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Environmental Migrants: A Myth?

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Environmental migration has been the subject of lively debate in recent years. The conundrum over why experts' global predictions of 50 million environmental refugees were not met in 2010 best captures how messages from advocacy and research can conflict with one another (Bojanowski 2011).[1] In *What Happened to the Climate Refugees?* Atkins (2011) states, "[T]he first available evidence seems to show that the places identified by the UNEP [United Nations Environment Programme] as most at risk of having climate refugees are not only not losing people, they are actually among the fastest growing regions in the world." Atkins's observation is less surprising if one bases one's predictions on *actual* behavioral responses to climatic events rather than on populations *at risk of exposure* (World Bank 2010). The human consequences of climate shocks are not exclusively based on the probabilities of natural disasters (hazard) or the potential numbers of people affected by such natural hazards (exposure), but also other factors, such as acclimatization, informal coping mechanisms, degree of remoteness, mitigation and prevention initiatives, and dependence on agricultural income (vulnerability).

Why do people migrate to reduce income risk, and why might they relocate to "risky" areas? The new economics of labor migration (NELM) offers a possible explanation (Taylor and Martin 2001). Households send migrants to work to reduce the potential losses caused by natural disasters at home. Migrants bring additional (and often less risky) income. By leaving, they also free up resources for the people left behind. They relocate to places where their expected returns are the greatest, where returns depend on their earning potential and the probability of employment in that location. These are enhanced through social networks that provide information on job opportunities and reduce relocation costs with temporary housing or credit for start-ups. Consider the example of a rural household that sends a family member to work in a city. Unskilled jobs are bountiful in most cities, even those at risk of exposure. Not only do the service and manufacturing industries in the cities offer higher earnings than in the agricultural sector, they are also less susceptible to the risks of natural disasters.

Acknowledging the hype and inconclusiveness of earlier work, the Intergovernmental Panel on Climate Change (IPCC) encourages more detailed evidence on observed climate impacts on mobility, especially in Africa (Boko et al. 2007). Recent International Food Policy Research Institute (IFPRI) research lets us put this debate into perspective. Microlevel evidence has improved our understanding of how climate affects individual and household decisions to migrate over time in African and Asian countries. Macrolevel analyses help us assess whether such country-specific evidence may be systematic enough to constitute a global phenomenon. Following our review of recent evidence, we segue into the main research challenges in identifying migration–climate links and discuss the policy options to formalize migration as an adaptation mechanism to climate change.

Climate and Migration: What We Have Learned

Microeconomic Evidence

Recent data collected by IFPRI researchers provide a unique opportunity to study the migration–climate linkages. The household panel surveys gather detailed information on the permanent moves of individuals over 10 and 20 years. The panel data are merged with publicly available daily and monthly climate indicators to explore the effects of rainfall and temperature anomalies on migration. In what follows, we describe the findings from three migration studies performed in countries particularly vulnerable to natural disasters: Nigeria, Ethiopia, and Bangladesh.

In 2008 IFPRI researchers administered a tracking questionnaire to household members who were originally surveyed in the 1988–1989 Northern Nigeria Household Survey (Udry 1990, 1994). They documented whether a

household member still resided in the household, and if not, what year he or she moved and to what location. This information was merged with the household data from the baseline survey and a time series of daily temperature indicators offered by the U.S. National Aeronautics and Space Administration (NASA). The final dataset provided a unique opportunity to focus on long-term migration and exposure to agricultural income risk.

The Nigeria migration study has three unique features (Dillon, Mueller, and Salau 2011). First, it is one of the only studies done in Africa that collects such detailed information on individual migration patterns over a 20-year period. Second, the authors use lagged temperature degree day shocks interacted with household landholdings at the baseline to proxy income risk rather than precipitation. Schlenker, Hanemann, and Fisher (2006) argue that temperature expressed in degree days is the most relevant for plant growth and accounts for the nonlinear relationship between plant growth and climate. The authors interact degree days with landholdings following Rosenzweig and Stark (1989) to account for the household's ability to mitigate agricultural income risk through inherited wealth. Lastly, the authors can identify the causal effect of weather anomalies on migration because of their use of household panel data that control for household idiosyncrasies through the inclusion of fixed effects.

The authors provide several model specifications varying the gender of the migrant, the type of shock (hot versus cold spell), and the frequency of shocks prior to the migrant's move. They find that males migrate in response to ex post risk, whether the risk is caused by warm or cold anomalies. The effect of a hot spell on male migration is larger in magnitude. There are cumulative impacts of shocks on migration. In particular, the migration rate grows with the frequency of hot spells (not cold spells) five years prior to one's move.

In Ethiopia, IFPRI, in collaboration with Oxford University and Addis Ababa University, collected a seventh round of the Ethiopia Rural Household Survey (ERHS) in 2009. The panel survey has been used to study several key development questions related to rural poverty over the last 20 years. The last three rounds of the survey—1999, 2004, and 2009—include detailed questions in the household roster about the permanent departure of a household member, the time of move, and the final destination. These data, combined with household information and exposure to natural disasters, were used to build a longitudinal dataset spanning a 10-year period to understand how gender-differentiated migration and migration type are correlated with droughts. Specifically, Gray and Mueller (2012a) employ binomial and multinomial choice models to measure the impact droughts have on the probability that a male or female did the following: moved within district or out of district (relative to no move), or moved for labor, marriage, or other reasons (relative to no move).

Table 1 displays the predicted probabilities of mobility conditional on drought exposure, as derived from the Gray and Mueller specification. Their results indicate a strong relationship between severe droughts and the movement of males for employment reasons. For example, as the climate conditions change from no drought to severe drought, the male migration

Table 1. Predicted probabilities of mobility for various levels of drought

		Men			Women		
Model	**Outcome**	*No drought (%)*	*Moderate drought (%)*	*Severe drought (%)*	*No drought (%)*	*Moderate drought (%)*	*Severe drought (%)*
Dichotomous	All mobility	5.7	6.1	9.8*	8.3	5.5**	7.5
Distance of migration	In district	3.2	2.5	3.3	4.9	2.9**	4
	Out of district	1.7	2.6	4.8**	2.5	2.3	2.9
Reason for migration	Labor	1.4	1.1	2.6+	0.1	0.1	0.2
	Marriage	1.1	1.2	1.4	4.8	2.6***	3.3**
	Other	1.5	2.1	2.7	1.5	1.3	2.4

Source: Gray and Mueller (2012a).
Notes: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.

rate for employment increases from 1.4 percent to 2.6 percent. The authors note that these predictions are more pronounced for males living in land-poor households, which is consistent with the use of migration as a method of last resort. Communal risk-pooling mechanisms available to Ethiopian households, such as burial societies (Dercon et al. 2008), may not be equipped to deal with widespread risk. Interestingly, male long-distance moves almost triple, which is also consistent with risk-coping. By increasing the distance between the migrant and the origin household, the households can reduce the correlation between origin and destination income risk (Rosenzweig and Stark 1989).

Applying a similar framework to that used in Ethiopia, Gray and Mueller (2012b) use a 15-year panel household survey, from 1994 to 2010 (part of IFPRI's Chronic Poverty and Long Term Impact Study in Bangladesh), to explore the relationship between population mobility, flooding, and crop failure in rural Bangladesh. The Bangladesh migration study has two unique features. First, the authors test for differences in migratory responses based on how widespread is the exposure to risk. In particular, they include variables that differentiate household from communal exposure to natural disasters. For dealing with idiosyncratic shocks, villages often have risk-sharing and informal lending arrangements (Udry 1990, 1994; Dercon et al. 2008; Armendariz and Morduch 2010). These informal arrangements are challenged in the event of widespread shocks, and the presence of local markets dependent on agricultural production less resilient (Jayachandran, 2006; Mueller and Osgood, 2009). Second, the authors focus on two types of natural disasters: flooding and crop failure. Displacement associated with flooding has received much attention in Bangladesh (see Findlay and Gedes, 2011 for a discussion). Many relief programs, however, have been specifically designed to target flood-exposed areas in the event of a major flood (Del Ninno et al. 2001; Quisumbing 2005). Unfortunately, there is a paucity of work on other natural disaster impacts in Bangladesh. These disasters may potentially be more damaging than flooding because there are so few institutions equipped to deal with them.

Gray and Mueller (2012b) find that, in fact, flooding has modest effects on mobility. Rather, crop failure attributable to drought has the strongest effects on mobility. Households in communities with widespread exposure to drought are more likely to move than ones limited to their own, personal exposure (see Table 2). For example, 10 percent of individuals who did not experience crop failure risk personally, but lived in a community where many faced such risk, moved away relative to 4.5 percent of individuals (with similar individual risk) who moved from a community with a low risk of crop failure. These patterns suggest that local adaptive capacity may be particularly limited in the event of widespread shocks outside of flooding.

Macroeconomic Evidence

The above microlevel evidence clearly demonstrates that extreme weather shocks, likely to magnify in frequency and intensity in the future (IPCC 2011), increase the economic incentives of individuals to migrate. While the microlevel approach has the advantage of identifying migration as a

Table 2. Predicted Probabilities of Population Mobility under Various Conditions of Crop Failure in Bangladesh

Exposure to crop failure		All moves	Within-district moves	Out-of-district moves	Person-years exposed
Subdistrict level	Household level				
<5% crop failure	No crop failure	4.5% ref	1.8% ref	1.8% ref	23,817
	Crop failure	3.2% +	1.3%	1.0%	290
5-20% crop failure	No crop failure	5.3% +	2.6% **	1.7%	6,027
	Crop failure	3.4%	1.7%	1.0% +	889
>20% crop failure	No crop failure	10.0% ***	5.0% ***	3.2% **	864
	Crop failure	6.6%	3.7% *	1.7%	343

Source: Clark and Gray (2012b).
Note: Asterisks indicate the significance of contrasts with the no-crop-failure condition: +P < 0.10, *P < 0.05, **P < 0.01, ***P < 0.001..

household-level coping strategy, it is difficult to know whether the relationship between climate and migration is drawn from a particular subset of countries that are particularly exposed and vulnerable to weather shocks. In other words, one may wonder whether such country-specific cases of environmental migration are systematic enough to constitute a global phenomenon. Furthermore, while most of the debate on this policy area focuses on the international consequences of climate change, little is known about the way climate-induced internal displacement may translate into international migration. Recent findings by IFPRI researchers provide theoretical and empirical explanations for such linkages.

Marchiori, Maystadt, and Schumacher (2012) use a theoretical model to describe how country-level dimensions of hazards, exposure and vulnerability to weather variations interact and link environmental push factors to rural–urban and international migration. Weather shocks are expected to have two effects. First, countries highly dependent on the agricultural sector will experience a fall in rural wages. This brings forth incentives for rural–urban migration. At the same time, a direct (amenity) effect, which is related to the possible spread of disease or a higher probability of death from flooding or excessive heat waves (World Bank 2010), induces incentives for urban–international migration. Second, the inflow of agricultural workers into the urban sector pushes urban wages down and gives further (economic) incentives for urban–international migration. The inflow of environmental migrants reduces average wages in the foreign country, and the economy moves back into a new equilibrium, where we now see a larger urbanization in the country that has experienced worsening weather conditions and a lower rural population, but also a lower total population due to the international migration.

Marchiori, Maystadt, and Schumacher (2012) test their predictions using a cross-country panel of Sub-Saharan African countries. They estimate a system of three equations that captures both direct (amenity) and indirect (economic incentives and urbanization changes) effects of weather anomalies on international migration. In line with the theory, their empirical model encompasses previous findings on the impact of weather variations on the level of urbanization (Barrios et al. 2006) and economic performance (Dell et al. 2009; Barrios et al. 2010). The results confirm the existence of a temperature-driven direct

Table 3. Direct and Indirect Effects of Weather Anomalies on International Migration

Regressions	(1) First-stage	(2) First-stage	(3) Second-stage
Models		**Fixed-effect two-stage least squares**	
Dependent variable	**GDP ratio**	**Urbanization**	**Net migration rate**
Rainfall anomalies	-0.023	-0.003	0.843
Temperature anomalies	-0.043***	-0.020**	2.841**
Rainfall anomalies* Agricultural dependence	0.049***	0.002	-1.258
Temperature anomalies* Agricultural dependence	0.008	0.045***	-4.253**
log (GDP p.c./GDP p.c.^{F})			21.58***
log (Urbanization)			67.51***
Observations	750	750	750
Number of countries	39	39	39

Source: Marchiori, Maystadt, and Schumacher (2012)..
Notes: ** significant at 5 percent; *** significant at 1 percent. GDP ratio is measured as the logarithm transformation of the ratio between the domestic GDP per capita and the GDP per capita in neighboring countries. Weather anomalies are computed as deviations of annual rainfall and temperature from the country's long-term mean (defined between 1901 and 2000), divided by its long-run standard deviation. Country-fixed effects, time and regional-time dummies, and other control variables are included in the above regressions.

effect on international migration and wages (proxied by relative GDP per capita) (see columns 1 and 3 of Table 3). Sub-Saharan African countries that have a large agricultural sector are particularly vulnerable. Weather anomalies increase the incentives to migrate out of one's country of origin and strengthen the urbanization process especially in agricultural-dependent countries (positive effects of the relative GDP per capita and the level of urbanization) (see column 3 in Table 3). Given the productivity gains associated with urban concentration, increased urbanization softens the impact of weather anomalies on international migration.

But overall, which effect dominates? Compared to what had been previously claimed, the phenomenon of environmental migration appears to be limited to a net figure of about 128,000 migrants due to climate anomalies over the period 1960–2000. However, the phenomenon is likely to magnify in the future. Under moderate scenarios, in terms of both climate and population changes, future climate changes could lead to an additional displacement of 5 to 24 million people every year by the end of the 21st century.[2] While there has been a long tradition of migration to the coastal areas in Africa, these locations could experience a significant proportion of their population fleeing toward the African mainland due to weather changes by 2099 (Figure 1). In Western Africa, the most affected countries include Benin, Ghana, Guinea, Guinea-Bissau, Nigeria, and Sierra Leone; in Eastern Africa, Kenya, Madagascar, Mozambique, Tanzania, and Uganda; in Southern Africa, Angola and Botswana; and in Central Africa, Congo and Gabon.

Policy and Research Challenges

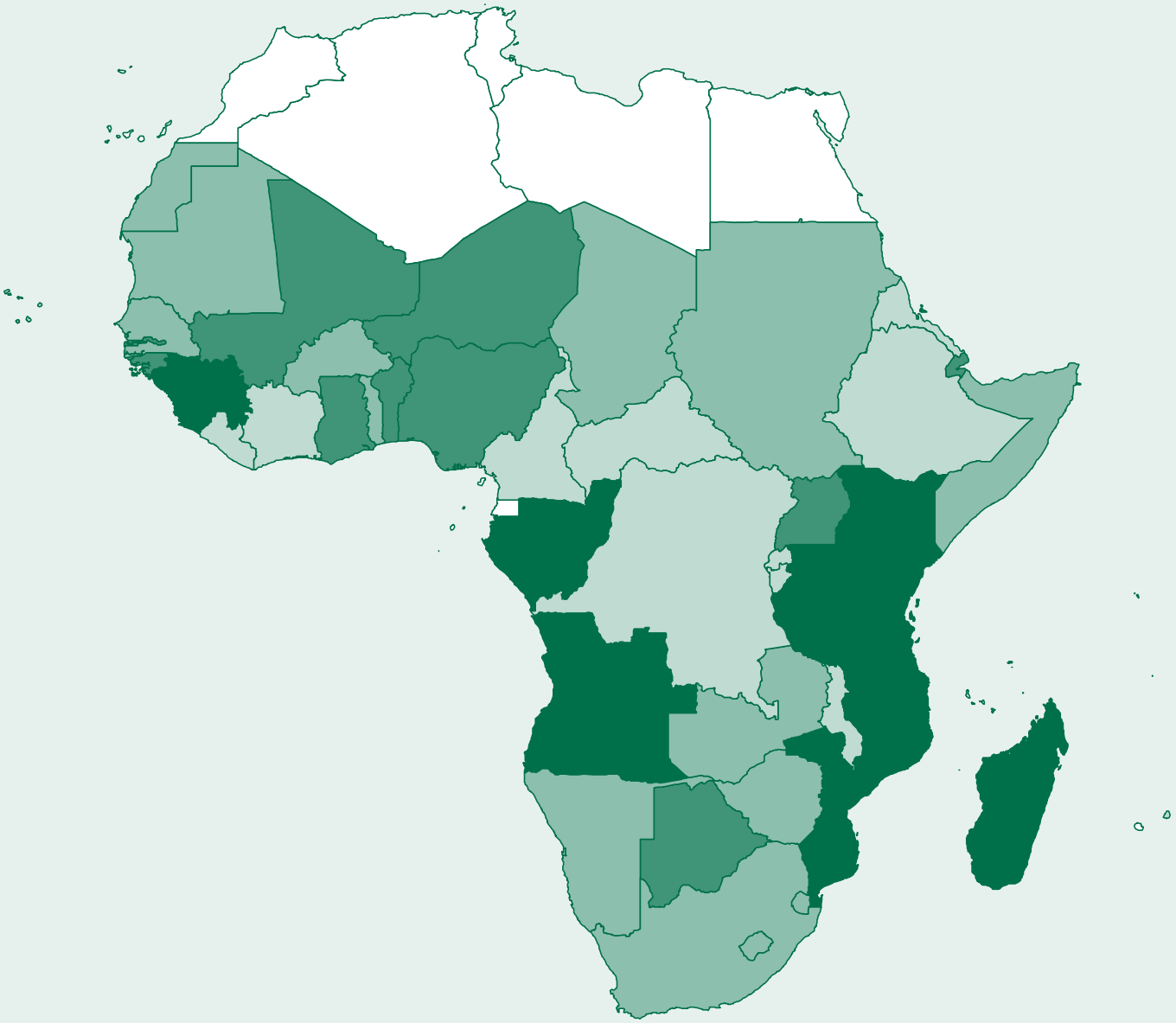
Recent empirical evidence has certainly improved our understanding of the complex relationship between climate and migration (see also Piguet et al. 2011 for a multidisciplinary review). Despite downsizing the dramatic projections that have been given in the past, recent evidence also indicates that migration is a common adapting strategy in developing countries. Environmental migration is likely to pose new challenges to policymakers in the decades to come. The most obvious recommendation is to promote policies that aim to make crops and livestock less sensitive to weather stresses and shocks. This may call for practices that encourage crop and livestock diversification, drought-resistant crop varieties and livestock species (Deressa et al. 2010), large investments in agricultural science and technology (Nelson et al. 2009), or protecting their assets (Fafchamps, Udry, and Czukas 1998; Kazianga and Udry 2006). Creating formal mechanisms to mitigate risk, such as insurance packages, can also help farmers cope with frequent shocks (Hill and Torero 2009). Enhancing the buffering role of urban centers may also call for further action to reduce congestion costs, improve infrastructure (e.g., public transport facilities and sanitation and water management), and remove internal migration barriers (e.g., guarantee property and transferability of migrants' rights).

Despite the recent empirical progress, important knowledge gaps still need to be addressed. First, there is a paucity of evidence on the migratory consequences of slow-moving climate phenomena. Most findings focus on weather shocks that require different adaptation strategies than those made necessary by a gradual change in climate. The main limitation of observing longer-term investments and responses to gradual climate change is that capturing behavioral and climatic trends requires access to surveys that cover a significant length of time.

Second, the literature also offers a very narrow view of migration by focusing on permanent moves. In fact, permanent moves are not the norm. Seasonal migration is more prevalent among the poor, yet it is not well documented in existing surveys (Banerjee and Duflo 2007). Circular migration (to and from rural areas) and stepwise migration (from less rural to more urban areas over a series of moves) are more common in Africa (UN-HABITAT 2010). A research challenge is to understand how the cumulative nature of environmental stresses and shocks may well turn repeated moves into permanent relocations. This conceptually, as well as empirically, calls for considering a more dynamic decisionmaking process—one that characterizes the elements that go into the selection process of household migrants as well as the information prior to the move that is used to inform future moves.

Third, little progress has been made with respect to quantifying the consequences of environmental migration. Too often, dramatic consequences are asserted for political reasons and not based enough on evidence (Piguet et al. 2011). The Malthusian assumption of increased pressure on natural resources following population inflows lacks empirical consensus. An emerging literature suggests rural migrants benefit from moving (Beegle, de Weerdt, and Dercon 2011), and could even benefit their hosting communities (Maystadt 2012). Recent work suggests origin communities might be better-off thanks to remittances that can be used for investment purposes (Yang and Choi 2007; Yang 2008; Quisumbing and McNiven 2010). Out-migration might also help communities under severe land pressure by providing households left behind with access to additional land. Lessons can be learned from new resettlement programs scattered across Sub-Saharan Africa that facilitate migration out of areas facing severe land and environmental constraints. Estimating the benefits of related programs on behalf of the individual participants and their origin and hosting communities could inform climate change policy particularly with respect to the development of long-term adaptation strategies.

Figure 1—Projected net environmental migrants per thousand of population, 2000–2099



Predicted net environmental migration from 2000 to 2099

- 5.21 to 7.38 (per thousand of population)
- 0 to 4.9 (per thousand of population)
- Not in sample
- -5.48 to 0 (per thousand of population)
- -7.41 to -5.99 (per thousand of population)

Source: Marchiori, Maystadt, and Schumacher (2012).

Notes

1. Use of the term *environmental refugee* in itself is contentious (Suhrke 1884; Kibreab 1997; Black 2001). The people crossing a border as a result of environmental damage would not be considered refugees by the mandate given to the United Nations High Commissioner for Refugees (UNHCR) by the 51 Convention of Geneva, but they would be counted as migrants in national statistics. We therefore refer to studies that document the movement and behavior of "environmental migrants," not refugees.

2. Moderate scenarios refer to the IPCC climate scenario A1B, which assumes an increasing but moderate emission trajectory over the 21st century, a more and more integrated world with rapid economic growth, and a world population peaking around 2050 and settling at 7.1 billion in 2100 (Christensen et al. 2007).

References

NOTE: Due to space constraints, it is not possible to include all references in this research brief. The full reference list is available online at http://www.ifpri.org/publication/environmental-migrants.

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