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BY **JASON BREMNER** AND **LORI M. HUNTER**

MIGRATION AND THE ENVIRONMENT

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Population Bulletin

MIGRATION AND THE ENVIRONMENT

BY **JASON BREMNER** AND
LORI M. HUNTER

TABLE OF CONTENTS

INTRODUCTION	2
Figure 1. Current and Future Population Exposure to Inundation in a 100-Year Storm Event Due to Sea Level Rise	3
DOES A CHANGING ENVIRONMENT CONTRIBUTE TO MIGRATION?	3
RESEARCH HIGHLIGHTS	4
Figure 2. Distribution of the Population in New Orleans by Race/Ethnicity, 2005 and 2012	4
Table. Deaths in the U.S. From Natural Disasters by Type, 1970-2004.....	5
Figure 3. A Continuum of Environmental Pressures That Contribute to Migration	5
Box 1. The Differential Impact of Floods and Heat Stress on Migration in Rural Pakistan	7
Box 2. Migration and Environment in Coastal Areas	9
DIFFERENT PRESSURES REQUIRE DIFFERENT POLICIES AND PROGRAMS	9
Box 3. RISE.....	10
CONCLUSION	10
REFERENCES	11

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MIGRATION AND THE ENVIRONMENT

A major concern is whether climate change will displace large numbers of people around the world.

**\$100
BILLION**

Estimated property damage due to Hurricane Katrina.

10%

The share of the world's population living in coastal areas that are less than 10 meters above sea level.

Environmental migrants are more likely to move short distances than across international borders.

Throughout human history, people have been on the move—exploring new places; pursuing work opportunities; fleeing conflict; or involuntarily migrating due to changing political, social, or environmental conditions.

Today there are an estimated 230 million international migrants, a number that is projected to double to over 400 million by 2050.¹ Beyond the people who cross international borders, probably more than two to three times as many are internal migrants, people who have moved within their own countries.²

The reasons for moving are complex, but over the past decade, as the evidence of global climate change has accumulated, academics, policymakers, and the media have given more attention to migration as a result of environmental change.

A major concern is whether climate change will displace large numbers of vulnerable people around the world. For example, because of rising sea levels, the population exposed to flooding during extreme storms is expected to grow dramatically over the coming decades (see Figure 1, page 3).

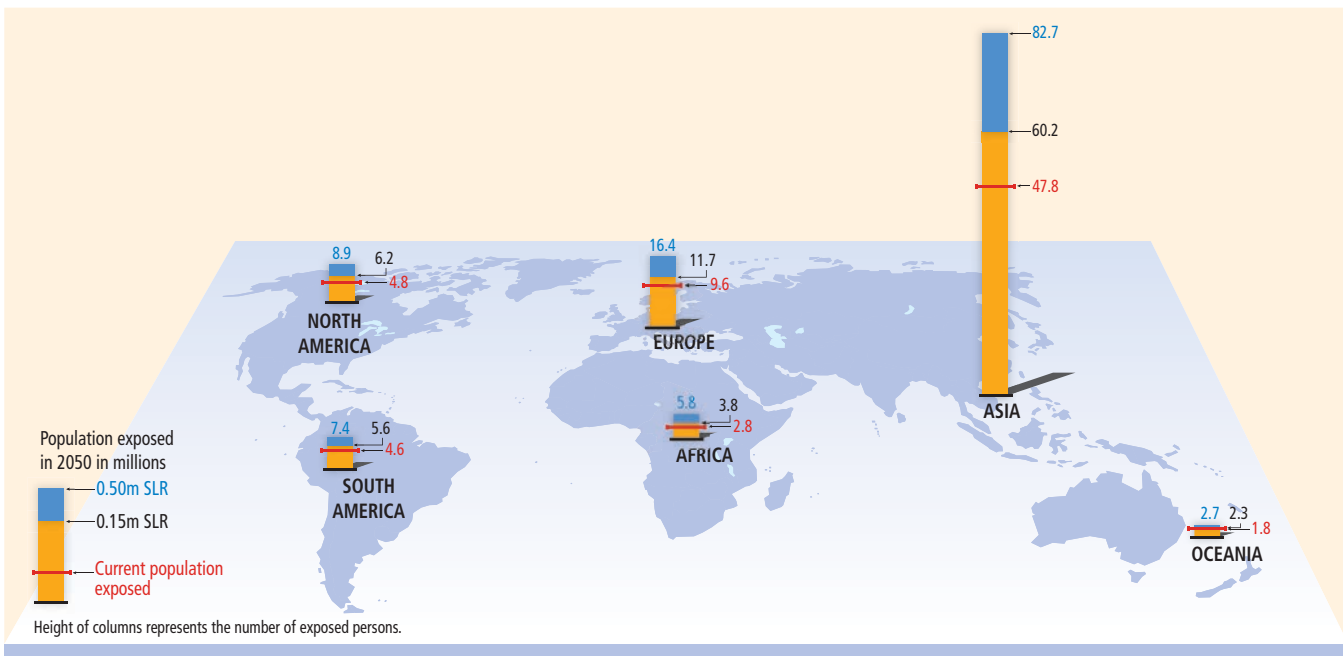
The impacts of climate change will vary widely across the globe—some regions will experience drought and increased temperatures while others will experience more extreme weather such as hurricanes. But people in rural areas, where households rely daily on their local environment, will feel these effects most intensely. A widely cited article estimated that more than 25 million people were displaced by environmental factors in 1995 and claimed that as global warming takes hold, more than 200 million people could be affected by future climate change.³ Many, however, disputed these numbers and rightly clarified that scientists, particularly experts in migration, have little understanding of migration-environment relationships.⁴

In spite of dozens of academic publications and several international conferences, well-documented cases of environmentally induced migration are mostly limited to large-scale events such as Hurricane Katrina in the United States or the tsunami that affected Indonesia, in which millions of people were displaced due to rapid and dramatic change. The still unclear long-term consequences of these types of events, as well as slower-acting forms of environmental change such as long-term droughts and soil degradation, limit our ability to predict the scale and nature of future human migration under accelerating global environmental change. New research, however, continues to shed light on the relationships between migration and the environment.

This *Population Bulletin* explores the relationship between migration and the environment and highlights innovative research from the Population Centers funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development. This research uses new approaches to link demographic, social, and environmental science methods, enabling researchers to more explicitly link people to the environment on which they depend. This linking, combined with following people over time, permits researchers to determine how environmental change contributes to people's mobility and how migration results in environmental change. The research suggests that the popular narrative of "environmental refugees" is oversimplified and inaccurate; rather, environmentally induced migration can be temporary, and is often within a country and over relatively short distances. Smaller numbers of people move across international borders.

FIGURE 1

Current and Future Population Exposure to Inundation in a 100-Year Storm Event Due to Sea Level Rise



For low-elevation coastal areas, current and future (2050) population exposure to inundation in the case of the 1-in-100-year extreme storm for sea level rise of 0.15 m and for sea level rise of 0.50 m due to the partial melting of the Greenland and West Antarctic Ice Sheets.

Source: Handmer, J., Y. Honda, Z.W. Kundzewicz, N. Arnell, G. Benito, J. Hatfield, I.F. Mohamed, P. Peduzzi, S. Wu, B. Sherstyukov, K. Takahashi, and Z. Yan, 2012: Changes in impacts of climate extremes: human systems and ecosystems. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 231-290. © IPCC 2012.

Does a Changing Environment Contribute to Migration?

Migrants respond to combinations of economic, social, and demographic factors in addition to the environment. Although scores of studies have assessed economic and social contributions to migration decisionmaking, assessing environmental influences on migration is complex. Besides taking into account all of the other economic and social factors known to contribute to migration, researchers must also look at various environmental factors such as flooding, drought, soil degradation, and land availability. Research on migration and the environment has been limited by the lack of appropriate data sets and by disciplinary boundaries between migration studies and environmental science.

Recently, however, researchers have used approaches from demographic studies of migration, often in combination with Geographic Information Systems (GIS), to overcome these challenges. These studies link individual-level data on migration to local characteristics of the environment, and analyze

the migration processes over a longer-term period using multivariate statistical models and multiple collections of data through household surveys. The research innovation is in linking people to different types of environmental data:

- In Kenya and Uganda, household survey data on migration was linked with data on agricultural land area as well as soil quality from soil samples of household agricultural plots.⁵
- Publicly available temperature and rainfall data was used to examine heat waves and droughts.
- Soil samples from agricultural plots helped assess soil quality and degradation over time.
- Satellite imagery was used to assess changes in land use and land cover, such as deforestation and the conversion of forests to pasture, or changes in transportation and road networks that increase accessibility.

These approaches represent a significant advance over small-scale case studies and cross-sectional studies in which data are only collected at one point in time and over a small study

area. The use of appropriate statistical techniques with data collected across multiple time periods now allows researchers to determine if migration can be attributed to environmental change and to the degradation of specific resources.

Research Highlights

ENVIRONMENTAL CHANGE CAN SERVE AS A DRAMATIC PUSH

Migration is clearly sometimes a non-negotiable response to environmental shocks, as in the case of mandatory evacuation in the face of hurricanes or other natural disasters. Consider Hurricane Katrina, which devastated the U.S. Gulf coast in August 2005. Over 1 million adults evacuated their homes (about 85 percent of residents); and nonemergency personnel who remained in shelters, homes, and hospitals left within several days. Katrina was estimated to have caused nearly \$100 billion in property damage, and for many people it was weeks to months before neighborhoods were safe enough for residents to return. Still, by 2012, the city's population had returned to only two-thirds of its pre-Katrina numbers, while other parts of the South (such as Texas) became home to many evacuees.

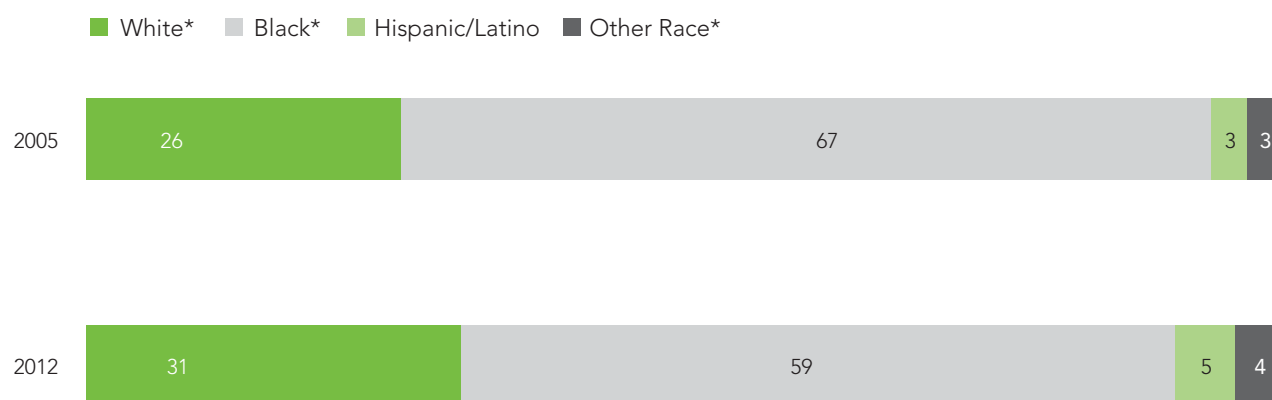
Even in the case of large-scale population displacements like Hurricane Katrina, levels of initial vulnerability and of the ability to restore devastated homes and livelihoods vary dramatically. Elizabeth Fussell, Narayan Sastry, and Mark VanLandingham studied these social inequalities by using a variety of techniques to track pre-Katrina residents to their post-Katrina locations for follow-up interviews.

Their results confirmed that African Americans and less-educated residents were more vulnerable to the disaster's effects, resulting in lower and slower rates of return migration.⁶ Their slow return, associated with living in disadvantaged neighborhoods that had higher exposure to flooding and housing damage, changed the overall racial composition of New Orleans. Blacks now make up only 59 percent of the population living in New Orleans, compared with 67 percent before Katrina (see Figure 2).

In natural disasters, the most vulnerable people are often the ones forced to move either because they live in marginal low-lying or steep-slope areas with greater exposure to hazards, or they live in poor-quality housing and are therefore subject to greater losses.

FIGURE 2

Distribution of the Population in New Orleans by Race/Ethnicity, 2005 and 2012



Notes: *Non-Hispanic; "Other Race" includes Asian/Pacific Islanders, American Indians/Alaska Natives, and persons of two or more races.

Source: U.S. Census Bureau, Population Estimates Program.

In addition to population displacement, one of the other major outcomes of natural disasters is mortality. However, at least in the United States, the types of natural disasters that cause the most property damage, such as tornados and hurricanes, have not caused the most disaster-related deaths. Instead, heat or drought caused the largest share of deaths from natural disasters between 1970 and 2004 (see table).

Another dramatic example of the migratory “push” of disasters comes from Indonesia in the aftermath of the 2004 tsunami. Between 350,000 and 550,000 residents were displaced, with coastal communities on the island of Aceh experiencing effects ranging from complete destruction to only minor damage. Differential vulnerability to the storm, and inequalities in longer-term impact, have been studied by researchers from Duke University's Population Research Institute and the Carolina Population Center at the University of North Carolina Chapel Hill.

In heavily damaged regions, displacement was widespread regardless of residents' gender, age, or education levels. Even so, individuals of lower social status and with less education were more likely to be displaced to camps rather than to private homes of friends or family, perhaps indicating a differential ability to tap into social networks in times of crisis.⁷

Of course, there is a continuum of pressure that environmental factors exert on livelihoods, and natural disaster displacement is at one extreme, representing acute events at a particular point in time. More chronic, longer-term strain, such as a drought that emerges across several growing seasons, yields different livelihood pressures and migratory responses (see Figure 3).

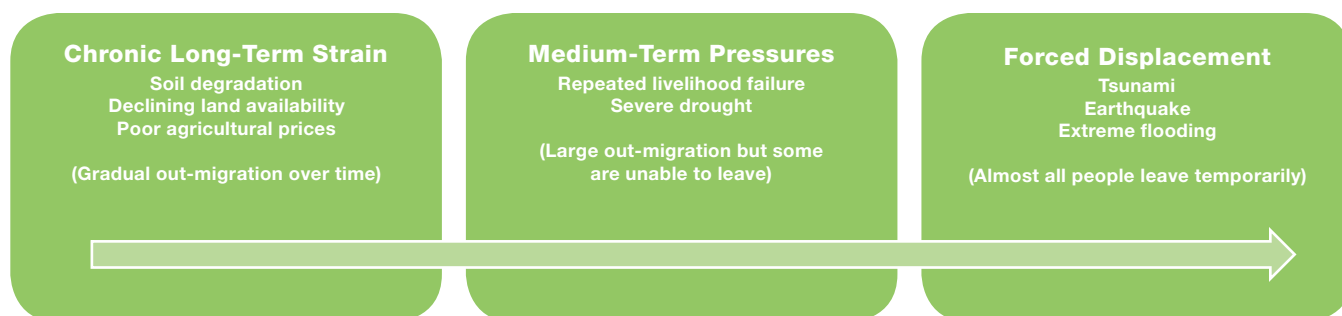
Deaths in the U.S. From Natural Disasters by Type, 1970-2004

	NUMBER	PERCENT
All Deaths From Natural Disasters	19,959	100.0
Heat or Drought	3,906	19.6
Severe Weather (severe storm/thunderstorm, fog, hail, wind)	3,762	18.8
Winter Weather	3,612	18.1
Flooding	2,788	14.0
Tornado	2,314	11.6
Lightning	2,261	11.3
Coastal (storm surge, rip current)	456	2.3
Hurricane or Tropical Storm	304	1.5
Geophysical (earthquake, tsunami, volcano)	302	1.5
Mass Movement (avalanche, landslide)	170	0.9
Wildfire	84	0.4

Source: Kevin A. Borden and Susan L. Cutter, "Spatial Patterns of Natural Hazards Mortality in the United States," *International Journal of Health Geographics* 7, no. 64 (2008): figure 1 and table 3, accessed at www.ij-healthgeographics.com/content/7/1/64, on June 16, 2014.

FIGURE 3

A Continuum of Environmental Pressures That Contribute to Migration



Source: Jason Bremner, Population Reference Bureau, 2014.

MOST ENVIRONMENTAL MIGRANTS VOLUNTARILY MOVE SHORT DISTANCES

Burkina Faso, in West Africa, is a poor nation with rural populations heavily dependent on rain-fed agriculture. Recent summer rains have consistently been 15 percent below the 1920-1969 average, and increasing temperatures exacerbate the effect of lower rainfall.⁸ In addition, per capita agricultural land is declining. This combination of land scarcity and lower precipitation makes people highly vulnerable to environmental variability and climate change.

Sabine Henry, Bruno Schoumaker, and Cris Beauchemin used detailed household survey data on migration history combined with rainfall measures to investigate the association between drought and migration in rural Burkina Faso. Their results suggest that migration represents a coping strategy, particularly lower-cost and short-distance moves between rural communities. In this way, migration appears to be a short-term voluntary strategy to diversify income sources during times of stress.⁹

A similar pattern emerges in rural Nepal in research undertaken through the Office of Population Research at Princeton University and the Population Studies Center at the University of Michigan. Nepal's Chitwan Valley was a forested frontier region until the 1950s when settlement and resultant forest clearing began. Today, many farmers perceive substantial environmental decline, less access to fuelwood and animal fodder, and reduced land availability and productivity. Surveys undertaken by demographers Douglas Massey, William Axinn, and colleagues revealed that local migration to seek opportunities elsewhere is more common among those who perceive such environmental constraints.¹⁰

A related story emerges in rural Guatemala where land scarcity, soil degradation, and overall productivity declines are associated with out-migration, especially to the forest frontier of northern Guatemala. Yet unlike Burkina Faso or Nepal, in rural Guatemala entire households may relocate permanently to locations more favorable to agricultural livelihoods.¹¹

ENVIRONMENTAL CHANGE MAY ALSO CONSTRAIN SOME MIGRANTS

The research reviewed above suggests that, in some times and in some places, households respond to environmental pressures through migration. Such migrations may involve entire households or only particular household members who move to seek new opportunities and perhaps send remittances home. But several studies show that adverse environmental conditions can also reduce migration, and that vulnerable populations are not necessarily more likely to be displaced.

Migration entails costs—economic, emotional, and social. The costs may be financial: A migrant may move to a new city

or location and need money for transportation, housing, and food. Emotional and social costs include leaving one's social network of family and friends for a destination with a smaller social network. Environmental strain can exacerbate these costs or decrease the financial resources that households have available for migration, and thus, in some cases, inhibit migration.

As an example of how environmental scarcity constrains migration, we can look to research in Ecuador conducted by Clark Gray and colleagues at the Carolina Population Center. In rural regions, productive land represents an important environmental asset. Landless households lack this form of "natural capital" and are least likely to send a migrant to an international destination, which is a particularly expensive form of migration.¹² Sabine Henry and colleagues' study of Burkina Faso also found lower levels of expensive international migration among households facing drought conditions.

These findings in Ecuador and Burkina Faso point to another key distinction within the environment-migration connection. The relationship varies by the type of migratory response—internal migration is often short-distance and within national boundaries, but international migration usually entails longer distances and is complicated and made more expensive by having to cross national borders. If the environmental conditions that migrants experience vary on a small scale (flooding is localized along a coastline and nearby inland areas are unaffected), then a low-cost internal move might be enough to find better conditions or alternative livelihood opportunities. But, if the scale of environmental change is far greater, such as widespread drought across a large region, then a longer and more-costly move may be needed.

These findings highlight the complex relationship between environmental change and migration (see Box 1, page 7). In some settings, environmental degradation actually reduces the likelihood of international migration—particularly to distant destinations—by reducing access to the resources people need to migrate.

ENVIRONMENTAL CHANGE INTERACTS WITH OTHER DRIVERS OF MIGRATION

The discussion above makes it clear that many factors shape people's decisions to migrate. Economic circumstances in both origins and potential destinations affect the likelihood that an individual or household would move because of environmental change. For example, rainfall shortages are more likely to push migrants if economic opportunities in nearby locales are plentiful.

Political conditions are also important. Both Hurricane Katrina and the Indian Ocean tsunami illustrate that migrants displaced by natural disasters are more likely to return if affected communities have received political support for rebuilding.

BOX 1

The Differential Impact of Floods and Heat Stress on Migration in Rural Pakistan

Researchers at the International Food Policy Research Institute and the Carolina Population Center used a unique, 21-year (1991-2012) longitudinal survey of households in rural Pakistan to examine the long-term migration of household members in response to extreme temperature and rainfall and to answer three important research questions:

- Do climate patterns explain the long-term mobility patterns of men and women in Pakistan?
- Is there evidence that extreme rainfall and heat affect agricultural income—a possible channel through which floods and heat affect migration?
- Are there barriers to environmental migration?

Findings from this research showed that extreme climate is linked with migration. Both men and women were more likely to move during periods of extreme heat than during normal periods, while periods of extreme rainfall had little effect on the likelihood of migration. The researchers examined how extreme temperature affected farm and nonfarm income and wages and found that agricultural incomes were negatively affected by extreme temperature, suggesting that households may need coping mechanisms to deal with dramatically

reduced income during periods of extreme heat. Men and women, however, responded differently to extreme heat. Men were more likely than women to move out of the village due to extreme weather, whereas women were more likely to move households within a village. Finally, in examining whether there are barriers to migration, the researchers found that while all people regardless of assets were more likely to migrate during extreme heat events, the poor were more likely to migrate than the rich. Research in other contexts has found that the poor are less likely to migrate and in particular are less likely to make high-cost international moves.

This research from Pakistan characterizes the direction of much of the emerging research on migration and the environment. Households are examined over long periods of time, survey data are linked with multiple types of environment and climate data, and findings are diverse across different contexts, gender, and specific environmental changes. Together, the findings in Pakistan illustrate the emerging understandings of the complexity of migration and environment relationships and the need for additional research.

Source: Valerie Mueller, Clark Gray, and Katrina Kosec, "Heat Stress Increases Long-Term Human Migration in Rural Pakistan" (2013), accessed at www.nature.com/ncclimate/journal/vaop/ncurrent/full/ncclimate2103.html, on June 19, 2014.

Ultimately, the influence on migration of environmental pressures such as drought and natural disasters is also shaped by social, economic, and political factors.

With a focus on the interaction between environmental strain and social networks, researchers have long studied the important role of social networks in Mexico-U.S. migration streams. Migration from Mexico is the main source of both legal and undocumented movement into the United States and is one of the largest and longest-sustained international flows of people in the world. Mexican immigrants to the United States have typically settled in "traditional" destination states such as California and Texas, where strong social networks provide social support and pathways to labor and housing opportunities. But recently, social networks have been emerging in new settlement areas of the South and Midwest. These social networks interact with environmental factors in origin areas to shape Mexico-U.S. migration. Researchers Lori Hunter and Fernando Riosmena of the University of Colorado Population Center, and their colleagues, have analyzed these interactions using census data and information from

the Mexican Migration Project. Drought in rural Mexico acts as a push factor for U.S.-bound migrants, but the push is not evenly felt. Households in drought-affected regions of rural Mexico with strong migration histories are more likely to send a migrant to the United States.¹³ Regardless of the impact of local droughts, migrant households tend to have more assets, suggesting that Mexico-U.S. migration as a livelihood strategy is less likely among poorer households.

POLITICAL DEFINITION OF REFUGEE DOES NOT FIT MANY ENVIRONMENTAL MIGRANTS

Because of the complexity of environmental migration, and because many factors usually combine with environmental change to spur migration, the term "refugee" fits poorly with what is known about environmental migration. The international definition of refugee refers to persons who cross international borders due to fear of persecution or violence. The idea of an environmental refugee then suggests that the move is forced and unwanted, which is not supported by many research findings on environmental migration.

In some settings, however, severe natural disasters may result in people crossing international borders. Furthermore, the long-term prospects of sea-level rise in some Pacific Island nations suggest that in several decades some nations could cease to exist. In these cases, the current international definition of refugee precludes protections for households threatened by environmental change, resulting in lower levels of humanitarian and legal support and protection for those moving in response to environmental pressures.

An example of this mismatch is underway in the South Pacific. The small island nations of Kiribati and Tuvalu face dramatic change as sea levels rise, with some residents already migrating. Yet, as islanders seek asylum in nearby Australia and New Zealand, public and policy debate continues regarding the creation of a new class of climate refugees. Without such a definition, island migrants cannot be granted asylum in receiving nations and therefore receive no additional support while also being constrained by current immigration policies.

MIGRATION CAN ALSO AFFECT THE ENVIRONMENT

Migration is not only a *response* to environmental conditions—it also often alters the environment in many destination and origin areas. Research from many locations has shown that deforestation and land degradation may occur in destination areas due to the land use patterns of new migrants. Both large forced migrations, which might occur after a natural disaster or during civil conflict, as well as voluntary migration by households to a new area to take advantage of available land and resources, may result in rapid environmental change. At the same time, the origin areas from which migrants departed can be affected by the remittances that are sent back by migrants if they are invested in agriculture and other natural-resource based livelihoods.

Conflict can rapidly displace large numbers of people who may seek shelter in other parts of the country as Internally Displaced Persons (IDPs) or move across an international border as refugees. IDPs and refugees, as well as those fleeing from natural disasters, usually carry few belongings, lack the most basic necessities, and must rely on natural resources for their survival. They may cut trees to build simple shelters; collect firewood to cook meals or to keep warm; and gather wild game, fruit, herbs, and other plants for food or medicine. Natural resources are also often used for livelihood and income-generation activities, such as agriculture or making charcoal to sell in local markets. However, unsustainable use of natural resources can lead to environmental degradation, with lasting effects on natural resources and the well-being of refugee and host communities who rely on the environment. For example, the thousands of refugees from Darfur severely strained Chad's local water and firewood resources.¹⁴

Similarly, continued civil unrest in South Sudan has shifted land practices as many people fled villages into forests for safety. Some have supported themselves through hunting, gathering, and small-scale cultivation. In particular regions, deforestation has intensified, although reforestation has occurred in other regions. The study of the environmental impacts of war and conflict has developed into a new field of research, "warfare ecology."¹⁵

Migrants who move for economic and livelihood reasons may affect the environment where they settle. Research conducted at the Carolina Population Center has analyzed the long-term environmental impacts of colonization of the Ecuadorian Amazon by settlers from other parts of the country.¹⁶ As oil companies established new roads in the Amazon for oil exploration, drilling, and production, migrants arrived from the highlands of Ecuador to claim newly available land. Surveys collected in 1990 and 1999 were linked with satellite imagery and have revealed a pattern of initial deforestation as households established plots along roads, followed by a longer-term trend of continued land clearing as farms were further subdivided into smaller and smaller plots.

Researchers at Indiana University's Department of Anthropology and Brown University's Population Center have been studying migration and environment relationships along the forest frontiers of the Brazilian Amazon. This long-term research project in the Altamira region of Brazil has studied colonization from the 1970s to present, examining the initial arrival of migrants to the Amazon from other regions of Brazil that resulted in rapid deforestation along roads in a fishbone pattern.¹⁷ However, subsequent generations, who are both descendants of the initial migrants or new migrants themselves, have not followed the same pattern. Instead, they have exhibited complex patterns of land use based on social and economic trends and changing agricultural and conservation policies. Together, these cases from the Amazon indicate that the initial arrival of migrants to new rural destinations often resulted in rapid environmental impacts in the absence of policies that safeguarded land and resources. Later patterns, however, varied greatly and require an understanding of local context and policy.

Another route through which migration affects environments is remittances sent to origin communities by migrants who are earning an income and saving wealth elsewhere. The World Bank estimates that over \$540 billion in remittances flow between countries, with over \$400 million flowing back to developing countries.¹⁸ These return flows may be invested by origin households in land improvements, including diversifying livelihoods or working toward more sustainability. For example, in Ecuador, remittances sent by international migrants helped rural households invest in hired labor and fertilizers for their farms, resulting in slight increases in maize harvests.¹⁹ Across Central America broadly, remittances do not appear to shape the use of chemical fertilizers, herbicides, and pesti-

BOX 2

Migration and Environment in Coastal Areas

Ten percent of the world's population lives in coastal areas that are less than 10 meters (33 feet) above sea level. Representing only about 2 percent of the world's land area, these low-elevation coastal zones are nonetheless home to 600 million people and are among the fastest-growing areas in the world because of urbanization and migration.

In the United States, for example, the population density of coastal counties has increased far faster than the density of inland counties. Therefore, more people will be exposed to hazards such as sea-level rise and storm surges—phenomena that are expected to worsen as a result of global warming.

People move to coastal zones because they are among the most productive ecosystems on the planet and people living there can take advantage of both land and marine resources. At the same time, coastal cities have become major hubs of transport and commerce through their ports. Even today, in an era of air, rail, and road transport, coastal cities have economic advantages. Coastal ecosystems such as mangroves and marshes, river deltas, and coral reefs have been heavily altered due to coastal development, and throughout the world, coastal fisheries are in decline.

Surprisingly little population-environment research, however, has focused on coastal ecosystems and fisheries. At Princeton University's Office of Population Research, researchers studied whether migrants degraded coastal ecosystems by examining the resource use of migrants and nonmigrants in North Sulawesi, Indonesia. Their findings indicated that migrants and nonmigrants did not have as many differences

regarding destructive fishing behaviors, technologies, and investments as the theory on migration and environment might predict. More recently, the Galapagos Initiative, a north-south research partnership between the Carolina Population Center and the University San Francisco de Quito, has begun examining population-environment relationships in the Galapagos Islands, specifically examining land use change. The coastal and marine resources have not yet been a focus of this initiative's research.

The dearth of research in this area may be because population-environment research in coastal environments presents additional methodological challenges. Linking households to the common property resources they use, and to environmental data on these resources, is more difficult in coastal and marine settings than for plots of land, forests, soils, and precipitation. At the same time, there is a significant need to develop innovative research methods to overcome these challenges and advance the knowledge in this area given continued migration, population growth, urbanization, and environmental change in low-lying coastal zones.

Sources: NOAA, *National Coastal Population Report, Population Trends from 1970 to 2020* (Washington, DC: NOAA, 2013), accessed at <http://stateofthecoast.noaa.gov/features/reports.html>, on June 19, 2014; Gordan McGranahan, Deborah Balk, and Bridget Anderson, "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones," *Environment and Urbanization* 19, no. 1 (2007): 17-37; Susan Cassels, Sarah Curran, and Randall Kramer, "Do Migrants Degrade Coastal Environments: Migration, Natural Resource Extraction, and Poverty in North Sulawesi, Indonesia," *Human Ecology* 33, no. 3 (2005): 329-63; and Stephen J. Walsh and Carlos F. Mena, "Science and Conservation in the Galapagos Islands: Frameworks & Perspectives," in *Social and Ecological Interactions in the Galapagos Islands*, ed. Stephen J. Walsh and Carlos F. Mena (New York: Springer, 2013).

cides, but do enhance origin households' ability to purchase and expand agricultural and ranch land.²⁰

In drought-affected Syria, migration is much more common in areas dependent on rain for agriculture. And among migrant households in these nonirrigated regions, remittances represent 50 percent of rural household income. Remittances result in household expansion of agricultural areas and increases in fertilizer use and mechanization, all of which lead to greater productivity. In addition, households often invest in livestock, particularly goats and sheep, in order to diversify potential income sources.²¹ But the expansion of agriculture and increasing numbers of livestock increase local environmental impacts.

These findings again illustrate the complexity of the migration-environment relationship, but most research has focused on forests and agricultural areas. Few studies have focused on migration in other environments (see Box 2).

Different Pressures Require Different Policies and Programs

Dramatic and spontaneous natural disasters garner substantial humanitarian aid to save lives and provide people with basic necessities. But long-term, chronic environmental pressures, such as heat stress, also put tremendous strain on rural households, especially households in less developed countries that rely on agriculture. People migrate in response to immediate disasters as well as to longer-term environmental strains. Humanitarian aid and development assistance can potentially reduce the negative impacts of both kinds of migration. There are few examples, however, of specific policy responses to environmental migration. Migration policy is a politically sensitive topic, and when combined with the equally sensitive topic of climate change, political consensus is rare.²²

The wide range of types of environmental changes that influence migration, from rapid onset environmental shocks to

BOX 3

RISE

The U.S. Agency for International Development's (USAID) RISE (Resilience in the Sahel-Enhanced) Initiative, launched in early 2014, commits more than \$130 million over the first two years of a five-year effort to build resilience to the recurrent crisis in West Africa's Sahel, a region where chronic poverty, food insecurity, drought, and violent extremism collide. Nearly 19 million people faced food insecurity in 2012 due to severe drought, for the third time in a decade.

RISE will work in targeted zones in Niger and Burkina Faso to help families and communities get ahead of the next shock and stay firmly on the path to development. This new initiative brings together humanitarian and development funding to both address humanitarian needs and build resilience, including efforts to strengthen institutions and governance, increase sustainable economic well-being, and improve health and nutrition. Consideration of research on drought and migration from Burkina Faso is critical to determining how future resilience initiatives treat environmental migration.

slow-onset environmental events, requires very different policy and program responses. Natural disasters require immediate support for displaced persons and assistance in rebuilding homes and livelihoods. In general, people who are most vulnerable will be those least able to rebuild and move quickly back to their homes and livelihoods. When related to slow-onset environmental events, on the other hand, migration may represent an adaptive strategy for some of the poorest households (see Box 1, page 7). Adaptive strategies to climate change are actively supported through many climate change initiatives, and research on migration and the environment suggests that more consideration should be given to the role of migration as an existing or potential adaptation strategy.

One promising policy development is that various governance systems, from international multilateral agencies to bilateral donors and national governments, are developing policies and programs to enhance the resilience of vulnerable households to the common environmental changes they face. For example, in response to the droughts in the Horn of Africa in 2011, the United States Agency for International Development (USAID), through resilience policy and program guidance, committed to better coordination of its development and humanitarian approaches to effectively build resilience in targeted areas of recurrent crisis.²³ For USAID, resilience is

"the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth."²⁴ USAID is just beginning to develop resilience projects (see Box 3) and has not yet specified how migration should be incorporated into strategies to build resilience, but programs will have to consider many aspects of the environment-migration relationship in resilience programming.

For example, in some regularly affected regions, households may benefit from new agricultural techniques and diversification of livelihoods to reduce the impact of drought and potentially reduce the need for temporary or permanent migration during severe droughts. At the same time, migration itself may be a resilience strategy. Some family members may leave home and move to other regions to diversify livelihoods and send remittances home. Policies and frameworks that aim to improve resilience, rather than policies that aim to influence environmental migration, will be more adaptable to local situations.

Conclusion

Our current limited understanding of migration and environment relationships does not help us predict with any clarity how migration might respond to future climate change on a global scale. Large-scale natural disasters such as Hurricane Katrina, the Indian Ocean tsunami, and the earthquake in Haiti will likely continue to displace large numbers of people; and the frequency of such events is likely to increase. The Indonesian case illustrates that even extreme events do not necessarily lead to an international refugee crisis. The consequences of more-pervasive forms of environmental change such as droughts and soil degradation are less certain, but current research indicates that they are also unlikely to lead to large-scale movements of migrants long distances across international borders.

These studies make clear that environmental migration is real and deserves international attention, but simplistic views of massive numbers of environmental refugees moving across borders should be set aside. Continued research on the connections between environmental change and migration are critical, particularly in different ecosystems such as coastal areas and drylands that have received little research attention. Because of the variety of ways in which migration is a response to environmental change, policies on migration are unlikely to be adaptable enough to different situations and environmental pressures. Resilience policies and programs, however, present an opportunity to reduce the impacts of disasters and environmental change, and to assess environmental migration in context.

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