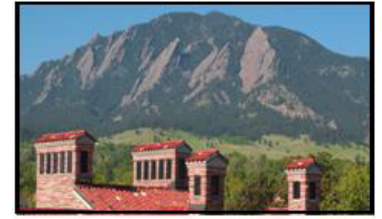


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Migration and the Environment

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Migration and the Environment

Recent public and policy concern with the implications of contemporary climate change have fueled a surge in scholarly attention to the environmental dimensions of migration. In the past 2 years alone, at least two special issues of key journals have been devoted to the migration-environment association.¹ Such attention is warranted.

Consider rural regions of less developed settings, in which millions of households depend daily on natural resources from local environments for both sustenance and fodder for livelihood activities. Clearly, a decline in availability or predictability of such resources will impact livelihood decision-making, potentially fueling migration. Shift your mental image now to settings lacking this direct local dependence such as major metropolitan areas of the U.S. upper Midwest. Even so, here the environment also shapes location decisions as seasonal migrants leave North America's snowy winter regions toward the sunny climate of the arid southwest.

Yet environmental factors related to migration decision-making have been, for years, mostly sidelined by migration scholars. With a long-term focus on socio-economic, cultural and political factors, migration research even in resource-dependent regions has tended not to extend to consideration of contextual factors. Of course, a key challenge, as in any migration research, is disentangling various influences and context, like social factors, is intertwined with other forces. Even so, neglecting consideration of environmental factors misses a potentially central aspect of migration's causes and consequences. Other challenges relate to measurement – reflecting

¹ The December 2010 issue of *Population and Environment* presented a collection of papers on “Human Migration and the Environment,” while a 2011 supplement of *International Migration* was devoted to “Environmental Induced Migration in the Context of Social Vulnerability”.

environmental characteristics within quantitative modeling efforts often requires a skill set outside of demography and, therefore, necessitates interdisciplinary work.

This review offers a summary of the state of knowledge regarding the association between migration and environmental factors, as well as a critique. We tour terminology, classic and contemporary conceptual frameworks, recent empirical results, as well as offering a discussion of methodologies often used by migration-environment researchers. We then explore methodological and substantive gaps while also bringing the critique to the realm of science-policy disconnect through discussion of contemporary political dialogue around climate change. It is our hope that this review lays a foundation for future academic work, while also offering a call to action.

Multiple Meanings of “Environment”

First, some terminology. The environment can take multiple meanings within migration scholarship, and can incorporate either, or both, natural and human-created landscapes. For example, some migration research focuses on the social environment, considering community context as related to migration decision-making and/or the ways the social environment is, itself, shaped by migration. This work has shown, for instance, that social bonds shape migration intentions (Oh 2003) and that the relative impoverishment of metropolitan neighborhoods shapes destination decisions within cities (South, Pais, and Crowder 2011). Here, social environments shape migration processes. Alternatively, migration impacts the social context as evidenced by recent work documenting enhanced racial stability at the community level brought about by the in-migration of higher-income whites to previously low-income neighborhoods (Ellen and

O'Regan 2011). In general, we might consider this work as focusing on neighborhoods' "social ecology" (Weden et al. 2011).

Second, some social scientists examine the built environment as a contextual factor that shapes residential satisfaction and, by extension, migration propensity. Work along these lines is often found within environmental psychology and public health literature. As illustration, factors examined include residents' satisfaction with building density within a neighborhood (Hu et al. 2010), perceptions of hardscape (Kweon et al 2010), and links between the built environment and health behaviors (for a review: Renalds et al. 2010).

Nonetheless, our focus within this review is on aspects of the natural environment which shape, or are shaped by, human migration. We argue that this is the contextual characteristic which has heretofore received least focus within migration research. In our case, the natural environment refers to biophysical characteristics and systems, especially as manifest within a particular locale – perhaps specific to a village in a setting where shared communal land provides necessary natural resources – or specific to a region if regional employment opportunities in the formal sector are shaped by weather patterns and associated agricultural productivity, for instance. Reuveny and Moore's (2009) four categories of environmental factors, specifically related to environmental disamenities, are useful here. Migration may be reciprocally related to, for example, cumulative environmental degradation (e.g., land scarcity, degradation, air pollution); weather-related natural disasters (e.g., storms);, production accidents (e.g., chemical spill), and/or resource-related development projects (e.g., artificial lakes).

Of course, contextual factors are themselves intertwined and also related to myriad socio-economic processes acting upon migration decision-making. As such, disentangling the natural environment as a predictor of migrant behavior is challenging at best (Jonsson 2010). This

scientific challenge is reflected in a broader recent dialogue regarding the most accurate terminology for portraying individuals and households who have migrated at least in part due to environmental conditions.

“Environmental Refugees” or “Environmental Migrants”?

Early media, activist, and some policy reports of mass migration resultant of climate change spawned the alarmist term “environmental refugees” (Hartmann 2010). Warnings of large-scale dislocation due to sea-level rise and extreme events received popular attention and media coverage, although they tended to be less grounded in empirical reality. Further, the term “refugee” implies persecution and movement crossing international boundaries – both characteristics that do not typically characterize migrants relocating due to inhospitable natural environments (Renaud et al 2011).

“Environmental migrants” represents the terminology more often used today to describe households that have experienced an environmental “push.” Clearly there is tremendous variation in the extent of the push, and the ways in which environmental factors interact with other socio-economic, political and cultural forces. A useful means of considering environmental migration is on a continuum of forced to voluntary, and as related to chronic or extreme events (Hugo 1996; Lein 2000). Mandatory evacuation in the case of natural disaster would clearly represent forced migration, while a multi-year drought gradually reduces livelihood options potentially resulting in voluntary migration. Renaud et al (2011) provide a full discussion of this continuum, in addition to exploration of reflective terminology such as “environmentally-motivated” or “-forced” migration. They argue that clarification of the role of environmental

conditions and change within migration decisions is essential for informed policy and programmatic response (Renaud et al. 2011).

Theoretical Frameworks Engaged within Migration-Environment Scholarship

Along lines similar to the “environmental refugee/migrant” discussions, migration theories and frameworks can usefully be categorized in maximalistic or minimalistic approaches as related to their inclusion of environmental dimensions (Suhrke 1994). The maximalist view posits environmental degradation as a direct cause of large-scale displacement. The minimalistic approach to the migration-environment association emphasizes that migration is not a monocausal phenomenon and that environmental change as context generally contributes indirectly in combination with other factors (Suhrke 1994). This approach typifies most migration-environment research (Jonsson 2010), including that undertaken within the variety of theoretical traditions reviewed next.

Migration scholars can find theoretical guidance in classic theoretical frameworks, although most don't emphasize environmental factors per se. Still, closer examination reveals that consideration of broader context is not new, although not historically emphasized (Hunter 2005). For example, Petersen (1958) suggested five broad classes of migration termed primitive, forced, impelled, free, and mass migration. The migration-environment connection is recognized only as a form of “primitive migration” shaped by “man's inability to cope with natural forces” (Petersen 1958:259). For agrarian populations, Petersen mentions two distinct push factors, sudden impacts such as droughts or insect infestation, and gradual impacts such as the Malthusian pressure of a growing population on land availability.

Wolpert (1966) placed a greater emphasis on environmental factors and described migration as a response to stress between household needs and local environmental characteristics. He developed an ecological system model accounting for the positive or negative effect of environmental factors on the migration decision. However, Wolpert's framework was developed predominantly for the urban context and, therefore, key environmental forces considered were traffic congestion, air and water pollution, lack of open spaces, and noise levels.

Additional guidance can be found within other classic migration theories, such as those by Speare (1974) and De Jong and Fawcett (1981). Speare suggests that "members of individual households can be viewed as tied to a particular location by bonds to other individuals, attachment to the particular housing unit, attachment to a job, attachment to a neighborhood-based organization or other local bonds" (Speare 1974:175). Further Speare explained that the bonds' strength is reflected in a general level of satisfaction, which shapes the likelihood of an individual and/or household considering relocation.

Probably the most commonly engaged framework, even if implicitly, is the neoclassical (Lawson 1998; Silvey and Lawson 1999) or rational choice (Gidwani and Sivaramakrishnan 2003) approach that assumes potential migration-decision making entails cost/benefit calculation. As Hunter (2005:280) summarizes, "individuals might accept somewhat lower pay to reside in a location with environmental amenities; conversely, individuals might have to receive higher compensation to continue to live in an environmentally unattractive or hazardous locale." Jonsson (2010) explains that the New Economic theory takes into account a wider spectrum of migration motives and emphasizes the importance social factors, such as place attachment, and family/household variables in affecting migration decisions (Brown and Bean 2006).

Most common within the Human Geography and Anthropological literature, Political Ecology also emphasizes the multidimensional (and unequal) nature of population-environment relationships more generally (Robbins 2004). Political Ecology highlights the role of politics and power structures in controlling access to resources. As related to migration, an example engaging Political Ecology is Sanderson's (2009) analyses of globalization and foreign direct investment in the Ghanaian mining sector, related large scale environmental degradation, and subsequent migratory response particularly as impacted by declining global timber prices.

Also concerned with the impact of power on the environment migration nexus is a recent framework developed by Carr (2005) based on a Foucauldian perspectives. Carr argues that environment, economy, and society are linked within migration decision-making through local manifestations of power and, to fully understand migration decisions, one must gain access to the local power/knowledge within which the migration possibility is considered. Carr uses findings from qualitative research in three villages in Ghana to illustrate this interplay. Environmental degradation, combined with the collapse of the logging industry in the study's Ghanaian villages, threatened the social status of male household heads due to unemployment. This power shift was fundamentally the motivation for migration to nearby villages with greater opportunity.

As a final conceptual framework engaged within migration-environment research, the Sustainable Livelihoods framework considers access to natural capital together with financial, physical, human, and social capital as determinants of a household's livelihood strategy (Carney et al. 1999; DeSherbinin et al. 2008). Under conditions of livelihood insecurity, perhaps related to a scarcity of natural resources, a household is likely diversify their livelihood strategies which might include the migration of a family member or relocation the entire household (Massey, Axinn, and Ghimire 2010). Of course the availability of natural capital interacts with the variety

of assets at a household's disposal, while there is also an important reciprocal relationship at work. Qin (2010), for example, observes that, in destination areas, migrants differ from non-migrants in their livelihood strategies (e.g., consumption pattern, use of firewood, agricultural intensification), which leads to distinct environmental outcomes in terms of changes in land quality, soil erosion, and forest regrowth.

Evidence of Environmental “Push” Factors

Environmental factors have shaped migration since early human history. Consider the ancient Sahara. Archaeological and paleo-anthropological evidence suggest that humans migrated as shifts in the monsoon allowed them to penetrate deeper into the desert. Alternatively, periods of droughts forced retreat in search of water and pasture – much like contemporary nomadic populations (Brooks et al. 2005; Gila et al 2011). More recent examples are also useful. Here, consider the Dust Bowl. Severe drought in the U.S. Great Plains from 1931 to 1939 led to massive soil erosion and drastic reduction in soil productivity. Winds filled the air with billowing clouds of dust, burying farm equipment and buildings. Hundreds of thousands of residents left the Great Plains, establishing new homes in more productive areas (Gregory 1989, Gutmann et al. 2005; Baumhart 2008).

As illustrated by examples of the Sahara and the U.S. Great Plains, much migration-environment research represents geographic case studies, focused on regions typically characterized by livelihood reliance on proximate natural resources. These studies engage both quantitative and qualitative methodologies, often operating at the household scale. Other work taps into historical analogs, such as the Great Plains example, to consider what future climate change might mean for population mobility. Mobility as related to natural disasters also

provides a lens through which to examine the migration-environment connection, and scholars have also engaged a macro perspective to yield empirical simulations of migration particularly in light of climate futures. The categorization of empirical work on migration-environment along these geographic and methodological lines facilitates the following review.

Household-Level Case Studies of Migration-Environment Linkages: In resource-dependent regions, cumulative processes of environmental degradation and declining productivity of local natural resources severely constrains livelihood options. Households exposed to such conditions may strategically diversify with some household members migrating in search of opportunity elsewhere (Abdelali-Marini et al. 2003; Keely 1973; Bilsborrow 2002). Indeed, existing scholarship links land availability and productivity to livelihood decline, and migration, in a variety of regions across the globe, including within Asia, Central and South America, as well as Africa.

As an example, land tenure policies in the Ecuadorian Amazon represent a “push” factor for young migrants who engage in temporary labor migration as means of amassing capital to purchase land (Bates and Rudel 2004). With a focus on the bisected Hispaniola island, Alscher (2011) examines distinctions in migration-environment patterns in contrasting Haiti and the Dominican Republic. The poorest households facing livelihood stress tend to migrate internally – the stress is predominantly related to lack of economic viability in rural regions which is, in turn, related to the dramatic loss of topsoil due to rampant deforestation (also livelihood-induced). Still, Haitian migrants are beginning to cross the international boundary that dissects the island to move onto land vacated by Dominican migrants since land pressures are far less intense across the border.

Across the globe, fragmentation of land holdings in Syria also appears to shape human capital decisions since land shortages often “push” males to migrate to urban areas and neighboring countries (Abdelali-Marini et al. 2003). A similar dynamic has been identified in rural Thailand; VanWey (2003) finds that households with smaller landholdings diversify their livelihoods through migration in order to supplement rural income. And in rural Benin, insecure land tenure plays a central role in continued internal migration among households already pushed from degraded origins (Doevenspeck 2011)

Of course, land access does not ensure productivity and, in this way, some scholars have linked precipitation patterns, as a force shaping agricultural potential, to migration patterns. Indeed, migration from north to south in Ghana is predominantly environmentally-induced, with natural resources acting as a “pull factor” within southern regions that offer more productive land. The “push” of drought is demonstrated in Burkina Faso where residents of drier regions are more likely to engage in both temporary and permanent migrations to other rural areas, as compared to residents of high-precipitation regions. In addition, short-term rainfall deficits increase long-term migration to rural areas but have the opposite effect on short-term moves to distant destinations (Henry et al. 2004). The 1983-1985 drought in Mali revealed similar patterns -- a dramatic increase in short-term cyclical migration as well as increases in the migration of women and children (Findley 1994).

Of course, drought shapes, and interacts with, poverty to ultimately determine the level of household vulnerability. In Niger, droughts lead to a vicious cycle of unsustainable levels of pressure on local natural resources, resulting degradation, intensification of poverty and eventually migration (Afifi 2011). Similarly, in the face of prolonged drought in rural Ethiopia, households with diversified livelihoods resist distress migration longer. Survival strategies

included shifts in consumption patterns, using food reserves, seeking non-farm employment, selling livestock, borrowing food, selling household farm/equipment, and gathering wild fruit. A threshold was apparent, however, after which coping options disappeared and all households, regardless of socioeconomic status, were affected and migration was likely (Meze-Hausken 2000).

Importantly, and as in the Ethiopian example, migration is often seen as a last resort. Individual migration breaks apart households, household migration breaks apart communities, and these fissures come with social cost. With a focus on a east Indian village, the division of family through migration to the city is perceived as a substantial social cost and undertaken only as a last resort in face of drought (Julich 2011). Similar findings characterize flood-ravaged regions of Mozambique. Environmental degradation – in the form of flooding, extreme events, and soil erosion – has already displaced thousands although migration is not typically seen as coping strategy, but rather, as failure (Stal 2011). In China’s Mekong Delta, despite being fearful of river bank collapse, households prefer to stay and eek out a living through fishing and plant collection. Established social networks, and local ancestral connections, represent strong connections to place (Dun 2011). Even on Pacific Islands atolls, characterized by extreme vulnerability to sea-level rise, residents want to stay (Mortreux and Barnett 2009).

Historical Analogs: History provides myriad examples of connections between human migration and environmental context (e.g., McLeman and Hunter 2010). Historical demographers have tapped into these to put current social-ecological processes within a broader historical context. As noted by Gutmann and Field (2010: 3) and with a focus on the U.S. setting, “the environment has both impeded and assisted forces of migration ... for centuries.” They draw on examples of hurricanes, earthquakes, and the Dust Bowl to illustrate their argument. The

San Francisco earthquake and subsequent fire of 1906, for example, destroyed half the city's housing stock and resulted in the evacuation of 300,000 residents. Nearly one-quarter of these evacuees never returned. Making use of historical data from city directories, Haas et al. (1977) reveal socioeconomic patterns in disaster-related migration and return. Not unlike vulnerability and migration from contemporary climate change, San Francisco's higher socioeconomic class districts and individuals stabilized fairly quickly after the earthquake, although unskilled workers were still in transition 5 years after the disaster (Gutmann and Field 2010).

Clearly, archival documents provide a rich data source for historical migration-environment research, but historical quantitative data can also be found. Again focusing on the Great Plains, and making use of a rich county-level data set, Gutmann et al. (2005) use pooled time series models to explore the association between population dynamics and environmental characteristics, 1930-1990. Climate effects on migration were revealed, working through agricultural impacts, especially during the 1930s-40s. Outmigration from Great Plains counties was greatest from areas of high unemployment and high levels of agricultural employment, thereby also revealing the importance of economic factors in shaping migration trends (Gutmann et al. 2005). Of course, this historical period was associated with relatively greater vulnerability to environmental extremes given lower levels of technological adaptation that might reduce the impact of environmental disasters (i.e. drought) on crop failures ~ such as might be the case in rural settings of less developed regions today.

Gilbert and McLeman (2010) also tap into the potential for lessons from history, with a focus on rural Alberta in the 1930s. They take a qualitative approach, weaving together an historical analog based on qualitative data from 37 in-depth interviews long-time residents of several rural communities who were willing to recall the experiences of their families and

communities during the 1930s. Resident recounts suggest the decade saw repeated crop failures due to extreme summer heat and low rainfall. Combined with an economic recession, falling commodity prices, and rising unemployment, migration was seen as an adaptive response to livelihood stress.

Learning From Natural Disasters: Another pathway to garner insight into the migration-environment connection is through research in the context of rapid onset natural disasters. Although distinct from chronic and long-term environmental pressure, certainly such events provide windows into household strategies in the face of environmental strain. To this end, a substantial body of migration research has emerged from the U.S. Gulf Coast's experience with Hurricane Katrina.

Hurricane Katrina devastated the U.S. Gulf Coast in late summer 2005, causing nearly 2000 deaths and the evacuation of thousands, including residents of the major metropolitan area of New Orleans. A pilot survey undertaken approximately 1 year after the storm found that patterns of return migration exacerbated existing inequalities since more advantaged residents were far more likely to return (Sastry 2009). Subsequent analyses have led to similar conclusions. As compared to the 2000 census, New Orleans post-storm has become relatively more white, older, more educated, less poor and with fewer renters (Frey, Singer and Park 2007; Groen and Polvika 2010; Stringfield 2010). Some of the inequalities in return migration are related to prior residential segregation. Blacks tended to live in areas that experienced greater flooding and hence suffered more severe housing damage which in turn, led to their delayed return to New Orleans (Fussell, Sastry, and VanLandingham 2010).

Related, the social costs of displacement of displacement are not borne evenly. Those most vulnerable – with lower levels of homeownership, health care, employment ties –

experience most difficulties during displacement and more severe challenges when trying to return (Hori and Schafter 2010).

Empirical Simulations: Also related to the environment as a migration “push” factor, several recently published works have undertaken empirical simulation of migration as related to projected environmental scenarios.

As an example, combining demographic, economic and climate projections, Barbieri and colleagues explore the demographic implications of environmental shifts in Brazil’s highly populated northeastern region. Brazil’s northeast contains nearly 30% of the nation’s population, due to historically high fertility levels, while the region is also experiencing high levels of urbanization and accompanying challenges in the large-scale provision of clean water and sewage. Projections suggest that climate change will severely impact the local agricultural sector, fueling migration and likely exacerbating urban challenges (Barbieri et al. 2010).

Grounding their simulation in a state-level empirical model of Mexico-US migration, Feng and colleagues (2010) project emigration based on future scenarios of agricultural productivity. By linking temperature and precipitation trends to corn and wheat, the researchers estimate that a 10% reduction in crop yields would lead an additional 2% of the Mexican population to emigrate (Feng, Drueger and Oppenheimer 2010). With a similar focus, but using a two-region overlapping generations model, Marchiori and Schumacher (2011) predict an increase in international migration as climate change impacts productivity in the south. Their calibration exercise suggests that “the number of migrants increases by a factor of four if climate change reduces southern productivity by approximately 5 percent.” (2011: 598)

Curtis and Schneider’s U.S.-based research demonstrates the utility of, and need for, small-area population projections linked with environmental data. Bringing together climate

projections with population distribution data for the continental U.S., Curtis and Schneider (2011) estimate that 20 million residents will be affected by sea-level rise by 2030. Further, they argue the impact of sea-level rise extends far beyond the directly effected counties due to the ripple effects of migration networks that link inland and coastal areas. In this way, the projected scale of population redistribution potentially arising from climate change has important implications for destination areas' public infrastructures.

And finally, an interesting contribution by Reuveny and Moore (2009) uses directed-dyad-year units as observations, reflecting migration flows from one country to another in a particular year. Their time series models integrate standard economic, social, and political factors predicting migration, in addition to measures of arable land, crop land, natural disasters and population-related natural resource pressure. They find we that environmental decline promotes out-migration from affected countries, net of the other included factors (Reuveny and Moore 2009).

Migration's Reciprocal Effect on the Environment

Thus far we've primarily explored environmental factors acting upon migration. Yet, environmental conditions, and change, may act as both cause and consequence of migration (Hugo 1996; NRC 1999). Further, migration yields these environmental consequences in both origin and destination areas.

Origin Impacts: The environmental impacts of migration at the area of origin are closely connected to remittances (Davis and Lopez-Carr 2010). An emerging literature explores two primary pathways. On the one hand, out-migration and remittances sometimes lead to a reduction in environmental pressure through agricultural de-intensification and land

abandonment as a result of a decline in available labor force and the simultaneous increase in cash income through remittances (Qin 2010, Rudel et al. 2005, Zimmerer 1993, Reichert 1981). From a conservationist perspective, land abandonment might be seen as a positive environmental outcome since it could lead to environmental recovery including vegetation cover increase (Olsson, Eklundh, and Ardo 2005, Rudel et al. 2005). As illustration, in the Bolivian Andes, out-migration brought about a decrease in the cattle which, in turn, reduced grazing pressure and led to the native shrubland expansion (Preston, Macklin and Warburton 1997). Other countries such as Albania (Muller and Sikor 2006) and Mexico (Lopez et al. 2006), have also seen positive effects of out-migration on growth of secondary vegetation.

Still, not everyone evaluates land abandonment as environmentally benign. For example, Zimmerer (1993) observed that soil erosion in the Bolivian Andes worsened as peasants stopped farming their lands and migrated elsewhere to engage in off-farm employment, presumably due to irreversibly transformed lands (c.f. Qin 2010). Also Robson and Nayak (2010) voice their concern that land abandonment and associated regrowth of forest areas will lead to biodiversity decline since landscape variation provides diverse habitat. An additional challenge is that out-migration can negatively impact traditional forms of natural resource management due to declines in the human capital necessary to maintain functionality of community-based natural resource institutions (Robson and Nayak 2010).

On the other hand, in some locales, remittances yield agricultural intensification (Taylor, Moran-Taylor, and Ruiz 2006, De Haas 2006). De Haas (2001) reports that, in arid regions of Morocco and Tunisia, migrant households intensified agricultural production through the purchase with remittance money of motor pumps for irrigation. Further, remittances have fueled farmland expansion and conversion of rainforest cattle pasture in Guatemala (Taylor, Moran-

Taylor, and Ruiz 2006), as well as the intensification of agricultural production through the hiring of additional farm-workers in Ecuador (Gray 2009). Increased use of fertilizers and pesticides has also been linked to remittances (Moran-Taylor and Taylor 2010, Gray 2009). In addition, remittances may indirectly encourage higher levels of agricultural production through shifts in consumption patterns likely to increase natural resource use (Davis and Lopez-Carr 2010), and potentially worsen residential trash and pollution problems (Qin 2010). Finally, the migrants themselves might impact agricultural practices upon return through the introduction of “new techniques or cropping patterns as they can afford the risks and costs of such investments” (De Haas 2001:30).

Non-agricultural effects have also been documented. An example comes from the farming provinces of Canar and Azuay, Ecuador, where remittances were invested in housing and land that converted the region into a peri-urban landscape of cultivated real estate (Jokisch 2002).

Destination Impacts: In-migration or immigration is frequently associated with localized population growth and attendant environmental impacts through, for example, land-use change, deforestation, desertification and soil erosion (Starrs and Wright 1995, Hugo 1996, Bilsborrow 1992). A number of studies have explored the detrimental impacts of migrants on tropical forests in the Amazon, Central and West Africa, and Southeast Asia (De Jong, Tuck-Po and Ken-ichi 2006). However, the largest body of work in this arena focuses on deforestation at the Amazonian frontier. Here, migrant settlement has been equated with deforestation for a variety of reasons, including unclear property rights and/or tenure systems that incentivize forest clearing (e.g., Carr 2009; Alston, Libecap and Mueller 2000).

However, as we know, context matters; In other settings, migrants do not appear to bring particularly negative environmental effects. As an example, focused on migrant/non-migrant fishing behavior in Indonesia, Cassels, Curran and Kramer (2005) observed no clear relationship between migration status and poor marine environmental quality via destructive fishing practices. In the U.S., a study of 200 urban counties identified no clear association between air pollution and immigrant concentration (Squalli 2009).²

Despite the lack of solid empirical evidence that migration disproportionately harms the environment, some critical voices have argued for drastic restriction of population movement. Cafaro and Staples (2009), argue that immigrants to the U.S. from less developed settings will substantially increase their consumption resulting in an increase in overall carbon footprint. In this way, they argue, immigration might spur climate change and should be restricted for environmental reasons. This aspect of the immigration debate received substantial popular attention several years ago when, in 2005, the Sierra Club was debating taking an organizational stand on immigration. In the end, the organization opted to not engage in a demographic dialogue.

Understudied Migration-Environment Topics

The consistent integration of environmental characteristics within migration research is likely still a long-way off. Yet concerns with contemporary climate change have certainly lent a wake-up call to migration scholars with regard to the potential importance of context. Following are

² Squalli (2009) made use of a framework of relevance in considering the migration-environment association. STIRPAT represents an extension of the more commonly known IPAT equation (Environmental Impact = Population * Affluence * Technology). The expansion, Stochastic Impacts by Regression on Population, Affluence, and Technology allows for elasticities within the decomposition exercise (Dietz and Rosa 1994).

four topical areas where migration researchers could offer insight of theoretical importance, as well as of use to contemporary policy and program response in the face of environmental change.

Short vs. Long Distance Moves in Response to Climate Change: Public and policy debate continues as to whether environmental change will be associated predominantly with internal population displacement or also cause substantial international migration. However, most migration scholars agree that the majority of climate-related migration will be internal and of shorter distance. For example, in a meta-analysis of 16 case studies from the African continent, Jonsson (2010) finds it very unlikely that individuals affected by environmental change will migrate to the global North or even across the border into a neighboring country. Rather, most of the observed movements were within countries and often of relatively short distance. Similarly Zaman (1991) found that individuals displaced by erosion in the Bangladesh floodplains relocated only a short distance. And short-distance circular migration almost doubled while international migration to France almost halved during a drought in Mali (Findley 1994). Finally, a household study in Nepal observed that environmental degradation was associated with elevated rates of local but not with interregional or international population mobility (Massey, Axinn, and Ghimire 2010).

There are several reasons for this pattern. First, long-distance and international migration require financial, human and social capital that the most vulnerable, impoverished rural households simply do not typically have. Second, and as discussed briefly above, connections to place run strong – even in vulnerable locales such as regularly-flooded delta regions in China and Mozambique, as well as Pacific Island atolls dangerously exposed to sea level rise.

Despite these findings, a number of scholars emphasize the possibility of substantial international exoduses in response to environmental change. Hugo (1996) was among the first to

outline various reasons for anticipating international moves such as 1) distinctions in economic, political, and social conditions between countries of the global north and south, 2) an international immigration industry has developed over the last decades, facilitating inter-country migrations, and 3) globalization as a connecting force for people, industries and institutions.

Bardsley and Hugo (2010) use Thailand as a case in point to illustrate how political and institutional structures might facilitate international migration in the face of environmental shifts. Strong networks maintained between Thailand and other countries have established active migration corridors through which environmentally-induced migration might intensify (Bardsley and Hugo 2010). The existence of similar migration corridors have been reported for the Pacific island nations as agreeable political relationships between island states and former colonial powers (e.g. Marshal Islands or Samoa and the U.S.) facilitate international population movement (Opeskin and MacDermott 2009). Pacific Islander migrant streams to New Zealand have also been identified (Shen and Gemenne 2011).

Rural-Urban Linkages: Urbanization is arguably among the most important demographic phenomenon of the last century. There are currently 21 “megacities” with over 10 million residents. And while a higher proportion of residents in more developed nations live in urban areas (74%), urbanization is occurring more rapidly in less developed settings. It is expected that 70 percent of the world population will be urban by 2050 (PRB 2011).

With rapidly growing, massive urban agglomerations come negative externalities such as high rates of unemployment, infrastructure strain, and environmental degradation (Bencivenga and Smith 1997, Beauchemin and Schoumaker 2005, Yin et al. 2011, Kavzoglu 2008). For example, Yin et al. (2011) conducted a longitudinal study in Shanghai metropolitan area during the transitional economy period of 1979-2009. Using satellite images they found that massive

urbanization has led to clearing of vegetation and a wide range of environmental degradation. Moreover, for the international context Mostafa (2010) demonstrated that per capita ecological footprints were positively associated with the level of urbanization across 140 nations.

There exists an important, but understudied, link between rural environmental degradation and urban growth (Adamo 2010; Fearnside 2008). More often, research designs and resulting conclusions end at examination of migration's 'push,' not querying destinations or the implications of destination choices. An exception is Sanderson (2009), who observed that environmental degradation through mining activities caused substantial out-migration from rural to urban areas in Ghana. Part of the urban 'pull' is related to public services, which draw rural to urban migrants (Beauchemin and Schoumaker 2005) – even households from deep Amazonian villages are drawn to the educational opportunities in peri-urban Brazilian destinations (Parry, Day, Amaral, and Peres 2010).

Of course, urban concentrations bring economies of scale for service delivery which may yield relative environmental gain, while also acting as a relief valve, of sorts, for rural demographic pressure. Indeed, rural-to-urban migration has been found to cut the magnitude of rural population pressure on deforestation rates (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002; Jorgenson and Burns 2007), and therefore perhaps allow development of secondary forest cover (Wright and Muller-Landau 2006).

Urban-to-rural population flows are also possible and the resulting "rural encroachment" can yield detrimental environmental effects within non-urban destinations (Burns et al. 1994:225). Out-migrants from urban areas tend to be relatively poor, unskilled and have low levels of education and might prioritize short-term survival and economic gains over long term perspectives leading to unsustainable natural resource extraction (Burns et al. 1994, Burns, Kick,

and Davis 2003). In more developed countries the process of urban-to-rural migration has been called “counter-urbanization” and is more often associated with amenity migration to environmentally attractive locales (Hunter, Saint Onge and Boardman 2005; Jackson et al. 2008).

Migration, Health and the Environment: A large body of literature examines the connection between migration and health – both as related to migrants themselves, migrant households at destinations, and as related to household members left behind. The “immigrant paradox” is particularly intriguing – research finds that despite typically being of lower socioeconomic status, immigrants to the U.S. tend to have superior health outcomes (e.g., Markides and Eschbach 2011). An open question is the ways in which this paradox may be associated with environmental settings. Yabiku et al. (2009) explored this, making use of long-term socioecological data in Phoenix, Arizona to demonstrate that environmental conditions help explain immigrant’s health disadvantages, but not advantages. In other words, the effect of neighborhood amenities becomes increasingly beneficial for a respondent’s health, the longer he/she has lived in the particular neighborhood. A related study links neighborhood stability, the built environment and vulnerability to heat extremes, indeed finding that communities characterized by greater socioeconomic disadvantage and less stable populations experienced relatively more heat distress (Uejio et al. 2011).

Also bringing health into the equation, extreme environmental conditions such as particularly high (e.g. Sub-Saharan Africa) or low (e.g. Alaska) temperatures, elevated levels of humidity (Amazonia) might impact the health of newly arrived migrants differently than the health of already adapted long-term residents. Vigotti, Muggeo and Cusimano (2006) found for Italy that the heat-related mortality risk for migrants differed according to their birthplace. Migrants from northern areas of the country who had migrated to the south had a higher risk of

dying from heat related causes than migrants from other southern areas or natives. Related, migration-related shifts in land use may alter the local environment in ways that impact health. Consider migrant colonization, deforestation and increased malaria risk within the Brazilian Amazon (Singer and Castro 2006).

Further, a process of negative health-selective migration among middle-aged cohorts of Australian women has been observed (Larson, Bell and Young 2004). Within this group, those with long-term, chronic diseases and overall poor health were actually characterized by higher levels of mobility. The authors suggest that migration might be triggered by a search for services and physical amenities, possibly leading to a reduction in aggregate level of health at amenity-rich destination areas.

Finally, perceived or real threats to health and well-being based on negative environmental characteristics (e.g. air-pollution, radiation, toxicity) might impact population mobility. However, empirical support for this hypothesis has yet to be found. In contrast, a number of studies conducted in the U.S. find that environmental and air pollution is not clearly associated with increased levels of outmigration (Crowder and Downey 2010, Squalli 2009, Hunter 1998), although areas with environmental risks gain relatively fewer new residents (Hunter 1998).

Social Inequalities in the Migration-Environment Association: Socioeconomically disadvantaged groups have been found to be disproportionately affected by environmental risks (for an overview, see Brulle and Pellow 2006). Yet few studies have examined the ways in which such social inequalities in environmental exposures may be, in part, related to differences in migratory behavior. Two theoretical perspectives are useful here. First, the income-inequality and spatial assimilation perspectives (Quillian 1999, Crowder and South 2005, Crowder, South,

and Chavez 2006) suggests that racial differences in the likelihood of moving into and out of environmentally hazardous neighborhoods emerges largely as a function of differences in socioeconomic status. Advantaged households should be able to avoid high polluted neighborhoods whereas disadvantaged households have limited mobility opportunities. On the other hand, the residential discrimination thesis (Godsil 1991, Mohai and Bryant 1992, Bullard 1993) on the other hand suggests that differences in exposure to environmental hazards and differences in mobility patterns are due to housing-market discrimination that restrict the housing options available to disadvantaged groups.

A handful of studies have explored the race/ethnicity, environment and migration relationship. For example Hunter et al.'s (2003) work models differences in the out-migration behavior between racial groups in relation to the presence of hazardous waste facilities, superfund sites, and annual toxic release levels, finding no racial differences in outmigration as related to environmental hazards. However, a recent study by Crowder and Downey (2010) found that racial minority groups enter hazardous areas more frequently than whites.

Beyond race/ethnicity, there are also gender dimensions to the migration-environment association. Clearly migration, as a social process, is inherently gendered and gender-influenced cultural expectations, policies, and institutions shape migration processes as well as individual interaction with local environments (e.g. Dannecker 2009). As examples, in some cultural settings, women tend to predominantly engage in livelihood migration (e.g. the Philippines; McKay 2005), while in others the “push” of environmental decline might be felt more by men (e.g. West Africa; Terry 2009). Yet virtually no scholarship brings this dynamic to the fore (Hunter and David 2010) with the notable exception of Gray (2010). His findings reveal gender distinctions in migration in the face of environmental pressures in the Ecuadorian Amazon.

Specifically, young women tend to move further than men, who are more likely to engage in seasonal migration, returning to their rural homesteads to tend farms (Gray 2010).

Central Methodologies in Migration-Environment Research

A wide variety of methodological approaches have been applied to the migration-environment question (Piguet 2010). Here, we briefly review four currently used, promising approaches.

Time series: The environmental effects of population dynamics logically require time to become measurably manifest (Sanderson 2009, Entwisle 2007). For example, it may take years before deforestation leads to a level of soil deterioration that adversely impacts subsistence agriculture. Thus, longitudinal time-series data are especially appropriate for population-environment connections (Cassels, Curran and Kramer 2005). A useful example is provided by Henry, Schoumaker, and Beauchemin (2004) who employed event history hazard models to investigate the impact of droughts on out-migration in Burkina Faso. They demonstrated that a time window (or lag) of three years was most appropriate since “rural households may have sufficient stocks of cereals or enough money, livestock and assets to purchase cereals following a poor harvest” but are likely to have depleted their assets after two or three consecutive bad harvests, “a situation that could force them into migration” (Henry, Shoumaker and Beauchemin 2004: 438). Following this approach, studies by Massey, Axinn, and Ghimire (2010) and Reuveny and Moore (2009) have used time series to model migration-environment connections.

Multilevel modeling: Multilevel models use mathematical algorithms that allow the simultaneous inclusion of individual level and aggregate level variables (Luke 2004). However, to-date few studies have used this modeling approach to include environmental factors in migration studies (e.g., Cassels, Curran and Kramer 2005). An example is Yabiku et al.’s (2009)

investigation of the impact of environmental factors on differential health outcomes between migrants and non-migrants. Here, household survey data were merged with local neighborhood characteristics related to traffic, heat, amenities such as parks and trees, and disorder such as trash, noise, crowding, and waste sites. Although multilevel modeling approaches have many advantages, a central drawback is the necessitation of a predefined hierarchy of spatial units (e.g. census tract) that might not appropriately reflect the spatial distribution of the phenomenon under study (Piguet 2010).

Agent-based modeling: Agent-based models (ABM) have also been promoted as useful tools for examining population-environment interactions (Auchincloss and Diez Roux 2008, Evans and Kelly 2008). An ABM simulates human behavior and allows individuals (active agents) to interact with the environment (passive agent) in complex ways including environmentally motivated migratory behavior (e.g. Mena et al. 2011). A key strength is its usefulness for the study of feedback, adaptation, and nonlinear relationships between coupled natural-human systems (O'Sullivan 2008). In addition, the predictions of human behavior is useful within the study of policy interventions (Miller et al. 2010). As an application example, Mena et al. (2011) developed an agent-based model to simulate environmental change (e.g. deforestation) associated with land use patterns of frontier migrant farmers in the Northern Ecuadorian Amazon. They combined socio-demographic and socio-economic data from a household survey with longitudinal satellite images of land cover and ultimately created spatially-explicit representation of land use/land cover for the region.

Qualitative Ethnographic methods: This category is home to a substantial number of recent studies connecting environment and migration (e.g., Carr 2005, Gibbons and Nicholls 2006, Jonsson 2010), several undertaken within the larger EACH-FOR project (Environmental

Change and Forced Migration Scenarios). EACH-FOR, co-financed by the European Commission, produced 23 case studies representing a wide variety regions across the world and was able to illustrate multiple ways in which environmental change acts as a trigger for migration (Jaeger et al 2009). Several of the examples offered within this review are products of the EACH-FOR collection including insights from Ghana (van der Geest 2011), Hispaniola Island (Alscher 2011), and Tuvalu (Gemenne and Shen 2011).

Indeed, much can be learned from qualitative studies about reasons underlying migration decision-making. As an example, Carr (2005) used participant observation, unstructured interviews, and small scale surveys in three villages in coastal Ghana to investigate the complex connection between environment, economy, and migration. Ecological degradation threatened men's power position in the household, which Carr identified as the underlying push factor for the movement to areas with better opportunities for cash income.

Subjectivity as a methodological challenges: Environmental challenges are relative, thereby hampering cross-setting analyses. For example Meze-Hausken (2000:389) points out that Irish and Ethiopian farmers would likely have very differing perceptions of drought and, in fact, even objective measurements of rainfall take different meaning within their daily lives. In fact, subjective perceptions of the local environmental conditions can actually be stronger predictors of migration than objective measures (Massey, Axinn, and Ghimire 2010). Thus, measurement challenges include accurately reflecting local environmental context in ways meaningful to residents and likely to manifest within migration decision-making processes.

Science-Policy Disconnects and Recommendations

Environmentally-induced migration continues to receive popular and media attention. Yet the image portrayed is often not informed by scientific understanding and, in some cases, actually contradicts current scientific knowledge.

Some studies have associated environmental migration with violent conflicts (Reuveny 2007) and threats to national security in general (Scheffran and Battaglini 2011). Yet the bulk of research suggests environmentally-related livelihood migration is far more likely to entail internal, short-distance moves as opposed to costly, and more controversial, international migrations. In addition, research across a variety of settings demonstrates that migration is not a decision taken lightly. The separation of individuals from households, or in the aggregate, the disintegration of entire communities, can entail substantial social cost. Although migration has historically been used as a coping strategy, it is often seen as a “last resort.” Given these understandings, programmatic and policy response should focus within borders, aiming to reduce livelihood vulnerability, and allowing families and communities to remain intact. Such efforts may go a long way toward stemming environmentally-induced migration.

In addition, dialogue tends to ignore differential vulnerability across, and within households, rather assuming with broad-brushed strokes equivalent response across actors. On the contrary, research from natural disasters and other bodies of work clearly demonstrates that households vary in their ability to respond to environmental change, either through migration or otherwise. Further, within households, men and women differentially experience the linkages between migration propensity and environmental conditions and change. Even so, such nuance tends to be lost within public and policy dialogue.

Indeed, politically, there has been virtually no dialogue about migration, even in broad-brush terms, within climate change negotiations. The recent United Nations Climate Change Conference, in Durban 2011, achieved success in the creation of a Green Climate Fund to support adaptation in developing countries, particularly those most vulnerable to the adverse effects of climate change. It remains to be seen if this brings support targeted to stem household-level vulnerability as related to migration.

Of course, political recognition of migration-environment linkages would be a logical first step, however, environmentally-induced migration tends to be invisible under legal frameworks (Johnson 2009). A first step was recently taken as the United Nations High Commissioner of Refugees (UNHCR) acknowledged in a recent policy document that “some movements likely to be promoted by climate change could indeed fall within the traditional refugee law framework, bringing them within the ambit of international or regional refugee instruments, or complementary forms of protection, as well as within UNHCR’s mandate” (UNHCR 2009:6). Even so, such frameworks neglect consideration of internal population movements and, as discussed at the chapter’s onset, the term “refugee” itself can yield political complications.

Conclusion

As we seek more depth in our understanding of migration’s causes and consequences, the migration-environment association becomes all the more clear. Much progress has been made over the past several years although certainly important work is ahead.

Fortunately, the migration-environment research community continues to move beyond Malthusian arguments focused on population pressures as the force underlying environmental

change and unsustainable natural resource use. The political, economic, and cultural contexts of population-environment connections have lent better critical understanding of the roles, for example, of globalization, inequality, and vulnerability in household migration decision-making.

Clearly migration-environment questions are inherently interdisciplinary. Although much work in this area has engaged scholars across disciplines, we must continue to expand these efforts. Natural science expertise is essential in accurately engaging the environmental data and the demographic community must continue to seek those interested in such collaborative work. Our challenge as migration scholars is to shed light on migration as a social process and, where that process is shaped by environmental forces, neglect of these factors means we've not done our job. In today's era of global climate change, and particularly in regions where natural capital is central to livelihoods, it's imperative that we measure and integrate consideration of environment's interaction with other factors in shaping migration --- otherwise, our work on the migration puzzle may simply be missing a critical piece.

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