

# Migration, Environment and Climate Change:

**ASSESSING THE EVIDENCE**



IOM International Organization for Migration

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Edited by  
Frank Laczko and Christine Aghazarm

in collaboration with



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# Migration and slow-onset disasters: desertification and drought

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## 1. Introduction

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The Intergovernmental Panel on Climate Change (“IPCC”) predicts that global warming will lead to major shifts in weather patterns, ocean currents, and possibly ecosystems. In addition to higher temperatures and rising sea levels, scientists forecast that rainfall will become more variable, drought more prevalent and prolonged. This will exacerbate soil erosion and desertification around the world. In some geographic regions, these events will combine with a higher incidence of rapid-onset disasters in the wet season, causing more violent and destructive storm surges, floods and hurricanes.

The changes in climate now anticipated (and which some presume is already occurring) will disrupt and perhaps permanently alter how and where food is grown. A significant number of countries could lose one-third to one-half of their capacity for agricultural production over the coming decades. Countries in equatorial Africa may lose as much as 60 per cent.

The rural poor dependent on agriculture for their subsistence and employment are due to suffer most. The loss of crops, livestock and demand for farm labour due to longer dry seasons and water scarcity may force people to migrate in search of better livelihood or more durable human security. There is now a growing understanding that those in rural communities struggling with persistent drought and desertification use migration as a coping strategy.

How many of the world’s 191 million international migrants have left their communities because of climate-related disasters, or how many will do so in the future is unknown for certain. Some speculate in the tens of millions, others in the hundreds of millions. Estimates are questionable without deeper research. However, anticipating that climate change will lead to larger numbers of displaced populations than would otherwise occur, some governments are seeking support for their adaptation strategies to address migration (see Martin Chapter 7 in this volume).

As decision-makers begin to formulate policies within the climate context, it will be important to consider what research data and tools exist to explain the relationship between climate variability and migration, to predict patterns of human mobility or to identify “hot spots” of the most vulnerable communities. The goal of this chapter is to consider succinctly the available information on drought and desertification-related migration to gain a better understanding of how predicted impacts of global warming may affect migration in the future. The chapter considers some of the scientific forecasts for drought and agricultural impacts, followed by an analysis of the field studies and literature. It will then identify the most significant data gaps and highlight the key policy challenges in addressing migration in the context of climate adaptation strategies.

The chapter will conclude with observations and suggestions for a new research agenda within the international community to address the most significant concerns. Several aspects, such as considering new migration management frameworks and investment in targeted interdisciplinary research, require immediate action.

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## 2. The changing climate and human vulnerability

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At the beginning of 2009, scientists made an alarming pronouncement: that humankind's alteration of the climate may be crossing an "ecological threshold," altering the ecosystems upon which life on earth depends, and this may be irremediable.<sup>2</sup> In 2008, new scientific models suggested that more rapid changes in climate were occurring and the world could experience temperature increases of 3–6°C over the next eight or nine decades (Clark et al., 2008). Similarly, examining the impact of temperatures on ocean currents and the rates in thawing of the Greenland and West Antarctic ice sheets, scientists have suggested that sea level could rise by 1.3 m in this same period, a rate that occurred only during the last ice age. (Clark & Weaver, 2008; see also Grinsted et al., 2009).

The Stern Review has identified that poorer countries will fare worst from these environmental changes (2006). Their low level of economic development means that they are more vulnerable and less able to adapt to climate disasters. From a biophysical perspective, they are geographically disadvantaged since most are located in lower latitudes where predicted temperature increases, longer dry seasons, and water scarcity will greatly restrict their capacity to grow food and raise livestock.

For many, agricultural production could drop significantly in the next several decades. The African continent is likely to suffer most harshly. The United Nations Development Programme estimates that up to 90 million hectares of drylands in sub-Saharan Africa could experience drought (UNDP, 2009: 18). With all but 4 per cent of Africa's croplands being rainfed (Heltberg & Siegel, 2008: 5), drought can have devastating

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<sup>2</sup> In a report examining new data on climate change and ecosystem impacts released in 2009, the US Climate Change Science Program cautioned that "more ecosystems may be getting pushed toward response thresholds simultaneously, and ... little is known regarding where the tipping points are." (Schlesinger et al., 1990; Reynolds & Stafford Smith, 2002, cited in, US Climate Science Program/USGS, 2009: 74–75).

effects on most of the continent's rural people who subsist off the land and have little or no access to stored water supply for irrigation.

Overall, African countries are expected to lose a great deal of their agricultural capacity. Analyzing a series of climate-related agricultural models, Cline moderately estimates that by 2080, production losses in countries within the equatorial belt could rise to 60 per cent (Cline, 2008). Losses may reach 56 per cent in Sudan, 52 per cent in Senegal, 39 per cent in Morocco, 36 per cent in Algeria and Mali, 31 per cent in Ethiopia, 19 per cent in Nigeria and 47 per cent in other countries in the Southern African region (ibid). Losses are also expected to be significant in parts of Asia and Latin America: 43-44 per cent in northern India, 41 per cent in Iraq, 36 per cent in Pakistan, and 35 per cent in Malaysia, and Mexico, and 43 per cent on average for some countries in South America (ibid).

By 2080, international agencies estimate that food shortages could lead to the malnutrition of 600 million people (UNDP, 2009: 18), The humanitarian crises that could result from food scarcity would be further compounded by the lack of clean water, spread of disease, and potential conflicts. The Stern Review estimates that nearly two billion people could be affected (2006).

In light of the predicted environmental, economic and social impacts, populations are likely to be displaced or to migrate in order to survive. How temporary or permanent this displacement or migration will be and where populations will go is uncertain. As discussed in the following section, mining the studies on drought-related migration can provide some initial insights.

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### 3. Drought, desertification and migration<sup>3</sup>

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Scholars, social scientists, and international bodies have debated how best to distinguish from the general category of economic migrants those environmental migrants where the decision to migrate was partially influenced by a change in the physical environment or natural resource base. Less clear is what percentage of the total migrant pool is comprised of environmental migrants, in today's debate, climate-related migrants. There have been numerous attempts to better define and characterize these migrants as a specific subset of all other economic migrants or refugees in need of special protection (see Zetter Chapter 8 in this volume).

The effort to distinguish these migration patterns is a challenge because it involves the simultaneous consideration of space and time, dynamic human attitudes and the national and international character of the movement. These can change over time. Studies must consider whether migration is seasonal (for work), temporary or permanent, related to individual, family or household decisions, and whether it is undertaken for primarily economic reasons or others, such as family reunification (see Kniveton et al. Chapter 2, Billsborrow Chapter 3 and Warner et al. Chapter 4 in this volume).

A number of studies, however, particularly related to drought have yielded some important data on the links between climate variability and migration. What is relatively unknown is how and where populations will move as climate variability *increases* in frequency and volatility. This raises a number of questions. Is there a direct relationship between the most critical climate-affected areas and increased migration, such that migration will necessarily be more significant in places where food and water security are most threatened? Will the

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<sup>3</sup> The case studies are based in large part on the author's survey in, 'Desertification and Migration,' published in *Governing Global Desertification*, eds., Johnson, P.M., Mayrand, K., and Paquin, M. (Ashgate Press, London, U.K.).

*increase* in migration translate into more internal, local migration, or to more people crossing borders? Are there ‘hot spots’ that warrant greater attention?

To better understand the state of knowledge in these areas, this section examines the findings of field research and case studies related to drought and desertification in rural agricultural communities. The case studies available for review span the African and North and South American continents and a few have been completed in Central Asia and Europe. Following a summary of key findings is a discussion of the gaps in data and methodology that, if filled, could notably enhance understanding of climate-related migration in the future.

## Findings of research and investigation

Desertification has been a major problem for dryland environments for centuries (Herrmann and Hutchinson, 2006). It involves land degradation in arid, semi-arid and dry sub-humid areas, otherwise defined by international agreements as “desertification” resulting from climate and human activities which reduces soil fertility and the ability of vegetation to thrive (ibid; see also UNCCD, 1994). Contributing factors of human activity include the overexploitation of lands and water, and deforestation for agricultural land expansion causing soil degradation (Drigo, 1999). Low rainfall or extreme rainfall variability and high temperatures can create drought. “On the ground, droughts manifest themselves in vegetation stress and ultimately loss of green vegetation cover, decreases in stream flow, and the dying out and cracking of soil surfaces” (Herrmann and Hutchinson, 2006: 16). Drier soils are more susceptible to wind and water erosion. These biophysical changes result in less soil fertility, less food production and less plant life for grazing livestock. Thinner herds are more susceptible to disease and, subsequently, less profitable.

While drylands are routinely subject to moisture deficits, including droughts, and thus susceptible to desertification processes, (ibid), the concern today is that the intensity, incidence and severity of drought and desertification are accelerating. This is leading to major environmental and socio-economic problems, particularly in parts of Africa where more than 70 per cent of Africa’s rural poor live in and depend on dryland agriculture for food and income. The concern is that “[t]he incidence in poverty in sub-Saharan Africa is increasing faster than the population” (IPCC, 2006). At the time of writing, the drought affecting countries in east Africa, particularly Kenya, Ethiopia, Uganda and Somalia, is moving

through its fifth year, “driving more than 23 million east Africans in seven countries towards severe hunger and destitution...” (Reuters, “East Africa Drought in Fifth Year, Millions Hungry”, Sept. 29, 2009).

The resources of humanitarian groups are becoming more strained. Oxfam’s East Africa Director has noted that , “[t]his is the worst humanitarian crisis Oxfam has seen in east Africa for over ten years,” citing that failed and unpredictable rains are becoming more common in the region, and “that broader climate change meant wet seasons were becoming shorter. Droughts have increased from once a decade to every two or three years” (Ibid, citing Paul Smith Lomas).

As drought and desertification threaten rural household income sources and food security, (either directly by affecting land assets or indirectly by contributing to the decline of agricultural employment), many rural agricultural families are forced to diversify their income streams to survive. This can be accomplished by having one or more family members migrate (Bilsborrow, 1992; see also Bilsborrow Chapter 3 in this volume). Generally, income decline and poverty (though not absolute impoverishment) are key determinants of migration from rural areas (Leighton, 2006; de Janvry 1997). Those facing the loss of livelihood are more likely to move than those who are relatively well off. The increased likelihood or incidence of poverty can influence whether a family considers migration as a coping strategy.

The migration involved tends to be seasonal or temporary migration, meaning that migrants will be returning to their communities of origin at the end of the agricultural employment season or, at least, on a regular basis. In some cases, they return to tend to their household agricultural activity, using the migration income to support their own investment.

Better documented are instances of drought-related migration from rural to urban destinations, or to international destinations where seasonal labourers may cross a nearby border of a neighbouring state for employment. This type of internal or closer-proximity migration related to drought is better understood than longer-distance (overseas) migration related to drought. International migration requires more planning, extended social networks, and is generally more costly than local migration (Perch-Nielson, 2004). Several studies discussed below suggest that if there are sufficient networks, opportunities and motivation, migrants will undertake a more distant international move as a longer-term or even permanent survival strategy (Skeldon, 2008).

The resources needed for any migration, whether local or international, are often considerable, given that most rural migrants are unskilled. Unless faced with immediate safety issues, it is generally not the poorest of the poor who can migrate from rural areas but those who can find the means to migrate (Massey, 1993; Bilborrow, 1992). Moreover, a migrant's income or poverty relative to others in the same community can be more important than his or her absolute deprivation (de Janvry, 1997).

Studies also show that gender can be a determinant of local migration. In 2010, the number of international migrants is expected to reach 214 million, of which women will account for 49 per cent (UN DESA, 2009). While women comprise nearly half of all international migrants, it is estimated that men may account for the greater share of seasonal migrants (Knabe & Nkoyok, 2006).

### **Migration “within” borders**

Seasonal movements or circular migration, leading migrants home at the end of the growing season, in response to droughts appear to be fairly common. This type of migration has been documented in Burkina Faso (Henry et al., 2004), Ethiopia (Ezra, 2001), Mali (Findley, 1994) and Senegal (Seck, 1996) among other studies in sub-Saharan countries. Others report that drought is a factor that has combined with high population growth to increase the incidence of poverty such that droughts in the Sahel that lasted years or decades, e.g., the 1968–1973 and 1982–1984 droughts, led to the use of migration as a systemic coping strategy (including in Burkina Faso, Chad, Djibouti, Ethiopia, Eritrea, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia and Sudan) (see Tomadong-Helin & Helin, 1991; Sahel Club, 1984).

In a recent study, Henry, Schoumaker and Beauchemin found that in analyzing certain migration data in Burkina Faso, the inclination to migrate from one rural area to another is three times higher for men living in drought-afflicted areas (poor agro-climatic areas) than for those living in areas with higher rainfall averages (Henry et al., 2004: 25). The length of drought also appeared to play a role: the data suggested that if the drought had occurred in the prior three years, men in the drier areas had a 60 per cent higher chance of migrating (ibid).

The impetus to migrate before and during drought events is relayed in case studies of Ghana. Data gleaned from recent interviews with

migrants suggest that both land failure and environmental degradation in the communities of origin, as well as the promise of better land in the south, prompted people to migrate (Kees van der Geest, 2008; Black et al., 2008) (where there is now more distress migration in drought years).

In Senegal, migration is a consistent coping response to long-term drought and desertification (Seck, 1996). Since the 1960s, more frequent drought and soil erosion have diminished crop yields, leading to a lack of farm employment and large-scale emigration to Dakar and other urban centres. By the early 1990s, it was reported that 90 per cent of the Tambacounda region's men between 30 and 60 years old had migrated at least once in their lifetime (ibid). Since the 1980s, other communities have engaged in migration as a coping strategy in times of drought (see Knerr, 2004).

Short-term, seasonal migration in response to drought is also documented in other regions of the world (Argentina (Adamo, 2003); India (Rogaly, 2002); Kazakhstan (Glazovsky & Shestakov, 1994; Shestakov & Streletsky, 1998); Niger (Afifi, 2008); Turkey (Zeynep Kadirbeyoglu, 2008)). Massey found that in Nepal, for example, the impairment of natural resources led to migration to nearby communities (Massey, 2007). He reported a much weaker correlation with cross-border international migration, with migrants being members of lower castes and non-Hindus (ibid).

### **Migration across borders**

A number of studies suggest that rural communities affected by drought and desertification may respond by engaging in internal or international migration, particularly where it is easy to cross neighbouring borders. The case studies while fewer in number, reveal that international migration has become more important for rural communities though overall it remains a much smaller portion of population mobility. In this context, much of the documented international migration has been the movement of people to neighbouring states within the Sahel region, and from Mexico to the United States.

During the 1968-1973 Sahelian drought, an estimated one million people migrated from Burkina Faso, at least temporarily, to other countries of the Sahel (Sahel Club, 1984, cited in Tamondong-Helin & Helin, 1991). Though it is believed that the majority of the movement was within the Sahel region, it is uncertain how many of these migrants may have returned to their communities or settled permanently in

other countries. Findley reports that Malians also moved to other areas in the Sahel roughly during this same period in response to drought (Findley, 1994: 539-542).

In Senegal's Tambacounda region, drought-related migration is reported to have begun as a more local or seasonal form of migration, discussed above, but eventually flowed to other African states and to Europe, in particular France where more extensive migrant networks exist (Seck, 1996). Although many migrants eventually returned home, the absence of men for extended periods made it difficult to rehabilitate degraded lands and increased the economic burden on the remaining women and children. Remittances became critically important to the community for survival, contributing 75 per cent of family incomes in 1993 and helping to finance schools, post offices and social service centres (Seck, 1996).

A few studies document declines in longer-distance international migration during drought for particular communities, while reporting that more local and even proximate cross-border migration increases. Findley's study, for example, reports that local and Sahelian country migration increased while longer distance international migration from Mali to France actually declined during the most significant drought years (Findley, 1994). Possibly, the financial capital needed to undertake such travel serves as a barrier after years of drought that reduces farm income. It has been postulated that community members wait for improved economic conditions before migrating overseas (see findings of Henry et al., 2004: 26; Kniveton et al., 2008); Kees van der Geest, 2008), choosing to migrate locally instead.

Studies of desertification affecting communities in Asian countries such as Bangladesh, Kazakhstan, India, Iran, Syria and Uzbekistan were similar to those reported in the African context above; playing a role in both internal and international migration (India: Maloney, 1991; Kazakhstan: Glazovsky & Shestakov 1994; Shestakov & Streletsky 1998; Syria: Escher, 1994; Goria, 1998). The precise role of drought in driving migration is uncertain, as most studies report a variety of interrelated factors. For example, Escher reports that a combination of drought, low agricultural production and population growth led to migration among the Syrian Druze (1994). Shestakov and Streletsky report that in Kazakhstan, migration was driven by lower household income after the pollution of water resources and erosion of the Aral Sea which caused desertification of pastures and farm lands (1998: 68).

In Latin America, case studies in Mexico document the prominent influence of drought and desertification on migration flows from rural to rural and rural to urban areas both inside the country and to the United States. Over two-thirds of the country's lands are affected by desertification (Leighton, 2006; and 1997). Recurrent drought, coupled with poor land management practices, contributes to soil erosion that reduces household income. Many rural families find it necessary to undertake migration in order to cope with diminished incomes. In some cases, people may migrate directly from their rural town to a destination in the United States, particularly where they have a family member or strong social network already established (Leighton, 1997; Munshi, 2003). Some of the states undergoing rapid desertification are also those with rapidly accelerating rates of migration, particularly Oaxaca and Tamaulipas (Leighton, 1997). In other contexts, the ability to obtain land for agricultural activity may determine migration. This is illustrated by Bilsborrow's study of migration in the Ecuadorian highlands (see Bilsborrow Chapter 3 in this volume).

In sum, research in the field conducted since 1990 has suggested that weather patterns, or climate variability that affects human survival, can influence rural-to-rural and rural-to-urban migration domestically. Studies have also documented that migrants may also cross nearby borders in response to recurrent drought, as particularly demonstrated in countries of the Sahel where borders are more porous. Though much fewer in number, there are studies that report the influence of drought on longer distance or overseas migration. A few anomalies exist as well that indicate that the severity of drought may not always instigate longer-distance migration. These findings may suggest that financing such longer distance migration may be less feasible after years of low agricultural returns so that more temporary or seasonal migration becomes a more feasible choice. This suggests that the role of "climate" in overseas migration is very context-specific. Finally, networks and financial means play a key role in all forms of migration but may be more important in determining international or overseas migration.

## Gaps in Data and Methodology

When analyzing the various case studies above, it is clear that gaps in data collection, analysis and methodology make it difficult to generalize on the extent to which environmental factors are the primary considerations in the decision to migrate. These gaps also make it difficult to build a more accurate picture of potential future climate-related migration.

The complex interactions between environmental, agricultural, social and economic factors means that further studies are required that transcend a single discipline or approach. Therefore, interdisciplinary research and field studies are needed which can able to capture both local level and national patterns (Heltberg & Siegel, 2008). Taking on such research implies high costs and time requirements and further constraints due to gaps in existing methodologies. One challenge lies in capturing the decision-making process of migrants. Some household surveys are unable to do this as migrants or their family members, when interviewed, may not report all of the factors influencing or leading to their decision to migrate, thereby potentially skewing the answers obtained (Bilsborrow, 1992).

Better methods to document and measure the environment–migration nexus are needed (see Kniveton et al. Chapter 2, Bilsborrow Chapter 3, Warner et al. Chapter 4 in this volume ). It will be important to use interdisciplinary models, though barriers to the availability of, and access to, environmental time series data and socio-economic data related to migration exist. Environmental time series data (e.g., land use change and biodiversity loss comparable over time), is often not collected at the community level, and at scales comparable to municipal-level demographic and socio-economic data. Available socio-economic data may not include information about migration in key communities.

Challenges also exist with regard to using census data. This does not usually include information on the decision-making processes of migrants or their flows into more than one destination. Nevertheless, if data can be collected and made available, there are models developed to integrate and correlate biophysical and socio-economic information which could be tested in environmentally induced migration contexts (Leighton, 2002). This would better equip decision-makers with knowledge to improve community adaptation strategies in anticipation of future climate crises.

To conclude, case studies from various regions of the world have illustrated that drought and desertification have an impact on the movement of people. Such movements are most often internal, cross-border and, to a lesser extent, international migration beyond the nearest border. Establishing trends or making generalizations are difficult as the case studies are context-specific. However, existing studies serve as a baseline for better understanding the linkages between migration decision- making processes and their relation to drought and land degradation. In the future, a combination of improved national-level data collection and interdisciplinary research would greatly enhance our understanding of these migratory trends.

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## 4. Other policy challenges: migration and climate adaptation

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Beyond the need to close research and data gaps, policy makers seeking to construct appropriate climate-migration related migration strategies, including in adaptation programmes, face additional challenges. These are two-fold. The first relates to whether migration is viewed as a positive element of development or as a form development failure. In practicality, the answers may be similar to those posed by other experts as to whether migration is a failure of adaptation or a form of adaptation (see Naik Chapter 5, Martin Chapter 7 in this volume). Without seeking to directly address that collateral issue, this section highlights the debate surrounding the extent to which environment-related migration can be beneficial for development. Understanding the key elements of the debate may help decision-makers better manage migration issues in the context of adaptation.

The second challenge may be to identify the most critically affected communities in terms of climate-related migration, in order to determine where to concentrate more immediate research and investigation if resources are limited. This section highlights one potential frame for identifying future “hotspots.”

### Remittances: a role in future adaptation?

As global migration has grown, so have remittance flows, and so has their potential impact on development. It has been suggested that migration has the affect of reducing poverty in the country of origin because the remittances sent home by migrants to their families can substantially improve household income and assets (Skeldon, 2008). It has been well documented that the amount of remittances transferred globally consistently exceeds foreign direct investment (FDI) and overseas development assistance, and are often more stable and resilient than the latter (ibid.; World Bank & Economic Commission for Africa, 2006). Remittances in the Latin America and Caribbean region, for example, have outpaced foreign direct investment and overseas development assistance flows combined since 2002, totaling US\$66.5 billion for 2007 (Vargas-Lundias, 2007: 14).

In 2007, the amount of global remittances reached US\$317 billion, ten times the amount calculated in 1990 (World Bank, 2008). For some African countries, in particular sub-Saharan Africa, the share of remittances as a percentage of GDP is also steadily increasing, rising from US\$4.9 billion in 2000 to US\$8.1 billion in 2006 (Economic Commission for Africa, 2006: 40–42, 75). Remittances for all countries on the continent now annually exceed US\$14 billion (*ibid*). In fact, these official figures reported probably under-represent the actual total value, as there are presumably large amounts of informal transfers taking place that are not captured in the official numbers.

### *Impacts at the community and household level*

There are varied considerations when examining the impacts of remittances on development. For the most part, remittances are personal, cash transfers from a migrant worker or immigrant to an individual or household in the country of origin. They can also be funds invested, deposited or donated by the migrant to the community of origin. These funds can play a central role in maximizing the benefits of migration for migrants and their families as well as for countries of origin and destination, because they are perhaps, as illustrated above, the largest economic benefit of migration for origin countries.

Remittances flow mainly to poor and marginalized families. In many cases, remittances make up a large percentage of total household income, acting as a substitute for earned income lost due to a variety of reasons including because of natural disasters, crop failure, etc. (IOM, 2007). Even in cases where remittances are not a regular part of monthly income, they often act as a safety net in the case of an emergency. For example, remittances were especially important during the Asian tsunami disaster of 2004 in terms of supplementing family income and aiding in reconstruction (Laczko & Collet, 2005). In Mexico, one study revealed that each additional family member migrating to the USA who sent home remittances increased the receiving family's income by 10 per cent (Vargas-Lundias, 2007: 32, citing Yunex-Naude, 2001: 3).

Remittances can also stimulate agricultural investments in communities that lack agricultural financial or insurance markets as well as be used for reinvestment in rural livelihoods. If they are invested in purchasing yield-increasing inputs and in shifting production to labour-intensive, high-value crops, this may increase the demand for farm labour in the community of origin thus reducing the future incentive for migration (Vargas-Lundias, 2007). Knerr's review of earlier studies in sub-Saharan

Africa noted that remittances from seasonal migration were used to support the agricultural activities of communities of origin (2004).

At the same time, it may be easy to overstate the redirection of remittances toward broader social and economic development. Migration, for example, can result in the loss of human resources in sending communities, particularly in the case of international migration, as it may prevent the return of family members to help with the local harvest (Vargas-Lundias, 2007: 30–31). It has also been argued that remittances may contribute to inequality in rural communities between those with relatives migrating and those without, and as between rural and urban areas (Skeldon, 2008). It is postulated that this could generate more migration among the relatively less well off which may or may not produce similar benefits (See Liu Yang, 2004; Black et al., 2005).

Research in one Moroccan community demonstrates how dynamic this is as an issue. In the case study, the migration of men away from traditional villages, along with the decline of nomadism, resulted in the neglect of lands and hydraulic systems in the community. This led to sand accumulation in once-active irrigation furrows. Families left behind struggled with diminished productivity and income (de Haas, 1998: 12). Yet, as families received and then began to invest remittances in water-harvesting technologies, farming in the area was revitalized (de Haas, 2003: 260). Over time, however, it has become clear that, the benefits were only enjoyed by families whose household participated in that reinvestment.

The sending and receiving of remittances is also a gendered process. Women headed households due to the migration of men may on the one hand be empowered or on the other may be further disadvantaged if discrimination exists which hinders their access to agricultural inputs (such as financing and credit) that could improve productivity. The level of impact with regard to the latter depends on several factors including geographic distance and the ability of the migrant to return periodically or seasonally.

In sum, countries of origin may tend to view migration as a beneficial strategy for both development and climate adaptation if migration is already having a substantial beneficial impact, especially if climate disasters are expected to adversely affect agriculture and employment. The caution lies in whether communities have freedom of choice to migrate or are forced to separate from their families and community

involuntarily, and in avoiding additional hardship to those already most vulnerable to climate disasters. These are critical challenges for those promoting long-term durable adaptation solutions, and for receiving country governments seeking to manage migration.

## Identifying Future Trends: Targeting “hotspots”

While there remain some key gaps in data available, existing information does help to signal which countries or communities may be potential “hot spots” that at some preliminary level warrant further research on climate-related migration as a priority. This section provides a few observations in this context.

Some countries are due to be affected by climatic events more severely than others and each country’s unique pattern of internal and international migration may, in turn, be disrupted. Outside of any consideration of climate change, migration will increase as the global population increases. The current rate of international migration is about 3 per cent of world population. At this rate, international migration could reach 263 million by 2050.<sup>4</sup> While rates for each country are reported, what portion of expected migration will be comprised of climate-motivated migrants is uncertain. For purposes of prioritizing research to identify which countries may experience the greatest challenges associated with climate-related migration, those countries with existing high rates of migration and where migration internationally is due to increase are countries that warranting an initial evaluation.

In this context, “hot spots” for international migration purposes should include the leading net emigration countries in which a number of significant slow-onset climate events (droughts, desertification) are expected to occur in roughly the same time period as the number of international migrants is expected to rise. Should these variables converge, the humanitarian crisis may become significant. For example, using this rough template, there are at least a dozen countries that are predicted to suffer severe agricultural and food production declines from prolonged droughts (where production may drop by over 30% and up to 60%) and that are expected to have significantly

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<sup>4</sup> Calculated based upon data provided by UN DESA, Migrant Stocks at 2300. (UN DESA, 2008).

higher international migration rates, irrespective of global warming, in the next few decades, 40 per cent to 150 per cent increases over the current number of international migrants. These countries include Ecuador, Ethiopia, Equatorial Africa, India, Iraq, Mali, Mexico, Morocco, Pakistan, Peru, Syria, Senegal, Sudan, Venezuela, Zambia and Zimbabwe. In prioritizing future research, these countries would be key.

A similar matrix could be constructed for the set of low-income countries that are threatened by both slow- and rapid-onset climate disasters (from droughts to floods to hurricanes to landslides), and that are also experiencing high rates of internal and/or international migration. This would generate a somewhat different list of countries,<sup>5</sup> but a number of countries make both lists, including Ecuador, India, Iraq, Mali and Senegal, as well as other countries in Equatorial Africa. Various matrices could be constructed to consider future scenarios. At present, few researchers concerned with climate change hot spots have built models that include migration factors or population mobility trends (see Arnold et al., 2006).

Building a research agenda that will include methods for anticipating how much of the increase in migration flows will be related to slow-onset climate disasters and where these additional flows will occur will help governments seeking to effectively manage such flows. Adaptation programmes are likely to have a higher chance of success if they consider how to give people a choice to remain in their communities or to migrate.

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<sup>5</sup> Depending on the combination of disasters selected, these countries likely include Afghanistan, Bangladesh, most of Central America, Cambodia, Colombia, Ecuador, Equatorial Africa, India, Iraq, Kazakhstan, Mali, Mozambique, Myanmar, Niger, Nigeria, Peru, the Philippines, Senegal, Thailand and Viet Nam. They may be viewed as key hot spots because they already face enormous social and economic challenges: a growing population that is food-insecure, unemployed and expected to increase its levels of migration in the future.

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## 5. Conclusion

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Existing research suggests that droughts, floods and other disasters, as they impact livelihoods and contribute to poverty, can play a significant role in migration, mixed within a more complex set of variables including finance and social networks between sending and receiving communities. Migration may be one of several adaptation strategies employed by households in response to droughts and other slow-onset disasters. The slow-onset nature of drought may provide household's with an opportunity to consider their options and thus be considered more of a voluntary undertaking. However, in some instances it may be the only viable solution for a household's survival. Seasonal migration versus more permanent migration tends to be the predominant coping strategy.

Migrants who leave their rural agricultural lands (due to slow-onset impacts, such as drought) usually move to rural areas or to nearby urban centers as discussed in the cases studies above. In some cases, they move across borders to neighboring countries, particularly where agricultural lands, water availability and jobs are more abundant. This follows more general migration patterns. For example, of the 17 million African international migrants worldwide, 63 per cent move within the African continent. Other movements across borders to neighbouring states occur among countries in Eastern Europe, Central and South Asia, parts of Latin America and between the USA and Mexico. However, longer-distance international migration incurs greater financial costs and planning and is therefore less frequent.

Climate events in the future may changes these patterns. For example, the decline of agricultural industries will likely affect the economies of the countries listed in Section III above and, to some extent, their neighbours. If agricultural employment declines over an entire region migrants may be forced to move to more distant destinations to find employment. The unsustainability of agricultural lands and increasing drought in the African continent may already be contributing to a growing trend in this regard. Both regular and irregular migration is increasing to the western and northern African coasts, and from there into European jurisdictions.

Higher levels of international migration due to environmental change pose challenges for developing and developed countries alike. International migration from developing countries is now equally divided between movement to other developing countries and to developed countries. Developing countries will encounter more pressure to handle higher levels of both immigration and emigration flows if rural people are forced to move longer distances in search of livelihood. The more frequent incidence and longer duration of droughts, the greater the challenges for sending and receiving communities, particularly where local infrastructure, employment and social services are already stretched. Understanding how and where environmental change will tip the balance toward additional migration for vulnerable communities is therefore of great importance.

### Recommendations for future policy -oriented research

An evaluation of the research to date suggests that there are wide gaps in the information available to policy makers. These gaps exist in content (how and when environmental changes become a primary driver of migration, and which communities are most vulnerable), scale and methodology (breadth of studies, and methods for interdisciplinary analysis), and frameworks for appropriate migration management strategies.

As a relatively new topic among social scientists, little research capital has been invested in broad-scale environment-migration studies. Those available are typically community-level studies and largely, though not always, anecdotal in nature. While these help to clarify context-specific socio-economic behaviors, their conclusions cannot readily be scaled-up to assist policy at the national level or used to create systems for early warning. The lack of statistically relevant data at the national or regional levels constrains the design of policies that could build resilience and promote adaptation among vulnerable communities.

Investing in the development of both short and long-term research, data collection, and monitoring projects could help to close these gaps. Three key areas warrant further attention.

1. Analysis of policy options for managing environment-related migration: The information presented in this chapter suggests that while precise numbers are not known, some portion of the migration occurring internally and internationally is resulting from slow-onset climate-events such as drought, flooding and desertification. While basic research and data collection is

needed, as recommended below, a further critical need is a cogent analysis of options for countries to manage environment-related migration before future crises emerge. Anticipating that migration will continue to pose serious challenges, countries have already begun to discuss migration as an adaptation planning strategy within their National Adaptation Programmes for Action (NAPAs). As yet, however, there is little analysis on what standards, policies or programmes are most appropriate for managing this category of internal or international migration flows, particularly among destination countries. Research that undertakes a robust exploration of the potential frameworks on the ways and means for better managing environment-related migration flows within countries, and as between sending and receiving countries, is critically needed. While global level evaluation of best practices is clearly warranted, research on a regional, rather than the global, scale may be of more immediate value to affected countries.

2. Content of research and identification of tipping points: Large data gaps exist in the literature and case studies as this chapter documents. Further research and field-work is needed on how and when biophysical variables such as drought, desertification, storms, and floods become a primary driver of migration, and on the impacts of that migration for sending and receiving areas. How and why families engage in migration is often the result of a complex set of variables, including the viability of farm employment, environmental stresses, economic policies, family and community networks between sending and destination area, and availability of financial resources to invest in migration. Relatively little is understood about the environmental “tipping points” that can lead to migration decisions. Case studies suggest, for example, that while prolonged drought can instigate international migration in some cases, in others it influences shorter-distance, seasonal migration. These anomalies can exist among communities in the same country. In-depth and comparative case studies are needed to better explain these relationships.
3. Scale of research, methodologies and identification of hot spots: Collecting and integrating analysis of national level data on environmental change related to migration could further help policy makers better identify communities at risk and hot-spots that need critical attention. However, national census and other statistics gathering efforts related to migration do not include environmental information that could help serve as identifiers in migration. In order to consider these relationships

it is necessary to evaluate different environmental and socio-economic data sets.

This poses a number of challenges, not just in the collection of data but in methodology for integrating and analyzing the data:

- i. Researchers can differ in their selection of the indicators they believe best represent the environment-migration relationship. Among the biophysical variables the level of rainfall, vegetation loss, deforestation and or land-use change are all relevant but results may differ depending on which variable is chosen for analysis. Among socio-economic indicators, demographic data, levels of employment, agricultural land development, potable water distribution, education, access to social services, and community infrastructure are among a myriad of possible indicators that can influence migration.
- ii. Even after indicators are harmonized, a constraint is the availability and accessibility of data, particularly in developing countries. Not all data needed may have been collected consistently in the communities sought to be studied. Jurisdictions may have historically differed in their data collection, or simply not collected data at all for certain indicators.
- iii. There remains the challenge of comparing and integrating the various environmental, social and economic data sets because these are often collected by different ministries at different points in time and at different scales (e.g., municipal versus statewide levels).

Promoting interagency and interdisciplinary data collection and data sharing could strengthen the capability of governments to observe and analyse migration patterns. Allowing researchers better access to official data could also enhance study results. One opportunity to improve the level of information available in this area most immediately would be to collect environmental data via the national census process. In this way, data would more easily be comparable with migration and other demographic data. It would also allow for comparability of information in sending and receiving communities.

Finally, a larger investment in the development of research methodologies for this type of interdisciplinary research that can help to support the content-based research recommended above. These methods can be shared among governments, researchers and affected communities to generate long-lasting benefits for appropriate policy reform.

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