"(Dis)entangling environmental migration: Local adaptation as resilience in Bangladesh"

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Abstract:

Climate change is often claimed to be one of, if not *the* primary, pressing global issue of the 21st Century. This claim has significant implications for the study of migration, as environmental factors are common push forces of human movement. The loss of a natural resource base, desertification, salinization of fresh water, and receding coastlines may be reasons for individuals to seek a new environment. Using Behavioral and Structurationist theories and the Sustainable Livelihoods Approach, I will argue that locally designed and implemented adaptation projects which acknowledge the contextual ecosystem, economy and social structures are appropriate responses to environmental migration. This strategy should be supported by broader-scale political action which addresses root causes of climate change and development challenges because it is impossible to disentangle climate change from existing local and structural influences. While the media often portrays climate change migration as a sudden and massive movement of people across international borders, creating an alarming refugee situation, research shows that environmental migration will primarily occur gradually due to slow-onset change, and will occur within national boundaries. The decision to migrate due to environmental change is a function of exposure and adaptive capacity; these factors impact the level of resilience or vulnerability of an individual to both gradual change and sudden shocks. However, mobility, or the ability to migrate, is selective regardless of adaptive capacity. Not all who desire or need to migrate are able to do so, due to lack of economic, social, or physical capital. This inability to move requires that livelihoods be maintained in local communities in order to serve those who do not migrate. Because mitigation efforts occur on the global scale and require a long timeline, in situ adaptation to environmental and climatic change must be an option and must be enacted. This paper will closely examine the low-lying country of Bangladesh for its status as a climate change "hot spot," and its adaptation initiatives.

Introduction

Climate change is often argued to be one of, if not *the* primary, pressing global issues of the 21st Century. This environmental shifting is predicted to lead to new patterns and quantities of migrants across the world as they seek ways to adapt to climate change. This paper will examine the intersection of environmental change (especially due to climate change), human migration, and responses to this kind of movement. This research will address the following questions: How does migration function as an adaptation strategy to environmental degradation/climate change? What are the appropriate responses to this kind of migration, and by whom? On what scale should we focus our actions? I will argue that locally designed and implemented adaptation projects which acknowledge the contextual ecosystem, economy and social structures are appropriate responses to environmental migration. This strategy should be supported by broader-scale political action which addresses root causes of climate change and development challenges because it is impossible to disentangle climate change from existing local and structural influences. For the purposes of this paper, the definition of climate change acknowledges that it is a historical phenomenon, but climate change today is occurring at an unprecedented rate and scale, and is human-induced by greenhouse gas emissions.

Migration can be thought of simply in terms of scale – how far are people moving and across what borders – and in terms of decisions – why do people choose to migrate, and to where, and at what point? Quantitative data examining population change and immigration records can help us to answer questions about scale. However, the second set of questions is not so simply answered. Determining the causes of migration requires acknowledging that

environmental, social, and economic factors interact and create infinite situations to either encourage or discourage migration. Environmental migration, in particular, is difficult to define, as multiple outside forces directly impact the environment and in turn cause the environment to impact individuals, creating tangled feedback loops. Furthermore, even empirical, ethnographic research may not directly highlight migration decisions based on the environment, because migrants themselves may not recognize nor acknowledge the environment's direct influence over their actions. Due to these intersecting and multiplying factors, this paper will maintain that no migration decision can be determined without understanding the various, contextual aspects of an individual's situation.

This paper will examine the contemporary literature surrounding environmental migration, challenge current assumptions, and determine an appropriate response. The literature draws on migration and development studies and explores them in the context of the changing natural environment. The paper will attempt to disentangle the apocalyptic images of climate change migration and present a more realistic, manageable future that rests upon local adaptation strategies, which will be demonstrated by a case study of the Subarnabad community in Bangladesh and the livelihood adaptation initiatives there. This paper does not seek to argue that the adaptation strategies employed in Subarnabad are transferable to other contexts. Rather, the community serves as an example of ways in which local institutions and context-specific solutions can be an appropriate response to the global climate change phenomenon.

Conceptual Framework

Contemporary climate change cannot be stopped. Adaptation, the process of adjusting to predicted or actual environmental change in order to avoid harm (IPCC, 2007), is the only way

forward. Even if greenhouse gas emissions are capped to produce no more than a 2 degree Celsius rise in global temperature compared to pre-industrial levels (IPCC, 2007), parts of the world will experience significant new risks and impacts from climate change. No matter what happens with emissions moving forward, there will be changes and so people and nations will need to adapt in some way (UNEP, 2014). While mitigation, or the slowing down of climate change, will still be necessary it must, as described by the United Nations Environment Program's Executive Director Achim Steiner, be "combined with large-scale and rapidly increased funding for adaptation. Investing in resilience and adaptation as an integral part of national development planning can [help] develop resilience to future climate change impacts" (UNEP, 2015). Mitigating efforts to control and reduce greenhouse gas emissions will be negotiated at the international scale, while adaptation strategies will be employed regionally and locally.

The decision to migrate due to environmental change is a function of exposure to risk and adaptive capacity. The impact of exposure is determined by vulnerability and resilience (McLeman & Smit, 2006). Vulnerability, the potential susceptibility to harm from environmental change, is a push factor of migration; it is a combination of socioeconomic and environmental factors, which may increase or decrease exposure to risk (IPCC, 2007). The flip side of vulnerability is resilience. Resilience indicates the ability of a population to withstand environmental change or degradation. As resilience increases, vulnerability decreases and vice versa (IPCC, 2007). When resilience increases, there will be less incentive for migration.

Climate change is often framed and thought of as a *global* problem that will need to be addressed on an international scale. Country officials have gathered at dozens of world summits

since 1988 when the United Nations Framework Convention on climate change was established to work towards limiting greenhouse gases (a. UNFCCC, 2014). However, these costly summits have rarely produced firm and binding policies. Rather, international gridlock and lack of cooperation have stalled negotiations, especially on the part of the most-emitting developed countries. George H.W. Bush demonstrated this at the Rio Earth Summit in 1992 when he told country officials, "the American lifestyle is not up for negotiation," (Vidal, 2012) indicating that any action on emissions would not come by way of the United States. In 2008, the international community was able to reach a degree of consensus on climate change action when the Kyoto Protocol treaty became active, eight years after its initial adoption. The Kyoto Protocol was a legally binding agreement calling on nations to limit and reduce their greenhouse gas emissions. While binding, it was binding for only four years and it was not mandatory. The United States, one of the highest-emitting nations, did not sign on (b. UNFCCC, 2014). To date, international work on climate change has taken extensive amounts of time and has been optional rather than mandatory, and so the mitigating impacts have been minimal. Rather than expecting change to occur at this scale, it will be crucial for local communities to take autonomous action in order to build resilience and reduce vulnerabilities.

Adaptation to climate change will be particularly important in developing countries because immediately pressing development challenges will be exacerbated by the phenomenon (Kok & de Coninck, 2007). Climate change will impact livelihoods, especially those dependent upon natural resources, making it more difficult to combat poverty. Water scarcity, which is tied to public health and food sources, will be further pressured by rising sea levels, droughts, and salinization of freshwater sources. The changing climate will shift the sources of arable land,

decreasing food production in some parts of the world. Therefore, climate change policies should be coupled with development policies (Kok & de Coninck, 2007).

This paper draws on Behavioral migration theory, Structurationist theory, and the Sustainable Livelihoods Approach to create a framework through which to view environmental migration. When paired, Behavioral and Structurationist theories explain that migration is a result of individual evaluations of opportunities and risks, integrated with large-scale structures that have influenced climate change. The Sustainable Livelihoods Approach combines these theories in the context of poverty, a problem that exacerbates the impacts of climate change on poor populations (Krantz, 2001). When combined, these three approaches help to answer the research questions regarding how migration and adaptation are connected, and what the implications are of this kind of adaptation strategy. Environmental degradation and climate change occur as a result of both global and local processes and actions, leading to undermined livelihoods and the necessity of migration for people dependent upon those livelihoods, indicating that local adaptation to preserve livelihoods is an appropriate response to climate change.

Behavioral theory rejects ecological fallacy, or the mistaken inference that data which applies to a group can be scaled down to apply to an individual. The theory focuses on individual decision-making, rather than macro-scale trends, as it relates to migration. It critiques the idea that humans act within the boundaries of economic or spatial rationale and claims that risk and uncertainty must also be considered and worked into behavior models (Golledge, 1980). The theory also creates a space in migration research to understand the reasons that people choose *not* to migrate (Golledge, 1980). It incorporates the idea of *place utility*, that is, the perceived

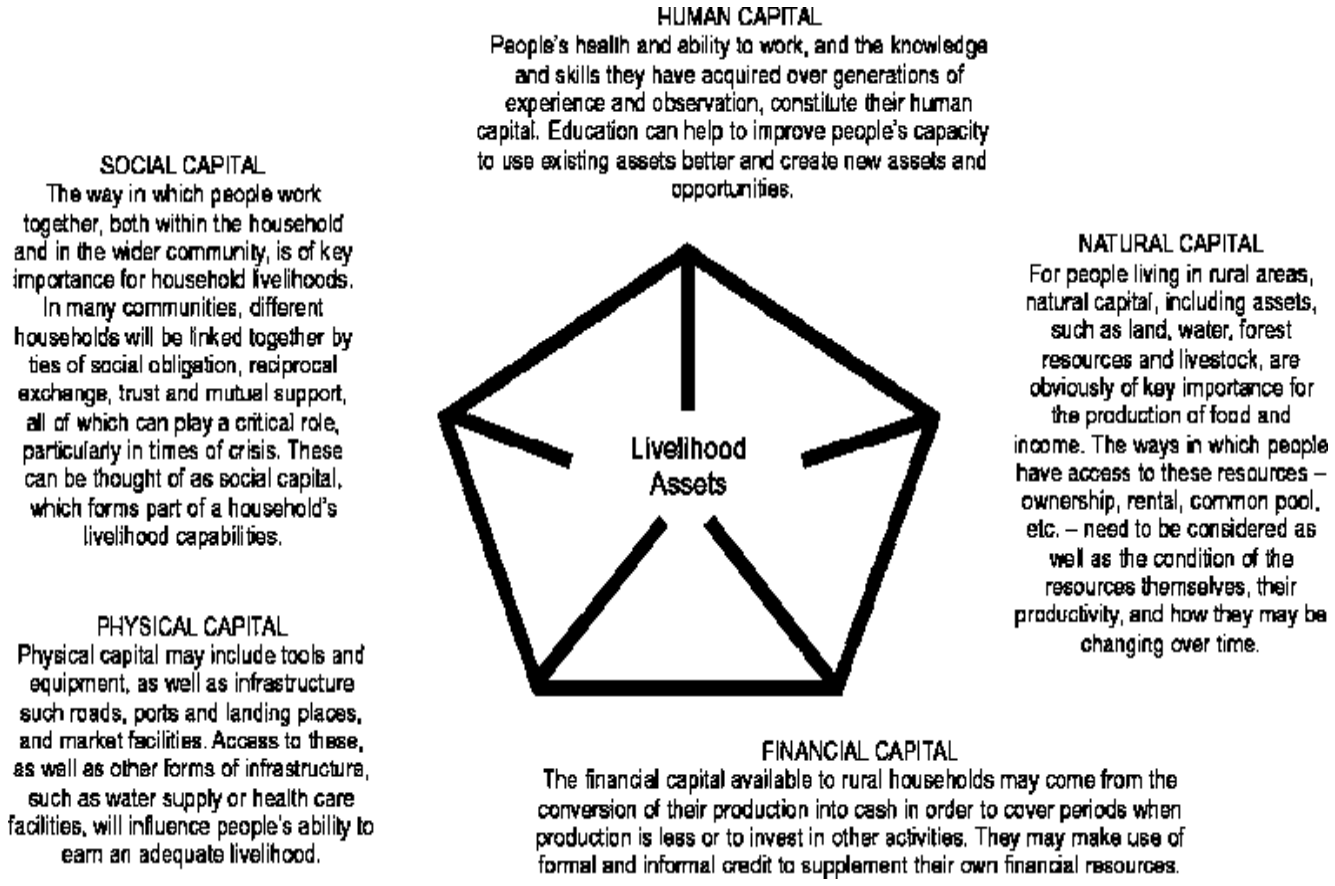
ability/desirability of living in a place based on the social, economic, or environmental situation (Golledge, 1980; Golledge & Timmermans, 1990). Viewing environmental migration through the lens of behavioral theory helps to answer questions about why some individuals choose migration as an adaptation strategy while others do not.

Structurationist theory acknowledges the links between individual decisions, social structures, time, and space. Social structures are both a channel for, and an outcome of, human agency (Kellerman, 1987). Structures influence actors in society, and these actors create and perpetuate structures. Interactions between structures and individuals must be examined in the contexts of time and space. A key aspect of structurationist theory is the *duality of structure*, meaning that the individual with agency and the greater structure cannot exist without each other (Kellerman, 1987). It's impossible to accept that climate change is pushing migration without considering the greater geopolitical, economic, and social factors contributing to climate change, especially its impact in developing countries. Developed countries, after two and a half centuries of industrialization, have contributed most to greenhouse gas emissions, the rising global temperature, and the resulting changing climates (IPCC, 2014). These nations are also the most prepared to deal with new shocks to their systems and have the most capability to adapt due to their economic, social, and political stability. Developing countries have fewer resources to commit to mitigation and adaptation (IPCC, 2014). Structuration theory ensures that we account for the structural influences on individual decisions to employ migration as an adaptation strategy.

The Sustainable Livelihoods Approach (SLA) will frame the case study used in this paper. This approach was created by the Brundtland Commission on Environment and

Development and became a widely accepted poverty eradication tool after the 1992 United Nations Conference on Environment and Development (Krantz, 2001). The approach includes five asset areas that contribute to a household's livelihood sustainability including: economic, human, social, physical, and natural (See Figure 1). A combination of these assets that allow a household to cope with stress and shocks (such as natural disasters or resource depletion) (Pouliotte, Smit, & Westerhoff, 2009) is considered a sustainable livelihood (Krantz, 2001).

Figure 1:
Livelihood Assets (Messer & Townsley, 2003). This image outlines the five capitals and how they contribute to livelihoods.



This approach relates to climate change migration because it accounts for the adaptive abilities of households, especially those whose livelihoods are dependent upon natural resources (Krantz, 2001). The focus on poverty eradication is appropriate considering that those who are most vulnerable to environmental change are poor populations in developing countries. There is a level of synergy between SLA and climate change – sustainable livelihoods not only build individual resilience, but also can have a mitigating impact on greenhouse gas emissions. It considers attributes which provide for a stable and sustainable livelihood, something which will be necessary as climate change and environmental degradation undermine local economic bases. It also sits at the intersection of Behavioral and Structurationist theories, as suggested by Krantz (2001, 21): "To understand the complex and differentiated processes through which livelihoods are constructed…it is insufficient just to analyze the different aspects of livelihood resources and strategies as separate elements. One must also analyze the institutional processes and organizational structures that link these various elements together." The SLA serves as an answer to questions regarding how and where to respond to climate change; it works to build resilience and adaptive capacity at the local level while accounting for greater influencing structures.

Together, Behavioral and Structurationist theories and the Sustainable Livelihoods Approach provide links between the multiple factors pushing migration due to climate change. Global greenhouse gas emissions, international climate agreements, and inequality between nations as well as local governance, available resources, and household capitals combine to influence the need and capacity for migration or in situ adaptation.

Current Literature: Accepted Assumptions/Up for Debate

Literature surrounding climate change migration provides often-contrasting images of the scale, direction, and reasons for this kind of movement. This section aims to disentangle the asserted trends and determine what the movement will most likely look like. The phrases "environmental migration" and "climate change migration" imply that the environment/climate are factors that influence people to move from their current location to a new one. However, the literature widely accepts that there is inherent uncertainty in drawing causal links between a changing environment and migration. Rather, climate change may be a factor that facilitates a tipping point – when it overlays existing social, economic, and environmental situations, it exacerbates pressures (McAdam & Loughry, 2009). Climate change will alter local environments, especially those of communities built along sea coastlines and densely populated deltas, low-lying islands, and areas that face potential water scarcity (IPCC, 2007). This environmental degradation will disrupt, and sometimes undermine, local livelihoods (UNEP, 2015) and may lead to migration (Adams & Adger, 2013; Barnett &Webber, 2010; Hugo, 2010; McAdam, 2010; Tacoli, 2009). This migration is highly context specific and varies depending on the physical geography, the way the climate is changing, and the greater social and economic structures of the place (Agers & Adgers, 2013).

A second accepted assumption in the literature is that migration is *selective*. It requires economic and social capital and physical ability to pick up one's life and move it somewhere new (Hugo, 2010). Migration is a decision influenced by gender, age, employment and income, level of education, and strength of social networks (Golledge, 1980). Lacking a certain degree of these "capitals" will prevent some people from moving, even if their security or safety is threatened by environmental changes (Hugo, 2010). Because migration as an adaptation strategy

is not available to everyone, it is crucial that local economies and infrastructure allow for in situ adaptation to be an option. For example, coastal areas at risk of severe weather events can improve management of coastal ecosystems in order to maintain a natural protective barrier to ocean storms (UNFCCC, 2006).

One of the primary debates in the literature is determining whether or not individuals who are pushed to move due to environmental factors should be considered "refugees" and to date there is no international consensus (McAdam, 2010; Hugo, 2010; Kalin, 2010; Penz, 2010; Williams, 2008). Currently, refugee status is determined by the 1951 Refugee Convention definition: a refugee is a person who

> "owing to well-founded fear of being prosecuted for reasons of race, religion, nationality, membership of a particular social group, or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to fear, is unwilling to return to it" (Kalin, 2010, 88).

This definition offers no protection to people who move due to environment or climate factors. This is not necessarily a negative thing. "Refugee" implies that individuals have a lack of agency or adaptive capacity. When migration occurs as a response to environmental factors, people are in fact making a decision – they are not helpless, but are actively seeking a solution and must make difficult decisions about when and how to migrate (Penz, 2010; McAdam & Loughry, 2009). An overarching definition of an environmental refugee and an ensuing international policy response could "downplay the cultural and livelihood needs of displaced communities and local knowledge bases for adaptation" (McAdam, 2010, 2). Debates surrounding this migration currently place too much emphasis on sudden-onset changes, which are interpreted as "disasters"

that cause massive flows of refugees across international borders and this misplaced emphasis has the potential to lead to ineffective responses (Tacoli, 2009).

As argued by Hugo (2010), climate change migration will be more complex than simply *climate change = environmental degradation = displacement and migration*. The future of mobility will be influenced by many factors. Not all those who face the impacts of climate change will move, and not all those who move will determine the environment a push factor. It is important to make a distinction between *migration* and *displacement* and recognize the influences of choice and time. If an individual moves before uninhabitable degradation, they are adapting; if they move after a place has become uninhabitable and no other strategies can be employed, they are being displaced. Displacement assumes involuntary migration while voluntary migration can be viewed as an adaptation choice (Hugo, 2010).

Distinguishing between voluntary and involuntary migration raises some questions. Can we determine or predict when migration as an adaptation strategy will be employed? Where is the threshold? When does the opportunity for voluntary migration pass and turn into involuntary migration? One useful way to explore this threshold is through the lens of fast-onset versus slow-onset change. Environmental disaster can occur in an instant as an extreme, one-time event. This fast-onset degradation usually results in temporary, rather than permanent, migration. The place in which it occurs can be rebuilt, as international aid money often comes flooding in. This type of event will force migration and lead to involuntary displacement (Hugo, 2010). It is this type of event that inspires alarmist and doomsday portrayals of climate change migration in the media (Tacoli, 2009) and which paints climate change migration as a matter of international concern. However, it is predicted to occur primarily as a result of slow-onset disasters (Hugo,

2010). This type of change or degradation occurs gradually over time as resources are unsustainably exploited.

Even when migration is pushed by natural disasters, it is difficult to discern the extent to which climate change is a direct cause. The increase in climate volatility is closely tied to our increasing awareness of it. As population density increases, more people are affected by each disaster. With coastal cities expanding, there is more infrastructure and economic loss with each storm event. The increasing loss of capital with each event exacerbates the perception of volatile climates (Kok & de Coninck, 2007), and so it is inaccurate to claim that these events are a direct cause of climate change (Kok & de Coninck, 2007). As the climate becomes more variable, resources become scarce, or a place becomes economically unviable people will eventually be motivated to migrate away; however, migration across international borders will be a last resort option most often employed in cases of quick-onset natural disasters (Hugo, 2010).

Because migration trends suggest that movement of people will most often occur internally, gradually over time, and voluntarily there should be a shift away from alarmist narratives. Rather than emphasizing debates on environmental refugees and the implications of international movement, the focus of planning and policies should be on local adaptability, resilience building, and resource maintenance.

Methods

This paper will use a case study to demonstrate the ways in which theory is replicated in real life. The case study, drawing primarily on research by Pouliotte, Smit, & Westerhoff (2009), will be the village of Subarnabad in Bangladesh, a community doing local-scale livelihood adaptation in the face of a changing environment and climate. According to Yin (2009), the case

study as a research method is particularly suitable for answering questions of *how* and *why*, and so it is appropriate for answering the questions posed in this paper about how migration and adaptation are related and why action should be taken in a particular way. The case study allows for causality to be traced over time, explaining and linking historical and contemporary factors which have resulted in a particular trend or occurrence (Yin, 2009). Case studies are the preferred method when explaining a contemporary subject, but when there is no control over the behavior of the subject; there is no manipulation of the subject by the researcher, and so the data is collected through observation and analysis (Yin, 2009). A critical drawback to consider of the case study method is that it is nearly impossible to generalize findings across a greater scale (Yin, 2009). However, as this paper argues, it is important to maintain a context-specific lens if solutions to problems are to be appropriate and successful.

Framing the Case Study

This case study will focus on local adaptation strategies that are designed around the local ecosystems, economy, culture, and climate change trends as a response to the inability of some community members to migrate away. Behavioral theory states that macro-scale trends in migration are not consistently applicable to individual choices, and so I will avoid sweeping generalizations and instead acknowledge that experiences and adaptation strategies are unique to the specific locale and population. However, I will also maintain that the rising sea levels, extreme weather events, and degradation of resources – the pushing factors of climate change migration – are not unlinked to global economic and political structures, and so will implicitly incorporate Structurationist theory. The Sustainable Livelihoods Approach will offer a framework in which to place the adaptation strategies and help explain why they are the

appropriate response to environmental change and degradation. Bangladesh is a perfect example of how structures (rising seas, lack of regulation, inequality) and individual decisions (human impact on the environment, migrating vs. not migrating) influence the environment and the environment influences migration.

Climate change hot spots, identified by the Intergovernmental Panel on Climate Change, are areas that will be significantly vulnerable to environmental changes (IPCC, 2007) and so will require adaptive efforts. The most vulnerable populations tend to be those whose livelihoods rely on natural capital and who are lacking financial resources (Barnett & Webber, 2010), including the community of Subarnabad. Much of the literature now indicates that adaptation to environmental change is best enacted on a local scale with insights and decisions made by the local population (Landreth & Saito 2014; Pouliotte, Smit, & Westerhoff, 2009; Roberts 2010).

Because climate change will most directly impact developing countries and regions of the world, Pouliotte, Smit, & Westerhoff (2009) suggest that adaptation should be "mainstreamed" into development discourse and projects. Rather than considering it as a silo-ed problem to be solved, climate change should be integrated into other "existing policies, programs, or management systems" (Pouliotte, Smit, & Westerhoff, 2009, 32), such as city planning, development projects, and conservation initiatives. Furthermore, mainstreaming climate change adaptation ensures that it is addressed in the first place, for it often goes overlooked when there are more immediately pressing development demands (Pouliotte, Smit, & Westerhoff, 2009; Roberts, 2010). Decisions are made which influence the climate, but these decisions are often made without consideration for the climate (Kok & de Coninck, 2007). Development initiatives that improve access to technology, implement hazard-warning systems, or build a stronger

economy will also contribute to climate change resilience demands (Pouliotte, Smit, & Westerhoff, 2009). Kok & de Coninck (2007) also advocate for policy mainstreaming and argue that it should be used "to capture the potential in other policy areas and sectors for implementing climate-friendly and climate-safe development pathways" (588), as this minimizes contradictory policy goals and utilizes synergistic outcomes.

Bangladesh

Bangladesh faces multiple and combining stressors, which contribute to its high level of vulnerability, including the natural geography, environmental degradation, population growth, and unequal distribution of resources. Bangladesh has a physical geography that consists almost entirely of a delta. Two-thirds of Bangladesh's population lives in the Ganges–Brahmaputra Delta, and this concentrated development has led to stresses such as subsidence (gradual sinking). Furthermore, there is a large population living within the floodplain, making them particularly vulnerable to natural disasters (IPCC, 2007). Bangladesh is home to about 700 moving waterways, with most of the land lying in the delta of the Ganges, the Meghna, and the Brahmaputra-Jamuna, and faces annual flood inundation (Alam, 2003). It has a high population density of more than 1000 people per square kilometer (Pouliotte, Smit, & Westerhoff, 2009). This dense population poses a challenge for carving out a livelihood, especially in a country that relies heavily on the natural environment for its economic gains and output.

Further exacerbating the natural stressors are the socioeconomic stress placed on livelihoods. About half of the country's land area is used for agriculture, the primary source of both food and income, especially in rural areas, and the agriculture industry accounts for about one-third of GDP (Alam, 2003). With a quickly growing population, the land is being

overworked and has resulted in a loss of productivity. This decline in available agricultural land is coupled with unequal distribution (a small proportion of the population owning a majority of the land) and an increasing demand of land for non-agricultural development projects (Alam, 2003). These trends leave a growing number of households without access to agricultural activities as a source of livelihood and result in the displacement of households to make room for projects such as dams, roads, and railways (Alam, 2003). Further stressing the agricultural sector is a decline in quality and quantity of water. In recent decades, most major rivers have seen a decline in water levels. Rising sea levels have contributed to degradation of soil through salinization. Encroaching development on inland lakes, pollution of water bodies, and over-exploitation of fish populations are stressing the fishing industry, which provides a livelihood for the landless in Bangladesh. Furthermore, the ability to navigate water bodies has been reduced due to increased silting, or the deposit of sand and clay by moving water (Alam, 2003). Erosion of riverbanks and increased flooding are also limiting the ability of populations to maintain their current locations, leading to migration to more marginalized lands and increased vulnerability (Alam, 2003). Rural populations, then, must either move to urban areas, migrate internationally, or find new sources of livelihoods in situ.

Subarnabad

Pouliotte, Smit, and Westerhoff (2009) offer a study of the village of Subarnabad, Bangladesh and its reactions and adaptations to a changing climate and shifting livelihood options. Subarnabad lies in the southwest corner of the country and stands at about 3 meters above sea level (See Figure 2). Its close proximity to the coast exposes it to a high incidence of

extreme weather events, and it faces frequent flooding from the Isamati River, a tributary of the Ganges (Pouliotte, Smit, & Westerhoff, 2009).

Their research sought to use the idea of mainstreaming climate change into general discussions about adaptation (Pouliotte, Smit, & Westerhoff, 2009). The project employs a bottom-up adaptation approach, which they call Community-Based Adaptation (CBA). CBA attempts to understand vulnerability of a place by examining the community-specific experience. It acknowledges that trends are connected to wider, global structures – by tying climate change adaptation strategies to development strategies, it is understood that adaptations cannot solely address a changing climate, but must encompass social and economic challenges as well (Pouliotte, Smit, & Westerhoff, 2009). The study examines livelihoods and states "the pursuit or diversification of livelihoods is tempered by wealth disparities and differential access to resources that are often constrained or facilitated by social relations, institutions, and organizations" (Pouliotte, Smit, & Westerhoff, 2009, 34), acknowledging the local and broader influences on livelihoods.

Figure 2:
Subarnabad, Bangladesh (Global Environmental Change Group, 2008). Map showing case study community.

The community of Subarnabad has seen a shift from agriculture to shrimp cultivation, causing environmental changes and the exacerbated poverty of a portion of the population. Land has been converted from crop production to salt water ponds for shrimp farming (Pouliotte, Smit, & Westerhoff, 2009). This shift came in part due to climate change. As the global climate has warmed, sea levels have risen and river flows in the country have changed. These dual processes have in turn caused siltation, or the pollution of water from particulate buildup (See Figure 3) and the intrusion of saltwater into freshwater aquifers. With agricultural land compromised by salt water, land was converted into shrimp harvesting ponds (Pouliotte, Smit, & Westerhoff, 2009) as an adaption strategy. However, this conversion favored pond owners while further marginalizing the poorest community members.

Figure 3:
Siltation (U.S. Fish and Wildlife Service). This image shows the build up of particles and disturbance of natural flow in waterways.

This marginalization generated a further need to increase adaptive capacity of six districts in the southwest region of Bangladesh. The key players involved in the adaptation project included CIDA, Canada's international development agency; CARE-Bangladesh, an NGO with extensive knowledge of local livelihoods and experience implementing livelihood development strategies; the Institute of Development Education for Advancement of the Landless (IDEAL), a local NGO with both understanding of the area and trust of the residents; and the community members themselves (Pouliotte, Smit, & Westerhoff, 2009). The new shrimp economy proved beneficial for the national economy and those at the top of the production line. However, it had adverse effects on the vulnerability of the poorest village residents. The already scarce available land continued to shrink, leaving many of the poor completely landless – they lost the ability to live for subsistence off the land, cultivate crops, or raise livestock (Pouliotte, Smit, & Westerhoff, 2009). Rather, they were pushed into the cash economy, working for the shrimp farm owners, losing any diversity in income generation.

One reaction to these changes was the migration of men outside of the region to find more work. However, with the assistance of IDEAL many in situ adaptation strategies found success. The NGO's work included providing loans, skills training, and technical support for beginning a new livelihood or diversifying from shrimp farming (Pouliotte, Smit, & Westerhoff, 2009). The new livelihoods included raising goats, chickens, and ducks for milk, meat, eggs, and livestock production (to sell on the market and to sustain the household), fattening crabs to sell, and the creation of grass mats and stools. The most popular project was the planting of saline-tolerant trees and vegetable gardens (Pouliotte, Smit, & Westerhoff, 2009). The introduction of these tolerant crops solved a myriad of the issues resulting from the conversion to

shrimp farming. The fruit and timber trees aided in generating longer-term income, provided a fuel source, and increased household food. The vegetable gardens also added a food source and a surplus for selling (Pouliotte, Smit, & Westerhoff, 2009). The need for these new livelihood options stemmed from the changing environment and loss of agricultural land, and the resulting marginalization of the poorest residents. While these livelihoods are not directly related to climate change adaptation, their ability to increase household incomes and alleviate poverty build resilience in the face of climate change by increasing household capitals and ability to cope with shocks.

Prior to the intervention of IDEAL, residents excluded from the wealth of the shrimp industry turned to short-term solutions including taking out loans, selling assets, decreasing food consumption, sending family members to work elsewhere, raising goats, and even theft and prostitution (Pouliotte, Smit, & Westerhoff, 2009). It is clear, then, that the interventions of the organizations provided a better alternative than no action. The local context and development-focused projects provided a way to reduce poverty and livelihoods that are resilient in the face of climate change.

Analysis

The country of Bangladesh provides an exemplar of the ways that environmental degradation/climate change, vulnerability, resilience, and adaptation interact within a local context but are impacted by larger social and economic structures. The community of Subarnabad, in particular the poorest residents who were excluded from the profits of shrimp farming, faced vulnerability from the dual forces of salinization and lack of livelihood diversity (Pouliotte, Smit, & Westerhoff, 2009). The changing environment was exceptionally difficult to

adapt to because the residents didn't have excess capitals to soften the shock to their way of life based on natural resources (agricultural land). Their vulnerability was exacerbated by the greater structural challenges that are faced within developing nations (IPCC, 2014; Kok & de Coninck, 2007). Together, the natural geography increases their *exposure* to climate volatility and the social/economic situation decreases *adaptive capacity* leading to greater *vulnerability* (Pouliotte, Smit, & Westerhoff, 2009).

To address this vulnerability, CIDA, IDEAL, CARE-Bangladesh, and the local community implemented new livelihoods as an adaptation strategy to build resilience. This resilience building helps to answer the original research questions of how migration and adaptation function in the face of environmental/climatic change, and what kind of response is appropriate to this change. Prior to the adaptation interventions of CIDA, IDEAL, and CARE-Bangladesh, temporary migration of some family members to other parts of the country was used as a way to adapt to the shift to shrimp farming and to generate more household income (Pouliotte, Smit, & Westerhoff, 2009). However, the selectivity of migration and the large amounts of capital it requires means that some of the poorest residents needed an alternative adaptation method (Hugo, 2010). This case study demonstrates that in situ, community-based adaptation approaches are appropriate. The livelihood diversification in Subarnabad grew directly out of the participation of community members who were involved in determining primary vulnerabilities, and in designing and implementing adaptation strategies (Pouliotte, Smit, & Westerhoff, 2009). This kind of development work ensures that projects are culturally appropriate and that labor and funding are going towards projects that are actually needed by the people on the ground (Adams, 2001). The next step needed, in order to ensure that local-scale

adaptation continues to be resilient, is national and international policy cooperation and mainstreaming of climate change into other policy areas to continue address the structural causes of climate change (Kok & de Coninck, 2007). Coupling local adaptation with broad-scale supportive policies will enable communities to build resilience and reduce vulnerability to environmental change.

The partners involved adopted a framework that incorporates Behavioral and Structurationist theories through their use of Community-Based Adaptation. This method allowed the partner organizations to understand vulnerability and adaptation in the specific context of Subarnabad and its residents, rather than using predetermined theoretical strategies. Primary data was collected through individual interviews, highlighting the primary concerns of the community – that environmental change was causing salt-water intrusion, leading to a shift from agriculture to shrimp farming and the marginalization of the poorest residents (Pouliotte, Smit, & Westerhoff, 2009). They used environmental, political and economic factors to describe vulnerability. They mainstreamed climate change adaption into general development projects, acknowledging that the local impacts of climate change cannot be viewed outside of greater influencing forces (Pouliotte, Smit, & Westerhoff, 2009). The study viewed livelihoods through a lens of exposure and capital – a method which parallels the Sustainable Livelihoods Approach. The study argued that the greater availability of and access to capitals, the more resilient the livelihood. Greater resilience means more ability to deal with and recover from stresses, or greater ability to adapt to a changing future. The income-generating and food-producing adaptation strategies built this kind of resilience for the poorest residents of Subarnabad.

A key weakness in this case study and the work done in Subarnabad is that, six years after the livelihoods were implemented, it was not possible to find follow-up studies. Since 2009, CIDA has merged with the Canadian Department of Federal Affairs and there is no website to be found for IDEAL, the local NGO. Without published documentation demonstrating how the livelihood strategies have worked since implementation, it is difficult to look into the future research questions: How have the livelihood options and the infrastructure around them held up over time? What has been the impact on the shrimp industry as poor residents have carved out their own space in the local economy? Will the new livelihoods be able to continue to adapt to future, unpredictable change? Often, one of the most significant failures of development work is shortsightedness; without follow-up to ensure proper functioning and maintenance, the impact of projects is unknown (Adams, 2001). Furthermore, Pouliotte, Smit, & Westerhoff (2009) are, to date, the only researchers to examine and collect primary data on Subarnabad and the adaptation strategies employed there. Future research should be done in this community to gage the long-term impacts of the new livelihood options.

Conclusion

This paper sought to answer the following research questions: How does migration function as an adaptation strategy to environmental degradation/climate change? What are the appropriate responses to this kind of migration, and by whom? On what scale should we focus our actions? A review of current literature on environmental migration and climate change adaptation answered these questions. This paper determined that migration is used as an adaptation response to climate change, especially when local livelihoods are undermined by environmental degradation (Adams & Adger, 2013; Barnett &Webber, 2010; Hugo, 2010;

McAdam, 2010; Tacoli, 2009). However, migration is selective because it requires significant amounts of economic and social capital to achieve (Hugo, 2010), indicating that in situ adaptation for those who lack capital must remain an option. Climate change will most severely impact the poorest residents of developing countries – those with the least amount of excess capital (Pouliotte, Smit, & Westerhoff, 2009). Mainstreaming climate change policies with development policies would help to bring climate change to the forefront of political action, as development is often the first priority of governments (Pouliotte, Smit, & Westerhoff, 2009). However, due to the long time scale and gridlock of international policies (b. UNFCCC, 2014), it is important for communities to implement adaptation strategies autonomously, as was demonstrated with the Subarnabad case study.

Looking to the (near) future, places that have been deemed climate change hot spots, places that can and should expect to see climate change impacting their landscape, would do well to do a vulnerability assessment in order to understand areas in which adaptation is most needed. Local governments, NGOs, and residents themselves should partner together to design and implement strategies that work towards building resilience while also addressing development goals. These adaptations will vary across all places, but communities can look to current strategies for inspiration and consider ways they can be altered in order to fit their local context. Lessons learned from Subarnabad include ensuring that one adaptation strategy does not further marginalize parts of a community, using livelihood diversification as a tool to build household resilience to change, and utilizing partnerships between multiple local organizations to implement appropriate strategies. It is important to recognize that a policy or project implemented in one locale may hinder or contradict the efforts of another community. This

demonstrates the need for national and international governing bodies to expedite the process of writing firm climate change policies that acknowledge that internal migration and local adaptation will be the primary responses.

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