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# CLIMATE CHANGE AND MIGRATION DYNAMICS

By Kathleen Newland

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## Executive Summary

Climate change is a new driver of human migration that many people expect will dwarf all others in its impact. But some of the most commonly repeated predictions of the numbers of people who will be displaced by climate change are not informed by an understanding of migration dynamics. Displacement is almost always a result of a complex mix of factors; people adapt to changes and governments (and a few other powerful actors) can influence what kind of movements take place in response to environmental changes. A combination of exposure to natural hazards, poverty-related vulnerability, and resilience (the ability to adapt) determine which regions and societies are most likely to suffer negative effects of climate change. Family and community networks, historical ties, proximity, and ease of access all help to determine where people will go if they feel compelled to move.

The most important mechanisms of displacement are sea-level rise, higher temperatures, disruption of water cycles, and increasing severity of storms. Prevention of climate-related displacement may be *obstructive*, focused on blocking migrants from arriving at their intended destinations, or *constructive*, helping people to maintain their livelihoods in the face of climate change and accommodating their movement as necessary.

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International cooperation is essential for a successful response to climate change. Policy responses to the multiple impacts of climate change need to proceed on several tracks at once, in different time frames. The necessary short-term response to sudden-onset disasters is humanitarian assistance; in the medium term, global efforts should focus on building resilience through adaptation. In the long term, purposeful mitigation of global warming may bend back the curve of climate change. Progress thus far on the mid- and long-range tasks has been very slow. Both technical and financial support from the industrialized states for adaptation in the most vulnerable countries is urgently needed, and it does not need to wait for new scientific breakthroughs. Many of the near-term manifestations of climate change will look very much like the consequences of longstanding human abuse of land and water resources. The measures that can be taken to preserve or restore rural livelihoods and the natural amenities that support large urban areas are the same measures that will reduce vulnerability and promote resilience and adaptation in the face of climate change.



## I. Introduction

The dangers of global warming on the earth's climate are felt by many national and global policymakers to require an urgent policy response. There is much less agreement, however, about what kinds of effects will be felt where, by whom, and precisely when. One fear that is often articulated but seldom explained with any precision is that the impact of climate change will trigger a historically unprecedented wave of international migration, which will dwarf the refugee flows that the international system barely copes with now. Indeed, some writers estimate that more than 200 million people could be displaced by climate change by 2050,<sup>1</sup> a number approximating the United Nations' (UN) estimate of the total number of international migrants in the world today.

Such estimates, which vary widely, usually come from climate-change experts; the higher figures are regarded by serious observers as more useful for advocacy than analysis. There has been little interaction between specialists on climate change and those on migration. As a result, most calculations of climate-induced migration are mechanistic: if they assume a sea-level rise of one meter, for example, the knowledge that 100 million people live no more than one meter above sea level generates the conclusion that 100 million people will be displaced. No allowance is made for adaptation to changes, or for the ability of governments (and a few other major actors) to influence the pattern of migration flows induced by climate change. Nor is it emphasized that most migration related to climate change is likely to take place within rather than across national borders.

A view of migration responses to climate change informed by migration dynamics and policy paints a much more nuanced picture. Displacement is almost always a result of a complex mix of factors. For example, the conflict in Darfur has been described by the United Nations Secretary-General, among others, as an environmental conflict, with drought leading different groups of people to move into each others' territory. Desiccation and a rise in average temperatures (which reduces plant and animal productivity in marginal areas of the tropics) may have contributed to the tensions that led to fighting, alongside ethnic conflict, power politics, and competition for control of the energy resources of the region — all playing out against a longstanding background of resource competition between nomadic pastoralists and settled farmers. Climate change will increase that competition in the region if trade, remittances, and humanitarian relief do not compensate for greater food and water insecurity (as they are unlikely to do while fighting continues). Nevertheless, the explanation of the conflict and resulting migration cannot be reduced to a single cause.

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*Most calculations of climate-induced migration are mechanistic.*

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While climate change will affect the whole planet, some areas of human habitation will be affected more than others. The global risk management firm Maplecroft concluded in 2010 that emerging economies in Asia and Africa are most vulnerable to climate change, specifically Bangladesh and India.<sup>2</sup> The firm's Climate Change Vulnerability Index combines exposure to natural hazards (droughts, severe storms, landslides, etc.) with poverty-related vulnerability and resilience (adaptation capacity) to calculate a country's risk. Bangladesh is in first place because of its poverty and densely populated, low-lying coastal delta. India is second, ranked highly because of the strain its huge, poor population exerts on natural resources. The remaining countries in the top ten for vulnerability were Madagascar, Nepal, Mozambique, Philippines, Haiti, Afghanistan, Zimbabwe, and Burma.<sup>3</sup> Mexico was the Organization for

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1 Nicholas Stern, *The Economics of Climate Change: The Stern Review* (London: HM Treasury, 2007), <http://siteresources.worldbank.org/INT/INDONESIA/Resources/226271-1170911056314/3428109-1174614780539/SternReviewEng.pdf>.

2 Maplecroft, *Climate Change Risk Atlas 2011* (Bath, UK: Maplecroft, 2010).

3 Alister Doyle, "Bangladesh, India most at risk from climate change," Reuters, October 19, 2010,



Economic Cooperation and Development (OECD) member country at greatest risk, and Norway was the least vulnerable of the 170 countries ranked.<sup>4</sup>

When the pressure to migrate increases for any reason, another complex combination of factors will be involved in decision making about whether to leave and where to go, and if so, for how long, and by what means. Migration patterns are not random, however, and while complex, are not entirely unpredictable. Financial resources, social networks, accessibility of the destination, and ethnic, linguistic, or historical ties may all enter into this calculation. If they can, people are likely to move to places where they have family or at least acquaintances. They will avoid extremely dangerous zones of transit if they have a choice *and* accurate information. At the same time, some migrants will find only a very limited range of choices open to them or will be subject to compulsory action. Most migration is short range, within a country or over a nearby border.

It is fairly easy to predict, for example, that the direction of migration flows resulting from climate change (like other migration flows) will be influenced by proximity, historical (often colonial) ties, and ethnic or linguistic affinity. As with migration resulting from the current political turmoil in the Middle East and North Africa, climate-influenced migration from the same region would likely move toward the closest European land masses across the Mediterranean. Emigration from Mexico, Central America, and the Caribbean is more likely to move toward the United States and Canada, with the exception of some who are permitted to move to the territory of former colonial or current metropolitan powers. The residents of the UK territory Montserrat, for example, were allowed to resettle in Britain following the volcanic eruption that rendered the island virtually uninhabitable; the same treatment might be accorded residents of small island metropolitan regions or former colonies forced to emigrate because of climate change. Residents of Martinique, Guadeloupe, St. Martin, and St. Barthelemy could expect to have access to France, as could those of Sint Maarten and Aruba to the Netherlands. This pattern could be repeated in the Indian Ocean and the Pacific, although in the latter the roles of Australia and New Zealand are already more important as countries of destination.

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The prospects for climate-related migration out of the heavily populated Asian mega-deltas, near-deserts, and mountain regions are more problematic. Adjacent countries are themselves poor and heavily populated, and are facing their own climate-change problems. The likelihood is that most migration in these regions will be internal, rural-to-urban, or across adjacent borders without authorization. India is already building a fence along parts of its border with Bangladesh to inhibit illegal inflows of people.<sup>5</sup> Such responses may intensify if climate change results in increased migration pressures.

Potential policy responses to increased migration resulting from the effects of climate change cover a range from purely defensive to proactive. States may do nothing in the face of such migration beyond reinforcing their borders in an effort to ensure that unwelcome migrants cannot access their territories, or trying to expel those who enter without authorization — similar to their actions now, but presumably reinforced in the face of heightened migration pressures.

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[www.reuters.com/article/2010/10/19/us-climate-bangladesh-idUSTRE69I6LE20101019](http://www.reuters.com/article/2010/10/19/us-climate-bangladesh-idUSTRE69I6LE20101019).

4 Ibid.

5 Bidisha Benerjee, "The Great Wall of India," Slate, December 20, 2010, [www.slate.com/id/2276362/](http://www.slate.com/id/2276362/).



Alternatively, states may provide humanitarian assistance to those adversely affected by climate change, hoping to tide them over until circumstances improve or resolutions other than international migration emerge. A more forward-looking policy response would be to support vigorously the efforts of states badly affected by climate change to help their people adapt to changed environments through financial, scientific, technical, and other forms of concerted assistance. It is theoretically possible that states would respond to climate-related displacement by offering national protection to the displaced and admitting them to resettle in national territory, but it is extremely unlikely that states will go beyond a very small number of humanitarian admissions related to climate change.

Part of the reason that states have not established clear policies relevant to migration induced by climate change is that the phenomenon is very difficult to identify. The occurrence of any single rapid-onset disaster, such as a severe storm, is difficult to attribute to climate change although it is clear that such events are becoming more common.<sup>6</sup>

## II. Climate-Related Mechanisms of Displacement

Climate change can affect the movement of people through at least four primary effects: rising seas levels, higher surface temperatures, disruption of the hydrological cycle, and more frequent severe weather events. Whether singly or in combination, these forces will have a profound effect on human settlement patterns, food and water security, the spread of water- or vector-borne diseases, and competition for nonextractive resources (possibly leading to violent conflict). Each of these can lead to migration directly, as people try to escape the negative effects, or indirectly, as people flee resulting violent conflict or political instability.

Long-term projections of the primary effects of climate change are subject to considerable uncertainty. According to World Bank estimates, if the sea level rises by one meter by the end of this century, 37 million people in East Asia will be affected.<sup>7</sup> Shorter-term projections can be more confident, although the possibility of more rapid global warming than is currently foreseen cannot be ruled out. Planning for the unknown on a very long time scale is practically beyond the experience of modern policymakers. But even the more reliable projections for the next quarter-century pose enormous challenges.

### A. Sea-Level Rise

It is predicted that the current levels of carbon dioxide in the atmosphere will produce warming sufficient to raise the sea level by between 17 centimeters and 29 centimeters in the next 40 years.<sup>8</sup> Two mechanisms are at work: the melting of water that has until recently been tied up in glaciers and the polar ice caps and the slight increase in volume that warmer water occupies compared to colder water. Projections of a one meter rise by the end of the century are considered conservative by many climate scientists.

Some countries will be much more severely affected than others. Egypt, Bangladesh, Vietnam, India, and China — all countries that have high-density populations and the most productive agricultural lands

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6 John Carey, "Storm Warnings: Extreme Weather Is a Product of Climate Change," *Scientific American*, June 28, 2011, [www.scientificamerican.com/article.cfm?id=extreme-weather-caused-by-climate-change](http://www.scientificamerican.com/article.cfm?id=extreme-weather-caused-by-climate-change).

7 Susmita Dasgupta, Benoit Laplante, Craig Meisner, David Wheeler, and Yan Jianping, "Sea Level Rise: Potential Impact on Developing Countries," (World Bank Policy Research Working Paper 4136, February 2007), [www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/02/09/000016406\\_20070209161430/Rendered/PDF/wps4136.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/02/09/000016406_20070209161430/Rendered/PDF/wps4136.pdf).

8 Projections by Debbie Hemming, Jason Lowe, Mathew Biginton, Richard Betts, and Derrick Ryall cited in Oli Brown, "Climate Change and Forced Migration: Observations, Projections and Implications," (IOM Research Series No. 31, International Organization for Migration, Geneva, November 2008), [www.iisd.org/pdf/2008/migration\\_climate.pdf](http://www.iisd.org/pdf/2008/migration_climate.pdf).





in low-lying coastal areas and river deltas —are most at risk, along with small island states. And 16 of the world's 22 largest cities are seaports.<sup>9</sup> The risks for these areas: flooding in the short term and the inundation of substantial areas in the longer term. Some very low-lying island states such as the Maldives could disappear altogether. The large countries among these will most likely see the majority of affected people migrate internally; in other cases, people will try to move to neighboring countries (India in the case of Bangladesh, China in the case of Vietnam) or farther away if some migration links have been established earlier (Vietnamese with relatives in the United States, for example).

## **B. Higher Temperatures**

Climate experts note that the optimal temperature zone for crop yields will shift with global warming. Research by William R. Cline of the Center for Global Development and the Petersen Institute for International Economics shows that average temperatures in parts of the tropics are already near the upper level for profitable crop production. A small rise in temperature of only a degree or two could therefore seriously reduce crop production in a number of countries where many people already live near the edge of viability.<sup>10</sup> The African countries of the Sahel (fringes of the Sahara Desert) are affected by this climate shift, which is already observable, but so are Northeastern Brazil and the Thar Desert in Northwest India and Southeast Pakistan (the most densely populated desert in the world). More northerly zones (and the limited land masses in southern temperate zones) could see some increase in production, both from longer growing seasons and the positive effects of an atmosphere richer in carbon dioxide. It is unlikely however that large-scale migration toward more productive agricultural areas in the north would occur, since labor in temperate-zone agriculture is so highly productive. Only 2 percent of the population of the United States is employed in agriculture, for example, compared to 54 percent in Bangladesh.

Warmer temperatures will also increase the vulnerability of human populations to water- borne diseases that thrive in warmer waters (e.g. cholera) and vector-borne diseases such as malaria. It is not clear that this in itself will lead to migration, although if public health measures and treatment fail to compensate for the increased possibility of exposure, increased health risk could enter the migration calculus for some people as one of many factors.

## **C. Disruption of Water Cycles**

Climate change will lead to severe disruption of the hydrological cycle, with different patterns of rainfall leading to both increased drought and flooding. Glacial melting could render the water flow in major river systems less reliable; much precipitation now falling as snow and held in mountain snowcaps and glaciers released gradually throughout the year could fall as rain or melt faster, resulting in quicker runoff. Some year-round river flows could become seasonal. Less rainfall over large land masses would imperil seasonal agriculture and lead to increased infiltration of seawater into rain-fed aquifers. The resulting impact is reduced food security — indeed, these effects are already being felt in the Sahel, prompting people to move to more prosperous countries in nearby regions (such as Côte D'Ivoire, until the outbreak of conflict) or to attempt the hazardous migration route to Europe.

Past experience of drought-related migration shows that permanent migration is not a routine response. Migration did not rise in the Senegal River basin in Mali during the droughts of 1983-85.<sup>11</sup> A study of Burkina Faso in the 1980s, which sought to explain the causes of migration, found that the variable

9 United Nations Department of Economic and Social Affairs (UNESA) Population Division, *World Urbanization Prospects: The 2005 Revision* (New York: United Nations, 2006), [www.un.org/esa/population/publications/WUP2005/2005wup.htm](http://www.un.org/esa/population/publications/WUP2005/2005wup.htm).

10 William R. Cline, "Global Warming and Agriculture: New Country Estimates Show Developing Countries Face Declines in Productivity," (CGD brief, Center for Global Development, Washington, DC, September 2007), [www.cgdev.org/files/14425\\_file\\_CGD\\_Global\\_Warming\\_Final.pdf](http://www.cgdev.org/files/14425_file_CGD_Global_Warming_Final.pdf).

11 Sally E. Findley, "Does Drought Increase Migration? A Study of Migration from Rural Mali during the 1983-1985 Drought," *International Migration Review*, 28, no. 3 (1994): 539-53.





“drought frequency” explained only 0.8 percent of the 73 percent explanatory value of the model.<sup>12</sup> During the severe drought in Bangladesh in 1994-95, migration occurred in less than 1 percent of affected households.<sup>13</sup>

Other droughts have been associated with large-scale migration, as in the Sahel in the early 1970s. But the relationship is not simple. A study of the four main periods of drought in the Great Plains of the United States found that migration *decreased* over time, even in drought periods of comparable intensity.<sup>14</sup> Technology, government assistance, and a more diversified economy all played a role in the reduced migration response. In more recent periods of drought in the Sahel migration has not risen and may even have declined — people need some resources in order to move, and those impoverished by years of declining agricultural yield due to drought are the very ones who do not have the means to do so. Nonetheless, residence in an arid region, which is the lot of one-sixth of the world’s population, must be considered a risk factor (one among many) for displacement in the face of climate change.

Long-term food insecurity, often associated with disruption of the hydrological cycle in a given region, is probably the most predictable motive for migration associated with climate change, although climate change is difficult to disentangle from other factors that depress crop yields and motivate people to relocate. Migration as a result of food insecurity has many root causes, including inequitable land tenure systems, land degradation from other sources such as overgrazing and deforestation, trade patterns, and subsidies of developed-country production that lower prices for agricultural commodities produced in developing countries, and so forth. All are implicated in the large rural-to-urban migrations of the past four decades, as well as other patterns of internal migration. As with most other manifestations of climate change, the relationship between water insecurity and migration, especially international migration, is complex and nonlinear.

#### D. Severe Storms

The increased incidence and ferocity of cyclones, hurricanes, typhoons, tornadoes, and other storms is probably the most visible threat associated with climate change in the minds of most people. The link between severe weather events (often called “natural” disasters) and migration is concrete — but most of the associated migration is temporary rather than permanent. One study of 18 different sites affected by natural disasters<sup>15</sup> in 12 different countries concluded that only three sites experienced a significant proportion of people (about 10 percent) considering permanent migration.<sup>16</sup> The regions most affected by severe storms include the Bay of Bengal (especially Bangladesh with its dense coastal and island populations of very poor people), the island and littoral regions of the Caribbean, and the Eastern Pacific.

The primary reason for initial displacement following a severe storm is structural damage, which leads to loss of shelter, income, and public utilities. The decision to migrate permanently depends on many factors, including the availability of insurance before the event, the effectiveness of emergency relief, the destruction of income-producing opportunities for individuals, and the level of investment that survives the event, such as homes, places of business, or equipment. Wealthier people who have more assets are less likely to migrate than those who are poorer, as shown in the case of Hurricane Katrina in New

12 Sabine Henry, Bruno Schoumaker, and Cris Beauchemin, “The Impact of Rainfall on the First Out-Migration: A Multi-level Event-History Analysis in Burkina Faso,” *Population and Environment*, 25, no. 5 (2004): 423-60, [www.springerlink.com/content/u5564mt67rn28220/](http://www.springerlink.com/content/u5564mt67rn28220/).

13 Bimal Kanti Paul, “Evidence against disaster-induced migration: the 2004 tornado in north-central Bangladesh,” *Disasters*, 29, no. 4 (2005): 370-85, <http://onlinelibrary.wiley.com/doi/10.1111/j.0361-3666.2005.00298.x/abstract>.

14 Richard A. Warrick, “Drought in the Great Plains: a Case Study of Research on Climate and Society in the USA,” in *Climatic constraints and Human Activities*, eds. Jesse Ausubel and Asit K. Biswas (Oxford: Pergamon Press, 1980).

15 A natural disaster is a catastrophe caused by natural hazards, which may be exacerbated by human action. Thus, a landslide is a natural hazard in a mountainous area, but can be made more likely to occur because of deforestation. Flooding is a natural hazard, but can be made more likely and more severe by climate change-induced disruption of the hydrological cycle. When a natural hazard is exacerbated by human action, such as global warming, it is fair to ask whether the resulting disaster should be called “natural.”

16 Ian Burton, Robert W. Kates, and Gilbert F. White, *The Environment as Hazard*, 2<sup>nd</sup> edition (New York: Guilford Press, 1993).



Orleans. Several years after the storm, the smaller remaining population in the city was less poor and less heavily composed of disadvantaged minority communities than before.

Opportunities to migrate internationally are also an important factor in poorer countries; Hurricane Mitch, which struck Honduras and severely affected other Caribbean countries in 1998, still holds the record as the second deadliest hurricane on record (behind a storm in 1780). Mitch killed more than 20,000 people and left about 2.7 million homeless. As a result of the hurricane, the US government gave Temporary Protected Status (TPS) to residents of Honduras who were in the United States at the time of the storm, thus granting them legal permission to remain in the country for an abbreviated time, even if they were unauthorized at the time of the TPS designation or had visas that expired in the aftermath.

Emergency preparedness, early warning systems, disaster risk reduction, and humanitarian relief have greatly reduced the death toll from climate-related disasters in most places. But the long-term impact will depend on the availability of local employment and income opportunities, and the access to alternative locations for resettlement.

### III. Vulnerability, Resilience, and Adaptation

The **vulnerability** of human populations to climate change lies at the intersection of exposure and the availability of resources to cope with the impact of such exposure. People who live in areas of high exposure with few resources are the most vulnerable, such as poor fishermen living on the coasts and coastal islands of Bangladesh.

A population's **resilience** in the face of climate change depends on access to human, social, political, and financial capital that allows individuals and their communities to recover from destructive episodes (such as a flood or a storm). Attempts to prevent migration associated with climate change can be obstructive or constructive. Obstructive prevention involves the construction of both physical and bureaucratic barriers to movement. The United States, India, and Israel have all constructed partial walls to obstruct movement from Mexico, Bangladesh, and the West Bank respectively, while Western Europe and the United States both try to protect their sea borders with marine patrols. Nonetheless, there are an estimated 11 million unauthorized migrants in the United States, and between 1.9 million and 3.8 million in the European Union.<sup>17</sup> Stricter visa regimes and internal enforcement efforts are part of the attempt to deter migration. Both forms of prevention could be expected to increase with migration pressures.

More constructive attempts to prevent migration associated with climate change assist people in their **adaptation** to new circumstances. These efforts include flood protection, land reclamation, engineering for more productive land use (including time-honored techniques such as terraces, wind-breaks, and irrigation), and the development of crop varieties more resistant to flooding, drought, higher temperatures, and increased salinity. For some people, it will also include relocation. The Maldives, the low-lying archipelago nation in the Indian Ocean, has repeatedly been cited as an almost certain casualty of climate change. Because the islands could be wiped out by even small rises in sea level, the government has begun taking small steps to secure land to relocate its entire population of 380,000.<sup>18</sup>

17 Department of Homeland Security (DHS) Office of Immigration Statistics, *Estimates of the Unauthorized Immigrant Population Residing in the United States: January 2010* (Washington, DC: DHS Office of Immigration Statistics, 2011), [www.dhs.gov/xlibrary/assets/statistics/publications/ois\\_ill\\_pe\\_2010.pdf](http://www.dhs.gov/xlibrary/assets/statistics/publications/ois_ill_pe_2010.pdf); Dita Vogel, "Size and Development of Irregular Migration to the EU" (policy brief, Clandestino Research Project, Hamburg Institute of International Economics, December 2009), [http://clandestino.eliamep.gr/wp-content/uploads/2009/12/clandestino\\_policy\\_brief\\_comparative\\_size-of-irregular-migration.pdf](http://clandestino.eliamep.gr/wp-content/uploads/2009/12/clandestino_policy_brief_comparative_size-of-irregular-migration.pdf).

18 Sumon K. Chakrabarti and Saeed Ahmed, "Sinking island's nationals seek new home," CNN, November 11, 2008, <http://edition.cnn.com/2008/WORLD/asiapcf/11/11/maldives.president/index.html>.



Migration is one of the forms of adaptation. The ability to migrate is itself a resource, dependent on family and social ties as well as government policies and capabilities. Governmental incentives for internal migration have a mixed record of success. The Soviet determination to develop the steppes west of the Urals for wheat and cotton production led to one of the great ecological disasters of modern times. On the other hand, several countries such as Brazil, Burma, India, Kyrgyzstan, and Nigeria have developed new cities in their interior lands — although not for purposes of adapting to climate change — which demonstrate that even poor countries can engineer new population centers.

Grand-scale engineering works of the sorts that have protected the Netherlands from the sea for centuries are often dismissed as an option for poor countries. Yet the Yellow River in China has been diked for so long that the river bed is actually above the level of the surrounding plain. And the heavily engineered landscapes of rice-growing East Asia, such as those in Bali and parts of the Philippines, show that even poor societies are capable of major adaptation of their environments. The scarce resources in poor countries today are less financial than social and political — the consensus on collective action to construct and maintain such systems.

## IV. International Cooperation

Foreign assistance has played a role in the construction of major infrastructure such as dams and flood-control projects in developing countries, as well as in the development of more productive and more disease- and drought-resistant crop varieties. But there is no certainty about what level of external resources might be applied to ameliorating migration pressures associated with climate change, or how. Financial aid could be applied to adaptive responses, confined to humanitarian assistance for people displaced by climate-related disasters, and to ad hoc assistance to affected countries. An example of the former is the collaboration of the European Commission, the UK Department for International Development, and the UN Development Program to support Bangladesh's Comprehensive Disaster Management Program, which combines early warning, disaster-risk reduction, and poverty reduction in a whole-of-government program to reduce vulnerability to environmental hazards.<sup>19</sup>

International cooperation also could be applied to migration as a response to the loss of human habitat. It seems extremely unlikely that mass relocation on a very large scale will be planned or implemented deliberately. There are, however, examples of small-scale proactive cooperation. New Zealand has already established an annual migration quota from the island nation of Tuvalu and agreed that the entire population of 12,000 may immigrate in case of complete inundation. In a similar but not climate-related arrangement, the United States permitted virtually the entire population of the British Caribbean island of Montserrat to enter the United States on a temporary basis, on humanitarian grounds, after a catastrophic volcanic eruption in 1995. When it became clear that the island would not become habitable again in the foreseeable future, however, this temporary status was revoked as inappropriate, and those of the affected people who did not have another source of entitlement to remain in the United States (such as having married a citizen or legal permanent resident) were resettled in Britain. By contrast, multiple natural and political disasters in Haiti, including two severe hurricanes in 2008, did not trigger a migration response until the earthquake of 2010, after which Haitians in the United States were granted TPS.

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19 UK Parliament International Development Committee, "Responding to climate change and natural disasters," Department for International Development's (DfID) Programme in Bangladesh, March 4, 2010, [www.publications.parliament.uk/pa/cm200910/cmselect/cmintdev/95/9508.htm](http://www.publications.parliament.uk/pa/cm200910/cmselect/cmintdev/95/9508.htm).



## V. Recommendations

Many of the near-term manifestations of climate change will look very much like the consequences of perennial human abuse of land and water resources. The results of over-grazing, deforestation, poorly designed irrigation systems (with inadequate drainage and resulting salinity), unsustainable rates of groundwater exploitation, and the absence of soil conservation measures have reduced the productivity of crops and livestock, and undermined the viability of rural economies for decades — perhaps even centuries. Migration, mostly rural-to-urban and seasonal, has long been a response to these environmental pressures as they interact with other forces. The measures that can be taken to preserve or restore rural livelihoods and the natural amenities (such as watersheds) that support large urban areas are the same measures that will reduce vulnerability and promote resilience and adaptation in the face of climate change.

No precise understanding of the course of climate change is needed to guide a major effort to help the residents of vulnerable areas adapt to its effects. Some of the “environmental amenities” that are damaged by climate change could be restored by careful management of forests, water resources, steep hillsides, and grasslands. In Mexico, for example, a move toward community management covers 60 percent to 80 percent of all remaining forest lands. Forest cover is increasing as a result, which will help stabilize the hydrological cycle.<sup>20</sup>

In the context of climate change, the staggering inefficiency of developing country agriculture can be seen as a resource. It is widely estimated that half of all the food produced in developing countries spoils before it can be consumed — an important cushion for food security, since known techniques can improve marketing, delivery, and storage systems. Similarly, conversion of flood or sprinkler irrigation to drip irrigation can save a high proportion of the water needed to support crops in arid and semi-arid areas. But of course, action must be taken to realize these potential gains.

A number of existing initiatives and opportunities must be strengthened. The United Nations Framework Convention on Climate Change (UNFCCC) has established a database of adaptation examples, but it is at present very thin. Support for community-based analysis and adaptation is practical and within reach of both public- and private-sector donors. Forty-four countries have filed National Adaptation Plans of Action with UNFCCC. International assistance could and should be applied to these adaptive responses, since they can raise the quality of life for people living in marginal areas long before the impact of greenhouse gas reduction is felt. But the formal establishment and subsequent flow of money into the Green Climate Fund have been slow. The fund is a new institution that will manage up to US\$100 billion per year (by 2020) pledged by industrialized countries to help developing countries mitigate the effects of climate change.<sup>21</sup> Europe and North America should lead the way in funding adaptation in vulnerable developing countries, knowing that many of the kinds of projects involved are standard good practice for promoting development as well climate resilience.

## VI. Conclusion

For the near term, palliative actions such as humanitarian assistance and small-scale relocation seem much more likely than long-term preventive and adaptive action. Most migration in response to climate

20 Elisabeth Malkin, “Growing a Forest and Harvesting Jobs,” *New York Times*, November 22, 2010, [www.nytimes.com/2010/11/23/world/americas/23mexico.html](http://www.nytimes.com/2010/11/23/world/americas/23mexico.html).

21 United Nations Framework Convention on Climate Change (UNFCCC), “Transitional Committee for the design of the Green Climate Fund,” accessed August 29, 2011, [http://unfccc.int/cooperation\\_and\\_support/financial\\_mechanism/green\\_climate\\_fund/items/5869.php](http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php).

change will be internal to the affected countries. The time horizon of major policy change suggests that crises will be dealt with as they arise. Whether the capacity to respond can keep up with the need, however, is even more unpredictable than the precise course of climate change itself.

Policy responses to the multiple impacts of climate change need to proceed on several tracks at once, with different temporal frameworks. The necessary short-term response is humanitarian, both in the context of sudden climate-related disasters such as cyclones and that of the slow erosion of food and water security and access to other basic needs. Humanitarian programs could be supplemented with broad risk-sharing programs such as the Munich Climate Insurance Initiative.<sup>22</sup>

The medium-term response should focus on adaptation at the community and country levels, aimed at building resilience in populations at risk from environmental deterioration caused by climate change (or any other causes). Adaptation concerns the more efficient use of natural resources, the restoration of degraded environments, and the intelligent use of both low and high technologies. But it also requires building the human and institutional resources to design and implement policies and programs for protection against the negative effects of climate change.

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*Most migration in response to climate change  
will be internal to the affected countries.*

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Long-term policies must, of course, be aimed at mitigation of greenhouse gas emissions in order to bend back the curve of global warming. This will require both completely new time horizons for policymaking and unprecedented levels of international cooperation.

Climate change, other things being equal, is likely to reduce the security of people's livelihoods in certain environments, and that process may encourage many of them to migrate. The policy challenge is to make sure that other things are *not* equal — in other words, to take steps to increase the productivity of natural systems and strengthen the resilience of the human communities that depend on them.

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22 Sven Harmeling, "Global Climate Risk Index 2009: Weather Related Loss Events and Their Impacts on Countries in 2007 and in a Long-Term Comparison," (briefing paper, Germanwatch, Bonn, December 2008), [www.preventionweb.net/files/8658\\_cri2009.pdf](http://www.preventionweb.net/files/8658_cri2009.pdf).





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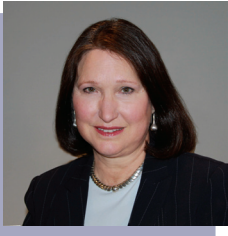


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