KNOMAD
Global Knowledge Partnership on Migration and Development

Environmental Change and Migration: State of the Evidence

KNOMAD Thematic Working Group on
Environmental Change and Migration

1. Introduction

Experts generally agree that the environment is but one of the many reasons that prompt people to migrate, sometimes operating on its own but more often through other mechanisms, particularly loss of livelihoods affected by environmental disruption (Black et al 2011, Foresight 2011, White 2011). Climate change may well increase the likelihood of both internal and international migration through four pathways: increased drought and desertification, rising sea levels, more intense and frequent storms, and competition for scarce resources (Martin 2012). Recognizing these potential impacts, in 2010, Parties to the UN Framework Convention on Climate Change (UNFCCC) adopted the Cancun Adaptation Framework, which called on all countries to take "measures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at national, regional and international levels." To date, there is relatively little research, however, that focuses on the impact of these forms of migration on the migrants who move, the communities they leave, or the destinations to which they migrate.

This brief review of the state of the literature and its accompanying annotated bibliography aims to assess the current state of the evidence on these two dimensions of environmental change and migration: 1) the environmental determinants of movements of people in both acute and slow onset situations; and 2) movements of people as an adaptation strategy in the context of environmental change. The goal of the review is to examine current knowledge about the interconnections between the environment and migration and identify areas of research needed to improve future evidence-based policymaking in this area.

2. Environmental Change as a Determinant of Migration

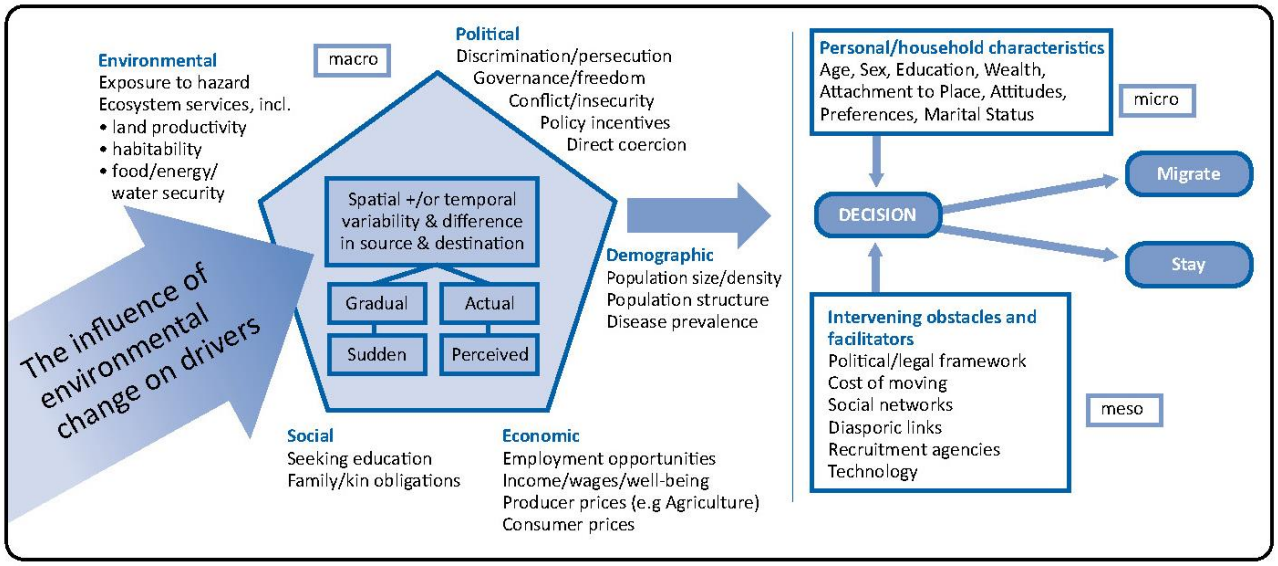
Better understanding the determinants of movement—whether it is migration, displacement, or relocation—requires research that is able to tease out the various factors that influence movements. The Foresight project provided an excellent framework for identifying the factors that help determine not only whether people move but also when and where they go (See Graph 1).

The schematic includes macro level factors, demonstrating the multiple drivers of movement (economic, social, political, demographic as well as environmental)[1]. It also demonstrates that both actual and perceived differences between conditions in source and destination communities are likely to influence mobility. On a temporal dimension, the graphic captures gradual and sudden onset drivers, which can in turn influence gradual or sudden movements. These drivers alone will not necessarily result in movement of people. The decision to migrate or stay is further influenced by personal and household demographic and

[1] Health factors not shown in the schematic may also be important in generating movements. Some people may migrate in search of better health care. On the other hand, research shows that acute health crises, including epidemics and pandemics may result in little migration. In many cases, quarantine policies make it very difficult for people to move from one location to another.

socio-economic characteristics as well as intervening obstacles and facilitators that determine whether migration is feasible. The mix of all of these determinants that lead to the decision to migrate or to stay in place makes research on the determinants of migration from environmental change so complex an endeavor.

Graph 1



Source: Foresight Project, Migration and Global Environmental Change

Understanding the environmental factors themselves is the first order of research. The mechanisms through which environmental change may affect movements of people have only recently received serious attention from researchers. There are four paths, in particular, by which environmental change may affect migration either directly or, more likely, in combination with the other factors identified in the Foresight schematic:

- Changes in weather patterns that contribute to longer-term drying trends that affect access to essential resources such as water and negatively affect the sustainability of a variety of environment-related livelihoods including agriculture, forestry, fishing, etc.
- Rising sea levels and glacier melt that cause massive and repeated flooding and render coastal and low-lying areas uninhabitable in the longer-term.
- Increased frequency and magnitude of weather-related acute natural hazards, such as hurricanes and cyclones, which already destroy infrastructure and livelihoods and require people to relocate for shorter or longer periods (IFRC 2011). As climate change intensifies these events, even more people in developing countries will be at risk.
- Competition over natural resources that may exacerbate pressures contributing to conflict, which in turn precipitates movements of people. Conflict will clearly make it more difficult to address the needs of climate-change affected populations, as witnessed in Somalia during the severe drought in the Horn of Africa. Only Somalia among the drought affected areas experienced high levels of famine and displacement.

These are very broadly conceived and do not include other environmental factors that may cause movement (for example, the destruction of habitat after a nuclear accident). Research on the ways in which dif-

ferent environmental changes affect people's lives and their propensity to move would be useful in increasing understanding of the interconnections between the environment and migration.

Also needed is research on the forms of movement that are likely to be associated with different environmental changes. The first two scenarios described above, for example, are likely to cause slow-onset migration, in which people seek new homes and livelihoods over a lengthy period as conditions in their home communities worsen. In some cases, the migration will likely be permanent and in other cases to be circular. The third and fourth scenarios are likely to create conditions that cause large-scale displacement, often in the context of emergencies. Depending on the specific situation, migrants from environmental change may resemble labor migrants, seeking better livelihood opportunities in a new location, or they may resemble refugees and internally displaced persons who have fled situations beyond their individual control. Research that goes beyond this broad characterization would be very useful for policymakers as responsibilities and responses to slow onset migration and large-scale displacement often differ within governments and other actors. These two forms of environmental hazard—acute and slow onset—need to be studied separately and in relationship to each other to assess what is known about each aspect in terms of the forms of movement they generate.

Understanding why people faced with very similar macro-level factors move or stay is also important. Research on vulnerability and resilience to environmental changes—that is, the capability to cope or adapt to them—may help policymakers and practitioners assess the degree to which people need to move and their ability to get out of harm's way. The most vulnerable populations may well be those who are trapped in fragile eco-systems, unable to support themselves there but unable to migrate to places of greater safety and opportunities. Among issues requiring research are 1) who are the most vulnerable to environmental change; 2) what are sources of resilience to adapt to environmental change; and 3) in what ways do vulnerability and resilience affect decisions to move and the timing, scale and form of migration that may take place.

Research is also needed to identify which migration may be temporary and which will be more permanent. The decision as to whether return is possible involves a range of variables, including the extent to which the environmental causes—either direct or through other channels—is likely to persist or frequently reoccur. Policies in the receiving communities and countries, depending on whether the migration is internal or international, will also affect the likelihood for return or settlement in the new location. In addition to immigration policies, the policies affecting return and settlement include land use and property rights, social welfare, housing, employment, and other frameworks that determine whether individuals, households, and communities are able to find decent living conditions and pursue adequate livelihoods. Return and reintegration is also affected by plans and programs to mitigate future dislocations from environmental hazards.

Better understanding the likelihood of internal versus international as well as short versus long distance movements occur is a further area of needed research. Many experts believe that most migration will be internal (except for low-lying small island states without higher elevations) or immediate cross border into neighboring countries. Such migration may be particularly challenging as the receiving communities and countries will likely have few resources, legal structures, or institutional capacity to respond to the needs of the migrants. Geographical proximity may also mean that destination areas face some of the same environmental challenges as areas of migration origin (e.g. drought, desertification) and may offer little respite in this regard. Why do certain communities become destinations—that is, what are the pull factors that attract those who move in the context of environmental change? What are the factors that those who move take into account in choosing where to migrate, and how much choice do they actually have? Case studies of existing patterns of internal and immediate cross border movements will be useful in identifying the patterns of movements and the likely impacts on the migrants themselves as well as their source and destination communities. So too would be studies of the determinants of longer distance movements, including those from developing to more developed countries. Understanding the intervening

factors, including legal frameworks and policy choices, is particularly important in the context of cross border movements since governments set policies that determine who can enter legally and for what purposes.

3. Migration as an Adaptation Strategy

As discussed above, the Cancun Adaptation Framework called on governments to take "measures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at national, regional and international levels." This language placed migration firmly on the climate-change adaptation agenda. Climate adaptation strategies related to migration fall into two major categories: First, and more commonly, governments view adaptation to climate change as a way to reduce migration pressures and allow people to remain where they are by modifying agricultural practices, management of pastoral lands, infrastructure such as dykes and coastal barriers, fishing patterns and other strategies to reduce pressures on fragile eco-systems.

Second, migration may instead be seen as an adaptation strategy itself. Some countries see migration as a way to reduce population pressures in places with fragile eco-systems; others recognize that resettlement of some populations may be inevitable, but should be accomplished with proper planning. Moreover, migrants already living outside of vulnerable areas may be important resources to help communities adapt and respond to climate change, a perspective that is of particular interest to development policy makers. Just as migrants are contributing to the broader development of their home countries, such strategies envision that the diaspora may have the technical knowledge and financial resources to help communities cope with the effects of climate change. Finally, in the absence of appropriate migration strategies, populations that should be relocated from hazardous situations may be trapped in place, unable to leave on their own.

Research is scarce on both issues—the efficacy of strategies to reduce emigration pressures, and the impacts of migration on migrants and communities of origin and destination when used as an adaptation strategy. With regard to the first issue, interdisciplinary research will likely be needed, engaging the expertise of researchers familiar with agriculture, fishing, infrastructure, land use and tenure and other relevant issues as well as those who understand the determinants of migration. Strategies that focus on specific environmental responses that do not take into account the other macro, meso and micro factors discussed above are unlikely to be efficacious in influencing migration patterns. Similarly, research to assess the strengths and weaknesses of these approaches will need to factor in a range of variables in order to come to useful conclusions on efficacy of the adaptation strategies. As many of these strategies are still in the planning stage, thinking through what factors to consider in evaluations would be timely.

A new body of research is beginning to assess the impact of migration as an adaptation strategy. The Rainfalls project, for example, posits four likely outcomes of migration for those who move as well as their families left behind: 1) some families will prosper as a result of migration; 2) others will survive but not be materially better off; 3) still others will be worse off having migrated; and 4) a final group will be trapped in place unable to migrate. Research to replicate or challenge these findings in other locations and with other environmental drivers would help expand understanding of the potentially multiple impacts of migration on those most affected by environmental change. Similarly, understanding the impacts derived from different forms of movement (displacement, migration and relocation) would help identify the strengths and weaknesses of these approaches to environmental adaptation. Do those who move voluntarily in anticipation of environmental harm show greater capacity to improve their situation than those who are spontaneously displaced or forced to participate in planned relocation programs? Alternatively, does the

involvement of third parties (e.g., humanitarian organizations in the case of displacement and development actors in the case of relocation) offset some of the harms that might otherwise occur when people are forced to leave home? What other factors influence the outcomes of different types of movements?

Another area of needed research is on the role of Diasporas in helping communities of origin adapt to environmental change. The role of Diasporas is an area of growing interest in the migration and development literature. This requires differentiation between the input of individual migrants and households and collective contributions of those banding together in hometown associations, professional groups and other associations. To what extent are Diasporas aware of the environmental changes facing their home countries and communities? What strategies are they currently supporting to help their home countries and communities adapt to the changing environment? To what extent would they support various adaptation strategies?

Since a number of governments are considering planned relocation of their citizens from environmentally hazardous areas to new sites, another essential area of research draws the lessons learned from other efforts to relocate populations. Two forms of planned relocation come to mind: development-induced resettlement and reintegration, and refugee resettlement. The former occurs when development projects, such as hydroelectric dams, require the removal of large numbers of people and their relocation elsewhere. Early research on these projects raised many questions about their impacts on the resettled groups, many of whom were worse off after relocation than they had been previously. Examination of more recent examples, particularly those that benefited from application of the World Bank guidelines on involuntary resettlement, may provide guidance for countries facing the potential for large-scale relocation in the future. Which strategies were beneficial for all parties and which ones were not? Similarly, refugee resettlement programs differ in terms of the impacts they have on those participating in relocation. Generally, refugees choose to apply for resettlement although they do not always have much real choice since they may be unable to return home or to remain in place. Refugee resettlement tends to be towards wealthier countries. Understanding the strategies that help participants in this process integrate into their new communities would nevertheless be useful as planning proceeds on relocation.

Finally, research would help identify some of the opportunities and barriers to the use of migration as an adaptation strategy. Some of these involve law and policy. For example, many likely destination countries do not have the legal frameworks for admission of those seeking to migrate across international borders. Most countries use strict admissions categories that generally focus on ties to the destination—family and employment are most common. Many do have humanitarian categories but mostly related to refugees—that is, those who have a well-founded fear of persecution on account of their race, religion, nationality, membership in a particular social group or political opinion. The vast majority of persons moving at least in part because of environmental change would not qualify under these categories. In some countries, there are also legal and policy barriers to internal migration, such as restrictive residence permits and difficulties in accessing identity documents. In addition, there are practical barriers to migration that need to be identified more precisely and assessed in the context of environmental change. Some are geographic—where is the safest and closest place? Others are economic—what are the costs of migration and how are they born by those needing to move? Still others are social—what role do networks play in determining whether, when and to where people move—and technological—what are the best and safest modes of migration and does access to modern communication and social media affect the short and long term experience of those who move?

4. Conclusion

This review aimed to provide an overview of the state of the literature on environmental change and migration and to identify some areas of research that is needed to build a stronger evidence base for policymaking. It is not meant to be exhaustive in laying out a research agenda.

To summarize, the core areas to be addressed in improving the evidence base for policymaking on environmental change and migration include:

- The environmental determinants of migration, displacement and planned relocation;
- The multi-faceted ways in which environmental factors relate to the many other causes of population movements in these three cases (migration, displacement and planned relocation);
- The impact of migration, displacement and planned relocation undertaken in the context of environmental change on the economic well-being of migrants, communities of origin, and communities of destination;
- The impact of migration, displacement and planned relocation undertaken in the context of environmental change on the psychological, health and social well-being of migrants, communities of origin, and communities of destination;
- The ways in which political and legal frameworks affect and are affected by migration, displacement and planned displacement occurring in the context of environmental change;
- The institutional framework in which the intersection between environmental change and migration is addressed at the local, national, regional and international levels;
- The policy implications of these findings?
- Identification of further gaps in knowledge, and how can they be best filled.

Cited References

Black, R., W. Adger, N. Arnell, S. Dercon, A. Geddes, D. Thomas (2011) "The Effect of Environmental Change on Human Migration." *Global Environmental Change* 21, S3–S11

Foresight: Migration and Global Environmental Change (2011) Final Project Report. The Government Office for Science, London

Martin, S. (2012) "Environmental change and migration: legal and political frameworks," Environment and Planning C: Government and Policy, Vol. 30, 2012: pp. 1045 – 1060

White, G. (2011) *Climate Change and Migration*. Oxford: Oxford University Press.

For recent literature on environmental change and migration, see Appendix 1: Annotated Bibliography.

Appendix 1
Annotated Bibliography
Recent Research on Environmental Change and Migration[2]

Abel, Guy, Bijak, Jakub, Findlay, Allan, McCollum, David, Wisniowski, Arkadiusz. "Erratum to: Forecasting Environmental Migration to the United Kingdom: An Exploration using Bayesian Models." ***Population and Environment*** **35.2 (2013): 204.**

The study attempts to use the Bayesian statistical modelling framework to combine historical migration data with expert knowledge to estimate future gross immigration and environmentally related migration in the United Kingdom. Using a variant of the Delphi survey of experts embedded within the Bayesian approach, authors predict that environment mobility will not rise significantly over the next decades, as the median environmental flows in 2030 and 2060 correspond to only 6.5 and 7.5% of the median total immigration flows, respectively. While the findings reinforce general arguments about the unpredictability of future migration patterns, it is the first time that such a modelling approach has been used in relation to environmental mobility.

Adams, Helen and W Neil Adger. "The contribution of ecosystem services to place utility as a determinant of migration decision-making." ***Environmental Research Letters*** **8.1 (2013).**

While traditional research has focused on economic impacts of environmental change on migration patterns (i.e. loss of livelihoods due to drying patterns), the authors take an alternative approach to understanding how environmental factors influence migration decisions. Cultural attachment, for instance, may involve an individual's utility gain from the environment in ways beyond its ability to provide an income. Authors surveyed 450 households in a small, coastal valley of Peru to analyze migration flows, decision-making and place utility. Results indicated that 44% of respondents gained benefit from non-provisioning ecosystem services (i.e. climate, lack of pollution, aesthetic of natural environment). The authors suggest that if environmental change degrades these ecosystem services, residential satisfaction falls, and the relative pull or push of other educational and economic opportunities increases. Therefore, when locations are already marginal with respect to income activities, a loss of the characteristics to which people form attachment may take a greater role in their decision to migrate.

[2] For a comprehensive compilation of earlier work on environmental change and migration, see Frank Laczko and Etienne Piguet, *Migration in a Changing Environment: A Bibliography*, Geneva: International Organization for Migration, 2012.

Adger, W. Neil, et al. "Cultural Dimensions of Climate Change Impacts and Adaptation." *Nature Climate Change* 3.2 (2013): 112-7.

This article reviews the most recent research on how climate change affects culture, specifically identity, community cohesion, and sense of place, and how culture significantly influences the identification of risks, decisions to respond to risks, and how those decisions are implemented by societies. The studies reviewed for this article were analyzed using qualitative research methods, such as ethnographic cultural inquiries, participant observation, narrative and historical analyses, and mental modeling approaches. These studies discovered societal responses to climate change not considered "rational" by institutions supporting climate change adaption due to the lack of cultural analysis. One recurring example is that the negative effects of migrations, such as emotional stress and weakened social structures, due to the loss of identity and sense of community will diminish or even negate the benefits of individual economic security. The authors argue that a greater incorporation of these cultural elements in climate change adaption policy is essential if these policies are to be successful.

Adamo, Aggrey Ochieng, John Njooroge, Leaven Claessens, Leonard Wamocho. "Land use and Climate Change Adaptation Strategies in Kenya." *Mitigation and Adaptation Strategies for Global Change* 17.2 (2012): 153-71.

In assessing perceptions of climate change vulnerability and adaptation options in the East Mount Kenya region, authors utilize a mixed methods approach. Stakeholders' Workshops were used to structure six questionnaire items to evaluate perceptions of land users, which were then used in surveying 198 respondents. The standardized data was subjected to ANOVA using Kruskal-Wallis test and Wilcoxon Scores and conducted at a 5% level of significance. With regard to social vulnerabilities, the findings reveal that respondents perceive themselves as predominantly vulnerable to displacement or migration as a consequence of climate change. The natural environmental factor that is perceived as most vulnerable is decreasing crop yields and drying rivers. Authors stress the importance in understanding both ecosystem and socio-economic attributes, while also deliberately including small units like households, when formulating regional adaptation plans.

Afifi, Tamer, Emma Liwenga, and Lukas Kwezi. "Rainfall-Induced Crop Failure, Food Insecurity and Out-Migration in Same-Kilimanjaro, Tanzania." *Climate and Development* 6.1 (2014): 53-60.

The authors study the interrelation between rainfall variability and human mobility in three villages in northeast Tanzania. The study involves a mixed-method approach that combines expert interviews, a household survey of 165 households, Participatory Research Approach (PRA) with communities, and meteorological data. Rainfall variability affected more than 80% of the economies of households surveyed, with frequent drought and water shortage as the main causes of migration. The three sites differed, though, in the degree of migration due to differences in elevation and socio-economic factors. Out-migration was lowest in the village that was poorest with the highest rate of education and the oldest population in higher, wetter zones.

Afifi, Tamer. "Economic Or Environmental Migration? The Push Factors in Niger." ***International Migration*** **49 (2011): 95-124.**

This paper researched the primary issues in environmental degradation in Niger and the corresponding impact they have on both domestic and international migration. Migration is a widespread practice and accelerating across the country due to rural poverty and food insecurity. The author conducted qualitative interviews with 25 experts on the issue of migration in Niger including local authorities, academics, and NGO and INGO personnel and 60 completed questionnaires by migrants and 20 non-migrant questionnaires completed by people who suffer from environmental problems but have not migrated. The findings showed that environmental degradation, such as droughts, soil degradation, the shrinking of Lake Chad, the Niger River problems, deforestation, and sand intrusion, is a primary determinant for migration since most livelihoods are wholly reliant on the environment and its health, such as farmers, cattle herders and fishermen. The author thus determines that most migration in Niger can be classified as "environmentally induced economic migration" since the economic problems that force migration are inseparable from environmental degradation.

Alscher, Stefan. "Environmental Degradation and Migration on Hispaniola Island." ***International Migration*** **49 (2011), 164-88.**

Based on field research on Hispaniola Island in the frame of the EACH-FOR project, the author explores the linkages between environmental change (e.g. deforestation, soil erosion, land degradation) and both internal and international migration in selected regions in Haiti and the Dominican Republic. Research included expert interviews with academics, government officials, and NGO activists and interviews with inhabitants of 65 affected areas. In Haiti, environmental change underlies the economic basis that drives migration decisions. In the Dominican Republic environmental factors are less intense, as the lack of agricultural subsidies and school system infrastructure predominantly drives urban migration. In addition, Haitian migration flows are intra-island while Dominican migrants migrate internationally, strengthening the argument that migrants from the poorest areas replace migrants from less poor areas.

Assan, Joseph Kweku, and Therese Rosenfeld. "Environmentally Induced Migration, Vulnerability and Human Security: Consensus, Controversies and Conceptual Gaps for Policy Analysis." ***Journal of international development*** **24.8 (2012): 1046-57.**

In exploring policy approaches to environmentally induced migration as a result of climactic vulnerability, the authors present three areas of policy concern. First, the authors detail the historical debate in defining environmentally induced migration and call for resolution in order to progress onto a global arena. In addition, the lack of a standardized definition also complicates the legal frameworks surrounding protection of these migrants. While there are numerous existing frameworks, conventions and norms to protect migrants, there are also significant gaps in international law with regard to people displaced by the effects of climate change. The authors' third point discusses the confusion regarding the statistical calculations of "climate migrants,"

while also admitting that such a goal may be unachievable due to the multi-causal dimensions of migration in general.

Barbieri, A. F., & Confalonieri, U. E. C. (2011). Climate change, migration and health: Exploring potential scenarios of population vulnerability in Brazil. In E. Piguet, A. Pécoud, & P. de Guchteneire (Eds.), *Migration and climate change* (pp. 49–73). Cambridge: Cambridge University Press.

Studying how population redistribution through migration impacts residents' health and vulnerability in future scenarios of climate change, the authors focus on the northeast region of Brazil between 2025 and 2050. Using low-and high-carbon emission scenarios outlined in recent IPCC reports, the climate models are used with agricultural and migration data to predict the economic impacts of climate change local populations. The authors estimate that climate change will continue historical trends of migration that results from severe droughts periods in the region combined with better labor opportunities in the Southeast. Due to the mobility of infected people, the authors stress that policymakers need to understand the changing foci of endemic diseases as well as the need for adaptation plans to include strengthening public health systems and infrastructure. Vulnerability Indices help to prioritize areas for intervention as any migration adaptation strategies in the context of climate change will certainly have to be developed in conjunction with other adaptation measures relevant for public health, like improving food security and water systems.

Barnett, Jon, and John Campbell. *Climate change and small island states: power, knowledge, and the South Pacific*. Earthscan, 2010.

Drawing on extensive research, the authors describe the various dynamics that exist when attempting to understand climate change in the Pacific Islands. The authors argue that the presentation of climate change in small island states is a discursive formation that limits understanding, and therefore action, to address the interests of those most affected: the people living in the islands. The book demonstrates that climate change is a problem of knowledge, power, and justice and criticizes the well-intentioned, but ineffectual efforts to date by NGOs and other power structures.

Bhattacharyya, Arpita, and Michael Werz. Center for American Progress. *Climate Change, Migration, and Conflict in South Asia.* 2012.

The authors explore the role of climate change, migration, and security broadly at the national level in India and Bangladesh, and specifically at northeast India and Bangladesh. Internal and

temporary displacement will account for the majority of migration that will take place in the context of environmental change, while international migration will continue at the largest estimated rate in the world. Tensions in the Assam region between members of the Bodo tribe and Muslim community create perceptions within both countries of heightened security threats as a result of migration. Urging U.S. policymakers to commit to increased aid, research, and international dialogue, the report stresses an overall pivot toward Asia and the region most likely to suffer the impacts of a changing climate.

Bilsborrow, Richard E., and Sabine J. F. Henry. "The use of Survey Data to Study migration–environment Relationships in Developing Countries: Alternative Approaches to Data Collection." ***Population and Environment*** **34.1 (2012): 113-41.**

This paper explores three different approaches to data collection in which survey data were used to study the effects that the environment may have on migration. The paper attempts to explore the interrelationship between migration and environment at the micro-level, often overlooked due to poor data from both migration and environment sources. Three examples are highlighted; a) the use of population and environmental data from different sources in Burkina Faso; b) the addition of questions to a survey developed for an alternative purpose in Guatemala using a USAID Demographic and Health Survey; c) designing a new survey to specifically collect both migration and environmental data in order to investigate interrelationships in Ecuador.

Birk, Thomas, and Kjeld Rasmussen. "Migration from Atolls as Climate Change Adaptation: Current Practices, Barriers and Options in Solomon Islands." ***Natural Resources Forum*** **38.1 (2014): 1-13.**

The study used a combination of qualitative field research methods to collect data from the atoll communities of the Reef Islands and Ontong Java, located in the periphery of the Solomon Islands. The methods used included structured household interviews, semi-structured interviews, focus groups and participatory observations as the main methods used. A total of 194 structured household interviews were made, representing about 20% of households in Ontong Java (90 out of 369) and 10% of households in Reef Islands (104 out of 980). The data collected from the initial interviews was enhanced further by 45 semi-structured interviews (36 in Reef; 9 in Ontong Java) and 17 focus group interviews (12 in Reef; 5 in Ontong Java. Participant observation by the authors also helped gain a better perspective of the livelihoods of the atoll islanders. As climate change and rising sea levels affects these atoll communities, they have had to develop short and long-term adaptive strategies to climate change. The data shows that migration has helped the islanders to improve access to social and financial capital, reduce stress on natural resources, and make the communities less vulnerable to extreme weather and other shocks. However, there remain barriers to migration such as high transport costs and problems in gaining access to housing, employment and government services in urban destination areas. If migration is to be a viable adaptive strategy to climate change and rising sea levels, these barriers will need to be overcome.

Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., & Thomas, D. The effect of environmental change on human migration. *Global Environmental Change, 21, Supplement 1*(0), (2011). 3-11.

The authors seek to build on the emerging empirical case-based literature by presenting a conceptual framework for understanding and assessing the effects of environmental change on human migration (internal and international). The framework identifies five drivers of migration: economic, political, social, demographic, and environment. Unlike former models that start with environment as a driver and examine its impact on migration, the authors propose that focusing on drivers of migration in general helps better understand how these drivers will be affected by environmental change. The authors find that household decisions to migrate are affected by the five drivers in combination, and environmental change affects migration directly and indirectly (i.e. changing livelihoods). The authors emphasize that by focusing on the details of the migration process, the framework illustrates that environmental change will amplify, and not cause, existing demographic trends of migration to urban areas. In addition, the study will help identify migration as a key element for managing environmental risks rather than as a problematic outcome of environmental change.

Black, R., Arnell, N.W., Adger, N., Thomas, D., & Geddes, A. "Migration, immobility and displacement outcomes following extreme events." *Environmental Science and Policy*, 27 (2013) 32–43.

Reviewing literature on empirical case studies about the relationship between different climate stressors and migration, this article examines the sensitivity of migration drivers in specific contexts to climate change, proposing a practical tool for climate adaptation planning that answers and how and why existing flows from/to specific locations may change in the future. It introduces the approach of integrated assessment and applies it to case studies, Ghana and Bangladesh. This integrated approach can provide a basis for wider estimation of future flows, although data constraints and complexity mean its initial application should be limited to regional or country-level scenarios.

Bohra-Mishra, P., & Massey, D.S. (2011). "Environmental degradation and out-migration: New evidence from Nepal." In Piguet, Pecoud, and Guchteneire *Migration and Climate Change (pp. 74-101).* Cambridge: Cambridge University Press.

Building on data collected from the Chitwan Valley Family Study in Nepal, the study uses event history data to model local, internal, and international migration as a function of environmental deterioration. Controlling for a number of economic, social, and demographic variables, the authors local moves are strongly related to population pressure, deforestation, and declining agricultural productivity. Gender differences exist, as environmental effects on local migration are more prevalent for women while increased firewood collection time is associated with a higher probability of men internally migrating. Generally, the authors suggest that gradual environ-

mental deterioration is associated with local, an not distant, population mobility and thus not in line with the alarming image of "environmental refugees" in media representations.

Chindarkar, N. "Gender and Climate Change-Induced Migration: Proposing a Framework for Analysis." *Environmental Research Letters* 7.2 (2012).

Offering a unique perspective on the climate-induced migration field, the author proposes a framework for gender analysis in vulnerability assessments. Drawing from a review of the literature, the author suggests that few studies link climate change, migration, and gender using empirical evidence and provides a framework to operationalize and examine vulnerability by looking at exposure, sensitivity, and adaptive capacity of women during specific phases of migration. The author stresses that among the most vulnerable groups, women to be disproportionately affected, which influences both the process and outcomes of climate change-induced migration.

Chun, Jane M. *Vulnerability to Environmental Stress: Household Livelihoods, Assets and Mobility in the Mekong Delta, Viet Nam*. International Organization for Migration. IOM Migration Research Series No. 52 (2014).

The Mekong Delta in Viet Nam is often cited as one of the most vulnerable areas in the world to severe and possible permanent inundations, seal level rise, and saline water intrusion. The author argues for a more nuanced approach to understanding vulnerability and household response measures in contexts of environmental stress and uses asset vulnerability as a framework to decipher differentiations of vulnerability across households. Asset vulnerability enables exploration of household vulnerability through the lens of measurable household assets, which determines a household's capacity to respond to opportunities, as well as stress. The author identifies critical determinants of household vulnerability in Vinh Tri and Long Thuan. Individuals who own their homes and agricultural land and who have healthy psychological and physical status are less likely to migrate. Relocation to areas far from natural assets causes households to lose their livelihoods and increase their debt burden. Migration is largely rural-urban and is facilitated by social networks. Multiple stressors shape rural life and livelihoods, with environmental stress coexisting alongside and sometimes overshadowed by other stressors.

Cohen, Ignacio Sánchez, et al. "Forced Migration, Climate Change, Mitigation and Adaptive Policies in Mexico: Some Functional Relationships." *International Migration* 51.4 (2013): 53-72.

Mexico, a country heavily exposed to climate change and variability, has historically large international migrations into the United States. The authors provide an historical analysis of migration patterns in Mexico, suggesting that large population movements since the end of the Mayan civilization have resulted from climate variability and drought. In addition, the authors describe an analytical framework that incorporates historical population trends, natural hazard probabilities, and tree ring analysis to better understand risk impacts of climate variability and model decision making processes. Due to the large livelihood dependency on agriculture and

the increased likelihood of weather variability in Mexico, the authors propose an integrated water policy that involves investment in water-saving technologies and consolidation of irrigation systems in heavy-use districts in the northern dry lands.

Coniglio, Nicola D. and Giovanni Pesce, "Climate Variability and International Migration: An Empirical Analysis". Environment and Development Economics (Jan 2015). 1-35.

The authors investigate the direct and indirect role of climatic shocks in developing countries as a determinant of out-migration flows toward rich OECD countries in the period 1990-2001. The authors utilize a macro approach, explicitly considering the heterogeneity of climatic shocks. The authors find that the occurrence of adverse climatic events in origin countries has significative direct and indirect effects on out-migration from poor to rich countries. The magnitude, sign, and nature of shocks matter in explaining the link between climate variability and international migration. Different socio-economic systems and the individuals within them have different degrees of vulnerability to the same type of climatic shocks. Climatic shocks are highly heterogeneous in nature and type, as are the individuals and communities affected by climatic events. The authors find that the adoption of coping mechanisms will depend on the perceived duration of the direct and indirect effects of climate shocks and on expectations of the occurrence of additional shocks in the future.

Connell, John. "Islands at Risk? Environments, Economies and Contemporary Change." ***Elgar Online*****. Edward Elgar Publishing, Inc. Cheltenham, UK, 2013.**

The author focuses on small, developing island states in the Caribbean, Pacific, and Indian Ocean regions to provide a comparative analysis of contemporary economic, social, political, and environmental change and the potential impact on these communities. The author explores the shift of economic dependence on agriculture to tourism, the problems of urbanization, and the role of remittances in a culture characterized by migration.

de Sherbinin, A., K. Warner, and C. Ehrhart. 2011. "Casualties of Climate Change," ***Scientific American*****, January 2011: 64-71**.

Examining three regions suffering the effect of climate change, the authors highlight those at most risk using migration as a reactive response to severe environmental change. In Mozambique, periodic flooding and drought in various regions threatens livelihoods and increasing the likelihood of future migration elsewhere. Flooding in Vietnam may surpass the beneficial levels needed to irrigate rice paddies, jeopardizing financial security of farmers. In addition, rising sea

levels in the Mekong delta could potentially displace millions of people from their homes. Finally, the authors focus on storms and drought in Mexico and Central America related to the effects of rainfall variability. Migration into urban settings and the United States may seek to exacerbate existing vulnerabilities.

de Sherbinin, A. Marc Levy, Susana Adamo, Kytt MacManus, Greg Yetman, Valentina Mara, Liana Razafindrazay, Benjamin Goodrich, Tanja Srebotnjak, Cody Aichele and Linda Pistolesi. "Migration and Risk: Net Migration in Marginal Ecosystems and Hazardous Areas." ***Environmental Research Letters*****, 7.4 (2012)**

Using modeled data on net migration over three decades from 1970 to 2000, this article analyzes the patterns of net migration for various sensitive ecosystems and high hazard regions of the world. Low-income regions have seen a large net migration out of marginal environments such as dry lands, mountains, and drought-prone areas, as well as a large net influx of migrants to coastal ecosystems and the low elevation coastal zone, including cyclone-affected and flood-prone areas. In North America, the reverse is true: net migration patterns are positive in drought-prone dry lands and mountain ecosystems. Broadly, the results confirm evidence that outmigration is a response to a lack of economic activity and marginal environmental conditions, and that people move to areas that are better connected economically, but which may be impacted by other kinds of hazard risks. Future refinements to this analysis could improve the accuracy of results.

Deheza, E., & Mora, J. "Climate change, migration and Security." RUSI, Whitehall Report 1-13, (2013)

The authors supplement the qualitative literature review with a quantitative statistical model that combines high-resolution atmospheric data and demographic variables gathered from the 2010 National census. Econometric results indicate that temperature and rainfall variability determine internal and international migration decisions. Principal findings demonstrate mean annual temperature influences internal migration more than the influence of being male. Authors also suggest that climactic variables impact regions throughout Mexico differently, which requires understanding the resiliency of those who chose not to migrate as a consequence of increasing temperatures, for example.

Dillon, Andrew, Valerie Mueller, and Sheu Salau. "Migratory Responses to Agricultural Risk in Northern Nigeria." ***American Journal of Agricultural Economics*** **93.4 (2011): 1048-61.**

Analyzing the effect that agricultural risk has on internal migration, the authors surveyed 200 households in northern Nigeria over a 22-year period, and investigated the degree to which internal migration ensures against ex ante and ex post agricultural risk. Authors estimated a linear

probability model (LPM) to measure migration determinants with relation to household characteristics (size, education, livestock assets, land holdings, etc.). In order to proxy agricultural income variability, the authors used temperature extremes rather than rainfall since the consequences of temperature can often be more severe on agricultural output.
Households send males to migrate elsewhere to mitigate risk *ex post*, and the effect on male migration is greater for hot shocks. Men and women possess different expected return in labor markets, and this difference may drive the selection of migrants.

Drabo, Alassane and Linguère Mously Mbaye. "Climate Change, Natural Disasters and Migration: An Empirical Analysis in Developing Countries," (2011) IZA Discussion Papers 5927, Institute for the Study of Labor (IZA).

Authors assessed the relationship between climate change and migration by focusing on migration rates due to climate change-induced natural disasters. The authors also analyzed the effect of natural disasters on migration in the context of education level. Panel data was compiled from the UN Population Division, M. Schiff and M.C Sjoblom (2008), and the CRED database from 1900 to 2010, and analyzed using an OLS fixed effects estimator. Findings reaffirm previous research and demonstrate that natural disasters are positively associated with emigration rates. While the intensity of natural disasters had little effect on migration rates, the effects of disasters on the migration of highly educated people was significant. This "brain drain" effect implies that the highly skilled individuals migrate at a time when their skills are most in need to help with the recovery process.

Dun, Olivia. "Migration and Displacement Triggered by Floods in the Mekong Delta." *International Migration* 49 (2011): 200-23.

The author, in collaboration with the International Organization for Migration office in Vietnam, conducted a series of qualitative field interviews between October and December 2007. The research examined the influence of environmental change (principally flooding and its impacts) on migration and population relocation in the Mekong Delta of Vietnam. A questionnaire was used to collect data from 32 Vietnamese migrants in Phnom Penh, Cambodia; semi-structured interviews with 12 internal migrant households who had moved from the Mekong Delta to Can Gio district of Ho Chi Minh City; and about 12 interviews with people and resettled households who lived or continue to live along the river banks in An Giang province of the Mekong Delta. In addition, 45 expert interviews amongst government officials, representatives from international NGOs, academics and others were interviewed to gain more knowledge about how migrants lives are affected by the flooding of the Mekong Delta. Results showed strong ties to the lands, not only for livelihoods and social networks but ancestral heritage amongst the inhabitants, reflecting a desire to stay in the riverbank communities and resistance to resettlement in post-disaster situations. The poor and landless were more resistant to change compared to wealthier citizens. The resettlement process also involves purchasing land, usually through taking loans, which can lead to further poverty or indebtedness among the landless poor. Analysis of the interviews reveals that many of those involved in resettlement chose to move to urban cen-

ters from the Mekong delta for socio-economic reasons, which are also often compounded by environmental degradations, as the migrants were typically seasonal day laborers.

Édes, Bart, Francois Gemenne, Jonathon Hill, and Diana Reckien. "Addressing climate change and migration in Asia and the Pacific." *Asian Development Bank*. Mandaluyong City: Asian Development Bank (2012).

Aimed at generating policy responses to migration stimulated by climate-related factors, the report focuses on the global area most prone to natural disasters: Asia and the Pacific. The report thorough assesses the state of the evidence with regard to environmental change and migration, highlighting methodological issues, migration patterns, climate change impacts, and the nexus of how climate change will affect migration, disaggregated by region. The report details framing the issue in a development agenda and offers several recommendations on how to improve the knowledge base, find funding opportunities, and government action.

Etzold, Benjamin, Ahmed, A.U., Hassan, S.R., Neelormi. "Clouds Gather in the Sky, but no Rain Falls. Vulnerability to Rainfall Variability and Food Insecurity in Northern Bangladesh and its Effects on Migration." *Climate and Development* 6.1 (2014): 18-27.

The study examines communities in northern Bangladesh and their perceptions of changing rainfall patterns on their decision to migrate to cope with food insecurity. Authors used a mixed methods approach to studying vulnerability to changing rainfall patterns, conditions of food security, and migration patterns. Data were collected through a 150 household survey, 33 focus-group discussions, and expert interviews. Results illustrated that local populations perceive the annual monsoon cycle as a livelihood risk since individuals are highly dependent on agricultural based livelihoods. Authors also stress the importance of Bangladesh's internal labor market system, which is structured on seasonal agricultural labor and informal work, and allows some households to cope with temporary crises. Authors also imply that social inequality and food insecurity, rather than environmental change, are the strongest drivers of migration in northern Bangladesh as social networks structure migration opportunities.

***Falling Through the Cracks: A Briefing on Climate Change, Displacement and International Governance Frameworks*. Environmental Justice Foundation (2014).**

This article provides an overview of the legal and policy frameworks governing climate-induced displacement at the international level. The authors identify core gaps in the current regime, most notably the lack of definitions describing persons compelled to move as a result of climate change impacts and protection frameworks and targeted assistance addressing cross-border displacement from states experiencing extreme climate change impacts that pose threats to the long-term sustainability of human settlements. The authors argue that the international community

must develop precise, legally-worded definitions to describe types of climate-induced displacement which inform and enable targeted policy measure**s.** The international community should work with states threatened by severe climate change impacts to develop national, bilateral, and multilateral frameworks which both reactively protect the rights of the vulnerable and proactively enable people to more freely, safely, and with dignity. The international community should prioritize building the operational capacity of national and international humanitarian actors to respond to rapid-onset hazards and assist displaced population as well as assisting vulnerable countries to build disaster-risk reductions programs. Planned relocation should be implemented as a last policy alternative and resettlement should voluntary and participatory.

Fatima, Rababa, Anita Jawadurovna, and Sabira Coelho. "Human Rights, Climate Change, Environmental Degradation and Migration: a new Paradigm" *Issue in Brief*, Issue N°8. IOM (office for Asia and the Pacific) and Migration Policy Institute, March 2014.

The issue brief address environmentally induced migrants' rights in one of the most vulnerable regions in the world: the Asia Pacific region. The authors provide the context for the current human rights framework, identify gaps in the framework and in its application, and review the legal options available to international actors. The authors conclude by offering recommendations on how to strengthen the soft law approach as an initial step before any broad global consensus or binding protection frameworks are established.

Feng, Shuaizhang, Alan B. Krueger, and Michael Oppenheimer. "Linkages among Climate Change, Crop Yields and Mexico–US Cross-Border Migration." *Proceedings of the National Academy of Sciences,* 107.32 (2010): 14257-62.

Focusing on climate change impact through agricultural productivity, the authors quantitatively assess the relationship between crop yields and migration in Mexico. Studying US bound out migration from 1995-2005, the authors estimate a two-stage fixed effects model to find that a 10% decrease in crop yields increase emigration rates by 2% irrespective of the crop (wheat or corn). These calculations then serve as the basis for authors' forecasting of migration rates under certain climate change scenarios outlined by different General Circulation Models. Authors estimate that projected CO2 emissions will result in decreased crop yields of 39-48%, which would increase emigration rates by at least 7.6% by 2080.

Ferris, Elizabeth. "Protection and Planned Relocations in the Context of Climate Change." UN High Commissioner for Refugees (UNHCR), August 2012, PPLA/2012/04.

The author explores relocation and resettlement in the context of climate change, highlighting the lessons learned from development-forced displacement and resettlement and develops a set of 22 preliminary understandings for upholding the rights of communities who are, or will be, relocated as a result of climate change. The author emphasizes the need for general principles to guarantee respect for those relocated and resettled due to climate change, which requires collaboration among humanitarian, development, and human rights actors. Building on

these principles will require adequate financing mechanisms, advanced planning, and addressing the role of land, among others.

Fielding, A. J. "The Impacts of Environmental Change on UK Internal Migration." ***Global Environmental Change*** **21, Supplement 1.0 (2011): S121-30.**

After discussing the social, political, demographic, and environmental drivers of migration in the UK, the author discusses the future trends of these drivers in the wake of varying levels of environmental change (e.g. sea level rise, extreme temperatures, flooding). The author finds that the UK is uniquely positioned to adjust to climate change with a major redistribution of its population. However, greater river and coastal flooding will make some areas hazardous for settlement. Government involvement is the most important factor in dictating climate change adaptation, and requires cooperation with urban planning officials to recognize vulnerable resettlement areas and drive infrastructure investments.

Findlay, Allan M. "Migrant Destinations in an Era of Environmental Change." ***Global Environmental Change*** **21, Supplement 1.0 (2011): 50-58**

The author synthesizes different kinds of evidence (e.g. migration theory, migration forecasts, research literature from environmental migration) to develop generalizations what dictates migrants' decision making with regard to choosing specific destinations. The study specifically focuses on the influence of food insecurity and drought on migration decisions, and Europe as a destination for migration flows. Providing six principles that govern the attraction of places to potential migrants, the author generally concludes that immobility and rootedness migration decisions, so policy makers should be concerned with the inability of the most vulnerable populations to adapt to climate change in situ. In addition, the authors emphasizes that instead of focusing on how to estimate the number of environmental migrants, researchers should explore the destinations of these migrants and the reasons behind choosing these destinations.

Findlay, A., & Geddes, A. (2011). "Critical views on the relationship between climate change and migration: some insights from the experience of Bangladesh." In Piguet, E., Pecoud, A., & de Guchteneire, P. (Eds.), ***Migration and climate change.*** **(pp. 138-159). UNESCO/Cambridge University Press.**

Authors use bibliometric data to explore the growth of term "environmental refugee" and its influence on current discourse surrounding environmental change and migration. The authors then draw several lessons learned from population mobility in places experiencing rapid environmental change, which highlight the influence of slow-onset process like land degradation in dictating migration decisions. Providing a case study from Bangladesh, the authors recommend policy interventions that are more sensitive to local social contexts that may help those "invisible" migrants that often go unnoticed using conventional metrics of vulnerability.

Fussell, Elizabeth, Katherine J. Curtis, and Jack DeWaard. "Recovery Migration to the City of New Orleans After Hurricane Katrina: A Migration Systems Approach." ***Population and Environment*** **35.3 (2014): 305-22.**

The authors use a migrations-systems approach to explain how the migration system around New Orleans, Louisiana, changed after Hurricane Katrina, and whether or not the most important sources for population recovery after the disaster were the most important destinations for migrants after the disaster. The research uses a place-based approach, focusing on the entire New Orleans migration system, and how it responds to an exogenous shock, allowing them to discern how places recover population after a disaster. They describe the existence and magnitude of migratory outflows from New Orleans before and after Hurricane Katrina using the Internal Revenue Service Statistics of Income Division county-to-county migration data files, which count household income and broad age groups. Pre-disaster migration system data is taken from the years 1999-2004, and is compared to data from 2007-2009 to measure the period after Hurricane Katrina. Findings indicate that after the disaster, New Orleans' migration system increased in-ties with, and received larger flows from, nearby coastal counties in the Gulf of Mexico, thereby spatially intensifying the in-migration dimension of the system. Most of these were counties that had received out-migrants from Orleans parish prior to the disaster. The magnitude of migration flows to Orleans parish depended on the amount of damage received. This paper contributes to a growing literature on migration responses to disasters at the population-level (as opposed to the individual level), and from a systems-perspective. Like other studies, the authors find heightened mobility after disasters. This mobility occurs within the existing migration system, as displaced households follow well-travelled pathways to nearby and familiar places.

Geddes A., Sommerville W. "Migration and Environmental Change: Assessing the

developing European approach" ***Policy Brief Series*****, Issue N° 2, Migration Policy Institute Europe, May 2013.**

The authors address the complex and multi-causal character of environmental migration. Various drivers of migration such as economic inequality are likely to interact with environmental changes and cause rural exodus. In the late 2000s, there has been no consensus between scholars on causality between the concepts and thus the link between migration and environmental change. Migration could be considered one of the best adaptation strategies in situations of increased poverty due to reduced earning and grazing season for herders. A holistic approach should clarify the concepts of 'environmental migrants' and 'climate refugees'. Even though the European Union's response to migration as a result to environmental changes has evolved, it is important to overcome institutional inertia and implement actual actions. EU decision makers could grant relief for rapid-onset natural disasters; include natural disaster related

migration in crisis-coordination policy frameworks for a joint European response; and include migration within key development strategies.

Geddes A, Somerville W. "Migration and environmental change in international governance: the case of the European Union." ***Environment and Planning C: Government and Policy*** **30.6 (2012) 1015 – 1028.**

Describing the multi-causal and complex relationship between environmental change and migration, the authors examine the policy implications of environmentally induced migration with regard to the European Union. Stating that future mass migration to Europe is highly unlikely, the authors provide an historical overview of European policy responses, which have been reactive and received little prioritization in international discussions. The authors provide several recommendations, which entail measures to reinforce and improve crisis coordination, support adaptation, and courage migration where appropriate.

Gemenne, Francois. "Why the numbers don't add up: A review of estimates and predictions of people displaced by environmental changes." ***Global Environmental Change*** **21 (2011), 41-49.**

This article reviews key estimates and forecasts in the literature on global environmental migration and analyzes the robustness and predictive value of their methodologies, as well as their impacts on public debate. Although often based on questionable methodology, predictions and estimates have often been quoted in the media and made a lasting impact in both policy and scholarly debates. The quest for numbers is hampered by disagreements over the definition of environmental migration, the challenge of accounting for what is most often an intra-national phenomenon, and a failure to consider varying degrees of vulnerability within a region, demographic changes over time, timeframes, and the potential adaptation or mitigation strategies. First, a right framework for research needs to be set that entails the design of a common working definition and the development of statistical systems and local research capacities. Quantitative research in the field should be rescaled, both with regard to timeframe and spatial dimension. Finally, new methods and techniques have to be tested, such as longitudinal studies, scenarios, or agent-based modelling.

Ginetti, Justin. ***Disaster-Related Displacement Risk: Measuring the Risk and Addressing its Drivers*****. International Displacement Monitoring Centre. (2015).**

Disaster-related displacement risk has quadrupled since the 1970s, and displacement risk has increased at twice the rate of population growth; people are twice as likely to be displaced now as they were in the 1970s. The author measures displacement risk using the formula "risk = hazard x exposure x vulnerability". Climate change may increase displacement risk by increasing the

frequency and intensity of some weather-related hazards as well as increasing certain communities' vulnerability and reducing the thresholds at which point people become displaced. The primary driver of increased exposure since the 1970s has been rapid, unplanned development in hazard-prone areas in developing countries, as rapid urbanization concentrates large numbers of vulnerable people in dangerous locations. The author argues that weak or corrupt governance structures can further exacerbate this process by creating incentives for people to move to hazard-prone areas or by forcing them to live there. Conflict and generalized violence affect several of the most at-risk countries, which increases the vulnerability of communities and undermines their ability to resist and cope with natural hazards.
Drivers of disaster-related displacement risk are the same as drivers of disaster risk in general, so measures taken to reduce disaster risk also reduce displacement risk. The author argues that disaster risk should be included in general risk-reduction strategies.

Goff, Leo, Hilary Zarin, and Sherri Goodman. "Climate-Induced Migration from Northern Africa to Europe: Security Challenges and Opportunities." ***The Brown Journal of World Affairs*** **18.2 (2012): 195-213.**

Authors address the security threats posed by mass migration from Africa into Europe as a result of climate change. Approaching the subject by examining migration as an adaptation strategy, the authors present an overview of current and projected Arica migration trends and the potential security threats they entail. Authors reveal that migration is driven by a combination of factors and not all migration is the same. Different types of migration pose different security risks and the authors propose a "security framework" that models scenarios based on the migration magnitude and the types of migration (regular-legal, irregular-illegal, and involuntary).

Gray, C. Soil quality and human migration in Kenya and Uganda. ***Global Environmental Change*****, (2011). 21, 421–430.**

In order to add to the relative limited quantitative literature on the relationship between soil characteristics and migration, the authors used random effects multinomial logit models to measure how soil quality impacts internal migration in the East Africa Highland countries of Uganda and Kenya. To implement the study, the author used longitudinal survey dataset from the REPEAT project, which contained information on migration on soil properties and migration for 1200 households. Findings revealed that soil quality significantly reduces migration in Kenya, especially with regard to temporary labor migration. In Uganda, soil quality marginally increases migration, which is consistent with the poverty trap of migration where rural populations are larger and access to agricultural resources is limited. The Kenya case suggests that households respond to low soil quality and the ensuing reduced agricultural yields by sending temporary migrants to generate additional income. In Uganda, the pattern is less clear, but the low soil quality reduces households' ability to send permanent non-labor migrants for reasons such as marriage and schooling.

Gray, Clark, and Richard Bilsborrow. "Environmental Influences on Human Migration in Rural Ecuador." *Demography* 50.4 (2013): 1217-41.

Using an innovative approach that combines multistage stratified sampling with the collection of event histories at various scales, the authors study migration patterns of over 500 households in the Andean highlands of Ecuador with regard to topography, climate, and weather shocks. Using a retroactive migration study, panel data, and GIS to collect biophysical data, authors sought to study static and slow changing environmental characteristics. Surprisingly, and inconsistent with conventional narratives, the findings suggest that higher quality land and positive rainfall shocks actually facilitated migration and may signal a new paradigm where rural households display considerable agency in responding to environment conditions. While climate changes (fast and slow) are likely to increase human migration, they are not necessarily in the expected directions. For instance, it may be possible that potential migrants will be trapped in place by changing climates.

Gray, C., & Mueller, V. Drought and population mobility in rural Ethiopia. *World Development*, (2012a) 40, 134–145.

Combining household surveys and satellite data sources, the authors study 1,500 rural Ethiopian households in 15 rural communities over a 15-year time period. Data collection began in 1994 and occurred in 1995, 1999, 2004, and 2009 and was used to build a person-year dataset that contained multiple measures of mobility. Discrete-time event history models analyze the effects of drought on mobility, and the results yielded robust evidence that contrasted traditional narratives. The authors find that men's labor migration doubled under severe drought (10% of adult men per year) and that land-poor households are most vulnerable, confirming previous research that suggests migration is a coping strategy for drought. However, women's short-distance and marriage-related mobility reduced by half under moderate drought, which may signal a decreased ability to pay for wedding expenses and the formation of a new household. Overall, the study indicates that households respond to drought in numerous ways, which suggests a hybrid narrative of environmentally induced migration that recognizes multiple dimensions of adaptation to environmental change.

Gray, Clark L., and Valerie Mueller. "Natural Disasters and Population Mobility in Bangladesh." *Proceedings of the National Academy of Sciences of the United States of America* 109.16 (2012b): 6000-5.

Exploring the conventional narrative that natural disasters consistently increase long-term population out-migration, the author collects longitudinal survey data from 1,700 households in Bangladesh from 1994-2010. To estimate the effects of natural disasters (i.e. flooding) on mobility, the author estimates discrete-time event history models. Results demonstrated that

flooding only modestly affects mobility. These effects are mostly seen at moderate intensities, for women, and for the poor. While mobility can be seen as a method to cope with natural disasters, it is not a universal effect. For instance, natural disasters can reduce mobility by increasing demand for labor at the origin or by removing the resources necessary to migrate. Additionally, and in contrast to author's hypotheses, disasters appear to affect only local moves, which is potentially due to the high costs and uncertainty regarding long-distance moves. Furthermore, household crop shocks reduce the resources necessary for migration, whereas subdistrict level shocks affect only risk-sharing networks and off-farm employment opportunities, increasing the motivation to move.

Gray, Clark, Frankenberg, Elizabeth, Thomas Gillespie, Cecep Sumantri, and Duncan Thomas. "Studying Displacement After a Disaster using Large-Scale Survey Methods: Sumatra After the 2004 Tsunami." ***Annals of the Association of American Geographers*** **104.3 (2014): 594-612.**

The authors apply population surveys, satellite imagery, and multivariate statistical analyses to examine human vulnerability and migration in the wake of the 2004 Indian Ocean Tsunami. Authors designed and fielded a large-scale population-representative longitudinal survey that tracked approximately 10,000 households living in coastal regions in Aceh and North Sumatra prior to the tsunami. Authors re-interviewed participants after the events, comparing damaged and undamaged areas. Unlike previous account of disaster-induced mobility, authors find that displacement from damaged areas was distinct from migration from undamaged areas and less selective overall. Farming households experienced lower mobility, while educated individuals migrated more. Other indicators of vulnerability, which included poverty and female-led households, did not predict displacement and the results reinforced conceptualizations of forced migration that stress the agency of the displaced and the importance of social networks and complex nature of responses to disasters.

Greiner, Clemens, and Patrick Sakdapolrak. "Rural–urban Migration, Agrarian Change, and the Environment in Kenya: A Critical Review of the Literature." ***Population and Environment*** **34.4 (2013): 524-53.**

Through a review of the literature on rural–urban migration in Kenya areas, this article examines the feedback effect that migration has on the environment in rural sending areas, particularly regarding agricultural change, land-use patterns, and soil conservation. Distinct relations between migration, agricultural change and the environment are mediated to varying degrees by flows of remittances, loss of labor, socioeconomic stratification, gender dynamics, and cultural factors. It is inadvisable to rely too heavily on generalized assumptions about the directions of these relations as they are likely to fail to account for the complexity of the phenomena. Future analysis of the migration–environment relationship should utilize a trans-local framework. Future research should address: the impact of rural–urban migration on other envi-

ronmental resources, such as forests, water or biodiversity; how cultural dimensions like the importance of meaning and belonging attached to places of origin and destination impact on the environment; the ever-increasing rural–urban interdependencies and their effects on the environment.

Hassani-Mahmooei, Behrooz, and Brett W. Parris. "Climate Change and Internal Migration Patterns in Bangladesh: An Agent-Based Model." ***Environment and Development Economics*** **17.6 (2012): 763-80.**

The authors create an agent-based model (ABM) to predict the migration dynamics within Bangladesh resulting from climate change which incorporates social, economic, and environmental variables and based on projected climate change scenarios. The model incorporates push factors such as climate change scenarios and subsequent consequences, poverty levels of the district, and local government development expenditures and pull factors like socioeconomic conditions in potential destinations. The results of the model showed that migration is likely to occur from the western districts, which are susceptible to droughts, and the southern districts, which are threatened by cyclones and floods to northern and eastern districts of the country. These findings suggest that urban areas will need to continue to accommodate an increased amount of migrants and development of the labor market and informed planning of additional required infrastructure are essential.

Hastrup, Kirsten, and Karen Fog Olwig 1948. "Climate Change and Human Mobility." New York: Cambridge University Press, 2012.

The book uses historical and contemporary case studies to study human mobility in the context of climate change. Case studies include the Inuit in prehistoric eastern Arctic, relocation of reef and Atoll island communities as an adaptation strategy, and migration and environmental change in northern Ethiopia, among others. Drawing upon a multidisciplinary approach, including geography and anthology, the book illustrates the importance of analyzing new patterns of mobility, historic cultural images and regulation practices in the wake of recent global processes.

Hoffman, Max, and Ana Grigera. Center for American Progress. ***Climate Change, Migration, and Conflict in the Amazon and the Andes*****. 2012.**

Unlike the regions studied in the other reports in the series, the Amazon and Andes do not possess the same likelihood of massive humanitarian disasters or country collapse with regard to rapid onset environmental change. The report focuses on the geographically and socio-politically marginalized communities in these regions, which tend to include the rural small-hold farmers and indigenous communities. The rich natural resource endowment requires that governments properly manage resource extraction and shape infrastructure planning to encourage the development of climate-resilient areas. Renewable energy sources provide governments

the opportunity to meet demand while allowing communities to remain in place. The report suggests that Brazil lead regional efforts to protect the environment and decrease threats of instability which result from the narcotics trade and may require cooperation with the United States.

Hua, Qin. "Environmental Effects on Rural-to-Urban Migration in China." ***Chinese Journal of Population Resources and Environment*** **10.3 (2012): 9-17.**

The authors develop a comprehensive multilevel conceptual framework to study the environmental causes of rural to urban migration in China, considered the largest such flow in world history. In his review of major migration theories and recent research on environmental effects on migration, the author uses China as an especially relevant case study. The author applies this framework to study on the effects of land resources on household labor migration decisions in rural China.

Hugo, Graeme. "Future Demographic Change and its Interactions with Migration and Climate Change." ***Global Environmental Change*** **21, Supplement 1.0 (2011): 21-33.**

Migration in the context of environmental change involves a complex relationship among a host of economic, social, political, and economic drivers. The author focuses on global demographic change as a driver of migration, discussing evolving demographic trends and their potential impacts on migration. The author describes that widening demographic differentials between countries has driven increased international migration, and that outmigration is often a function of a country experiencing the middle stages of the demographic transition when population growth peaks. In addition, there is a strong link between "hotspots" of projected rapid population growth and climate change "hotspots" in low-income countries. The author predicts that climate change will impact the rates of mortality and morbidity on many vulnerable populations though migration.

Hugo, Graeme. "Migration and Climate Change." 15 Vol. Northampton, MA: Edward Elgar, 2013.

In his attempt to investigate the current and future effects of environmental change on migration, the author examines 44 articles from 1993-2010. The book studies internal and international migration, the social and economic impacts of forced migration and resettlement policies, the migratory flows that result from natural hazards, and the risk of conflict and the implications of climate change for vulnerable areas. The author offers recommendations for government action and internal organizational policy in helping address the potential effects of climate change on people's movements.

International Organization for Migration. 2012. "Climate Change, Environmental Degradation and Migration." Geneva. IOM International Dialogue in Migration, No. 18, 2011.

The publication builds upon the report from a workshop entitled "The Future of Migration: Building Capacities for Change," held in Geneva in March 2011. The report recommends that policymakers create a range of policies and programs that adequately capture the multiple facets of environmental migration. In order to achieve this, the workshop identified four principal areas of capacity building emerged: building knowledge and improving data collection; strengthening policy, institutional, administrative and legal frameworks; and reinforcing operational and technical capacities.

Hummel, D., Doevenspeck, M., & Samimi, C. "Climate Change, environment and Migration in the Sahel." ***Selected issues with a focus on Senegal and Mali. Migration, Climate and Environment*****, 1 (2012).**

Global Environmental Change (GEC) in sub-Saharan Africa is likely to drive further migration, much of it permanently to African cities. The argument presented here further suggests that Africa's rapidly expanding and very fragile urban areas (many of them coastal) are likely to be the major locus of the impact of GEC over the next thirty to fifty years because of their fast rate of population growth and weak state capacity to manage GEC induced urbanization and GEC at the city scale. The authors argue that we need to understand the foundational drivers of urbanization, exploring its linkages with GEC, rather than looking for how GEC is an isolated driver of urban growth and urbanization. Taking the sub-Saharan African demographic evidence seriously means that the scholarly and policy emphasis currently directed to GEC migration and displacement might be more effectively redirected to questions of the interface between global environmental change and urban areas. Migration and displacement will almost certainly escalate over the next decades in the light of predicted GEC, but these are not necessarily the most critical issues shaping Africa's development. Understanding migration and displacement is not sufficient preparation for responding to predicted GEC impacts.

Islam, Mohammad Mahmudul, and Johannes Herbeck. "Migration and Translocal Livelihoods of Coastal Small-Scale Fishers in Bangladesh." ***The Journal of Development Studies*** **49.6 (2013): 832-45.**

Authors use a combination of participatory and qualitative methods to gather primary data on household characteristics, which include assets, poverty status, vulnerability context, and usage of remittances. Seventy individual interviews with fisherman and 10 key-informant in-depth expert interviews reveal that while better resourced fisherman use migration as a means to accumulate more assets, poorer fisherman migrate to cope with shocks.

Joarder, M.A.M., & Miller, P. (2013). Factors affecting whether environmental migration is temporary or permanent: Evidence from Bangladesh. Global Environmental Change.

The analyses are based on data collected from household surveys in the North-East of Bangladesh in 2010 and 2011. The data cover four themes, namely migrant characteristics, environmental change related factors, conflict and adaptation strategies, and social networks. Estimates are obtained using binary logit models that demonstrate that most sets of variables have statistically significant impacts on a temporary versus permanent migration decision. Prior work experience plays a major role in the decision to migrate temporarily or permanently. Households that had identified a loss of assets due to environmental factors are more likely to become permanent migrants. Conversely, those households that identified a loss of livestock or crop failure were more likely to become temporary migrants. The empirical results reveal the groups that can be targeted in destination regions in settlement policy, and equally the groups whose return home can be facilitated once any immediate danger has passed.

Joseph, George, Quentin Wodon, Andrea Liverani, and Brian Blankesporr. "Is Climate Change Likely to Lead to Higher Net Internal Migration in Yemen?" In: *Climate Change and Migration: Evidence from the Middle East and North Africa Region*, World Bank Study (2013)

Authors consider net migration rates and predict to what extent changes in climate are likely to affect such net internal migration flows. The authors employ a fractional logit model to analyze a combination of data gathered from a 2004 census, a weather database, and GIS statistical software. Results demonstrate that higher temperatures and higher temperature variability are associated with lower net migration rates but not to a large effect. In addition, increases in temperatures under various predictive scenarios will not likely increase migration rates in Yemen.

Joseph, George and Quentin Wodon. "Is Internal Migration in Yemen Driven by Climate or Socio-Economic Factors? *Review of International Economics*, 21.2 (2013) 295-310.

Using a gravity model to analyze push and pull factors of migration in Yemen, the authors assess whether past migration patterns have been related to climate variables or socio-economic variables in Yemen. Similar to Joseph et al. (2013), a combination of GIS information, census data, and weather station data are used to better understand the effects of rainfall and temperature variability on migration throughout Yemen. Principal findings suggest that the effect of socio-economic pull factors such as employment opportunities and the rate of urbanization at the place of destination have stronger statistical significance and magnitude than climatic push factors.

Jülich, Sebastian. "Drought Triggered Temporary Migration in an East Indian Village." *International Migration* 49 (2011): 189-99.

This paper looks into the impact of drought in a rural village in India and the relative of importance of temporary migration as an adaption strategy. The author conducted comprehensive socioeconomic survey with each household of the case study village. The survey findings and analysis led the author to conclude that temporary migration is an important adaptation strategy for the community (which is believed to be similar to other surrounding communities), especially for those with limited access to credit and irrigated land. However, empirically the people most vulnerable to drought were the ones least likely to migrate due to human, social, and financial resource constraints.

Kaelin, Walter, and Nina Schrepfer. "Protecting People Crossing Borers in the Context of Climate Change: Normative Gaps and Normative Approaches." United Nations High Commissioner for Refugees (UNHCR), February 2012, PPLA/2012/01

The paper first provides context and background of current discussions and approaches surrounding environmentally induced international migration. The authors identify the normative gaps in international protection regimes and discuss the implications of the complex dynamics at the nexus of climate change and migration. The authors explore the general obligations of states at the three levels of mitigation, adaptation, and protection, while also analyzing existing approaches to address cross0order displacement and migration at several regional levels. The authors propose a strategy for normative regulations based on the four pillars of prevention, migration management, temporary and permanent protection schemes and resettlement. Other legal instruments are discussed, which include a hard versus soft law and the authors recommend a multi-level approach to address the multidimensional challenges of international migration and displacement at the normative level.

Kelley, Colin P., Shahrzad Mohtadi, Mark A. Cane, Richard Seager, and Yochanan Kushnir, "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought". Ed. Brian John Hoskins. *Proceedings of the National Academy of Sciences of the United States of America,* Vol. 112, No. 1 (2 March 2015).

Before the Syrian uprising that began in 2011, the greater Fertile Crescent experienced the most severe drought in the instrumental record. For Syria, marked by poor governance and unsustainable agricultural and environmental policies, the drought had a catalytic effect, contributing to political unrest. The government of President Hafez al-Assad initiated policies to increase agricultural production, including land distribution and irrigation projects, quota systems, and subsidies for diesel fuel to garner the support of rural constituents. These policies endangered Syria's water security by exploiting limited land and water resources without regard for sustainability and depleted the groundwater on which farmers depend, increasing Syria's vulnerability to

drought. After Bashar al-Assad took power in 2000, he liberalized the economy by cutting the fuel and food subsidies on which many Syrians had become dependent, further destabilizing the lives of those affected. This led to mass migration of rural families to urban areas. Rapidly growing urban centers of Syria, marked by illegal settlement, overcrowding, poor infrastructure, unemployment, and crime, were neglected by the Assad government and became the heart of the developing unrest. Thus migration in response to the severe and prolonged drought exacerbated the unemployment, corruption, and inequality often cited as contributing to the unrest.

Kniveton, Dominic, CD Smith, and Richard Black. "Emerging Migration Flows in a Changing Climate in Dryland Africa." ***Nature and Climate Change*** **2.6 (2012): 444-7.**

This study looks into how climate and population change interact and influence domestic and international migration patterns within and from Burkina Faso. The authors use an Agent Based Model (ABM) for their analysis in which different individuals' circumstances and behaviors lead to decisions on migration. Since the authors look only at seasonal adaptive migration they use the theory of planned behavior as a foundation for the econometric model which includes variables of attitudes regarding behavior subjective norms and each agents control over life choices (like migration). The authors used household survey data, which included information on migration patterns and focus group conversations to construct their ABM. The econometric analysis led to the conclusion that in Burkina Faso migration related to climate change is driven by population growth. This leads to the authors' conclusion that migration policy interventions should be based on data not only predicting changes in climate, such as rainfall, but also demographic changes.

Kniveton, Dominic, Christopher Smith, and Sharon Wood. "Agent-Based Model Simulations of Future Changes in Migration Flows for Burkina Faso." ***Global Environmental Change*** **21, Supplement 1.0 (2011): 34-40.**

Based on the Theory of Planned Behavior, the agent-based model proposed by authors simulates several scenarios of migration from, and within, Burkina Faso. The conceptual model indicates that climatic stressors such as rainfall do not directly determine migration, but rather influence other drivers of migration like employment opportunities or access to natural resources. Using data gathered from a retrospective multilevel family-type survey conducted in 2000-2001, authors replicate the migration decisions of 4,449 individuals and simulate four wet and dry scenarios based on three variables: Demographic and economic growth (high/low), and social (inclusive/exclusive) and political governance (diverse/connected). By 2060, he future dry model produces the largest total and international migration flows when combined with low demographic growth and inclusive and connected social and political governance.

Kolmannskog, Vikram. "Climate Change, Environmental Displacement and International Law." ***Journal of International Development*** **24.8 (2012): 1071-81.**

The author addresses the legal framework protecting those displaced by environmental events. The author focuses on the need to distinguish between forced and voluntary migration, and argues that policy makers, legal professionals, and humanitarian and development practitioners should exploit existing international law by applying a context-oriented interpretation of internally displaced person law, refugee law, and human rights law when developing new legal and policy statutes. In assessing the possibilities and limitations in existing international law regarding environmentally displaced persons, the author suggests that soft laws or guiding principles could be used as authoritative guidance when applying the various legal frameworks to EDPs.

Laczko, Frank, Aghazarm, Christine., International Organization for Migration., Intergovernmental Committee for Migration., Rockefeller Foundation., United Nations University.,Institute for Environment and Human Security. *Migration, Environment and Climate Change: Assessing the Evidence*. Geneva: International Organization for Migration, 2009.

The book emerged out of several recommendations from the "Research Workshop on Migration and the Environment: Developing a Global Agenda for Research," held in Munch in April 2008. The book contains seven key areas of research, covering data challenges, research methods, acute and slow onset events, and policy responses. Reviewing key research to date, the book highlights innovative approaches to measuring and collecting data on the migration and environment nexus.

Lilleør, Helene Bie, and Katleen Van den Broeck. "Economic Drivers of Migration and Climate Change in LDCs." *Global Environmental Change* 21, Supplement 1.0 (2011): 70-81.

The study serves as a literature review of key migration models in the economic literature and how they are affected by climate change and climate variability. Two main drivers of migration identified throughout the literature are income level differentials between origin and destination areas, and income variability in origin areas. The authors also introduce a third model, the New Economics of Labor Migration (NELM) models, which focus on households, rather than individual migrants, as a unit of migration analysis. The authors review micro and macro-based statistical models used throughout the literature, finding that micro studies find negative effects of rainfall shortages on income levels while macro studies appear less conclusive eon the effects of rainfall and temperature. The authors conclude that climate change is likely to affect the two economic drivers of migration previously discussed, but the effect on income differentials is the only one with any empirical support.

Livingston, Steven and Joseph Guay. "Climate Change Induced Displacement: Leveraging Transnational Advocacy Networks (TANs) to Address Operational Gaps. *Brookings Tech Tank Blog*, Brookings Institution. (3 March 2015).

Transnational Advocacy Networks (TANs) enabled by newer monitoring technologies can track human migrations in near real-time and might help soften the harsher effects of climate change on human populations. TANs often include international and domestic NGOs, research organization, social movements, foundations, and branches of governments and can facilitate Information exchange. Mobile phones open up the possibility of monitoring human migration patterns over time. Social media, and open-sourced data have empowered crisis mappers to offer near real-time analysis and augment situational awareness for first responders in the field, and these networks facilitate collaborations between digital and on-the-ground humanitarians. Commercial, high-resolution remote sensing satellites are also being developed that can track movement of populations in real time.

Leckie, Scott, Ezekiel Simperingham, and Jordan Bakker. *Climate Change and Displacement Reader*. New York: Earthscan, 2012.

The author brings together fifty-one leading texts on climate change and displacement by providing an overview of important issues relating to the nexus. While discussing current and proposed international law and governance frameworks, the authors also analyze NGO response to climate change adaptation. Focusing primarily on Pacific Island and South East Asian nations, the reader provides a consolidated source of findings through a human rights lens.

Lopez-Carr, D. "Agro-Ecological Drivers of Rural Out-Migration to the Maya Biosphere Reserve, Guatemala." *Environmental Research Letters,* 7.4 (2012)

This paper presents data from surveys conducted in areas of high out-migration to the agricultural frontier in northern Guatemala. The results suggest that land scarcity and degradation in origin communities are linked to out-migration in general and to the forest frontier of northern Guatemala in particular. The author examines data from a relatively rare type of data collection to address the question of how ecological processes may have contributed to the migration of households to the northern agricultural frontier of Petén from different areas of rural Guatemala. To date there has been very little data collection in areas of origin to study why people leave settled rural areas for the relatively scarcely settled frontier, despite this being a fundamental part of the process of explaining the causes of tropical deforestation. Therefore, the research presented in this paper explores data from one of the first surveys specifically designed and carried out (in 1999 and 2000) in communities of high out-migration to an agricultural colonist frontier in Central America. The results show respondents citing a lack of land, lack of secure land titles, and soil degradation as the principle factors in out-migration. Climate change factors of floods and pests were also identified as crucial factors to out-migration.

Mallick, B., and J. Vogt. "Cyclone, Coastal Society and Migration: Empirical Evidence from Bangladesh." *International Development Planning Review,* 34.3 (2012): 217-40.

Using survey data from 288 male respondents affected by Cyclone Aila in Bangladesh in 2009, the authors explore the societal consequences of the cyclone, revealing the effects of social segregation caused by migration, with the event of a natural calamity as the intervening variable. Findings from the study are based on evidence from a case study carried out in 2010 in 12

villages in the Satkhira District of Southwest Bangaldesh, using household surveys from a stratified sampling procedure. Face-to-face interviews were employed to focus on the specific socio-demographic situation before and after Cyclone Aila, the adaptive measures and strategies that the affected people had taken, their opinions about disaster management operations, and their future plans. Findings indicate that migration was necessary and unavoidable for the poorer segments of the community, and that the poor suffer more in relative terms, but not necessarily in absolute terms. Income opportunity plays the most significant role in the decision to migrate. Households characterized by landlessness, below-average income opportunities, and massive damage costs chose to migrate chiefly because there was no incentive for them to stay. The study also demonstrates the importance of support networks, including relocation support and opportunities for education, as a counterweight to incentives to migrate.

Marchiori, Luca, and Ingmar Schumacher. "When Nature Rebels: International Migration, Climate Change, and Inequality." ***Journal of population economics*** **24.2 (2011): 569-600.**

The authors investigate the relationship between climate change and international migration by constructing a two-country, general equilibrium, overlapping-generations theoretical model following Galor (1986), based on a Harris-Todaro model of the economic incentives for migration, using the theoretical two regions of the "Global North" and "Global South". The authors factored into the model the predicted effects of climate change on productivity in the South. The main findings indicate that climate change will most likely increase world migration. A simple calibration exercise suggests that the number of migrants increases by a factor of four if climate change reduces productivity in the South by over 5% in the future. Using the same empirical model, the authors show that changes in immigration policy may increase the number of migrants but worsen climate change and has an ambiguous effect on North-South inequality. Investments in greener technology on the part of the North leads to fewer long-term migrants, and a better environment, but again yields ambiguous results for inequality.

Marchiori, L., J. Maystadt, and I. Schumacher. The impact of weather anomalies on migration in sub-Saharan Africa. ***Journal of Environmental Economics and Management*** **63.3 (2012): 355-374.**

The authors develop several econometric models to explain migration trends over the past 40 years and to predict future migration patterns through the next century using country panel data from 1960 to 2000 for 39 sub-Saharan countries with variables including weather characteristics, economic and demographic variables, among others. The authors find that both internal and international migration is influenced through weather anomalies and thus, climate change through two channels – wage level differences between the rural, urban, and internal labor markets and through direct consequences of climate anomalies such as disasters and disease spread. Since rural areas are more vulnerable to weather anomalies, increased climate change will lead to increased urbanization from migration as people look to improve livelihoods. The authors take this consequence one step further and argue that increased urbanization will lead to a decline in urban wages due to excess supply of labor which well then lead to increased levels of international migration. The authors also point out that not only wages drive

migration but also direct push factors such as endemic malaria, dengue, or meningitis fueled by weather patterns. The authors find that weather anomalies do increase incentives for international migration in countries dependent on the agricultural sector.

Martin S., "Environmental Change and Migration: what do we know" ***Policy Brief*****, N° 2 Migration Policy Institute, September 2013.**

The author suggests that climate change may well increase the likelihood of both internal and international migration through four pathways: increased drought and desertification, rising sea levels, more intense and frequent storms, and competition for scarce resources. While these individual factors may not each cause displacement, vulnerable populations may use migration as the only viable adaptation strategy when faced with these environmental changes. Planned migration may help ease pressure on sensitive areas through relocation or circular migration strategies. Some displacement is inevitable and requires the governments incorporate migration into climate adaptation strategies. Cooperation among international organizations, academics, and government representatives will help identify guiding principles and build policy frameworks that will help governments develop effective policies.

Martin, M., Billah, M., Siddiqui, T., Black, R., & Kniveton, D. Policy analysis: Climate Change and Migration in Bangladesh (Working Paper 2). (2013). Refugee and Migratory Movements Research Unit (RMMRU), Dhaka; Sussex Centre for Migration Research (SCMR).

The authors analyze how, why, where, and when migration can be an effective adaptation strategy in Bangladesh through a literature review and a qualitative analysis of government policy regarding both international and internal migration and review studies of climate change related migration in Bangladesh to develop policy recommendations to begin facilitating policy that improves migration and not hinders it. The authors conclude that an anticipated or planned migration should be considered as an effective way for the population to adapt to climate change and that internal migration does not receive the public policy attention it warrants given the large number of internal migrants in the country.

Massey, Douglas, William Axinn, and Dirgha Ghimire. "Environmental Change and Out-Migration: Evidence from Nepal." ***Population Environment*****. 32.2 (2010), 109-136.**

Authors study short and long-term migration patterns in the Chitwan Valley of Nepal as a consequence of environmental degradation. Analysis draws on data from the Chitwan Valley Family Study (CVFS) and authors gather four kinds of basic information: household survey data (n=1,583), individual interviews of life histories (n=5,271), land use data, and demographic event data.

Mayer, Benoit. "Constructing; Climate Migration' as a Global Governance Issue: Essential Flaws in the Contemporary Literature." *McGill International Journal of Sustainable Development Law and Policy* 9.1 (2013): 87.

In her review of seven books and reports published between 2009 and 2012, the author highlights several key issues in literature regarding environmentally induced migration. The author takes issue with many contradictions in the current literature and the unintended consequences of such contradictions when discussing the policy implications of climate induced migration. The author describes a supposed disproportionate focus in the literature on international migration, and the contradiction between empirical studies that quantify the relationship between climate change and migration and the weak causal link that complicates distinguishing climate migrants from other migrants. Before "solutions" are to be discussed in international fora, the author stresses that the normative literature needs to develop a more consistent argument.

McAdam, Jane. "Climate Change, Forced Migration, and International Law." Oxford: Oxford University Press, 2012.

Drawing on fieldwork in India, Kiribati, Tuvalu, and Bangladesh, the author addresses the legal frameworks surrounding environmentally induced migration by offering insights on why people migrate and the extend to which climate change triggers such movement. The author suggests that climate change multiplies threats, which in turn magnify existing vulnerabilities of populations. In addition, migration decisions are multi-casual and thus make it impossible to provide accurate estimates of people moving due to climate change. The book also stresses that movements will be internal rather than across internal borders, while highlighting vulnerable island populations as more likely to migrate internationally. The author questions whether traditional international responses, such as the formation of new treaties or institutions, are appropriate and what legal frameworks should exist to address this area of growing concern.

McLeman, Robert A. "Climate and Human Migration: Past Experiences, Future Challenges." New York: Cambridge University Press, 2014. Web.

Offering accessible explanations of complex processes, the author provides a thorough summary of the extensive literature focusing on the relationship between climate change and migration. Synthesizing the academic literature through real-life events like Hurricane Katrina, the Dust Bowl, African droughts, and floods in Bangladesh and China, the author seeks to communicate to researchers, students, and policy-makers alike the potential impacts of a changing climate on migratory patterns in developing and developed countries.

McLeman, Robert. "Developments in Modelling of Climate Change-Related Migration." *Climatic Change* 117.3 (2013): 599-611.

Modelling of climate change-migration is still a relatively emerging research area, and the author notes that there has been no peer-reviewed studies found dating prior to the last decade. Nonetheless, the author reviews the state of the literature to offer insights about how to improve this important new approach. Highlighting the lack of reliable global data on population movements as a main obstacle, the author describes the potential for combining national, sub-national, and regional census data with climate data in order to provide sufficient information for agent-based modelling approaches. While the use of GIS and statistical-based approaches to modelling will only provide information on migration hotspots rather than future migrant numbers, the author is optimistic about developments in the field that will help improve human behavioral assumptions that underlie these models and will help improve their predicative capacity (i.e. EACH-FOR, Foresight).

McMichael, Celia, Jon Barnett, and Anthony J. McMichael. "An Ill Wind? Climate Change, Migration, and Health." ***Environmental Health Perspectives*** **120.5 (2012): 646-54.**

Little research has focused on the potential effects of climate change on the health of migrants, and the authors explore the health implications of three types of movements most likely induced by climate change. The movements include forcible displacement by climate change, resettlement schemes, and migration as an adaptive response. The predicted health outcomes of climate-related migrants were approximated using current research into the health of refugees, migrants, and people in resettlement schemes. The authors find that when migration is used as an adaptive strategy, health risks are likely to be minimized. Situations of forced migration will result in the most adverse health outcomes for both displaced and host populations.

Milan, Andrea, and Raul Ho. "Livelihood and Migration Patterns at Different Altitudes in the Central Highlands of Peru." ***Climate and Development*** **6.1 (2014): 69-76.**

Using data and insights from fieldwork in mountain areas of Peru, this article analyzes the relationship between increasing rainfall variability, livelihoods, and human mobility in three rural communities in the Central Highlands. It uses combined data from 150 household surveys, 14 expert interviews, and 23 participatory research approaches (PRA) sessions involving almost 150 people. The first section of the report focuses on perceived and actual changes in recent rainfall patterns and their effects; the second details livelihood and migration patterns at different altitudes. More than four-fifths of the population noted changes in rainfall patterns and their negative effect on livelihoods, even though mobility patterns in the area are determined primarily by broader economic considerations. Households at lower altitudes have different migratory habits than those in the highlands and are more affected by rainfall variability. Future empirical studies on rainfall variability, livelihoods, and migration in mountainous areas characterized by subsistence rain-fed agriculture would enhance understanding of the relationship between rainfall variability, food and livelihood security and migration.

Milan, Andrea, and Sergio Ruano. "Rainfall Variability, Food Insecurity and Migration in Cabricán, Guatemala." *Climate and Development* 6.1 (2014): 61-8.

This study looks into Guatemalan highland migration patterns in relation to rainfall variability caused by climate change and the risk of these populations becoming trapped in food insecure areas. The authors collected primary data through random sample household surveys, interviews with experts, and Participatory Rural Appraisal sessions. The data showed that most migration decision were the result of rainfall patterns since most of the livelihoods in the region are derived from rain-fed agriculture. There were significant findings that there has been more weather related hardship in these areas in the recent past. The opportunities for diversifying income generating activities "in situ" apart from agriculture are decreasing and migration opportunities to the U.S. have become very expensive and dangerous reducing those opportunities as well. Opportunities for migration within the country have also been reduced to structural changes in the commercial farming sector. This means that the risk management strategies for rainfall variation presently being used by the population in the Western Highlands will become less viable over time, potentially leading to this vulnerable population being trapped.

Mueller, V., C. Gray, and K. Kosec. "Heat Stress Increases Long-Term Human Migration in Rural Pakistan." *Nature Climate Change* 4.3 (2014): 182-5.

Using panel data over a 21-year period of 4,000 individuals, the authors study whether rainfall and extreme heat affect agricultural practices and long-term migration practices in rural Pakistan. Authors used a discrete-time event history model to measure individual responsiveness to weather variables. The authors also examine whether evidence exists that extreme rainfall and heat affect agricultural and other sources of income and other barriers to movement, meanwhile taking into account gender implications. Temperature extremes, and not flooding, explain the long-term migration of men in Pakistan, with an extreme scenario predicting a 12 percent increase in male migration. Heat stress affects farm and non-farm income, while asset and land poor individuals were more likely to migrate due to the low financial barriers to move.

Mueller, Valerie, and Agnes Quisumbing. "How Resilient are Labor Markets to Natural Disasters? The Case of the 1998 Bangladesh Flood.' *The Journal of Development Studies* 47.12 (2011): 1954-71.

This paper analyzes data collected from The Bangladesh Flood Impact panel household survey, which is conducted by the International Food Policy Research Institute (IFPRI) and is designed to evaluate the impact of the most severe natural disaster of the century (The 1998 flooding of Bangladesh). The study attempts to explore the short and long term affects of this historic flooding in Bangladesh and its impact on migrants, specifically the impact on their wages and earnings. The authors estimate a pooled ordinary least squares (OLS) regression to measure the impact of the deviation in the flood depth in 1998 from normal conditions during the wet season on pre-flood earnings. The authors find short-term declines in agricultural and non-agricultural wages following the 1998 'flood of the century' in Bangladesh. Agricultural workers

who moved towards non-agricultural employment to cope benefitted through a lower percentage reduction in short-term wages. Endowed with human capital, salaried workers were unable to mitigate income risk. Extending the eligibility of credit access or relief programs may preserve local businesses and their employees in the years following a flood, helping to mitigate financial risk of those affected by environmental shocks.

Murali, Janakaraj, and Tamer Afifi. "Rainfall Variability, Food Security and Human Mobility in the Janjgir-Champa District of Chhattisgarh State, India." *Climate and Development* 6.1 (2014): 28-37.

Authors test the hypothesis that migration is a coping mechanism against climate variability using a mixed method approach that combines expert interviews and a total of 53 PRA sessions with meteorological data and information about rainfall patterns. PRA sessions were gender, age, occupational, and caste sensitive. One hundred and eighty households in four villages in central India were random sampled and surveyed over the course of two weeks in November 2011. Findings reveal that due to the monoculture of paddy cultivation, seasonal migration predominates migratory flows. Water scarcity directly causes migration through shorter and delayed rain seasons, and indirectly though decreased income caused by decreased agricultural productivity due to less rain. The vast majority of respondent households (96.6%) described insufficient income as the most important trigger for migration decisions. The authors suggest that government awareness programs should include water rationing and crop diversification to address vulnerabilities.

Nawrotzki, Raphael J., Fernando Riosmena, and Lori M. Hunter. "Do Rainfall Deficits Predict U.S.-Bound Migration from Rural Mexico? Evidence from the Mexican Census." *Population Research and Policy Review* 32.1 (2013): 129-58.

In this study, the authors use the 2000 Mexico census and rainfall data to determine if droughts lead to increased levels of Rural Mexico to U.S. migration. The authors created econometric regression models with economic and social control variables and found a significant relationship showing that drier Mexican states do see higher levels of migration to the U.S. during periods of drought. The authors conclude by suggesting that policies with the aim to reduce Mexico to U.S. migration should focus on mitigating climate and weather vulnerability of Mexican households in rural areas. This could include aid in establishing irrigation systems and subsidizing crops resistant to drought.

Nawrotzki, Raphael J. "Climate Migration and Moral Responsibility." *Ethics, Policy & Environment* 17.1 (2014): 69-87. Web.

Using Peter Singer's "Historical Principle" as the basis for ethical discussions about climate migration, the author suggests that the current ethical debating surrounding immigration avoids addressing causality. Using the "polluter pays" notion that takes into account historical wrongs, the author believes that developed countries should recognize their historical contributions to climate change in developing countries. Taking responsibility requires amending immigration

policies to include environmental factors and ease restrictions for potential environmental migrants. The author concludes by calling for the creation of an international authority responsible for determining criteria for environmentally induced migrants and establishing norms for international governance to address global inequalities.

Obokata, R., Veronis, L., & McLeman, R. Empirical research on international environmental migration: a systematic review. *Population and Environment*, (2014) 1-25.

Authors generate an inventory of peer-reviewed articles that examine environmental actors and international migration that have been published as of mid-2013. Using various selection criteria, the authors focus on 31 countries and categorize them according to country of origin and destination, the environmental and non-environmental factors that contribute to migration decisions, and the types of methodologies used by researchers (i.e. quantitative and modelling, qualitative, and mixed methods). The authors make several recommendations, including a greater need for longitudinal studies, deeper political and economic context, and more mixed method approaches. Particular regions are also understudied, which include South America and the Middle East, as well as urban settings. While international migration due to environmental change is not occurring in large numbers, examining second and third order impacts of environmental events may help reveal a more accurate estimate.

Oliver-Smith, Anthony. "Debating Environmental Migration: Society, Nature and Population Displacement in Climate Change." *Journal of international development* 24.8 (2012): 1058-70.

This article approaches the problem of environment and migration through a consideration of convergent themes regarding nature and society in ecological theory and in social scientific disaster research. The paper argues that the articulation between ecological and social theory provides grounding concepts for both framing the issue and research on the problem of actual and potential mass displacement of human populations by environmental change, specifically global climate change. The author explores the concept of environmental migrants, highlighting the debate as to whether these migrants are indeed environmental migrants or economic migrants, or an interrelated mix of the two. The author asserts that effective policy responses to environmental displacement and migration cannot be developed without an in-depth understanding of the phenomena of climate change, human-environment relations, and migration and the linkages among them. The author concludes that the terms "natural disasters" or "environmental refugee" obfuscates the man-made processes of ethnic or political violence, migration or famine, and forms of environmental determinism. The author contends that blaming climate change and environmental degradation on nature more easily allows government and development agencies to uproot populations and avoid responsibility. The author ends by stating that the migration patterns are not merely aspects of environmental change, but a combi-

nation of environmental, political and economic causes that disproportionately affect poor and vulnerable communities.

Oppenheimer, Michael. "Climate Change Impacts: Accounting for the Human Response." *Climatic Change* 117.3 (2013): 439-49.

This article considers three arenas where recent progress illuminates future challenges to assessment and modeling of human responses. It considers migration of humans/economic activity in response to climate change as an example of how primary responses to climate change can trigger large indirect impacts on distant resources and populations; recent insights into the unintended indirect consequences of biofuel production; and responses to the risks of heat waves and Indian Ocean cyclones. The findings illustrate that responses to the direct impacts of climate change lead to important indirect impacts; that adaptation responses interact with components of development including vulnerability and emissions mitigation policies; future impacts cannot be reasonably evaluated without insights into how learning from experience will be incorporated into policies and other responses.

Opondo, D.O. "Erosive coping after the 2011 floods in Kenya." *International Journal of Global Warming*, 5.4 (2013), 452–466.

Using a combination of household questionnaire surveys, focus group discussions, and in-depth and expert interviews, the author examines coping strategies of 400 households in eastern Kenya. With 98% of households impacted by flooding, results reveal that households participated in "erosive coping" by modifying food consumption (82%), receiving help form organizations (76%), reduced household expenditures (71%), and migrating (595). Of those households that migrated, migration was primarily rural (96%) and 60% migrated for less than six months.

Penning-Rowsell, E., Sultana, P., & Thompson, P. (2013). The 'last resort'? Population movement in response to climate-related hazards in Bangladesh. *Environmental Science and Policy*, 27s, 44–59.

The authors conducted a field study consisting of focus group discussions in 10 villages of five disaster prone districts covering 250 total participants in order to understand natural hazard related migration (caused by natural disasters or longer term environmental changes) in Bangladesh. These focus groups revealed that most hazard-related migration is related to income recovery and involves men moving only, particularly among the landless population. The factors causing migration are long-term impact changes such as riverbank erosion and not more devastating events like floods or cyclones since long-term land capability is unchanged. The authors conclude that migration in Bangladesh is mostly small-scale, temporary, and the last resort. Generally, people choose to remain on their land regardless of natural hazards. This suggests

that mass migration may not occur as a consequence of increased climate change related natural hazards.

Piguet, Etienne. Linking climate change, environmental degradation, and migration: A methodological overview. *WIREs Climate Change,* 1 (2010), 517–524.

The author uses six types of research methods to categorize literature dealing with the relationship among climate change, environmental degradation, and migration. Focusing on research strategies that are analytical and attempt to disentangle environmental drivers from other political, social, demographic, or economic drivers of migration, the author identifies several different typologies. Ecological inference based on area characteristics involves reconstructing individual behavior from group-level data (i.e. looking at migration rates from municipalities with a high intensity of natural disasters). A second approach uses individual sample surveys to understand individual household behavior in the context of environmental events. Time series approaches are similar to ecological inference, but substitute data on temporal evolutions in a given area for data on spatial units. Multilevel analysis combines ecological data, household survey data, time series data to obtain more precise analysis by expanding the range of variables. In addition, agent-based modelling (ABM) uses computer simulations that hypothesize the rules of behavior that lead to migration decisions in a context of multiple environmental and non-environmental stimuli. Finally, the most common methods involve qualitative and ethnographic approaches to interview those in threatened areas or, in some cases, analyzing historical analogues. With all methods have strengths and limitations, the author suggests that the most insightful and original approaches analyze data collected through time consuming processes that use a combinations of qualitative and quantitative methods.

Piguet, Etienne, Frank Laczko, and International Organization for Migration. *People on the Move in a Changing Climate: The Regional Impact of Environmental Change on Migration / Etienne Piguet, Frank Laczko, Editors*. 2 Vol. Dordrecht: Springer, 2014.

In the first synthesis and comparison of regional differences in environmentally induced migration, the book helps address important gaps in empirical literature and offers important policy recommendations for decision-makers to prioritize courses of action. In order to produce the exhaustive assessment of the state of knowledge on the environment-migration nexus, authors provide key findings from regional experts that utilize an array of qualitative and quantitative methodological approaches.

Piguet, Etienne, Antoine Pecoud, and Paul de Guchteneire. "Migration and Climate Change: An Overview." *Refugee Survey Quarterly* 30.3 (2011): 1-23.

The authors describe the two main methodological approaches to examine migration and climate change. First relies on descriptive and prospective approaches to "hotspot" analysis while the second attempts to distinguish the environmental component of migration from the other drivers. The authors provide an historical overview of the debate and provide emerging empirical findings and their potential policy implications. While arguing the interconnectedness of environmental factors with other political and economic variables, the authors stress the importance of the issue's social dimension in increasing household resilience to climate change. Moving the debate to more productive discussions involves improving data collection methods and cross-disciplinary cooperation.

Piguet, Etienne. "From 'Primitive Migration' to 'Climate Refugees': The Curious Fate of the Natural Environment in Migration Studies." ***Annals of the Association of American Geographers*** **103.1 (2013): 148-62.**

The author details the intellectual history of the study of environmental impacts on migration in the last half century to understanding how changing philosophies have shaped academic discourse. The author proposes that the disappearance of the environmental in migration studies in the early 20th century is a function of several factors, including the demise of determinism and the western idea that progress implies a decreasing impact of nature on human fate. In addition, and relevant for current discussions on the topic, the author claims that a heavy focus on the economic paradigm in migration theory shifted attention away from environmental factors. The reemergence of the environment in migration studies in the late 1980s brought with it an alarmist discourse of "climate refugees" and a more negative perception of migration in the context of environmental change. While more recent research has shifted the focus away from such perceptions, additional work is needed to continue to disentangle the various factors involved in the relationship between the environment and migration.

Rademacher-Schulz, Christina, Benjamin Schraven, and Edward Salifu Mahama. "Time Matters: Shifting Seasonal Migration in Northern Ghana in Response to Rainfall Variability and Food Insecurity." ***Climate and Development*** **6.1 (2014): 46-52.**

Authors utilized a mixed methods approach (i.e. household surveys, PRA, rainfall distribution and agricultural production data) to study dry season migration types in four communities in the Upper West region of Ghana. Differentiating between coping and adaptation mechanisms, authors find that some households use migration as a coping strategy for acute food shortages while others use migration *ex ante:* a risk management strategy to cushion the impacts of a bad harvest or the anticipation of decreased income streams. Increased migration during the 2011 rainy season signaled adaptation to crisis or survival strategy running contrary to the local agricultural cycle, which may negatively affect the livelihood security of households.

Renaud, Fabrice G., Olivia Dun, Koko Warner, and Janos Bogardi. "A Decision Framework for Environmentally Induced Migration." ***International Migration*** **49 (2011), 5-29.**

This article proposes a decision framework for categorizing migrants on the move because of environmental stressors. It examines the circumstances that motivate a move, including the state of the environment and coping capacities, and adapts existing definitions to apply to these circumstances. Further discussion on the categories of migrants and environmental factors should incorporate stakeholders from various disciplines (particularly migration studies, social sciences, natural sciences, law and the humanitarian sector) to further develop these working definitions.

Roschmann, Christian, et al. *Climate Change: International Law and Global Governance*. Baden-Baden: Nomos, 2013.

Seeking to address both international climate change law and global climate change governance, the two-volume book discusses the complex nature of these interrelated concepts. The second volume reflects on the United Nations Framework Convention on Climate Change (UNFCCC) and provides some discussions of the impact of climate change on global security, climate induced migration movements, and adaptation in the face of loss and damage resulting from changing climates.

Sakdapolrak, Patrick, Panomsak Promburom, and Alexander Reif. "Why Successful in Situ Adaptation with Environmental Stress does Not Prevent People from Migrating? Empirical Evidence from Northern Thailand." *Climate and Development* 6.1 (2014): 38-45.

Conducted in four rural, upland villages located in the Lamphun province of Thailand, the study uses a multi-method field-based research design that consists of a household survey (n=206), participatory rural appraisals (35) and expert interviews (13). The vast majority (86%) of households identified agriculture as the main source of income, and findings reveal that three-quarters of respondents suffered declining income as a result of declining crop yields caused by environmental stress. Rainfall-related events do not directly effect migration decisions, as the weather events did not exceed the threshold where household survival needs were threatened. In addition, households that had diverse livelihoods were able to buffer crop losses more effectively. Migration was not considered a primary coping strategy for the effects of environmental change, but it is a widespread livelihood strategy and allows households to diversify risk of income losses though, among other things, social remittances.

Shen, Shawn, and Tony Binns. "Pathways, Motivations and Challenges: Contemporary Tuvaluan Migration to New Zealand." *GeoJournal* 77.1 (2012): 63-82.

The study focuses on Tuvaluan migrants to New Zealand and challenges the common narrative that there is a clear distinction between migrants and refugees. Quantitative data (census data and government statistics) were combined with a qualitative methodology that incorporated field-based research. Focus groups and in-depth individual interviews included more than 70 participants in Auckland and in Tuvalu to better understand "humanitarian stream" migration to New Zealand since the late 1990s. Tuvaluan migration to New Zealand is based on a complex relationship that involves economic disparities, as findings reveal that those most likely to mi-

grate can afford to, and tend to have higher levels of education and income. Therefore, those left behind tend to be the most vulnerable.

Shen, Shawn, and François Gemenne. "Contrasted Views on Environmental Change and Migration: The Case of Tuvaluan Migration to New Zealand." ***International Migration*** **49 (2011): 224-42.**

In this paper, the authors analyze the causal factors of migration from Tuvalu to New Zealand. The author's conducted interviewed members of the Tuvaluan society, including representatives of the state, the church, the NGOs and the public in Tuvalu and emigrant families in New Zealand. The authors conclude that environmental factors are clearly the leading causes of Tuvaluan migration, but not only because of climate change, which would include increased flooding and storm surges, but also because of poor water and soil quality and slow environmental degradation not related to climate change. Additionally, economic, social, medical, family and educational factors, contribute to the migration decision, as well. Climate change does not appear to have had an impact on livelihoods in Tuvalu since most primary income sources are not purely reliant on the environment (like agriculture), which is different from many other environmental migration situations around the world. However, the authors noted a significant weight of psychological fears and feelings of climate change and the rising levels of the sea contributing to migration decisions.

Shumway, J. M., Samuel Otterstrom, and Sonya Glavac. "Environmental Hazards as Disamenities: Selective Migration and Income Change in the United States from 2000–2010." ***Annals of the Association of American Geographers*** **104.2 (2014): 280-91.**

Framed in an amenity migration framework that attempts to explain migration decisions, the authors present an environmental hazards impact index to compare several U.S. counties' exposure to natural hazards. Using a hazards database disaggregated by country that includes more than 600,000 records of events since 1960, the study combines IRS income statistical data to compare differences in numbers of income characteristics of in- and out-migrants that are exposed to differing impacts of natural hazards. Authors find that counties that experience the greatest impacts from environmental hazards are losing income as a result of migration. These losses occur through both net out-migration and income loss from out-migrants having higher incomes than in-migrants. The authors stress that the counties with the greatest impacts of environmental hazards can least afford the loss of income.

Smith, Christopher D. "Modelling Migration Futures: Development and Testing of the Rainfalls Agent-Based Migration Model – Tanzania." ***Climate and Development*** **6.1 (2014): 77-91.**

As few studies incorporate the use of ABMs to link climate change, environmental migration, and migration, the author introduces the Rainfalls Agent-Based Migration Model – Tanzania (RABMM-T) to study and simulate migration decision-making four plausible future scenarios of rainfall variability. Parameterization involved univariate and multivariate regression analysis of

household variables to control for confidence. The conceptual framework provided for RABMM –T has four levels of analysis: external, structural/institutional, household, and individual. Modelling, based on the survey data similar to Afifi et al. (2014), generally shows that migration from vulnerable households in Tanzania is sensitive to changes in rainfall patterns, especially under extreme drying, as household resilience and total migration increases under these scenarios. Extreme wetting results in the lowest numbers of migrants from vulnerable households, but the author emphasizes how social and demographic trends can significantly alter predicted outcomes.

Smith, Roy, and Karen E. McNamara. "Future Migrations from Tuvalu and Kiribati: Exploring Government, Civil Society and Donor Perceptions." ***Climate and Development*** **(2014): 1-13.**

Through an historical overview of recent international conferences and ten
Interviews with government and NGO officials, the authors examine how different actors in the two Pacific nation states view migration as an adaptation strategy in the context of environmental change. Considered "front-line" states in relation to the negative impacts of climate change, Tuvalu and Kiribati differ in the ways they acknowledge migration as adaptation in policy discussions. Tuvaluan officials acknowledge that migration may become a worst-case scenario that will have to be responded to, while those in Kiribati recognize that a well-managed response to gradual onset processes is preferable to disaster response scenarios.

Sow, P., SA Adaawen, and J. Scheffran. "Migration, Social Demands and Environmental Change Amongst the Frafra of Northern Ghana and the Biali in Northern Benin." ***Sustainability,*** **6.1 (2014): 375-98.**

The field research in this paper was carried out within the scope of the Environmental Change and Forced Migration Scenarios (EACH-FOR) with financial support from the European Union. The field research for the paper was conducted in partnership with the International Organization for Migration (IOM) Mozambique between September and October 2007 in Mozambique. The data collection process consisted primarily of semi-structured expert interviews conducted in the capital of Mozambique, interviews with displaced people at 13 resettlement centers along the Zambezi River valley, and completing 20 questionnaires with migrants living in urban areas. Heavy rain in Southeast Africa in 2008 displaced over 80,000 people along the Zambezi River valley, adding to already displaced populations form floods in 2000, 2001, and 2007. The paper identifies the lack of data on the linkages between the environment, displacement and migration, and highlights the major issues in dealing with these impacts. The paper concludes by suggesting that resettlement may not be the best policy for overcoming environmental shocks or degradations because resettlement causes further problems like deforestation, soil erosion or water scarcity and is not solving the problems of the vulnerable migrants nor their destination communities.

Stal, Marc. "Flooding and Relocation: The Zambezi River Valley in Mozambique." ***International Migration*** **49 (2011): e125-45.**

The author studies extreme flooding along the Zambezi River in Central Mozambique as a result of heavy rains in 2001, 2007, and 2008. Data collection involved semi-structured interviews with experts, displaced people in resettlement centers along the Zambezi River, and migrants living in urban areas. While resettlement plans were intended to relocate people to flood safe areas, drought in these areas forced many to return to low-lying vulnerable areas that experienced continued flooding. The author concludes that permanent resettlement after extreme weather events is not the best option in Mozambique as it causes deforestation, soil erosion, and water scarcity and fails to address underlying issues like endemic poverty.

Stojanov, R.; Kelman, I.; Shen, S.; Duží, B.; Upadhyay, H.; Vikhrov, D.; Lingaraj, G.J.; Mishra, A. Contextualizing Typologies of Environmentally Induced Population Movement. *Disaster Prevention and Management*, (accepted)

The purpose of this study is to show how typologies for environmentally induced population movement need to be understood in a contextualized manner in order to be useful. This study interrogates some academic discourses concerning environmentally induced population movement. By analyzing key environmental factors said to contribute to population movement, in addition to considering time factors, this study uses the case of Tuvalu to demonstrate overlapping categories and the importance of contextualization. Current typologies provide a basis for considering a wide variety of motives for environmentally induced population movement, in relation to different drivers, motivations, time scales, and space scales. Yet contextualization is required for policy and practice relevance.

Stojanov, R.; Kelman, I.; Martin, M.; Vikhrov, D.; Kniveton, D.; Duží, B. (2014): *Migration as Adaptation? Population Dynamics in the Age of Climate Variability*. Brno: Global Change Research Centre, Academy of the Sciences of the Czech Republic. ISBN 978-80-87902-03-5

The authors of this book analyze each case study to see whether environmental factors or climate variability and trends play roles in decisions to migrate and if so, which roles and how. This relationship cannot be understood simply as linear, as evidenced by the analytical work and the results of empirical research presented in this book. An important role is played by the adaptive capacity of the community in question, namely the extent to which the given community is sensitive and vulnerable to fluctuations in weather and what ability it has to adapt to changes. There are examples where migration due to climate change can be understood as a coping strategy, an adaptation strategy, a form of risk management, or a combination. In such cases, a member of the household, usually a male seeks employment, usually in a major city,

and sends his family part of his earnings (remittances) to compensate for losses. Sometimes, the entire household moves to find greater security and a more secure / higher source of income.

The main aim of this publication is to analyze the relationships and dynamics of environmental change, or the impacts of climate change, trends, and variability, alongside population processes, in terms of coping with these changes and adapting to evolving conditions. In the book, we will define such concepts theoretically and apply them practically through several empirical studies from Bangladesh, Kenya and the Czech Republic.

van der Geest, Kees. "North- South Migration in Ghana: What Role for the Environment?" ***International Migration*** **49 (2011): 69-94.**

The paper's purpose is to analyze the importance of environment and consequently, climate change, in North-South migration in Ghana. The author used surveys to gather qualitative and quantitative data to determine the causes of migration for 203 migrants Northwest Ghana to a more favorable environment in the Brong Ahafo Region. The results showed that environmental causes were the most cited reasons for migration, although it was more common to say that more favorable environmental conditions in the new area led to migration (pull factors) than poor environmental conditions at their origin (push factors). The author does note that the findings in the paper are not sufficient to provide a complete assessment of the link of environment to migration.

Tacoli, Cecilia. "Not Only Climate Change: Mobility, Vulnerability and Socio-economic Transformations in Environmentally-fragile Areas of Bolivia, Senegal and Tanzania." ***International Institute for Environment and Development***, **London (2011).**

Drawing on case studies in Bolivia, Senegal, and Tanzania, the author describes how environmental change locally interacts with socio-economic factors to shape migration patterns, which then affect livelihoods and resilience of several levels (i.e. individuals, households, and communities). The author relies on country specific case studies that use vulnerably mapping techniques and satellite imagery to
Although environmental changes are gradual, the author describes how "precipitating events" like harsh droughts or epidemics of livestock disease restrict individuals' diversification strategies.

Vikhrov, D.; Stojanov, R., Duží, B.; Juřička, D. (2014): Commuting patterns of Czech households exposed to flood risk from the Becva River. ***Environmental Hazards: Human and Policy Dimensions***, **13 (1): 58-72.**

Using unique data collected in October–December 2012 we estimate the link between commuting for work and level of individual exposure to floods. We find that commuters on average have higher earnings than non-commuters. Individuals affected by one flood commute by 11.2% more than unaffected individuals. We conjecture that the increase is linked to intentions to cover flood-related losses, decrease households' vulnerability to flood risk or out-migrate from the risk areas. Individuals affected by at least two floods are by 20.2% less likely to commute relative to those unaffected. We explain this non-linear effect by the fact that many households out-migrate after the first flood. Stayers commute less, because they are different from non-stayers in some underlying characteristics related to education, employment and family circumstances, which strongly affect commuting behavior. We further find that in a commuting family an individual is by 53.8% more likely to commence commuting relative to a non-commuting family. Choice of commuting destination is often similar to that of other family members.

Warner, Koko, and Tamer Afifi. "Where the Rain Falls: Evidence from 8 Countries on how Vulnerable Households use Migration to Manage the Risk of Rainfall Variability and Food Insecurity." ***Climate and Development*** **6.1 (2014): 1-17.**

The authors present empirical research to frame migration as a risk management option vis-à-vis climactic stressors. The article introduces a set of eight comparable case studies and provides an overview of the key issues, results, and implications of migration as a risk management strategy with regard to rainfall-related food and livelihood security. In conducting field research in the eight case study countries, researchers used a PRA (n=2000), household survey (n=1300), and semi-structured interviews with various experts in order to have as many possible insights into national and local issues. The qualitative and quantitative data served as inputs for the agent-based model employed in the Tanzanian study. Authors propose that resilient households experience "content" migration while vulnerable households practice "erosive" migration, although significant overlaps do exist that can complicate the application of these terms.

Warner, Koko. "Environmental Change and Migration: Methodological Considerations from Ground-Breaking Global Survey." ***Population and Environment*** **33.1 (2011): 3-27.**

This paper shares the methods and fieldwork experiences of the Environmental Change and Forced Migration Scenarios (EACH-FOR) project, a multi-continent survey that assesses the impact of environmental change on migration at the local, national, regional and international level. It includes a literature review, and also an examination of how EACH-FOR designed its methodological approach, as well as how field researchers implemented this methodology amid diverse local conditions and social contexts and different types of environmental changes.

Following the design stage, the EACH-FOR project undertook fieldwork in 23 geographic areas, representing the project's case studies. Over the full project, approximately 1,500 observations/surveys were gathered (roughly half from migrants and half from non-migrants) who indicated that environmental factors had played some role in their decision to migrate. Moving forward, research methods can improve comparative fieldwork-based studies by refining ques-

tions around how environmental change affects mobility and longer-term population distribution. Further research must improve the articulation of falsifiable, more specific hypotheses. Ideally, donors and decision makers would provide practical parameters for research projects or programs which are longer in duration (multiyear), which support rigorous data collection and which make possible follow-up work in the same regions. Identification of variables such as rainfall variability, which have time series data and can be compared across eco-regions will help sharpen research questions and methods. Capturing interactions between additional variables like livelihood and food security will further expand understanding.

Warner, K. and van der Geest, K. "Loss and damage from climate change: local-level evidence from nine vulnerable countries." ***International Journal of Global Warming*** **5.4 (2013), 367–386.**

In this study, authors conduct the first ever multi-country, evidence-based analysis of climate change induced loss in Bangladesh, Bhutan, Burkina Faso, Ethiopia, the Gambia, Kenya, Micronesia, Mozambique, and Nepal. Researchers gathered qualitative and quantitative data though household surveys (n=3,269) and more than one hundred focus group discussions and interviews in the context of how climate variability (i.e. flooding, drought, coastal erosion, etc.) impacts several social factors such as livelihoods, physical assets, health and housing. The authors highlight the economic losses that resulted from extreme flooding force household members to migrate to urban centers to meet basic food needs.

Werz, Michael and Laura Conley. Center for American Progress. ***Climate Change, Migration, and Conflict in Northwest Africa*****. 2012.**

The report describes how the intersections of climate change, migration, and security create an arc of tension in Northwest Africa that comprises of Nigeria, Niger, Algeria, and Morocco. Within this region exist international migration routes, including commercial cargo destined for trade and seasonal labor migrants moving from areas vulnerable to rainfall fluctuations. Examining how the effects of climate change interact with internal and international security challenges along these routes is in the interest of the U.S. due to their involvement in counterterrorism activities in the region. Destabilizing due to climate change-related migration in these fragile regions could potentially undermine international efforts at strengthening governance structures, for example. The report offers a series of recommendations to reorient US and international policy in the arc of tension, which includes aligning funding with areas not prioritized in recent government annual reviews (e.g. QDDR).

Wodon, Quentin and Andrea Liverani, George Joseph, and N. Bougnoux. "Climate Change and Migration in the MENA Region." (2013) World Bank Study, Washington D.C.

The study includes several case studies of that use a new household survey as well as qualitative data collected in 2011 in Algeria, Egypt, Morocco, Syrian Arab Republic, and Yemen. The authors examine how households in vulnerable areas perceive climate changes and how they are affected by extreme weather events, their coping and adaptation strategies, and whether these changing conditions affect their decisions to migrate. Broadly speaking, the individual studies signal that households are not fully able to recover from the effects of extreme weather events and that response programs are insufficient to meet the demand.

Wooding, Bridget, and Marcos Morales. "Migración y medio ambiente. Una reflexión pertinente." (2014) Santo Domingo: Editora Búho.

The authors explore how migration and environmental degradation encourage a type of reflection where they can be understood as a cause or a consequence of one another. It originates from original research conducted to understand how environmental degradation occurs in a protected area; it also verifies the impact migration has in that process. The document outlines how public policies should be focused on the following areas: environment and management; migration; livelihoods and communities and development, starting from the experience acquired in the communities of the implementation of diverse projects and programs that have tried to address poverty in the area.

Wooding, Bridget, and Marcos Morales. "Migración y sostenibilidad ambiental en La Hispaniola, (2014)." Santo Domingo: Editora Búho.

The authors analyze how migration and environmental degradation serve to illustrate the dynamics between human beings and nature in the context of national parks Nalga de Maco (Dominican Republic) and Pic Macaya (Haiti). Both cases are developed through an understanding of social, productive and cultural relations generated by those protected areas located as they are in a highly anthropized environment whose conservation is at risk for future generations. The text takes as its starting point field-gathered data and examines the ways that discourses on migrants, degradation, and rural inhabitants are constructed. It encourages thinking beyond a binary logic that opposes culture and nature, incorporating diverse frameworks such as knowledge, markets and development projects.

Wrathall, David. "Migration Amidst Social-Ecological Regime Shift: The Search for Stability in Garifuna Villages of Northern Honduras." *Human Ecology*, 40 (2012), 583-596.

The author utilizes an analytical framework that involves the stability of social-ecological systems in studying flooding in 34 Honduran villages and the ensuing migratory flows. Studying "slow" and "fast" environmental stressors that shift lands to states of inhabitability, the author conducted 89 life history interviews, gathered demographic data from 101 households, and utilized satellite imagery. The author finds that the social and ecological relationships are adversely affected by flooding since migrants are forced to depend more on remittances and are geo-

graphically separated from important areas. Ensuing poverty traps demonstrate that environmental stressors seriously impact social relationships within communities.

Wrathall, David, Jeffrey Bury, Mark Carey, Bryan Mark, Jeff McKenzie, Kenneth Young, Michel Baraer, Adam French, and Costanza Rampini. "Migration Amidst Climate Rigidity Traps: Resource Politics and Social–Ecological Possibilism in Honduras and Peru." ***Annals of the Association of American Geographers*** **104.2 (2014): 292-304.**

Authors employ a mixed-method vulnerability mapping technique combined with ethnographic research to compare political structures and adaptive migration in Honduras and Peru. Focusing on villages flooded in Honduras's north coast and communities experiencing glacier recession in Peru's Cordillera Blanca, the authors explore how existing dominant power structures are reinforced under the effects of environmental stress. In Honduras, migrants from wealthier social strata move permanently while in Peru, existing labor migration becomes more prevalent. In addition, indigenous lands in Honduras have been privatized and sold to non-indigenous peoples in an effort to cope with economic losses and debt repayment. In Peru, migration makes households less dependent on water and thus favors those vested interests that control the water supply.