgent through a participatory process with multiple local and national stakeholders. The proposed projects include rainwater harvesting, disaster preparedness to extreme weather events, desalinization of sea water, promotion of modern irrigation technologies, improved crop management, establish a national research center on climate change and adaptation issues, develop and implement sustainable land management strategies, and construct coastal defenses. Financing would come from donors and implementing agencies would include the Environmental Protection Authority (EPA), the Ministry of Agriculture and Irrigation, the Ministry of Water and Environment, the Civil Aviation and Meteorological Authority, and the Marine Science and Biological Research Authority. With the Republic of Yemen being a pilot country under the World Bank's Pilot Program for Climate Resilience with the Minister of Water and Environment and the EPA as the main contact points, US$1.5 million are available for adaptation projects (Climate Facts Update, 2010).

Examples of projects being supported by donors include a US$13.5 million grant by the US government through the World Food Program to support humanitarian efforts (Sorel 2010). IOM activities in the Republic of Yemen include technical cooperation and training (funded by the European Union) on migration and border management, hosting conferences on labor migration with Gulf Cooperation Council (GCC) countries as well as Somalia and Ethiopia, assisting government agencies with the fight against human trafficking, and providing emergency assistance to families displaced by the 2008 flooding in Hadramout and by conflict in northern the Republic of Yemen (Al-Ariqi 2010). Among other activities, UNDP assists the Republic of Yemen with preparing its second National Communication to UNFCCC, provides capacity and institutional building, strategic planning and basin level water governance and management to manage the Republic of Yemen's water resources, and provides technical

assistance to help local authorities manage the recovery process after the 2008 flooding. The UNHCR provides assistance both to international displaced refugees and to, in particular, Somali refugees . Among other activities, the FAO provides poor smallholder farmers with improved drought-resistance seeds, as well as fertilizers (FAO 2009).

Conclusion

The objective of this chapter was to explain the rationale for the choice of the focus countries in this study, and provide contextual background on each of the five countries. The focus countries were chosen because they tended to have large populations, be vulnerable to extreme weather events and especially droughts, represented various settings in terms of socioeconomic conditions, and provided access to other available data sources in some cases, on top of the data being collected specifically for the study. As to the contextual background about the countries, information was provided on traditional patterns of international and domestic migration as well as on the challenges faced by the various countries regarding climate change, and the ways the countries have organized themselves institutionally to respond to those challenges. While the countries are diverse, they do appear to face many common challenges.

Notes

1. In addition, the choice of countries was also informed by the ongoing dialogue on issues related to climate change and migration between the countries and World Bank and the Agence Française de Développement, so that the study would be both welcome and more likely to be used.
2. It is customary to consider four criteria when defining the Arab world: language, ancestry, religion, and culture. On all four counts, the Islamic Republic of Iran does not conform to the characteristics associated with the Arab world.
3. In 2005 US$, adjusting for purchasing power parity.

Bibliography

ACSAD and ISDR. 2011. *Drought Vulnerability in the Arab Region: Case Study—Drought in Syria, Ten Years of Scarce Water (2000–2010)*. Damascus and Cairo: Arab center for the Studies of Arid Zones and Dry Lands and United Nations International Secretariat for Disaster Reduction.

Agoumi, A. 2003. *Vulnerability of North African Countries to Climatic Changes—Adaptation and Implementation Strategies for Climate Change*. Winnipeg, Canada: International Institute for Sustainable Development.

Agrawala, S., A. Moehner, M. El Raey, D. Conway, M. van Aalst, M. Hagenstad, and J. Smith. 2004. *Development and Climate Change in Egypt: Focus on Coastal Resources and the Nile*. Paris: Organisation for Economic Co-operation and Development (OECD).

Ait Hamza, M., B. El Faskaoui, and A. Fermin. 2009. "Migration and Environmental Change in Morocco: The Case of Rural Oasis Villages in the Middle Draa Valley." *EACH-FOR Case Study Report*. Bonn: UNUIEHS.

Al-Ariqi, Y. 2010. "Fawzi Al-Zioud, Office in Charge of the IOM in Yemen, to the Yemen Times: 'IOM, through Its Cooperation with the EU, Strives at Empowering the Government of Yemen and Civil Society to Address Many of the Unique Migration Challenges Yemen Faces Today.'" *Yemen Times*, October 21.

ALM (Adaptation Learning Mechanism). 2011. "MENARID—Adaptation to Climate Change Using Agriobiodiversity Resources in the Rainfed Highlands of Yemen." *Adaptation Learning Mechanism*, September 22.

Alqusairi, D. undated. *Risk Profile and Emergency Management of Syria*. Washington, DC: FEMA

Al-Tholaya, A. 2010. "Climate Change in Yemen: Drastic Changes in the Coming 50 Years." *Yemen Times*, May 3.

Aujourd'hui. 2008. "Plan Maroc Vert: L'agriculture marocaine à la croisée des chemins [Moroccan Green Plan: The Moroccan Agriculture at the Crossroads]." *Bulletin de veille*, April 25.

Boucek, C. 2009. *Yemen: Avoiding a Downward Spiral, Carnegie Papers: Middle East Program*. Washington, DC: Carnegie Endowment for International Peace.

Brown, O., and A. Crawford. 2009. *Changements Climatiques et sécurité en Afrique—Une étude réalisée pour le Forum des ministres des Affaires étrangères d'Afrique du Nord en 2009*. Winnipeg, Canada: International Institute for Sustainable Development.

CENTRA Technology, Inc., and Scitor Corporation. "North Africa: The Impact of Climate Change to 2030. Geopolitical Implications." Conference report prepared for the National Intelligence Council, 2009.

CIA (Central Intelligence Agency). 2011. "Algeria." *The World Factbook*, August.

Climate Funds Update. 2010. *Pilot Program for Climate Resilience*. Washington, DC: Climate Funds Update .

Cline, W. R. 2007. *Global Warming and Agriculture: Impact Estimates by Country.* Washington, DC: Center for Global Development/Peterson Institute for International Economics.

de Haas, H. 2007. *North African Migration Systems: Evolution, Transformations and Development Linkages.* Oxford, UK: University of Oxford International Migration Institute.

de Regt, M. 2007. "Migration to and Through Yemen: The Case of Migrant Domestic Workers." Discussion, American University Cario, Egypt.

Di Bartolomeo, A., T. Jaulin, and D. Perrin. 2010. *CARIM Migration Profile -Algeria: The Demographic-Economic Framework of Migration*. Florence, Italy: European University Institute.

DREF Operation. 2009. "Syria: Drought." *International Federation of Red Cross and Red Crescent Societies*, August 3.

Dumont, J.-C. 2006. "Immigrants from Arab Countries to the OECD: From the Past to the Future." Paper presented at the United Nations Expert Group Meeting on International Migration and Development in the Arab Region, United Nations Secretariat Population Division, Beirut, Lebanon, May 15–17.

EACH-FOR (Environmental Change and Forced Migration Scenarios). 2008a. *General Overview Study—Middle East and Northern Africa*. Bonn, Germany: United Nations University.

———. 2008b. *D.2.5.1. General Overview Study—Middle East and Northern Africa*. UNU-EHS, Germany, February 14.

———. 2009a. "Egypt Case Study Report." UNU-EHS, Germany, January 30, 2009.

———. 2009b. *D.2.5.1. General Overview Study—Middle East and North Africa*. Germany: UNU-EHS.

Egyptian Environmental Affairs Agency (EEAA). 2010. "Egypt Second National Communication under the United Nations Framework Convention on Climate Change." *Egyptian Environmental Affairs Agency,* May.

Eido, M. 2006. *Stakeholder Analysis Climate Change in Syria*. Damascus: Ministry for Local Administration and Environment, July.

El-Atrache, T. 2009. "Syria: 160 Villages Deserted 'Due to Climate Change'." *Arab Environment Watch*, June 2.

EMWIS (Euro-Mediterranean Information System on Know-How in the Water Sector). 2010. "Morocco: Helping Village Women to Adapt to Climate Change." *Euro-Mediterranean Information System on Know-How in the Water Sector*, August 18.

ESCWA and LAS (Economic and Social Commission for Western Asia and League of Arab States). *Arab Region State of Implementation on Climate Change (Draft)*. Beirut, Libanon: ESCWA and LAS

EuropeAid. 2008. "Working Together: Fighting Illegal Immigration." *ENPI Special*, No. 6, September .

European Commission. 2010. *Labour Markets Performance and Migration Flows in Arab Meditterranean Countries: Determinants and Effects.* Vol. 2 of *National Background Papers Maghreb*. Occasional Paper 60, European Commission Directorate-General for Economic and Financial Affairs, Brussels, Belgium, April.

European Union. 2007. *EU-Egypt Action Plan*. Egypt: European Union.

Fargues, P. 2008. *Emerging Demographic Patterns across the Mediterranean and their Implications for Migration through 2030*. Washington, DC: Migration Policy Institute.

Fargues, Philippe, and Ali Bensaad. 2007. *Senders Turned Into Receivers: Transit Migration in the Middle East and North Africa*. Florence, Italy: European University Institute.

FAO (Food and Agriculture Organization). 2009. "Syria Drought Response Plan 2009." FAO, Syriya, August 11.

———. Undated. *FAO Technical Cooperation Department Field Programme Activities—Egypt*. Egypt: FAO.

FAOUN (Food and Agriculture Organization of the United Nations). 2009. "FAO/WFP Crop and Food Security Assessment Mission to Yemen." *Food and Agriculture Organization*, December 9.

———. Undated. *Algeria Country Brief*. Algeria: FAOUN.

GCIM (Global Commission on International Migration). 2005. "Morocco's Migration Transition: Trends, Determinants and Future Scenarios." *Global Migration Perspectives*, No. 28, April.

Gubert, F., and C. J. Nordman. 2009. "Migration Trends in North Africa: Focus on Morocco, Tunisia and Algeria." *OECD Journal: General Papers* 15 (2009): 75–108.

IDRS (International Development Research Centre). undated. *Projects in Algeria: Evaluation of Environment and Natural Resources Management Capacity Building Efforts in Algeria*. Algeria: IDRS.

Institut Royal des Etudes Stratégiques [Royal Institute for Strategic Studies]. *Présentation: Changements Climatiques*. Maroc: Royal Institute for Strategic Studies.

IOM (International Organization for Migration). 2010a. *Morocco*, Morocco: IOM.

———. 2010b. *Africa & Middle East: IOM Expands Aid Efforts to Reach More Conflict-Affected Displaced People and Host Communities*, *Press Briefing*, October 12.

———. Undated. *IOM Activities—Algeria*, September 22.

———. Undated. *Country Profiles: Syria*. Syria: IOM.

International Organization for Migration (IOM) Cairo. 2010. *Migration and Development in Egypt*. Cairo: IOM.

IRIN. 2010a. *Yemen: Failing to Harvest the Rain*. August 10.

———. 2010b. *Yemen: Capital City Faces 2017 Water Crunch*. March 23.

Kawakibi, S. 2009. *La Gestion de la Migration en Syrie: Une perspective globale*. Florence, Italy: European University Institute.

Khawaja, M. 2002. "Internal Migration in Syria: Findings from a National Survey." Report 375, FAFO, Oslo, Norway.

Kingdom of Morocco, Ministry for Regional Planning, Urbanism, Housing and the Environment. 2001. *Communication Nationale Initiale à la Convention Cadre des Nations Unies sur les changements climatiques* [First National Communication for the United Nations Framework Convention on Climate Change].

Kingdom of Morocco. 2009. *Plan national de lutte contre le réchauffement climatique* .[National Action Plan Against Climate Change] November.

Libération. 2010. "Abdellatif Khattabi, coordinateur du project Adaptation au changement climatique au Maroc—' La Vision 2010 n'a pas pris comptes des risques écologique'" [Abdellatif Khattabi, coordinator of the project 'Adaptation to Climate Change in Morocco'—'The 2010 Vision did not take ecological risks into account'].*Libération*, April 18.

———. 2009. "Depuis une quarantaine d'années, le Maroc est soumis à des conditions difficiles— Programme d'adaptation aux changements climatiques" [Morocco has been Subject to Difficult Conditions for the Past Forty Years—Adaptation Programme to Climate Change]. *Libération*, May 20.

Marzouk, N. 2010. *L'émigration syrienne hautement qualifiée: les enjeux sociopolitiques.* Florence, Italy: European University Institute.

McSweeney, C., M. New, and G. Lizcano. 2009. "Acceptance of Offer to Participate in the Pilot Program for Climate Resilience." *Yemen: Republic of Yemen*, 2009.

MAF (Ministry of Agriculture and Fishery). 2008. *Plan Maroc Vert. Présentation générale* [Moroccan Green Plan General Presentation].

MATE (Ministère de l'Aménagement du Territoire, et de l'Environnement [Ministry for Territorial Management and Environment]). 2001. *Elaboration de la stratégie et du plan d'action national des changements climatiques. Communication nationale initiale*, 30 April.

———. 2010. *Seconde communication nationale de l'Algérie sur les changements climatiques à la CCNUCC*, 25 November.

MSEA (Ministry of State for Environmental Affairs). *Initial National Communication of the Syrian Arab Republic—Submitted to the United Nations Framework Convention on Climate Change*, April 2010.

NAPC (National Agricultural Policy Center). 2006. *Mid-Term Review of the Syrian Agricultural Strategy*. Damascus, Syria: Ministry of Agriculture and Agricultural Reform.

———. 2008. *Non-Agricultural Activities in Rural Areas and Their Impacts on Agriculture in Selected Aareas of Syria*. Damascus, Syria: Ministry of Agriculture and Agricultural Reform.

NIC (National Intelligence Council). "North Africa: The Impact of Climate Change to 2030—Geopolitical Implications." Conference Report prepared by CENTRA Technology, Inc., and Scitor Corporation, December 2009.

Qabbani, A. 2010. "State of Denial." *Syria Today*, November.

Ratha, D., S. Mohapatra, and A. Silwal. 2010. *Migration and Remittances Factbook*. Washington, DC: World Bank.

Rudolf, J. C. 2010. "In Yemen, Water Grows Scarcer." *New York Times Green*, October 25.

RY (Republic of Yemen). 2008. *National Adaptation Programme of Action*. Yemen: RY.

Sekkai, R. 2008. "Migrants Target Booming Algeria." *BBC Focus on Africa Magazine*, January 2.

Shalaby, T. 2010. "The Impact of Climate Change on Migration: The Case of Egypt." Presentation at the First Workshop on Climate-Induced Migration and Displacement in MENA, June 15–16.

Shidiwah, M. *Phase I Proposal for Yemen's Pilot Program for Climate Resilience*. Washington, DC: EPA.

Sorel, M. A. 2010. "Climate Change Exacerbates Yemen's Water Woes." *Foreign Policy Digest*, September 1.

Sowers, J., and E. Weinthal. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Dubai: UAE, September 2010.

Swain, A. 2001. "Water Wars: Fact or Fiction?" *Futures* 33: 769–81.

Temlali, Y. 2010. "Algeria, Land of E(Im)migration." *Babel Med*, 2010

UNCCD (United Nations Convention to Combat Desertification). *Country Information Database: Egypt*. Egypt: UNCCD.[

UNDP (United Nations Development Programme). 2010a. *Adaptation aux Changements Climatiques au Maroc pour les Oasis Resilientes*. World Bank and AFD, *Managing Social Dimensions of Climate Change in MENA: Climate Change and Human Mobility Concept Note*. Washington, DC: World Bank.

———. 2010b. *Approche territoriale des changements climatiques' entre le PNUD et le Ministère de l'Aménagement du Territoire, de l'Environnement et du Tourisme*.

———. Undated. *UNDP Yemen*. Yemen: UNDP.

———. Undated. *L'éducation environnementale dans le système scolaire*.

———. Undated. *MDG Achievement Fund JP—Climate Change Risk Management in Egypt*.

UNDP Climate Change Profile. 2009. documentation.

UNEP (United Nations Environment Programme). Undated. *Briefing Notes on Algeria*.

UNHCR (United Nations High Commissioner for Refugees). 2011a. *2011 UNHCR Country Operations Profile—Egypt*. Egypt: UNHCR.

UNHCR (United Nations High Commissioner for Refugees). 2011b. *UNHCR Country Operations Profile—Syrian Arab Republic*. Syria: UNHCR.

———. Undated. *Clashes in Southern Yemen Spark New Displacement*. Yemen: UNHCR.

UNIDO (United Nations Industrial Development Organization). Undated. *Brief Description of UNIDO Project DG/ALG/94/006, NU/ALG/94/006*.

Warner, Koko, Tamer Afifi, Olivia Dun, Marc Stal, and Sophia Schmidl. 2008. "Human Security, Climate Change, and Environmentally Induced Migration." *United Nations University Institute for Environment and Human Security Report*, June 30.

World Bank. 2000. *Comprehensive Development Review, Yemen: Building Block on Urbanization*. Washington, DC: World Bank.

———. 2003. "World Bank Loan to Fight Poverty in Rural Algeria with Job Creation." *Press Release No. 2003/314/MNA*, Washington, DC: World Bank, April 23.

———. 2010. *Project Appraisal Document on a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of US$4.0 Million to the Republic of Yemen for an Agro-Biodiversity and Climate Adaptation Project*, May 5, 2010.

———. 2011a. *Integrating Climate Change in the Implementation of the Plan Maroc Vert*, May 3.

———. 2011b. *World Development Indictors*. Washington, DC: World Bank.

Wynter, A. 2009. "Yemen Red Crescent on Climate-change Front Line." *Red Cross Red Crescent—News*, June 18.

Zohry, A. 2005. "Interrelationship between Internal and International Migration in Egypt: A Pilot Study, Development Research Centre on Migration." *Globalization and Poverty Research Report*. Brighton: University of Sussex, July.

CHAPTER 3

Data Collection

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A large part of this study is based on data collected in 2011 in five focus countries of the MENA region. In addition, other existing data sources were used as well, as documented in the various chapters that follow, but this need not be discussed in this chapter. This chapter documents the process followed and some of the choices made for new data collection, both quantitative and qualitative, for the study on climate change and migration in the MENA region. After a brief introduction, we explain the nature of the household survey questionnaire, what it enables us to document, as well as some of its limits. Next, we explain how the household survey sites were selected and how the samples were constructed in each of the five focus countries. We also provide a few comments on the challenges encountered during survey implementation. The chapter finally explains the process used for the focus group discussions and in-depth interview, as well as for the interviews with key informants conducted in each country.

Introduction

Having explained the rationale for the choice of focus countries for this study and having provided general background on each of the five countries in chapter 2, this chapter documents the process followed and the choices made for new data collection in the five focus countries—Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of Yemen. Documenting these choices is important because much of the effort under this study in terms of staff time and study costs consisted in collecting and analyzing new data in the five countries—that is, household surveys and qualitative focus groups as well as in-depth household interviews and key informants interviews. But documenting these choices is also important to clarify what the study can and cannot do—what it can inform us about, but also what it cannot inform us about given the data's limits in terms of representativeness as well as the types of questions asked and to whom.

We first describe briefly the nature of the household survey questionnaire, and especially the questions in the survey what it enables us to do, as well as some of its limits. In each of the five focus countries the same household survey

was implemented, with only minor adaptations to take into account country characteristics. The survey questionnaire included a total of 17 sections, many of which were designed to gather background information on household members. But the three chapters that have been written in this study using the household surveys focus on the questions related to household perceptions of climate change, coping mechanisms and adaptation strategies, and finally both temporary and permanent migration.

Next, we explain how the household survey sites were selected in each of the five countries and how the survey samples were constructed in each subarea. We also provide a few comments on weights and on some of the challenges encountered during survey implementation. Data collection was not easy. In Egypt, Syria, and the Republic of Yemen, the quantitative and qualitative fieldwork was interrupted by the 2011 Arab Spring events, causing delays of weeks and, in some cases months, with frequent interruptions in fieldwork once the data gathering resumed. While these events did not appear to affect responses in the survey, the teams implementing the survey had to be flexible in order to adapt. In addition, in the Republic of Yemen interviewers faced some intimidation and threats to their physical security, which caused further delays in data collection there.

Finally we provide background on the objectives of the qualitative data collection, as well as the process followed and techniques used, such as probing on specific questions. As was the case for the survey data collection, data collection was challenging in some countries. In the Republic of Yemen the deteriorating security conditions made focus group recruitment very difficult, which led to a switch from focus groups to in-depth interviews for that country. In Algeria, focus group recruitment was hampered by local suspicion. Time constraints and worries about the spread of Arab Spring dynamics prevented sustained efforts at focus groups recruitment, so that in that country as well the team opted for in-depth interviews. We also discuss the approach used for interviews with key informants, who included government officials as well as researchers and representatives of nongovernmental and international organizations.

The structure of the chapter follows closely the above discussion. After explaining some of the characteristics of the household survey questionnaire in section two, section three is devoted to the process followed for collecting the household survey data. Section four discusses the qualitative data collection through focus groups in Egypt, Morocco, and Syria, and in-depth interviews in Algeria and the Republic of Yemen, as well as interviews with key informants. A brief conclusion follows.

Household Survey Questionnaire

In each of the five focus countries the same household survey was implemented, with only minor adaptations to take into account country characteristics. The survey questionnaire included a total of 17 sections, many of which were designed to gather background information on household members, including on

demographics, education, health, and occupation, as well as household well-being. Three chapters have been written in this study using the household surveys conducted in the five countries. This section briefly describes the data used in each of the three chapters, and the types of questions in the survey which make this analysis feasible.

Chapter 4 focuses on household perceptions of extreme weather events and climate change, and the impact of adverse events on their livelihood. The analysis is based on three main questions. First, households are asked if they have noticed any changes in weather patterns in the last five years, with the potential changes identified in the questionnaire including more erratic rainfall, less or more rain, more frequent droughts, floods, or sandstorms, and changes in temperatures, among others. Next household are asked if, again compared to five years ago, they have noticed changes in their environment—these would include deforestation, livestock losses, crop failures, water pollution, less fertile land, and so on. Finally, households are asked if they experienced losses of crops, income, livestock, or fish as a result of changes in weather patterns.

Chapter 6 looks at the ways through which households cope with the impact of adverse weather events, and how they adapt to changes in the climate and their environment. On coping, households who declare that they have experienced a loss of crops, income, livestock, or fish due to weather shocks or changes in the environment are asked if they used the following coping strategies: (1) Selling or pawning livestock; (2) Selling or pawning assets other than livestock, such as land or jewelry; (3) Withdrawing children from school; (4) Using their savings; and finally (5) Asking for a loan. Households who did not experience a loss linked to an adverse weather events are asked whether they would rely on the same coping mechanisms in case they would experience such a loss. On adaptation, households are asked whether they have taken specific actions to adapt to changing conditions. Many different actions are listed in the questionnaire, including changing in the timing of planting, changing the source of water used, drilling boreholes, changing production technologies or crop choices, increasing the use of fertilizer or pesticides, seeking or increasing off-farm employment, and so on. Similar questions are asked about the community level response to climate change, and about the availability of government programs that could help households cope with and adapt to climate change.

Finally, chapter 7 looks at the relationship between household perceptions of climate change and whether household members have migrated either temporarily (this is referred to as resident migration because the member still resides in the household), or permanently (this is referred to as nonresident migration). The analysis is made possible through information asked about migration not only among current household members, but also among those who used to live in the household and have left permanently. There are however limits to the analysis that can be conducted with such data. First, because the surveys were implemented in sending areas affected by extreme weather events, we do not record information on the migration of entire households—we only record the migration of household members. Second, 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. It could be that household perceptions of climate change are wrong—for example, even if households declare that rainfalls are becoming more erratic, this may not be the case in reality. At the same time, one could argue that decisions such as that of migrating are influenced at least as much by the perceptions of households of the reality as by the reality itself. Also, questions in the survey about the reasons for migration provide a way of checking whether the estimates of the impact of perceptions on migration in the regression analysis are of a reasonable order of magnitude.

It must be emphasized that because the surveys are not nationally representative and were implemented only in two sending areas affected by extreme weather events, as discussed in the next section, we are not able to provide estimates of migration by entire households away from the sending areas—we only record the migration of household members.

To mitigate this weakness, we also conducted work with nationally representative data. For Morocco, we used the nationally representative Morocco Household and Youth Survey (MHYS) implemented between December 2009 and March 2010. Much of the questionnaire of that survey focuses on issues critical to youth, such as the obstacles they encounter on the labor market and for civic participation. But the questionnaire also included data on migration as well as on various shocks affecting households and their ability to cope with these shocks. Being aware that the survey would be implemented, we were able to add additional questions on household perceptions regarding changes in climate, and whether this affected migration decisions. Those data are then used for two chapters in the study on, respectively, the ability of households to cope with weather and other shocks (chapter 5), and the migration decisions of household members (chapter 10). For the Republic of Yemen we used data from the latest census and the latest national integrated household survey to conduct additional analysis of migration patterns. The census data were used together with other data (including climatic data) to analyze the determinants of migration rates between districts (chapter 9). The national household survey was used to analyze who benefits from remittances from international and domestic migrants, and what impact those remittances have on the welfare and human development indicators of the households who receive them, and whether this impact depends on where the beneficiary households live (chapters 11 and 12). The fact that we are able to rely on national data for Morocco and the Republic of Yemen helps in placing some of the findings from the new household surveys in a broader context, so that the use of the two types of data complement each other.

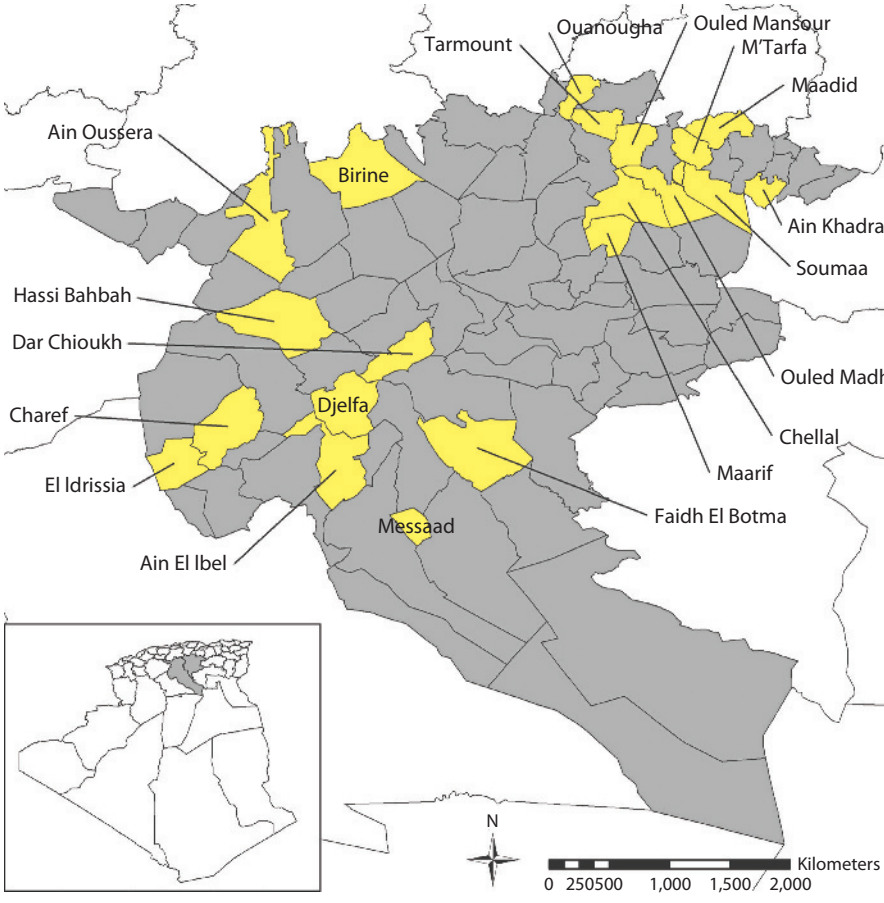
Household Survey Data Collection

Survey Sites Selection

In each of the five countries the same household survey was implemented in two predominantly rural areas. These two areas were located in regions that are

considered to be vulnerable to climate-induced environmental degradation in the agricultural sector and are also areas that have produced significant out-migration internal to the countries. In other words, the regions were chosen based on existing environmental conditions and on their contribution to internal migration patterns. The majority of the areas have been subjected to long-term drought and water scarcity or incidence of flooding. While there is ongoing debate regarding whether the sources of climate change are caused by human actions or by natural climatic factors, the selection of the areas was meant to reflect the latter. In practice, we relied for the selection of the areas on recommendations from climate change and environment experts in the respective countries, population and migration experts, ministry officials, and existing information from a wide variety of sources on climate and migration trends in each country. The remoteness of the areas and security risks also influenced survey site selection. Official approval from ministries in each country was obtained to conduct the survey in each survey site. The sample size in each area was 400 households for a total of 800 households in each of the five countries.

Map 3.1 Map of the Selected Area for the Household Survey in Algeria

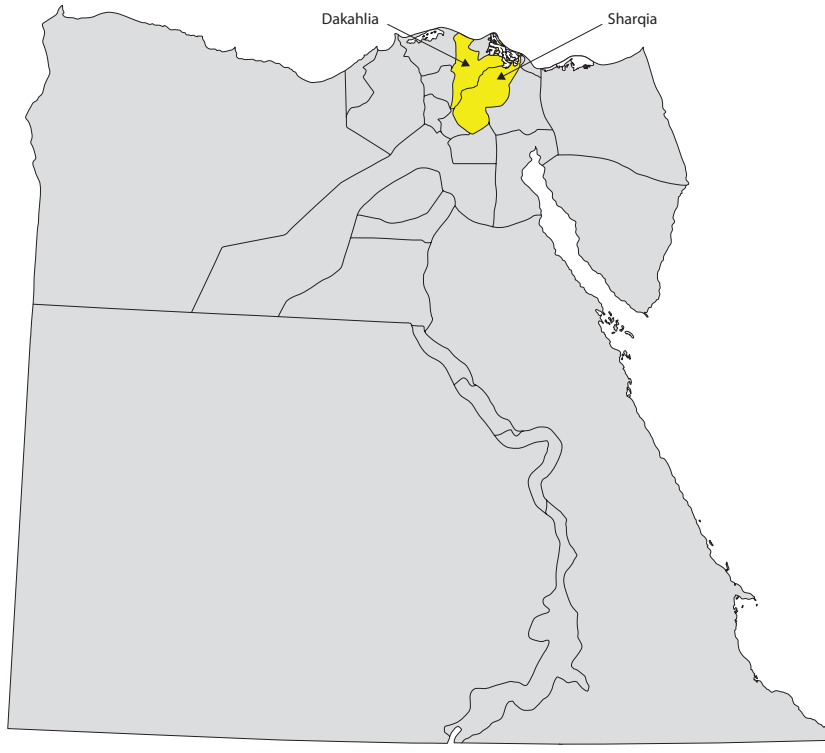


Source: World Bank data.

In Algeria, two sites were selected. M'Sila is located in the Steppe region and has been classified by the Algerian Ministry of Agriculture and the National Centre for Spatial Techniques as an area that is "sensitive" or "very sensitive" to desertification. Approximately, 62 percent of the region has been designated as such. Djelfa is also located in the Steppe zone and has similarly been designated as "sensitive" or "very sensitive" to desertification. In that region, approximately 500,000 hectares of land are in the process of desertification and more than seven million hectares are under threat of desertification.

In Egypt, the first area chosen area was Dakhalia in the Northeast. Experts at the Cairo College for Engineering indicate that water consumption has increased 17 percent owed to hotter and longer summers there. In the governorate of Dakhalia, approximately 11,000 hectares of land in 2010 were no longer viable as a result of poor weather conditions, which has caused diminished water supply for agriculture. Farmers staged regular protests outside of the governor's office demanding initiative to improve availability of water. The second region is Sharqia, also in the Northeast. Similar water scarcity has damaged rice farms causing farmers to use sewage water for irrigation purposes. The Central Agency for Public Mobilization and Statistics reports that water resources in Egypt will decline by 15 billion cubic meters by 2017 in these and other areas throughout the country, a significant decrease from the requirement of 86.2 billion. Each of

Map 3.2 Map of the Selected Area for the Household Survey in the Arab Republic of Egypt



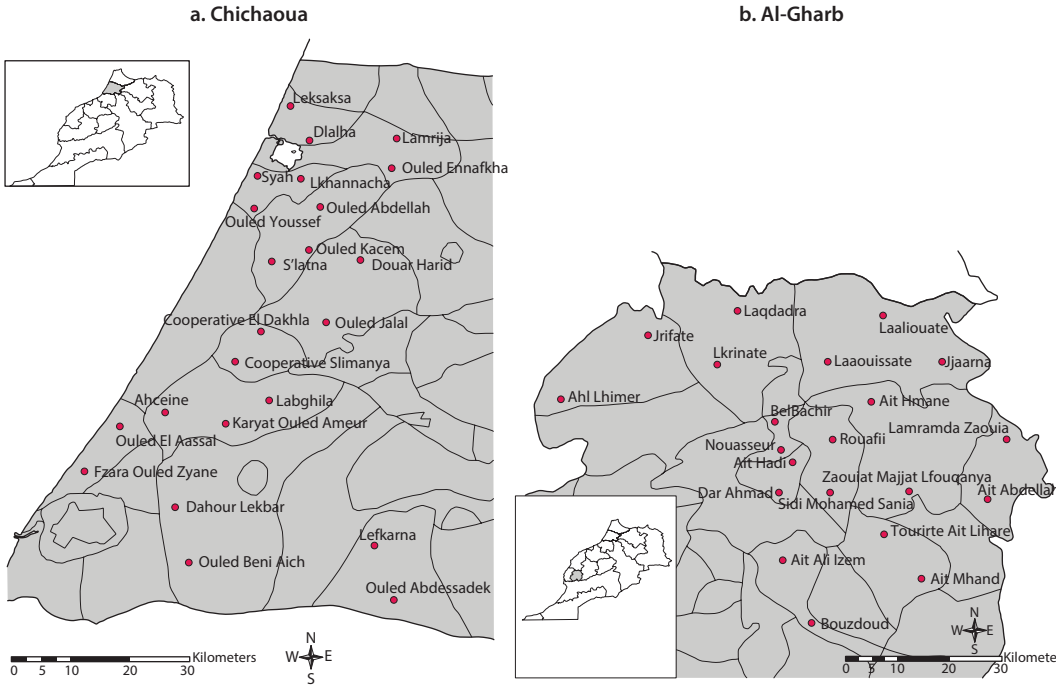
Source: World Bank data.

the above areas is a supplier of migrants to other areas within Egypt, mostly to urban areas, such as Cairo, a major destination for rural migrants who seek to escape poverty. These survey areas were approved by officials and researchers associated with the Egyptian Environmental Affairs Agency.

In Morocco, the first site was Chichaoua in the Plains Region. Chichaoua Province has been affected by drought over recent decades. The pattern has been accompanied by severe drought events. The second region is Al-Gharb in the Northwest. The Al-Gharb plain is Morocco's second largest agricultural producing region. In 2009, Al-Gharb accounted for roughly 35 percent of the country's cereal acreage. Al-Gharb has been severely affected by flash flooding from the Sebou River—events exacerbated by heavy snowfall and rains—which began in 2009. Thousands were displaced amid loss of homes and shelter and significant damage to infrastructure and agricultural production. Yet, Gharb also suffers from cycles of lack of rainfall. In 2011, for example, rainfall decreased by 14 percent. The area was recommended by Moroccan government officials and is an outlier among the survey sites, an area that has been affected by short-term weather events in the form of a natural disaster.

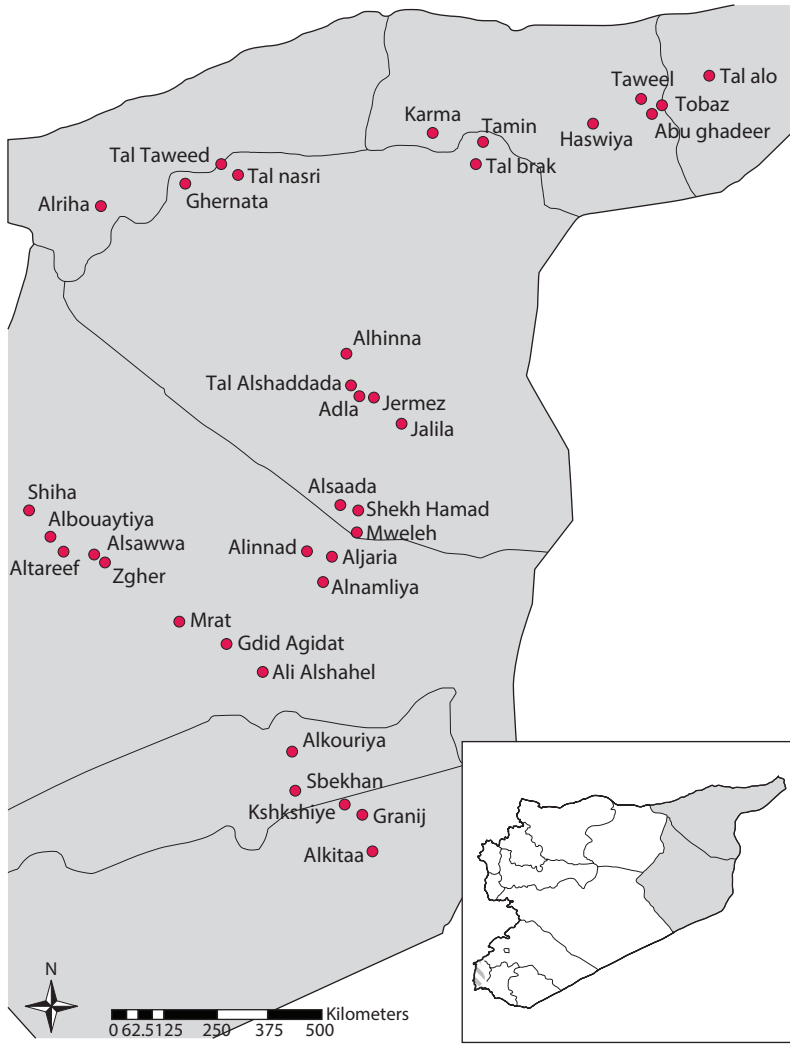
In Syria, the first area is Al-Hassakeh in the North. The region has been afflicted by drought and land degradation over a long period. The Qamishle and al-Shadaddi districts have been particularly affected. Tens of thousands of Syrians have been displaced from al-Hassakeh as a result of severe drought. The second

Map 3.3 Maps of the Selected Area for the Household Survey in Morocco



Source: World Bank data.

Map 3.4 Map of the Selected Area for the Household Survey in the Syrian Arab Republic



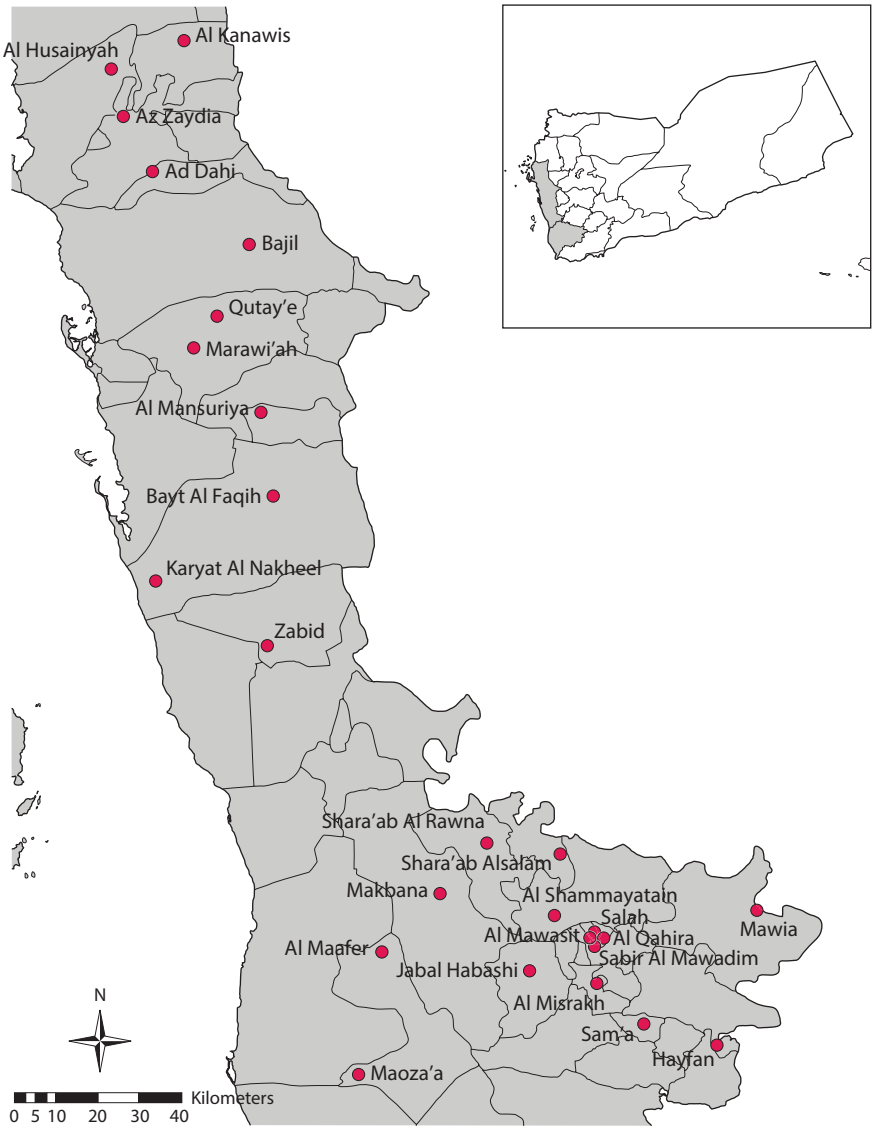
Source: World Bank data.

area is Deir ez Zour in the East. Like al-Hassakeh, Deir ez Zour to the east have also suffered from drought and land degradation. In both al-Hassekh and Deir ez Zour, approximately 1.3 million have been profoundly affected by drought especially since 2008, and according to the Syrian government, some 800,000 are vulnerable. Though precise figures are difficult to acquire, between 40,000 and 60,000 families are estimated to have migrated, including 35,000 from al-Hassekeh alone. Both Deiz Ezzor and al-Hassakeh are home to crops considered strategic by the Syrian government, such as wheat, cotton and barley. Metropolitan Damascus has been a major destination for rural migrants for many decades.

In the Republic of Yemen, the two areas were Hudaydah in the West and Taiz in the South. Both areas are designated as high-drought risk areas. About a third of the Republic of Yemen's poor are concentrated in these areas. Taiz has been

affected by both long-term water scarcity and acute drought, the latter occurring since 2008 causing significant displacement. The situation in Taiz is more severe, however, as the region faces a humanitarian situation in 2011 caused by the collapse of the Salah government last year. Civil unrest and violence have compounded water scarcity as health care, education, and physical security are threatened. Taiz is among the areas in the Republic of Yemen suffering from the most severe water shortages. Rainfall has decreased or ceased all together since late 2008-early 2009, depleting ponds and tanks which are the typical reservoirs of natural rainfall for the agricultural sector.

Map 3.5 Map of the Selected Area for the Household Survey in the Republic of Yemen



Source: World Bank data.

Sample Design and Weights

For each country, the target was to implement the survey with a sample of 800 households. Sample selection followed a general framework, with variations on how household units were selected depending on the country. Each country was first divided into two strata composed of: (1) areas with high level of environmental degradation, and (2) areas with low level of environmental degradation. Only areas in stratum 1 with high level of environmental degradation were eligible for inclusion in this study. In each country, two areas with high environmental degradation and high migration were selected. These areas were typically selected systematically, but nonrandomly, because of factors such as importance, size, or location.

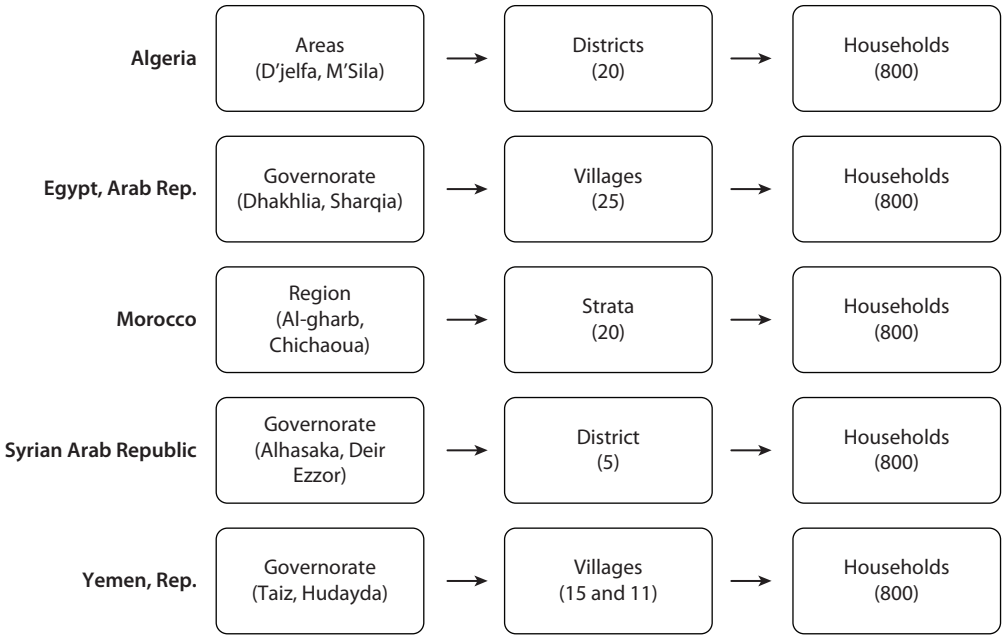
Thus, we cannot produce weights that generalize the sample of households in these two areas to produce country-level statistics, not only because this would not be appropriate with only two areas surveyed but also because we do not have a probability of selection of these two areas. Instead, where feasible we estimated household-level weights to generate representative statistics from each sample of households for their respective area. But again, the weighted area-level summaries may not be representative of the country with respect to level of environmental problems, degradation, and migration due to nonrandom selection of these areas into the study.

The survey implementation was supervised by Rand under contract with Agence Française de Développement (AFD) and the World Bank. In each country, Rand worked in partnership with local teams: the University of Algiers in Algeria, IPSOS Middle East and North Africa (MENA) in Egypt and Syria, TNS Global in Morocco, and the Market Research Organization (MRO) in the Republic of Yemen. In each of the two areas sampled per country, a multistage sampling design was carried. Figure 3.1 visualizes how the sample was selected in each of the five countries, but household selection rules were country specific and are described below.

The Algeria sample was split evenly between the prefectures Djelfa and M'sila. Within each prefecture, 10 administrative districts were selected with probability proportionate to size using the 2008 district population as the measure of size. The number of households per district was then allocated proportionately, with more interviews in larger municipalities. In the absence of a complete listing of dwellings in each prefecture, households were selected within districts using a random selection algorithm in the field. The 2008 population sizes of each district used for designing the sample as well as the number of interviews per district are listed in table 3.1.

In Egypt, the sample was split evenly between the two governorates of Dakhalia and Sharqia. Within each governorate, the selection of villages was dictated by the Egyptian government authority approving the survey (the Egyptian Environmental Affairs Agency). This means that villages were selected in a nonrandom fashion. Nine villages were selected in Dakhalia and 16 in Sharqia. The allocation of interviews across villages within each governorate was done using a probability proportionate to size approach, with the number of households in the village being used as the measure of size. The number of households was obtained

Figure 3.1 Sampling Methodology for the Household Surveys



Source: World Bank data.

Table 3.1 Location Information for Algeria Survey Sample

	Population (2008)	*Share (%)*	*Sample*		*Population (2008)*	*Share (%)*	*Sample*
Djelfa area				**M'Sila area**			
Djelfa	288,228	38.1	152	Maadid	24,168	19.44	78
Hassi Bahbah	86,421	11.42	46	Tarmount	9,954	8.00	32
Feidh El Botma	32,501	4.29	17	Mtarfa	8,074	6.50	26
Birine	30,913	4.08	16	Chellal	5,411	4.30	17
El Idrissia	32,900	4.35	18	Ouled Mahdi	7,069	5.70	23
Messaad	102,453	13.54	54	Ain Khadra	29,046	23.40	93
Dar Chioukh	30,372	4.00	16	Ouanougha	14,397	11.60	46
Charef	24,028	3.17	13	Ouled Mansour	5,731	4.61	19
Ain El Ibel	28,406	3.75	15	Maarif	13,269	10.67	43
Ain Oussera	100,631	13.3	53	Souamaa	7,189	5.78	23
Total		100.0	400	Total		100.0	400

Source: World Bank data.

from 2006 general census by the Central Agency for Public Mobilization and Statistics (CAPMAS). For the selection of households within a village, fieldwork supervisors selected random starting points within each village. Each interviewer was advised to start by selecting the first house to the right of the starting point. The interviewer then attempted to conduct an interview with every fourth building. In case of a refusal, the interviewer moved to the next housing unit to complete a questionnaire. If the next housing unit had multiple apartments, only one

was selected to complete an interview. A maximum of 8–10 interviews were conducted at each point. Table 3.2 provides the population size of each sampled village, along with the number of interviews completed per village.

In Morocco, the sample was evenly split between the regions of Al-Gharb and Chichaoua. Within each region, 10 strata were defined and 40 households were sampled per stratum under an equal allocation design (see table 3.3). The 40 households were selected in two stages to improve efficiency of fieldwork. First a

Table 3.2 Location Information for Arab Republic of Egypt Survey Sample

	Population	*Sample*		*Population*	*Sample*
Dakhalia			**Sharqia**		
Meet El Kom Vill.,Talkha City	22,944	30	*Hehaya City*		
Kafr El Dabosy, Sherbeen City	12,204	16	El Zarzamon Village	8,692	18
Meet El AamaL, Aga City	24,717	33	El Adwa	10,649	22
Meet Zonkor, Talkha City	6,323	8	Sobeha Village	9,598	20
Balkas City	103,549	—	El Mosalmy Village	3,575	8
El Gamalia, Mansoura City	71,652	95	El Salamon Vill	7,398	16
Meet Salsabil, Mansoura City	35,628	49	*El Hosaynia City*		
El Danabik Village, Mansoura City	8,535	11	Smakin Shark Vill	7,790	16
Abo Daood El Enab Village, Aga City	5,159	7	Smakin Gharb Vill	12,478	26
Meet Mzag, Mansoura City	10,687	14	Soad Island Vill	40,090	84
Gamasa City	755	—	*Abo Kabir City*		
			El Shekh Island Vill	3,394	7
			Awlad Musa Vill	15,903	33
			El Sawaky Vill	5,997	13
			Nazlt El Arien Vill	9,442	20
			Fakos City		
			El Ghadadna Vill	7,019	15
			Akyad El Bahria Vill	21,365	45
			Akyad El keblia	18,696	39
			Kafr El Hag Omar	7,858	17

Source: World Bank data.
Note: — = not available.

Table 3.3 Location Information for Morocco Survey Sample

	Households	*Interviews*		*Households*	*Interviews*
Al Gharb			**Chichaoua**		
Moulay Bousselham	2,292	40	Ahdil	1,146	40
Lalla Mimouna	1,531	40	Ait Hadi	819	40
Bahhara Oulad Ayad	3,213	40	Lamzoudia	1,439	40
Sidi Mohamed Lahmer	4,608	40	Sid Mokhtar	635	40
Souk Tlet EL Gharb	2,866	40	Sidi Bouzid Ragragui	1,504	40
Sidi Allal Tazi	1,542	40	Sidi M'hamed Dalil	591	40
Mograne	3,623	40	Douirane	1,698	40
Mnasra	4,088	40	Gmassa	1,184	40
Ameur Seflia	5,466	40	Majjat	1,059	40
Dar Bel Amri	4,941	40	M'zouda	1,299	40

Source: World Bank data.

random sample of douars (villages) was selected from a complete listing of douars in each region, although douars with less than 100 households were not selected. Second, in the absence of a complete listing of households within each douar, an algorithm was used to ensure a random sample of households in a way similar to that of Egypt. The starting point was the village center. In cases where the population in the douar was dense, a pattern of skipping three households was implemented. Interviewers adhered to the "right-hand rule" so that interviews were conducted on the right-hand side of the road/path/"street." Random selection of roads/paths was not possible in rural areas similar to urban areas. Instead, a path was specified by the supervisor and two people followed a path in opposite directions (for example, north and south or east and west). The first household along the path was selected, with skipping of three households in dense areas. If no one was at home, the interviewers proceeded to the next house along the road/path/street. To avoid excessive clustering, no more than 20 households were selected from the largest douars, for a total of 40 household interviews per stratum.

The Syria survey was implemented in the governorates of Alhasaka and Deir Ezzor. Within Alhasaka, six areas/provinces and 20 villages were selected from two of the four districts. Multiple provinces and areas in Alhasaka were not eligible for inclusion due to safety concerns, no relevant climate/weather impacts, and language issues for areas that bordered Iraq. In Deir Ezzor, 10 areas/provinces and 16 villages were selected. These areas/provinces represented all three districts in Deir Ezzor. Thus, the sample in Deir Ezzor has better coverage than that in Alhasaka. Highly urban areas, such as the city centers, were excluded from both samples. The total number of interviews was divided equally between the two governorates. Within each district, areas were selected using a random sampling approach (with certain exclusion criteria noted above). Within areas, the number of interviews was proportionately allocated based on population size. One or more villages were randomly chosen in each area, although villages that were very small and where local government permission was denied by the mayor were excluded. In Alhasaka and Deir Ezzor, 20 and 15 villages were sampled from the 6 and 10 areas, respectively. The details on the location of the sample are provided in table 3.4.

Finally, the the Republic of Yemen sample was split between the governorates of Taiz and Hudayda according to population (58 percent of the sample in Taiz and 42 percent in Hudayda, see table 3.5). Interviews were completed in 15 villages within Taiz and 11 villages within Hudayda. The primary reasons for selecting the 15 villages in Taiz and 11 villages in Hudayda were the distribution of population, community variety, local knowledge, and the observed degree of environmental degradation. The most critical areas with respect to environmental problems were chosen in both governorates. The total sample size within each governorate was allocated across the chosen villages on the basis of number of households on the basis of data produced by the the Republic of Yemen Central Statistical Organization. Each village was divided into different sectors (or neighborhoods) and interviews were divided equally among the two sectors. In each

Table 3.4 Location Information for Syrian Arab Republic Survey Sample

District	*Area*	*Population*	*Villages*	*Interviews*
		Alhasaka		
			Adla	25
			Alhinna	12
	Alshaddada	58,916	Jalila	19
			Jermez	27
			Tal Alshaddada	27
			Alsaada	19
Alhasake Centre	Markada	34,745	Shekh Hamad	24
			Mweleh	22
			Karme	22
	Bi'r Alhelou	38,833	Tal brak	27
			Tamim	26
			Alriha	24
	Alarish	30,544	Ghernata	26
			Tal Taweel	5
	Tel Tamr	10,000	Tal Nasri	20
			Abu Ghadeer	6
			Haswiya	19
Almalkiya	Jawwadiya	40,535	Tal elou	27
			Taweel	11
			Tobaz	12
		Deir Ezzor		
	Kisra	63,226	Sawwa	24
			Al Tarif	23
	Basira	40,236	Ali Alsaleh	30
	MouHasan	35,113	Jdid Agidat	26
Central Deir ezzor	Altibne	48,393	Shiha	36
	Khisham	28,718	Mrat	21
	Sour	37,552	Aljarya	20
			Alinad	16
Alboukamal	Hajeen	97,870	Ghranig	40
			Keshkeshiya	30
	Aljalaa	29,255	Alkitaa	20
	Ziban	65,079	Alkouriya	26
			Altayyana	19
Al-mayadeen	Ishara	96,001	Dablan	37
			Sbekhan	32

Source: World Bank data.

sector the interviewers contacted every third household by location to achieve quasi randomness.

Household sampling weights are usually defined as the inverse of the probability of selection of a household in a sample. In general, the probability of selection of a household consists of two components. The first component can be

Table 3.5 Location Information for Republic of Yemen Survey Sample

	Households	*Percent*	*Sample*		*Households*	*Percent*	*Sample*
Taiz				**Al Hudayda**			
Al Misrakh	18,277	7	32	Bajil	32,232	19	65
Sabir Al Mawadim	18,848	7	33	Al Katea'	16,116	10	32
Salh	17,705	7	31	Al Marawi'ah	14,651	9	30
Al Qahirah	23,417	9	41	Al Mansuriyah	12,697	8	26
Hayfan	18,277	7	32	Bayt Al Faqiah	14,651	9	30
Al Mawasit	23,988	9	42	Al Husainieh	12,697	8	26
Sama'	21,132	8	37	Zabid	13,186	8	27
Mawiyah	17,134	6	30	Karyet An Nakheel	10,744	7	22
Mawza'	16,563	6	29	Ad Dahi	13,186	8	26
Ash Shamaya-tayn	15,992	6	28	Az Zaydiyah	11,721	7	24
Al Ma'afer	13,136	5	23	Al Qanawis	14,162	8	28
Jabal Habashy	19,990	8	35				
Makbanah	10,281	4	18				
Shara'b Ar Rawnah	16,563	6	29				
Shara'b As Salam	13,707	5	24				
Total Taiz	265,011	100	464	Total Al Hudayda	166,042	100	336

Source: World Bank data.

denoted as P(district), the probability with which a district or other subarea is selected within a prefecture or governorate. The second component is the probability of selection of a household within a district, P(household|District). With a random selection of households within a district, this is the ratio of the number of interviews competed in a district and the population size of the district. The probability for a household to be selected is then P(Selection)=P(district)× P(household|District) and the sampling weight is 1/P(Selection). This is the approach used for assigning households weights in Algeria.

In Morocco, given that villages were randomly selected from each stratum, they have an equal probability of selection. This then simplifies the probability of selection of households, which is simply the ratio of the total number of household interviewed in a stratum and the size of the stratum. That is, P(Selection) = Number of interviews/Number of families in an area, with again the sampling weight defined as the inverse of the probability of selection. In Syria, the sample was essentially self-weighted (equal probability of selection for all households), given that the areas within districts were selected randomly, and so were the households within districts. In Egypt, due to the nonrandom selection of villages, it is not advisable to produce weights (within villages, households were selected randomly). Similarly, due to the systematic selection of villages within governorates in the Republic of Yemen, sample weights are also not provided (again, within villages households were selected randomly, but villages themselves were not).

Challenges in Survey Implementation

In Algeria data collection ran from April to October, 2011. Interviewers participated in training and orientation sessions before going to the field, lasting approximately three days. Data were collected through face-to-face interviews, after securing permission from local leaders in each district. The primary fieldwork challenges in order to access households were related to transport, hot weather, and long distances between villages and houses. There were also difficulties with some families who did not want to answer questions, because they thought the questions were an intrusion into their personal life. The interview teams went to great lengths to explain to farmers the nature of the survey and reassure them that the goal was not to probe into their private lives. Although some households refused to participate in the survey and some did not complete the entire questionnaire, he overall nonresponse was less than 1.5 percent. The survey took on average 1.5 hours to complete.

In Egypt, data collection ran from May (following a delayed start) to June 2011. Fieldwork training lasted two days and covered detailed descriptions of the questionnaire contents, the importance of probing for particular questions, and role playing activities to gain experience with the questionnaire. The interview teams consisted of 29 individuals (23 male, 6 female). Household refusals to participate in the field were primarily due to the length of the questionnaire and the personal nature of questions. A total of 99 households refused to participate and 133 people showed reservations when asked questions on personal life details. The supervisors for the data collection team were responsible for quality control, which included accompanying interviewers to household visits (20 percent of interviews), checking a subsample of questionnaires for accuracy (20 percent of interviews), and telephone call backs (35 percent of interviews). Double data entry was conducted for 15 percent of the questionnaires as an additional test. Some problems we reencountered during interviews, including respondents who were observed to give any answer just to finish the interview, respondents that did not take the survey seriously, and interruptions from other people in the household during the interview.

In Morocco, fieldwork was completed between April and May 2011. The field team consisted of approximately 20 interviewers, and training for the interviewers lasted three days. The training for the Chichaoua team was held in Marrakech, while the training for the Al Gharb team was held in Casablanca. A relatively large number of households refused to participate in the survey (144), but there were no major challenges associated with the fieldwork and household refusal rates were not tied to any particular issues other than general challenges with length and sensitivity to certain questions.

In Syria, fieldwork was carried out between March and June 2011. Interviewers were trained during separate training sessions for each region, with each training session lasting one day. The training included interview procedures, questionnaire review, and mock interviews. Supplemental training was done at the start of fieldwork and following supervisor review of initial completed interviews. The survey teams comprised 35 individuals, including interviewers, supervisors, and

the office team. A total of 1,200 households were contacted for 800 successful interviews, with a rate of unsuccessful interviews of 8 percent. Average interview length was just under one hour. Interview teams encountered security problems in many villages, and they were required to secure approvals to be allowed to work in most villages. Four villages refused to participate in the survey. Other challenges included transportation and lack of roads to some remote villages. Supervisors reviewed completed questionnaires, accompanied interviewers on household visits (for 31 percent of the interviews), conducted debriefing sessions with interviewers, and conducted telephone-based data verification (for 24 percent of interviews).

In the Republic of Yemen the survey took place between June 2011 and February 2012—with significant periods of nonactivity due to violence in the areas where the survey was being implemented. The survey team consisted of 26 individuals, including 7 supervisors. The fieldwork teams faced a number of access-related obstacles, including difficult terrain and lack of transportation. Some respondents were reluctant to provide their names or the names and personal information of their family members. Because of these and other challenges, participation refusal rates were at around 30 percent across both survey areas.

Qualitative Data Collection

Focus groups and semi-structured in-depth interviews were also implemented in the five countries for this study. Focus groups are a set of individuals that are selected and assembled to discuss a given topic of research from the perspective of personal experience. The conduct of focus groups is based on the assumption that: participants have a specific experience of or opinions about the topic under investigation. An explicit interview guide is used and the varied experiences of participants are explored in relation to a set of predetermined research questions.

Focus group research draws upon respondents' attitudes, sentiments, beliefs, experiences and reactions in ways that are not feasible using other methods—for example, observation, one-to-one interviewing, or survey questionnaires. These attitudes, feelings and beliefs may be partially independent of the group's social setting, but the social and interactive environment provided by a focus group can help respondents articulate and further reflect upon views. Compared to individual interviews, which target individual attitudes and impressions, focus groups elicit an array of views and psychological processes in a group context.

The original intent was to conduct focus groups in the five countries. But as mentioned in the introduction, lack of security in the Republic of Yemen made focus group recruitment difficult, and in n Algeria, focus group recruitment was hampered by local suspicion. In both countries, this led to a shift toward semi-structured in-depth interviews which provide similarly rich and textured information. In such interviews individuals engage in a discussion themselves and are posed open-ended questions not unlike the question-answer process in a focus group setting.

Focus groups and in-depth interviews either can be used at the preliminary stages of a study to inform other aspects of research or may be used to confirm findings produced from other research methods, such as following a quantitative survey. In such a scenario, focus groups are useful as a confirmatory method that may valid certain hypotheses or assumptions about attitudes, emotional processes, or understandings of concepts. In other words, they can help explain survey findings. Yet as with any method, focus groups and in-depth interviews are not without their limitations. First, neither method permits sweeping generalizations across entire populations. This is because focus group samples are not representative of large populations. Second, the moderator risks the loss of control over the direction and tenor of focus group discussion. Group interactions and dynamics are strongly influenced by the dialogue created by participants. Consequently, the moderator may have difficulty controlling the flow of discussion. Third, and related to the previous limitation, is the difficulty in drawing out and isolating individual viewpoints. Since focus group and interview participants speak in specific contexts, and within specific cultures, it may be difficult to clearly identify an individual attitude. Still, both approaches can also be used as an evaluative tool to assess reactions to policies and events and are also useful as points of departure for future research through generating hypotheses.

The qualitative fieldwork was conducted among adults 18 years of age and older in each country between November 2010 and February 2012. Implementation dates varied by country due to Arab Spring protests and government collapse which interrupted fieldwork in Egypt, Syria, and the Republic of Yemen, starting in January 2011. Although the results do not appear to be seriously affected, there is some mention of concern about the security situation related to Arab Spring events among Egyptian focus group respondents. Results are based on the conduct of seven focus groups in Morocco, Egypt, and Syria, with each group comprising six to eight participants: four focus groups among urban migrants, who have relocated internally from rural areas; and three focus groups in each rural area among rural residents. The structure of the focus groups was determined by assumptions and hypotheses believed to be critical in informing respondent attitudes and their adaption strategies. The rural and urban groups were comprised of both men and women, and the groups were divided by age, gender and socioeconomic status. In Algeria and the Republic of Yemen, as already mentioned, semi-structured interviews were conducted instead.

In order to accurately capture variation in attitudes, respondents were recruited from select areas referred to as rural or "sending areas" and urban or "receiving areas." Rural or "sending areas" are often the source of internal migrants moving to cities, and were selected for this study based on their long-term physical exposure to environmental degradation and declining agriculture, as well as corollary trends of rural outmigration to other areas internal to countries. The rural areas were also the sites of household surveys mentioned in the previous section. In other words, the rural focus group sites in Algeria (M'Sila), Morocco (Lamzoudia), Egypt (Dakhalia), Syria (al-Hassakeh), and the Republic of Yemen (Hudaydah) were chosen based on the extent of documented environmental degradation and

of rural out-migration patterns. "Receiving areas," by contrast, are urban areas that are common destination points for internal migrants seeking better opportunities. These were selected based on trends of rural to urban migration. In most cases, these areas were among the countries' largest, most populous cities. Thus, in Algeria, Morocco, Egypt, Syria, and the Republic of Yemen, the urban focus group sites were Algiers, Casablanca, Cairo, Damascus, and Sanaa. Table 3.6 provides more details on the qualitative research sites.

Respondents were randomly recruited door-to-door using a screening questionnaire that filtered for select demographic characteristics. For receiving areas, involvement in agricultural activity prior to migrating was a critical selection criterion for those recruited in urban neighborhoods. Migrants had to have come from households that relied solely on agriculture as the main source of income, and relocated to urban areas due to unfavorable agricultural conditions in their homes of origin within the last 10 years. All rural respondents in sending areas were selected based on the primacy of agriculture as the main source of economic activity. Respondents for in-depth interviews were also recruited similarly to focus group respondents.

Discussions in focus groups and in-depth interviews in urban areas were organized around nine questions, with probing for specific aspects or sub-question within each of the main nine question. The nine questions were as follows: (1) What would you say the biggest problem facing your household these days?; (2) As you know, some people who live in this area have relocated from other places. From where did you relocate?; (3) Why did you leave?; (4) Before you decided to move, what did you do to try to survive in your village?; (5) How dependent is/was your family on financial help from other family members living in other areas or abroad?; (6) When we choose to relocate to another area, we may relocate to a particular area based on certain factors. Why did you choose this town and neighborhood?; (7) Since you have relocated here what are the biggest problems or challenges you have faced?; (8) Are you aware of any government programs that are targeted for people who have relocated for the reasons you described?; and finally (9) Under what circumstances would you return to your previous home?

Similarly, the qualitative work in rural areas was organized around a core set of eight questions, and some probing within each. The questions were as follows: (1) Thinking about where you live now, including the surrounding conditions, what would you say is the biggest problem facing your community today?; (2) Some people believe that this area has been affected by poor weather conditions, and by this, I mean drought, storms, or flooding. To what extent has this been a problem in your view? In what ways have poor weather conditions affected the daily life of your household?; (3) How dependent is/was your family on financial help from other family members living in other areas or abroad?; (4) Sometimes, the weather is not very good and farming is difficult. What kinds of programs are you aware of that are intended to help you improve conditions in your community and for your household?; (5) Imagine a situation where there was a major flood or drought here and you were completely unable to earn an income from

Table 3.6 Qualitative Research Sites

Egypt, Arab Rep.				
	Location	*Socioeconomic status*	*Gender*	*Age*
#1	Urban Cairo	D/E	F	25–35
#2	Urban Cairo	D/E	M	36–45
#3	Urban Cairo	C1/C2	F	36–45
#4	Urban Cairo	C1/C2	M	25–35
#5	Dakhalia	C1/C2	M	36–45
#6	Dakhalia	D/E	M	25–35
#7	Dakhalia	C1/C2	F	36–45
Fieldwork date: March 22–March 27, 2011				
Morocco				
	Location	*Socioeconomic status*	*Gender*	*Age*
#1	Casablanca	D/E	M	30–35
#2	Casablanca	D/E	M	40–45
#3	Casablanca	C1/C2	M	20–25
#4	Casablanca	C1/C2	F	20–25
#5	Lamzoudia	D/E	M	40–45
#6	Lamzoudia	D/E	F	30–35
#7[a]	Lamzoudia	D/E	M	30–35
Fieldwork date: November 22–November 25, 2010				
a. Fieldwork date: February 10, 2011				
Syrian Arab Republic				
	Location	*Socioeconomic status*	*Gender*	*Age*
#1	Al-Hassakeh	D/E	F	25–45
#2	Al-Hassakeh	D/E	M	25–45
#3	Al-Hassakeh	C1/C2	M	25–45
#4	Al-Hassakeh	C1/C2	M	25–45
#5	Damascus	D/E	F	25–45
#6	Damascus	D/E	M	25–45
#7	Damascus	D/E	M	25–45
Fieldwork date: August 17–August 20, 2011				
Algeria (Semi-structured In-depth interviews)				
	Location	*Socioeconomic status*	*Gender*	*Age*
#1	Urban Algiers	C1/D	7M	25–35
	Urban Algiers	C1/D	13M	36–45
#2	Rural Djelfa	C1/D	15M	36–45
Fieldwork date: February 2012				
Yemen, Rep. (Semi-structured in-depth interviews)				
	Location	*Socioeconomic status*	*Gender*	*Age*
#1	Urban Sanaa	C/D/E	3M	25–35
	Urban Sanaa	C/D/E	7M	36–45
#2	Rural Hudaydah	D/E	3F	25–45
	Rural Hudaydah	C/E	7M	25–45
Fieldwork date: November 29-December 5, 2011				

Source: World Bank data.

farming. What would the four things you would be most likely to do in order to survive?; (6) Some of you mention that you would move somewhere else in our country. To what town or city would you most likely move?; (7) Why would you move there?; and finally (8) Once you would have moved to this area, what would you do to earn a living and survive?

In addition to the focus groups or in-depth household interviews, interviews with key informants were also carried in each of the five countries. In each country, a dozen government officials were interviewed and a dozen additional respondents were contacted from various organizations, including universities, international organizations, and nongovernmental organization (NGO)s. For government officials, the questions asked were as follows: How important an issue is climate change—has it become more of a priority for your government?; Why has climate change become an important concern? Do you see climate change as a significant problem in the future?; How has environmental degradation affected rural populations in particular? What about urban areas that are attract rural migrants?; What are the challenges facing policy makers in dealing with climate change migration? What are the gaps in knowledge and resources?; What is the government doing about rural-urban migration? Is there any public assistance available to migrants and rural populations affected by environmental degradation? Can you please describe them to me?; What is the government planning to do?; What do you think is the level of public awareness about existing programs?; Why has it been difficult to address this issue?; If there are no programs, what kinds of programs would be most beneficial in your view?.

For nongovernmental experts, the main questions were as follows: How has climate change affected this country? In your view, has is contributed significantly to environmental degradation? And how do you think climate change will affect the country in the future?; How has environmental degradation affected rural populations in particular? Do certain populations, such as women and girls, bear a greater burden?; What kinds of problems are you seeing?; Some people may choose to relocate to other areas as a coping mechanism. What is the profile of a typical migrant in this country? In other words what type of person migrates and why?; To where do people tend to migrate in this country and why?; Have these patterns and destinations changed over time to your knowledge?; What sorts of challenges do migrants face when they relocate from one place to another? What are the political, social, economic, health-related, and practical challenges that migrants face?; Not everyone is able relocate. What would you say are the biggest obstacles to migration?; Many migrants face various kinds of environmental shocks, such as floods and or drought. These shocks often affect agricultural productivity and thus income and the very livelihood of households. How do migrants cope to these situations? What survival strategies do they adopt?; Is there any government assistance available to migrants and rural populations affected by environmental degradation?; Is there any nongovernment assistance available to migrant and rural populations affected by environmental degradation?; What do you think is the level of public awareness about existing programs?; And if there are no programs, what kinds of programs would be most beneficial in your view?

Conclusion

New data collection on perceptions of climate change and migration decisions was a key component of this study. This chapter has documented the process followed and the choices made for data collection, both quantitative and qualitative. The discussion of the data collection for the household surveys included a review of key questions in the survey questionnaire, as well as the sampling design and some of the challenges encountered during survey implementation. For qualitative data collection, we discussed the approach used in the various countries and its rationale, as well as the main questions that were asked not only in focus groups, but also in in-depth interviews, and in the interviews with key informants.

Perhaps the most important point to emphasize again in concluding this chapter is the fact that neither the household surveys nor the focus groups and the other qualitative data are representative of the countries as a whole in which they were implemented, since they are only representative (or quasi-representative in some cases) of the areas selected for fieldwork. Yet the data are illustrative of the conditions prevailing in the five countries, and since these countries account for a large share of the population in the region, they are also illustrative for the region as a whole, or at least as much as they could be given constraints in the size of the samples.

PART 3

Impacts, Coping Strategies, and Adaptation Mechanisms

CHAPTER 4

Perceptions of Climate Change, Weather Shocks, and Impacts on Households

Franck Adoho and Quentin Wodon

What are the perceptions of households in the Middle East and North Africa Region regarding changes in the climate of the areas where they live? To what extent are households affected by extreme weather events such as droughts or floods? And who tends to suffer the most from such events when they occur? This chapter suggests answers to these questions on the basis of new household survey data collected in 2011 in Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of Yemen. The household surveys were implemented in two climate affected areas in each country. Overall, households in these areas do perceive important changes in the climate, for example with droughts becoming more frequent. While many households declare being affected by extreme weather events, with resulting losses in income, crops, livestock, or fish catchment, this is especially the case of the poor who appear to suffer the most from extreme weather events.

Introduction

Climate change is expected to result in an increase in global temperatures by 3°C to 5°C in this century, as well as in a reduction in rainfall and greater seasonal temperature and rainfall variability in many areas. Higher sea levels are also a threat to many areas, including in the MENA region where a large share of its population is located in low lying areas. With agriculture remaining essential for livelihood in the region, and existing conditions in terms of water scarcity being already precarious in many areas, climate change represents a significant concern for households (Verner 2012; see also World Bank 2010 and Foresight 2011). Expectations are that extreme weather events such as floods and droughts are likely to become more frequent, which has implications for coping and adaptation mechanisms, as well as internal and international migration (for example, UNDP 2009; World Bank 2010; Elasha 2010; IPCC 2012; McSweeney, New, and Lizcano 2009). For a brief review of the literature which informs this chapter, see the introduction of chapter 1 by Wodon et al. (2014) and chapter

2 on the five countries of focus for this work by Burger et al. (2014a), both in this study.

This chapter focuses on household perceptions regarding climate change, the impact of extreme weather events, and the ways through which households cope with such events. More specifically, the chapter looks at four main questions: (1) What are the perceptions of households in the Middle East and North Africa Region regarding changes in the climate of the areas where they live?; (2) To what extent are households affected by extreme weather events such as droughts or floods and who tends to suffer the most from such events when they occur?; and (3) How do households cope with extreme weather events? The chapter suggests answers to these questions on the basis of new household survey data collected in 2011 in Algeria, Egypt, Morocco, Syria, and the Republic of Yemen (see Burger et al. 2014a, 2014b). The household surveys were 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, and coping strategies, among others.

Overall, households do perceive important negative changes in the climate, for example with droughts becoming more frequent, or rainfall more erratic. While many households declare being affected by extreme weather events, with resulting losses in income, crops, livestock, or fish catchment, this is especially the case of the poor who appear to suffer the most. As far as coping mechanisms are concerned, again the poor ten do have fewer options than better off households. While none of the findings are unexpected, they do confirm that the poor tend to be most affected by extreme weather events that are likely to become more frequent with climate change, while they also have fewer means to cope with such events. It must however be emphasized that the household survey results are not meant to be representative of the five countries in which the work was carried, since only a few areas were surveyed in each country. It must also be recognized 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 stated, the chapter is organized as follows. Section two introduces the data used for the analysis. Section three discusses household perceptions about climate change and extreme weather events. Section four provides evidence on the impact of changes in weather patterns and the environment. A brief conclusion follows.

Data

This chapter relies on data from five household surveys implemented in Algeria, Egypt, Morocco, Syria, and the Republic of Yemen. The same household survey

instrument was used in all countries with minor adjustments for country context. In each country, 800 households were interviewed. The survey questionnaire was designed by a World Bank team, and the surveys were implemented in the five countries by Rand in collaboration with local partners.

In Algeria, the survey was implemented in the prefectures of Djelfa and M'sila. Djelfa is in the north-central part of Algeria, while M'Sila is in the northern part. The sites were selected based on reported high sensitivity to desertification and with input from the Algerian government. For example, according to the Ministry of Agriculture and National Center for Spatial Techniques, 62 percent of M'Sila province is classified as "sensitive" or "very sensitive" to desertification. The sample size of 800 families was equally split across the two prefectures.

In Egypt, we selected two Governorates: Dakhalia and Sharqia. Dakhalia is north-east of Cairo, while Sharqia is in the northern part of the country. The total sample of 800 interviews was distributed equally across the two governorates. Within each governorate, the selection of villages was dictated by the Egyptian government authority that was approving the survey work (Egyptian Environmental Affairs Agency). There were nine villages selected in Dakhalia, and 16 villages in Sharqia. A total of 400 interviews were conducted in each governorate.

In Morocco, two regions (Al-Gharb, Chichaoua) were selected based on the extent of environmental degradation due either recent disasters or longer-term processes. Within each region, 10 areas or strata were constructed across the entire region. We considered each area (town) selected as its own stratum, and the 10 strata to be overall representative of the region. There were 40 household interviews completed per stratum, under an equal allocation design.

In Syria we selected the governorates of Alhasaka in the northeast and Deir Ezzor in the east. Within Alhasaka, six areas/provinces and 20 villages were selected from two of the four districts. Some areas in Alhasaka were not eligible for inclusion due to safety concerns, no relevant climate/weather impacts, and language issues for areas that bordered Iraq. In Deir Ezzor, 10 areas/provinces and 16 villages were selected. These areas/provinces represented all three districts in Deir Ezzor. Interviews were divided equally between the two governorates.

In the Republic of Yemen, we selected the governorates of Taiz in the south and Hudayda in the western region. The governorates were chosen because of their exposure to environmental degradation and high rates of migration due to environmental reasons. The sample of 800 interviews was allocated according to population size (58 percent in Taiz and 42 percent in Hudayda. The interviews were completed in 15 villages within Taiz and 11 villages within Hudayda.

The survey questionnaire included a total of 17 sections. This chapter focuses on part of the data collected in section five on perceptions related to extreme weather events and climate change, and in section eight on adverse events. Specifically, the analysis focuses on household answers to four questions (data from the other sections are used for the regression analysis).

First, households were first asked: "Compared to 5 years ago, have you noticed any changes in the weather patterns in the following way?" For each of a dozen types of potential changes in weather patterns, households could answer "yes,"

"no," or "don't know" (two additional codes capture refusal to respond or feedback from the households that the condition is not applicable, but these cases were rare). The potential changes in weather patterns identified in the questionnaire were: "Rainfall is more erratic; Less rain; More rain; More frequent drought; More frequent floods; More frequent rain storms; More frequent sand storms; Rainy season is shorter; The start of the rainy season is later; The end of the rainy season is earlier; The temperature is hotter; and finally The temperature is colder."

Second, households were asked: "Compared to 5 years ago, have you noticed any of the following changes in the environment?" Again for each of a dozen options, households could answer "yes," "no," or "don't know." The types of changes in the environment listed were: "Deforestation and less trees; More frequent livestock loss; More frequent crop failure; Less fish in rivers, lakes or sea; More air pollution; More water pollution in rivers, lakes, sea or streams; Less water in boreholes, rivers, lakes or streams; Land is dryer; Less fertile land; More soil erosion; More insects and pests in crops; More diseases in animals and livestock; Towns and urban areas are more crowded; People have migrated out to other places." Note that the last two types of changes in the environment result from human responses through migration to changes in weather patterns and the environment. While migration itself may bring changes in the environment, those last two changes will not be included in the analysis of this chapter, which focuses more directly on changes in weather patterns and how they affect households.

The third important question in the section of the questionnaire in climate change used in this chapter relates to the impact of weather and environmental patterns. Specifically, households were asked the following question: "In the past 5 years, have you or your household experienced the following events as a result of weather and environmental patterns?" As before, households could respond "*yes*," "*no*," or "*don't know*", this time for four different types of losses: "Loss of crops; Loss of income; Loss of livestock or cattle; and Less fish caught."

Finally, in section eight of the questionnaire, households were asked the following question: "I am now going to read a list of adverse events that may have occurred over the last 5 years. By shocks, I mean severe weather that has affected your household's welfare. Thinking of adverse events over the last 5 years that have had an impact on your household, please tell me which one adverse event impacted your household the most?" The potential answers for that question were the following: "Drought; Flood; Storms; Mudslides; Excessive heat; Excessive rain; Pest infestation; and Crops and livestock diseases." Given these four questions, the objective of the chapter is very simple: it is to document household perceptions regarding changes in weather patterns and their environment as well as adverse events, and whether these changes and events lead to various types of losses for households, depending on the households' characteristics.

Perceptions of Climate Change

Do households believe that changes in weather patterns and their environment are taking place in the five countries? Before answering that question, it is

important to mention a caveat to the analysis. Perceptions of changes in weather patterns need not mean that weather patterns are actually changing or that climate change is actually occurring. In addition, while the questions were asked over the last five years, it could be that household responses reflect perceptions that have matured over a longer period of time. The reason why the questions were asked about the last five years is that household recall of weather patterns is likely to be more accurate over that period than over longer periods of time. As to the reliance on data on perceptions, even if they may not always reflect reality very well (the issue of recall adds to that), they are still an important entry point in trying to understand how changes in weather patterns of the environment affect household livelihoods, and how households respond to such events. In fact, at least to some extent, one might argue that decisions on how to cope with and adapt to changes in weather patterns and the environment may be influenced as much by how households and individuals perceive those changes than by the events themselves. Thus the information is valuable.

Household perceptions about changes in weather patterns and the environment have been ranked in table 4.1 according to the share of households sharing these perceptions (that is, answering "*yes*") in the five-country sample. More than three fourths of households in the combined sample (77.5 percent) declare that rain has become more erratic, and almost three quarters (72.4 percent) declares that temperatures have increased. 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. Households also believe that the diseases are increasing for animals and livestock, that there are 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.

A few of the extreme weather events often associated with climate change, such as rain storms and floods, are however not perceived as more frequent by a majority of households, but even for those events, almost half of respondents mention that they have increased in frequency (these events tend to be more localized, so it is to be expected that a smaller share of the sample would report them, which does not necessarily mean that they are less frequent). Some households do suggest that temperatures are becoming cooler (this is the case for almost half of the sample), and that there is actually more rain, but this is often the case only for a minority of households, and the overall picture that emerges is that of negative perceptions of changes in weather patterns and the environment, generally toward a dryer climate.

Basic statistics are also provided in table 4.1 on perceptions by country, and according to the welfare level of households. The welfare quintiles are based on an index of wealth estimated through factorial analysis, as often done in the absence of data on consumption. The quintiles are based on an index of wealth estimated through factorial analysis, as often done in the absence of good data on consumption. There are clear differences between countries in perceptions, as expected. In Syria, virtually all households declare that most of the changed in weather patterns

Table 4.1 Perceptions of Climate Change and Environmental Conditions

Percent

	Country					Assets Quintiles					
	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*All*
Changes reported by a majority of households											
Rain more erratic	81.7	43.6	91.1	99.6	71.6	76.8	74.4	78.0	79.8	78.6	77.5
Temperature is hotter	82.9	40.6	69.8	100.0	68.5	66.6	68.5	67.5	79.1	79.7	72.4
Less Rain	81.8	20.5	48.9	100.0	81.6	62.3	57.8	61.6	72.8	77.7	66.6
Land is dryer	64.5	13.8	73.0	98.3	74.6	63.4	65.5	65.1	65.0	65.2	64.8
Less fertile land	53.0	12.4	79.7	94.6	71.5	67.8	64.3	60.0	60.2	59.0	62.2
Rainy season starts later	51.9	12.1	71.4	100.0	67.2	46.4	58.6	62.3	66.0	69.1	60.5
Rain season is shorter	55.5	13.3	64.6	100.0	67.8	47.4	53.5	60.2	68.2	71.4	60.2
More frequent droughts	56.2	16.5	59.3	100.0	63.4	62.7	63.8	63.1	53.8	52.6	59.1
More diseases in animal and livestock	52.2	23.4	58.9	91.8	61.1	63.7	63.3	55.3	55.7	49.3	57.5
More insects and pets in crops	38.5	18.5	71.4	92.4	60.8	52.1	54.5	55.0	61.9	57.8	56.3
Less water in boreholes, rivers, lakes, or streams	50.1	11.4	64.6	90.0	64.4	47.5	52.5	59.3	62.9	58.3	56.1
More air pollution	36.1	23.3	71.2	83.0	64.4	55.8	57.0	57.2	51.9	56.2	55.6
More frequent crop failure	41.7	21.0	65.9	87.0	61.2	62.8	59.2	59.9	50.6	44.9	55.4
Rainy season end earlier	39.2	15.1	54.3	99.8	61.6	47.8	51.3	62.2	55.1	53.8	54.0
More frequent livestock loss	47.6	17.5	56.1	88.1	53.0	63.3	55.7	53.9	49.8	40.1	52.5
More soil erosion	29.6	12.6	75.3	91.1	53.5	48.8	53.9	58.8	51.5	49.5	52.4
Changes reported by a minority of households											
More frequent sandstorms	50.7	10.3	36.7	99.5	45.8	51.2	51.0	54.5	44.7	42.0	48.6
Temperature is colder	54.1	27.8	34.5	73.8	42.8	40.9	44.4	42.5	52.7	52.0	46.6
More water pollution in rivers, lakes, sea, or steams	20.1	18.8	65.5	47.0	41.7	34.4	41.2	48.0	38.0	32.0	38.6
Deforestation and less trees	39.6	13.0	37.3	68.6	34.3	52.0	45.2	41.2	29.6	25.4	38.6
Less fish is rivers, lakes, or sea	1.2	12.4	38.5	36.0	35.1	24.2	26.0	27.2	26.0	20.0	24.7
More frequent rainstorms	21.2	9.8	59.4	0.1	16.9	25.8	28.3	25.2	16.6	12.0	21.5
More rain	15.1	20.8	52.0	0.0	17.5	23.6	27.5	28.5	15.3	11.1	21.1
More frequent floods	17.8	3.5	58.2	0.0	7.6	21.1	22.4	23.6	12.1	8.5	17.4

Source: World Bank data.

and in the environment are occurring. In Egypt by contrast, none of the changes is reported by a majority of households, with the most frequent change reported being that of rain being more erratic by 43.6 percent of households. The other three countries fall somewhere in between, with some changes reported more in some countries and others in others. Of course, these data are not representative of the countries as a whole, but only of the two areas sampled in each of the countries. Still, there is clear evidence that in most areas—with the exception of Egypt, households do perceive negative changes in weather patterns and the environment to take place. By contrast, differences in perceptions by quintiles of well-being are smaller, also as expected, given that within areas all households should broadly notice the same changes in climate and the environment, even if the impact of these changes may not be the same for all households.

While table 4.1 provides detailed data on various dimensions of autonomy identified in the screening card, it is also useful to come up with summary measures or indices of autonomy. These are obtained through multiple correspondence analysis (MCA), a technique used for analyzing the relationship between variables taking categorical values. This type of analysis is often used to uncover the main underlying factors that capture the variance in a data set, typically with visualization along two or three dimensions. Here, we are using the techniques to obtain aggregate indices of the changes in perceptions regarding changes in weather patterns and the environment. By construction the indices constructed through the MCA are defined in such a way that they explain a share of the variance in the underlying variables as large possible. In implementing the MCA, we relied on the subset of variables related to the perceptions of weather patterns and the environment for which at least 5 percent of the sample responded in the affirmative, so as to reduce potential noise in the data. Given that for most changes in weather patterns and the environment more than 5 percent of household declare that these changes are actually occurring, this procedure does not affect the results too much.

The results for the first two factors of the MCA are presented in tables 4.2 and 4.3. In each table, the original variables are ranked according to their contribution to each of the two factors, by descending order of contribution. For example in table 4.2 the three variables contributing the most to the first factor are "Land is dryer-No" and "Less Fertile Land –No", and "Rainy season starts later-No". By contrast, in table 4.3, the variables contributing the most to the second factor are "More Rain-Yes", "More frequent floods-Yes," and More frequent rainstorms-Yes". The first factor explains a very large share (88.3 percent) of the inertia or variance in the data included in the MCA, with the second factor explaining an additional 6.0 percent of the inertia. Given that these two factors explain most of the inertia in the original variables, we will use only these two factors in the subsequent analysis.

Consider first table 4.2. In order to understand intuitively what the first factor represents, it is necessary to look at both the contribution of each variable and modality to the factor, and the sign and value of the coordinates for the variables. The first 12 largest contributors are all indicators of good climatic conditions in that there is no deterioration in these variables—land is not dryer nor is it less

Table 4.2 Results from Multiple Correspondence Analysis—First Factor

Categories	*Mass*	*Quality*	*% inertia*	*Coordinate*	*Sq. corr. coefficient*	*Contribution*
Land is dryer-No	0.014	0.959	0.039	1.714	0.954	0.043
Less fertile land-No	0.016	0.959	0.036	1.58	0.959	0.039
Rainy season starts later-No	0.016	0.942	0.033	1.44	0.92	0.034
More Insect and pets in crops-No	0.019	0.951	0.032	1.355	0.942	0.034
More frequent drought-No	0.017	0.963	0.03	1.389	0.96	0.033
Rain season is shorter-No	0.017	0.93	0.033	1.407	0.881	0.033
More soil erosion-No	0.02	0.958	0.031	1.303	0.946	0.033
Less water in boreholes, rivers, etc.-No	0.019	0.96	0.029	1.309	0.96	0.032
More diseases in animal/livestock-No	0.018	0.949	0.03	1.327	0.942	0.032
More frequent livestock loss-No	0.02	0.936	0.029	1.246	0.921	0.031
More frequent crop failure-No	0.018	0.955	0.028	1.274	0.928	0.03
More air pollution-No	0.018	0.969	0.028	1.28	0.955	0.03
More soil erosion-Yes	0.022	0.958	0.028	−1.159	0.946	0.03
More frequent livestock loss-Yes	0.022	0.936	0.026	−1.123	0.921	0.028
Rainy season ends earlier-No	0.019	0.971	0.025	1.172	0.956	0.027
More Insect and pets in crops-Yes	0.023	0.951	0.026	−1.089	0.942	0.027
Less water in boreholes, etc.-Yes	0.023	0.96	0.023	−1.051	0.96	0.026
Temperature is hotter-No	0.012	0.966	0.024	1.467	0.912	0.025
Rain more erratic-No	0.01	0.954	0.023	1.601	0.953	0.024
Less rain-No	0.014	0.91	0.03	1.309	0.729	0.024
Less fertile land-Yes	0.026	0.959	0.022	−0.968	0.959	0.024
More diseases in animal/livestock-Yes	0.024	0.949	0.022	−1.001	0.942	0.024
More frequent drought-Yes	0.025	0.963	0.021	−0.959	0.96	0.023
More frequent sandstorms-Yes	0.02	0.969	0.021	−1.069	0.962	0.023
Rainy season ends earlier-Yes	0.022	0.971	0.021	−1.014	0.956	0.023
More frequent crop failure-Yes	0.023	0.955	0.022	−0.998	0.928	0.023
More air pollution-Yes	0.023	0.969	0.022	−1.003	0.955	0.023
Land is dryer-Yes	0.027	0.959	0.021	−0.913	0.954	0.023
More frequent sandstorms-No	0.021	0.969	0.02	1.018	0.962	0.022
Rain season is shorter-Yes	0.025	0.93	0.022	−0.938	0.881	0.022
Rainy season starts later-Yes	0.025	0.942	0.021	−0.933	0.92	0.022
Deforestation and less trees-Yes	0.016	0.938	0.02	−1.135	0.925	0.021
More water pollution in rivers, etc.-Yes	0.016	0.929	0.023	−1.141	0.819	0.021
Less fish is rivers, lakes, or sea-Yes	0.01	0.941	0.02	−1.348	0.835	0.019
Less rain-Yes	0.027	0.91	0.015	−0.68	0.729	0.013
Deforestation and less trees-No	0.025	0.938	0.013	0.725	0.925	0.013
More water pollution in rivers, etc.-No	0.026	0.929	0.014	0.721	0.819	0.013
Temperature is hotter-Yes	0.03	0.966	0.009	−0.566	0.912	0.01
Rain more erratic-Yes	0.032	0.954	0.007	−0.473	0.953	0.007
Less fish is rivers, lakes, or sea-No	0.031	0.941	0.006	0.442	0.835	0.006
Temperature is colder-No	0.023	0.899	0.004	0.41	0.898	0.004
Temperature is colder-Yes	0.019	0.899	0.004	−0.483	0.898	0.004
More rain-Yes	0.009	0.766	0.014	0.375	0.078	0.001
More frequent rainstorms-Yes	0.009	0.787	0.011	−0.323	0.076	0.001
More rain-No	0.033	0.766	0.004	−0.103	0.078	0
More frequent floods-No	0.034	0.778	0.002	0.032	0.013	0
More frequent floods-Yes	0.008	0.778	0.011	−0.147	0.013	0
More frequent rainstorms-No	0.033	0.787	0.003	0.091	0.076	0

Source: World Bank data.

fertile; the rainy season does not start later, nor is it shorter; droughts are not more frequent, and insects and pests in crops are not increasing, and so on. The coordinates for all those variables are positive, so that when these modalities are observed in the data, the first factor takes on a larger value. The next set of contributors include many variables that take a positive value—yes, there is more soil erosion and livestock losses, as well as more insects and pests in crops. There is also less water in boreholes, the rain is more erratic, the land is less fertile, droughts are more frequent, and so on. For these modalities, the coordinates are negative, suggesting that these modalities reduce the value assigned to the first factor. Overall, a higher value for the first factor thus suggests good weather conditions especially in terms of rainfall and its implications for land fertility, while a lower value suggests that negative structural changes are occurring, with less rain, more droughts, and thereby poorer agricultural conditions.

Consider next table 4.3. The variables and modalities with the largest contributions to that factor are very different. More rain as well as more frequent floods and rainstorms are the first three contributors, and they have positive coordinates. Negative answers to questions about the frequency of rainstorms and floods as well as the amount of rain are also important contributors, but with negative coordinates. This second factor seems to capture the presence of excess water, especially through floods and rainstorms, which tend to be sudden events, as opposed to more structural conditions. While a larger positive value for the first factor denotes good conditions, a larger positive value for the second factor is associated with excess water, which is a negative.

In order to facilitate the interpretation of the econometric analysis in section four, we will use the two factors of the MCA, but with two transformations. First, we will consider the negative value of the first factor as our first summary climate variable. This means that a larger positive value for the first factor will denote worse structural conditions in terms of climate (higher temperatures, reduced land fertility, more droughts and erratic rainfall, and so on). With that first transformation, larger positive values for both factors will denote worsening climate and environmental conditions. Second, we will normalize the two factors so that they both take a value between zero and one (this is done by redefining each factor as its value minus the minimum value, and dividing the result by the difference between the maximum and minimum values). Thus, a value close to zero will imply that the conditions are among the best in the sample, while a value close to one will denote some of the worst conditions in the sample. For ease of interpretation, and even though this does not capture all of what the two factors represent, we will denote the two factors as respectively "Dryer/Warmer Weather" and "Excess Rain." The question will be whether these two factors are closely associated with losses for households.

Impact on Households

Having described the perceptions of households about changing weather patterns and their environment, we now turn to the question of whether households

Table 4.3 Results from Multiple Correspondence Analysis—Second Factor

Categories	*Mass*	*Quality*	*% inertia*	*Coordinate*	*Sq. corr. coefficient*	*Contribution*
More rain-Yes	0.009	0.766	0.014	4.272	0.688	0.164
More frequent floods-Yes	0.008	0.778	0.011	4.317	0.765	0.141
More frequent rainstorms-Yes	0.009	0.787	0.011	3.785	0.71	0.131
Less rain-No	0.014	0.91	0.03	2.51	0.181	0.09
Less rain-Yes	0.027	0.91	0.015	–1.302	0.181	0.047
More rain-No	0.033	0.766	0.004	–1.172	0.688	0.045
More water pollution in rivers, etc.-Yes	0.016	0.929	0.023	1.607	0.11	0.042
More frequent rainstorms-No	0.033	0.787	0.003	–1.066	0.71	0.037
Less fish is rivers, lakes, or sea-Yes	0.01	0.941	0.02	1.843	0.106	0.035
More frequent floods-No	0.034	0.778	0.002	–0.956	0.765	0.031
Rain season is shorter-No	0.017	0.93	0.033	1.268	0.048	0.027
More water pollution in rivers, etc.-No	0.026	0.929	0.014	–1.016	0.11	0.026
Temperature is hotter-No	0.012	0.966	0.024	1.375	0.054	0.022
Rainy season is shorter-Yes	0.025	0.93	0.022	–0.845	0.048	0.018
More frequent crop failure-No	0.018	0.955	0.028	–0.832	0.027	0.013
Rainy season starts later-No	0.016	0.942	0.033	0.845	0.021	0.012
Less fish is rivers, lakes, or sea-No	0.031	0.941	0.006	–0.605	0.106	0.011
More frequent crop failure-Yes	0.023	0.955	0.022	0.652	0.027	0.01
Rainy season starts later-Yes	0.025	0.942	0.021	–0.547	0.021	0.008
Temperature is hotter-Yes	0.03	0.966	0.009	–0.531	0.054	0.008
More frequent livestock loss-No	0.02	0.936	0.029	–0.615	0.015	0.007
More frequent livestock loss-Yes	0.022	0.936	0.026	0.555	0.015	0.007
Rainy season ends earlier-No	0.019	0.971	0.025	0.565	0.015	0.006
More air pollution-No	0.018	0.969	0.028	–0.592	0.014	0.006
More soil erosion-No	0.02	0.958	0.031	–0.571	0.012	0.006
More soil erosion-Yes	0.022	0.958	0.028	0.508	0.012	0.006
Rainy season ends earlier-Yes	0.022	0.971	0.021	–0.488	0.015	0.005
Deforestation and less trees-Yes	0.016	0.938	0.02	0.528	0.014	0.005
More air pollution-Yes	0.023	0.969	0.022	0.464	0.014	0.005
More insect and pets in crops-No	0.019	0.951	0.032	–0.511	0.009	0.005
More insect and pets in crops-Yes	0.023	0.951	0.026	0.411	0.009	0.004
More diseases in animal/livestock-No	0.018	0.949	0.03	–0.453	0.007	0.004
Deforestation and less trees-No	0.025	0.938	0.013	–0.338	0.014	0.003
Land is dryer-No	0.014	0.959	0.039	0.46	0.005	0.003
More diseases in animal/livestock-Yes	0.024	0.949	0.022	0.341	0.007	0.003
More frequent sandstorms-No	0.021	0.969	0.02	0.313	0.006	0.002
More frequent sandstorms-Yes	0.02	0.969	0.021	–0.329	0.006	0.002
Land is dryer-Yes	0.027	0.959	0.021	–0.245	0.005	0.002
More frequent drought-No	0.017	0.963	0.03	0.286	0.003	0.001
More frequent drought-Yes	0.025	0.963	0.021	–0.197	0.003	0.001
Rain more erratic-No	0.01	0.954	0.023	0.119	0	0
Rain more erratic-Yes	0.032	0.954	0.007	–0.035	0	0
Temperature is colder-No	0.023	0.899	0.004	0.054	0.001	0
Temperature is colder-Yes	0.019	0.899	0.004	–0.064	0.001	0
Less water in boreholes, rivers, etc.-No	0.019	0.96	0.029	–0.013	0	0
Less water in boreholes, rivers, etc.-Yes	0.023	0.96	0.023	0.011	0	0
Less fertile land –No	0.016	0.959	0.036	0.061	0	0
Less fertile land –Yes	0.026	0.959	0.022	–0.037	0	0

Source: World Bank data.

declare having been affected by specific extreme weather events, and in that case which events had the largest impact on them. The data can also be used to assess whether households suffered from specific losses due to such events. As shown in table 4.4, when asked if they have been affected by a weather-related disaster in the last five years, almost all households say that this is indeed the case, except in the case of Egypt where the proportion is smaller, but still high at 70.75 percent.

When asked which adverse event had the largest negative consequences for them, households cited droughts first (30.9 percent of the overall sample), followed by excessive heat (which can be associated with droughts) and floods, both affecting about 8 percent of households. These two factors—droughts and

Table 4.4 Reported Incidence of Extreme Weather Events and their Impact
Percent

	Country					
	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*All*
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 adverse impact	41.93	77.13	33.21	—	60.68	42.57
	Quintiles					
	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*All*
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 adverse impact	37.31	32.61	31.52	52.54	57.84	42.57

Source: World Bank data.
Note: — = not available.

excessive heat on the one hand and floods on the other hand—are closely related to the two factors that were obtained from the MCA in the previous section, although the MCA factors tend to capture a broader range of phenomena, including some of the consequences of changes in weather patterns, for example in terms of land fertility. Note that there are differences between countries in table 4.4. In Syria, all households declare having been affected by droughts, which are also considered as the most damaging adverse event. In Morocco by contrast, floods were the main adverse event affecting households. There are also some differences between households according to their quintile of wealth, but these are less pronounced. For example, the data suggest that households in the poorer quintiles are more likely to identify the adverse events that affected them the most, probably because they are more vulnerable to such events.

The fact that the poor are more likely to suffer from changes in weather patterns and the environment is confirmed by households' responses to the other question about the effect of these changes on them. As mentioned in section two, 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 (the surveys do not provide data on the magnitude of the losses; they only inform us as to whether losses occurred). Table 4.5 summarizes the responses. More than half of all respondents said that changes in weather patterns and the environment 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 (this would be observed only for those households whose livelihood depend on fishing). 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. Yet as expected, households belonging to lower quintiles of well-being were more likely than better-off households to declare having suffered from the various types of losses.

Table 4.5 Economic Impacts of Environmental Change
Percent

	Country					
	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*All*
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					
	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*All*
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: World Bank data.

Do these results on the differentiated impact of adverse weather events on households depending on their welfare level still hold when conducting multiple regression analysis? The answer to this question is provided in table 4.6 which displays the results of standard probit regressions on whether households declare having lost income, crops, livestock/cattle, or caught less fish. The marginal effects estimated at the mean of the sample are displayed, and the levels of statistical significance are based on robust standard errors. Many of the variables included in the regression have statistically significant impacts on the probability of losses. There are differences between countries in the likelihood of losses as well as the types of losses incurred, which is not surprising, given the differences in the local economies in the various areas. For example, losses in crops are most likely in the Republic of Yemen, which is also the country with the largest share of GDP accounted for by agriculture, while losses in income are most likely in Syria, which is the country in which more households reported adverse events.

As expected, the two climatic conditions factors have statistically significant impacts on the likelihood of losses. The impacts are large. Recalling that the climatic factors are normalized to take a value between zero and one, going from the best conditions (value of zero) to the worst conditions (value of one) in the sample for the first factor related mostly to droughts as well as dryer and warmer weather increases the probability of losses by 42.4 percent for crops, 45.8 percent for income, 31.0 percent for livestock or cattle, and 10.8 percent for fishing. For the second factor, which is related mostly to floods and excess water, the impacts of going from best to worst conditions are of a similar order of magnitude, at 42.7 percent for crops (the same order of magnitude as that observed for the first factor), 27.6 percent for income, 34.3 percent for livestock or cattle, and 15.1 percent for fishing. Thus, even if the occurrence of adverse events and environmental conditions related to the first factor are more frequent than those related to the second factor, once those conditions come into play, both types of changes in weather patterns and environmental conditions have large negative effects on the livelihoods of households.

Also as expected, the probability of a loss is higher in many cases for poorer households. This is clear for crop and income losses, where in both cases households in the bottom three quintiles of wealth tend to have an increase in the probability of a loss of about 10 percentage points as compared to households in the top quintile of wealth. On the other hand, losses in livestock and cattle as well as in fishing are highest in the fourth quintile of well-being, possibly because those households are more likely to be involved in these activities which tend to require more assets, while households in the top quintile tend not to be working much in agriculture. It could of course be that part of the relationship between welfare levels and losses associated with adverse weather events is due to an endogeneity issue, in that the lower level of wealth observed for the households who suffered from a loss may reflect the loss itself. Yet because of the way the questions are asked over a five-year period, and because welfare is measured through assets as opposed to income, it is likely that the correlations also reflect

Table 4.6 Correlates of Probability of Various Losses Due to Adverse Events (dF/dX)

	Loss of crops	*Loss of income*	*Loss of livestock or cattle*	*Less fish caught*
Country (ref. = Syria)				
Algeria	0.293***	–0.344***	0.171***	—
Egypt, Arab Rep.	0.119*	–0.344***	0.021	0.070
Morocco	0.138***	–0.549***	0.104***	0.134***
Yemen, Rep.	0.482***	–0.143***	0.445***	0.473***
Climatic conditions				
Factor 1: Dryer/warmer weather	0.428***	0.458***	0.310***	0.108***
Factor 2: Excess water	0.427***	0.276***	0.343***	0.151***
Quintiles (ref. = Q5)				
Q1	0.104**	0.069*	–0.035	0.022
Q2	0.088**	0.118***	–0.022	0.009
Q3	0.134***	0.110***	0.049	0.011
Q4	0.041	0.059	0.053*	0.046**
Household size (ref. = Less than four)				
From 5 to 8	0.013	–0.000	–0.000	0.001
More than 8	0.029	–0.009	0.112***	–0.017*
Land status (ref. = Other)				
Landowners	0.424***	0.218***	0.167***	0.080***
Land tenants	0.347***	0.070	0.059	0.051*
Head age (ref. = 50+ years)				
Below 30	–0.105**	–0.133***	–0.052	–0.024***
30–39	–0.037	–0.122***	0.060**	–0.017**
40–49	–0.017	–0.111***	0.029	–0.014**
Head gender (ref. = Female)				
Male	0.110	–0.077	–0.060	–0.072
Head marital status (ref. = Other)				
Single	0.147	0.221**	0.279**	0.098
Married	0.090	0.108	0.059	0.020*
Head education (ref. = Below primary)				
Primary	0.058*	0.014	0.037	0.006
Preparatory	–0.046	–0.059	–0.005	0.019
Secondary	–0.091**	–0.112***	–0.043	–0.015*
Above Secondary	–0.053	–0.134**	–0.056*	–0.010
Head public employee (ref. = no)				
Head is public employee	0.038	0.035	-0.007	0.008
Head occupation (ref. = Salaried)				
Self-employed farmer	0.224***	0.251***	0.045	–0.024***
Nonagric self-employed	–0.048	0.064	0.004	–0.008
Other employer	0.111**	0.206***	0.022	0.009
Servant/unqualified	0.034	0.136***	0.048	0.013
Other	–0.014	0.123**	0.044	0.028
Agriculture/fisheries/pastoral activities	0.075	0.182***	0.155***	0.006
Number of observations	3,009	3,009	3,009	2,302

Source: World Bank data.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

simply a higher propensity of low-income households to be more exposed to such losses due to their occupations.

The relationship between occupation and losses actually comes out strongly as well in the regression. First, households who own land (and probably cultivate it), and to some extent households who are land tenants, both tend to have a higher probability of losses related to adverse weather events. A similar pattern is observed in terms of the types of occupation of the household head, with the highest marginal impact on the likelihood of losses for crops and incomes observed among the self-employed in agriculture, in comparison to the reference category of the salaried. Those households who have better jobs as salaried worker, as well as households whose heads have higher levels of education, tend to be the least likely to suffer from crop, income, livestock/cattle, or fishing losses related to adverse weather events.

All of these results make sense, and the regressions simply display basic facts that are somewhat obvious—namely that households that tend to be poorer as well as those who rely on agriculture and livestock as well as fishing for their livelihoods are the most exposed to losses related to changes in weather patterns and environmental conditions. The other variables in the regressions—such as the household size and the gender of the household head, do not have statistically significant impacts on the likelihood of losses. But two more variables display statistically significant correlations. First, in several instances households with younger household heads tend to be less affected by adverse weather shocks, perhaps because they tend to be less employed in traditional agricultural activities than households with older heads, with these effects being only partially controlled for in the regression through the other independent variables. At the same time however, those who are single are more likely to suffer an income or livestock loss, perhaps at least in the first case because they are also more likely to be involved in casual labor that is less required when crops are destroyed by droughts or floods.

Conclusion

The goal of this chapter was to contribute to a better understanding of perceptions of climate change and environmental degradation, as well as extreme weather events and their impact on households in the MENA region. The analysis was based on household surveys implemented in five countries, with a focus in each country on two areas more susceptible to be affected by adverse weather shocks. The data suggest that a substantial majority of households do perceive important changes in the climate and their environment. Some of the most commonly reported changes include more erratic rain, higher temperatures, less rain, dryer and less fertile land, and more frequent droughts. In some areas by contrast, excess rain is the issue, especially when it leads to floods. As expected, these household perceptions of changes in weather patterns and the environment are strongly correlated with the likelihood that households declare having suffered from various types of losses in livelihood due to adverse climatic events.

Also as expected, the data suggest that households involved in agriculture, and especially the poor as measured through indices of wealth, are most likely to suffer from losses in crops and income, the two most frequently cited types of losses associated with adverse weather events. By contrast, households who tend to be more protected through a better education and salaried employment are much less likely to suffer from the negative effects of perceived climate change and adverse weather shocks. While none of those results are in themselves surprising, they help to set the stage for subsequent chapters devoted to an analysis of how households cope with these changes, first through migration, and then through other coping and adaptation mechanisms.

Annex 4A: Distribution of Perceptions by Quintiles of the MCA's First Factor

Table 4A.1 Distribution of Perceptions by Quintiles of the MCA's First Factor
Percent

		Quintiles of the First Factors				
		Q1	*Q2*	*Q3*	*Q4*	*Q5*
Rain more erratic	No	58.10	28.18	17.27	5.47	4.89
	Yes	41.90	71.82	82.73	94.53	95.11
Less rain	No	80.92	34.54	30.04	19.65	5.52
	Yes	19.08	65.46	69.96	80.35	94.48
More rain	No	75.31	75.19	70.96	78.36	92.60
	Yes	24.69	24.81	29.04	21.64	7.40
More frequent drought	No	88.03	63.34	35.29	11.07	6.27
	Yes	11.97	36.66	64.71	88.93	93.73
More frequent floods	No	92.52	77.56	73.34	74.63	91.34
	Yes	7.48	22.44	26.66	25.37	8.66
More frequent rainstorms	No	92.52	77.68	67.08	69.40	83.44
	Yes	7.48	22.32	32.92	30.60	16.56
More frequent sandstorms	No	91.90	69.20	57.70	26.62	10.54
	Yes	8.10	30.80	42.30	73.38	89.46
Rainy season is shorter	No	91.52	45.76	42.30	16.17	4.02
	Yes	8.48	54.24	57.70	83.83	95.98
Rainy season starts later	No	92.27	46.01	35.17	17.41	5.52
	Yes	7.73	53.99	64.83	82.59	94.48
Rainy season ends earlier	No	89.90	59.60	46.93	28.48	6.78
	Yes	10.10	40.40	53.07	71.52	93.22
Temperature is hotter	No	68.70	29.80	24.41	13.31	2.89
	Yes	31.30	70.20	75.59	86.69	97.11
Temperature is colder	No	74.19	53.87	55.19	53.36	33.75
	Yes	25.81	46.13	44.81	46.64	66.25
Deforestation and less trees	No	95.76	83.54	60.70	46.02	18.82
	Yes	4.24	16.46	39.30	53.98	81.18
More frequent livestock loss	No	96.13	74.44	47.18	13.93	5.14
	Yes	3.87	25.56	52.82	86.07	94.86
More frequent crop failure	No	90.27	65.71	41.55	19.65	2.26

table continues next page

Table 4A.1 Distribution of Perceptions by Quintiles of the MCA's First Factor *(continued)*
Percent

		Quintiles of the First Factors				
		Q1	*Q2*	*Q3*	*Q4*	*Q5*
	Yes	9.73	34.29	58.45	80.35	97.74
Less fish is rivers, lakes, or sea	No	97.88	88.53	77.10	71.02	41.78
	Yes	2.12	11.47	22.90	28.98	58.22
More air pollution	No	94.26	57.86	42.05	19.40	5.90
	Yes	5.74	42.14	57.95	80.60	94.10
More water pollution in rivers, lakes, sea or steams	No	97.26	77.68	57.07	58.08	15.93
	Yes	2.74	22.32	42.93	41.92	84.07
Less water in boreholes, rivers, lakes, or streams	No	94.14	62.34	37.17	26.00	2.76
	Yes	5.86	37.66	62.83	74.00	97.24
Land is dryer	No	93.27	51.00	20.03	8.58	0.75
	Yes	6.73	49.00	79.97	91.42	99.25
Less fertile land	No	97.01	52.99	26.16	12.06	1.51
	Yes	2.99	47.01	73.84	87.94	98.49
More soil erosion	No	97.88	69.70	43.18	21.02	3.39
	Yes	2.12	30.30	56.82	78.98	96.61
More insect and pets in crops	No	95.76	64.84	36.42	21.89	3.64
	Yes	4.24	35.16	63.58	78.11	96.36
More diseases in animal and livestock	No	92.39	66.46	34.04	14.80	7.03
	Yes	7.61	33.54	65.96	85.20	92.97

Source: World Bank data.

Bibliography

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Burger, N., B. Ghosh-Dastidar, A. Grant, T. Ruder, O. Tchakeva, and Q. Wodon. 2014. "Data Collection." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 3 in this study.

Elasha, B. O. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

Foresight. 2011. *Migration and Global Environmental Change,* London: The Government Office for Science.

IPCC (Intergovernmental Panel on Climate Change). 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate* Change, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, and G.-K. P. K. J. Mach, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge, UK, and New York, NY: Cambridge University Press.

McSweeney, C., M. New, and G. Lizcano. 2009. "UNDP Climate Change Profiles: Documentation." Mimeo, United Nations Development Program, New York.

Sowers, J., and E. Weinthal. 2010. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Belfer Center for Science and International Affairs, Cambridge, MA.

United Nations Development Programme and Arab Fund for Economic and Social Development. 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Verner, D., ed. 2012. *Adaptation to a Changing Climate in the Arab Countries*. Directions in Development. Washington, DC: World Bank.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2007. *World Bank Development Report 2008. Agriculture for Development*. World Washington, DC: World Bank.

———. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

CHAPTER 5

Weather Shocks, Impacts, and Households' Ability to Recover in Morocco

Minh Cong Nguyen and Quentin Wodon

What is the likelihood that Moroccan households, and especially those involved in agriculture, may be confronted with extreme weather events such as droughts and floods? Who suffers the most from such events when they occur? To what extent are different types of households able to recover from such shocks? This chapter provides answers to these questions on the basis of questions on weather shocks added to a nationally representative household survey implemented in Morocco in 2009–10. The data suggest that most households working in agriculture are affected by weather shocks, often seriously. In the population as a whole, the proportion of households affected is about one fourth. A majority of households declare not being able to recover much from weather shocks, as well as other shocks. But in comparison to other shocks, including unexpected increases in the prices of food and other basic essential commodities, households are slightly more likely to be able to recover from weather shocks.

Introduction

Climate change is expected to result in an increase in global temperatures by 3°C to 5°C in this century, as well as in a reduction in rainfall and greater seasonal temperature and rainfall variability in many areas. Higher sea levels are also a threat to many areas, including in the MENA region where a large share of its population is located in low-lying areas. With agriculture remaining essential for livelihood in the region, and existing conditions in terms of water scarcity being already precarious in many areas, climate change represents a significant concern for households. Expectations are that extreme weather events such as floods and droughts are likely to become more frequent, which has implications for coping and adaptation mechanisms (for example, Elasha 2010; IPCC 2012; UNDP 2009; McSweeney, New, and Lizcano 2009; Verner 2012; World Bank 2010). For a brief review of the literature which informs this chapter, see the introduction

of chapter 1 by Wodon et al. (2014) and chapter 2 on the five countries of focus for this work by Burger et al. (2014a), both in this study.

In the case of Morocco, periodic droughts have now become the norm rather than the exception. These droughts tend to have substantial effects on households involved in agriculture in part because irrigated land is rare (Skees 2001; Swearingen and Bencherifa 2000). The evidence points to a decrease in rainfall of up to 25 percent and an increase in the frequency of droughts over the last three decades, which in turn has led to an increase in the volatility of the contribution of agriculture to GDP (Azzam and Sekkat 2005; Barakat and Handoufe 1998; Skees 2001). While farmers have developed new ways to cope with droughts and the share of households relying primarily or solely on agriculture for their livelihood has decreased (Swearingen and Bencherifa 2000), many households remain engaged in agriculture and highly vulnerable to droughts, especially among the rural poor.

This chapter provides a new assessment of the extent to which households are subject to extreme weather shocks in Morocco, who suffers the most from these shocks, and whether households are able to recover from the shocks. The analysis is based primarily on perceptions, with households assessing subjectively the extent to which they are affected by weather shocks as well as their ability to recover from these shocks. The data come from a recent nationally representative household survey data collected in Morocco in 2009/10. The main objective of the survey was to collect data on youth employment and civic engagement, but questions were added to the survey for this study on climate change both to assess to what extent households were affected by extreme weather events and to be able to compare their ability to recover from those shocks as opposed to other shocks.

The data suggest that virtually all households working in agriculture are affected by weather shocks, often seriously. In the population as a whole, the proportion of households affected by weather shocks is about one fourth, simply because this is also roughly the proportion of those involved in agriculture, with other households less likely to be affected. A majority of households declare not being able to recover much from weather shocks, as well as a range of other shocks, and this is especially the case for poorer households. But in comparison to other shocks, including unexpected increases in the prices of food and other basic essential commodities, households are slightly more likely to be able to recover from weather shocks.

These findings confirm, as was already observed in the analysis of chapter 4 (Adoho and Wodon, 2014), that the poor tend to be most affected by extreme weather events that are likely to become more frequent with climate change, while they also have fewer means to cope with such events or recover from them. The chapter is organized as follows. Section two introduces the data used for the analysis. Section three provides basic statistics on the extent to which households are affected by weather and other shocks, and whether they are able to recover from the shocks. Section four provides a multivariate analysis of the correlates of both the likelihood of being affected by various shocks, and the ability to recover. A brief conclusion follows.

Data

This chapter is based on data from the Morocco Household and Youth Survey (MHYS) implemented in 2009/10. The survey is nationally representative (even if it does not include the scarcely populated Western Sahara southern part of the country) and includes data on 2,000 households (1,216 in urban areas and 784 in rural areas). The survey was implemented with funding from the World Bank between December 2009 and March 2010. Much of the questionnaire focused on issues critical to youth, and especially the obstacles that they encounter on the labor market and for civic participation. Questions were also asked about young people's intentions to emigrate. Other more traditional modules deal with standard questions on household member demographics and education as well as employment information. The questionnaire also focused on various shocks affecting households and their ability to cope with these shocks. In order to be able to use the survey also for this work on migration in the MENA region, additional questions as well as options within existing questions were asked at the design stage of the survey on household perceptions regarding changes in climate, and whether this affected migration decisions. While the survey also included a separate instrument administered to most young individuals in the surveyed households, that part of the survey is not used here.

Apart from a range of household and individual characteristics which are used as controls in the regression analysis, a few central questions are used for the analysis presented in this chapter. In section 6B of the questionnaire devoted to climate change and shocks in agriculture, households are asked the following question: *"Is one of the members of household involved in agriculture or agriculture related activities?"* For those households involved in agriculture, the following question was then asked: *"Over the last five years has your household faced the following problems?"* The list of problems identified was as follows: (1) Reduction in agricultural yields due to inadequate rainfall (periodic and recurrent water scarcity due to droughts); (2) Reduction in agricultural yields due to too much water (too much rain or flooding); (3) Poor soil quality due to erosion reducing agricultural yields; (4) Changing and unpredictable climate and temperatures reducing agricultural yields (that is too hot, too cold, too rainy, too dry); (5) Pest or locust infestation reducing agricultural yields; (6) Reduced job opportunities in the agricultural sector; (7) Death of livestock due to bad weather conditions; (8) Reduction in the stock of livestock since the availability of grazing land is becoming less due to droughts and floods. Next households were asked: "How serious was the financial loss to the household due to these climate related factors listed above?" The potential answers were very serious, moderate, serious, and negligible. Finally households were asked "Was (the household) forced to change the economic activity after the shock?"

In section 6A about the incidence of shocks and household responses, households are asked whether since November 2004, the respondent or a member of the household experienced various shocks. The shocks listed are as follows: (1) Weather shocks (droughts; floods; pest infestation, crop and livestock diseases); (2) Unexpected increase in prices of food or other essential commodities

consumed; (3) Unexpected loss of job; (4) Involuntary reduction in employment or the number of hours worked; (5) Unexpected decline in prices or demand for products that you sell; (6) Unexpected increase in prices or shortages of inputs or products needed for your activity; (7) Loss of asset or of livestock due to theft, death, or accident; (8) Cut-off or decrease in remittances to household; (9) Death of main earner for the household; (10) Death of another member of the family; (11) Serious injury or illness that kept any member from doing normal activities; (12) Divorce or abandonment by husband; (13) Big amount of dowry for daughter's marriage; (14) Other (specify). For every shock that they were faced with, households are then asked "Have you managed to recovered from the negative consequences of this shock?" The possible answers were not at all, not much but some, much but not completely, or completely.

Basic Statistics

Information on the share of households involved in agriculture and affected by various climate and weather shocks is provided in table 5.1. The data are provided by type of shock, and information is also reported on the share of households that have been affected by at least one of the shocks in the last five years in the sample of households involved in agriculture, as well as in the overall sample of households. Table 5.1 suggests that 28.1 percent of households are involved in agriculture, with the proportion being as expected much higher in rural areas and in the lower wealth quintiles of the population (following standard practice, wealth quintiles were obtained using factorial analysis on a range of assets owned by households as well as dwelling characteristics). For example, in the bottom quintile of wealth, 70.7 percent of households have at least one member involved in agriculture. Among those involved in agriculture, an overwhelming majority declares having been affected by at least one climate-related shock. That proportion is at 92.1 percent, and does not vary too much according to the quintile of well-being of the household, although it is lower in the top quintile in comparison with other quintiles.

The most likely shock is a reduction in agricultural yields due to inadequate rainfall (62.2 percent of households) followed by reduced job opportunities in the agricultural sector (43.9 percent), a reduction in agricultural yields due to too much water (38.2 percent), and changing and unpredictable climate and temperatures reducing agricultural yields (34.5 percent). Other shocks affect less than a third of those involved in agriculture, but are still significant. Among those involved in agriculture, there are few differences between quintiles in terms of the likelihood to be affected by specific shocks. However, in the population as a whole, the likelihood of being affected by climate-related shocks is much higher in the bottom quintiles simply because the share of the population in those quintiles involved in agriculture is much higher, as already mentioned. For example the proportion of those affected by the various shocks listed in table 5.1 is at 65.8 in the bottom quintile nationally, versus 5.3 percent in the top quintile. As to the seriousness of the shocks, it is also similar across quintiles, or at least

Table 5.1 Weather Shocks and Impact on Agriculture

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Urban*	*Rural*	*All*
Household has a member involved in agriculture or related activities	70.69	38.82	18.20	7.04	5.30	6.15	64.00	28.07
Household faced with climate-related shock								
Reduction in agricultural yields due to inadequate rainfall	60.98	58.66	74.87	68.23	50.35	56.37	63.09	62.18
Reduction in agricultural yields due to too much water	39.89	33.38	41.82	49.74	19.15	25.43	40.17	38.17
Poor soil quality due to erosion reducing agricultural yields	22.91	21.10	21.23	19.79	16.51	15.01	22.87	21.80
Changing and unpredictable climate and temperatures reducing agricultural yields	34.84	31.43	43.86	32.10	22.89	27.34	35.64	34.51
Pest or locust infestation reducing agricultural yields	14.13	18.61	26.63	22.39	7.08	8.25	18.62	17.21
Reduced job opportunities in the agricultural sector	43.75	49.31	38.72	35.56	34.15	29.97	46.04	43.86
Death of livestock due to bad weather conditions	28.37	31.25	14.62	22.58	10.41	13.18	28.53	26.44
Reduction in stock of livestock due to lower availability of grazing land	37.55	32.52	14.62	19.12	10.61	21.78	32.73	31.24
At least one problem in the last five years (sample of households in agriculture)	93.09	88.79	95.92	97.52	81.20	86.69	92.96	92.10
At least one problem in the last five years (national sample)	65.81	34.47	17.46	6.87	4.30	5.33	59.49	25.85
Seriousness of financial loss to the household due to climate								
Negligible	20.20	24.14	24.73	37.92	18.31	28.58	21.87	22.78
Moderate	44.51	36.16	42.00	39.88	35.49	34.55	42.38	41.31
Serious	22.90	24.44	25.61	15.95	27.39	20.13	23.98	23.46
Very serious	5.48	3.47	3.58	3.77	0.00	3.43	4.55	4.40
Household forced to change the economic activity after the shock	17.38	13.38	14.79	29.39	13.64	20.42	15.84	16.46

Source: World Bank data.

there are few patterns that display clear differences by quintiles. Households in the bottom quintiles are slightly more likely to state that the shocks was very serious than is the case among other quintiles, but the differences are not very large. Much the same can be said about the probability that households were forced to change the economic activity after the shock.

As mentioned in the previous section, another question asked in the survey is about the types of shocks that have affected households. The shocks listed include not only weather shocks (as one category) but also a dozen other shocks including unexpected increases in the prices of food or other essential commodities, unexpected losses of job or involuntary reductions in employment or the number of hours worked, unexpected declines in prices or in the demand for products sold, or conversely unexpected increases in prices or shortages of inputs or products needed for the household's activity, and other shocks related to theft,

death, accidents, illnesses, or adverse family events such as divorce or abandonment and large amounts of dowry paid for a daughter's marriage. The survey asked not only whether households were affected by those shocks but also whether they have been able to recover from the shocks.

Table 5.2 provides the results regarding the share of households affected by the most important shocks (the shocks affecting less than 2 percent of households are not included in the table) and their ability to recover from those shocks. The shock that affected the largest share of the population was the increase in food and other prices, with 71.7 percent of households declaring being affected. Weather shocks came in second with 21.6 percent of the population being affected. Note that this proportion is of the same order of magnitude as the share of the population affected by climate shocks because of their involvement in agriculture in table 5.1. In table 5.1, 25.9 percent of households declared being affected, and there is a high degree of coherence in the responses to both

Table 5.2 Incidence of Shocks and Ability to Recover

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Urban*	*Rural*	*All*
(1) Increase in food/other prices	**79.29**	**74.45**	**75.34**	**72.86**	**55.05**	**68.13**	**77.64**	**71.73**
No recovery	50.39	49.05	52.53	49.44	47.59	51.19	48.19	49.96
Some recovery	36.19	34.57	32.42	27.79	21.55	27.35	36.65	31.16
Substantial recovery	11.40	15.82	11.67	19.96	17.24	16.29	13.34	15.08
Full recovery	2.02	0.55	3.38	2.81	13.63	5.17	1.82	3.79
(2) Unexpected loss of job	**13.81**	**16.16**	**15.86**	**14.23**	**11.04**	**14.96**	**13.17**	**14.28**
No recovery	52.08	55.14	53.20	56.52	46.96	57.01	46.28	53.26
Some recovery	30.65	26.61	23.74	27.14	15.58	23.92	27.92	25.32
Substantial recovery	10.58	15.58	9.80	14.18	28.84	13.20	18.01	14.88
Full recovery	6.70	2.68	13.25	2.16	8.62	5.86	7.79	6.54
(3) Weather shocks	**51.79**	**29.99**	**14.77**	**7.04**	**3.93**	**6.88**	**45.70**	**21.58**
No recovery	38.24	48.67	34.40	26.51	6.89	31.77	40.46	38.74
Some recovery	33.25	32.98	41.06	32.46	40.64	30.28	35.47	34.44
Substantial recovery	21.93	15.61	13.88	21.04	41.85	27.10	17.83	19.66
Full recovery	6.58	2.73	10.66	19.99	10.62	10.86	6.24	7.16
(4) Reduction in employment/hours worked	**18.23**	**15.73**	**15.59**	**11.31**	**6.28**	**11.37**	**17.06**	**13.53**
No recovery	54.98	47.03	49.27	46.68	38.27	47.12	50.83	48.89
Some recovery	20.85	27.73	36.70	28.20	23.45	32.17	22.76	27.67
Substantial recovery	21.48	23.58	10.42	25.11	38.28	18.48	24.76	21.48
Full recovery	2.69	1.66	3.61	0.00	0.00	2.23	1.64	1.95
(5) Serious injury or illness preventing work	**8.31**	**7.12**	**8.50**	**5.88**	**4.06**	**6.34**	**7.58**	**6.81**
No recovery	56.19	24.14	58.59	59.93	48.06	55.03	42.89	49.91
Some recovery	29.60	30.64	22.46	15.45	23.86	21.14	29.71	24.75
Substantial recovery	11.44	27.98	7.92	5.90	19.18	11.37	17.17	13.81
Full recovery	2.78	17.23	11.03	18.72	8.90	12.47	10.23	11.53

table continues next page

Table 5.2 Incidence of Shocks and Ability to Recover *(continued)*

	Q1	*Q2*	*Q3*	*Q4*	*Q5*	*Urban*	*Rural*	*All*
(6) Shortage of inputs/increase in prices	**9.87**	**6.73**	**4.93**	**3.51**	**2.80**	**3.20**	**9.48**	**5.58**
No recovery	73.32	26.09	49.45	44.95	7.50	42.81	50.62	47.84
Some recovery	15.92	28.70	36.66	16.51	37.86	31.26	21.14	24.75
Substantial recovery	10.76	39.16	13.90	30.86	42.92	15.89	28.24	23.83
Full recovery	0.00	6.06	0.00	7.69	11.72	10.03	0.00	3.58
(7) Loss of asset/livestock	**13.29**	**7.14**	**3.70**	**0.82**	**0.78**	**1.38**	**11.34**	**5.15**
No recovery	54.75	45.35	64.49	70.03	70.77	60.48	53.33	54.52
Some recovery	24.21	30.31	13.99	0.00	29.23	14.64	25.55	23.73
Substantial recovery	14.29	17.38	6.08	29.97	0.00	11.53	14.63	14.11
Full recovery	6.75	6.97	15.44	0.00	0.00	13.36	6.50	7.64
(8) Decline in prices/demand for sales	**6.53**	**5.36**	**6.75**	**2.51**	**3.72**	**4.36**	**5.94**	**4.96**
No recovery	47.76	33.98	51.16	32.60	18.53	39.41	40.83	40.06
Some recovery	31.05	21.57	44.51	41.68	52.93	43.10	29.30	36.84
Substantial recovery	21.20	32.41	4.32	25.72	28.54	14.48	27.76	20.50
Full recovery	0.00	12.03	0.00	0.00	0.00	3.01	2.10	2.60
(9) Death of other family member	**3.08**	**4.33**	**3.90**	**1.55**	**2.68**	**2.65**	**3.81**	**3.09**
No recovery	49.26	19.71	61.10	46.80	39.95	49.60	33.86	42.24
Some recovery	35.39	28.41	12.68	15.94	16.67	14.38	32.00	22.61
Substantial recovery	8.74	19.50	26.22	15.18	10.53	16.85	17.55	17.17
Full recovery	6.61	32.37	0.00	22.09	32.85	19.18	16.60	17.97
(10) Death of main earner	**1.76**	**2.25**	**2.42**	**2.07**	**1.06**	**2.32**	**1.29**	**1.93**
No recovery	87.88	79.66	71.33	81.76	77.94	78.96	80.61	79.38
Some recovery	12.12	8.75	28.67	0.00	22.06	15.34	8.71	13.66
Substantial recovery	0.00	0.00	0.00	18.24	0.00	5.70	0.00	4.26
Full recovery	0.00	11.59	0.00	0.00	0.00	0.00	10.68	2.71

Source: World Bank data.

questions in that those involved in agriculture declaring being affected by the climate shocks are also in many cases those mentioning being affected by a weather shock in the other part of the questionnaire. The fact that the two questions yield similar results is reassuring about the ability of the survey to identify those affected by climate shocks.

The third largest type of shock in terms of the share of the households affected is the unexpected loss of job (14.3 percent), followed closely by a reduction in employment or hours worked (13.5 percent). The other shocks (serious injury/illness preventing work, shortage of inputs or increase in input prices, loss of assets or livestock, decline in prices or in the demand for sales, death of another family member, or death of the main income earner in the household) tend to affect a smaller of households. For all 10 shocks identified in the survey, the likelihood of being affected is higher in the bottom quintile as compared to the top quintile, but the differential is especially large for weather shocks, as well as the loss of assets or livestock. This is again related to the fact that the poor are much

more likely to make a living in agriculture and livestock, and are therefore much more likely to be affected by extreme weather events.

What about the ability of households to recover from shocks? This ability seems to be limited for most shocks. About half of households declare that they were not able at all to recover from most shocks, including the increase in food/other prices, unexpected job losses, a reduction in employment or hours worked, a serious injury or illness preventing work, a shortage of inputs/increase in prices, or a loss of asset/livestock. The share of those not able to recover is slightly lower at about 40 percent for weather shocks as well as for a decline in prices/demand for sales and the death of other family member, but it is much higher for the death of the main income earner in the household, at 70.4 percent. The share of those declaring being able to achieve some, but not a substantial recovery, is also high, so that only a relatively small minority of households declare being able to recover from the shocks substantially or fully. In many cases, but not in all cases, poorer households tend to be less able to recover from various shocks than wealthier households, and this is especially the case of weather shocks. Thus, not only are poor households more likely to be affected by weather shocks due to their involvement in agriculture, but in addition they are also less likely to be able to recover from those shocks when they occur.

Correlates of the Likelihood of Shocks and the Ability to Recover

This section provides a more detailed analysis of the likelihood of being affected by various shocks and the ability to recover in a multivariate setting using regression analysis. The analysis is still descriptive, but it permits for example to assess whether some types of households, say by quintile of wealth, are more likely to be affected by shocks, or less likely to be able to recover when affected, controlling for other factors such as their geographic location.

Table 5.3 provides the results of simple probit regressions (with robust standard errors) for the correlates of the probability of being affected by the main types of shocks (for shocks affecting very few households, the regression analysis was not implemented). Consider first the coefficient estimates for the level of well-being of households by quintiles of wealth. There is clear evidence that poorer households tend to be more affected by many of the shocks than better-off households. In some cases, the coefficients are statistically significant only for the top quintile (the reference category being the bottom and poorest quintile), which suggests that only the wealthiest households are comparatively more protected than other households. But in other cases there is a clear gradation in risk. This is the case for weather shocks, where the coefficients estimates are statistically significant for three of the four quintiles of wealth, and monotically decreasing as wealth increases. Households in the top quintile are 13.1 percentage points less likely to be affected by weather shocks that households in the bottom quintile controlling for other factors, and this decreases to 11.4 points for the fourth quintile, 7.1 point for the third quintile, and 3.0 points for the second quintile, although that last coefficient is not statistically significant. Similar monotonic or

Table 5.3 Correlates of the Probability of Being Affected by Different Types of Shocks (dF/dX)

	Weather shocks	*Increase in prices*	*Job loss*	*Less hours worked*	*Lower prices for products*	*Higher prices for inputs*	*Loss of assets*	*Death of other member*
Head's age	0.005*	0.003	−0.002	−0.004*	−0.001	−0.003***	−0.001	−0.000
Head's age squared	−0.000*	−0.000	0.000	0.000	0.000	0.000***	0.000	0.000
Female head	−0.041	−0.039	−0.024	0.054***	0.033***	0.008	−0.013	0.021**
Head married	−0.080	−0.089	0.015	−0.015	0.012	−0.003	0.006	−0.006
Adult female ratio	0.052	−0.025	−0.126***	−0.155***	−0.020	−0.045**	−0.008	−0.005
Household size	0.007**	0.005	0.009***	0.010***	0.003**	0.003**	0.003**	0.001
Owns > 1 acre	0.212***	−0.069**	−0.091***	−0.028	0.002	0.021*	0.018*	0.015
Urban	−0.153***	−0.078***	0.032	−0.001	0.013	−0.016*	−0.018*	−0.002
Head Education								
Primary	0.005	0.010	−0.007	0.002	0.002	0.003	−0.005	0.007
College	−0.001	−0.032	−0.077**	−0.079**	−0.021	0.022*	0.003	0.026**
Secondary	−0.081***	−0.069	−0.009	−0.052**	−0.006	−0.001	−0.017*	0.058*
Tertiary and up	−0.048	−0.096	−0.066**	−0.045	0.023	−0.002	Dropped	0.017
Head Occupation								
Work for other	−0.041*	0.036	−0.029	0.034	−0.006	−0.016*	−0.014	−0.004
Agricultural work	0.083***	0.089**	−0.076***	0.015	0.032***	0.011	0.012	−0.009
Nonag. Work	−0.037	0.049	−0.041**	0.147***	0.113***	0.058**	−0.006	0.006
Self-produce work	−0.035	−0.164	Dropped	−0.011	Dropped	Dropped	Dropped	0.087
Wealth Index								
Q2	−0.030	−0.033	−0.002	−0.029	−0.012	−0.006	−0.009	0.018
Q3	−0.071***	0.008	0.003	−0.027	−0.004	0.005	−0.005	0.014
Q4	−0.114***	−0.013	−0.033	−0.061***	−0.027***	−0.003	−0.024***	−0.011
Q5	−0.131***	−0.211***	−0.059**	−0.094***	−0.024***	−0.011	−0.020**	0.003

table continues next page

Table 5.3 Correlates of the Probability of Being Affected by Different Types of Shocks (dF/dX) *(continued)*

	Weather shocks	*Increase in prices*	*Job loss*	*Less hours worked*	*Lower prices for products*	*Higher prices for inputs*	*Loss of assets*	*Death of other member*
Region								
Guélmim-Es Sem.	0.126	0.220***	–0.002	0.024	–0.019	0.007	Dropped	–0.011
Souss-Massa-Draâ	0.083	0.005	0.127*	0.077	0.024	0.036	–0.009	–0.007
Gharb-Cher.-B.	0.123	0.174***	–0.060*	0.052	0.036	0.037	–0.006	–0.019**
Chaouia-Ouard.	0.047	0.015	0.036	–0.035	–0.024**	–0.016*	–0.018**	–0.015
Marr.-Ten.-AH.	0.075	–0.048	0.287***	0.203***	0.051	0.075	0.015	–0.006
Oriental	–0.106***	0.055	0.064	–0.030	0.011	0.002	–0.018**	–0.025***
Grand-Casablanca	0.118	0.098**	0.063	0.040	0.005	–0.016	–0.023***	–0.027***
Rabat-Salé-Z.-Z.	–0.099***	0.220***	–0.086***	0.047	–0.017	–0.019**	–0.021***	Dropped
Doukala-Abda	0.002	–0.125*	0.038	–0.009	0.039	–0.017**	–0.008	–0.013
Tadla-Azilal	–0.010	–0.120*	0.002	0.008	–0.013	–0.022***	–0.025***	–0.005
Méknès-Tafilalet	0.179**	0.171***	0.045	0.034	0.014	0.012	–0.019***	–0.020**
Fès-Boulemane	0.077	0.038	0.117	0.139*	0.037	–0.009	Dropped	–0.017*
Taza-Al H.-Tao.	0.083	0.113**	0.039	–0.098***	–0.023**	–0.021***	–0.014	–0.021***
Observations	1,986	1,986	1,976	1,986	1,976	1,976	1,762	1,858

Source: World Bank data.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

quasi-monotonic gradation patterns are observed for a few of the other shocks (even though coefficients may not always be statistically significant) including especially job losses and less hours worked, as well as serious illnesses or injuries.

A number of other statistically significant coefficients are interesting. As expected, when households own more than one acre of land, which is the case mostly for households involved in agriculture, or when the household head is involved in agriculture, they tend to be much more likely to be affected by weather shocks. The effects are not only statistically significant, but also large, at 21.2 percentage points for landownership, and at an additional 8.3 percentage points for a household head working in agriculture as compared to salaried work. By contrast, households with substantial land are less likely to be affected by unexpected increases in food prices or other essential commodities, simply because many of these households tend to be net producers of food, so that they may actually benefit from increases in food prices. Note however that households with a head involved in agriculture are more likely to be affected by the increase in food prices than the reference category of salaried work—so not all households in rural areas are protected from such food price increases. Households with land and those with a head involved in agriculture are both less likely to be affected by job losses, suggesting the protective effect of self-employed for this type of shock. But households with land are more likely to be affected by an increase in input prices and by losses of assets and livestock. A few other effects related to the occupation of the head are at work, including differences in the probability to lose work.

Urban households are less likely to be affected by weather shocks than rural households, but also somewhat surprisingly less likely to be affected by unexpected increases in the price of food, perhaps because they tend to be better of (even if this is partially controlled by the assets quintiles). Urban households are more likely to be affected by the death of the main income earner in the household, perhaps because they tend to be smaller and thereby without other income sources. Larger households tend to be more affected by most shocks, which reflects the fact they live in areas more affected by weather shocks and that with more household members, the probability that at least one of them will suffer from a negative shock is simply higher. Female-headed households are also more likely to be affected by several of the shocks; also this is compensated in part by the coefficient for the female adult ratio. Households with older heads are less affected by several of the shocks, possibly because of a higher rate of self-employment when working, but they are more affected by the possibility of the death of the main earner, as expected. In general, a higher level of education for the household head is associated with a lower risk of being affected by shocks—this is mainly the case for weather shocks (since households with better educated heads work less in agriculture) and job losses or losses in hours worked (since individuals in households with better educated heads tend to have more secure and stable jobs), but there are a few cases when education is positively correlated with shocks.

In a few cases the likelihood of shocks is related to geographic location after controlling for household characteristics. The reference geographic location in the regression model is the prefecture of Tanger-Tétouhan, which is located in the tip of the northern part of the country towards Spain. In the case of weather shocks, in comparison to that region, only one region has a statistically significant and higher likelihood of shocks (the region of Méknès-Tafilalet, located in the north-east part of the country, bordering Algeria), while two regions have a lower probability of weather shocks (the regions of Oriental, located just north of Méknès-Tafilalet, and Rabat-Salé-Zemmour-Zaér, located to the west of Rabat-Salé-Zemmour-Zaér). All other geographic effects are not statistically significant, even though they are all positive. It should not be inferred from these results that the likelihood of weather shocks is uniform across areas, but simply that the household survey data do not generate very marked profiles of weather shocks by area at the level of regions. Of course, the fact that the household survey sample is limited in each of the regions (there are 14 regions included in the survey, and 2000 household, so that on average less than 150 households are included in the sample for each region) also contributes to the lack of statistical significance of the effects. In a nutshell, while it is important to include geographic in the regression analysis, not too much should be inferred from the coefficient estimates for these controls. But the results displayed according to household characteristics, and especially the vulnerability of poorer households to weather and other shocks, are important.

What about the ability to recover from the shocks? A probit regression analysis is provided in table 5.4, where for the sake of simplification, a household was considered as being able to recover from a shock if the household declared that it had recovered very much or completely (the results are not qualitatively different when estimating an ordered probit or logit). All households who declare having been affected by a shock are included in the analysis, and when a household has been affected by more than one shock, the different shocks are taken into account. The fact of combining all types of shocks in the analysis enables us to use the data in a richer way, including by comparing whether it is more or less difficult for households to recover from different types of shocks (by contrast, if the analysis were conducted for each type of shock separately, for many shocks the sample size would be too small to uncover meaningful results). Two different models are estimated, with the addition in the second model of the leave-out-mean share of households declaring having been affected by a shock in a given area.

Again, a very clear pattern emerges in table 5.4 by quintile of wealth, with richer households much more likely to be able to recover from shocks. Households in the top quintile are approximately 20 percentage points more likely to recover from a shock than households in the bottom quintile, and for the fourth quintile, the gain is at about 11 percentage points versus the bottom quintile. A better education is also associated with a higher likelihood of recovering, although the effect is statistically significant only for the *collège* level (which means lower secondary education and not higher education as is the case in the United States). Households involved in nonagricultural work are also more likely

Table 5.4 Correlates of the Ability to Recover from Shocks (dF/dX)

	Without LOM	*With LOM*
Head's age	–0.005*	–0.004*
Head's age squared	0.000**	0.000**
Female head	0.011	0.014
Head married	0.070	0.048
Adult female ratio	–0.035	–0.020
HH size	–0.003	–0.003
Own more than 1 acre	0.051**	0.043*
Urban	–0.011	–0.015
Head's Education		
Primary	0.024	0.026
College	0.112***	0.099***
Secondary	0.024	0.023
Tertiary and up	0.039	0.051
Head's Occupation		
Work for other	0.027	0.031
Agricultural work	0.020	0.031
Nonagricultural work	0.072**	0.084***
Self-produce work	0.070	0.042
Wealth Index		
Q2	0.043*	0.038
Q3	0.044	0.034
Q4	0.112***	0.115***
Q5	0.213***	0.203***
Region		
Guélmim-Es Semara	0.123	0.124
Souss-Massa-Draâ	0.100*	0.089
Gharb-Cherarda-Béni Hssen	–0.044	–0.050
Chaouia-Ouardigha	0.083	0.080
Marrakech-Tensift-Al Haouz	0.136**	0.118**
Oriental	–0.069	–0.040
Grand-Casablanca	0.058	0.049
Rabat-Salé-Zemmour-Zaér	–0.104***	–0.093**
Doukala-Abda	0.109	0.108
Tadla-Azilal	–0.042	–0.033
Méknès-Tafilalet	0.009	0.015
Fès-Boulemane	–0.011	0.005
Taza-Al Hoceima-Taounate	0.045	0.057
Events		
Weather shocks	0.075***	0.062**
Serious injury illness	0.021	–0.000
Unexpected loss of job	–0.000	–0.004
Reduction in employment/hours worked	0.037	0.051
Decline in prices/demand for products	0.006	0.020
Increase in prices/shortage of inputs	0.038	0.038
Loss of assets/livestock	–0.006	0.013
Leave-out mean	—	0.122***
Number of observations	2,891	2,694

Source: World Bank data.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

to recover from shocks, as are households with older heads (taking into account quadratic effects). Geographic effects are for the most part not statistically significant. But what is important is the fact that as compared to the excluded category of shocks, which is the unexpected increase in food or other essential commodity prices, the ability of households to recover from a weather shock is actually higher by six to seven percentage points depending on the specification, and not lower (the coefficients for the other shocks are not statistically significant, but this may be because for some of the shocks the sample is small). The fact that the ability to recover from shocks was slightly higher for weather shocks than for the rise in food and other prices was already apparent in the basic statistics in table 5.2, but this is simply confirmed in the regression analysis after introducing a number of controls. While this does not mean that the effect of weather shocks is small, it means that other shocks—in this case the increase in food and other prices—may be even more devastating.

Conclusion

What is the likelihood that Moroccan households, and especially those involved in agriculture, may be confronted with extreme weather events such as droughts and floods? Who suffers the most from such events when they occur? To what extent are different types of households able to recover from such shocks? This chapter provides answers to these questions on the basis of questions on weather shocks added to a nationally representative household survey implemented in Morocco in 2009/10. The data suggest that most households working in agriculture are affected by weather shocks, often seriously. In the population as a whole, the proportion of households affected is about one fourth. A majority of households declare not being able to recover much from weather shocks, as well as other shocks. But in comparison to other shocks, including unexpected increases in the prices of food and other basic essential commodities, households are slightly more likely to be able to recover from weather shocks.

Bibliography

Adoho, F., and Q. Wodon. 2014. "Perceptions of Climate Change, Weather Shocks, and Impacts on Households." In *Climate Change and Migration: Evidence from the Middle East and North Africa Region*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 4 in this study.

Azzam, A., and K. Sekkat. 2005. "Measuring Total-Factor Agricultural Productivity under Drought Conditions: The Case of Morocco." *The Journal of North African Studies* 10 (1): 19–31.

Barakat, F., and A. Handoufe. 1998. "Approche agroclimatique de la sécheresse agricole au Maroc." *Sécheresse* 9: 201–08.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by

Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Elasha, B. O. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

El Raey, M., K. Dewidar, and M. El Hattab. 2009. "Adaptation to the Impacts of Sea Level Rise in Egypt." *Climate Research* 12 (27): 117–28.

Foresight. 2011. *Migration and Global Environmental Change*. London: The Government Office for Science.

IPCC (Intergovernmental Panel on Climate Change). 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, G.-K. P. K. J. Mach, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge, UK, and New York, NY: Cambridge University Press.

McSweeney, C., M. New, and G. Lizcano. 2009. "UNDP Climate Change Profiles: Documentation." Mimeo, United Nations Development Program, New York.

Skees, J., et al. 2001. "Developing Rainfall-Based index Insurance in Morocco." World Bank Policy Research Working Paper 2577, World Bank, Washington, DC.

Swearingen, W. D., and A. Bencherifa. 2000. "An Assessment of the Drought Hazard in Morocco." In *Drought: A Global Assessment*, Vol. 1, edited by D. A. Wilhite. New York: Routledge.

Sowers, J., and E. Weinthal. 2010. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Belfer Center for Science and International Affairs, Cambridge, MA.

United Nations Development Programme and Arab Fund for Economic and Social Development. 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Verner, D., ed. 2012. *Adaptation to a Changing Climate in the Arab Countries*. Directions in Development. Washington, DC: World Bank.

Warren, R., N. Nicholls, R. Levy, P. Price. 2006. "Understanding the Regional Impacts of Climate Change: Research Report Prepared for the Stern Review on the Economics of Climate Change." Tyndall Centre for Climate Change, Research Working Paper 90, Tyndell Centre for Climate Change Research, Norwich, UK.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2007. *World Bank Development Report 2008: Agriculture for Development*. World Washington, DC: World Bank.

———. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

CHAPTER 6

How Do Households Cope with and Adapt to Climate Change?

Franck Adoho and Quentin Wodon

What are the coping mechanisms and adaptation strategies (apart from migration, which is discussed in part 3 of the study) that households use in order to respond to changes in climate and environmental conditions? Are households forced to sell assets or take other emergency measures in cases of losses due to extreme weather events? Beyond short-term emergency responses, are they taking measures to adapt to changing conditions? This chapter, which as was the case for chapter 4 is based on new household survey data collected in 2011 in Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of Yemen, documents the coping and adaptation strategies of households as well as government and community responses to changes in weather patterns and the environment. Overall, the results suggest that coping and adaptation strategies used by households to deal with shocks are diverse, but still limited, as are the community and government responses that could help them.

Introduction

As already mentioned in previous chapters, weather and environmental conditions in many areas of the MENA region have worsened in the recent past and are expected to worsen further in the future. This is likely to lead to substantial increases in temperature, reductions in rainfall, and a higher likelihood of extreme weather events such as droughts and floods (Elasha 2010; IPCC 2012; McSweeney, New, and Lizcano 2009; UNDP 2009; Verner 2012; World Bank 2010). These trends will exacerbate water scarcity issues and threaten agricultural sectors which remain essential for the livelihood of a substantial share of the population in many countries, and especially in some of the countries analyzed in this study (for a brief review of the literature which informs this chapter, see the introduction of chapter 1 by Wodon et al. [2014] and chapter 2 on the five countries of focus for this work by Burger et al. [2014a] in this study).

In chapter 4 of the study, an analysis of new household survey data collected in 2011 in Algeria, Egypt, Morocco, Syria, and the Republic of Yemen suggested

that households living in areas exposed to weather shocks indeed do perceive a change in weather patterns and in their environment. Furthermore, a large majority of households declare having lost income, crops, livestock or cattle, or fish due to adverse weather events and changing environmental conditions over the five years preceding the surveys. It was also shown that the poor have paid the highest price in terms of a higher likelihood of losses for the changes that are taking place in the climate.

This chapter is based on the same data as that used in chapter 4 (on the data and the choice of focus countries, see Burger et al. 2014a, 2014b), but the focus shifts to a discussion of the coping mechanisms and adaptation strategies used by the households when affected by adverse weather events or changes in their environment. Both the households who declare having been affected by weather shocks and suffered losses and the population as a whole living in the areas where the surveys where implemented are considered. Apart from looking at household specific coping mechanisms and adaptation strategies, data are also provided as to whether communities are promoting adaptation strategies at the local level, and whether the government also provides support for adaptation, as well as for coping among others through the availability of social protection programs that could help households in need.

The structure of the chapter is as follows. Section two introduces the data used for the analysis, and especially the main questions in the surveys related to coping and adaptation. Sections three and four respectively discuss households coping mechanisms and adaptation strategies. Community and government responses are discussed in section five. A brief conclusion follows.

Data and Methodology

As in chapter 4, this chapter relies on data from five household surveys implemented in Algeria, Egypt, Morocco, Syria, and the Republic of Yemen. In each country, 800 households were interviewed, typically in two main areas per country. A brief description of the areas where the surveys were implemented in each of the countries was provided in chapter 2. The survey questionnaire included a total of 17 sections. This chapter focuses on part of the data collected in section five on perceptions related to extreme weather events and climate change, and specifically on the coping mechanisms and adaptation strategies used by households to cope with changing climatic conditions and adverse weather shocks. Data are also provided as to whether communities are promoting adaptation strategies, and whether the government also provides support to do so.

On coping, households who declared that they had experienced a loss of crops, income, livestock or fish due to weather shocks or changes in the environment were asked if they used the following coping strategies: (1) Selling or pawning livestock; (2) Selling or pawning assets other than livestock, such as land or jewelry; (3) Withdrawing children from school; (4) Using their savings; and finally (5) Asking for a loan. In addition, households who did not experience a loss linked to an adverse weather events were asked whether they would rely on

the same coping mechanisms in case they would experience such a loss. In that case, households could say that they strongly agree that they would use the coping mechanisms, that they somewhat agree, that they somewhat disagree, or that they strongly disagree. Statistics will be provided on the reliance on various coping mechanisms for both the households who did experience a loss and for the sample as a whole, including in that case the responses of households to the same question in the case of a hypothetical loss. In addition to the basic statistics, regression analysis will be provided for analyzing the extent to which households who actually experienced a loss (and for whom the information may be more reliable) have used the various coping mechanisms. For the regression analysis, a Heckman probit model is used with a first-stage probit regression on the probability of experiencing a loss, and a second-stage regression on whether households have relied on the specific coping strategy after the loss. The identification variable for the system is the leave-out-mean probability of experiencing a loss in the area where the household lives, with the area defined as the primary sampling unit of the household in the survey dataset.

On adaptation, households were asked whether they have taken specific actions to adapt to changing weather patterns following losses of crops, income or livestock due to weather or environmental changes. All households answered the question, not only those who declared having suffered losses. The following potential actions that could be taken by households were listed: (1) change in the timing of planting the main crop; (2) change in the source from which the water is drawn; (3) as compared to five years ago, longer time to gather or collect water; (4) collecting more firewood; (5) as compared to five years ago, longer time to collect firewood; (6) terracing the land; (7) drilling boreholes; (8) change in the production technologies used, such as land preparation, sowing or weeding; (9) change in the crop choices, increase in the crop variety, or adopting drought or flood resistant crops; (10) change in the percentage composition of crops versus. livestock; (11) increase in the use of fertilizer or pesticides; (12) seeking or increasing off-farm employment; (13) receiving occupational training for nonfarm employment; (14) using more stored water as compared to five years ago; (15) consuming more stored grains and stored animal products as compared to five years ago; (16) being aware of people moving out of the community as a result of weather or environmental changes; (17) in the last five years, having people moved into the community; (18) if people moved into the community, this leading to conflict in the community; (19) in the past five years, having personally experienced a conflict over agricultural land or livestock as a result of weather or environmental changes; and finally (20) in the last five years, having personally experienced a conflict over water for household use or cultivation as a result of weather or environmental changes. Simple probit regressions are estimated to look at the correlates of the probability that households use the various strategies.

On community-level responses, households were asked whether in order to cope with the loss of crops, income or livestock due to weather or environmental changes, their community had undertaken the following actions: (1) Planting trees or installing soil protection measures; (2) Building banks on rivers, streams

or small check banks to reduce flooding; (3) Developing new infrastructure such as boreholes, wells, irrigation, or roads; (4) Gathering and disseminating information on measures to reduce the loss of crops, income, or livestock; (6) Taking measures to prepare for future disasters like floods or droughts; (7) Taking action to improve market access for agricultural products or handicrafts,and so on; and finally (8) Taking action to purchase seeds, animals or farm equipment. The responses reflect the perception by households as to whether their community has adopted adaptation strategies. Because this provides only community-level information, only summary statistics are provided as opposed to a regression analysis on the correlates at the household level of these perceptions. Correlates of perceptions might be interesting to analyze, but given that many households in the same community will respond in similar way to the questions, the information provided by those correlates may not be that useful.

Finally, on government responses, households were asked whether in order to cope with the loss of crops, income, or livestock due to weather or environmental changes, the government had undertaken a number of actions. While some actions are similar to those mentioned in the question on community responses, others refer more to social protection programs. The list of options in the questionnaire was as follows: (1) Planting trees or installing soil protection measures?; (2) Building banks on rivers, streams, or small checking banks to reduce flooding; (3) Developing new infrastructure such as building boreholes and canals for irrigation or roads; (4) Providing seeds or fertilizer or fodder for livestock; (5) Providing storage facility for crops; (6) Providing cash or food for work; (7) Distributing cash for food during floods and droughts; (8) Providing drinking water; (9) Providing skills training programs; (10) Providing credit during crop loss; (11) Improving access to markets by providing transportation; and finally (11) Supporting prices when agricultural prices are low. Again, the responses reflect the perception by households as to whether their government has provided support, and not whether they personally have received support. For that reason, as for the community level responses, only summary statistics are provided in the analysis as opposed to regression analysis.

One more point requires a brief explanation regarding the way climatic conditions are treated in the analysis. The survey questionnaire includes a large number of variables on the perceptions of households regarding various changes in weather patterns and their environment. Instead of trying to assess individually the impact of each of those variables on coping mechanisms and adaptation strategies, we rely on two broader indices of household perceptions regarding climatic conditions that were constructed through a multiple correspondence analysis (MCA). The approach used is discussed in chapter 4. What matters for the interpretation in this chapter is that the first factor mostly captures the extent to which households perceive that the climate is becoming dryer and warmer, and it is associated with droughts and the lack of rain. The second factor mostly 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, with one characterizing the worst conditions in the sample, and zero the best conditions.

Household Coping Mechanisms

Table 6.1 provides basic statistics on how households have dealt or might deal with losses linked to adverse weather events. As mentioned in the previous section, households that were affected by climate and environmental patterns and that lost income, crops, or livestock and cattle, or who caught less fish, were asked whether they used one of several coping mechanism. Their answer had to be "yes" or "no" (or don't know). The households who did not suffer losses were

Table 6.1 Household Coping Mechanisms to Deal with Climate Change and Shocks
Percent

	Selling or pawning livestock	*Selling or pawning other assets*	*Withdrawing children from school*	*Using one's savings*	*Asking for a loan*
	All households (actual and hypothetical loss)				
All	40.61	46.79	36.42	60.55	46.21
Country					
Algeria	68.96	50.65	60.15	78.42	50.48
Egypt, Arab Rep.	21.00	20.25	5.13	26.88	13.75
Morocco	41.41	35.26	31.12	46.62	42.04
Syrian Arab Republic	33.75	65.50	54.00	90.38	60.25
Yemen, Rep.	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
	Households with an actual loss only				
All	42.30	54.09	46.47	78.22	42.57
Country					
Algeria	75.84	61.19	79.13	77.69	35.18
Egypt, Arab Rep.	17.13	26.29	10.36	79.68	27.09
Morocco	55.01	54.39	50.81	89.41	61.72

table continues next page

Table 6.1 Household Coping Mechanisms to Deal with Climate Change and Shocks *(continued)*
Percent

	Selling or pawning livestock	*Selling or pawning other assets*	*Withdrawing children from school*	*Using one's savings*	*Asking for a loan*
Syrian Arab Republic	30.05	68.39	50.68	96.19	43.05
Yemen, Rep.	27.01	41.03	21.54	48.21	43.25
Quintiles					
Q1	46.65	60.16	51.33	78.88	40.17
Q2	49.83	61.26	53.61	81.53	45.89
Q3	44.21	54.36	49.46	75.11	44.46
Q4	35.39	42.30	37.02	79.45	41.12
Q5	31.36	49.69	36.96	75.62	40.27
Losses					
Lost income	43.00	56.62	47.02	81.10	43.26
Lost crops	55.37	56.08	51.18	76.51	45.18
Lost livestock or cattle	60.19	53.96	46.79	74.01	48.84
Less fish caught	47.23	51.20	37.82	70.95	50.75
Receives remittances					
Local remittances	54.91	61.74	66.41	78.60	31.83
International remittances	30.80	58.36	49.23	83.68	41.88

Source: World Bank data.

asked whether they would use the various coping mechanism if they were affected by climate patterns in the future. Households who strongly or somewhat agreed that they would use the mechanisms were codified as likely to use it, and those who somewhat or strongly disagreed were classified as not likely to use the mechanism, so that the information could be dichotomized and compared with the response provided by those affected by shocks. In table 6.1, the share of households actually using or likely to use the various mechanisms as a proportion of the total population is provided first (the top part of the table factors in those not affected by shocks). The statistics only for the subsample of households actually affected by losses is provided next.

For the population as a whole, 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 (typically 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. This last result on the potential impact on schooling of weather shocks is surprising and would warrant further analysis before being taken at face value. 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.

The responses for the subsample of those actually declaring a loss are fairly similar, which is not surprising, given that a majority of household do declare losses, as documented in chapter 4. The main difference is that the reliance of households on the first four coping mechanisms is higher among those actually affected than among the sample as a whole, which could reflect the fact that an actual shock elicits more responses than a hypothetical one, but could also reflect the fact that the households actually affected tend to be poorer, which may require them to rely on such coping mechanisms more, even if many of the mechanisms such as selling livestock or assets, or withdrawing children from school often have adverse long-term consequences. In the sample of those affected, the share of those who sold or pawned livestock increases to 42.3 percent, while that of those who sold other assets increases to 54.1 percent. The probability of withdrawing children from school reaches 46.5 percent (again, this last result warrants more analysis), and that of using one's savings reaches 78.2 percent. The only case where the reliance on the coping mechanism is lower among those who incurred a loss than among the population as a whole is that of loans, which may again reflect the fact that those affected by losses tend to be poorer and thereby may not have access to credit, whether from friends or relatives or from financial institutions.

What about the correlates of the use of various coping mechanisms among the subset of households actually affected by a shock for which the information is likely to be more reliable than for the population as a whole? Table 6.2 provides the results of Heckman probit models (the first-stage probits on the probability

Table 6.2 Correlates of the Coping Mechanisms Used by Households (dF/dX)

	Selling or pawning livestock	*Selling or pawning other assets*	*Withdrawing children from school*	*Using one's savings*	*Asking for a loan*
Countries (ref. = Algeria)					
Egypt, Arab Rep.	–0.442***	–0.266***	–0.419***	0.039	–0.148**
Morocco	–0.282***	–0.157***	–0.281***	0.108**	0.084*
Syrian Arab Republic	–0.405***	–0.170***	–0.339***	0.324***	–0.030
Yemen, Rep.	–0.461***	–0.275***	–0.387***	–0.316***	–0.005
Climatic conditions					
Factor 1: Dryer/warmer weather	0.444***	0.257***	0.002	0.075	0.027
Factor 2: Excess water	–0.125*	–0.091	0.118**	0.031	0.155**
Losses (ref. = No loss)					
Income	0.151***	0.118***	0.046*	0.228***	0.118***
Crops	0.183***	0.065**	0.017	0.098**	0.029

table continues next page

Table 6.2 Correlates of the Coping Mechanisms Used by Households (dF/dX) *(continued)*

	Selling or pawning livestock	*Selling or pawning other assets*	*Withdrawing children from school*	*Using one's savings*	*Asking for a loan*
Livestock/cattle	0.196***	–0.008	0.014	–0.022	0.049**
Fish	–0.033	–0.005	0.012	0.052	–0.022
Wealth quintiles (ref. = Q5)					
Q1	–0.042	0.038	0.021	–0.038	–0.004
Q2	0.036	0.019	0.032	–0.043	0.027
Q3	–0.022	–0.034	0.013	–0.088**	0.024
Q4	–0.036	–0.067*	–0.010	–0.036	–0.001
Land status (ref. = Neither)					
Land owners	0.234***	0.001	–0.064**	0.082*	0.098***
Land tenants	0.171***	0.064	–0.050	0.157**	0.152***
Remittances					
Receives remittance	–0.017	–0.035	–0.015	–0.002	–0.081**
Age of head (ref. = 50+ years)					
Less than 30	–0.118**	0.014	–0.012	–0.148**	0.118**
30–39	–0.088**	–0.055*	–0.030	–0.090**	0.127***
40–49	–0.114***	–0.059**	–0.045**	–0.022	0.094***
Gender					
Head is a male	–0.147*	–0.017	0.034	–0.054	0.022
Education of head (ref. = None)					
Primary	0.027	0.045	–0.072**	0.054	–0.062*
Preparatory	–0.006	–0.006	–0.084*	0.025	–0.097**
Secondary	–0.028	0.040	–0.105**	–0.008	–0.052
Above secondary	–0.101	0.095	–0.025	–0.075	–0.043
Head occupation (ref. = Salaried)					
Self-employed farmer	–0.065	–0.117***	0.040	–0.137***	–0.229***
Nonagric self-employed	–0.100	–0.070	–0.032	–0.035	–0.189***
Other employer	–0.097	0.047	0.063	0.017	–0.037
Servant/unqualified	–0.004	0.011	0.116*	0.103	–0.106*
Other	0.072	0.014	0.097	0.123	–0.025
Agriculture/fisheries/pastoral	0.121*	0.054	0.072	0.036	–0.078
Head public employee (ref. = No)					
Head is public employee	–0.148***	–0.127***	–0.035	–0.042	–0.020
Observations	3,004	2,995	3,009	2,976	3,000

Source: World Bank data.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

of experiencing a loss are not shown; they are very similar to the regressions presented in chapter 4). Country effects are still at work, but one interesting fact is that among those affected by shocks, the likelihood of using various mechanisms is not affected much by the quintile of wealth of the household (remember however that poorer households are often more likely to be exposed to losses due to adverse weather events). On the other hand, households in areas

characterized by worsening droughts tend to be more likely to have to sell assets, while by contrast the impact of worsening floods (the second factor in the MCA analysis) is only marginally statistically significant. Thus, apart from causing losses, droughts and the lack of rain are likely to have further negative consequences for households by inducing them to sell assets, while this is not observed to the same extent for floods.

Another finding is that some types of losses increase the likelihood that households will rely on coping mechanisms. Income losses are associated with a higher probability of relying on all coping mechanisms, while a loss in crops is associated with a statistically higher probability of relying on coping mechanisms in only three cases—selling or pawning livestock, selling or pawning other assets, and using one's savings. A loss of livestock or cattle is associated with a likelihood of relying on two mechanisms—selling or pawning livestock and using one's savings. Catching less fish does not lead to a reliance on the various coping mechanisms.

Landowners and tenants are more likely to have to sell livestock or ask for loans, but less likely to withdraw their children from school. Understanding this difference in behavior regarding schooling would require a more detailed analysis, but a possibility might be that children from landowners and tenants might already be less likely to go to school, because of the necessity to work the land. At this stage of the analysis this is only a conjecture. While the gender of the household head does not make much of a difference in terms of the coping mechanisms used, the education of the head does make a difference, with households with less-well-educated heads less likely to withdraw children from school, perhaps again because the children are already less likely to be in school. On the other hand, some of the occupations associated with lower earnings are also associated with a higher likelihood of withdrawing children from school. Instead of reaching a conclusion here on these patterns of withdrawal of children to school, a more detailed analysis of schooling patterns (who is enrolled in what grade, for example) would be required before reaching conclusion on that specific coping mechanism.

Households benefitting from remittances are less likely to ask for a loan, probably because they already receive some cash in hand thanks to the transfers that they receive from friends or relatives who migrated. Households with younger heads are less likely to sell assets or use their savings, and more likely to ask for loans. This might be because they have fewer assets that they can sell or savings that they can use in times of difficulties because they have had less time to accumulate those, which then forces them to ask for loans, while households with holder heads have more options apart from loans. Households with a head self-employed as a farmer are less likely to sell other assets, to use one's savings, or to ask for loans, perhaps because the ability of those households to do so is limited given their low earnings and accumulation potential or ability to repay loans. The lower likelihood of asking for loans is also observed for the self-employed in other sectors and servants as well as unqualified workers. Those working in fisheries or pastoral activities are on the other hand more likely to sell livestock, as expected. Finally, households with a head in the public sector are less likely to

sell livestock or other assets, possibly because many do not have livestock to sell, and may also not need to sell assets.

Household Adaptation Strategies

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 nonfarm 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 five 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 and most of the options available in the questionnaire are provided in table 6.3. 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 4 in 10 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, the Republic of 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.

Table 6.3 Household Adaptation Strategies to Deal with Climate Change and Shocks
Percent

	Change in production technology	*Change in crops mix, varieties*	*Change crops vs. livestock*	*More fertilizers, pesticides*	*Seeking nonfarm work*	*Training for nonfarm 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, Arab Rep.	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
Syrian Arab Republic	5.38	4.38	3.38	5.88	1.13	2.00
Yemen, Rep.	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
Landownership						
Landowners	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 (land, livestock)*	*Conflict (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, Arab Rep.	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
Syrian Arab Republic	12.75	17.00	85.25	2.63	0.38	1.00
Yemen, Rep.	37.69	33.12	26.96	21.14	16.58	20.18

table continues next page

Table 6.3 Household Adaptation Strategies to Deal with Climate Change and Shocks *(continued)*
Percent

	Use of stored water	*Stored grains/ products*	*People moving out*	*People moving in*	*Conflict (land, livestock)*	*Conflict (water)*
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
Landownership						
Landowners	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: World Bank data.

As before households with international remittances who tend to also be better off tend to rely less on those adaptation strategies than other households.

In a similar way to the analysis presented in the previous section on the correlates of coping mechanisms, an analysis of the correlates of the adaptation strategies used by households can be provided. This is done in table 6.4 with probit models for the main adaptation strategies. As for coping mechanisms, country effects are still at work, but among those affected by shocks, and in many cases the likelihood of using various adaptation strategies does not seem to be affected by the quintile of wealth of the household. There are exceptions though, with statistical significance in the case of the first quintile, as compared to the reference category of the top quintile. In many cases, the poorest households are more likely to use adaptation strategies, probably because they are also those affected the most by climate change, as documented in chapter 4. But in a few cases, households in the bottom quintile are less likely to adopt a strategy, and this is especially the case for terracing the land, increasing the use of pesticides and fertilizers, and (knowing people who are) moving out, three options that are often costly and may therefore be out of reach for the very poor (the fact that the very poor are less likely to witness conflict over water could possibly signal their lack of access or property rights over water).

Table 6.4 Correlates of the Use of Adaptation Strategies by Households (dF/dX)

	Change in time of planting	*Change in water source*	*More time to gather water*	*Collecting more firewood*	*More time to collect firewood*	*Terracing the land*
Countries (ref. = Algeria)						
Egypt, Arab Rep.	–0.117***	–0.020	–0.054*	–0.257***	–0.214***	–0.153***
Morocco	–0.116***	–0.078***	–0.076***	–0.064***	–0.118***	0.045**
Syrian Arab Republic	–0.114***	–0.091***	–0.100***	–0.233***	–0.238***	–0.030
Yemen, Rep.	–0.040**	0.154***	0.206***	0.001	–0.072***	0.113***
Climatic conditions						
Factor 1: Dryer/warmer weather	0.166***	0.102***	0.194***	0.164***	0.305***	–0.105***
Factor 2: Excess water	0.007	0.113***	0.161***	0.097**	0.143***	0.099***
Losses (ref. = No loss)						
Income	0.122***	–0.000	0.086***	0.095***	0.107***	0.040**
Crops	0.009	0.019	0.037*	0.120***	0.072***	–0.022
Livestock/cattle	–0.004	0.046***	0.167***	–0.024	–0.036**	0.078***
Fish	0.026	–0.031**	–0.056**	0.057*	0.061*	0.080***
Wealth quintiles (ref. = Q5)						
Q1	0.071**	–0.017	–0.050*	0.065**	0.099***	–0.039**
Q2	0.009	0.020	0.034	0.042	0.007	0.014
Q3	0.001	–0.008	0.041	0.063**	0.056*	–0.022
Q4	0.024	–0.018	0.059*	–0.005	0.054*	0.030
Land status (ref. = Neither)						
Landowners	0.097***	0.074***	0.054**	0.076***	0.058***	0.132***
Land tenants	0.015	0.145***	0.106**	0.105***	–0.003	0.136***
Age of head (ref. = 50+ years)						
Less than 30	–0.030	–0.034	–0.097***	–0.034	–0.113***	0.005
30–39	–0.011	–0.025*	–0.018	–0.020	–0.072***	0.030
40–49	–0.018	–0.003	–0.033*	–0.035*	–0.055***	0.048***
Gender of head (ref. = Female)						
Male	–0.015	0.046	0.020	–0.134*	–0.180**	–0.006
Status of head (ref. = Other)						
Single	–0.050	0.010	0.044	0.032	0.115	0.017
Married	0.014	0.013	0.006	0.081*	0.078*	0.004
Education of head (ref. = None)						
Primary	–0.019	–0.023	0.036	–0.004	–0.008	–0.006
Preparatory	–0.038*	–0.020	0.023	–0.017	–0.063**	0.022
Secondary	–0.020	–0.008	–0.016	–0.078***	–0.068**	–0.045**
Above Secondary	–0.002	–0.021	–0.004	–0.094***	0.001	–0.018
Head public employee (ref. = No)						
Head is public employee	–0.061***	–0.032**	–0.069***	–0.059**	–0.104***	0.001

table continues next page

Table 6.4 Correlates of the Use of Adaptation Strategies by Households (dF/dX) *(continued)*

	Change in time of planting	*Change in water source*	*More time to gather water*	*Collecting more firewood*	*More time to collect firewood*	*Terracing the land*
Head occupation (ref. = Salaried)						
Self-employed farmer	0.091***	0.043*	0.020	0.046	0.031	0.116***
Nonagric self-employed	0.021	0.008	–0.030	0.004	–0.021	0.085**
Other employer	0.045	0.029	0.057	0.095**	0.051	0.091***
Servant/unqualified	0.008	0.063*	0.072*	0.053	0.044	0.048
Other	0.017	–0.004	–0.022	0.024	–0.011	–0.048*
Agriculture/fisheries/pastoral	0.058	–0.023	–0.022	0.130***	0.107**	0.046
Number of observations	2,936	2,927	2,930	2,929	2,926	2,928

	Drilled boreholes	*Changed production technology*	*Changed crops*	*Changed crop share vs. livestock*	*Increased use of fertilizer or pesticides*	*Sought or increased off-farm work*
Countries (ref. = Algeria)						
Egypt, Arab Rep.	–0.171***	–0.164***	–0.075***	–0.023	–0.166***	–0.262***
Morocco	–0.118***	–0.167***	–0.125***	–0.058***	–0.074***	–0.201***
Syrian Arab Republic	–0.120***	–0.173***	–0.129***	–0.077***	–0.153***	–0.292***
Yemen, Rep.	–0.079***	–0.088***	–0.080***	0.008	–0.027	–0.162***
Climatic conditions						
Factor 1: Dryer/warmer weather	0.020	0.145***	0.168***	0.102***	0.057	0.189***
Factor 2: Excess water	0.162***	0.071**	0.037	0.113***	0.302***	0.019
Losses (ref. = No loss)						
Income	–0.029*	0.124***	0.137***	–0.017	0.051**	0.054**
Crops	–0.027*	0.022	–0.000	0.035***	–0.014	0.086***
Livestock/cattle	0.030**	–0.013	–0.008	0.029**	0.013	–0.113***
Fish	0.029	–0.001	0.013	0.055**	0.004	0.006
Wealth quintiles (ref. = Q5)						
Q1	0.007	0.122***	0.190***	0.016	–0.066***	0.020
Q2	0.004	0.068**	0.060**	0.026	–0.060***	–0.007
Q3	0.038	0.003	0.067**	0.024	–0.038*	0.013
Q4	–0.002	0.011	0.042	–0.012	–0.008	0.033
Land status (ref. = Neither)						
Landowners	0.116***	0.190***	0.133***	0.054***	0.273***	0.111***
Land tenants	0.073*	0.074*	0.091**	0.146***	0.197***	0.092**
Age of head (ref. = 50+ years)						
Less than 30	–0.033	0.021	0.050	–0.010	–0.060**	–0.098***
30–39	–0.019	–0.011	0.015	0.025*	–0.020	–0.010
40–49	–0.014	–0.001	0.016	0.025**	0.013	0.017
Gender of head (ref. = Female)						
Male	0.060**	0.040	0.003	–0.004	0.073*	0.039

table continues next page

Table 6.4 Correlates of the Use of Adaptation Strategies by Households (dF/dX) *(continued)*

	Drilled boreholes	*Changed production technology*	*Changed crops*	*Changed crop share vs. livestock*	*Increased use of fertilizer or pesticides*	*Sought or increased off-farm work*
Status of head (ref. = Other)						
Single	−0.055	−0.095**	−0.032	0.004	−0.028	0.004
Married	−0.030	−0.080	−0.041	−0.016	−0.012	−0.058
Education of head (ref. = None)						
Primary	−0.008	0.019	−0.019	−0.002	0.031	−0.099***
Preparatory	−0.049**	−0.107***	−0.033	−0.028*	0.087**	−0.043
Secondary	0.022	−0.007	−0.019	0.025	0.108***	−0.005
Above Secondary	0.040	0.001	0.014	0.019	0.070	−0.002
Head public employee (ref. = No)						
Head is public employee	−0.018	−0.031	−0.049**	−0.002	0.072**	−0.016
Head occupation (ref. = Salaried)						
Self-employed farmer	−0.002	0.040	0.060**	0.041**	0.039	−0.093***
Nonagric self-employed	0.036	0.055	−0.008	0.031	0.192***	−0.052*
Other employer	0.085**	0.078*	0.041	0.001	0.046	−0.083***
Servant/unqualified	−0.061***	0.018	0.131***	0.044	0.062	−0.065*
Other	−0.033	−0.036	−0.009	0.003	−0.057	−0.127***
Agriculture/fisheries/pastoral	0.022	0.091**	0.129***	0.030	0.066*	0.020
Number of observations	2,925	2,929	2,925	2,926	2,926	2,926

	Training for nonfarm work	*Used more stored water*	*Consumed more stored food*	*People moving out*	*Any type of conflict*	*Conflict over water*
Countries (ref. = Algeria)						
Egypt, Arab Rep.	−0.094***	−0.007	0.105**	0.191***	−0.090***	−0.048***
Morocco	−0.210***	−0.203***	0.019	0.269***	−0.120***	−0.047***
Syrian Arab Republic	−0.135***	−0.090***	−0.153***	0.594***	−0.108***	−0.076***
Yemen, Rep.	−0.025*	0.103***	0.061*	0.111***	−0.067***	0.071***
Climatic conditions						
Factor 1: Dryer/warmer weather	0.174***	0.103***	0.334***	0.215***	0.132***	0.032
Factor 2: Excess water	0.129***	−0.086**	0.058	0.223***	−0.042*	0.106***
Losses (ref. = No loss)						
Income	0.061***	0.090***	0.235***	−0.046*	0.056***	0.010
Crops	−0.006	−0.012	0.047*	0.077***	0.028**	0.012
Livestock/cattle	−0.028**	0.044**	−0.025	0.126***	−0.024***	0.035***
Fish	0.002	0.053	0.059	−0.029	0.035*	0.000
Wealth quintiles (ref. = Q5)						
Q1	0.122***	−0.039	0.114***	−0.115***	0.097***	−0.026**
Q2	0.067**	0.034	0.123***	−0.011	0.069**	−0.015
Q3	0.034	0.006	0.068*	0.047	0.121***	−0.006
Q4	0.054**	−0.030	0.120***	−0.011	0.017	0.001

table continues next page

Table 6.4 Correlates of the Use of Adaptation Strategies by Households (dF/dX) *(continued)*

	Training for nonfarm work	*Used more stored water*	*Consumed more stored food*	*People moving out*	*Any type of conflict*	*Conflict over water*
Land status (ref. = Neither)						
Landowners	0.067***	0.122***	0.173***	0.057**	0.047***	0.034***
Land tenants	0.021	0.167***	0.135***	–0.087**	–0.019	–0.026*
Age of head (ref. = 50+ years)						
Less than 30	–0.035*	–0.051*	–0.002	–0.096**	–0.036**	–0.037***
30–39	–0.004	–0.006	0.008	–0.079***	–0.027***	–0.026***
40–49	–0.000	0.027	0.003	0.012	–0.014	–0.011
Gender of head (ref. = Female)						
Male	–0.066	0.099***	0.078	0.038	–0.074	0.008
Status of head (ref. = Other)						
Single	–0.028	–0.061	–0.145**	0.106	0.051	–0.015
Married	–0.000	0.004	–0.120	0.015	0.024	–0.027
Education of head (ref. = None)						
Primary	–0.027	0.076***	–0.016	–0.005	–0.028**	–0.012
Preparatory	–0.026	0.071**	–0.051	–0.035	–0.008	–0.017
Secondary	0.027	0.085**	0.019	0.072*	–0.007	–0.007
Above secondary	0.043	0.078*	–0.035	–0.053	0.015	–0.008
Head public employee (ref. = No)						
Head is public employee	–0.022	–0.015	–0.050	–0.047	–0.048***	–0.023**
Head occupation (ref. = Salaried)						
Self-employed farmer	0.005	0.001	0.093***	–0.031	–0.001	–0.003
Nonagric self-employed	–0.014	0.030	0.037	0.001	0.007	0.001
Other employer	–0.021	–0.039	0.029	0.052	0.067*	0.041*
Servant/unqualified	0.092**	0.010	0.142***	–0.006	0.037	0.107***
Other	–0.071***	–0.045	0.134**	–0.050	–0.038**	–0.003
Agriculture/fisheries/pastoral	0.019	–0.002	0.031	0.030	0.043	0.042
Number of observations	2,926	2,926	2,926	2,929	2,933	2,931

Source: World Bank data.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As for coping mechanisms, households in areas characterized by worsening droughts are more likely to use most of the adaptation strategies listed, which makes sense given that they are more affected by adverse weather events. Apart from a few coefficients that are not statistically significant, the only exception is for terracing the land, which may again denote the cost of the option and may not be very effective against droughts. In addition, and this is different from what was observed for coping mechanisms, households more affected by floods and associated conditions are also more likely to rely on adaptation strategies. The only exception is the reliance on stored water, which is clearly not needed when suffering from an excess of water.

What about the impact of the type of loss suffered, when such loss was incurred? As for coping mechanisms, income losses tend to be associated with a

higher probability of using many of the adaptation strategies when the effects are strongly statistically significant, at least at the five percent level. Similarly, all strongly statistically significant effects for the loss of crops indicate a higher use of adaptation strategies. For livestock, the effects are more varied, with a higher use of some adaptation strategies and a lower use of others.

Landowners are also more likely to use the various adaptation strategies. This is again as expected given that they tend to be more affected by adverse weather events. The same is observed for land tenants, but to a slightly lower extent in terms of the magnitude of the coefficients, their statistical significance, and some cases with opposite effects (for people moving out and conflicts over water, although the second effect is only marginally significant.)

There are also some statistically significant effects in terms of the characteristics of the household head according to age, gender, marital status, education, and occupation, but these are more the exceptions as opposed to the rule given that many coefficients are not statistically significant. Still, households with younger heads are less likely to use many of the adaptation strategies, whether this is because they have fewer means to do so or because they have other options, including that of migration which is often undertaken by younger individuals. Households with a head working as a public employee are also less likely to have to resort to many of the adaptation strategies, the only positive and statistically significant effect being that of the use of fertilizers and pesticides, which is likely to be more affordable to them. Another result which was to be expected is that farmers are also more likely to rely on some of the strategies. What these results suggest is that even though overall the likelihood of using the various adaptation strategies is low in the sample, it is higher for those households who needs such strategies the most, both because of their occupation (in agriculture) and because of their exposure to shocks as captured by the two factors reflecting changes in weather conditions.

Community-Level and Government Responses

In the previous two sections, information was provided about ways in which households cope with or adapt to weather or environmental changes. What about the role of communities and governments? As mentioned in section two, the survey questionnaire asked households whether to cope with the loss of crops, income, or livestock due to weather or environmental changes, the communities in which the household live implemented a number of initiatives. Table 6.5 provides basic statistics on the shares of households declaring that this was indeed the case. Overall, the data suggest that the extent of community involvement to adapt to climate change is rather 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 1 in 10 households on average. There are large differences between countries, with households in Algeria and the Republic of Yemen much more likely to mention community initiatives than households in the other three

Table 6.5 Community Level Response to Deal with Climate Change and Shocks
Percent

	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, Arab Rep.	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
Syrian Arab Republic	14.63	1.63	4.13	2.00	1.50	0.88	1.50
Yemen, Rep.	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: World Bank data.

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.

Similar questions were asked about the role of governments, albeit as mentioned in section two 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 6.6. 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 1 in 10 households declare that the government has been active. There are again differences between countries, with households in Algeria, Syria, and the Republic of 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, as was the case for community-level responses, the extent of government support also appears to be rather limited.

Table 6.6 Government Response to Deal with Climate Change and Shocks
Percent

	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, Arab Rep.	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
Syrian Arab Republic	10.75	10.88	21.88	23.88	21.38	18.13
Yemen, Rep.	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, Arab Rep.	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
Syrian Arab Republic	13.88	30.75	2.88	4.38	10.75	15.38
Yemen, Rep.	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: World Bank data.

Conclusion

The goal of this chapter was to contribute to a better understanding of how households cope with and adapt to changing climatic conditions in the MENA region. The analysis of new household survey data from five countries suggests that while changes in weather patterns and the environment of households have affected a large majority of households, the coping mechanisms and adaptation strategies used by households to deal with those shocks are limited.

Many households appear to have to sell livestock of other assets when affected by adverse weather events, and a large share also appears to be withdrawing

children from school. The ability to ask for loans seems to be limited in the bottom quintiles, while savings can be quickly exhausted. These coping mechanisms, while necessary in the short term, may put at risk the ability of households to increase their earnings in the future, including for the children.

Furthermore, while the likelihood of using various adaptation strategies is higher among the most affected households, virtually all the adaptation strategies are implemented only by a small minority of households. This suggests that while adaptation is taking place, it may not be taking place at the level that the deteriorating climatic conditions appear to call for. Finally, the extent to which households benefit from community level and government programs and initiatives to help them cope with and adapt to weather and environmental changes is limited.

Bibliography

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Burger, N., B. Ghosh-Dastidar, A. Grant, T. Ruder, O. Tchakeva, and Q. Wodon. 2014. "Data Collection." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 3 in this study.

Elasha, Balgis Osman. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

IPCC (Intergovernmental Panel on Climate Change). 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, and G.-K. P. K. J. Mach, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge, UK, and New York, NY: Cambridge University Press.

McSweeney, C., M. New, and G. Lizcano. 2009. "UNDP Climate Change Profiles: Documentation." Mimeo, United Nations Development Program, New York.

United Nations Development Programme and Arab Fund for Economic and Social Development. 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Verner, D., editor, 2012, *Adaptation to a Changing Climate in the Arab Countries*, Directions in Development, World Bank, Washington, DC.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

PART 4

Climate Change and Migration

CHAPTER 7

Do Changes in Weather Patterns and the Environment Lead to Migration?

Franck Adoho and Quentin Wodon

Migration is one of several strategies used by households to respond to changes in climate and environmental conditions as well as 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 on new data collected in 2011 in Algeria, the Arab Republic of Egypt, Morocco, the Syrian Arab Republic, and the Republic of Yemen in two climate affected areas per country. The chapter provides an analysis of the impact of changes in weather patterns and the environment (as perceived by households) on migration, both by members residing in the households (temporary migration) and former household members who have left (permanent migration). The results suggest that perceptions of negative changes in weather patterns and the environment are indeed associated with a higher likelihood of migrating temporarily or permanently.

Introduction

There is a consensus that adverse weather events are likely to lead to migration as individuals and households migrate under climate pressures in order to improve their livelihoods. Such population movements have been taking place for thousands of years (Gupta, Anderson, and Pandey 2006), and today the resulting pressures are accelerating the process of urbanization, given that those most affected by climate change tend to be involved in agriculture in rural areas. With the climate expected to worsen in many parts of the world, including the MENA region, there is substantial concern that migration may accelerate, whether one refers to tye4rms such as environmental migration, forced environmental migration, environmentally motivated migration, climate refugees, environmental displaced persons, disaster refugees, environmental displaced persons, or eco-migrants to refer to this reality. Some estimates suggest that hundreds of millions of people may have to migrate in the next thirty to fifty years (Christian

Aid 2007; Foresight 2011; Jakobeit and Methmann 2007; Stern Review 2006), but there is considerable uncertainty about when and even whether such migration will take place.

Of course, climate change is not the only factor that may lead to migration. Most migrants today migrate in search of economic opportunities, and this search is only partially related to the increasing occurrence of extreme weather events such as droughts or floods in rural areas. Said differently, there is probably no such thing as a 'pure' climate migrant. In fact, the empirical evidence on the effect of climate patterns on migration remains limited, and different patterns may yield very difference responses. While fast-onset disasters may induce only temporary displacement (for example, Findley 1994; Haug 2002; Paul 2005), longer-term trends toward desertification or sea-level rise may have slower but more definitive impacts on the ability of households to remain in certain areas. Because of the many ways in which climate patterns may affect migration, and because migration is itself affected by many other dimensions apart from climate patterns, estimating the impact of weather or environmental conditions on migration is not easy. Ideally, it would be best to have data on changes in climate, as well as changes in migration patterns, and to correlate both while taking also into account data on many other factors that may affect migration. But such datasets are scarce, especially in the Middle East and North Africa where household surveys are few and often not publicly available.

This chapter is based on new household survey data collected in 2011 in five countries—Algeria, Egypt, Morocco, Syria, and the Republic of Yemen (on data collection and the choice of focus countries, see Burger et al. 2014a, 2014b). For a brief review of the literature which informed the data collection and this chapter, see the introduction of chapter 1 by Wodon et al. (2014) and chapter 2 on the five countries of focus for this work by Burger et al. (2014a), both in this study.

One of the objectives of the surveys was to assess whether perceptions of climate change on the part of households affect migration decisions on the part of household members. 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 elicited data on household perceptions of climate change and environmental degradation, and measured whether household members have migrated either temporarily (this is referred to as resident migration because the member still resides in the household) or permanently (this is referred to as nonresident migration).

There are a number of limits to the analysis that can be conducted with such data. First, because the surveys were implemented in sending areas affected by extreme weather events, we do not record information on the migration of entire households—we only record the migration of household members. This is however not too much of a problem given that most migration is typically undertaken by household members, instead of entire households. Second, the surveys are not meant to be representative of the five countries in which the work was carried, since only a few areas were surveyed in each country. Third, it must be

recognized 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. As we are working with cross-sectional household surveys and subjective perceptions of households regarding their environment, it could be that household perceptions of climate change are wrong—even if households declare that rainfalls are becoming more erratic, this may not be the case in reality. At the same time, one could argue that decisions such as that of migrating are influenced at least as much by the perceptions of households of the reality as by the reality itself.

These caveats being clear, the chapter is organized as follows. Section two introduces the data used for the analysis, and some of the questions in the surveys which are the focus of the discussion. Section three provides estimates of migration rates according to both household and individual-level characteristics. That section also discusses results on the subjective reasons mentioned by households as to why some of their members have migrated. Section four provides an analysis of the correlates of migration. A brief conclusion follows.

Data

As was the case for chapters 4 and 6 in this study, this chapter is based on the analysis of new household surveys implemented by Rand under contract with the World Bank and the Agence Française de Développement in five countries: Algeria, Egypt, Morocco, Syria, and the Republic of Yemen. The same household survey instrument was used in all countries with minor adjustments to reflect country context. In each country, approximately 800 households were interviewed in two regions that tend to be affected by extreme weather events ranging from droughts to floods. For a discussion of the areas where the survey was implemented in each of the five countries, the reader is referred to chapter 3 which provides the necessary details.

While the data from all five countries were used without substantial problems in chapters 4 and 6, an important caveat must be noted for this chapter. Unfortunately, the quality of the migration data for one of the countries—Algeria—is not as good as that for the other four countries. There are two different issues that must be acknowledged for the analysis conducted in this chapter. First, the Algeria survey turned out to have been implemented without proper and systematic identification of individuals within households, so that it is not clear that an individual coded, say, 5 in one section of the questionnaire is the same individual as the individual coded 5 in another section of the questionnaire. This means that individual-level regressions cannot be implemented with the Algeria dataset.

This problem does not affect household level regression analysis in other parts of the study as long as the household level analysis includes variables for the household as a whole or the household head (who is the first individual on which data is collected in the various sections). But it does affect regressions that require information on each of the individuals in the household, which is the

case for migration. Thus, neither statistics nor regression results will be provided for Algeria at the level of individuals, although we will provide some basic statistics at the level of households for that country as well as for the four other countries. In addition, the resident migration rates obtained for Algeria appear to be far too low. Thus, even though we will provide basic migration statistics for that country at the level of households, the results may not be as valid as those for the other countries, and again the detailed individual level statistics and the regression analysis will be conducted only with the sample for the other four countries.

The questionnaire for the surveys enables us to look at both temporary or resident and permanent or nonresident migration. We define temporary migration as migration by household members who are still considered as members of the households, while permanent migration refers to migration by household members who have left the household. It must be emphasized that because the surveys are not nationally representative and were implemented only in two sending areas affected by extreme weather events, we are not able to provide estimates of migration by entire households away from the sending areas—we only record the migration of household members. As noted in the introduction, this is however not too much of a problem, given that most migration is undertaken by household members, instead of entire households.

The survey questionnaires provide information on the migration of both resident and nonresident household members. While many surveys do have information on resident members, relatively few surveys also have a special module asking questions about nonresident migrants, but our surveys do. In addition, the surveys include a detailed module on household perceptions regarding changes in weather patterns and the environment. The perceptions of these changes can then be related to the decision by some household members to migrate temporarily or permanently. It could be that household perceptions about the changes in weather patterns and their environment are mistaken, but even if this were the case, perceptions probably matter as much as real events in how household members make decisions regarding migration.

Apart from basic statistics, we rely on regression analysis of the correlates of migration decisions in order to assess the impact on migration at the margin (controlling for a range of household and individual characteristics) of differences in perceptions about changes in weather patterns and the environment. But we will also use a direct question asked to households about the main reasons for the migration of some of their members. The question was asked for resident migrants as follows: "What were the two most important reasons why [NAME] moved here? Please state in order of importance: a—First reason; b—Second reason." The potential answers for respondents listed in the survey questionnaire were as follows: (1) Better employment opportunity (seasonal jobs) in the destination; (2) Divorce/separation/death of spouse; (3) Better employment opportunity (nonseasonal jobs) in the destination; (4) Delivery; (5) Lack of employment opportunity in place of origin; (6) Family problems; (7) To accumulate savings; (8) Accompany patient; (9) Transferred (job); (10) Escape flood; (11) Schooling; (12) Escape

drought; (13) Better infrastructure; (14) Poor quality of land or depleted soils; (15) Join family; (16) Civil conflict/war; (17) Marriage; and finally (18) Other.

Of those answers, the options related to droughts and floods are directly related to extreme weather events, and some of the other options, such as the poor quality of land or depleted soils may be indirectly related to change in weather patterns and the environment. A similar question is asked to nonresident migrants, although with only one main reason for migration provided instead of two for nonresident migrants. Comparing the information obtained from those subjective perceptions of migration with the results from the regression analysis provides a way to check if the order of magnitude of the coefficient estimates obtained from the regression analysis appear to make sense or not.

Basic Statistics

What is the extent of migration in the sample? Data on both resident and nonresident migration rates are provided at the level of households in table 7.1, which includes Algeria as well as the other four countries (see section two on the Algeria dataset). Three in every ten households (29.9 percent) have one or more

Table 7.1 Household-Level Migration Rates
Percent

	All			*Last 5 years*		
	Resident	*Nonres.*	*Either type*	*Resident*	*Nonres.*	*Either type*
All	13.46	21.98	29.92	10.79	16.12	23.30
Country						
Algeria	0.60	13.50	14.10	0.21	10.17	10.38
Egypt, Arab Rep.	17.88	19.13	26.25	11.75	12.38	17.38
Morocco	1.75	26.74	27.65	1.41	18.40	19.49
Syrian Arab Republic	18.13	35.88	46.75	17.75	29.75	41.50
Yemen, Rep.	28.86	14.68	34.83	22.76	9.95	27.74
Quintiles of wealth						
Q1	14.99	23.16	31.68	11.64	16.06	23.19
Q2	14.42	20.50	29.02	11.52	15.09	22.86
Q3	16.15	25.11	35.22	12.91	19.27	27.65
Q4	10.49	20.79	26.59	9.34	15.10	21.41
Q5	11.45	20.48	27.41	8.68	15.25	21.62
Losses						
Lost income	12.54	22.74	30.06	9.84	15.97	22.62
Lost crops	14.33	23.34	32.20	11.67	17.53	25.73
Lost livestock or cattle	11.69	26.99	33.90	8.72	18.38	24.54
Less fish caught	17.73	27.87	38.91	11.62	13.95	22.96
Ownership of land by the household						
Owns land /Rent land to other	10.18	24.13	29.55	7.56	16.08	21.06

table continues next page

Table 7.1 Household-Level Migration Rates *(continued)*
Percent

	All			*Last 5 years*		
	Resident	*Nonres.*	*Either type*	*Resident*	*Nonres.*	*Either type*
Rents land from other/ cooperative	19.85	16.74	28.36	15.73	12.85	22.82
Does not own/cultivate land	14.74	21.24	30.30	12.19	16.49	24.67
Quintiles for droughts climatic factor						
Q1 (best conditions)	14.31	17.66	24.57	10.17	12.07	17.97
Q2	9.35	19.98	26.10	7.07	14.70	19.05
Q3	12.99	16.22	24.39	10.52	11.16	18.17
Q4	12.49	23.52	31.32	9.78	17.57	24.75
Q5 (best conditions)	18.17	32.47	43.20	16.42	25.10	36.54
Quintiles for floods climatic factor						
Q1 (best conditions)	11.57	19.33	27.93	10.09	14.86	22.67
Q2	15.17	20.68	30.24	13.72	17.17	26.99
Q3	13.61	21.97	29.13	11.22	15.59	22.87
Q4	18.76	21.35	31.54	13.26	15.25	23.15
Q5 (worst conditions)	8.35	26.86	31.02	5.51	17.82	20.64

Source: World Bank data.

migrants, whether resident or nonresident. When the question is restricted to migrants over the last five years, the proportion is lower, at 23.3 percent. Having nonresident migrants is more likely than having resident migrants, which suggests that the rate of permanent departure is fairly high. This is explained in part because some nonresident migrants leave the household to marry, which is a normal demographic process, but most nonresident migrants actually leave for other reasons, as will be discussed in more details below.

There are large differences between countries in the likelihood of migration, especially among resident members. Migration rates are highest in Syria where almost half of the households have migrants and the Republic of Yemen where a third of households have migrants. By contrast, migration rates are lowest in Algeria. In that country, while the nonresident migration rate may be realistic, the resident migration late appears to be very low, so one could wonder if there is not a data issue here, although a very low nonresident migration rate is also observed for Morocco. What is clear is that migration rates depend substantially on the particular features and history of each country, and indeed each region within the five countries. While there are differences in migration rates between quintiles of wealth, these do not appear to be very large, even if resident migration rates tend to be lower in higher quintiles. More differences will emerge when looking at the characteristics of individual migrants. There are also differences in migration rates according to whether households suffered from losses due to adverse weather events, but again they tend for the most part not to be very large.

The most important finding from table 7.1 for our purpose is the fact that there are differences in migration rates according to perceptions of changes in the

climate of the areas in which households live. In chapter 4 of this study, Adoho and Wodon (2014) construct through a multiple correspondence analysis (MCA) two indices or factors that summarize household perceptions regarding changes in weather patterns and the environment. The first factor mostly captures the extent to which households perceive that the climate is becoming dryer and warmer, and it is associated with droughts and the lack of rain. The second factor mostly 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.

In table 7.1, migration rates are computed according to the quintiles of climate perceptions of households. For example, the first quintile for the first factor consists of the households who tend to perceive that the climate is not getting dryer and warmer, while the top quintile consists of those households who perceive that the climate is getting much more dry and warm, and these are the households most likely to be affected by droughts. The same interpretation holds for the quintiles of the second factor, whereby those in the top quintile are most affected by excess water, which essentially again is associated with floods. Table 7.1 suggests that household level migration rates are substantially higher in the top quintile of the first MCA factor than in the bottom quintiles, and this holds for both resident and nonresident migrations. The differences are not as clear-cut for the second factor. Resident migration rates are lower in the top quintile of the second MCA factor, while nonresident migration rates are higher in the top quintile.

Statistics were presented at the level of households in table 7.1 in part in order to be able to include Algeria in the analysis. But it is more interesting to analyze migration decisions at the individual level and data are available at that level. This is done table 7.2, although as mentioned in section two, Algeria is excluded from

Table 7.2 Individual-Level Migration Rates by Selected Characteristics
Percent

	Resident migration		*Nonresident migration*	
	All sample	*Last 5 years*	*All sample*	*Last 5 years*
All	7.62	6.15	8.04	5.65
Countries				
Egypt, Arab Rep.	6.29	4.13	6.13	3.95
Morocco	0.61	0.52	8.10	5.22
Syrian Arab Republic	11.22	10.64	12.75	10.37
Yemen, Rep.	11.61	8.66	4.99	2.85
Losses				
Lost income	8.96	7.24	8.02	5.03
Lost crops	8.73	6.72	9.00	6.42
Lost livestock or cattle	7.79	5.77	8.50	5.09
Less fish caught	8.72	5.82	7.97	3.34

table continues next page

Table 7.2 Individual-Level Migration Rates by Selected Characteristics *(continued)*

	Resident migration		*Nonresident migration*	
	All sample	*Last 5 years*	*All sample*	*Last 5 years*
Quintiles of wealth				
Q1	8.72	7.09	6.80	4.80
Q2	6.85	5.31	7.39	5.10
Q3	8.68	6.97	8.07	5.99
Q4	5.82	5.04	8.20	5.68
Q5	7.42	5.84	11.44	7.78
Ownership of land by the household				
Owns land /Rent land to other	7.50	5.54	8.67	5.21
Rents land from other/cooperative	10.32	7.86	5.95	4.98
Does not own/cultivate land	7.39	6.28	7.94	5.95
Relationship of the migrant with the HH head				
Self	13.28	9.98	4.29	2.89
Husband/wife	3.73	3.00	2.29	2.09
Son/daughter	7.08	6.22	9.98	7.10
Other	4.39	3.52	20.46	13.43
Age group of the migrant				
Less than 30	9.56	9.08	10.60	7.46
30–39	9.32	7.51	9.57	6.79
40–49	7.78	6.39	3.40	2.34
50–59	6.89	5.15	2.50	1.73
60+	6.40	5.11	2.18	1.35
Gender of the migrant				
Male	8.41	7.75	11.76	8.34
Female	7.54	5.99	3.66	2.48
Education level of the migrant				
Below primary	6.65	5.57	5.56	3.88
Primary	7.38	6.20	9.98	7.92
Preparatory	8.09	5.99	3.67	2.43
Secondary	12.28	8.72	9.41*	5.93*
Higher	12.37	9.66	—	—
Quintiles for droughts climatic factor				
Q1 (best conditions)	5.60	4.11	6.13	4.26
Q2	7.35	5.36	6.08	4.12
Q3	8.17	6.64	7.33	4.77
Q4	6.01	4.98	8.70	6.68
Q5 (best conditions)	10.78	9.37	11.36	7.89
Quintiles for floods climatic factor				
Q1 (best conditions)	8.40	7.00	6.32	4.15
Q2	5.49	4.24	5.79	3.94
Q3	8.57	6.54	8.12	5.54
Q4	7.72	6.04	8.25	6.21
Q5 (best conditions)	8.24	7.24	11.19	7.94

Source: World Bank data.

this analysis. Some 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. Migration rates at the level of individuals are by definition lower than at the level of households since only a subset of the household members migrate, but many of the points already made at the level of households remain. For example, migration rates are higher in Syria and the Republic of Yemen than in Egypt, and lowest in Morocco among the four countries for which data are provided. Importantly, while nonresident migration rates were higher than resident migration rates at the level of households, the two rates are of a similar order of magnitude when considering individuals. This is not surprising since, among other factors, resident migration is less costly to finance for a households than nonresident migration, so that more household members can migrate temporarily than permanently. There are some differences in migration rates by quintiles of wealth, landownership status and according to the types of losses suffered due to adverse weather events, but these tend not to be systematic.

Differences tend to be much more systematic when looking at the characteristics of the migrants. First, migration rates tend to be higher among heads of household for resident migration (heads tend to be those going away temporarily to find work), while they are lower for household heads among nonresidents (who have a household to take care of and cannot leave other household members behind permanently). The likelihood of migrating is clearly higher for younger individuals (those below the age of 30) than for older individuals (for example those aged 40 or above). Migration rates are higher for men than for women, and this is especially the case for nonresident migration. Finally, migration rates are higher when the individuals are more educated, probably because the opportunities for the more educated to find better employment opportunities elsewhere tend to be higher (for nonresident migrants, the top two categories of education have been merged in the statistics as is done for the regressions).

What is however of higher interest for this chapter is the relationship between individual migration rates and the climatic conditions of the areas where households live. The observation made regarding higher household-level migration rates in areas with poor conditions in terms of droughts remains—individual-level migration rates are still higher in the top quintile of the first MCA factor than in the bottom quintiles, and this holds for both resident and nonresident migrations. But now, we also have at the level of individuals a positive relationship between high values for the second MCA factor, indicating areas subjected to floods, and migration rates, especially when considering the extent of migration over the last five years, which is also the interval on which the two factors for the perceptions about climate change are estimated. There is thus some statistical evidence that worse climatic conditions, or more precisely perceptions of negative changes in weather patterns and the environment, are associated with more migration.

To what extent are climate factors key determinants of migration? While this question is best answered using multivariate regression analysis, as mentioned in section two indicative information can also be obtained from direct responses given by respondents in the survey (typically household heads) about the reasons for migrating. The statistics on the self-declared reasons for migration are provided in table 7.3. In the case of nonresident migration, up to two reasons for migration could be provided, while only the main reason could be provided in the case of resident migration. Note that the data appear to be of better quality in the case of nonresident migration, where missing values are rare. In the case of resident migration by contrast many responses are missing, but the available responses are still instructive.

In the case of nonresident, the two main reasons to migrate are the search for better employment opportunities and the lack of employment opportunity in place of origin. Both reasons are related, but in terms of the language used, the first reason can be associated more with pull factors at the area of destination, while the second can be associated more with push factors from the area of origin. Together, those two reasons account for more than half of all departures for which information on the reasons to migrate is available. Marriage comes third

Table 7.3 Self-Declared Reasons for Migration
Percent

	Nonresident		*Resident*	
	1st reason	*2nd reason*	*1st reason*	*1st reason w/o missing*
Better employment opportunity	34.79	17.17	5.84	36.0
Lack of employment opportunity in place of origin	21.07	25.93	2.92	18.0
To accumulate savings	5.41	18.21	2.06	12.7
Transferred (job)	1.37	2.78	0.49	3.0
Schooling	1.78	0.69	0.75	4.6
Better infrastructure	2.42	3.99	0.26	1.6
Join family	4.52	4.77	1.56	9.6
Marriage	18.4	4.42	0.14	0.9
Divorce/separation/death of spouse	0.16	0.52	0.10	0.6
Delivery	0.08	0.69	0.03	0.2
Family problems	1.61	1.99	0.16	1.0
Accompany patient	0.24	0.35	0.10	0.6
Escape flood	0.40	0.26	—	—
Escape drought	5.73	5.9	0.75	4.6
Poor quality of land or depleted soils	—	0.43	0.03	0.2
Violence, violent conflict, or threat of violence	—	0.17	0.07	0.4
Other	1.94	7.72	0.91	5.6
Missing	0.08	3.99	83.8	—
Total	100.0	100.0	100.0	100.0

Source: World Bank data.
Note: — = not available.

as the main reason to migrate permanently, reflecting the natural departure of young adults from the household. But when considering the second main reason to migrate permanently, accumulating savings is much more often mentioned than marriage, and that reason is also prominent as a factor leading to resident or temporary migration. Climate factors are mentioned as reasons for both nonresident and resident migrations, but not very often. In the case of nonresident migration for example, 5.7 percent of migrants cite the need to escape a drought as the first reason to migrate (virtually all households mentioning droughts are from the Syria survey, as shown in the annex), and another 5.9 percent mention droughts as the second reason to migrate (again, mostly in Syria). Floods are also mentioned, but to a lower extent.

In the case of resident migration, the data are not very good due to a large number of missing values, but when those missing values are eliminated, droughts are also mentioned as the first reason to migrate by around five percent of migrants. Furthermore, it is likely that the search for better employment opportunities and the lack of employment at the places of origin are also related in part to poor climatic conditions in the places of origin. Thus, as is the case for permanent migration, even if climatic factors may not be the main factor at play for the current patterns of temporary migration, they do appear to have a significant role.

Correlates of Resident and Nonresident Migration

While the basic statistics reviewed so far provide useful information on self-declared reasons to migrate (as seen from the point of view of the main respondent to the survey, which is typically the household head), a more robust and detailed analysis can be conducted using multivariate regression analysis. Recall in the discussion of the basic statistics the emphasis placed on comparing migration rates according to the level of climatic stress of households using the synthesis variables created by the multiple correspondence analysis. The basic statistics suggested higher rates of migration in areas with higher climatic stress. The question for the regression analysis is whether this apparent relationship between climatic factors and migration remains after controlling for a range of household and individual characteristics.

Tables 7.4 and 7.5 give the results from probit regression on the correlates of resident and nonresident migrations. Resident migrants are still considered to be part of the household, while nonresident migrants have left the household. The estimations are done for the sample as a whole and for those who migrated over the last five years. In each case two alternative specifications are provided. In the first specification, the losses incurred by households due to adverse weather events are included in the set of independent variables. In the second specification this is not done, given that these losses themselves are a result of adverse weather events, so that including them in the set of independent variables may take away some of the impact of weather events on migration. This does however not appear to be the case as most of the results are not very sensitive to the

Table 7.4 Correlates of Migration among Resident Members (dF/dX)

	With Losses		*Without Losses*	
	Migrated	*Migrated in last 5 years*	*Migrated*	*Migrated in last 5 years*
Country (ref. = Syrian Arab Republic; Algeria excluded)				
Egypt, Arab Rep.	0.094***	0.025**	0.099***	0.044***
Morocco	–0.039***	–0.036***	–0.039***	–0.032***
Yemen, Rep.	0.098***		0.094***	0.050***
Climatic conditions				
Factor 1: Poor weather/climatic conditions	0.049***	0.033***	0.045***	0.031***
Factor 2: Severe water shocks	0.050***	0.035***	0.044***	0.033***
Losses due to adverse events (ref. = No losses)				
Income	–0.000	0.003	—	—
Crop	–0.005	–0.007	—	—
Livestock or cattle	–0.019***	–0.016***	—	—
Fish	0.006	0.002	—	—
Quintiles (ref = Q5)				
Q1	0.007	–0.000	0.008	0.007
Q2	0.004	–0.000	0.004	0.005
Q3	0.008	0.004	0.007	0.008
Q4	–0.010*	–0.008	–0.011*	–0.004
Household size (ref. = Below 5)				
5 Thru 8	0.007	0.069***	0.004	0.012
9 or more	0.009	0.081***	0.007	0.014
Land status (ref. = Neither)				
Own land /rent land to other	0.009*	0.002	0.004	–0.002
Rent land from other/cooperative	0.031**	0.024**	0.029**	0.024**
Relation to head (ref. = Husband/Wife/Other)				
Self	0.026**	0.029***	0.030***	0.028***
Son/daughter	–0.026***	–0.025***	–0.024**	–0.021**
Age (ref. = 50+ years)				
Less Than 30	0.022***	0.035***	0.023***	0.033***
30 Thru 39	0.041***	0.051***	0.043***	0.050***
40 Thru 49	0.018**	0.018**	0.019**	0.019**
Gender (ref. = Female)				
Male	0.027***	0.020***	0.026***	0.020***
Marital Status (ref. = Div./Widow)				
Single	0.002	0.002	0.001	0.004
Married	–0.009	–0.010	–0.009	–0.007
Education (ref. = Below primary)				
Primary	–0.012**	–0.015***	–0.014**	–0.013**
Preparatory	0.009	0.004	0.009	0.005

table continues next page

Table 7.4 Correlates of Migration among Resident Members (dF/dX) *(continued)*

	With Losses		*Without Losses*	
	Migrated	*Migrated in last 5 years*	*Migrated*	*Migrated in last 5 years*
Secondary	0.022**	0.019**	0.024***	0.014*
Above secondary	0.013	0.015	0.016	0.013
Public employee (ref. = No)				
Migrant is public employee	–0.013***	–0.011**	–0.012**	–0.010**
Occupation (ref. = Salaried)				
Self-employed farmer	–0.022***	–0.020***	–0.022***	–0.019***
Nonagric self-employed	–0.004	–0.005	–0.003	–0.003
Other employer	–0.010	–0.003	–0.009	–0.005
Servant/unqualified	0.007	0.012	0.006	0.010
Other	–0.012**	–0.004	–0.012*	–0.005
Agric/fish/pasto	0.022**	0.018**	0.022**	0.020**
Number of observations	7,123	7,123	7,123	7,123

Source: World Bank data. Robust standard errors.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

difference in specification (with or without losses from adverse climate), but testing for the possibility that this could have happened was important.

The main variables of interest are the two MCA factors. Recall that these factors are normalized between zero and one, with values of zero denoting the best climatic conditions in the sample and values close to one denoting the worst conditions. The first factor captures events such as droughts and the lack of rain, while the second captures instead excess rain, and especially floods. In table 7.5, higher values for both factors (that is, 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. Tthe effects for nonresident migration are similar, although statistically significant only for the whole period, as opposed to the last five years. Thus overall higher values for both factors (that is, worse climatic conditions) result in higher rates of both temporary and permanent migration. For example, in the specification with the losses incurred due to adverse weather events, the maximum increase in the sample in the value of any one of the two factors from zero to one would yield an increase in the probability of resident migration of about five percentage points when considering the whole sample, and about 3.5 points when considering the last five years. That the increase is larger for the sample as a whole was to be expected, given that migration rates are higher when considering a longer period of time during which migration may take place. The effects are slightly smaller in the specification without losses. For nonresident migration, the effects are smaller, but still of a similar order of magnitude, especially for the full period estimation.

Are these estimates likely to be of the right order of magnitude? This is of course a very difficult question to answer with limited data, but a comparison

Table 7.5 Correlates of Migration among Nonresident Members (dF/dX)

	With Losses		*Without Losses*	
	Migrated	*Migrated in last 5 years*	*Migrated*	*Migrated in last 5 years*
Country (ref. = Syrian Arab Republic; Algeria excluded)				
Egypt, Arab Rep.	0.033*	–0.010	0.038*	–0.014
Morocco	–0.047***	–0.032***	–0.045***	–0.036***
Yemen, Rep.	–0.255***	–0.141***	–0.251***	–0.151***
Climatic conditions				
Factor 1: Poor weather/climatic conditions	0.047**	0.010	0.052***	0.006
Factor 2: Severe water shocks	0.039**	0.016	0.040**	0.013
Losses due to adverse events (ref. = No losses)				
Income	–0.002	0.005	—	—
Crop	–0.010	–0.004	—	—
Livestock or cattle	0.012	0.002	—	—
Fish	0.013	–0.024***	—	—
Quintiles (ref = Q5)				
Q1	–0.136***	–0.073***	–0.136***	–0.073***
Q2	–0.106***	–0.057***	–0.106***	–0.058***
Q3	–0.089***	–0.046***	–0.090***	–0.046***
Q4	–0.063***	–0.038***	–0.063***	–0.039***
Household size (ref. = Below 5)				
5 Thru 8	0.583***	0.326***	0.583***	0.325***
9 or more	0.736***	0.486***	0.734***	0.488***
Land status (ref. = Neither)				
Own land/rent land to other	0.067***	0.025***	0.067***	0.020***
Rent land from other/cooperative	0.003	0.016	0.001	0.015
Relation to head (ref. = Husband/Wife/Other)				
Self	–0.119***	–0.050***	–0.120***	–0.051***
Son/daughter	–0.067***	–0.022***	–0.068***	–0.023***
Age (ref. = 50+ years)				
Less Than 30	0.085***	0.029**	0.085***	0.030**
30 Thru 39	0.061***	0.021	0.061***	0.021
40 Thru 49	–0.022	–0.017*	–0.023	–0.017*
Gender (ref. = Female)				
Male	0.056***	0.023***	0.056***	0.023***
Education (ref. = Secondary or above)				
No education	–0.051***	–0.037***	–0.051***	–0.037***
Primary	–0.038***	–0.019***	–0.038***	–0.018**
Preparatory	–0.032***	–0.013	–0.031***	–0.013*
Occupation (ref. = Salaried)				
Self-employed	–0.090***	–0.052***	–0.091***	–0.051***
Unemployed/servant/unqualified	0.079***	0.047***	0.080***	0.046***
Other	0.136***	0.075***	0.135***	0.076***
Observations	5,827	5,827	5,827	5,827

Source: World Bank data. Robust standard errors.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

between the results suggested by the regression analysis and the data on subjectively declared reasons for migration mentioned in the previous section helps in provide at least a partial cross-check. Consider a large increase in the value of the MCA indices of 0.30 (those indices are scaled to take a value between zero and one, so that an increase in the value of any one of the two indices of 0.30 is large). If we look at the probabilities of migration in the last five years, this would generate an increase in the probability of resident migration of about one percentage point, while the impact on nonresident migration is not statistically significant. If we look at the data on migration for a longer period, the increase in migration is statistically significant for both resident and nonresident migrations, and it would be at about 1.5 percentage point for both types of migration. Given that the overall migration rate in the sample is at about 7–8 percentage points, this increase would not be negligible by any means, and it would represent between one tenth and one fifth of the overall level of migration observed. This proportion is a bit higher than the share of migrants who declared that droughts and floods were the main reasons to migrate, but this is what we would have expected given that poor climate may also be in part responsible for some of the migrants leaving the households temporarily or permanently in search of better employment opportunities or because of a lack of employment opportunity in their place of origin. Said differently, the findings obtained with the subjective perceptions of the reasons to migrate and the regression analysis of the impact of climate perceptions on migration tend to be broadly coherent.

What about the impact of losses incurred from adverse weather events? The marginal impact of most losses on migration are not statistically significant, with the exception of losses in assets or livestock, which are associated with a decrease in migration rates of just under two percentage points. This might be related to the fact that the resources needed to facilitate migration by household members may have been weakened (migration, even on a temporary basis, is costly when sending the migrant away, even if it generates additional resources later).

A number of other variables have statistically significant effects. In comparison to the reference country (Syria), resident migration rates are higher in Egypt and the Republic of Yemen, and lower in Morocco. For nonresident migration, the rates are again higher in Egypt than in Syria, and lower in Morocco, but the Republic of Yemen rates are also below those observed in Syria.

Resident migration rates tend not to change much by quintile of well-being. For nonresident migration by contrast, the effects are much larger and statistically significant, with poorer households less likely to have nonresident migrants, probably in part because of the cost of sending one household member away permanently. Landownership above one acre of land—which may be a sign of wealth in rural areas—is associated with a statistically significant increase in permanent migration by household members, while households renting land as tenants are more likely to have some of their members migrate temporarily. The effect of education on resident migration is not systematic, while it is again for resident migration with the better educated much more likely to migrate, a finding that is coherent with the previous comment made about the relationship

between wealth and permanent migration. Self-employed individuals working in agriculture tend to migrate less, and this is observed for both temporary and permanent migration, but those with low employment status (the unemployed, servants and unqualified workers) are more likely to be nonresident migrants, controlling for other household and individual characteristics, probably because of better employment opportunities elsewhere.

In terms of demographic variables, the effects are as expected as well. Individuals from larger households are more likely to migrate permanently (their labor is likely to be less needed at their place of origin given the presence of other household members), while the effect is smaller and less often statistically significant for resident migration. Another important difference between resident and nonresident migrations is that the likelihood of resident migration is higher for household heads, while for nonresident migration it is higher for other household members, as expected. Both resident and nonresident migration rates are much higher for younger individuals, with the effects being especially large for nonresident migration.

Conclusion

Migration is one of several strategies used by households to respond to changes in climate and environmental conditions as well as extreme weather events. The objective of this chapter was to use new household survey data collected in 2011 in two climate-affected areas of five MENA countries (Algeria, Egypt, Morocco, Syria, and the Republic of Yemen) in order to assess whether perceptions of changes in weather patterns and the environment are correlated with the decision to migrate by some household members. Both resident (temporary) and nonresident (permanent) migrations were considered. Statistical as well as regression analysis were implemented.

Overall, the findings from both the statistical analysis and the regression estimates suggest that socioeconomic and demographic factors today probably play a larger role than climatic factors in the temporary and permanent migration decisions of household members. This is a finding that is coherent with other chapters in this study, some of which use similar analytical methods while others are based on different types of data and approaches.

However, this does not mean that changes in weather patterns and the environment do not play an important role in migration decisions. When combining the results from the statistical analysis and the regressions, it is legitimate to suggest that climatic events may well account for about 10–20 percent of current levels of migration, which is still large. And the role that weather patterns play could well increase in the future as climatic conditions deteriorate further.

Annex 7A: Reasons for Migration by Country, Five Countries Sample

Annex 7A.1 Reasons for Migration by Country, Five Countries Sample

Percent

	Algeria	*Egypt, Arab Rep.*	*Morocco*	*Syrian Arab Republic*	*Yemen, Rep.*	*All*
First reason						
Better employment opportunity at destination	1.0	5.7	8.9	15.5	3.6	34.8
Lack of employment in place of origin	2.7	2.7	3.2	10.1	2.3	21.1
Accumulating savings	0.6	1.5	0.0	1.9	1.3	5.4
Transferred (Job)	0.0	0.3	0.2	0.2	0.7	1.4
Schooling	0.0	0.2	0.4	0.4	0.7	1.8
Better infrastructure	0.5	0.0	0.9	0.4	0.6	2.4
Join family	0.0	0.4	0.6	2.7	0.8	4.5
Marriage	5.9	1.5	8.0	0.2	2.8	18.4
Divorce/separation/death of spouse	0.0	0.1	0.0	0.0	0.1	0.2
Delivery	0.0	0.1	0.0	0.0	0.0	0.1
Family problems	0.0	0.4	0.2	0.2	0.8	1.6
Accompany patient	0.0	0.0	0.2	0.0	0.0	0.2
Escape flood	0.0	0.0	0.3	0.1	0.0	0.4
Escape drought	0.0	0.0	0.2	5.6	0.0	5.7
Other	0.0	0.6	0.0	0.1	1.3	1.9
Missing	0.0	0.1	0.0	0.0	0.0	0.1
Total	10.8	13.7	23.0	37.4	15.1	100.0
Second reason						
Better employment opportunity at destination	1.4	3.0	4.3	6.1	1.2	16.0
Lack of employment in place of origin	0.2	2.2	5.4	15.5	0.8	24.1
Accumulating savings	2.4	5.2	0.4	5.4	3.5	16.9
Transferred (Job)	0.0	0.3	1.0	0.6	0.6	2.6
Schooling	0.0	0.0	0.2	0.2	0.2	0.6
Better infrastructure	1.5	0.2	1.0	0.5	0.5	3.7
Join family	0.6	0.4	1.4	0.2	1.9	4.4
Marriage	1.1	0.2	1.6	0.2	0.9	4.1
Divorce/separation/death of spouse	0.0	0.2	0.0	0.1	0.2	0.5
Delivery	0.0	0.4	0.0	0.0	0.2	0.6
Family problems	0.1	0.1	0.1	0.5	1.1	1.9
Accompany patient	0.0	0.1	0.0	0.1	0.2	0.3
Escape flood	0.0	0.1	0.2	0.0	0.0	0.2
Escape drought	0.0	0.0	0.6	4.9	0.0	5.5
Poor quality of land or depleted soils	0.0	0.0	0.2	0.1	0.2	0.4
Violence, conflict, or threat of violence	0.0	0.0	0.0	0.0	0.2	0.2
Other	3.2	0.2	0.0	0.3	3.4	7.2
Missing	0.0	1.0	0.0	2.7	0.0	3.7
Total	10.6	13.6	16.4	37.4	15.1	93.1

Source: World Bank data.

Bibliography

Adoho, F., and Q. Wodon. 2014. "Perceptions of Climate Change, Weather Shocks, and Impacts on Households." In Climate Change and Migration: Evidence from the Middle East and North Africa Region, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 4 in this study.

Barrios, S., L. Bertinelli, and E. Strobl. 2006. "Climatic Change and Rural–Urban Migration: The Case of Sub-Saharan Africa." *Journal of Urban Economics* 60 (3): 357–71.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Burger, N., B. Ghosh-Dastidar, A. Grant, T. Ruder, O. Tchakeva, and Q. Wodon. 2014. "Data Collection." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 3 in this study.

Christian Aid. 2007. "Human Tide: The Real Migration Crisis—A Christian Aid Report." Christian Aid, London.

Elasha, Balgis Osman. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

Findley, Sally E. 1994. "Does Drought Increase Migration? A Study of Migration from Rural Mali During the 1983–1985 Drought." *International Migration Review* 28 (3): 539–53.

Foresight. 2011. *Migration and Global Environmental Change.* London: The Government Office for Science.

Gupta, A. K., D. M. Anderson, D. N. Pandey. 2006. "Adaptation and Human Migration, and Evidence of Agriculture Coincident with Changes in the Indian Summer Monsoon during the Holocene." *Current Science* 90 (8): 1082–90.

Haug, R. 2002. "Forced Migration, Processes of Return and Livelihood Construction among Pastoralists in Northern Sudan." *Disasters* 26 (1): 70–84.

Jakobeit, C., and C. Methmann. 2007. *Klimaflüchtlinge—Die verleugnete Katastrophe.* Hamburg: Greenpeace.

Paul, Bimal Kanti. 2005. "Evidence Against Disaster-Induced Migration: the 2004 Tornado in North-Central Bangladesh." *Disasters* 29 (4): 370–85.

Stern, N. (2006). *The Economics of Climate Change—The Stern Review.* Cambridge University Press: Cambridge.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

CHAPTER 8

Climate-Induced Migration in the MENA Region: Results from the Qualitative Fieldwork

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This chapter is based on qualitative focus group and in-depth interview data collected among rural residents and urban migrants in the five focus countries for this study. The chapter documents the relationship between climate change and internal human mobility as seen by the population, as well as some of the other adaptation strategies used by households to cope with a deteriorating climate. Rural residents are clearly aware of climate change. They perceive a shift in climactic conditions that affects their livelihood due to deteriorating agricultural conditions. Among households affected by climate change, migration appears to be more of a strategy of last resort than of first resort, although there are exceptions. For those who migrate to urban areas, obtaining a job as well as a proper dwelling is hard and further hindered by corruption and competition for limited employment opportunities. The obligation to send remittances also puts pressure on migrants. Yet, despite difficulties and pressures, the perceived benefits of migration in terms of the independence and opportunities afforded by urban life remain substantial.

Introduction

The MENA region is experiencing warmer temperatures and precipitation levels are falling. Adverse extreme weather events are expected to increase in frequency and severity in coming decades. As a result of its impact on the environment, climate change has significant effects on economic outcomes. In many MENA countries—including those that are the focus of this study—economic growth and poverty levels are strongly influenced by agriculture and agricultural-related activity. For example, about three fourths of Morocco's poor depend on agriculture for their livelihood. This population lives on land with poor agricultural potential which is sensitive to changes in rainfall. While agriculture in Morocco represents only one seventh of gross domestic product (GDP), it employs almost half of the labor force.

A similar pattern is evident in the Republic of Yemen, where agriculture accounts for a similar share of GDP and employs 55 percent of the labor force. In the Arab Republic of Egypt also, agriculture represents only one seventh of GDP, but it employs 55 percent of the labor force. In the Syrian Arab Republic, 45 percent of the population works in agriculture, and the country is on the verge of water poverty, against the backdrop of declining rainfall and a decline in the availability of agricultural land as well as rising temperatures (MSEA 2010; Qabbani 2010; el Atrache 2009). Such trends are evident throughout the MENA region where it is estimated that overall, 80–100 million people may experience water stress by 2025 (Warren et al. 2006). By 2050 water availability per capita is expected to decline by 50 percent versus current levels and declining precipitation is likely to reduce further the availability of agricultural land and its productivity, thereby endangering the livelihood of millions of households (UNDP 2009).[1]

As vulnerable rural populations attempt to cope with new and challenging circumstances, various strategies are at their disposal. Individuals or households may eat less, sell assets, remove children from school, or they may migrate as one of a number of strategic choices. Migration is indeed a common means of dealing with risks from the environment. But the extent to which climate change affects migration is unclear, because migration is affected by multiple push and pull factors. Push factors do include changes in the climate such as warming temperatures, heat waves, declining rainfall, and also floods, among others. These events act as catalysts for migration from rural to urban areas or to other countries, whether temporarily or permanently. This is because climate and subsequent environmental degradation decrease agricultural crop production, as well as livestock or water availability, which adversely affects economic activity. But pull factors that may have nothing to do with climate change also influence migration. The existence of economic opportunities such as employment, well-established community networks that help reduce uncertainty and risk, and housing in urban areas may all be variables that pull migrants to a particular area independently of changes in the climate. The possibility of better access to schools, health care, electricity, and possibly clean water and functioning sewage systems in urban areas also influences the decisions of some migrants to leave.

There is unfortunately a dearth of rigorous analysis on climate change and migration to better understand the impact of climate change on human mobility in the MENA region. This is not only the case for quantitative analysis, but also for qualitative analysis. For a brief review of the literature which informs this chapter, see the introduction of chapter 1 by Wodon et al. (2014) and chapter 2 on the five countries of focus for this work by Burger et al. (2014a) in this study.

As a complement to the quantitative analysis conducted in other chapters, the goal of this chapter is to contribute to a more in-depth or "thicker" understanding of the complex relationships between climate change, environmental degradation, and migration than is feasible through statistics and (reduced form) econometric analysis. The chapter seeks to illustrate the precarious conditions rural communities face as a result of climate-induced environmental degradation,

identify why potential migrants select—or do not select—various adaptation strategies including that of migration, and describe the challenges household members face once they choose to relocate to urban areas.

More precisely, this chapter aims to provide answers to a number of questions, each of which addresses various aspects of the relationship between climate change and migration. Among residents in rural areas, what do respondents see as the greatest challenges facing their households? As households attempt to cope with unfavorable agricultural conditions caused by climate change, how prevalent is migration as an adaptive strategy relative to others? To what extent do economic and social burdens differ across gender? What is the role of remittances for rural household productivity and survival? Among urban migrants, key questions include: For those who have opted for migration as an adaptation strategy, to what extent has integration into urban settings been a positive process or a negative one, and why? How important are community networks for reducing uncertainty, such as for providing information, access to employment opportunities, and for facilitating the overall social and economic integration process? To what extent have the expectations of rural migrants been met? And finally, among rural migrants, what is the likelihood of return to rural places of origin?

In order to explore these themes, focus groups and semi-structured in-depth interviews were conducted among both rural residents and urban migrants in the five focus countries—Morocco, Egypt and Syria, and Algeria and the Republic of Yemen (on data collection and the choice of focus countries, see Burger et al. 2014a, 2014b). The participants in focus groups and the individuals who were interviewed were asked about their perceptions of climate change, and their individual views of household circumstances and other factors that shape migration choices and other adaptation strategies. Each of the five countries is subject to climate change and environmental degradation, but not to the same extent. Given variance in historic experiences, domestic institutions, and climate pressures, one would expect that individual attitudes and responses would differ between areas and countries. To some extent, this indeed turned out to be the case, and yet there were many similarities in the experiences shared across countries.

The chapter is structured as follows. Section two outlines the reasons for conducting qualitative work as part of this study and the approach used here through focus groups, semi-structured in-depth interviews, and interviews with key informants. Section three discusses the findings for sending rural areas. Section four does the same for receiving urban areas. Section five is touches upon the correspondence between the qualitative results presented in this chapter and some of the results obtained using household surveys in other chapters. Section six summarizes some of findings from the interviews with key informants. A brief conclusion follows.

Rationale for Qualitative Work and Methodology

While this study relies mostly on quantitative survey data, it also factors in through this chapter qualitative fieldwork. The combination of quantitative and

qualitative data is important and warranted by the nature of some of the questions being analyzed. Before presenting the qualitative data sources, it is useful to briefly outline some of the reasons that have led to the decision to combine quantitative and qualitative data sources for this study.

Survey-based and other quantitative methods have long been privileged in the development economics and environmental science literature because of the higher degree of statistical reliability of such data. But qualitative research tools have also proved to be important to identify social issues, assess stakeholder interests and interactions, and identify the many different transmission channels through which exogenous shocks as well as policy interventions may have an impact on individuals and groups. That is, qualitative research and findings have often been found essential to complement the traditional focus on quantitative analysis.

Quantitative methods based on statistics provide robustness to the results if they rely on appropriate samples, and regression analysis helps to control for a large number of other variables when measuring the impact of a specific variable on a given outcome. Yet quantitative data often cannot fully capture causality, especially when the analysis fails to provide appropriate contextual information. Qualitative methods help to shed light on why people make the decisions they do. Qualitative research is often people-centered, and it may include both objective and subjective dimensions, to the degree that it considers both objective conditions for people's lives and their perceptions and feelings about their situation. While this can also be done to some extent with quantitative data, qualitative data often provides a richer context for interpretation.

An important aspect of qualitative research methods refers to what scholars call research access. While no hasty conclusions should be made about the advantages of qualitative research techniques (respondents may refuse to be interviewed while they may accept to fill in an anonymous questionnaire), such methods are often better suited to address sensitive issues. One example in the case of this study relates to women's perceptions of the implications of climate change and migration. In the quantitative survey data collection, in part because of cost constraints, only one person was interviewed in each household, and this was typically the (male) household head. In the focus groups and in-depth interviews, care was taken to interview both men and women, which provides for a better understanding of the point of view of women on climate change and migration issues. This is important given that in the region, migration remains primarily undertaken by men, who may have a different view of its benefits and costs than women. Also, the challenges faced by those women who have migrated need not be the same as those faced by men—the risk of sexual and other forms of harassment is for example much higher for women than it is for men, but the social as opposed to economic opportunities that migration may provide in terms of gaining more freedom is likely to be higher for women.

Another argument in favor of integrated research methods relates to the potential of complementing quantitative data with actor-oriented perspectives in applied research. An actor-oriented perspective entails the variety of social

practices and at times incompatible worldviews between various actors and the multiple realities to which these practices and worldviews respond. In the case of research on climate change and service delivery, key actors would include not only the household members who migrate and those who do not, but also the governmental officials and nongovernmental experts who implement policies and programs in this area. The experience and voice of those affected by climate change as well as the perspective of professionals are often overlooked when relying only on quantitative survey data.

Still another argument in favor of integrated research methods relates to policy making. Qualitative data derived from interviews and focus groups are often criticized for their subjectivity. This is a legitimate concern, and it underscores the fact that qualitative research methods must be implemented rigorously by well-trained researchers, with their results ideally supported by further quantitative analysis. But at the same time, policy-oriented social analysis is concerned with change and agency. In such contexts, the subjectivity of the various actors, and how as persons they perceive their situations matters for understanding the basis of agency.

The qualitative fieldwork for this specific study is especially important because it is the only information available in the study on how well migrants are doing in urban areas. This is because the survey data collection and most of the analysis conducted for the study focused by design on rural sending areas. But assessing through qualitative fieldwork how well migrants are doing is crucial to understand what is going on in sending areas, since outcomes for migrants affect through their ability to send remittances how well households are doing back home.

For example, part of this study suggests that remittances tend to be received less (in probability and in amounts) by households living in climate poor areas, even if though remittances received in those areas are even more crucial than elsewhere to reduce poverty and improve human development indicators. This chapter helps to understand why remittances do not always reach climate poor areas. This is probably in part because many urban migrants from those areas have a hard time finding good jobs, so that even if they consider it their moral obligation to send remittances back home, they may not always able to do so. Furthermore, this migration appears to be a strategy of last resort in the areas most affected by droughts and a deteriorating climate, which may also help to explain why households living in those areas are less likely to receive remittances. This could appear counter-intuitive. Given that opportunities are scarce in the areas most affected by the changing climate, one would expect high rates of migration away from those areas. Yet once the social context is taken into account, it becomes clear that migration is not necessarily the first choice of migrants in those areas because they have strong personal links with their area of origin that many do not wish to lose through migration (this is however highly context specific and varies between countries).

In this chapter, the qualitative findings that are discussed are based on results from focus groups semi-structured in-depth interviews, and interviews with key

informants. A general description of the methodology used for the qualitative analysis is provided in chapter 3 (Burger et al. 2013a). Additional details are given in this section and especially in annexes 8A through 8C to this chapter. On focus groups, the original intent was to conduct them in the five countries. But lack of security in the Republic of Yemen made focus group recruitment difficult, and in Algeria focus group recruitment was hampered by local suspicion. In both countries, this led to a shift toward semi-structured in-depth interviews which provide similarly rich and textured information. The fieldwork was conducted among adults 18 years of age and older in each country between November 2010 and February 2012. Results are based on seven focus groups in Morocco, Egypt, and Syria, with each group comprising six to eight participants: four focus groups among urban migrants, who have relocated internally from rural areas; and three focus groups in each rural area among rural residents. In Algeria and the Republic of Yemen, as already mentioned, semi-structured interviews were conducted instead. The rural areas for the qualitative work were selected among the sites used for the household survey data collection: M'Sila in Algeria, Lamzoudia in Morocco, Dakhalia in Egypt, al-Hassakeh in Syria, and Hudaydah in the Republic of Yemen. The urban areas were the countries' largest, most populous cities: Algiers, Casablanca, Cairo, Damascus, and Sanaa. Table 8.1 summarizes the location of the qualitative research sites.

It was suggested earlier that a key contribution of this chapter to the overall study consists in documenting the living conditions of migrants in urban areas. To what extent is the choice of the cities in table 8.1 appropriate for conducting the focus groups and in-depth interviews? Is it correct to implicitly assume through the choice of these sites for the fieldwork that most migration is toward urban areas, and specifically toward large urban centers, so that the choice of these cities would be appropriate? Table 8.2 provides data from the household surveys collected in the five countries in mostly rural areas affected by adverse weather shocks. Those are the data used in several other chapters of the study (chapters 4, 6, and 7). While those data are not nationally representative, they are representative, or at least illustrative of the weather and migration patterns in some of the areas most affected by climate change

In table 8.2 nonresident migration refers to permanent migration by household members who used to belong to the household but have left. Resident migration by contrast is temporary, in that the migrant is still considered by the household as being part of the household in the areas of origin. Table 8.2 suggests that for four of the five countries (due to data issues this analysis cannot be

Table 8.1 Qualitative Research Sites for Focus Groups and In-depth Interviews

	Morocco	*Algeria*[a]	*Egypt, Arab Rep.*	*Syrian Arab Republic*	*Yemen, Rep.*[a]
Urban (4)	Casablanca	Algiers	Cairo	Damascus	Sanaa
Rural (3)	Lamzoudia	Djelfa	Dakhalia	al Hassakeh	Hudaydah

Source: World Bank data.
a. Semi-structured in-depth interviews.

Table 8.2 Types of Migration by Area of Destination—Individual Level
Percent

	Residents (temporary migration)		*Nonresidents (permanent migration)*		
	Rural	*Urban*	*Rural*	*Small urban area*	*Large city*
All	34.64	65.36	20.62	8.28	71.10
Country					
Egypt, Arab Rep.	10.63	89.38	16.47	11.76	71.76
Morocco	4.69	95.31	12.71	5.37	81.93
Syrian Arab Republic	76.58	23.42	27.86	11.02	61.12
Yemen, Rep.	8.47	91.53	19.89	3.23	76.88
Quintiles					
Q1	40.02	59.98	19.16	10.05	70.79
Q2	39.89	60.11	26.61	10.65	62.75
Q3	29.52	70.48	25.92	5.81	68.27
Q4	27.83	72.17	11.26	7.86	80.89
Q5	27.56	72.44	18.96	6.33	74.70

Source: World Bank data.

performed for Algeria), both temporary and permanent migration takes place toward urban areas, especially in the case of nonresidents. In addition, for nonresidents the survey questionnaire identifies separately small urban areas and large cities, and clearly migration is taking place mostly toward those large urban centers. Given that the focus in this chapter is on permanent migrants, conducting the interviews in the cities listed table 8.1 seems appropriate.

Discussions in focus groups and in-depth interviews in urban areas were organized around core questions, with probing for specific aspects or subquestions within each of the main question. The same was done in rural areas, but with a different set of questions. Annexes 8A and 8B provide the list of questions used in urban and rural areas, as well as the subtopics on which the focus group leaders and the interviewers (for in-depth interviews) probed participants. In addition, key informant interviews were carried with a dozen government officials and a dozen respondents from universities, international organizations, and nongovernmental organizations (NGOs) in each country. The main questions asked to government officials and nongovernmental experts are listed in Annex 8C.

To understand who participated in the urban focus groups and in-depth interviews, it is important to note that filters were used for the selection of participants. If a migrant came from another urban area, or if s/he had relocated to the present area more than 10 years ago, s/he was not selected in the sample. Only migrants who had relocated because they could not earn a living in rural areas due to poor agricultural conditions or because they needed to migrate to work and help their family were included in the sample. Those who said that they migrated because they were tired of their area of origin, because they needed to migrate to go to school or because they missed friends and family relatives who had moved to their urban area were not selected.

In addition to focus groups and in-depth household interviews where the focus groups could not be implemented, we also relied on interviews with key informants. This is because the ability of countries to adapt—and help affected populations adapt—to climate change depends in part on governance and institutional capacity (Sowers and Weinthal 2010). In order to assess this capacity and the extent to which issues related to climate change and migration were present in the policy and development agenda, interviews were carried with key informants—government officials and nongovernmental experts—in each of the five countries. For the purpose of understanding the decisions to migrate of household members and the consequences, both positive and negative, of such decisions for both migrants and the household back home, the information obtained from key informants was not the most valuable. But that information does help in placing climate-induced migration in a broader context. For that reason, we also report as an example the feedback received from key informants in the specific case of Morocco, because for that country key informants were especially knowledgeable about migration flows.

Focus Groups and In-depth Interviews in Rural (Sending) Areas

Focus group respondents were aware of the shifts taking place in the climate and attribute associated declining agriculture fortunes with deteriorating environmental conditions caused by changing weather patterns. Conditions in rural or "sending areas" have become very difficult, according to the vast majority of focus group respondents. Participants complained of fewer days of rainfall and lower irrigation levels. For key crops such as potatoes, wheat, and rice, the results are devastating. *"Rice is burnt in some seasons, because we cannot find enough water to irrigate it"* (Male, 36–45 years old, Dakhalia). Egyptians, in particular, also cited government expropriation of agricultural land as an obstacle to profitable and sustainable agriculture, though this problem was not mentioned in other countries. Many former rural residents from each country also mentioned the rising costs of seeds and other agricultural inputs. Rural residents explained that poor quality of crops mean lower prices for agricultural products and this reduces income. While incomes from agricultural activity are decreasing, the prices for essential goods are on the rise, observed most participants. The inability to earn a stable and adequate income from crops implies that relying solely on agricultural activity is not feasible any more. The experience shared in box 8.1 from a resident in the town of Djelfa in Algeria is one shared by many other focus group participants and respondents in the in-depth interviews.

Rural residents have no choice but to rely on multiple sources of income because without such additional income sources, households cannot sustain themselves. One Egyptian woman explained that poor prices turn farmers away from agriculture altogether: "They [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

Box 8.1 Testimony from a Rural Respondent in Algeria

Well, 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 rain is the main source of life here. …The impact of poor weather conditions on my farm 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).

many in the family" (Female, 25–35 years old, Cairo, Egypt). Or as a Syrian man put 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). Traveling long distances between homes and jobs is cumbersome—and expensive—with a number of respondents from all five countries expressing frustration about the expense of transportation and lack of good roads.

In the Republic of Yemen, almost every rural resident from the area of Hudaydah emphasized the severity of the 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, tend to sleep during the day because of exhaustion. As a result, fewer daytime hours are dedicated to work and income generation. Furthermore, Yemeni respondents explained that agricultural productivity is further complicated by lack of governance and neglect of the agricultural sector, ineffective government policies, and corruption. Unfavorable crop prices and pressures to generate income amid extreme rural poverty have caused growers to shift away from agricultural food crops in favor of qat production which is far more profitable: "…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. And we note that there are more than 300 qat vendors in the single market. How much do they add up to in the overall Republic? …Tomatoes, now, are now non-existent, and it is essential now that we important them from Syria" (Male, 30–39 years old, Sanaa, the Republic of Yemen). But qat requires a great deal of water, and Yemeni respondents noted with worry that water scarcity has led to conflicts over access to wells. As a way to cope with water scarcity, a Yemeni woman from Hudaydah described a complicated water distribution scheme where water is distributed to certain communities on certain days of the week.

For farmers in all five countries, the burden of living in impoverished rural areas is not just one of financial cost, but also one of poor health, a concern mentioned frequently by Egyptian rural focus group respondents. For example, some

pointed out that farmers are being increasingly exposed to contaminated water because waste leaks into irrigation canals. Other Egyptian participants mentioned being sick due to illnesses such as the flu. With only limited income at their disposal, many Egyptian respondents said that their households cannot afford quality health care or cannot access health facilities because they are not in close proximity.

The fieldwork suggested that coping strategies are multifaceted among rural households. Common coping mechanisms include selling assets, removing children from school so they can work to support the household, and shifting food consumption habits such as eating less chicken or beef or eating one less meal. Most respondents report having had to employ one or more of these mechanisms to cope with the negative impact of climate change on agricultural production. Borrowing food or money from the community is also an important survival and coping mechanism in times of economic stress. Women, in particular, are also mindful of the impact of income losses on their 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).

Rural respondents also stated that on the whole there is only limited or no involvement of local organizations in their communities, including nongovernmental organizations. In the absence of such organizations to provide advice and assistance and help mitigate the impact of climate change on agriculture, rural residents rely on each other. As a rural Egyptian man explained: "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).

With rural poverty levels high and prospects of substantially improving incomes low, remittances are essential for daily survival. They can be used to purchase durable goods, food, clothes, health care, land, and housing but they can also be used to invest in businesses. Remittances are vital as they may contribute to the health of both household and national economies. Remittances appeared especially important for rural focus group respondents from the Republic of Yemen, where a number of participants declared having family members who had migrated internationally, primarily to Persian Gulf countries. Saudi Arabia is the most popular destination for Yemeni migrants, and remittances allow those who receive them to enjoy a reasonably high standard of living. In the absence of remittances, live is much harder: "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, the Republic of Yemen). By contrast, participants from Morocco and Algeria did not appear to depend as much on remittances, and only a few mentioned that they receive remittances from relatives. Across all focus groups, no one referred to seeking solace or assistance from mosques and respondents were united in their

reprehension toward using children to peddle, saying emphatically that it is never unacceptable.

When asked if they were aware of government or nongovernmental programs addressing climate change in their communities or helping to alleviate its social and economic impact, many respondents stated that they were not aware of such programs. But there were some exceptions. A few Yemeni residents mentioned the Saleh Organization, but concluded that it only provided temporary help or relief. Rural Algerians were aware of forms of government assistance for the agricultural sector, referring to low-interest loans and government provision of advisors who travel to villages to help teach growing methods. However, the impact of the advisors appeared uneven. More isolated locales are far from their reach, and on the main, bureaucracy and corruption make loan acquisition from formal institutions such as banks a lengthy and frustrating process. So much so that many farmers said they avoid this option altogether.

Rural participants in the fieldwork suggested a number of government initiatives that could help farmers better adapt to their changing environment and could help blunt the economic impact of decreasing agriculture. Table 8.3 summarizes commonly mentioned recommendations for government assistance among respondents. In addition, Egyptian respondents mentioned the importance of strengthening agricultural unions. In one focus group, rural participants recalled that in the past agricultural unions were stronger and benefitted from linkages to the Egyptian parliament, and therefore 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. However, participants were less sanguine about whether any real changes would actually materialize. Pervasive local and national-level corruption and patronage were seen as major obstacles to progress in the countryside: "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).

Table 8.3 Selected Suggestions by Participants for Government Assistance in Rural Areas

Job training for rural populations, including job-appropriate training for women
Improvements in infrastructure (clinics, schools, roads, electricity, clean water, transportation, sewage systems)
Doctors and nurses
Transportation for children, especially so that girls can go to school
Low-interest loans and credits for agricultural inputs
Strengthening or creating agricultural unions and organizations so they can better serve farmer interests
Improved access to water via removing dams and/or building wells
Encourage investment in rural businesses and industries
Addressing corruption

Source: World Bank data.

Syrians in al-Hassakeh recommended removing the dam at the al-Kabhour river to allow greater access to water for the population, in addition to encouraging the government to keep its promises to improve rural infrastructure. Assistance with navigating the process to obtain loans was also requested. Job training and improved employment opportunities for both rural men and women were mentioned as helpful in all five countries. Men and women said that although local norms may frown upon women working, particularly in public spaces typically reserved for men, training and employment that is discreet and can be done in or near the household would be welcomed by men and women. In contrast to respondents from the other countries, Moroccan participants were virtually unanimous in objecting to rural women working in positions deemed unacceptable according to community norms (for example, sales and teaching), since this is considered shameful. 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.

Focus Groups and In-depth Interviews in Urban (Receiving) Areas

Most migrants who participated in the focus groups and in-depth interviews came from households that depend on rainfed agriculture for their livelihood. The typical profile is a man aged between 25 and 45. The majority of female participants relocated to urban areas to follow their husbands. Younger women between the ages of 18–25 are unmarried and migrated to the cities to work in order to support their families back home. All female participants had a relative or close family friend who already lived in the city and they arrived accompanied by a relative.

Why migration? Many respondents said that they migrated from their rural homes because chronic droughts caused a decline in agricultural productivity. Few mentioned floods or being displaced as a result of natural disasters as the reason for their relocation. "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). Married urban female migrants recalled having to increase their workload prior to migrating to cities. A 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).

A finding consistent across all five countries was that many (but by no means all) respondents appeared to have chosen migration as an adaptation strategy of last resort after other strategies proved unsuccessful. Many migrants described a life before they migrated of hardship and precariousness accompanied by a constant lack of food, water, and income for basic needs, education, and employment. In many households, male family members had to leave school in order to work, and many families also had to eat less and forego at least one meal per day.

Selling assets was common: "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).[2]

A critical step in the integration process for migrants resettling in urban areas is finding employment. Most rural migrants said that they came to urban areas in search of better job opportunities, either to support their parents or to improve future prospects for themselves and their own family. Jobs commonly held by female migrants include housecleaning, and working as a seamstress. For men, there was more variety, including occupations such as waiter, mason, doorman, gardener, baker, seller of vegetables, fruits, and crafts, factory worker, small shopkeeper, janitor, car parker/attendant, and driver. Many men hope to ultimately save enough to own their own small business, such as a small shop. Finding jobs, however, is not an easy feat amid high unemployment in the region, especially among youths. While some respondents found that urban communities were receptive to their arrival from the countryside, others said that they were met with more hostility, especially in Morocco and Syria, where respondents complained of negative stereotyping and pervasive discrimination from established urban residents, 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 from Morocco said they felt disadvantaged vis-à-vis their urban counterparts because they lacked a degree and French-and Arabic-speaking capability, features that are needed to secure even the 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 felt inferior and unwelcome in Damascus. Wherever they went, they felt treated like strangers and "different." This makes finding a job difficult. For Yemenis, the main obstacle to finding a job was corruption, which is deep and pervasive. Corruption was mentioned by Yemenis as a major problem in general far more often than other participants: "You need to bribe your way into a position. That is your easy way toward a good job position – and we all love the easy way" (Male, 30–39 years old, Sanaa). Table 8.4 lists some of the jobs held by respondents (only women indicated occupations of housecleaning and seamstress; the other occupations were dominated by males).

Table 8.4 Selected Suggestions by Participants for Government Assistance in Urban Areas

Improved access to services and urban infrastructure (education, housing stipends, etc.)
Assistance with obtaining proper documents necessary to secure loans, permits, housing, and jobs
Training for learning French (in Morocco)
Addressing corruption (especially in Yemen, Rep.)

Source: World Bank data.

Almost as challenging as finding a job is the challenge of finding a decent place to live. Virtually all participants shared their frustration with the lack of adequate housing. Urbanization has caused a shortage of housing in many cities, and many immigrants live in suboptimal dwellings. Uncomfortable and overcrowded conditions appear to be the norm for both newly arrived and more settled 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 that have poor services and inadequate infrastructure. Expert interviews indicate that Ben Messous, Diar Echam, and Oued Keriche are popular areas for rural immigrants relocating to the city. "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, the specter of corruption is again a problem, as a resident of Sanaa who wanted to construct a home explained (see box 8.2).

Migrant community networks in urban areas are critical for acquiring information about available jobs and housing for new migrants. Such networks make certain areas more attractive than others, and they facilitate the transition for migrants. Established communities often share a lineage, tribe, birthplace, or ethnic background. Relatives or family friend are key intermediaries for finding a job and a place to live. Social networks are critical for information gathering and for reducing the risks and uncertainty associated with migration. One young Egyptian male migrant attributed his success in finding a job rather quickly to a cousin who had connections with members of the medical community. But another said: "I had no family relations—and it took me a whole year to get a job" (Male, 25–35 years old, Cairo, Egypt).

Even for those with access to a social network, feelings of dislocation were common, and one of the least appealing aspects of relocating to urban areas is the loss of personal interactions with community members, and of the sense of belonging to a community. Many migrants noticed that they now only have limited interactions with their neighbors, if they are fortunate to know them at all,

Box 8.2 Testimony from an Urban Respondent in the Republic of Yemen

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 focus group, age 35–45)

and they also lamented the shift of emphasis on family and traditions. 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). Crime and harassment also comes with life in the city. Harassment was mentioned especially by female Moroccan respondents who voiced dismay with the unwanted attention they receive from 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 migration also offers opportunities, especially for youths. Young Moroccan respondents expressed a greater sense of independence, belonging, and self-actualization. A married man celebrated his new life, which no longer included 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. For other young former rural dwellers, relocating, while challenging, was still 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). Moving to the city may also be emancipating. Some Moroccan women noticed that since they migrated, they have little desire to get married and have children right away. One said that she escaped a life of near-servitude. Another explained that she left her rural home to escape an arranged marriage. Compared to life in the rural sector, the ability to work in the city also 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). These various views among both men and women were however much more prevalent in Morocco than in the other four countries.

Given both the challenges and opportunities of urban life, views are mixed on whether or not migrants would like to return to their rural homes. Men were far more likely than women to say they will someday return to their rural homes, preferably as more prosperous individuals. Although cities offer a wider range of opportunities for migrants and their children, migrants, and especially men did miss the stronger sense of community in rural areas. Women, by contrast, appeared to appreciate more the distance from their families, for the reasons mentioned above.

Finally, remittances figured prominently in the resource allocations of migrants. In Egypt items such as ghee, oil, bread, flour, and sugar are purchased for families in addition to funds being sent directly to homes. In all countries, the amounts sent back vary with the level and stability of the migrants' incomes. Male respondents tended to remit more than females. But for most migrants, male and female, sending remittances to their family was without doubt 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).

While most urban migrants reported sending remittances to their family in rural areas, some Yemeni urban respondents stated that they received remittances from family members working abroad, especially in Saudi Arabia. For many rural and urban Yemeni households alike, international remittances appeared 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, the Republic of 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, the Republic of Yemen).

It is also important to note that mobility also involves seasonal migration, especially among men. About a fifth of male focus group respondents declared periodically returning to their rural places of origin. Some travel during holidays and specials occasions, amounting to travel roughly two to three times per year on average. Smaller numbers return to help cultivate land still held by their families or to live part time with their families. Respondents reported that this is very challenging as it costs money to travel and 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).

On balance, views are mixed regarding the degree to which expectations from migration have been met. The primary objective of acquiring sustainable employment is often more difficult than respondents anticipated, particularly for women. Many expected to find a job much sooner than they did. 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. For Moroccans especially, this means acquiring the ability to speak French or finishing their general education in order to have better paying occupations.

What about the areas where respondents felt that government and nongovernmental programs might help? Access to health care, education and job training, credit for housing and rental assistance were deemed vital among participants for advancing the integration of rural migrants into urban communities. Some suggestions were also more country specific. In Morocco some

respondents complained about not having the appropriate official documents that would enable them to work and receive financial 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). As mentioned earlier, French-speaking capability was also seen as relevant in the Moroccan context for fully functioning in the labor force. The service sector and high-skilled labor sector require French because of significant interaction with French speaking Moroccans or Europeans.

While language was not a problem for focus group respondents from the other countries, Moroccan respondents called for government assistance in French language training.

Egyptians emphasized the need for government assistance with agricultural inputs such as seeds and fertilizer, as well as no-interest loans and credit. Yemeni residents had little faith in their institutions to provide assistance: "I heard about [various programs] and [people] did not get their help because those responsible … 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" (Male, 25–30 years old, Sanaa, the Republic of Yemen). Other focus group participants' views were also critical of their governments, but the sentiment was not as widespread and virulent elsewhere as was the case in the Republic of Yemen. Table 8.4 summarizes some the areas of focus proposed for government assistance by urban respondents.

Heterogeneity between Countries in the Reasons for Migration

A quick read of the discussion in the two previous sections could be perceived as simply highlighting common tendencies in the various countries for both urban and rural areas. There are clearly such common tendencies, but one should not underestimate the heterogeneity in the qualitative data and in the underlying circumstances of individuals and households, including in terms of the reasons for migration and how well migrants fare once they have migrated. These circumstances are highly dependent on the local context. There are not only differences between individuals and households, but also between areas within any country and between countries in the drivers of migration. Depending on the country, migration may or may not be a strategy of last resort, and the decision to migrate may or may not be closely related to droughts and declining agricultural fortunes at their place of origin. The role of pull versus push factors is likely to be different in the various countries given differences in dynamism and opportunities.

The fact that there are differences between areas and countries actually comes up in the qualitative data presented above. On average, migrants in Morocco, and to some extent also in Egypt, tend to mention more frequently the opportunities that migration may offer at the places of destination in terms of jobs and freedom, while migrants in Syria, and to some extent in Algeria and the Republic of

Yemen, are quicker to relate their decision to migrate to the difficulty to survive in rural areas due to the deteriorating climate, droughts, and low agricultural yields. For triangulation of the results from the study, it is reassuring that these stylized differences between countries in the reasons to migrate obtained from the qualitative work also show up in the quantitative data from the household surveys implemented at the same time and in the same sending areas in the five focus countries (see chapter 3 on data collection). In the surveys households could provide two reasons for the migration of household members. Basic statistics on those reasons to migrate are provided in table 8.5 for permanent (nonresident) migration.

For the sample as a whole, the two main reasons to migrate are the search for better employment opportunities and the lack of employment opportunity in place of origin. Both of these reasons are of course related, but as mentioned in chapter 7, in terms of the language used, the first reason can be associated more with pull factors, while the second can be associated more with push factors. Marriage is also important, especially so in Algeria, but this cannot be related specifically to push or pull factors. Climate and environmental push factors, such as droughts and floods, as well as the poor quality of land or depleted soils are mentioned, but less often, and virtually all mentions of droughts come from Syrian households. Accumulation of savings is another important reason to migrate, and can probably be associated more with pull factors than with push factors, even if one could discuss this (schooling and better infrastructure also relate more to pull factors, although less in terms of direct employment opportunities and livelihood).

Dividing the share of the main reasons associated with pull factors with the share of the main reasons associated with push factors yields a simple index that can be compared for the various countries. As shown in table 8.5, the ratio of pull versus push factors is highest in Egypt, where it takes on a value of 3.10. This makes sense given that Egypt is the country the least affected by droughts, with data from a recent study by the Arab Center for the Studies of Arid Zones and Dry Lands and the United Nations Secretariat of the International Strategy for Disaster Reduction Regional Office for Arab States suggesting that only 2.04 percent of the country is vulnerable to droughts (ACSAD and ISDR 2011). The ratio of pull versus push factors in our household surveys is lowest in Syria, where it takes a value of 0.80, which again makes sense given that Syria is by far the country in our sample the most susceptible to droughts according to the ACSAD-ISDR study (almost two thirds of the country is vulnerable to droughts according to that study), and that it did suffer recently from major droughts that led to substantial displacement. Among the other three countries, the Republic of Yemen has the largest ratio of pull versus push factors, which may be related to the opportunities provided not only by Sanaa but also by neighboring Saudi Arabia. And Morocco has the lowest ratio, which corresponds again well to the fact that after Syria it is among the five focus countries the most susceptible to droughts.

Table 8.5 Reasons for Permanent Migration, Five Countries Sample, 2011
Percent

		Algeria	Egypt, Arab Rep.	Morocco	Syrian Arab Republic	Yemen, Rep.	All
	First reason						
(1)	Better employment at destination	12.78	41.76	38.58	41.47	24.06	35.04
(2)	Lack of employment at origin	22.81	20.00	14.23	27.00	14.97	20.68
(3)	To accumulate savings	4.33	11.18	0.00	5.18	8.56	5.09
	Transferred (Job)	0.00	2.35	0.41	0.43	4.81	1.27
	Schooling	0.00	1.76	1.67	1.08	4.81	1.74
	Better infrastructure	3.75	0.00	5.52	1.08	4.28	2.80
	Join family	0.00	2.94	2.23	7.34	5.35	4.38
	Marriage	56.33	11.18	33.31	0.43	18.72	18.92
	Divorce/separation/death of spouse	0.00	0.59	0.00	0.00	0.53	0.16
	Delivery	0.00	0.59	0.00	0.00	0.00	0.08
	Family problems	0.00	2.94	0.57	0.65	5.35	1.55
	Accompany patient	0.00	0.00	0.72	0.00	0.00	0.18
(3)	Escape flood	0.00	0.00	1.91	0.22	0.00	0.55
(4)	Escape drought	0.00	0.00	0.86	14.90	0.00	5.60
	Other	0.00	4.12	0.00	0.22	8.56	1.87
	Missing	0.00	0.59	0.00	0.00	0.00	0.08
	Second reason						
(5)	Better employment at destination	10.50	21.89	23.93	16.41	8.02	16.63
(6)	Lack of employment at origin	3.22	15.98	37.89	41.47	5.35	26.96
(7)	To accumulate savings	22.24	38.46	2.56	14.47	22.99	17.84
	Transferred (Job)	0.00	2.37	5.30	1.51	4.28	2.62
	Schooling	0.00	0.00	1.78	0.43	1.60	0.76
	Better infrastructure	11.90	1.18	6.29	1.30	3.21	3.80
	Join family	4.18	2.96	7.54	0.65	12.30	4.56
	Marriage	9.33	1.78	8.36	0.65	5.88	4.15
	Divorce/separation/death of spouse	0.00	1.18	0.00	0.22	1.60	0.50
	Delivery	0.00	2.96	0.00	0.00	1.60	0.67
	Family problems	0.62	0.59	0.70	1.30	7.49	1.97
	Accompany patient	0.00	0.59	0.00	0.22	1.07	0.34
(8)	Escape flood	0.00	0.59	0.92	0.00	0.00	0.26
(9)	Escape drought	0.00	0.00	3.38	13.17	0.00	5.78
(10)	Poor quality of land or depleted soils	0.00	0.00	1.34	0.22	1.07	0.51
	Violence, conflict, or threat of violence	0.00	0.00	0.00	0.00	1.07	0.17
	Other	38.01	1.78	0.00	0.86	22.46	8.61
	Missing	0.00	7.69	0.00	7.13	0.00	3.87
	Ratio and Vulnerability to Droughts						
	Ratio of pull vs. push factors	1.92	3.10	1.08	0.80	2.97	1.24
	Vulnerability to droughts (share of areas)	11.64	2.04	25.30	63.65	14.97	-

Source: World Bank data. Data on vulnerability to droughts from ACSAD and ISDR (2011).
Note: Ratio of pull vs. push defined as [(1)+(3)+(5)+(7)]/[(2)+(3)+(4)+(6)+(8)+(9)+(10)].

Interviews with Key Informants: The Example of Morocco

One more piece of empirical evidence was collected for the qualitative fieldwork through interviews with key informants. In all five countries government officials and nongovernmental experts are well aware of the stress caused by changes in climatic conditions, and of the fact that climate change contributes to rural-urban migration flows even if today it is not the main driver of these flows. They also realize that in most cases, the lack of sufficiently ambitious and well-developed policies and programs contributes to the inability to propose concrete solutions and help to those most affected by climate change in rural areas. Many of the comments made by government officials and nongovernmental experts in the various countries were similar, so that rather than provide examples from all countries, it is probably more instructive to cover one country in slightly more depth. This is done in this section for Morocco, because more respondents were either experts on migration or were conducting ongoing research on migration-related issues.

Key informants in Morocco explained that migration was historically by men and driven by inequitable development in rural areas. The absence of networks in destination areas made women vulnerable to prostitution or slave labor, so they were less likely to migrate than men. Migrants migrated both internationally and internally, in that case principally to Casablanca, which continues to remain as a prime destination for rural migrants since the Greater Casablanca area alone still attracts around 15 percent of all national migration flows in the country. Today territorial units nearby Casablanca have also become preferred destinations for newcomers. This is for example the case of Ain Sebaa, Sidi Moumen, Moulay Rachid, Hay Hassani, Mohammedia city, and districts of Sidi Bernoussi and Hay Mohammadi. Migration to other to cities has also picked up as rural migrants are searching for destinations closer to their homes.

Key informants explained that three main features remain central to migratory flows irrespective of origin and destination locations. The first is the importance of networks which play a critical role in providing support to migrant families and in helping them to decide their destinations. A second key feature is the importance of the remittances sent by migrants, which are critical not only for household survival in rural areas but also for communities. In Tiznit for example, migrant associations are helping build two thirds of the roads. Several informants also stated that migration facilitated women empowerment in rural areas, as the women who remained in the countryside while their husbands were away working in the cities gained more independence and were also more likely to interact with their neighbors. A third important feature, especially in recent years, has been the role of climatic patterns in internal migration. Drastic changes in climatic conditions have led to an expansion of shanty towns. In Tafilelt for example, a fourth of the population has migrated due to climatic hazards that had affected agricultural production. Likewise, in the Draa region which has historically been an important center of trade but more recently has been experiencing frequent and longer droughts, out-migration has increased. In general, informants agree that the so-called Oasis belt is

losing its population as people are becoming increasingly affected by the negative effects of droughts.

Outgoing migration is primarily stemming from the water crisis that Morocco is experiencing. Six of our respondents mentioned water as a major issue, in part due to more droughts, but also with flooding in some areas. For example the Tafilalt region, one of the most important oasis regions in the country, has suffered from severe droughts and flooding which in turn have undermined the oasis agriculture. While droughts used to occur every four to five years, they now occur every two years. Climatic hazards are also leading to severe desertification in the Sahara region. Rising sea water levels are also a concern, among others in Saadia were tourism may have contributed to destroying plant life and consequently making the land vulnerable. A respondent suggested that 60 percent of Saadi may soon be under water.

These severe climatic conditions have had a large impact on rural populations, with farmers experiencing increased water scarcity with no access to water reserves. Women have to travel much further away to get water. Some respondents were convinced that agricultural yields will fall by 20 percent in 20 years, which drive more migrants from rural areas toward urban centers. Life in the cities will then become difficult for both locals and migrants. Many respondents mentioned ongoing housing and employment crises in urban areas. As locals and migrants compete for survival, integration will become a major problem and economic discrimination will rise, as may black markets and the informal economy. In large cities such as Casablanca, many migrants are already found to be living in shanty towns. The pressures of living in cities along with influences from urban lifestyles have also been weakening social structures between migrants and their families which may have severe consequences for those still living in Morocco's rural areas.

In recognition of these challenges, respondents explained that the Moroccan government launched initiatives at both the national and local levels. One such initiative is a higher focus on rural development programs, among others, through the Human Development Initiative (HDI) which is designed to target vulnerable populations in both rural and urban areas. At the local level, the government is also conducting awareness programs to inform people about climate change. The objective is to teach people about conservation and preservation of water resources, disaster preparedness to limit the negative effects of droughts, and different irrigation schemes to encourage the agricultural sector to become independent of water resources. Climate change has also been included as a key component in other initiatives such as Morocco Green and the Communal Development Plan. There is also an Energy Strategy Plan being initiated, and work is ongoing toward an insurance plan named 'Natural Catastrophe Insurance.' Active research programs are also on-going in a few universities. Despite these initiatives, respondents perceived some fatalism, with many believing that everything is happening because of Allah's will. And at times government programs may contribute to the issues. One respondent mentioned a dam which instead of stopping flooding drained water resources from the ground, leading to poor water quality and affecting surrounding palm trees.

Conclusion

Adverse weather trends such as increased flooding and droughts shape the decisions to migrate made by household and individuals. Climate change is widely perceived to reduce crop yields and livestock production, decrease water availability, reduce fishing populations, and limit opportunities in rural areas that depend heavily on agriculture. The goal of this chapter was to contribute to a better understanding of the relationships between climate change, environmental degradation, deterioration of agriculture, and human mobility, through an exploration of the attitudes of rural residents and urban migrants in our five focus countries. Rural residents use a range of coping mechanisms to survive, ranging from eating less and borrowing money to selling livestock and other assets. Remittances are also important for survival, and when this source of income is insufficient, additional household members are forced to migrate to other areas in search of better opportunities. Overall, while in some countries such as Egypt and to some extent Morocco, there is a perception that migration opens up new opportunities, in other countries such as Syria, for many migrants migration may be a strategy of last resort than a real choice. While such differences between countries seem to emerge from the qualitative fieldwork, and tend to also be supported by quantitative household survey data, of course individual situations remain highly household and area specific within each of the five countries.

The qualitative work also suggests that for urban migrants, the arduous task of obtaining a job is further hindered by corruption and fierce competition with locals for limited employment opportunities. Social dislocation is a risk, with many migrants feeling inferior, alienated, and different in their new urban environs. Many face job discrimination, harassment, and exploitation at the hands of their supervisors and would-be employers. Poor housing conditions, rising food and rent prices, and the obligation to send remittances back home place substantial pressure on urban migrants. Yet, these coexist alongside some benefits. For example, migrants appreciate the independence, social outlets, and opportunities that urban life has to offer.

A number of suggestions were made by households as well as migrants about the types of programs that could be of help to them, in both urban and rural areas. It is not the place in this chapter to comment on whether such recommendations are appropriate, or even feasible to implement by governments. In order to come up with such an assessment, a much more detailed analysis of the types of programs proposed, their cost and their benefits, would be required. But what does emerge from the interviews with key informants is that while government officials and nongovernmental experts are aware of the consequences of climate change and extreme weather events for the population, they also recognize that the extent to which governments are dealing with these issues today is limited. This is a finding that is also emerging from other chapters in this study, in that both the community level responses and government programs and policies not only to cope with weather shocks but also to adapt to climate change, remain insufficient.

Annex 8A: Focus Group Discussion and In-depth Interview Questions in Urban Areas

I. What would you say the biggest problem facing your household these days? Probing: Too little income; Poor living conditions; Lack of employment; Poor relations with my neighbors; Adjusting to the community; Lack of education; No family unity; Poor housing.

II. As you know, some people who live in this area have relocated from other places. From where did you relocate? Probing: How long have you been living here?; Can you describe your previous home to me—what did you like the most? What did you like the least?

III. Why did you leave? Probing: To what extent were poor weather conditions, such as drought, storms, or flooding, a reason for your relocation?; Was it the main reason, part of the reason, or only a very small part of the reason?; What was the impact of poor weather conditions on your household's ability to earn a livelihood?; Describe this to me. Did your household lose income because the weather affected farming?; Can you tell me what happened? Where there other reasons you relocated?

IV. Before you decided to move, what did you do to try to survive in your village? Probing: Changed jobs; Had more than one job; Ate or bought less food; Removed children from school? Was that a son or daughter?; Sent children asking for money; Sold Assets. Which assets?; Borrowed money. From where?; Tried to grow different kinds of crops? Which ones?; Used different tools and methods. Which ones?; Worked more and longer hours. Did women and girls especially have to work more?; Relied on income from family members who moved from your village to work elsewhere in the country or abroad? Where?; Relied on income from family already living in cities, other areas, or abroad?; What else?

V. How dependent is/was your family on financial help from other family members living in other areas or abroad? Probing: Would you starve or lose your home without it?; Could you only barely get by?; Would you be generally fine and only have to cut back a little or give up some things?; Would you generally be fine and not have to cut back at all without assistance?

VI. When we choose to relocate to another area, we may relocate to a particular area based on certain factors. Why did you choose this town and neighborhood? Probing: Family members already lived in the area. Why was this important?; I know other people who moved here from my village. Why was this important?; Word of mouth; Proximity to home of origin; Heard of job opportunity; There are people from my ethnic group/tribe/religion/background.

VII. I would like to know more about your life since you relocated here. Since you have relocated here what are the biggest problems or challenges you have faced? Probing: Finding a job. Can you tell me more about this?; Debt. Can you tell me more?; Crime. Can you tell me more about this?; Fitting into this community/conflicts with neighbors. Can you tell me more about

this?; Getting good health care. Can you tell me more about this?; Going to school/affording school. Can you tell me more about this?; Getting basic services such as clean water. Can you tell me more about this?; Access to electricity; Access to functioning sewage systems; Housing. Can you tell me more about this?; Thinking of where you previously lived, do you think that things like health care, education, clean water, sewage are better here?

VIII. Are you aware of any government programs that are targeted for people who have relocated for the reasons you described? Probing: Credit programs; Job training; Information about farming methods such as irrigation plans, better seeds, methods of feeding animals and caring for livestock; Information about alternative crops; Information about alternative farming activities; What about nongovernmental programs that are intended to help people like you?; Financial assistance; Thinking about what it was like when you first moved here from your origin town, what types of assistance would have been helpful for your household?

IX. Under what circumstances would you return to your previous home? Probing: How frequently do you return home?; What do you do when you get there?

Annex 8B: Focus Group Discussion and In-depth Interview Questions in Rural Areas

I. Thinking about where you live now, including the surrounding conditions, what would you say is the biggest problem facing your community today? Probing: What about the economic situation? Why is this a problem in your view?; Lack of education? Why is this a problem in your view?; Conflict over resources such as water? Why is this a problem in your view?; Housing conditions? Why is this a problem in your view?; Bad farming conditions? Why is this a problem in your view?; Is drought a problem? How in your view?; Is flooding or storms a problem? How in your view?; Anything else?

II. Some people believe that this area has been affected by poor weather conditions, and by this, I mean drought, storms, or flooding. To what extent has this been a problem in your view? In what ways have poor weather conditions affected the daily life of your household? Probing: How has it affected your ability to earn a living from farming activity? In what way?; What sort of impact has it had on the amount of income brought into your household? Can you tell me more?; How has it affected relations among your family members? Have things become more or less stressful? In what way?; And in what ways have relations with your neighbors changed, if at all? How you become more or less dependent on neighbors? In what ways?; Is there more conflict over resources like water or good land?; Some household members are not as healthy; Ate or bought less food; Removed children from school? Was that a son or daughter?; Sent children asking for money; Sold assets. Which assets?; Borrowed money. From where?; Tried to

grow different kinds of crops? Which ones?; Used different tools and methods. Which ones?; Worked more and longer hours. Did women and girls especially have to work more?; Family members went abroad to work? Where?; Do you have to rely more on income from relatives living in cities, other areas, or abroad?; What else?

III. How dependent is/was your family on financial help from other family members living in other areas or abroad? Probing: Would you starve, lose your home and important assets without it?; Could you only barely get by? Tell me more; Would you be generally fine, and only have to cut back a little or give up some things? Where would you cut back?; Would you generally be fine and not have to cut back at all without assistance?;

IV. As I have mentioned, sometimes, the weather is not very good and farming is difficult. What kinds of programs are you aware of that are intended to help you improve conditions in your community and for your household? Probing: Do you know of any programs that provide credit and financial assistance?; Are you aware of information that helps you develop better irrigation practices?; How about programs to help you find other crops to farm, better seeds, or better tools?; What about programs to help you find buyers for your goods?; For those of you who aren't aware, what sorts of programs would best help you when your farming suffers as a result of poor weather?

V. I would now like to do something different in this discussion. I would like you to imagine a situation where there was a major flood or drought here and you were completely unable to earn an income from farming. Take five minutes to think about this. After five minutes, I am going to ask you the four things you are most likely to do in order to survive. Please state first what you are most likely to do and so on. Probing: Sell family assets (personal belongings, tools, animals, durables); Eat/buy less food; Purchase lower -food; Borrow money from relatives; Borrow money from friends, neighbors, community elders; Borrow food from relatives, neighbors, community elders; Grow only enough food to feed my family; Seek assistance from local mosques; Engage in illegal activities (things some might be ashamed of); Turn to local NGOs for assistance, such as…; Turn to state programs for assistance (cash or food transfers); Join with others to call attention to our situation; Learn about methods and technologies that would improve productivity of our land and animal breeds; Switch to other forms of agricultural activity to survive, such as…; Spend less money on health care and education; Pray more often/become more engaged in religion; Find other "nonfarming" jobs in the area for alternative income; Ask children and women in the family to work; Take girl children out of school; Work longer hours; Work additional jobs; Share living spaces with relatives; Rent rooms or land to others; Migrate/relocate to other areas in our country.

VI. Some of you mention you would move somewhere else in our country. I would like those who would seriously consider moving to please raise their hand. To what town or city would you most likely move?

VII. Why would you move there? Probing: I have been there before and it is familiar; There is family who can help support us/me. How would they support you?; People I know from this area who have moved there and who can help support us/me; I don't know anyone there, but I hear they have jobs; Migrants tend to go there.
VIII. Once you moved to this area, what would you do to earn a living and survive?

Annex 8C: Key Informant Questions for Government Officials and Nongovernmental Experts

A. Government officials: How important an issue is climate change—has it become more of a priority for your government?; Why has climate change become an important concern? Do you see climate change as a significant problem in the future?; How has environmental degradation affected rural populations in particular? What about urban areas that are attract rural migrants?; What are the challenges facing policy makers in dealing with climate change migration? What are the gaps in knowledge and resources?; What is the government doing about rural-urban migration? Is there any public assistance available to migrants and rural populations affected by environmental degradation? Can you please describe them to me?; What is the government planning to do?; What do you think is the level of public awareness about existing programs?; Why has it been difficult to address this issue?; If there are no programs, what kinds of programs would be most beneficial in your view?.
B. Nongovernmental experts: How has climate change affected this country? In your view, has is contributed significantly to environmental degradation? And how do you think climate change will affect the country in the future?; How has environmental degradation affected rural populations in particular? Do certain populations, such as women and girls, bear a greater burden?; What kinds of problems are you seeing?; Some people may choose to relocate to other areas as a coping mechanism. What is the profile of a typical migrant in this country? In other words what type of person migrates and why?; To where do people tend to migrate in this country and why?; Have these patterns and destinations changed over time to your knowledge?; What sorts of challenges do migrants face when they relocate from one place to another? What are the political, social, economic, health-related, and practical challenges that migrants face?; Not everyone is able relocate. What would you say are the biggest obstacles to migration?; Many migrants face various kinds of environmental shocks, such as floods and/or drought. These shocks often affect agricultural productivity and thus income and the very livelihood of households. How do migrants cope to these situations? What survival strategies do they adopt?; Is there any government assistance available to migrants and rural populations affected by environmental degradation?; Is there any nongovernment assistance available to

migrant and rural populations affected by environmental degradation?; What do you think is the level of public awareness about existing programs?; And if there are no programs, what kinds of programs would be most beneficial in your view?

Notes

1 Aside from its economic impacts, climate change is also associated with local conflict (Reuveny 2007; Nordas and Gleditsch 2007), although there is some debate on this. The argument for which there is some evidence is that the effects of climate change have been associated with tension among communities as groups compete for access to scarce natural resources such as land and water. Climate change also presents unique challenges to women in particular. MENA migrants, whether internal or external, tend to be overwhelmingly male. This means that women are left to assume the burden of increased workload at the place of origin and may also be isolated to the extent that many rural institutions are male dominated, thus making it difficult for women to have access to them—particularly those that center on decision making. For women who may have migrated, they may be more likely to be denied better job opportunities compared to their male counterparts, and they may not have to same social outlets as males in urban areas which impacts quality of life.

2 Algeria stood out in that the decision to migrate there was driven primarily by violence wrought by the civil war which ravaged the country from 1992 to 1999, causing some 150,000 deaths. Insurgent violence was widespread in urban areas as well as in the countryside. Older Algerians were more likely to have been impacted by the civil war than younger migrants. A few male respondents pointed to insurgent violence as one of the reasons for their departure from the countryside in addition to the impact of climate change on agriculture: "I left my village for two reasons. First because of the aggravation of terrorism in Djedjel, and second because of 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).

Bibliography

ACSAD and ISDR. 2011. "Drought Vulnerability in the Arab Region: Case Study—Drought in Syria, Ten Years of Scarce Water (2000–2010)." Damascus and Cairo: Arab center for the Studies of Arid Zones and Dry Lands and United Nations International Secretariat for Disaster Reduction.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

Burger, N., B. Ghosh-Dastidar, A. Grant, T. Ruder, O. Tchakeva, and Q. Wodon. 2014. "Data Collection." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 3 in this study.

El-Atrache, T. 2010. "Syria: 160 Villages Deserted 'Due to Climate Change." *Arab Environment Watch*, June 2, 2009.

Fargues, Phillippe. 2008. *Emerging Demographic Patterns across the Mediterranean and their Implications for Migration through 2030*. Washington, DC: Migration Policy Institute.

Ministère de l'Aménagement du Territoire, et de l'Environnement (Ministry for Territorial Management and Environment; MATE). 2001. "Elaboration de la stratégie et du plan d'action national des changements climatiques. Communication nationale initiale." April 30, as of (accessed September 22, 2010), http://unfccc.int/essential_background/library/items/3599.php?rec=j&priref=3344#beg

———. 2010. "Seconde communication nationale de l'Algérie sur les changements climatiques à la CCNUCC." November 25.

Ministry of State for Environmental Affairs. 2010. "Initial National Communication of the Syrian Arab Republic." Submitted to the United Nations Framework Convention on Climate Change.

Nordås, R., and N. P. Gleditsch. 2007. "Climate Change and Conflict." *Political Geography* 26 (6): 627–638.

Qabbani, Abdulhamid. 2010. "State of Denial." *Syria Today*, November.

Ragnhild, Nordas, and Nils Peter Gleditsch. 2007. "Climate Change and Conflict." *Political Geography* 26 (6): 627–38.

Reuveny, Rafael. 2007. "Climate Change-induced Migration and Violent Conflict." *Political Geography* 26 (6): 656–73.

Sowers, Jeannie, and Erika Weinthal. 2010. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Belfer Center for Science and International Affairs, Cambridge, MA.

Syrian Ministry of State for Environmental Affairs. 2010. "Initial National Communication of the Syrian Arab Republic." Submitted to the United Nations Framework Convention on Climate Change, Syria, April.

Tkacheva, Olesya, Nicholas Burger, and Audra K. Grant. 2011. *Results from Surveys on Climate Change and Migration in Egypt and Algeria*. Santa Monica: RAND Corporation.

United Nations Development Programme and Arab Fund for Economic and Social Development. 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Warren, R., N. Nicholls, R. Levy, P. Price. 2006. "Understanding the Regional Impacts of Climate Change: Research Report Prepared for the Stern Review on the Economics of Climate Change." Tyndall Centre for Climate Change, Research Working Paper 90, Norwich, UK.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2007. *World Bank Development Report 2008: Agriculture for Development*. Washington, DC: World Bank.

Zohry, Ayman. 2009. "The Development Impact of Internal Migration: Findings from Egypt." Mimeo, IUSSP, Marrakech.

CHAPTER 9

Is Climate Change Likely to Lead to Higher Net Internal Migration? The Republic of Yemen's Case

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Concerns abound about the potential impact of climate change on future migration, especially in the Middle East and North Africa, one of the regions that is likely to suffer the most from climate change. Yet it is not clear whether so far climate patterns have been a key driver of internal migration in countries such as the Republic of Yemen, despite the pressures created by water scarcity. By combining data from the Republic of Yemen's latest census and a weather database as well as other geographic information, we analyze the determinants of past net internal migration rates. Next, using future climate change scenarios, we predict the potential impact of rising temperatures on future net internal migration rates. The results suggest that while climate does have an impact on net internal migration rates, this impact is limited, so that on the basis of past patterns of climate and migration, rising temperature may not have a large impact on future net internal migration.

Introduction

Climate change is likely to lead to substantial migration flows (for a recent review of the evidence to-date, see Foresight 2011). Jakobeit and Methmann (2007) suggested some years back that there may be up to 150–200 million environmental refuges in 30 years, but this estimate was considered as conservative by the Stern Review on the Economics of Climate Change (2006) and the Foresight report notes that 42 million people were displaced by natural hazards just in 2010. It is also clear that the impact of climate change may be very different on different types of households depending on their coping mechanisms (see Meze-Hausken 2004, on Ethiopia) and that the magnitude of migration flows will depend on country conditions. For example, fast onset disasters such as hurricanes and floods, as well as droughts or decreasing agricultural yields may lead to only temporary displacement (for country case studies, see Findley 1994; Haug 2002; Henry, Schoumaker, and Beauchemin 2004; Paul 2005; Shuaizhang

et al. forthcoming; see also Barrios, Bertinelli, and Strobl 2006), while slow onset events such as desertification or rising sea levels may take longer to occur but may also have longer lasting effects on net migration flows.

The Middle East and North Africa (MENA) is likely to be one of the most vulnerable regions to climate change, both due to a number of cities threatened by rising sea levels and the vulnerability of agricultural production given water scarcity which is expected to increase further. Average temperatures in many MENA countries may increase by two degrees Celsius by the end of the century, including in the Republic of Yemen, a country where the depletion of groundwater resources is likely to reduce agricultural output by 40 percent (World Bank 2010; for a review of the literature which informs this chapter, see the introduction of chapter 1 by Wodon et al. [2014] and chapter 2 on the focus countries for this work by Burger et al. [2014] in this study).

In a country like the Republic of Yemen, climate change is likely lead to higher migration principally due to the need for households to improve their livelihoods. But many households also tend to be fairly attached to their area of origin, and when they move, this is typically driven more by socioeconomic factors than climate variables, as shown by Joseph and Wodon (2013) using a gravity-type model with census data on internal migration rates combined with data on weather patterns at the district level. Building on Joseph and Wodon (2013), we consider in this chapter net migration rates (as opposed to bi-directional flows) and predict to what extent changes in climate are likely to affect such net internal migration flows. We focus on net migration rates because from a policy point of view, these are likely to be more important than overall bi-directional flows.

The results suggest that controlling for other factors that may affect net internal migration rates, these rates tend to be lower toward areas with higher temperatures, but the impact of temperature on net migration rates, while statistically significant, is small. Using predicted values for future temperatures under alternative climate change scenarios, out-of-sample predictions of expected net international migration rates suggest limited changes in patterns of migration due to rising temperatures. It should be emphasized however that because we rely on past patterns of migration and climate, our results can only be considered as suggesting (in an imperfect and indicative way) that slowly changing climate patterns may affect migration in the not too distant future in a limited way only, but they should not be relied upon to assess how structural breaks such as dramatic changes in climate patterns may affect long-term migration.

The chapter is organized as follows. Section two presents our data and methodology. Section three describes our results. A brief conclusion follows.

Data and Methodology

Net internal migration rates are obtained at the district level from the latest the Republic of Yemen census implemented in 2004. The census has information on 2,752,629 households with 19,708,760 individuals living in 333 districts. It provides information on the current residence, previous residence and place of birth

of all individuals living in the Republic of Yemen at the time of the census. Information is also available on the number of years each individual has been living in the current residence, which along with age enables us to compute net internal migration rates for different age cohorts. For each cohort, we have 333 observations corresponding to the 333 districts in the Republic of Yemen (as of the administrative structure in 2004). Considering seven cohorts corresponding to age groups defined at five years of interval for the population aged 20–54, this provides us with 2,331 observations. The census also provides demographic and socioeconomic information including the level of education of the population, its occupation and employment characteristics, and the extent of urbanization. Finally, we also have at our disposal poverty estimates at the district level that were obtained through the combination of household and survey data through the poverty mapping technique (see Elbers et al. 2003).

In addition, information on the distance between major cities in each district is calculated from the highest population center in each district to all other districts using an Euclidean distance function in ESRI ArcGIS 9.3 software, and the same procedure is used for distance to the coast. Travel time to the nearest city with 100,000 populations uses a methodology developed from Nelson (2008) with regionally specific information (World Bank 2011). The road data provide kilometers of asphalt roads. The mean slope of district land is derived from a global dataset by Verdin et al. (2007). The percentage of irrigated land is taken from Global Map of Irrigated Areas version 4 (Siebert et al. 2005; Siebert, Hoogeveen, and Frenken 2006). Weather data on annual mean temperature and rainfall and their variability are collected from BIOCLIM (Busby 1991).

Denoting by Y_i the net internal migration rate to district to as a proportion of the population of the district, and by X_i the characteristics of the district, we estimate a standard regression using a fractional logit model:

$$Y_i = \alpha + \beta' X_i + \varepsilon_i \tag{1}$$

We also use a decomposition proposed by Fields (2004) to assess how much of the variation in net internal migration rates between districts is accounted for by each of the independent variables. The weights from the decomposition are constructed to sum to the total percentage of the explained variance (that is, the R^2). Denote by s_k the share of the variation in the dependent variable attributed to the kth explanatory variable, by β_k is the multiple regression coefficient for that variable, and by σ_k is the standard deviation of the kth explanatory variable. Cov($X_k\beta_k$, Y) is the correlation between the kth explanatory variable and the dependent variable Y and σ_Y is the standard deviation of the dependent variable. We have:

$$S_k = \frac{\mathrm{Cov}(X_k\beta_k, Y)}{\mathrm{Var}(Y)} = \mathrm{Cor}(X_k, Y)\frac{\sigma_k}{\sigma_Y}\beta_k \tag{2}$$

Normalized weights p_k are obtained by dividing s_k by R^2 so that each weight is expressed as fraction of the percentage of total explained variance and the weights sum to 100. Five slightly different specifications are used to test for the

robustness of the coefficient estimates. The first model or baseline specification does not include dummy variables for the governorates (the administrative level immediately above the district), and it includes the climate variables in both levels and squared values. In the second model, governorate dummy variables are added (although not shown in the regression table—these estimates are available upon request). Next, in the third specification we keep the governorate dummies, but do not include the quadratic terms for the climate variables.

In the last two specifications, we also keep the governorate dummies, but we replace the climate variables that measure seasonality by three intervals each including one third of the districts, with the "low" interval (in terms of temperature or rainfall) being the excluded reference category in the regression, and the other two intervals being included as dummy variables. The reason to do so is that for the predictive analysis, while we do have estimates of future temperature and rainfall from climate change models, we do not have estimates of future seasonality in temperature and rainfall that are as reliable. At the same time, it is unlikely that for most districts changes in seasonality would be so dramatic as to shift the interval of seasonality to which a district belongs. Then the last two models can then be considered as the best models for out-of-sample predictions of the potential impact of higher temperatures and lower rainfall on future net internal migration rates. The difference between the last two models is that one includes squared values for mean temperature and rainfall, while the other does not.

For the predictions of future migration under likely future climate patterns, we rely on data from Strzepek and Schlosser (2010). These data provide expected percent changes in temperature and precipitation for the years 2030 (defined as the average for the period 2026–35) and 2050 (defined as the average for the period 2046–55) on a monthly basis in comparison to the model baseline (1961–90) which are historical data from the CRU TS 2.1 (Mitchell and Jones 2005). Strzepek and Schlosser define three scenarios (Wet, Mid, and Dry) using a Climate Moisture Index (CMI), which is an indicator of the aridity of a region. The CMI depends on the average annual precipitation and average annual potential evapotranspiration (PET). The Wet scenario is defined as the global climate model (GCM) that has the largest increase in average CMI over the baseline period, while the Dry scenario is defined as the GCM that has the largest decrease in average CMI over the baseline period. The Mid scenario is defined as the GCM closest to the mid-point between the Wet and Dry scenarios. Since GCMs vary in spatial resolution, the results are coerced to the CRU half degree by half degree resolution and then summarized by district.

Results

Table 9.1 provides basic statistics on the main variables of interest. Net internal migration rates are not very large. They range from -2.86 percent to 0.37 percent. The fact that the rates are larger in negative values suggest that net internal migration on average tends to take place from districts with smaller populations to districts with larger populations, as expected. Table 9.1 also provides summary

Table 9.1 Basic Statistics on Key Variables of Interest, Republic of Yemen, 2004–06

	Mean	*Std. Dev.*	*Min*	*Max*
Dependent variables				
Net migration rate for youth (age 20–24)	−0.001	0.247	−1.710	0.359
Net migration rate for older cohort (age 25–54)	−0.038	0.338	−2.861	0.370
Net migration rate—total	−0.033	0.327	−2.861	0.370
Independent variables				
Log of total population in the district	10.63	0.92	7.32	12.65
Squared poverty gap in the district	0.05	0.05	0.00	0.31
Share of urban population in the district	0.20	0.30	0.00	1.00
Share of employed in manufacturing, construction	0.15	0.09	0.00	0.60
Share of employed in trade and services	0.46	0.20	0.05	0.91
Share of population with public water supply	0.18	0.26	0.00	0.95
Share of population with public lighting	0.32	0.34	0.00	0.97
Average slope of terrain in the district (%)	15.35	12.30	0.00	49.33
Share of literate population above 40	0.17	0.12	0.01	0.61
Share of primary educated population above 40	0.14	0.13	0.00	0.51
Share of secondary educated population above 40	0.02	0.03	0.00	0.17
Share of tertiary educated population above 40	0.02	0.03	0.00	0.22
Percentage of irrigated land in the district	3.28	5.97	0.00	44.73
Annual mean temperature (°C)	21.95	4.16	13.93	30.45
Annual mean temperature squared	500.88	187.19	196.57	927.45
Annual precipitation	20.42	12.37	2.61	50.97
Annual precipitation squared	577.29	611.00	7.23	2600.47
Temperature seasonality (standard deviation × 100)	28.83	3.32	18.79	40.61
Temperature seasonality squared	842.67	203.13	353.45	1656.13
Precipitation seasonality (coefficient of variation)	8.47	1.82	4.69	13.34
Precipitation seasonality squared	75.28	32.00	21.99	179.40
Travel time to nearest city with 100,000 population (hours)	3.68	3.20	0.02	20.35
Travel time to nearest city squared	23.77	50.77	0.00	414.30
Distance to coast/100 (only Yemen, Rep.)	0.96	0.53	0.00	2.51
Distance to coast squared/100 (only Yemen, Rep.)	1.20	1.20	0.00	6.30
Km of asphalt roads /100	0.16	0.30	0.00	3.23
Km of asphalt roads squared /100	0.12	0.76	0.00	10.43
Medium temperature level (tercile)	0.33	0.47	0.00	1.00
High temperature level (tercile)	0.33	0.47	0.00	1.00
Medium rain level (tercile)	0.33	0.47	0.00	1.00
High rain level (tercile)	0.33	0.47	0.00	1.00

Source: World Bank data.

statistics for the independent variables used in the regression. The summary statistics show that the Republic of Yemen's population still lives predominantly in rural areas with an average urban population across districts of about 20 percent. Trade and services provide employment to 42 percent of the employed. Education levels tend to be low, with 17 percent of the population above 40 years of age being literate. The share of irrigated land is also low, at only 4 percent.

Mean temperatures are relatively high, but not excessive at 22 degrees Celsius. Precipitations are low, at 200 millimeters per year on average. Temperature and precipitation seasonality are high. Many districts are located far from the nearest city with more than 100,000 inhabitants. Most districts also have limited water, public lighting, and road infrastructure.

Regression results are provided in table 9.2. Net migration rates are smaller in districts with a large population, but this is a stock effect—even if migrants tend to go to more populated districts, given that rates are expressed in proportion to existing populations, larger districts tend to have smaller rates controlling for other factors. Poverty does not seem to be correlated with net migration in a statistically significant way, even though the sign is negative as expected in almost all cases. Districts with a higher share of urban population have lower net migration rates—this could be seen as surprising, but the raw data suggests indeed that migration does not necessarily take place toward the largest cities, at least within the Republic of Yemen (there is apparently substantial international migration toward cities in Saudi Arabia, but this is not captured here).

Migration tends to be directed toward districts with a higher share of employment in trade and services, which does make sense, given that many migrants may be leaving agricultural occupations. Migration is higher toward areas with higher access to piped water supply, although the impact of public lighting is negative in a few cases (but also smaller and only marginally statistically significant). Migration is higher in areas with a higher share of the population above 40 having secondary education, with a negative correlation in the case of tertiary education—this might capture areas where migrants have a reasonable expectation of finding good employment, given that many migrants will not have tertiary education. Migration tends to take place in areas with less irrigated land—maybe because areas with irrigated land are already well occupied. Travel time to the nearest large city is in many cases positively related to migration rates but this is partly offset by the squared term, and in some cases, the impact is not statistically significant, including for the preferred specifications (4) and (5). The same can be said for distance to the coast. Finally, migration rates are higher for the age groups 20–24 and then 25–29 (the reference category is 15–19) than for any other age group, as expected.

As for climate variables, there is a clear negative effect of higher temperatures on net migration rates, which is important for our out-of-sample predictions of future migration. The sign and the magnitude of the coefficients tend to be stable across specifications (taking into account the squared term when included). By contrast the impact of the level of rainfall is not statistically significant. Seasonality also does matter, and this is easiest to see in specifications (4) and (5) which suggest higher net migration rates to areas with lower temperature variability, with a smaller impact again for rainfall which is not always statistically significant.

The fact that temperature—in levels and variability—affects net migration rates is an important result, but this does not mean that the effect is large. As shown in table 9.3 which provides the results of a decomposition of the explained

Table 9.2 District-Level Correlates of Net Migration Rates, District Level

	(1)	(2)	(3)	(4)	(5)
	Base	*With regional dummies, squared terms*	*With regional dummies, no squared terms*	*With climate variability brackets, squared terms*	*With climate variability brackets, no squared terms*
Log total population	−0.060***	−0.054***	−0.054***	−0.050***	−0.048***
Squared poverty gap	−0.134	−0.143	−0.158	−0.031	0.005
Urban population (%)	−0.603***	−0.562***	−0.571***	−0.541***	−0.534***
Manuf./construction employment (%)	0.137***	0.035	0.025	0.047	0.078*
Trade/services employment (%)	−0.018	0.117***	0.121***	0.113***	0.133***
Population with public water supply (%)	0.198***	0.147***	0.175***	0.139***	0.151***
Population with public lighting (%)	−0.019	−0.038**	−0.025	−0.034*	−0.039**
Mean slope (%)	0.002***	0.001	−0.000	0.001*	0.000
Literate population above 40 (%)	−0.259*	−0.056	−0.061	−0.098	−0.114
Primary educ. population above 40 (%)	−1.139***	−0.940*	−1.153**	−0.875*	−0.743
Secondary educ. pop. above 40 (%)	11.570***	7.839***	7.178***	8.072***	7.252***
Tertiary educ. population above 40 (%)	−8.764***	−5.885***	−5.768***	−6.121***	−6.004***
Irrigated land (%)	0.000	−0.003***	−0.003***	−0.002**	−0.002***
Annual mean temperature	−0.115***	−0.098***	−0.011***	−0.104***	−0.009***
Annual mean temperature squared	0.002***	0.002***	—	0.002***	—
Annual precipitation	−0.003	−0.002	−0.001	0.001	−0.001
Annual precipitation squared	0.000**	0.000	—	−0.000	—
Temperature seasonality	−0.071***	−0.042***	−0.025***	—	—
Temperature seasonality squared	0.001***	0.000*	—	—	—
Precipitation seasonality	0.022	0.123***	0.011***	—	—
Precipitation seasonality squared	−0.002	−0.007***	—	—	—
Travel time to nearest large city	0.038***	0.037***	0.012***	0.031***	0.000
Travel time to nearest large city squared	−0.003***	−0.002***	—	−0.002***	—

table continues next page

Table 9.2 District-Level Correlates of Net Migration Rates, District Level (*continued*)

	(1)	(2)	(3)	(4)	(5)
	Base	*With regional dummies, squared terms*	*With regional dummies, no squared terms*	*With climate variability brackets, squared terms*	*With climate variability brackets, no squared terms*
Distance to coast/100 (only Yemen, Rep.)	−0.080*	0.054	−0.054***	0.029	−0.070***
Distance to coast squared	−0.004	−0.046***	—	−0.028*	—
Km of asphalt roads /100	0.006	−0.020	0.007	−0.014	0.018*
Km of asphalt roads squared/100	−0.010	0.008	—	0.007	—
Age group (20–24)	0.050***	0.050***	0.050***	0.050***	0.050***
Age group (25–29)	0.031**	0.031**	0.031**	0.031**	0.031**
Age group (30–34)	0.023	0.023	0.023	0.023	0.023
Age group (35–39)	0.013	0.013	0.013	0.013	0.013
Age group (40–44)	0.007	0.007	0.007	0.007	0.007
Age group (45–49)	0.003	0.003	0.003	0.003	0.003
Temperature variability—medium	—	—	—	−0.069***	−0.079***
Temperature variability—high	—	—	—	−0.158***	−0.180***
Rainfall variability—medium	—	—	—	0.012	0.023***
Rainfall variability—high	—	—	—	−0.007	0.035***
Constant	3.140***	2.030***	1.525***	1.689***	0.862***
Number of observations	2331	2331	2331	2331	2331
R^2	0.623	0.691	0.685	0.692	0.685

Source: World Bank data.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 9.3 Fields Decomposition of Explained Variance in Migration Rates

	(1)	(2)	(3)	(4)	(5)
	Base	*With regional dummies, squared terms*	*With regional dummies, no squared terms*	*Climate variability levels, squared terms*	*Climate variability levels, no squared terms*
Log of total population	6.4	5.1	5.2	4.8	4.6
Squared poverty gap	−0.6	−0.6	−0.7	−0.1	0.0
Share of urban population	56.0	47.0	48.2	45.2	45.1
Share of employed in manufacturing, construction	−0.3	−0.1	0.0	−0.1	−0.2
Share of employed in trade and services	0.6	−3.5	−3.6	−3.3	−4.0
Share of population with public water supply	−11.5	−7.7	−9.3	−7.3	−8.0
Share of population with public lighting	1.4	2.5	1.6	2.2	2.6
Mean slope (%)	4.4	1.0	−0.7	2.2	0.4
Share of literate population above 40	6.4	1.2	1.4	2.2	2.6
Share of primary educated population above 40	7.6	5.7	7.0	5.3	4.5
Share of secondary educated population above 40	−51.1	−31.2	−28.8	−32.1	−29.1
Share of tertiary educated population above 40	76.2	46.1	45.6	47.9	47.5
Percentage of irrigated land	−0.2	1.1	1.2	0.9	1.1
Annual mean temperature	−13.9	−10.7	−1.2	−11.3	−1.0
Annual mean temperature squared	10.0	7.6	—	8.2	—
Annual precipitation	−0.7	−0.5	−0.2	0.2	−0.2
Annual precipitation squared	1.0	0.5	—	−0.2	—
Temperature seasonality (standard dev. *100)	−3.9	−2.1	−1.2	—	—
Temperature seasonality squared	3.1	1.0	—	—	—
Precipitation seasonality (coeff. of variation)	−0.7	−3.6	−0.3	—	—
Precipitation seasonality squared	1.3	4.0	—	—	—
Travel time to nearest city with 100,000 pop.	6.7	5.8	1.9	4.9	0.0
Travel time to the nearest city squared	−0.6	−0.3	—	−0.4	—
Distance to coast/100 in Yemen, Rep.	1.9	−1.1	—	−0.6	1.5
Distance to coast squared	0.3	2.9	1.1	1.8	—
Km of asphalt roads /100	0.1	−0.3	—	−0.2	0.3
Km of asphalt roads squared /100	−0.2	0.1	0.1	0.1	—

table continues next page

Table 9.3 Fields Decomposition of Explained Variance in Migration Rates (*continued*)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	Base	*With regional dummies, squared terms*	*With regional dummies, no squared terms*	*Climate variability levels, squared terms*	*Climate variability levels, no squared terms*
Temperature variability-medium	—	—	—	−1.1	−1.3
Temperature variability-high	—	—	—	−0.7	−0.8
Rainfall variability-medium	—	—	—	0.3	0.6
Rainfall variability-high	—	—	—	0.2	−1.1
Age group (20–24)	0.3	0.3	0.3	0.3	0.3
Age group (25–29)	0.1	0.1	0.1	0.1	0.1
Age group (30–34)	0.0	0.0	0.0	0.0	0.0
Age group (35–39)	0.0	0.0	0.0	0.0	0.0
Age group (40–44)	0.0	0.0	0.0	0.0	0.0
Age group (45–49)	0.0	0.0	0.0	0.0	0.0

Source: World Banks' estimation.
Note: — = not available

variance proposed by Fields (2004), these variables account only for a limited share of the explained differences in net migration rates between districts (Fields decomposition shares can also be computed for regional governorate effects in the regressions, but these shares are small and therefore are not included in the table). The share of the difference in migration rates explained by temperature levels is only at about 3–4 percent when considering linear and quadratic terms, and it is lower when quadratic terms are omitted. This is small in comparison to the role of urbanization, education, infrastructure, employment, and even population size. This suggests that changes in future temperature levels might have only a limited impact on future net migration rates.

Table 9.4 provides the results of the estimation of future migration rates obtained with estimates of future temperature levels (given that rainfall does not

Table 9.4 Actual and Predicted Net Migration Rates

	Model (4)							
	Youth (age 20–24)				*Others (age 25–54)*			
	Cold	*Medium*	*Hot*	*All*	*Cold*	*Medium*	*Hot*	*All*
2004 data								
Actual	−0.02461	0.03595	−0.01306	−0.00057	−0.09771	0.01867	−0.0356	−0.03821
Predicted	−0.05101	0.05462	−0.00533	−0.00057	−0.08865	0.01698	−0.04297	−0.03821
2030 predicted								
Mid scenario	−0.06134	0.04844	−0.0033	−0.0054	−0.09898	0.0108	−0.04094	−0.04304
Dry scenario	−0.06204	0.04824	−0.00222	−0.00534	−0.09968	0.0106	−0.03986	−0.04298
Wet scenario	−0.06181	0.04827	−0.00312	−0.00555	−0.09945	0.01063	−0.04076	−0.04319
2050 predicted								
Mid scenario	−0.06618	0.04725	0.00156	−0.00579	−0.10381	0.00961	−0.03608	−0.04343
Dry scenario	−0.06775	0.04694	0.00365	−0.00572	−0.10539	0.0093	−0.03399	−0.04336
Wet scenario	−0.06457	0.04755	−0.0004	−0.00581	−0.10221	0.00991	−0.03804	−0.04345
	Model (5)							
	Youth (age 20–24)				*Others (age 25–54)*			
	Cold	*Medium*	*Hot*	*All*	*Cold*	*Medium*	*Hot*	*All*
2004 data								
Actual	−0.02461	0.03595	−0.01306	−0.00057	−0.09771	0.01867	−0.0356	−0.03821
Predicted	−0.05696	0.06444	−0.0092	−0.00057	−0.0946	0.0268	−0.04684	−0.03821
2030 predicted								
Mid scenario	−0.05565	0.06613	−0.00741	0.00102	−0.09329	0.02849	−0.04505	−0.03662
Dry scenario	−0.05593	0.06574	−0.00797	0.00061	−0.09357	0.0281	−0.04561	−0.03703
Wet scenario	−0.05584	0.06586	−0.00761	0.0008	−0.09348	0.02822	−0.04525	−0.03684
2050 predicted								
Mid scenario	−0.05761	0.06373	−0.01015	−0.00134	−0.09525	0.0261	−0.04778	−0.03898
Dry scenario	−0.05825	0.06299	−0.01107	−0.00211	−0.09589	0.02535	−0.04871	−0.03975
Wet scenario	−0.05696	0.06444	−0.0092	−0.00057	−0.0946	0.0268	−0.04684	−0.03821

Source: World Bank data.

have a statistically significant impact on net migration rates, the out-of-sample predictions were computed only for expected changes in temperature). For easier reading, the districts were grouped into three intervals, each accounting for one third of the districts, and labeled as low, medium, and high temperature districts. Because migration rates are higher for the age group 20–24, we present statistics for that group, as well as for older individuals. The table suggests that net migration rates are lower for low and high temperature districts. Predicted migration rates are obtained under higher temperatures under the mild, dry, and wet scenarios, and considering both expected temperatures in 2030 and 2050, but the differences versus the predicted migration rates today are very small, and the differences between the three scenarios, as well as between 2030 and 2050 are also small. In other words, at least based on patterns of past migration, expected changes in temperature might not affect net internal migration rates to a significant extent.

Conclusion

Is climate change expected to generate larger net internal migration flows in the Republic of Yemen away from areas with higher expected temperatures? Using census and weather data, this chapter has tried to answer this question. We found that although higher temperatures and higher variability in temperatures are associated in a statistically significant way with lower net migration rates, the effects are not large. Out-of-sample predictions suggest that with the increase in temperatures that are to be expected under various climate change scenarios, the impact of climate change on net migration rates is not likely to be large. It should be strongly cautioned however that these results are based on past patterns of migration and climate in the Republic of Yemen, and "business as usual" extrapolations of past patterns. Therefore, the simulation may not capture what might happen in the future under more drastic changes in climate, including much more severe weather shocks.

Bibliography

Barrios, S., L. Bertinelli, and E. Strobl. 2006. "Climatic Change and Rural–Urban Migration: The Case of Sub-Saharan Africa. *Journal of Urban Economics* 60 (3): 357–71.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study, Washington, DC: World Bank, chapter 2 in this study.

Busby, J. R. 1991. "BIOCLIM–A Bioclimate Analysis and Prediction System. *Plant Protection* Quarterly 6: 8–9.

Elbers, C., J. O. Lanjouw, and P. Lanjouw. 2003. "Micro-Level Estimation of Poverty and Inequality." *Econometrica* 71 (1): 355–64.

Fields, G. S. 2004. "Regression-Based Decompositions: A New Tool for Managerial Decision-Making." Department of Labor Economics Working Papers, Cornell University, Ithaca, USA.

Findley, S. E. 1994. "Does Drought Increase Migration? A Study of Migration from Rural Mali during the 1983–1985 Drought." *International Migration Review* 28 (3): 539–53.

Foresight. 2011. "Migration and Global Environmental Change: Final Project Report." The Government Office for Science, London.

Haug, R. 2002. "Forced Migration, Processes of Return and Livelihood Construction among Pastoralists in Northern Sudan." *Disasters* 26 (1): 70–84.

Henry, S., B. Schoumaker, and C. Beauchemin. 2004. "The Impact of Rainfall on the First Out-Migration: A Multi-Level Event-History Analysis in Burkina Faso." *Population and Environment* 25 (5): 423–60.

Jakobeit, C., and C. Methmann. (2007). *Klimaflü¸chtlinge—Die verleugnete Katastrophe*. Greenpeace: Hamburg.

Joseph, G., and Q. Wodon. 2013. "Is Internal Migration in Yemen Driven by Climate or Socio-Economic Factors?" *Review of International Economics* 21 (2): 295–310.

Meze-Hausken, E. 2004. "Migration Caused by Climate Change: How Vulnerable Are People in Dryland Areas?" *Mitigation and Adaptation Strategies for Global Change* 5 (4): 379–406.

Mitchell, T. D., and Jones, P. D. 2005. "An Improved Method of Constructing a Database of Monthly Climate Observations and Associated High-Resolution Grids." *International Journal of Climatology* 25: 693–712.

Nelson, A. 2008. "Travel Time to Major Cities: A Global Map of Accessibility, Global Environment Monitoring Unit." Joint Research Centre of the European commission, Ispra, Italy. http://gem.jrc.ec.europa.eu.

Paul, B. K. 2005. "Evidence against Disaster-Induced Migration: The 2004 Tornado in North-Central Bangladesh." *Disasters* 29: 370–85.

Shuaizhang, F., A. B. Krueger, and M. Oppenheimera. forthcoming. "Linkages among Climate Change, Crop Yields and Mexico–US Cross-Border Migration." Paper presented at the Proceedings of the National Academy of Sciences.

Siebert, S., P. Döll, J. Hoogeveen, J.-M. Faurès, K. Frenken, and S. Feick. 2005. "Development and Validation of the Global Map of Irrigation Areas. *Hydrology and Earth System Sciences* 9: 535–47.

Siebert, S., J. Hoogeveen, and K. Frenken. 2006. "Irrigation in Africa, Europe and Latin America—Update of the Digital Global Map of Irrigation Areas to Version 4." Frankfurt Hydrology Paper 05, Institute of Physical Geography, University of Frankfurt, Frankfurt am Main, Germany and Food and Agriculture Organization of the United Nations, Rome, Italy.

Stern, N. 2006. *The Economics of Climate Change—The Stern Review*. Cambridge: Cambridge University Press.

Strzepek, K., and C. A. Schlosser. 2010. "Climate Change Scenarios and Climate Data to Support the Economics of Adaptation to Climate Change. " Mimeo, World Bank, Washington, DC.

Verdin, K. L., J. W. Godt, C. Funk, D. Pedreros, D. Worstell, and J. Verdin. 2007. "Development of a Global Slope Dataset for Estimation of Landslide Occurrence Resulting from Earthquakes." U.S. Geological Survey Open-File Report 2007–1188, Colorado.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2010. *Yemen: Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications*. Washington, DC: World Bank.

———. 2011. "Poor Places, Thriving People: How the Middle East and North Africa Can Rise Above Spatial Disparities." MENA Development Report, Washington, DC: World Bank.

CHAPTER 10

Extreme Weather Events and Migration: The Case of Morocco

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Do extreme weather events such as droughts or floods lead to migration away from the areas affected by these events? This chapter aims to provide an answer to that question for Morocco using a new nationally representative household survey implemented in 2009/10. The data suggest that around one in four households have been affected by weather shocks in the five years preceding the survey implementation. Droughts and floods are not directly identified by households as major reasons for migration, but insufficient agricultural revenue and a lack of agricultural employment as well as better employment opportunities at the place of destination are mentioned as reasons to migrate, and these are affected by adverse weather shocks. Furthermore, in regression analysis, after controlling for a wide range of individual and household characteristics, the probability of both temporary and permanent migration increases if the household has been affected by an adverse weather shock or the consequences thereof. Thus, while adverse weather events may not be the main driver of migration, they do contribute to it.

Introduction

The frequency of droughts has increased in Morocco over the last few decades, with negative impact on farmers and the economy as a whole (Azzam and Sekkat 2005; Barakat and Handoufe 1998; Skees 2001). Most agricultural land is not irrigated, which means that affected households often have limited ways to reduce the impact of droughts on their livelihood (Skees 2001; Swearingen and Bencherifa 2000). In chapter 5 of this study, a recent national household survey for Morocco was used to document the extent to which Moroccan households, and especially those involved in agriculture, are confronted with extreme weather events such as droughts. The analysis suggested that most households working in agriculture were affected by weather shocks, often seriously. In the population as a whole, the proportion of households affected was about one fourth, simply because households not in agriculture were not likely

to be affected. Many households affected declared not being able to recover from these shocks.

Given the high level of vulnerability of households to weather shocks and their limited means to cope with the shocks and adapt to climate change, one might expect that weather shocks would contribute to out-migration in the affected areas. It would make sense that some household members would leave the areas most affected by drought, and there is indeed some evidence to this effect. After a severe drought in 2007, two thirds of the illegal migrants arrested in Spain were from the farming and mining region of Khouribga (EACH-FOR 2008). Another study by Hamza, El Faskaoui, and Fermin (2009) found that environmental degradation was one of the reasons leading to past or intended migration. Yet these studies have been fairly localized and based on small samples, so that it is difficult to generalize from them—for example the study by Hamza, El Faskaoui and Fermin has a sample size of 30, so that it is unclear at the national level whether climate shocks are a major or relatively small factor affecting migration.

The objective of this chapter is to test whether these weather shocks indeed contribute to migration, both temporary and permanent, by using a broader sample (for a brief review of the literature which informs this chapter, see the introduction of chapter 1 by Wodon et al. (2014) and chapter 2 on the focus countries for this work by Burger et al. (2014) in this study. The analysis is based on a nationally representative household survey? the Morocco Household and Youth Survey (MHYS) implemented between December 2009 and March 2010. Much of the questionnaire of that survey focuses on issues critical to youth, such as the obstacles they encounter on the labor market and for civic participation. But the questionnaire also included data on migration as well as on various shocks affecting households and their ability to cope with these shocks. One of the shocks is that of adverse weather events (such as droughts and floods). It is thus feasible using econometric techniques to assess whether households who were affected by extreme weather events experienced higher migration rates among their members after controlling for a range of other household and individual characteristics.

The chapter is organized as follows. Section two introduces the data used for the analysis. Section three provides basic statistics on the extent to which households are affected by weather and other shocks, and on the extent of both temporary and permanent migration among household members. Section four then provides the multivariate analysis of the correlates of temporary and permanent migration among household members. A brief conclusion follows.

Data

As was the case for chapter 5 of this study, this chapter is based on data from MHYS implemented in 2009/10. The survey is nationally representative (even if it does not include the scarcely populated Western Sahara southern part of the country) and it includes data on 2,000 households (1,216 in urban areas and 784

in rural areas). The survey was implemented with funding from the World Bank between December 2009 and March 2010. Much of the questionnaire focused on issues critical to youth, and especially the obstacles that they encounter on the labor market and for civic participation. Questions were also asked about young people's intentions to emigrate. Other more traditional modules deal with standard questions on household member demographics and education as well as employment information. The questionnaire also focused on various shocks affecting households and their ability to cope with these shocks, including weather shocks. In order to be able to use the survey for this work on migration in the Middle East and North Africa (MENA) region, additional questions as well as more options within existing questions were added to the questionnaire on household perceptions regarding changes in climate, and whether this affected migration decisions.

Apart from a range of household and individual characteristics which are used as controls in the regression analysis, a few central questions are used for the analysis presented in this chapter. In section 6A about the incidence of shocks and household responses, households are asked whether since November 2004, the respondent or a member of the household experienced various shocks. The shocks listed are: (1) Weather shocks (Droughts; floods; Pest infestation, crop and livestock diseases); (2) Unexpected increase in prices of food or other essential commodities consumed; (3) Unexpected loss of job; (4) Involuntary reduction in employment or the number of hours worked; (5) Unexpected decline in prices or demand for products that you sell; (6) Unexpected increase in prices or shortages of inputs or products needed for your activity; (7) Loss of asset or of livestock due to theft, death, or accident; (8) Cut-off or decrease in remittances to household; (9) Death of main earner for the household; (10) Death of another member of the family; (11) Serious injury or illness that kept any member from doing normal activities; (12) Divorce or abandonment by husband; (13) Big amount of dowry for daughter's marriage; (14) Other (specify). This is the information used in the regression analysis to assess the impact of weather shocks on migration controlling for a range of other independent variables.

Data on migration is available for all household members, both those who remain today members of the households, and those who used to be members but have left permanently. We can thus measure both temporary and permanent migration by household members. On the other hand, we only record the migration of household members, as opposed to that of whole households, but this should not be too much of a problem given that most migration is typically undertaken by household members, instead of entire households. It must also be recognized 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. What the questionnaire provides us with is information on whether households declare having been affected by a weather shock—but the decision to migrate is probably based on repeated shocks or changing conditions, as opposed to a single shock, and we cannot verify to what extent the declarations of households correspond closely to actual weather data for their area. But on the other hand one could argue that decisions such as

that of migrating are influenced at least as much by perceptions of households of weather patterns as by the weather patterns themselves.

While all households respond to the question of whether they suffered from a weather shock, in a separate part of the questionnaire households working in agriculture are asked whether they were faced with a number problems in the last five years. The list of problems identified was as follows: (1) Reduction in agricultural yields due to inadequate rainfall (periodic and recurrent water scarcity due to droughts); (2) Reduction in agricultural yields due to too much water (too much rain or flooding); (3) Poor soil quality due to erosion reducing agricultural yields; (4) Changing and unpredictable climate and temperatures reducing agricultural yields (that is, too hot, too cold, too rainy, too dry); (5) Pest or locust infestation reducing agricultural yields; (6) Reduced job opportunities in the agricultural sector; (7) Death of livestock due to bad weather conditions; (8) Reduction in the stock of livestock since the availability of grazing land is becoming less due to droughts and floods. Next households were asked: "How serious was the financial loss to the household due to these climate related factors listed above?" The potential answers were very serious, moderate, serious, and negligible. Finally households were asked "Was (the household) forced to change the economic activity after the shock?" This information will also be used in the regression analysis as some problems encountered by agricultural households—who tend to be more exposed to climate shocks—may lead to migration and the problems identified in the questionnaire may potentially better capture changes in structural environmental conditions than a weather shock would.

Basic Statistics

Table 10.1 provides summary statistics on the main variables of interest. The first two columns of the table give the migration rates observed for the various groups of households or individuals. The last two tables provide the summary statistics for the same variables as they are used in the regression analysis—note that in a number of cases the summary statistics are missing and replaced by the symbol "—" because these are the excluded reference categories in the regressions (the shares of those with that dummy variable can be readily computed from the other shares for the corresponding category of variables). In what follows, we focus the discussion of the basic statistics on the migration rates, while the summary statistics are provided simply for the sake of completeness in information and standard practice.

The temporary migration rate is at 5.71 percent for the sample as a whole, and is a bit higher than the permanent migration rate, at 4.00 percent. The temporary migration rate is at its highest level among individuals aged 25–34, while for permanent migration, the rate is highest among those aged 15–24. The older an individual gets, the less likely it is that s/he will migrate. Migration rates are much higher for women than for men, and this is confirmed when looking at the position of the individual in terms of being a head of household or a spouse (rates for spouses are much higher), or at the interaction effects between gender and marital status.

Table 10.1 Summary Statistics on Individual Level Migration Rates

Percent

	Migration rates		*Summary statistics*	
	Temporary migration rates (%)	*Permanent migration rates (%)*	*Temporary migration regression*	*Permanent migration regression*
All sample	5.71	4.00	5.71	4.00
Age group				
Age 15–24	3.80	6.02	0.295	0.315
Age 25–34	7.23	5.87	0.215	0.221
Age 35–44	6.63	2.31	0.159	0.153
Age 45–54	5.76	0.66	0.152	0.142
Age 55 and over	6.16	0.88	—	—
Female	9.65	6.34	0.505	0.503
Male	1.83	1.63	—	—
Spouse	7.00	4.97	0.252	0.235
Head	1.85	0.70	—	—
Education				
No education	4.51	2.34	—	—
Primary	7.34	4.69	0.241	0.244
College	5.96	4.31	0.166	0.167
Secondary	4.34	5.30	0.126	0.129
Tertiary and up	9.84	8.03	0.052	0.056
Married	5.06	0.00	0.588	0.588
Not married	6.16	0.00	—	—
Female and married	7.51	0.00	0.324	0.324
Not female and married	1.92	0.00	—	—
Head age	—	—	55.166	55.309
Head age squared	—	—	3,219.087	3,232.687

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Table 10.1 Summary Statistics on Individual Level Migration Rates *(continued)*
Percent

	Migration rates		*Summary statistics*	
	Temporary migration rates (%)	*Permanent migration rates (%)*	*Temporary migration regression*	*Permanent migration regression*
Female head	5.97	3.62	0.169	0.172
Male head	4.35	5.69	—	—
Head married	4.06	4.19	0.986	0.986
Head not married	5.75	3.96	—	—
Head education				
No Education	5.83	0.00	—	—
Primary	5.30	3.75	0.230	0.232
College	4.39	5.43	0.068	0.068
Secondary	4.46	3.45	0.063	0.061
Tertiary and up	10.62	5.91	0.029	0.029
Head occupation				
No work	5.39	0.00	—	—
Work for other	5.78	3.19	0.300	0.296
Agricultural work	7.07	4.92	0.174	0.179
Nonagricultural work	4.32	2.69	0.132	0.129
Self-produce work	9.04	6.05	0.004	0.004
Own more than 1 acre	5.04	3.45	0.242	0.248
Own less than 1 acre	7.91	5.63	—	—
Urban	7.93	4.47	0.596	0.589
Rural	4.28	3.64	—	—
Wealth index				
Q1	9.58	4.97	—	—
Q2	6.85	3.45	0.200	0.200
Q3	4.31	3.52	0.207	0.205
Q4	3.17	3.34	0.213	0.210
Q5	4.95	4.68	0.175	0.175

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Table 10.1 Summary Statistics on Individual Level Migration Rates *(continued)*
Percent

	Migration rates		*Summary statistics*	
	Temporary migration rates (%)	*Permanent migration rates (%)*	*Temporary migration regression*	*Permanent migration regression*
Regions				
Guélmim-Es Semara	2.73	5.15	0.024	0.024
Souss-Massa-Draâ,	12.56	5.68	0.106	0.107
Gharb-Cherarda-Béni Hssen	6.65	2.65	0.071	0.069
Chaouia-Ouardigha	6.79	4.23	0.078	0.079
Marrakech-Tensift-Al Haouz	8.99	2.54	0.114	0.114
Oriental	1.08	1.47	0.058	0.056
Grand-Casablanca	2.28	3.44	0.131	0.130
Rabat-Salé-Zemmour-Zaér	4.47	3.69	0.068	0.067
Doukala-Abda	7.06	4.13	0.061	0.061
Tadla-Azilal	5.52	7.67	0.061	0.064
Méknès-Tafilalet	3.54	7.12	0.062	0.063
Fès-Boulemane	1.81	1.98	0.045	0.045
Taza-Al Hoceima-Taounate	7.83	3.00	0.078	0.078
Tanger-Tétouan	1.47	3.09	—	—
Economic and climate shocks				
Weather shocks (droughts, floods, and so on)	4.82	3.79	0.248	0.252
No weather shocks (droughts, floods, and so on)	8.53	4.52	—	—
Unexpected increase in prices of food/other	5.01	4.10	0.735	0.736
No Unexpected increase in prices	5.96	3.92	—	—
Job related shocks	5.26	4.13	0.249	0.249
No job related shocks	7.04	3.48	—	—
Cut-off or decrease in remittances	5.62	3.80	0.015	0.017
No cut-off or decrease in remittances	11.65	14.21	—	—
Death/sick of HH member (incl. main earner)	5.51	3.81	0.117	0.119
No death/sick of HH member (incl. main earner)	7.19	5.21	—	—

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Table 10.1 Summary Statistics on Individual Level Migration Rates *(continued)*
Percent

	Migration rates		*Summary statistics*	
	Temporary migration rates (%)	*Permanent migration rates (%)*	*Temporary migration regression*	*Permanent migration regression*
Climate change and shock in agriculture				
Reduction in agricultural yield due to less water	4.85	3.46	0.236	0.243
No reduction in agricultural yield due to less water	8.58	5.63	—	—
Reduction in agricultural yield due to more water	5.54	3.70	0.169	0.173
No reduction in agricultural yield due to more water	6.56	5.32	—	—
Reduced job opportunities in the agricultural sector	5.15	3.98	0.149	0.150
No reduced job opportunities in the agricultural sector	8.97	3.89	—	—
Serious financial loss due to climate related factors	5.50	4.06	0.092	0.092
No serious financial loss due to climate related factors	7.79	3.09	—	—
Change the economic activity after the shock	5.39	3.84	0.056	0.058
No change the economic activity after the shock	10.87	5.93	—	—

Source: World Banks' calculations based on Morocco Household and Youth Survey 2010 (age 15 and older).
Note: Number of observations: 7,884 for temporary migration, 8,502 for permanent migration. — = not available; HH = Household head.

In general, and especially in the case of permanent migration, migration rates are higher among the better educated. This is observed whether one looks at the education level of the individuals, or at that of the household heads. Migration rates also tend to be higher among households whose heads is self-employed, which would include small business owners. There are also higher among individuals belonging to a household with little hand, possibly because there is less pressure to stay at the place of origin in order to work the land. Temporary migration is especially high among poorer households as measured through an index of wealth, while permanent migration is slightly higher among both the bottom and the top quintiles.

Migration rates are higher among household located in urban areas, which may indicate substantial migration from smaller to larger areas as well as international migration from urban centers. There are also large differences in migration rates depending of the regions where households live. The highest temporary migration rate is observed in Souss-Massa-Draâ,, followed by Marrakech-Tensift-Al Haouz, Taza-Al Hoceima-Taounate, Doukala-Abda, Chaouia-Ouardigha, and Gharb-Cherarda-Béni Hssen. For permanent migration, the highest rates are observed from Tadla-Azilal, Méknès-Tafilalet, Souss-Massa-Draâ,, and Guélmim-Es Semara.

When looking at migration rates according to whether households have been exposed to weather and other types of shocks, it is remarkable to note that migration rates are essentially always higher among households who were not affected by negative shocks. This does not mean that shocks, including weather shocks, may not be correlated with migration in a multivariate setting, but it does suggest that overall, in the country as a whole, much of the migration that is taking place may not be primarily related to weather shocks.

A similar message emerges from the data provided in table 10.2 on the reasons declared by households for the migration of household members. For temporary migration, the main motivation by far is the fact that better offers of agriculture employment are available at the place of destination-this is the rationale for half of all temporary migrants. The same reason is mentioned for permanent migration, although in that case marriage is mentioned more often. The lack of jobs at the place of origin is mentioned, and it could be related to adverse weather conditions. It could also be that the availability of better agricultural employment at the place of destination is related to the effect of climate change and droughts at the place of origin. But this cannot simply be assumed given that being a victim of a drought or a flood is explicitly listed among the potential reasons to migrate in the questionnaire, and that very few households declare that these were the main reasons for the migration decisions of their members.

Correlates of the Probability of Migration

The basic statistics presented in the previous section appear to suggest that migration rates are lower in areas affected by extreme weather shocks. This does not mean however that weather shocks have a negative impact on migration. For

Table 10.2 Reasons for Migration by Household Members, Morocco, 2009/10
Percent

	Temporary migration	*Permanent migration*
Migration with the rest of the household	6.97	1.21
Better business opportunities in the new place	3.70	2.57
Low offer of jobs in the nonagriculture in place of origin	9.57	4.53
Change of profession	6.25	2.94
Studies of the person	6.27	4.91
Better infrastructure	0.00	0.48
Family reunification, join the large family	6.53	3.16
Marriage	0.71	44.67
Divorce separation	0.20	1.29
Victim of flood	0.12	0.00
Victim of drought	0.53	0.40
Victim of another environmental cause	0.20	0.00
Insufficient agricultural revenue or low agricultural employment	5.31	1.09
Better offers of agriculture employment in the new place	49.37	27.45
Other	4.27	5.31
Total	100	100

Source: World Bank data.

example, a positive association was found between education and the likelihood of migration. If migration is lower among households affected by weather and other shocks, this might simply reflect the fact that these households tend to live in rural areas, work in agriculture, and be less well educated. Controlling for education, it could very well be that weather shocks could have a positive effect on migration. In order to assess the marginal impact of weather and other shocks on migration after controlling for a range of individual and household characteristics, this section provides a regression analysis of the likelihood of temporary and permanent migration in a multivariate setting. The analysis is still descriptive, but it enables us to assess whether controlling for individual and household characteristics as well as broad levels of geographic location, adverse weather shocks have a statistically significant effect on migration, whether positive or negative.

Table 10.3 provides the results of probit regressions (with robust standard errors) for the correlates of the probability of migrating either temporarily or permanently. Note that in the case of permanent migration, only migration for reasons not related to marriage is considered. Two different specifications for the model are provided— the second specification includes a series of additional household level variables which are not included in the first because of the risk of endogeneity with those variables in that, for example, migration may affect who is considered as the household head, or the education level of the household head. This risk of endogeneity is much larger in the case of permanent migration, but for comparison purposes the two models are estimated for both regressions. Marginal effects are provided (dF/dX), so that a value of 0.02 would represent an increase in the likelihood of migration of two percentage points.

Table 10.3 Correlates of Individual Migration, Morocco, 2009/10 (dF/dX)

	Temporary migration		*Permanent migration*	
	Model 1	*Model 2*	*Model 3*	*Model 4*
Individual characteristics				
Age 15–24	−0.016**	−0.011	0.039***	0.048***
Age 25 to 34	0.007	0.011	0.041***	0.049***
Age 35 to 44	0.006	0.009	0.014*	0.017**
Age 45 to 54	−0.000	0.002	−0.011**	−0.008*
Female	−0.061***	−0.063***	−0.026***	−0.034***
Spouse	−0.022***	−0.021***	−0.016***	−0.011***
Education (base no education)				
Primary	0.021***	0.025***	−0.000	−0.001
College	0.029***	0.032***	−0.006*	−0.007**
Secondary	0.021**	0.021*	−0.000	−0.003
Tertiary and up	0.084***	0.069***	0.014*	0.009
Married	0.011**	0.013**	—	—
Female*married	0.016	0.017	—	—
Household characteristics				
Head age	—	0.001	—	0.001**
Head age squared	—	−0.000	—	−0.000
Female head	—	−0.005	—	−0.001
Head married	—	−0.010	—	−0.026***
Head education (base no education)				
Primary	—	−0.006	—	0.001
College	—	−0.008	—	0.011**
Secondary	—	−0.002	—	0.003
Tertiary and up	—	0.023	—	0.003
Head occupation (base no work)				
Work for other	—	−0.004	—	−0.002
Agricultural work	—	−0.011*	—	−0.001
Nonagricultural work	—	−0.013***	—	−0.004
Self-employment, producer	—	0.017	—	0.006
Household size	−0.001	−0.001*	−0.005***	−0.004***
Own more than 1 acre	−0.001	−0.001	0.006	0.008*
Urban	−0.002	−0.002	−0.002	−0.002
Adult female ratio	—	0.016	—	0.054***
Wealth index (base Q1)				
Q2	−0.010**	−0.010**	−0.007**	−0.004
Q3	−0.020***	−0.020***	−0.008**	−0.005
Q4	−0.027***	−0.027***	−0.002	−0.001
Q5	−0.017***	−0.018***	0.002	0.004
Regions				
Guélmim-Es Semara	−0.010	−0.011	0.024	0.015
Souss-Massa-Draâ,	0.043***	0.044***	0.010	0.007

table continues next page

Table 10.3 Correlates of Individual Migration, Morocco, 2009/10 (dF/dX) *(continued)*

	Temporary migration		*Permanent migration*	
	Model 1	*Model 2*	*Model 3*	*Model 4*
Gharb-Cherarda-Béni Hssen	0.021*	0.024*	−0.007	−0.006
Chaouia-Ouardigha	0.012	0.011	0.002	−0.001
Marrakech-Tensift-Al Haouz	0.015	0.017*	−0.007*	−0.006*
Oriental	−0.027***	−0.025***	−0.010**	−0.009**
Grand-Casablanca	−0.018***	−0.017***	−0.002	−0.004
Rabat-Salé-Zemmour-Zaér	0.002	0.000	−0.001	−0.002
Doukala-Abda	0.017	0.016	0.001	0.003
Tadla-Azilal	0.011	0.010	0.024**	0.021**
Méknès-Tafilalet	−0.013*	−0.013*	0.016*	0.008
Fès-Boulemane	−0.022***	−0.022***	−0.008*	−0.010***
Economic and climate shocks				
Weather shocks (Droughts, floods, and so on)	0.013**	0.014**	−0.004	−0.004
Unexpected increase in prices of food and others	0.006	0.007*	0.002	0.001
Job related shocks	0.006	0.007	0.000	0.004
Cut-off or decrease in remittances	0.066**	0.059**	0.041**	0.034**
Death/sick of HH member (including main earner)	0.003	0.002	0.005	0.002
Climate change and shock in agriculture				
Reduction in agricultural yield due to less water	0.003	0.004	0.019***	0.015**
Reduction in agricultural yield due to more water	−0.016***	−0.016***	−0.002	−0.001
Reduced job opportunities in the agricultural sector	0.002	0.002	−0.008**	−0.007**
Serious financial loss due to climate related factors	−0.001	−0.002	−0.005	−0.005
Change the economic activity after the shock	0.011	0.010	0.011	0.010
Number of observations	7,884	7,884	8,502	8,502

Source: World Banks' calculations based on Morocco Household and Youth Survey 2010.
Note: Region dummies are included but not reported here. — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The main variables of interest are at the bottom of table 10.3, and we start the discussion with those. Being subject to an adverse weather shock appears to increase the probability of temporary migration depending on the specification, but not the probability of permanent migration. It looks like household members are coping with weather shocks (which might be one-time events) by looking for work elsewhere, but that these conditions do not yet lead to permanent departures. However, a reduction in agricultural yields due to less water increases permanent migration, suggesting that when the changes in environmental conditions are perceived to be more permanent, some household members do feel the need to migrate permanently. By contrast, a reduction in agricultural yields due

to excess water (probably through floods) reduces the likelihood of migrating temporarily, possibly because the shocks may reduce the resources available to household members to migrate, and such shocks are not as likely to be perceived as permanent changes in conditions that affect long-term livelihood.

Unexpected increases in prices of food and others basic commodities also lead to more temporary migration, but the effect is only marginally significant in one of the two specifications, so one could argue that there is no clear effect. Finally, the largest effect on both temporary and permanent migration comes from being affected by a cut-off or decrease in remittances from previous household members who had migrated. This decrease in remittances leads to a large increase in both types of migration, suggesting a certain level of dependence on remittances among the households receiving them since they send other members away when this is the case (note that the ability to send new members away may be facilitated by network effects that having other members who migrated before entail).

Apart from shocks, a number of individual level characteristics affect the probability of migration. Younger individuals are more likely to migrate permanently, given that they have often not yet created a household at the place of origin, but age does not affect the probability of temporary migration in the same way. Better educated individuals appear to be more likely to migrate temporarily, but not permanently. Those who are married are more likely to migrate temporarily, but this is essentially the case for men who are heads of households, while married head are less likely to migrate permanently. As to household level characteristics, temporary migration is more frequent among members for the poorest households (bottom quintile of wealth), but the differences are less systematic for permanent migration. Whether households own more than one acre of land or not does not make much difference after controlling for other variables. Households where the head does not have work are more likely to have temporary migrants.

While the urban versus rural location of the household does not have a statistically significant impact on the probability to migrate, there are geographic effects at work after controlling for individual and household characteristics. The reference geographic location in the regression model is the prefecture of Tanger-TéÈtouhan, which is located in the tip of the northern part of the country toward Spain. In comparison to that region, temporary migration is lower in Oriental, Grand-Casablanca, Méknès-Tafilalet, and Fès-Boulemane, and higher in Souss-Massa-Draâ,. Again in comparison to Tanger-Tétouhan, permanent migration is lower in Chaouia-Ouardigha, Marrakech-Tensift-Al Haouz, and Fès-Boulemane, and higher in Tadla-Azilal.

Conclusion

Do extreme weather events such as droughts or floods lead to migration away from the areas affected by these events in Morocco? The analysis presented in this chapter suggests that this is the case. While droughts and floods are not directly identified by households as major reasons for migration, the characteris-

tics of areas affected by droughts, such as insufficient agricultural revenue and employment are mentioned as reasons for migration by households. Furthermore, in regression analysis, being subject to an adverse weather shock appears to increase the probability of temporary migration, and a reduction in agricultural yields due to less water (droughts) increases permanent migration. Other factors do have a larger effect on the probability of migration, so that climate and environment related variables may not be the main drivers of temporary and permanent migration. But they do appear to contribute to migration.

Bibliography

Azzam, A., and K. Sekkat. 2005. "Measuring Total-Factor Agricultural Productivity under Drought Conditions: The Case of Morocco." *The Journal of North African Studies* 10 (1): 19–31.

Barakat, F., and A. Handoufe. 1998. "Approche agroclimatique de la sécheresse agricole au Maroc." *Sécheresse* 9: 201–08.

Burger, N., A. Grant, S. Kups, Y. Rana, and Q. Wodon. 2014. "Focus Countries." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 2 in this study.

EACH-FOR, 2008, General Overview Study - Middle East and Northern Africa, Bonn, Germany: United Nations University.

Elasha, B. O. 2010. "Mapping of Climate Change Threats and Human Development Impacts in the Arab Region." Mimeo, United Nations Development Program, New York.

Foresight. 2011. *Migration and Global Environmental Change.* London: The Government Office for Science.

Hamza, M. A., B. E. Faskaoui, and A. Fermin. 2009. "Migration and Environmental Change in Morocco: The Case of Rural Oasis Villages in the Middle Draa Valley." EACH-FOR Case Study Report, United Nations University Institute for Environment and Human Security (UNUEHS), Bonn.

IPCC (Intergovernmental Panel on Climate Change). 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In *A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, and G.-K. P. K.J. Mach, S.K. Allen, M. Tignor, and P.M. Midgley. Cambridge, UK, and New York, NY: Cambridge University Press.

McSweeney, C., M. New, and G. Lizcano. 2009. "UNDP Climate Change Profiles: Documentation." Mimeo, United Nations Development Program, New York.

Skees, J., S. Gober, P. Varangis, R. Lester, and V. Kalavakonda. 2001. "Developing Rainfall-Based index Insurance in Morocco." World Bank Policy Research Working Paper 2577, World Bank, Washington, DC.

Sowers, J., and E. Weinthal. 2010. "Climate Change Adaptation in the Middle East and North Africa: Challenges and Opportunities." The Dubai Initiative Working Paper No. 2, Belfer Center for Science and International Affairs, Cambridge, MA.

Swearingen, W. D., and A. Bencherifa. 2000. "An Assessment of the Drought Hazard in Morocco." In *Drought: A Global Assessment*, Vol. 1, edited by D. A. Wilhite. New York: Routledge.

UNDPAFESD (United Nations Development Programme and Arab Fund for Economic and Social Development). 2009. *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York: UNDP.

Verner, D., ed. 2012. *Adaptation to a Changing Climate in the Arab Countries*. Directions in Development. Washington, DC: World Bank.

Warren, R., N. Nicholls, R. Levy, and P. Price. 2006. "Understanding the Regional Impacts of Climate Change: Research Report Prepared for the Stern Review on the Economics of Climate Change." Tyndall Centre for Climate Change, Research Working Paper 90, Norwich, UK.

Wodon, Q., N. Burger, A. Grant, and A. Liverani. 2014. "Climate Change, Migration, and Adaptation in the MENA Region." In *Climate Change and Migration: Evidence from the Middle East and North Africa*, edited by Q. Wodon, A. Liverani, G. Joseph, and N. Bougnoux. World Bank Study. Washington, DC: World Bank, chapter 1 in this study.

World Bank. 2007. *World Bank Development Report 2008. Agriculture for Development*. Washington, DC: World Bank.

———. 2010. *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

PART 5

Remittances

CHAPTER 11

Do Remittances Reach Households Living in Unfavorable Climate Areas? Evidence from the Republic of Yemen

George Joseph, Quentin Wodon, and Brian Blankespoor

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. This chapter uses a nationally representative household survey for the Republic of 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. We are interested in testing 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 does not seem to be the case in the Republic of Yemen.

Introduction

Cross-country and country studies suggest that migration and remittances tend to increase in response to climate and other shocks, with remittances helping households to cope with the effect of the shocks (World Bank 2006). While private international capital flows tend to dry up after such shocks, remittance flows tend to increase or at least remain stable after natural disasters, as well as macroeconomic or financial crises and armed conflicts (for example, Clarke and Wallsten 2004; Weiss, Fagen and Bump 2005; World Bank 2006). Yang (2007) provides cross-country evidence on the response of international financial flows to hurricanes, and concludes that for poorer countries, increased hurricane exposure is associated with greater remittance flows. In the Caribbean, a 1 percent decrease in real gross domestic product may be associated with a 3 percent increase in migrant remittances with a two-year lag (Mishra 2005).

Evidence from household surveys also indicates that households use both migration and remittances as coping strategies in response to climate shocks. Migration flows increased in the aftermath of disasters in Jamaica in 1989, after hurricane Gilbert and in Central America in 1998, and after hurricane Mitch (Wisner 2003). In El Salvador, an agricultural shock increases the probability of migration of a household member to the United States by 24.3 percent (Halliday 2006). Studies using household survey data also confirm the consumption smoothing role played by remittances in recipient households (Quartey and Blankson 2004). Yang and Choi (2007) show for the Philippines that remittances help to compensate for nearly 65 percent of the loss in income due to rainfall shocks. Increased remittances helped to smooth household consumption and compensate for the loss of assets after an earthquake in El Salvador in 2001 (Halliday 2006). A survey of households in four villages in Pakistan after the devastating earthquake in 2005 reveals that migrant remittances were important factors in disaster recovery and reconstruction (Suleri and Savage 2006). Remittance-receiving households in the Aceh region of Indonesia were found to have recovered faster from the 2004 Tsunami because of immediate relief provided by migrant remittances, although remittance transfers were adversely affected due to the disruption of financial services and informal remittance transfer channels (Wu 2006). Konseiga (2007) finds evidence of migration to Cote d'Ivoire and resulting remittances used as a survival strategy in drought prone areas in North Eastern Burkina Faso.

Despite the emerging consensus in the literature that migration and remittances are indeed part of an overall livelihood strategy by which households try to insure against shocks in disaster prone regions, there is less evidence on whether households use migration and receive remittances as part of a livelihood strategy in regions prone to slow onset disasters, or more generally adverse weather conditions as opposed to specific climate shocks. Said differently, it is not clear whether remittances are likely to be higher in areas that suffer from poor climate in the absence of specific major climate shocks. On the one hand, households in such areas often are poorer and thus need support, which may be an incentive for migrants to remit. But such households also have limited means to send migrants away, especially internationally, and thus may not benefit from as large flows of remittances than households living in regions with better climate. In addition, migrants from unfavorable climate regions are also less likely to be well educated and may thus have lower earning potential, which may in turn limit their ability to remit.

By combining a nationally representative household survey with climate and geographic data, this chapter tests whether in the Republic of Yemen remittance flows, both domestic and international, benefit more those households located in areas with unfavorable climate than households living in better climate areas. This is done both with and without controls for household characteristics that may affect remittances, but may also be endogenous—a fact that is often brushed aside in empirical work on remittances.

The Republic of Yemen is an interesting case study for such work, given that it is highly vulnerable to the vagaries of weather. This is suggested not only by

historical patterns of climatic variability, but also by extreme levels of water scarcity and high economic reliance on water dependent sectors such as agriculture and fisheries. The topography of the country is highly diverse, with coastal plains where the population is concentrated, a mountainous interior, and upland deserts to the north toward the Saudi Arabia border. Annual precipitation in many parts of the country is low, although much higher in the western mountainous highland region. Temperatures are high, with more than occasional extreme values, but they also vary a lot across areas and over the year. While climate models do not all agree on how the Republic of Yemen's climate is expected to change, there is agreement that temperatures are likely to rise, while rainfall will fall. Due to near complete depletion of groundwater resources, agricultural output is projected to decrease by 4 percent in the next two decades (World Bank 2010). For households who will remain in areas with unfavorable climate, the ability to rely on remittances may well therefore be crucial for their livelihoods. Looking at current patterns of remittances is one way to assess whether the hope of steady and substantial remittances flows for households living in "climate-poor" areas is realistic.

The chapter is structured as follows. Section two presents the data and methodology. Section three presents the estimation of models for the likelihood of receiving remittances and the amounts received, both for domestic and international remittances. A conclusion follows.

Data and Methodology

We use the most recently available nationally representative household budget survey implemented in the Republic of Yemen, whose data were collected in 2005/06. The survey includes 13,136 households (98,941 individuals) living in 309 of the country's 333 districts. Apart from the location of households, the survey provides information on a wide range of socioeconomic characteristics including among others demographics, education, health and anthropometrics, employment and occupation, consumption and assets, and income including remittances. Data are available on both domestic and international remittances.

Beyond the household survey, and based on the location of households proxied through the most populous city in the district in which the household lives, we also use information on the distance between the household/district location and the coast, as well as the distance to the nearest airport. These distances are calculated using an Euclidean distance function in ESRI ArcGIS 9.3 software. We also use measures of travel time to the nearest city with a population of at least 100,000 using a methodology developed from Nelson (2008) with regionally specific information (World Bank 2011). The percentage of irrigated land is taken from Global Map of Irrigated Areas version 4 (Siebert et al. 2005; Siebert, Hoogeveen, and Frenken 2006). Weather district-level data on annual mean temperature and rainfall and their variability/seasonality are collected from BIOCLIM (Busby 1991). All weather variables are computed on observations for the period 1990–2000. We also include in some specifications governorate

dummy variables to control for additional geographic effects operating at a higher level of aggregation than the district.

The estimation method-a standard Heckman (1979) selection model—enables us to look at both the likelihood of receiving remittances, and the amount of remittances received. Estimations are provided for domestic and international remittances separately. The Heckman specification allows to control for potential selectivity in who receives remittances. It is however not easy find a variable that affects the probability of receiving remittances and not their amount. One candidate could be the leave-out-mean likelihood of receiving remittances (domestic or international) in the district in which the household lives, which reflects migration networks. However, while this variable certainly affects the likelihood of migrating, it may also affect the amount of remittances received by households. For example, it could be that larger networks may be associated with better employment opportunities at destination, which can, in turn, influence the amounts of remittances sent by the migrants (Munshi 2003). On the other hand, it could also be that if more migrants are coming to destination areas, they may compete for the same jobs and thereby benefit from lower wages which might reduce the amounts of remittances they are able to send back home. Also, even if networks only influence migration costs and not wages at destination, they might still influence the demand for remittances in migrant-sending households (Carrington, Detragiache, and Vishwanath 1996; McKenzie and Rapoport 2010). For this reason, the leave-out-mean is included in our analysis in both the probit on whether households receive remittances, and in the levels regression for the amount of remittances received by households, with the Heckman model simply identified through the nonlinearity in the probit equation.

Table 11.1 provides summary statistics for the variables used in the estimations. Out of the total number of households (13,136), 12,987 are used for the estimation due to missing values for some variables. The number of households receiving remittances is 5,334 (43.63 percent when using sample weights), of which 4,019 (33.90 percent) receive domestic remittances, and 1,920 (14.10 percent) receive international remittances, and 605 (4.38 percent) receive both. 7,653 households (56.37 percent) do not receive any remittances. The average amount of remittances received among households who receive domestic remittances is YER 46,654 (US$252 at the average exchange rate in 2004 of US$1 = YER 185), while the average amount for international remittances is as expected significantly higher, at YER 218,786 (US$1,183). Given low standards of well-being in the country, these are rather substantial transfers.

Based on the basic statistics provided in table 11.1, a few facts are worth pointing out. First, the differences in the characteristics of households receiving domestic and international remittances are smaller than one might have expected based on experience in other low income countries (see for example Hildebrandt and McKenzie 2005). Households receiving international remittances are "better off" in many dimensions (such as poverty status, education of the household head, land cultivation status, and so on), but not by a whole lot. For example, poverty measures are lower among households receiving

Table 11.1 Summary Statistics

	National		*Domestic*		*Int'l*		*None*		*Both*	
	Mean	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*
Dependent variables										
Household receiving remittances (%)	43.63	49.6	100	0	0	0	0	0	100	0
Household receiving domestic remittances (%)	33.9	47.3	100	0	31.05	46.28	0	0	100	0
Household receiving international remittances (%)	14.1	34.8	12.91	33.54	0	0	0	0	100	0
Amount of domestic remittances (YER)	15.818	48.255	46.654	73.691	40.761	45.983	0	0	40.761	75.305
Amount of international remittances (YER)	30.851	199.821	148.055	233.514	218.786	492,082	0	0	148.055	635,426
Independent variables—household level										
Rural location (%)	71.7	45.05	78.46	41.11	72.48	44.68	67.61	67.61	74.07	43.86
Household head with no education (%)	55.77	49.67	61.35	48.70	59.73	49.06	51.37	51.37	54.96	49.79
Household head with primary education (%)	12.04	32.55	11.6	32.03	9.87	29.84	12.83	12.83	11.7	32.16
Household head with middle school education (%)	11.3	31.66	9.69	29.59	12.07	32.59	12.32	12.32	14.61	35.35
Household head with high school education (%)	9.34	29.10	8.04	27.19	7.13	25.74	10.54	10.54	7.61	26.55
Household head with tertiary education (%)	8.9	28.48	5.99	23.74	7.25	25.94	10.91	10.91	6.9	25.37
Household members above 21 with middle school (%)	10.65	20.88	8.83	19.43	10.87	20.15	11.71	11.71	11.09	20.48
Household members above 21 with high school (%)	8.82	18.62	7.81	17.90	8.86	18.74	9.48	9.48	9.63	20.94
Household members above 21 with tertiary (%)	6.27	17.33	4.64	14.92	5.35	16.33	7.41	7.41	5.42	17.46
Cultivating household with land (%)	52.1	49.96	58.48	49.28	50.48	50.01	48.63	48.63	51.57	50.02
Household owns livestock (%)	60.6	48.87	64.4	47.89	61.01	48.79	58.16	58.16	59.93	49.05
Indebted household (%)	53.96	49.85	61.58	48.65	46.66	49.90	51.34	51.34	55.74	49.71
Independent variables—district level										
Leave-out-mean international migrants (%)	0.14	0.14	0.15	0.15	0.27	0.20	0.12	0.12	0.29	0.21
Leave-out-mean domestic migrants (%)	0.34	0.28	0.56	0.31	0.36	0.26	0.21	0.21	0.53	0.30
Percentage of irrigated land in the district (%)	4.29	6.40	3.96	7.03	3.1	5.20	4.71	4.71	3.4	6.63
Annual mean temperature (°C)	22.24	4.63	21.61	4.22	22.16	4.35	22.6	22.60	21.66	4.32
Annual mean temperature squared (°C)	516.23	209.39	484.78	188.87	509.84	196.71	534.54	534.54	487.88	193.77
Temperature seasonality (standard deviation × 100)	27.85	2.85	27.32	2.63	27.65	2.67	28.19	28.19	27.43	2.57
Temperature seasonality squared	783.85	172.31	753.42	157.17	771.47	155.19	803.34	803.34	759.19	149.39

table continues next page

Table 11.1 Summary Statistics *(continued)*

	National		*Domestic*		*Int'l*		*None*		*Both*	
	Mean	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*
Annual precipitation (mm)	24.15	13.25	28.25	12.33	24.62	13.99	21.65	21.65	25.21	13.78
Annual precipitation squared (mm)	758.88	680.50	950.23	663.27	801.64	701.48	638.22	638.22	824.78	669.45
Precipitation seasonality (coefficient of variation)	8.4	1.69	8.52	1.50	8.66	1.87	8.29	8.29	8.78	1.73
Precipitation seasonality squared	73.4	29.08	74.83	26.23	78.55	33.26	71.76	71.76	80.11	31.08
Temperature annual range (max–min, °C)	21.53	2.91	22.05	2.67	21.28	2.77	21.28	21.28	21.71	2.91
Travel time to nearest city of 100,000 (minutes)	375.79	334.25	432.94	353.01	441.72	375.32	333.8	333.80	490	420.33
Travel time to the nearest airport (minutes)	348.15	299.67	414.44	327.13	393.7	313.36	303.61	303.61	434.7	344.89
Travel time to the nearest port (minutes)	480.81	337.25	556.04	348.77	537.83	384.56	430.86	430.86	603.87	432.19
Selected other variables not used in the regressions										
Age of the household head (years)	44.71	14.86	45.63	16.20	45.9	15.57	43.96	43.96	46.09	16.62
Number of males above age 15	2.05	1.46	1.83	1.41	2.13	1.51	2.16	2.16	2.08	1.53
Number of children below age 5	1.08	1.15	1.02	1.14	1.02	1.13	1.12	1.12	0.99	1.12
Number of members above 65	0.21	0.49	0.26	0.54	0.22	0.49	0.18	0.18	0.27	0.54
Household size	7.5	3.87	7.03	3.74	7.78	3.88	7.71	7.71	7.41	3.97
Poverty headcount (%)	35.4	45.75	33.88	45.33	31.05	44.05	36.99	31.00	30.76	44.33
Poverty gap (%)	9.73	15.69	9.1	15.19	8.26	15.21	10.39	8.53	9.14	16.48
Squared poverty gap (%)	3.82	8.04	3.53	7.69	3.24	8.18	4.12	3.33	3.74	8.93

Source: World Bank data.
Note: — = not available.

international remittances, but the differences are smaller than one might have expected. In general, the fact that poverty measures are relatively high among both domestic and international migrants suggests that migration is likely for the most part to be unskilled (this is related to the relatively low skills employment opportunities that are available for international migrants in nearby oil producing countries of the Gulf region, and especially neighboring Saudi Arabia). In terms of weather variables characterizing the areas in which households live, the differences between households receiving remittances, whether domestic or international, and the national sample are also small.

Turning to the regression methodology, it is important to start by pointing out that in many papers on the determinants of remittances using household survey data, a number of household level variables are included in the correlates. This is however often problematic, because most of the household level correlates are at risk of being endogenous. Consider the correlates included in tables 11.2 and 11.3. Whether the household head has a given level of education depends on who the household head is. When households receive remittances, it is typically because they have one or more migrants, and this may well include the household head. This is the case when the husband or father has left the family either temporarily or for a longer period of time in order to increase his earnings through better employment, and thereby help the family members back at home through remittances. In that case, if the wife is then considered as the household head at home in the survey, given that her level of education is often likely to be lower, the level of education of the head depends on the decision of the husband to migrate and send remittances, and is thus endogenous.

The same problem arises, albeit probably in a more diluted way, with the shares of household members above the age of 21 that have various levels of education. But more generally, the type of occupation of the household members at home, and whether they cultivate land, own livestock, or have debts, may all be endogenous. If one were to include additional variables (as is often done) such as poverty status or quintiles of well-being based on consumption, this would clearly depend on the remittances received (or lack thereof). Even if this often ignored in the applied survey-based literature in the drivers of migration and remittances, it is in general difficult to find household socioeconomic characteristics that are truly exogenous to the decision of some household members to migrate and send remittances. And while some of these problems are alleviated when the household survey has information on members that were part of the household but have left (see for example Binzel and Assaad 2011), this is not the case for most surveys, and such information is not available in our data.

This being said, in this chapter our main interest is less on how household level correlates affect whether they receive remittances or not, than on whether remittances reach households that are located in areas with comparatively unfavorable climate. This is why we include in the correlates a large number of district-level variables that were merged with the household survey data and that account for weather (temperature and rainfall), irrigated land characteristics, and location of the districts in which households live. We have quite a few

Table 11.2 Heckman Selection Model for Domestic Remittances, 2006

	With household level variables				*Without household level variables*			
	Without regional dummies		*With regional dummies (not shown)*		*Without regional dummies*		*With regional dummies (not shown)*	
	Second stage: amounts	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*
Rural	−0.092	0.011	−0.108*	0.020	−0.130***	0.012	−0.114**	0.022
Head with primary education	−0.294***	−0.094	−0.217***	−0.105*	—	—	—	—
Head with middle school education	−0.262***	−0.107*	−0.281***	−0.114**	—	—	—	—
Head with high school education	−0.247***	−0.174***	−0.270***	−0.176***	—	—	—	—
Head with technical education	−0.627***	−0.309**	−0.607***	−0.329**	—	—	—	—
Head with tertiary education	−0.303**	−0.319***	−0.268**	−0.322***	—	—	—	—
Share of household members above 21 with primary education	0.007	−0.166*	−0.087	−0.158*	—	—	—	—
Share of household members above 21 with middle school education	0.052	−0.235***	0.026	−0.253***	—	—	—	—
Share of household members above 21 with high school education	0.316**	−0.122	0.260*	−0.125	—	—	—	—
Share of household members above 21 with tertiary education	0.635***	−0.071	0.465**	−0.081	—	—	—	—
Cultivating household with land	−0.001	−0.113***	0.051	−0.110***	—	—	—	—
Household owns livestock	−0.052	−0.037	−0.063	−0.042	—	—	—	—
Indebted household	−0.208***	0.127***	−0.170***	0.131***	—	—	—	—
(Mean) irrigated land (%)	0.000	−0.007***	−0.003	−0.010***	0.001	−0.006***	−0.002	−0.008***
Annual mean temperature	−0.064	−0.017	−0.248***	−0.017	−0.105	−0.027	−0.280***	−0.016
Annual mean temperature squared	−0.001	0.001	0.006***	0.001	−0.000	0.001	0.007***	0.001
Temperature seasonality (standard deviation*100)	0.568***	−0.003	0.511***	0.021	0.569***	−0.025	0.533***	0.016
Temperature seasonality squared	−0.008***	−0.000	−0.008***	−0.001	−0.008***	0.000	−0.008***	−0.001
Annual precipitation	0.060***	−0.011	−0.015	−0.012	0.065***	−0.007	−0.014	−0.009
Annual precipitation squared	−0.001***	0.000	0.000	0.000	−0.001***	0.000	0.000	0.000

table continues next page

Table 11.2 Heckman Selection Model for Domestic Remittances, 2006 *(continued)*

	With household level variables				*Without household level variables*			
	Without regional dummies		*With regional dummies (not shown)*		*Without regional dummies*		*With regional dummies (not shown)*	
	Second stage: amounts	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*
Precipitation seasonality (coefficient of variation)	0.144	0.120	0.116	0.085	0.154	0.114	0.175	0.056
Precipitation seasonality squared	−0.010	−0.006	−0.006	−0.005	−0.011	−0.006	−0.009	−0.003
Temperature annual range (max–min)	−0.335***	0.023	0.008	0.055	−0.344***	0.030	0.007	0.056
Travel time to nearest city of more than 100,000 pop.	−0.002***	−0.000	−0.001**	−0.000	−0.002***	0.000	−0.001**	−0.000
Travel time to the nearest airport	0.000***	0.000	0.001***	0.000	0.000***	0.000	0.001***	0.000
Travel time to the nearest port	0.002***	0.000	0.000	0.000	0.002***	−0.000	0.000	0.000
Leave-out mean migration rate	−1.254***	3.076***	−1.189***	2.963***	−1.330***	3.058***	−1.206***	2.950***
Constant	9.408***	−1.889	5.239*	−2.539	9.891***	−1.915	4.737*	−2.537
Rho	−0.158		−0.062		−0.155		−0.048	
Sigma	1.231		1.177		1.247		1.19	
Lambda	−0.195		−0.074		−0.193		−0.057	
Number of observations	4,004	12,953	4,004	12,953	4,004	12,953	4,004	12,953

Source: World Bank data.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 11.3 Heckman Selection Model for International Remittances, 2006

	With household level variables				*Without household level variables*			
	Without regional dummies		*With regional dummies (not shown)*		*Without regional dummies*		*With regional dummies (not shown)*	
	Second stage: amounts	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*
Rural	−0.128	−0.086**	−0.105	−0.082*	−0.204*	−0.059*	−0.143*	−0.044
Head with primary education	−0.314**	−0.240***	−0.259*	−0.242***	—	—	—	—
Head with middle school education	−0.547***	−0.101	−0.448***	−0.107*	—	—	—	—
Head with high school education	0.023	−0.400***	0.114	−0.416***	—	—	—	—
Head with technical education	−0.408	−0.325*	−0.364	−0.356**	—	—	—	—
Head with tertiary education	−0.424**	−0.200**	−0.408*	−0.201**	—	—	—	—
Share of household members above 21 with primary education	0.042	0.031	−0.110	0.034	—	—	—	—
Share of household members above 21 with middle school education	0.205	−0.294***	0.093	−0.322***	—	—	—	—
Share of household members above 21 with high school education	−0.186	0.160	−0.292	0.155	—	—	—	—
Share of household members above 21 with tertiary education	0.299	−0.141	0.176	−0.173	—	—	—	—
Cultivating household with land	0.151*	−0.007	0.204**	0.013	—	—	—	—
Household owns livestock	−0.191**	−0.052	−0.183**	−0.052	—	—	—	—
Indebted household	−0.484***	−0.118***	−0.373***	−0.117***	—	—	—	—
(Mean) irrigated land (%)	−0.008	−0.009***	−0.003	−0.008***	−0.012	−0.007**	−0.008	−0.006*
Annual mean temperature	0.135	−0.017	0.131	−0.147**	0.093	−0.044	0.011	−0.147**
Annual mean temperature squared	−0.005*	0.000	−0.004	0.004**	−0.004*	0.001	−0.001	0.004**
Temperature seasonality (standard deviation*100)	0.260	0.092	0.438	0.122	0.183	0.078	0.613**	0.126
Temperature seasonality squared	−0.004	−0.002	−0.006	−0.002	−0.002	−0.001	−0.008*	−0.002
Annual precipitation	0.031	−0.017**	−0.019	0.010	0.031	−0.011	0.001	0.014
Annual precipitation squared	−0.000	0.000**	0.000	0.000	−0.000	0.000*	0.001	0.000

table continues next page

Table 11.3 Heckman Selection Model for International Remittances, 2006 *(continued)*

	With household level variables				*Without household level variables*			
	Without regional dummies		*With regional dummies (not shown)*		*Without regional dummies*		*With regional dummies (not shown)*	
	Second stage: amounts	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*	*Second stage: amounts*	*First stage: probit*
Precipitation seasonality (coefficient of variation)	−0.732***	0.007	−0.219	0.060	−0.849***	0.005	−0.436*	0.017
Precipitation seasonality squared	0.034***	0.002	0.013	−0.003	0.041***	0.001	0.026*	−0.000
Temperature annual range (max–min)	−0.050	−0.010	0.004	−0.044	−0.071	−0.018	−0.069	−0.050
Travel time to nearest city of more than 100,000 pop.	0.000	−0.000	0.001	−-0.000	0.001	−0.000	0.001	−0.000
Travel time to the nearest airport	−0.000	0.000	0.000	0.000	−0.000*	0.000	0.000	0.000
Travel time to the nearest port	−0.000	0.000	−0.001	0.000	−0.001	0.000	−0.001	0.000
Leave-out mean migration rate	−1.774**	3.140***	−2.183***	2.860***	0.070	3.216***	0.196	2.973***
Constant	14.263***	−2.340*	6.506	−1.783	14.855***	−2.039	3.360	−1.883
Rho	−0.767		−0.804		−0.351		−0.109	
Sigma	1.713		1.721		1.419		1.306	
Lambda	−1.313		−1.384		−0.498		−-0.143	
Number of observations	1,920	12,987	1,920	12,987	1,920	12,987	1,920	12,987

Source: World Bank data.
Note: — = not available.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

district-level variables, and much more so than is typically found in the literature, as well as higher level governorate dummies. Therefore we have the possibility of estimating at least somewhat meaningful models even without household characteristics, even though it must be clear that one could argue that it is problematic to try to explain household level variations with mostly geographic variables. If one considers the models without household level variables as a test for robustness of the results obtained with the model with household controls, then the procedure enables us to test whether the partial correlations observed between remittances and district-level characteristics are indeed robust to the inclusion of household controls or not. To the extent that the results are robust, we can be more confident in the results obtained for the geographic effects. As we will show, the fact that the sign, magnitude, and statistical significance of most of the district-level variables do not change much whether we include household level correlates or not is a good sign of the validity of the estimates for the district-level variables which are the focus of this chapter.

Results

Tables 11.2 and 11.3 provide the regression estimates (Heckman model) for the likelihood of receiving domestic and international remittances, respectively, as well as the amounts received. This is done with and without regional (governorate) variables as additional controls. The coefficients of the regional dummies are not reported here to save space, but they are available upon request and many of them are statistically significant. Differences in results in the specifications with and without governorate dummies tend to be small.

Consider first the results for domestic remittances without the household level controls in order to focus on the district-level variables. Districts with more irrigated land are less likely to receive remittances. Apart from the migration network variable which has a strong effect on the probability of receiving remittances and several regional dummies that are not shown in the table, this is the only variable for which a statistically significant effect is observed in the probit when no household controls are included.[1] One explanation might be that there is less need for households to send migrants away when more land is available for cultivation, which would reduce remittances. As for the amounts of domestic remittances received, the coefficients of the many of the weather variables are statistically significant either in the specifications with or without regional dummies, and in several cases in both specifications. The coefficients for three of the five weather variables (and their squared values when applicable) suggest that domestic remittances are lower in districts with unfavorable climate. This is the case for higher temperatures (negative impact with regional dummies), higher levels of precipitation (positive impact without regional dummies), and larger differences between minimum and maximum temperatures (negative impact without regional dummies). The coefficients for precipitation seasonality are not statistically significant. The only weather variable which suggests more remittances in climate poor areas is temperature seasonality, for which a higher value

is associated with higher remittances. But one could argue that this is counteracted to some extent through the negative correlation between the amount of domestic remittances received and the difference between the maximum and minimum temperature.

This suggests that unfavorable climate is associated with lower amounts of domestic remittances. We are of course not claiming that climate itself necessarily influences the amounts of remittances received. The mechanisms at work may be much more complex, and are likely to be related in part to the fact that households living in districts with unfavorable climate may be poorer and less educated. In that case, even when households are able to afford the cost of sending migrants (the weather variables where not statistically significant in the probits), the migrants may not be able to send back as large remittances as is the case for migrants from other areas. This is only a speculation, but whatever the reasons for the findings, the fact is that districts with structural disadvantages in terms of their climate receive less domestic remittances. The fact that many of the effects vanish when including regional dummies is not too surprising, given that weather patterns differ between regions, so this does not invalidate the results.

Consider next international remittances. The likelihood of receiving remittances is again lower in districts with a higher share of irrigated land, probably for the same reason as mentioned before. Higher temperatures are also associated with a lower probability of receiving international remittances (this is observed with regional dummies and the positive sign for the quadratic term does not affect the overall sign of the effect.) There is a positive effect on the probability of receiving remittances for the squared value of precipitation but this is only marginally statistically significant. Turning to the amounts received, two of the weather variables have a negative impact: higher temperatures lead to lower amounts received in the specification without regional dummies, and more precipitation seasonality reduces the amounts of remittances in the two specifications with and without regional dummies. In the case of the specification with regional dummies, temperature seasonality is associated with more remittances, but this is the only case where indicators of poorer weather lead to more remittances. The upshot is that overall, households in districts with less favorable climate also tend to be less likely to receive international remittances, and when they do, the amounts received tend to be lower, as observed with domestic remittances.

Do these results remain when adding household level controls? They do, and remarkably so, not only in terms of sign and magnitude, but also in terms of statistical significance. In the case of domestic remittances, all results for the weather variables remain virtually the same when household level controls are added. In the case of international remittances, stability is also observed in most cases, with two exceptions. First, the effect of temperature seasonality on the amounts received in the specification with regional dummies vanishes when household controls are added. Second, the effect of precipitation on the probability of receiving remittances becomes statistically significant in the specification

without regional dummies when household controls are added. These two changes both go in the way of our conclusion, which is that climate poor areas are less likely to receive remittances and when they do, receive less of them.

Beyond climatic variables, the other district variables (apart from the leave-out-means) which measure isolation of the districts also have an impact on domestic remittances, but not on international remittances, and the effects are robust to the inclusion of household controls. For domestic remittances, being further away from an airport increases the likelihood of receiving domestic remittances, perhaps because international travel is more difficult. Being further away from an airport or a port also increases the amount of remittances received, possibly for the same reason. But being away from a large city reduces domestic remittances, perhaps because of fewer well paying employment opportunities for domestic migrants in nearby districts.

Finally, for the sake of completeness, it is worth briefly discussing the results for the household controls, even if they must be treated with caution due to the risk of endogeneity. Households in rural areas are as likely to receive remittances as households in urban areas in most cases, but they tend to receive lower amounts, as expected. A higher level of education is associated with both a lower likelihood of receiving remittances, and a lower amount of remittances received—the effects tend to be more often statistically significant for the household head than for the share of household members above the age of 21. The effect on the probability to migrate may reflect the fact that much of the Republic of Yemen's migration is unskilled, and the effects on the amounts of remittances received may be linked to the fact that households whose members have higher education levels may need remittances less. Households cultivating land are less likely to receive domestic remittances, probably because there is less of a need for members to leave, but are more likely to receive international remittances, perhaps because of a higher ability to pay for the cost of international migration. Households with debts are more likely to benefit from domestic remittances, but the reverse is observed for international remittances. As to the correlation between indebtedness and amounts, it is negative for both forms of remittances. Different rationale might be provided for such results, but again endogeneity may be an issue. As for network effects, when the effects are statistically significant they tend as already mentioned to increase the probability of receiving remittances, but they are negatively correlated with the amount of remittances received for both domestic and international remittances. This would be consistent with a story emphasizing the competition between a larger number of migrants for limited job opportunities (especially in a context of substantial unemployment), which would then reduce the amounts of remittances that they are able to send back home.

Conclusion

The literature suggests that migrant remittance flows increase in the aftermath of natural disasters, macroeconomic or financial crises, and act as a safety net for

households that have migrants either within or outside the country. Furthermore, there is an emerging consensus that migration and remittances are part of an overall livelihood strategy by which households try to insure against shocks in regions which are prone to natural disasters and adverse weather conditions. Less is known however on whether remittances are likely to be higher in areas that suffer from poor climate more generally, in the absence of specific weather shocks. Assessing whether this is the case is however difficult, because data from household surveys are rarely combined with weather data in order to test the impact of climate on remittance patterns.

Using the Republic of Yemen's latest nationally representative multipurpose household survey as well as detailed district-level weather and other data, we have tried to assess whether households living in areas with higher temperatures and lower rainfalls, as well as more variability or seasonality in both, are more likely to benefit from remittances than households living in districts with more favorable climate. The results suggest that in the Republic of Yemen, both the likelihood of receiving remittances and the amounts of remittances received tend to be lower in districts with unfavorable climate. The effects are especially strong for domestic remittances. This suggests in turn that in areas with unfavorable climate, the ability of household to rely on remittances for their livelihoods or to cope with shocks may be more limited than one might have hoped.

Notes

1 As pointed out to us by a referee, it could in theory be that the mean share of the land that is irrigated, as an aggregate outcome of farming decisions taken at the household level, depends on remittances. This could happen if such remittances were invested in irrigation, or inversely if the receipt of remittances were to worsen the incentives to undertake productive investments. Yet the level of remittances is small and most remittances tend to be used for consumption purpose, with little positive or negative impact on investments. In addition, investments in irrigation tend to be low in general for a range of terrain as well as cultural and agricultural reasons that have little to do with remittances. Finally, the mean irrigated land variable is computed over all households in a given district, as opposed to a Primary Sampling Unit, so that the risk of endogeneity is further reduced.

Bibliography

Binzel, C., and R. Assaad. 2011. "Egyptian Men Working Abroad: Labor Supply Responses by the Women Left Behind." IZA Discussion Papers No. 5589, Institute for the Study of Labor, Bonn.

Busby, J. R. 1991. "BIOCLIM—A Bioclimate Analysis and Prediction System." *Plant Protection Quarterly* 6: 8–9.

Carrington, W. J., E. Detragiache, and T. Vishwanath. 1996. "Migration with Endogenous Moving Costs." *American Economic Review* 86 (4): 909–30.

Clarke, G., and S. Wallsten. 2004. "Do Remittances Protect Household in Developing Countries against Shocks? Evidence from a Natural Disaster in Jamaica." Mimeo, World Bank, Washington, DC.

Halliday, T. 2006. "Migration, Risk, and Liquidity Constraints in El Salvador." *Economic Development and Cultural Change* 54 (4): 893–925.

Heckman, J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (1): 153–61.

Hildebrandt, N., and D. McKenzie. 2005. "The Effects of Migration on Child Health in Mexico." World Bank Policy Research Working Paper 3573,World Bank, Washington, DC.

Ishra, P. 2005. "Macroeconomic Impact of Remittances in the Caribbean." Mimeo, International Monetary Fund, Washington, DC.

Konseiga, A. 2007. "Household Migration Decisions as Survival Strategy: The Case of Burkina Faso." *Journal of African Economies* 16 (2): 198–233.

McKenzie, D., and H. Rapoport. 2010. "Self-Selection Patterns in Mexico–U.S. Migration: The Role of Migration Networks." *Review of Economics and Statistics* 92 (4): 811–21.

Mishra, P. 2005. "Emigration and Brain Drain: Evidence from the Caribbean." IMF Working Paper No. WP/06/25, International Monetary Fund, Washington, DC.

Munshi, K. 2003. "Networks in the Modern Economy: Mexican Migrants in the US Labor Market." *Quarterly Journal of Economics* 118 (2): 549–99.

Nelson, A. 2008. "Travel Time to Major Cities: A Global Map of Accessibility, Global Environment Monitoring Unit." Joint Research Centre of the European commission, Ispra, Italy. http://gem.jrc.ec.europa.eu.

Quartey, P., and T. Blankson. 2004. "Do Migrant Remittances Minimize the Impact of Macro-Volatility on the Poor in Ghana, Report prepared for the Global Development Network." International Monetary Fund, Washington, DC.

Siebert, S., P. Dö˜ll, J. Hoogeveen, J.-M. Faurès, K. Frenken, and S. Feick. 2005. "Development and Validation of the Global Map of Irrigation Areas." *Hydrology and Earth System Sciences* 9: 535–47.

Siebert, S., J. Hoogeveen, and K. Frenken. 2006. "Irrigation in Africa, Europe and Latin America—Update of the Digital Global Map of Irrigation Areas to Version 4." Frankfurt Hydrology Paper 05, Institute of Physical Geography, University of Frankfurt, Frankfurt am Main, Germany and Food and Agriculture Organization of the United Nations, Rome, Italy.

Suleri, A. Q., and K. Savage. 2006. *Remittances in Crisis: A Case Study of Pakistan*. London: Overseas Development Institute.

Weiss-Fagen, P. and M. N. Bump. 2005. "Remittances in Conflict and Crises: How Remittances Sustain Livelihoods in War, Crises, and Transitions to Peace." The Security-Development Nexus Program Policy Paper, International Peace Academy, New York.

Wisner, B. 2003. "Sustainable Suffering? Reflections on Development and Disaster Vulnerability in the Post-Johannesburg World." *Regional Development Dialogue* 24 (1): 135–48.

World Bank. 2006. *Global Economic Prospects: Economic Implications of Remittances and Migration*. Washington DC: World Bank.

———. 2010. *Yemen: Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications*. Washington, DC: World Bank.

———. 2011. "Poor Places, Thriving People: How the Middle East and North Africa Can Rise Above Spatial Disparities." MENA Development Report, Washington, DC: World Bank.

Wu, T. 2006. *The Role of Remittances in Crisis: An Aceh Research Study*. London: Overseas Development Institute.

Yang, D. 2007. "Coping with Disaster: The Impact of Hurricanes on International Financial Flows, 1970–2002," Mimeo. Department of Economics, University of Michigan, Ann-Harbor.

Yang, D. and H. Choi. 2007. "Are Remittances Insurance? Evidence from Rainfall Shocks in the Philippines." *World Bank Economic Review* 21 (2): 219–48.

CHAPTER 12

Does the Impact of Remittances on Poverty and Human Development Depend on the Climate of Receiving Areas?

George Joseph and Quentin Wodon

This chapter uses matching techniques and a recent nationally representative 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. Remittances are found to have a statistically significant impact on many of the indicators, and this is especially the case for international remittances which tend to provide more resources to their beneficiaries. The impact of remittances on measures of poverty and malnutrition is also found to be stronger in districts that are affected by unfavorable climate (as measured through higher temperatures or lower levels of rainfall), while the impact of remittances on school enrollment is found to be stronger in areas with better climate. The results are consistent with households in the least favorable areas using their remittances to meet basic needs first, while households in better areas can use remittances flows for education investments.

Introduction

Migration of household members and the potential resulting remittances are part of livelihood strategies used by households to insure against shocks in regions which are prone to natural disasters and adverse weather conditions. There is ample evidence that migration and especially remittances may reduce poverty and improve human development outcomes for receiving households. According to Mansuri (2007), school enrollment rates increase by 54 percent for girls in migrant households in rural Pakistan (the increase is lower for boys at seven percent). Frank and Hummer (2002) find that infants born into Mexico-to-US migrant households have better birth outcomes: while nine percent of infants in

international migrant households have low birth weights, 11 percent of those in nonmigrant households have this condition. Hildebrandt and McKenzie (2005) and McKenzie (2006) suggest that international migration has positive effects on both infant mortality and child weight among Mexican households.

Remittance-receiving households typically have better asset ownership and are more entrepreneurial. Taylor and Mora (2006) suggest that international migrant households have the largest marginal budget share for investments in rural Mexico. Makdissi and Wodon (2004) suggest that households with migrants have better housing. Osili (2004) shows that in Nigeria, a ten percent increase in migrants' income increases the probability of investing in housing by three percentage points in the country of origin. Remittances also help to smooth consumption during adverse shocks—both through ex ante preparedness and ex post adaptation.

Controlling for the endogeneity of the remittance-receiving status of households, remittances help to smooth consumption after floods in Bangladesh and build disaster resilient housing in Ghana and Burkina Faso and ensure sufficient liquidity during food shortage in Ethiopia (Mohapatra, Joseph, and Ratha 2011). Gubert (2007) finds that households in rural Mali use remittances to insure themselves against adverse shocks, with a 500 kilogram drop in grain output leading to a 48 percent increase in remittances; if that drop in grain output is coupled with a death in the family, remittances rise by 124 percent.

There is also evidence that migration and remittances reduce poverty. Lokshin, Bontch-Osmolovski, and Glinskaya (2007) show that in Nepal almost 20 percent of the decline in poverty between 1995 and 2004 was linked to migration. Adams and Page (2005) suggest that a ten percent increase in per capita international remittances leads to a 3.5 percent decline in the share of people in poverty. International remittances reduce poverty in Latin America by 0.4 percent for each percentage point increase in the remittances to GDP ratio (Acosta et al. 2007). Conversely, a drop in international remittances may lead to higher poverty, as observed in Burkina Faso after the crisis in Côte d'Ivoire reduced the ability of migrants to remit (Siaens and Wodon 2011).

The question investigated in this chapter is somewhat different. We are interested in assessing whether the impact of remittances on poverty and human development indicators depends on the areas in which households live. Our hypothesis is that remittances may have a larger impact in areas affected by unfavorable climate because it is in those areas that households tend to be most vulnerable. By combining climate and household survey data from Yemen, we test whether domestic and international remittances reduce poverty and improve education and malnutrition indicators more in areas with high temperatures and low rainfalls.

Yemen is an interesting case study for this work. First, it has high levels of migration, both domestic and international, and as a result many households do benefit from remittances. In the nationally representative household survey for 2006 that we use for the analysis, 43.63 percent of the population benefits from either domestic or international remittances (the proportions are 33.90 percent

for domestic remittances, 14.10 percent for international remittances, and 4.38 percent for both.) Yemen's topography is diverse, with a mountainous core at the center, coastal plains in the east, west, and south, and upland deserts to the north, toward the Saudi Arabia border. The country suffers from a relatively harsh climate in many areas. Rainfall is limited and the population must deal with high levels of water scarcity as well as persisting economic reliance on water dependent sectors such as rainfed agriculture. The average annual mean temperature is 22 degrees Celsius in our data from BIOCLIM, but there are large differences between various parts of the country as well as over the year, and temperatures have peaked to well above 50 degrees. Climate change is likely to progressively bring in even higher temperatures and lower rainfalls in the future. Climate is not only likely to play an important role in decisions by household members to migrate and remit, but it is also likely to affect poverty and human development outcomes both directly and indirectly through its impact on livelihoods. In turn, as a coping mechanism, the impact of remittances may differ between areas.

The chapter is structured as follows. Section two presents the data and methodology. Section three presents the results from the estimation of the impact of remittances, both domestic and international, on poverty and human development outcomes. A conclusion follows.

Data and Methodology

We use the most recently available nationally representative household budget survey implemented in Yemen, whose data were collected in 2005/06. The survey includes 13,136 households (98,941 individuals) living in 309 of the country's 333 districts. Apart from the location of households, the survey provides information on a wide range of socioeconomic characteristics including among others demographics, education, health and anthropometrics, employment and occupation, consumption and assets, and income including remittances. Data are available on both domestic and international remittances, with 43.6 percent of households receiving some form of remittances (33.9 percent for domestic remittances and 4.38 percent for international sources, and some overlap between both; we treat households receiving remittances from domestic and international sources as international remittance receiving households.)

Beyond the household survey, and based on the location of households proxied through the most populous city in the district in which the household lives, we also use information on the distance between the household/district location and the coast, as well as the distance to the nearest airport; these distances are calculated using an Euclidean distance function in ESRI ArcGIS 9.3 software. We also use measures of travel time to the nearest city with 100,000 populations using a methodology developed from Nelson (2008) with regionally specific information (World Bank 2011). The percentage of irrigated land is taken from Global Map of Irrigated Areas version 4 (Siebert et al. 2005; Siebert, Hoogeveen, and Frenken 2006). Weather data on annual mean temperature and rainfall and

their variability are collected from BIOCLIM (Busby 1991). All weather variables are computed on observations for the period 1990 to 2000.

The estimation method—a standard matching procedure—enables us to look at the impact of remittances on a range of outcomes. These include the poverty status of the household (based on consumption per equivalent adult), as well as education enrollment for children below the age of 15, immunization for children below the age of 5, and malnutrition. Using standardized *z* scores for height for age, weight for age and body mass index, and based on World Health Organization (1995) guidelines, all children whose height for age and weight for age *z* score is less than –2 are deemed stunted and wasted respectively; similarly, all children whose body mass index is less than 16 are deemed as underweight (grade 3 thinness). The logit regressions used for the matching procedure are available upon request, with some examples provided in the appendix—care was applied to make sure that balancing properties were respected. We used *k*-nearest neighbors matching, with *k* equal to 4, a radius of 0.02, and we excluded the one percent of observations with extreme values for the indicators of interest.

Results

In principle, we would expect remittances to have a potentially large impact on poverty and human development indicators. The average transfer received by households who benefit from domestic remittances is YER 46,654 (US$252 at the average exchange rate in 2004 of US$1 = YER 185), and the average amount for international remittances is as expected significantly higher, at YER 218,786 (US$1,183). Given rather low standards of well-being in the country as a whole, these are substantial transfers which should make a difference for households.

Tables 12.1–12.3 provide the results from the matching for all, domestic, and international remittances, respectively. Consider first table 12.1, which accounts for any type of remittances received, whether domestic or international. Using a cut-off point for *t*-statistics of 1.96 corresponding to a 95 percent confidence interval, the impact of remittances is statistically significant at the national level for six variables: the three poverty measures (for example, with a reduction of six points for the headcount index from 28.71 percent to 22.81 percent), male and female school enrollment (increase of three points for boys and two points for girls), and stunting (reduction of two points).

Note that statistical significance is easier to obtain at the national level than for subsets of the districts, given the larger number of observations available at the national level. For our purpose, the interesting comparison is between districts with high or low temperatures, as well as between districts with high and low levels of rainfall. Specifically, we will consider the top 20 percent districts with high temperature and the bottom 20 percent districts in terms of rainfall, and compare these groups with respectively the bottom 20 percent districts in terms of temperatures and the top 20 percent districts in terms of rainfall. Our prior is that we expect larger impacts of remittances in districts with high temperatures or low levels of rainfall.

Table 12.1 Matching Results—Any Remittances, Republic of Yemen, 2005/06

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
	National				
Poverty headcount	22.40	24.97	22.81	28.71	−6.42
Poverty gap	5.56	6.59	5.68	7.94	−7.49
Squared poverty gap	2.06	2.51	2.11	3.15	−6.87
Male enrolment (age 6–14)	80.60	78.20	80.58	77.81	3.23
Female enrolment (age 6–14)	65.74	64.84	65.74	63.58	2.04
Male immunization	57.58	56.19	57.62	57.56	0.06
Female immunization	57.91	58.31	57.85	57.12	0.62
Stunted	45.35	44.18	45.51	47.69	−2.13
Wasted	29.65	30.60	29.80	31.49	−1.79
Underweight	54.29	55.72	54.60	53.92	0.67
	Top 20% districts in terms of mean temperature				
Poverty headcount	19.73	21.38	19.45	26.37	−3.20
Poverty gap	4.36	5.30	4.30	6.67	−3.55
Squared poverty gap	1.53	1.99	1.50	2.53	−3.15
Male enrolment (age 6–14)	76.69	71.37	76.32	72.54	1.44
Female enrolment (age 6–14)	68.56	63.39	68.35	64.61	1.24
Male immunization	57.95	58.46	57.71	60.78	−1.03
Female immunization	59.23	58.40	59.79	57.36	0.71
Stunted	36.38	42.67	36.29	43.49	−2.61
Wasted	32.12	36.39	32.87	38.84	−2.21
Underweight	63.93	65.25	64.33	66.33	−0.75
	Bottom 20% districts in terms of mean temperature				
Poverty headcount	13.69	16.03	13.76	21.29	−2.23
Poverty gap	3.07	4.14	3.10	6.45	−3.18
Squared poverty gap	1.02	1.50	1.03	2.63	−3.36
Male enrolment (age 6–14)	85.95	84.63	86.33	82.73	1.01
Female enrolment (age 6–14)	72.34	73.89	75.87	70.38	1.41
Male immunization	59.83	59.50	60.40	59.51	0.14
Female immunization	59.69	64.76	61.13	58.07	0.58
Stunted	46.59	43.96	45.52	43.34	0.41
Wasted	26.32	30.66	26.48	28.51	−0.42
Underweight	51.49	52.75	52.44	55.34	−0.54
	Bottom 20% districts in terms of mean rainfall				
Poverty headcount	17.49	21.10	16.94	22.93	−3.06
Poverty gap	4.11	5.66	3.81	6.37	−4.02
Squared poverty gap	1.58	2.27	1.40	2.67	−3.81
Male enrolment (age 6–14)	79.27	78.14	79.46	77.78	0.74
Female enrolment (age 6–14)	72.62	70.02	73.20	71.29	0.74
Male immunization	55.96	56.05	56.04	57.16	−0.38
Female immunization	55.43	55.23	55.37	55.12	0.08
Stunted	25.19	34.51	25.19	32.52	−2.89

table continues next page

Table 12.1 Matching Results-Any Remittances, Republic of Yemen, 2005/06 *(continued)*

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
	Bottom 20% districts in terms of mean rainfall				
Wasted	19.34	27.87	19.61	26.51	−2.91
Underweight	57.12	62.88	57.01	62.26	−1.93
	Top 20% districts in terms of rainfall				
Poverty headcount	21.94	23.97	22.14	25.85	−1.23
Poverty gap	5.39	5.73	5.47	7.11	−1.77
Squared poverty gap	2.00	2.02	2.03	2.81	−1.81
Male enrolment (age 6–14)	85.07	82.22	84.94	79.18	2.25
Female enrolment (age 6–14)	72.31	72.80	72.53	63.41	2.95
Male immunization	58.92	60.15	58.47	53.47	1.31
Female immunization	59.11	62.03	59.35	60.09	−0.18
Stunted	50.40	47.76	49.79	46.62	0.81
Wasted	33.04	31.38	33.08	35.11	−0.56
Underweight	58.01	57.16	58.32	57.98	0.09

Source: World Bank data.

Table 12.2 Matching Results—Domestic Remittances, Republic of Yemen, 2005/06

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
	National				
Poverty headcount	22.83	24.97	23.35	28.17	−4.61
Poverty gap	5.71	6.59	5.87	7.55	−4.86
Squared poverty gap	2.12	2.51	2.18	2.91	−4.22
Male enrolment (age 6–14)	79.69	78.20	79.63	78.29	1.34
Female enrolment (age 6–14)	64.63	64.84	64.58	64.16	0.34
Male immunization	57.48	56.19	57.59	58.81	−0.94
Female immunization	58.75	58.31	58.61	60.21	−1.14
Stunted	48.83	44.18	49.18	49.35	−0.14
Wasted	31.55	30.60	31.82	32.51	−0.62
Underweight	54.82	55.72	55.23	55.53	−0.25
	Top 20% districts in terms of mean temperature				
Poverty headcount	21.89	21.38	21.53	27.86	−2.48
Poverty gap	5.14	5.30	5.10	7.23	−2.66
Squared poverty gap	1.87	1.99	1.85	2.78	−2.39
Male enrolment (age 6–14)	75.81	71.37	75.52	72.46	0.99
Female enrolment (age 6–14)	68.97	63.39	69.19	63.26	1.66
Male immunization	55.05	58.46	54.08	62.98	−2.48
Female immunization	58.58	58.40	58.41	55.16	0.77
Stunted	39.55	42.67	39.44	50.29	−3.10
Wasted	36.18	36.39	37.12	42.72	−1.62

table continues next page

Table 12.2 Matching Results-Domestic Remittances, Republic of Yemen, 2005/06 *(continued)*

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
Underweight	70.34	65.25	71.69	69.72	0.61
	Bottom 20% districts in terms of mean temperature				
Poverty headcount	12.81	16.03	12.55	20.32	−2.15
Poverty gap	2.79	4.14	2.77	6.74	−3.66
Squared poverty gap	0.88	1.50	0.88	2.87	−3.98
Male enrolment (age 6–14)	84.58	84.63	85.79	86.50	−0.12
Female enrolment (age 6–14)	69.73	73.89	71.49	70.39	0.24
Male Immunization	59.01	59.50	59.06	53.05	0.89
Female immunization	59.37	64.76	59.53	62.42	−0.46
Stunted	47.84	43.96	48.61	41.76	1.11
Wasted	26.20	30.66	27.38	25.78	0.28
Underweight	51.48	52.75	52.23	54.53	−0.36
	Bottom 20% districts in terms of mean rainfall				
Poverty headcount	19.50	21.10	19.08	25.02	−2.29
Poverty gap	5.03	5.66	4.60	6.49	−2.21
Squared poverty gap	2.05	2.27	1.75	2.57	−1.82
Male enrolment (age 6–14)	78.20	78.14	78.99	73.22	1.97
Female enrolment (age 6–14)	74.65	70.02	74.93	73.24	0.53
Male immunization	54.14	56.05	54.41	60.28	−1.43
Female immunization	53.62	55.23	53.63	56.34	−0.64
Stunted	28.33	34.51	27.58	33.48	−1.75
	Bottom 20% districts in terms of mean rainfall				
Wasted	23.33	27.87	24.23	30.03	−1.81
Underweight	62.14	62.88	64.43	61.53	0.83
	Top 20% districts in terms of rainfall				
Poverty headcount	22.94	23.97	23.10	27.13	−1.13
Poverty gap	5.56	5.73	5.63	7.57	−1.75
Squared poverty gap	2.03	2.02	2.06	3.00	−1.80
Male enrolment (age 6–14)	84.04	82.22	83.75	77.87	1.77
Female enrolment (age 6–14)	71.36	72.80	71.79	64.27	2.09
Male immunization	57.91	60.15	58.19	56.65	0.35
Female immunization	59.51	62.03	59.55	62.67	−0.61
Stunted	52.03	47.76	51.24	44.21	1.55
Wasted	33.41	31.38	33.67	35.92	−0.53
Underweight	58.39	57.16	59.04	57.06	0.44

Source: World Bank data.

Consider again table 12.1. In districts with high mean temperatures, the impacts of remittances are statistically significant for five variables, namely the poverty measures, as well as the measures for stunting and wasting. In districts with low temperatures, the effects are also statistically significant for the poverty measures, but not for the nutrition measures. When comparing districts with low

Table 12.3 Matching Results—International Remittances, Republic of Yemen, 2005/06

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
	National				
Poverty headcount	20.49	24.97	20.76	29.88	−7.20
Poverty gap	5.13	6.59	5.22	8.31	−7.35
Squared poverty gap	1.94	2.51	1.98	3.33	−6.26
Male enrolment (age 6–14)	81.53	78.20	81.54	77.66	3.30
Female enrolment (age 6–14)	67.61	64.84	67.54	63.67	2.68
Male immunization	57.25	56.19	57.48	56.19	0.81
Female immunization	56.20	58.31	56.27	56.24	0.02
Stunted	36.91	44.18	37.05	44.20	−4.89
Wasted	24.95	30.60	25.05	28.94	−2.94
Underweight	52.89	55.72	53.28	54.54	−0.85
	Top 20% districts in terms of mean temperature				
Poverty headcount	13.16	21.38	12.62	24.57	−4.62
Poverty gap	2.69	5.30	2.59	6.06	−4.48
Squared poverty gap	0.94	1.99	0.93	2.38	−3.72
Male enrolment (age 6–14)	77.78	71.37	77.96	69.21	2.50
Female enrolment (age 6–14)	67.12	63.39	66.99	66.77	0.05
Male immunization	64.13	58.46	63.47	64.16	−0.17
Female immunization	62.09	58.40	61.62	60.68	0.22
Stunted	28.82	42.67	27.96	41.97	−4.10
Wasted	27.08	36.39	25.81	34.52	−2.62
Underweight	55.21	65.25	54.48	64.07	−2.65
	Bottom 20% districts in terms of mean temperature				
Poverty headcount	16.67	16.03	13.02	14.51	−0.52
Poverty gap	4.03	4.14	2.72	3.77	−1.28
Squared poverty gap	1.46	1.50	0.92	1.33	−1.07
Male enrolment (age 6–14)	90.27	84.63	93.17	84.82	2.97
Female enrolment (age 6–14)	79.42	73.89	85.15	69.43	4.28
Male immunization	60.91	59.50	65.22	66.51	−0.27
Female immunization	56.47	64.76	61.31	61.90	−0.11
Stunted	42.67	43.96	40.31	36.78	0.79
Wasted	21.98	30.66	23.47	26.89	−0.87
Underweight	45.69	52.75	51.02	47.86	0.7
	Bottom 20% districts in terms of mean rainfall				
Poverty headcount	17.26	21.10	16.67	23.57	−2.79
Poverty gap	4.23	5.66	3.85	6.42	−3.13
Squared poverty gap	1.70	2.27	1.45	2.69	−2.89
Male enrolment (age 6–14)	78.96	78.14	79.46	75.58	1.33
Female enrolment (age 6–14)	69.01	70.02	69.05	69.65	−0.18
Male immunization	58.06	56.05	57.94	58.99	−0.28
Female immunization	56.92	55.23	57.42	53.80	0.94
Stunted	22.78	34.51	22.71	27.69	−1.56
Wasted	18.35	27.87	18.75	21.51	−0.93

table continues next page

Table 12.3 Matching Results-International Remittances, Republic of Yemen, 2005/06 *(continued)*

	Before matching		*After matching*		
	Remittances	*No remittances*	*Remittances*	*No remit.*	*t statistic*
Underweight	55.24	62.88	55.42	62.64	−2.08
	Top 20% districts in terms of rainfall				
Poverty headcount	15.64	23.97	15.49	29.44	−4.53
Poverty gap	4.14	5.73	4.10	6.41	−2.45
Squared poverty gap	1.57	2.02	1.58	2.20	−1.41
Male enrolment (age 6–14)	87.25	82.22	87.53	79.46	3.16
Female enrolment (age 6–14)	72.12	72.80	74.13	60.49	3.62
Male immunization	60.63	60.15	62.41	56.40	1.52
Female immunization	57.01	62.03	58.74	60.24	−0.35
Stunted	42.32	47.759	41.87	49.20	−1.97
Wasted	30.73	31.379	30.85	31.21	−0.1
Underweight	56.68	57.16	57.30	54.55	0.74

Source: World Bank data.

or high rainfall, there are even more differences. In districts with low rainfall, the effects of remittances are statistically significant for the same five measures as observed in the case of high temperatures. By contrast, in districts with high rainfall, the effect of remittances is statistically significant for none of these indicators, but it is for male and female school enrollment. Taking both statistical significance and the magnitude of the effects when they are statistically significant, the results suggest that remittances have a larger impact on poverty and especially nutrition measures in areas affected by more difficult climate, while in areas with better climate (especially higher rainfall), education gains tend to be larger.

Similar results tend to be observed in tables 12.2 and 12.3 when considering domestic and international remittances separately, although there are differences between the impacts of both types of remittances. One would expect that for households benefitting from remittances, the impacts on the various indicators would be larger in the case of international remittances simply because the average level of international remittances among beneficiaries is much higher than the average level of domestic remittances among beneficiaries. This is indeed observed through the fact that at the national level, for example, impacts are statistically significant for only three indicators with domestic remittances (the three poverty measures), while impacts are statistically significant for seven indicators in the case of international remittances (the three poverty measures, as well as school enrollment for both boys and girls, and stunting and wasting).

But what about the comparison between districts in terms of climate? Consider first domestic remittances. When looking at temperatures, apart from the results for the poverty measures which tend to be similar in both sets of districts, we see that for domestic remittances, there is a statistically significant impact of remittances on stunting in districts with high temperatures, while this is not the case for districts with low temperatures. (There is also a curious reduction in male immunization with remittances in high temperatures districts-but

this is the only case of unexpected result, and the only time that the effect is statistically significant for immunization, so one can probably discount that observation). When looking at rainfall, we see that the effects on poverty are statistically significant for two of the poverty measures in low rainfall areas, while this is not the case in high rainfall areas. As for education, we see a (marginally) statistically significant gain in school enrollment for boys in areas with low rainfall, while there is a gain for girls in areas with high rainfall. Still, overall, the evidence points to a larger impact of domestic remittances in districts with either high temperatures or low rainfall.

This is also observed for international remittances, especially when comparing districts with low and high temperatures. In districts with low temperatures, the impact of international remittances is statistically significant for school enrollment only, while in districts with high temperatures, the impacts are statistically significant for the poverty measures, school enrollment for boys, and the three measures of malnutrition. The differences in impact are lower when comparing districts with high and low levels of rainfall—there the impacts are similar in terms of statistical significance and often as well magnitude for the poverty measures, but school enrollment gains tend to be statistically significant in areas with high rainfall (both types of districts in terms of rainfall levels exhibit some gains in nutrition measures from international remittances, with one of the three impacts being statistically significant, albeit not the same one in the two types of districts).

Conclusion

Is the impact of remittances on poverty and human development different in various areas depending on their climate? By combining nationally representative household survey data with climate data, we have tried to answer this question in the case of Yemen. Our main results can be summarized in four main points. 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, the results suggest, as might be expected, that 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 can be used by households for investments, such as investments in the education of children.

Bibliography

Acosta, P., P. Fajnzylber, and H. Lopez. 2007. "The Impact of Remittances on Poverty and Human Capital: Evidence from Latin American Household Surveys." In *International Migration Policy and Economic Development: Studies across the Globe*, edited by C. Ozden, and M. Schiff. Washington, DC: World Bank.

Adams, R., and J. Page. 2005. "Do International Migration and Remittances Reduce Poverty in Developing Countries." *World Development* 33 (10): 1645–69.

Busby, J. R. 1991. "BIOCLIM—A Bioclimate Analysis and Prediction System." *Plant Protection Quarterly* 6: 8–9.

Frank, R., and R. Hummer. 2002. "The Other Side of the Paradox: The Risk of Low Birth Weight among Infants of Migrant and Nonmigrant Households within Mexico." *International Migration Review* 36 (3): 746–65.

Gubert, F. 2007. "Insurance against Poverty." *Journal of African Economies* 16 (1): 172–75.

Hildebrandt, N., and D. McKenzie. 2005. "The Effects of Migration on Child Health in Mexico." World Bank Policy Research Working Paper 3573, World Bank, Washington, DC.

Lokshin, M., M. Bontch-Osmolovski, and E. Glinskaya. 2007. "Work-Related Migration and Poverty Reduction in Nepal." World Bank Policy Research Working Paper 4231, World Bank, Washington, DC.

Makdissi, P., and Q. Wodon. 2004. "Migration, Poverty and Housing: Welfare Comparisons Using Sequential Stochastic Dominance." *Estudios de Economía* 1: 5–20.

Mansuri, G. 2007. "Temporary Migration and Rural Development." In *International Migration Policy and Economic Development: Studies across the Globe*, edited by C. Ozden and M. Schiff. Washington, DC: World Bank.

McKenzie, D. 2006. "Beyond Remittances: The Effects of Migration on Mexican Households." In *International Migration, Remittances and the Brain Drain*, edited by C. Ozden and M. Schiff. Washington, DC: World Bank.

Mohapatra S., G. Joseph and D. Ratha. 2011. "Remittances and Natural Disasters: Ex-Post Response and Contribution to Ex-Ante Preparedness." *Environment, Development and Sustainability* 14 (3): 365–87.

Nelson, A. 2008. "Travel Time to Major Cities: A Global Map of Accessibility, Global Environment Monitoring Unit." Joint Research Centre of the European commission, Ispra, Italy. http://gem.jrc.ec.europa.eu.

Osili, U. O. 2004. "Migrants and Housing Investments: Theory and Evidence from Nigeria." *Economic Development and Cultural Change* 52 (4): 821–49.

Siaens. C., and Q. Wodon. 2011. "International Migration, Conflict and Remittances: The Impact of the Crisis in Côte d'Ivoire on Burkina Faso." Mimeo, World Bank, Washington, DC.

Siebert, S., P. Döll, J. Hoogeveen, J.-M. Faurès, K. Frenken, and S. Feick. 2005. "Development and Validation of the Global Map of Irrigation Areas." *Hydrology and Earth System Sciences* 9: 535–47.

Siebert, S., J. Hoogeveen, and K. Frenken. 2006. "Irrigation in Africa, Europe and Latin America—Update of the Digital Global Map of Irrigation Areas to Version 4." Frankfurt Hydrology Paper 05, Institute of Physical Geography, University of Frankfurt, Frankfurt am Main, Germany and Food and Agriculture Organization of the United Nations, Rome, Italy.

Taylor, J. E., and J. Mora. 2006. "Does Migration Reshape Expenditures in Rural Households? Evidence from Mexico." World Bank Policy Research Working Paper 3842, World Bank, Washington, DC.

World Bank. 2010. *Yemen: Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications*. Washington, DC: World Bank.

———. 2011. "Poor Places, Thriving People: How the Middle East and North Africa Can Rise above Spatial Disparities." MENA Development Report, World Bank, Washington, DC.

WHO (World Health Organization). 1995. "Physical Status: The Use and Interpretation of Anthropometry." Report of a WHO Expert Committee, Tech. Rep. Series 854, World Health Organization, Geneva.

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Climate change and migration are major concerns in the Middle East and North Africa region, yet the empirical evidence on the impact of climate change and extreme weather events on migration remains limited. Information is broadly lacking on how households in vulnerable areas perceive changes in the climate, how they are affected by extreme weather events, whether they benefit from community and government programs to help them cope with and adapt to a changing climate, and how these conditions influence the decision of household members to migrate, either temporarily or permanently.

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