

Ecomigration and Violent Conflict: Case Studies and Public Policy Implications

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Abstract In 2005, a hurricane named Katrina hit the states of Louisiana and Mississippi in the US, destroying properties and flooding areas. Many people left the region and still have not returned. While some of these people may eventually return, some may not, becoming “migrants.” Assuming this phenomenon will occur, is it unique? What is the role of the environment in migration? Can there be violent conflict between such migrants and residents in areas absorbing migrants? We evaluate these questions in the cases of Hurricane Katrina, the US Dust Bowl in the 1930s, and Bangladesh since the 1950s, demonstrating that environmental change can trigger large out-migration, which can cause violent conflict in areas receiving migrants. These findings have important policy implications. Climate change is expected to degrade the environment considerably in this century. Minimizing climate change-induced migration and violent conflict in receiving areas requires an engineered economic slowdown in the developed countries, and population stabilization and economic growth in the developing countries financed by the developed countries.

Keywords Population movements · Hurricane Katrina · Great Plains · Bangladesh · Climate change

Introduction

In the fall of 2005, Hurricane Katrina hit the coastal areas of Louisiana and Mississippi in the US, destroying properties, flooding about 80% of New Orleans, and demolishing much of Biloxi-Gulfport. As a result, more than a million people left the region. At the time of writing this paper, more than two years after the disaster, most of these people have not returned. The Katrina example suggests that it is beneficial to distinguish between “out-migrants,” people leaving their homes permanently with the intention of moving to some other place, and “in-migrants,” people arriving into an area with the intention of settling there. While it may be premature to refer to all of the people displaced by Hurricane Katrina as out-migrants, as we generally do not know their intentions, it is likely some of these people will not return to coastal Louisiana and Mississippi. Assuming this will be the case, is this out-migration unique? More broadly, what is the role of environmental degradation in out-migration? Can the arrival of in-migrants that left their homes due to environmental degradation promote conflict between them and the residents in the area that receives them?

These questions lead to our theoretical premise: environmental degradation can cause extensive out-migration, leading to potential conflict in the area migrated to. This premise invites another question: what do we mean by conflict? In general, conflict covers many hostile interactions, including insults, threats, and violent actions such as theft, beating, armed scuffles, appropriation of resources and property, murders, civil strife, insurgencies, militarized disputes, and interstate or intrastate war. We focus on these examples of violent interactions. To streamline the presentation, hereafter we use the term “conflict” to denote “violent conflict.”

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The role a deteriorating environment (broadly defined to include all types of environmental declines and natural disasters) plays in migration and the possibility of conflict between newcomers and residents of the area absorbing them stand as central issues in this paper. I refer to these people as “ecomigrants.” After discussing the theoretical basis for ecomigration and conflict, I demonstrate the operation of these forces in three cases involving migrations: from the US Great Plains in the 1930s, from Bangladesh to India and within Bangladesh since the 1950s, and from Louisiana and Mississippi in 2005.

The issue, however, is broader. If adverse environmental change has played a role in out-migration, it might do so in the future. If the arrival of ecomigrants caused conflict in receiving areas, it might do so again. Climate change is the largest environmental change expected in this century. While its effects are not yet fully known, we can gain insight from our cases because climate change is expected to intensify many of the very forces observed in these cases, including droughts, storms, and floods, leading to ecomigration and potentially conflicts in areas migrated to. I conclude the article by discussing implications for public policy meant to minimize ecomigration and conflict due to climate change.

Theories of Ecomigration and Conflict

We can think intuitively about people that consider out-migration as comparing conditions in place A, in which they reside, to conditions in place B, to which they consider moving. They decide whether to move based on which place they deem more favorable, considering all the relevant forces. In standard migration theory, the relevant forces are classified by type – economic, sociopolitical, and psychological – and by the direction in which they operate – push, pull, and network (Cohen 1996; Weiner and Teitelbaum 2001; Martin and Widgren 2002). Push forces operate in A and cause people to leave A. Pull forces operate in B and attract people to move to B. Network forces assist in the move. Examples exist for each classification. Economic push forces include low wage, high unemployment, high population density, poverty, and underdevelopment, while economic pull forces include high wage, a better job, low population density, prosperity, and modernity. An example of an economic network force is financial aid. Sociopolitical push forces include war, persecution, discrimination, and lack of democracy, while pull forces include peace, family or brethren unification, preferential treatment, and democracy. Sociopolitical network forces include aid in obtaining work and entry permits or even help crossing borders illegally. Psychological push forces include feelings of strangeness in one’s birthplace, while pull forces include viewing another country as one’s ancestry. Psychological

network forces include emotional support and encouragement during the move.

These forces are routinely observed in the international system. For example, people may migrate within Europe in search for a better job, as do many migrants that relocate to the US. People routinely relocate to other countries in order to be closer to family members. Today many people are leaving Iraq in search of more peaceful places, some people are leaving China in favor of a freer society, and many Jews are immigrating to Israel, identifying the state as their heritage.

While standard migration theory does not include as forces types of environmental degradation, these forces have been observed in many cases. For example, El Hinnawi (1985) observes that in sub-Saharan Africa droughts and land degradation can cause population movements. He denotes these migrants as “environmental refugees” – people forced to leave their homes due to environmental problems that threaten their lives or quality of life. Jacobson (1989), Refuge (1992), and Lee (2001) employ this term in discussing the same phenomenon, but other scholars criticize it. McGregor (1995) argues that use of this term would reduce support for political refugees and confuse existing procedures, while Hugo (1996) notes that governments do not recognize these people as refugees. Wood (2001) and USCR (2002b) note that while regular refugees cross borders, environmental forces can cause intrastate movements. Suggesting other terms, Hugo (1996), Swain (1996), and USCR (2002b) employ “environmental migrants” to denote people forced to leave due to natural disasters; Suhrke (1993) employs “environmental refugees” to denote people forced to leave due to environmental problems; and Wood uses “ecomigrants” to denote people migrating due to the combined effect of environmental and standard forces.

In deciding which term to employ, it should be noted that the phrase “forced to leave” implies that people facing environmental problems have no practical choice but to leave the affected area. Yet unless they are expelled by force, even people facing life threats may choose to stay. Wood’s term “ecomigrants” describes people that consider both the above standard forces and environmental forces in migration. This is also my approach.

We expect that the geography of ecomigration may cross international borders. Environmental problems rarely follow political lines. What is being crossed by migrants is the “environmental border,” where the degradation stops or the disaster doesn’t reach. This logic is in fact shared by all out-migrants. Political refugees must cross political borders, usually of a nation. Those fleeing ethnic violence must cross ethnic borders, which may not follow political boundaries. Migrants leaving due to economic decline must cross the economic bounds of the decline, which may not

follow political borders. The decision making leading to out-migration in all these cases is similar: consider the costs and benefits of migrating or staying based on all the relevant forces, including those pertaining to crossing a political border (e.g., obtaining a visa).

Environmental problems that can lead to out-migration differ in their speed and predictability. For example, natural disasters such as storms, floods, and droughts tend to be fast-acting and relatively unpredictable, although some areas and seasons may be more prone to disasters than others. Fast environmental changes caused by production accidents (e.g., the Chernobyl nuclear accident) or wars (e.g., burning oil wells during the first Gulf War), and relatively slower changes caused by development projects (e.g., Three Gorges Dam in China) are generally idiosyncratic. Cumulative degradations such as soil erosion, deforestation, fresh water scarcity, or pollution tend to worsen slowly, though predictably if the human activities causing them do not change. Regardless of their type, I argue that environmental forces play a role in causing out-migration, in addition to the above-mentioned standard forces.

So far, conflict has been listed as one of the forces causing out-migration, but looking at the reverse relationship, scholars have long argued that in-migration can promote conflict between newcomers and residents of the area receiving them (e.g., Organski and Organski 1961; Weiner 1992). While most past studies do not focus on ecomigration, their mechanisms apply here. We can synthesize them in four non-mutually exclusive channels. First, the in-migration can burden the destination's economy and resources, promoting native-migrant competition for jobs and other resources. The greater the scarcity of resources in the receiving area and importance of resources for people, the greater is the risk of conflict. Second, the arrival of in-migrants may upset the existing ethnic balance. For example, migrants may be considered threatening by others. Host nations might fear separatism, while migrants may wish to reunify with their home country. Situations involving long-standing ethnic disputes may be particularly prone to conflict. Third, in-migration can enable ploys to exploit the situation and induce suspicions about such ploys. For example, the sender state may suspect the host accepts migrants in order to use them later against the sender, or it may resent (actual or perceived) mistreatment by the host, and the host may suspect migrants are sent to destabilize its regime. Fourth, the conflict may follow existing fault lines. For example, pastoralists and farmers may compete over land and water, and poor migrants may resent the more affluent conditions of residents.

Similar to ecomigration forces, these conflict channels do not operate in a vacuum. Regions with auxiliary conditions of underdevelopment and inequality are

expected to be more prone to conflict due to in-migration because they give rise to grievances and make it harder to accommodate pressures. Diversified, developed countries (DCs) or rich societies can absorb migrants relatively smoothly. Poor economies that depend on the environment for livelihood are more limited in this regard, making them relatively more conflict prone, particularly when property rights are vague or weakly enforced. Conditions involving gender, family dynamics, and the number of people relocating per period can also be important. The arrival of in-migrants consisting mostly of women, children, and elderly, and having family ties with residents in the receiving area is relatively less likely to cause conflict. The larger the migration and the shorter the period over which it occurs, the harder it is to absorb the migrants, raising the likelihood of conflict.

This logic applies to both ordinary migration and ecomigration. What generally distinguishes ecomigration from ordinary migration is its scope and speed. Whereas ordinary migration tends to be spaced over time, environmental problems can cause many people to move over a short period.¹ Land erosion, for example, expands relatively slowly and may cause small out-migration for a while, without grave consequences for conflict; however, once the erosion passes some critical level, it can devastate agricultural societies, pushing many to move at once. Intense droughts, storms, and floods can also push many to move at once, especially when the environment is their livelihood. In these cases, the likelihood of conflict is expected to rise, all other things being equal.

Taking a broader view, the spirit of this discussion can be traced back to Malthus (1798) who argued that eventually population growth would lead to resource scarcity, economic decline, starvation, malady, and conflict. Recently, Kaplan (1994), Homer-Dixon (1999), and others have returned to this paradigm, observing conflicts in lesser developed countries (LDCs) due to growing resource scarcity and environmental problems. Other scholars have criticized this view. Some argue that current environmental pressures are not severe and will not intensify much in the future (e.g., Simon 1996; Lomborg 2001). Critics argue that as resources become scarce, their prices rise, promoting innovation and a move to substitutes (e.g., North 1995; Simon 1996; Deudney 1999), and a large population can alleviate resource pressure through economies of scale, which enables industrialization (Boserup 1981) and innovation (Simon 1996). Some critics feel that people can mitigate problems by cooperating or changing their practices and institutions (Conca 2001; Matthew *et al.* 2003). Despite these counterarguments, the restatement of

¹Wars and genocides can also cause many people to move at once.

the Malthusian view has been supported by many policy-makers, including the Clinton administration in the US (Gore 1992; Herman 1999; Trittin 2000). The current Bush administration seems less interested in it, but the issue has not disappeared (Matthew 2002; Schwartz and Randall 2003).

We argue that ecomigration can lead to conflict in the receiving area, but we do not say that it must. Migration can benefit the receiving area through several channels, including increasing the labor force and tax-base, and the host country may adapt to the migration by reforming its institutions, alleviating tensions that promote conflict. However, we believe conflict due to ecomigration is possible, as demonstrated next.

Three Case Studies

In principle, one could study ecomigration empirically by asking migrants why they left, conducting statistical analyses, and employing case studies. The first two approaches are quite impractical for our purpose; existing data track migrants entering countries legally, tend to focus on entries into DCs, and do not provide information on ecomigration. Employing the case study approach, I present three cases that vary in terms of their environmental causes, level of development, and sociopolitical details, focusing on the US Great Plains during the 1930s, Bangladesh (East Pakistan before 1971) since the 1950s, and coastal Louisiana and Mississippi in 2005. As with all case studies, choice of episodes is necessarily subjective, and details of one case may not apply to other cases.² Also, my analysis may not speak directly to the relative importance of the environment in migration compared with other causes. That said, all studies have limitations and the typical expectation is not that one paper can encompass everything, particularly when processes are as complex as here.

The US Dust Bowl

In the 1930s, a prolonged drought in the US Great Plains coupled with strong winds to produce extreme dust and sand storms, eroding soil and reducing the quality of life. Carlson (1935: 333), for example, described the storm of April 14, 1935, later dubbed as Black Sunday: “A black or yellow copper-brown cloud pokes its ugly head over the

horizon. The impact is like a shovel full of fine sand flung against the face. Cars come to a standstill, for no light in the world can penetrate that swirling murk.” Dust became the signature of the Great Plains region. By 1935, people began referring to the Great Plains as the Dust Bowl (PBS 2002; Worster 1979). By 1938, the storms had damaged 80% of the land in the Great Plains, 40% severely; about 13.5 million acres lost at least 2.5 inches of topsoil, 10 million of those losing 5 inches of soil (Hansen and Libecap 2004).

The drought was an important cause of the calamity, but not the only cause. The low vegetation in the region was not sufficient to hold the topsoil in place, and overgrazing further stripped the land. Employing the techniques prevalent in those days, farmers plowed and tilled the land aggressively, partially in response to the soaring World War I demand for crops. This exhausted the soil’s nutrients and loosened the topsoil. Normally, in wet-years, the growing crops themselves assisted in holding the soil in place, but when the drought hit, fewer crops grew. Still the farmers continued to till and plow the land intensely. With fewer forces to hold it down, the strong winds blowing in the Great Plains carried the loosened dry topsoil for miles (Baumhardt 2001; UNCCD 2001).

Environmental degradation removed the basis for the agricultural-based lifestyle, setting the stage for ecomigration. The land erosion reduced land productivity, resulting in lower crop yields. As agricultural outputs fell, many farmers were not able to keep up with their loan payments, so lost their lands in bank foreclosures. As a result, thousands of desperate families left the Great Plains in search of some new means of livelihood. By 1936, a government committee, called the “Great Plains Committee,” estimated that 165,000 people had already left the Great Plains (Great Plains Committee 1936:8), and by 1938, 12–20% of the region’s population had left (Webb and Brown 1938). A 1941 study estimated that a total of 982,000 people left the Great Plains during the 1930s due to environmental degradation (Gillette 1941), but recent studies concluded the number was close to 2.5 million (Worster 1979; UNCCD 2001; PBS 2002). Most of these people drifted to adjacent states, but about 300,000 traveled as far as California (Worster 1979; Deane and Gutmann 2003).

The Great Plains ecomigrants often were not welcome in the receiving areas. In California in particular, they became “targets of one ugly slur after another,” often referred to as “Okies” (whether or not they came from Oklahoma), “no good bastards,” or “ignorant filthy people” (Gregory 1989: 100). Some Californians believed that they were “by God’s inscrutable will, inferior men,” and would remain so “until, by a stupendous miracle, He gives them equality among His angels;” others even went so far as to suggest bribing them to be sterilized (Worster 1979: 52).

²For example, implications from the cases I present may not apply to cases of migration caused by industrial accidents or development projects, such as the Chernobyl nuclear accident, which permanently displaced 231,000 people (UNDP 2002), and the Three Gorges Dam project, which permanently displaced 1.4 million people by 2007 (BBC News, 26 January, 2007) and may displace 2 million by 2009 (IRN 2003).

Migrants and residents clashed over jobs, resources, and way of life. Facing competition for jobs and land, local people urged the police to scatter the newcomers. Some Californians beat migrants, burned their shacks, and accused them of supporting Communism. In 1936, the city of Los Angeles sent policemen to stop the migrants at the state borders. Unable to buy houses in California, many migrants lived in poor camps along roads, while others worked on corporate-owned farms, which paid them poorly and forced them to rent high-priced company-owned shacks and buy groceries at high-priced corporate stores. Other migrants left agriculture altogether, setting up residence at poor shanty-towns, with names such as Okieville, without electricity and running water. The label “Okies,” persisted in California and other places for many years, as did the discrimination the migrants faced in the marketplace and daily life (Davenport 1935; Worster 1979; Gregory 1989; PBS 2002).

Bangladesh

Unlike the circumstances in the US case, population pressure played an important role in the case of Bangladesh. Having one of the highest fertility rates in the world (AAAS 2000), the Bangladeshi population has grown quickly, reaching 86 million in 1980 and 131 million in 2000. By the 1990s, population density reached 1,000 people per km². Bangladesh’s income per capita has been consistently one of the lowest in the world, about half of it coming from agriculture (WDI 2001, 2002). About 42% of the people lived below poverty, and 85% lived in rural areas (Myers and Kent 1995). These pressures played a role in causing land scarcity. Arable land per capita declined from the already small level of 0.1 hectares in 1979, to 0.07 in 1997 (WDR 1999).

The growing population pressure exhausted much of the scarce land. Unable to make a living, some people moved to steeper hillsides, cleared trees, and began farming anew. The farmers exhausted the steeper hillsides faster, since their inferior topography subjected these lands to greater erosion. Additionally, the country’s topography and climate exacerbated the land pressures. About half of Bangladesh is located a few meters above sea level, and about a third is flooded in the rainy season (Lee 2001); the floods recharge the land with nutrients, but also constrain the accessible land, intensifying land scarcity. The country also has been hit often by natural disasters. From 1976–2001, droughts affected 25 million people, floods affected 270 million people, and rain and wind storms affected 41 million people (CRED 2002).³

³See also Homer-Dixon (1999), Barashi (1991), and Boyce (1990).

The Indian Farakka Barrage worsened conditions. Completed in 1975, the Barrage diverts water from the Ganges river to its Indian tributary, reducing the flow of water in the Bangladeshi tributary. As a result, salt water intrusion into the Bangladeshi channel from the Indian Ocean intensified, land productivity fell, and river fisheries declined. The lower water flow reduced silt conveyance and raised the riverbed, leading to more floods and erosion, adversely affecting about 35 million people (Swain 1996; Lee 2001; Rahman 1984).

Since the 1950s, 12 to 17 million Bangladeshis have migrated to India (often illegally), moving mostly to the adjacent states of Assam and Tripura. When asked why they moved, they often give natural disasters, land scarcity, land degradation, and poverty as reasons (Suhrike 1997; Hazarika 1993).⁴ About 2 million moved to India’s West Bengal from the Kulna region in Bangladesh, the area most adversely affected by the Farakka Barrage (Swain 1996). About 400,000–600,000 people moved internally to the Chittagong Hill Tracts (CHT) (Lee 2001; Hassan 1991). Other factors also promoted the migration: unequal land distribution intensified land scarcity; inheritance norms led to division of lands among family members, resulting in plots that were too small to support a living; the relatively higher standard of living and lower population density in India attracted the Bangladeshis; Bengalis, the major ethnic group in Bangladesh, saw Bangladesh and the adjacent Indian states as greater Bengal, ignoring borders (Homer-Dixon 1999; Abbott 1991; Boyce 1987); and the Bangladeshi government called on Bengalis to move to CHT, seeking to “Bengalize” the largely non-Bengali region (Lee 2001; Hassan 1991).

The Bengali migrants clashed with the residents of the receiving areas along socioeconomic, ethnic, religious, and national lines. The newcomers typically altered the economy, land distribution, and political power balance in the receiving areas. In Assam, the non-Bengali natives have long resented the Bengali newcomers, a resentment that can be traced back to the colonial era when the British installed Bengalis as regional officials. While India’s Congress party, the dominant political party, supported the migration, seeking to limit the natives’ power, the Assamese accused the newcomers of stealing their lands. As native-migrant violence erupted in the early 1980s, the Indian government offered to deport illegal migrants arriving after 1971, but the Assamese rejected the offer, demanded the exclusion of all the migrants from the 1983 elections, and boycotted the vote. The Bengali-Assamese violence intensified and

⁴About 1–2 million of these people moved due to the 1971 war (Homer-Dixon 1999).

thousands were killed on both sides, including 1,700 Bengalis killed during a five-hour rampage in 1983 (Kalbag 1983; Swain 1996).⁵

Unlike in the state of Assam, in the state of Tripura the original, primarily Buddhist or Christian people became the minority due to the Bengali migration. By 1981, they consisted of only about one third of the total population, down from about 90% in 1947. Resentful and increasingly competitive with Bengali migrants over land and resources, the native people turned to violence, which raged from 1980 to 1988. The Indian government tried to calm the local outrage in the 1990s by returning land to Tripuris owners and by tightening the controls over migration, but the migration and the violence continued, albeit at a lower intensity (Hazarika 1993).

The CHT region is home to about 1% of the Bangladeshi population. Before 1964, the Pakistani government followed the British in prohibiting Bengali migration to the predominantly non-Muslim CHT region (Lee 2001; Shelley 1992; Timm 1991). As the migration intensified after 1971, the local tribesmen demanded the renewal of the pre-1964 prohibition, but in 1975 the Bangladeshi government refused to do so. As the natives turned to anti-migration violence, the Bangladeshi government sent an army to the region, armed the settlers, and forced many tribesmen to move to army-controlled villages (Mey 1984). The violence escalated in the 1980s, resulting in the deaths of about 3,000 rebels, civilians, and soldiers in 1980–1991 (Lee 2001). In 1992, the Bangladeshi army reportedly killed 1,000–2,000 tribesmen in response to killing of Bengali migrants, but the Bangladeshi government denied the report (Shelley 1992). In late 1997, the government and the rebels signed a cease fire agreement, but the situation in the CHT region remains volatile and tense (IDMC 2006; SACW 2007).

The US Hurricane Katrina

In August 25, 2005 a Category 1 hurricane storm dubbed “Katrina” hit Florida, causing relatively minor damage. Moving to the Gulf of Mexico, by August 29 it grew into a Category 5 hurricane, the worst on the scale, and headed toward the Louisiana–Mississippi coastline, its center pointing toward New Orleans (McQuaid and Schlefstein 2006; US Army Corps of Engineers 2006; US House of Representatives 2006). New Orleans is especially vulnerable to storm surges in the US, resulting both from geography and human action. Over time, the turning of

the Mississippi River into a maritime highway destroyed much of the natural soil sedimentation that kept the area above sea level. The clearing and draining of coastal swamps and replacing them with industry and houses eliminated vegetation and wetland areas that protected the coastline and absorbed some of the impact from storms. Aware of this vulnerability, the city’s developers built a system of levees, canals, and pumps to defend it from Category 2–3 storms. Providing a false sense of protection, the system led to even more development in vulnerable low-lying areas (Prugh 2006; LaCoast 2005; Colten 2005; Barras *et al.* 2004; Kelman 2003).

Upon landfall in August 29, 2005, Katrina weakened to a Category 3, but the water upsurge it created was still that of a Category 5 storm. The rushing waters topped many levees and caused 50 breaches, flooding 80% of metropolitan New Orleans with up to 20 feet of water (Times 2006; US Army Corps of Engineers 2006). The brunt of the storm also hit coastal Mississippi destroying more than 90% of the beachfront buildings in the Biloxi-Gulfport metropolitan area (McQuaid 2006). In all, about 92,000 square miles were turned into a disaster area (US House of Representatives 2006). In June 2006 The US Army Corps of Engineers acknowledged the crucial role of the levee breaches in the flooding of New Orleans. “The hurricane protection in New Orleans and Southeast Louisiana,” the Corps said, “was a system in name only” (US Army Corps of Engineers 2006: I-3).

Katrina devastated the region. As of August 2006, 2,180 people had died during or after the storm: 1,464 in Louisiana, 236 in Mississippi, and 480 in other states (LDHH 2006; Sunherald, December 14, 2005). In summer 2006, only 50% of New Orleans’ hospitals, 23% of its child-care centers, and 17% of its buses and streetcars were running (Times 2006), 22% of the region’s oil production and 13% of the gas production were offline (Mineral Management Service 2006), and more than 200,000 people lost their jobs (Reuters, August 24, 2006). Many structures and infrastructures suffered cataclysmic damages. In St. Bernard Parish, Louisiana, for example, only four houses were not destroyed, and Bay St. Louis County, Mississippi lost close to 90% of its real property value (US House of Representatives, 2006). In all, about 353,000 homes were destroyed (Times). By April 2006, the federal government sought \$105 billion for repairs and rebuilding of the devastated region (Boston Globe, April 1, 2006), but some estimates put the total loss as high as \$225 billion (Wolk 2005).⁶

⁵Additional casualty data were recorded as follows: 3,000 before 1983, Swain (1996); in 1983, 3,000–5,000, Suhrke (1997); in the early 1980s, 4,000–5,000, Hassan (1991).

⁶For other total loss estimates see NOAA (2006), \$125 billion; McQuaid (2006), \$150 billion; and Burton and Hicks (2005), \$156 billion.

As Katrina approached, about 80% of the population in the region left, and about 100,000 people, mostly poor and elderly, who were unable to leave, were evacuated by government forces (McQuaid 2006). In October 2005, it was estimated that Katrina displaced some 1.36 million, but in January 2006, the Federal Emergency Management Agency (FEMA) estimated that Katrina and Hurricane Rita, which came ashore on September 24, displaced nearly 2 million people, dwarfing the number of people displaced by all other US natural disasters, except the Dust Bowl (Washington Post, 13 January, 2006; Louisiana Family Assistance Center 2006).

As of late 2006, many displaced people had not returned. Accurate data on evacuees' intentions are not available, but interviews conducted in September 2005 with Louisiana evacuees indicated that thousands did not intend to return (Reuters, 5 September, 2005). By December 2005, about 500,000 still had not returned (White House 2006), and by January 2006 Louisiana's hardest hit areas were still missing 385,000 people (39%) and Mississippi's hardest hit areas were still missing 42,000 people (18%) (US Census Bureau 2006). In February, New Orleans, originally a bustling metropolis of 470,000 people, was a struggling city of barely 100,000 (US House of Representatives 2006). In June, 60% of the people in Orleans Parish and 80% of the people in St. Bernard Parish still had not returned (US Army Corps of Engineers 2006). In all, as of August 2006, 60% of New Orleans' residents still had not returned to their homes (Times 2006). Most evacuees ended up in neighboring states or counties, but some traveled far, spreading over 30 states (White House 2006), including Texas (250,000 evacuees), other Louisiana counties (50,000), Arkansas (60,000), Alabama (25,000), Tennessee (15,000), Georgia (15,000), other Mississippi counties (12,500), Oklahoma (5,000), New Jersey (3,000), Colorado (2,000), and Florida (1,000) (PBS 2005a, b; LAFD 2005; Mongobay 2005; State of New Jersey 2005; Bloomberg 2006).

Evacuees were generally accepted in resettlement areas, but some signs of conflict did appear. On September 1, 2005 the Governor of Texas called on President Bush to reimburse Texas' costs in absorbing evacuees. Two days later, he asked FEMA to divert people to other states, arguing that Texas was running out of capacity (Contact the Press Office 2005; Gallery Watch 2005; Associated Press 2005). As occurred in California in the 1930s, the city of Gretna, Louisiana across the river from New Orleans, sent policemen to block entry of displaced people from crossing to Gretna, firing shots as signs of warnings to drive them away (NPR 2005). Some evacuees were met with suspicion and even a sense of veiled antagonism. By September 22, 2005, Texan officials had run 20,000 criminal background checks on evacuees, finding minimal criminal data.

Running similar checks, Massachusetts, Tennessee, and Pennsylvania also found minimal criminal data, but Rhode Island, South Carolina, and West Virginia insisted that more than 50% of the evacuees they absorbed had violent criminal records. "It would be prudent for people taking them," warned South Carolina's Law Enforcement Division Chief, "to know what criminal pasts they might have" (Fox News 2005).

While the Texan background checks did not yield many criminal results, by February 2006, the city of Houston had 28% more homicides relative to February 2005; the tolls for November and December 2005 went up by 70% relative to the same periods in 2004. Increasingly worried, on December 31, 2005, city officials asked FEMA for funds to curb the crime and violence (Daily Telegraph 2005; Bloomberg 2006). On March 12, 2006, tensions carried all the way to Washington as the US government denied a Texas request for more funds and Senator Bond from Missouri called on Texas to be "a good neighbor and not a paid companion." Texas Senator Hutchinson replied that it was an affront to question the generosity of Texas, and Representative Brady added "I don't recall Senator Bond opening the St. Louis Dome to those Katrina victims" (Associated Press 2006). A March, 2006 poll found that Houston was increasingly tired and watchful of its new 150,000 residents. About 75% of Houston's residents said they felt strained, 67% blamed the newcomers for the rise in crime, and a similar share said that if evacuees stay permanently, Houston would be worse off (Houston Chronicle 2006).

Comparing the Cases

The three cases share several features which support our theory that environmental decline may promote out-migration, which may lead to conflict between residents and newcomers in the receiving area. First, the affected societies depended on the environment for livelihood. In the Great Plains and Bangladesh, societies were largely agricultural. Coastal Louisiana and Mississippi depended on fuels extraction and refinement, agriculture, tourism, and the Mississippi waterway. When environmental conditions deteriorated in the three regions, many people lost their livelihood and decided to leave.

Second, human action exacerbated the environmental aspect of the disaster(s) hitting the regions. In the Great Plains, the drought's effect was made worse by inappropriate land tilling methods. In Bangladesh, the land degradation, floods, and decline in fisheries were made worse by the expansion of agriculture and deforestation on inappropriate geography and by the Indian Farakka Barrage on the Ganges. In the case of New Orleans, human actions

eliminated natural processes that could have ameliorated the impact of Katrina, and a defunct levy system failed to protect the city.

Last, environmental forces overlapped with political, economic, sociological, and psychological factors. In the Great Plains case, in-migrants and residents competed over resources in the receiving area, and residents looked down on newcomers. Things were made worse by the deep economic depression that gripped the nation. In Bangladesh, ethnic tensions, underdevelopment, and competing claims over land led to armed violence and insurrection, making an already bad situation worse. In the case of Katrina, many displaced people, particularly those that could not leave by themselves, were poor and African Americans. Here, as well, some residents refused to absorb displaced people, perhaps because they suspected that many evacuees were criminals. When many newcomers arrived at once, as in Texas, residents complained that absorbing them was too costly. Larger scale conflict was averted because the US government invested in solving the problem, and the media reported on the calamity virtually in real-time, prompting the government to mediate disputes before they intensified.

The cases also exhibit differences. First, in the Great Plains and Bangladesh cases, most of the people who left became out-migrants. Their arrival in the receiving areas led to conflict between them and residents. In the case of Hurricane Katrina, many displaced people returned to their homes during 2006, though, at least so far, many others have not. The evacuees were generally received more warmly than in the other two cases discussed, but there were still signs of rejection by the residents of the receiving areas.

Second, in the Great Plains and Katrina cases, migrants and residents shared nationality and, by and large, ethnicity and religion. They also did not harbor deep animosities due to previous encounters. This helps to explain why the average levels of tension between ecomigrants and residents of receiving areas were relatively low. In contrast, the Bangladesh migrants and the residents of the receiving areas did not share ethnicity, religion, or, in most cases, nationality, and their relations were tense before the migration began, all of which played a role in the militarized violence observed in this case.

Last, comparing the experiences in the three cases suggests that public policy can make a difference in ecomigration. Similar to the 1930s, droughts in the 1890s and 1910s provoked migration from the US Great Plains. While the drought in the 1930s was one of the worst in US history, the population share leaving was smaller than in previous droughts in the region. The reason for the difference had to do with public policy. In January 1935, the federal government formed the Drought Relief Service to coordinate aid to farmers, and in April 1935, congress

established the Soil Conservation Service, declaring soil erosion “a national menace.” The new service developed techniques that would guard against soil erosion and paid farmers to use them. These policies reduced the extent of migration (Warrick 1980; PBS 2002).

The US government of the 1930s, while less developed than today, was more able and effective than the Pakistani/Bangladeshi governments in recent decades in limiting the scope of ecomigration by promoting adaptation-in-place. The current US government has proven to be even more effective in rehabilitating coastal Louisiana and Mississippi and convincing many people to return to the region. Taken together, our cases suggest that if a country can invest money in areas besieged by environmental calamities, the scope of ecomigration is smaller and transitions continue more smoothly.

Climate Change and Migration

While the analysis of the role of adverse environmental change in migration and conflict is important, the issue is broader. If severe environmental degradation played an important role in migration and conflict in the past, it might do so again in the future. Looking ahead, climate change is the largest expected source of environmental degradation. If these expectations materialize, can climate change cause migration? Can this migration lead to conflict? I believe the answers to both questions are yes.

In the twentieth century there were patterns of change consistent with a tendency of global warming. For example, the frequency and duration of warm periods rose and glaciers retreated. Since the 1950s, the average global temperature rose about 0.1°C per decade, winter snow covers declined about 10%, summer northern sea ice coverage fell 15%, northern ice thickness fell 40%, and the frequency and intensity of extreme weather events rose. These variations are attributed primarily to greenhouse gas emissions generated by man-made fossil fuel burning (IPCC 2001c, 2007).

The expected effects of climate change in this century differ across scenarios, depending on assumptions regarding variables such as energy use, population and economic growth, innovation, and preferences for sustainable development (IPCC 2001b). But in all scenarios, sea level rise the intensity and frequency of extreme weather events increase, and agriculture, forests, fresh water, and coastal infrastructures exhibit the largest damages. LDCs are predicted to be the most vulnerable to climate change due to their limited adaptive capacity and large dependence on the environment for generating livelihoods.

In the twentieth century, the sea level rose about 20 cm due to global warming-induced ice-pole melting. Table 1

Table 1 Effects of a One-Meter Rise in Sea Level Assuming No Mitigation

Case	Country	Land Loss, %	Population Exposed, Million
Asia			
1	Bangladesh*	20.7	14.8
2	India*	0.4	7.1
3	Indonesia*	1.9	2
4	Japan*	2.4	4.1
5	Malaysia*	2.1	>0.05
6	Vietnam*	12.1	17.1
7	China*	1.3	72
Africa			
8	Egypt*	0.3	8
9	Nigeria*	2	3.2
10	Senegal*	3.1	0.11–0.18
11	The Gambia*	0.92	0.042
Latin America			
12	Belize*	0.29	0.07
13	Guyana*	1.1	0.6
14	Uruguay*	0.1	0.013
15	Venezuela*	0.6	0.056
16	Argentina*	0.1	n/a
Europe			
17	Netherlands	5.9	10
18	Germany	3.9	3.2
19	Poland*	0.5	0.24
Island States			
20	Tuvalu*	100	0.01
21	Maldives*	85	0.3
North America			
22	US	0.37	n/a

* denotes developing country, and n/a denotes data not available. Cases 1–6 are from IPCC (2001b), case 7 from Gommers *et al.* (1998) and Nicholls and Leatherman (1996), cases 8, 10–15, 17–19 from IPCC (2001a), cases 9, 16 from Nicholls and Leatherman, cases 20, 21 from World Disaster Report (2002) and case 22 is from Titus *et al.* (1991), Neumann *et al.* (2000) and IPCC (2001a)

presents data on the potential effects of a 1-m sea-level rise on land and population, assuming no protective measures are taken. As shown, the most intense impacts are expected in Asia, with more than 117 million people exposed to inundation. Exposure could also affect close to 13.5 million in Europe, 11.5 million in Africa, 740,000 in Latin America, and 300,000 in the Pacific islands. Additionally, several small island-states in the Pacific may lose all their lands, and other countries may suffer significant losses (e.g., Gambia, Bangladesh, Vietnam, the Netherlands). The US may lose 0.37% of its land (an area the size of Maryland), and the Katrina case suggests that millions would be affected.⁷

⁷Assessments of total areas vulnerable to inundation are not available for all countries. For Canada, for example, studies focus only on select regions (IPCC 2001a).

As noted, some scholars believe that ingenuity will solve all problems. This view has its critics, but accepting it for the moment, the process of innovation is surely not instantaneous. It takes time to move from the stage of an idea to the stage of having a product. Climate change, we have seen, is driven by the burning of fossil fuels that propel the global economy. Despite large-scale efforts put toward the issue for more than three decades, substitutes for fossil fuels are not well developed for global adoption. Moreover, so far nations have failed to agree on how to mitigate climate change. In light of these complexities, it makes sense to assume that climate change will probably intensify in the coming years.

Several responses to climate change are possible. People could put in place defense mechanisms, do nothing and accept the resulting damages, or leave the affected areas. The choice is expected to depend crucially on the intensity of climate change effects and society's adaptive capacity. Adapting to a rise in sea level by building coastal defenses, for example, can be effective. However, this effort is likely to be technically complex and expensive. As an illustration, it took the Netherlands decades to complete defense walls along its North Sea coasts, structures which are considered to be one of the wonders of the modern world (Allen *et al.* 1998). The cost of defending the Japanese cities of Nagoya, Tokyo, and Osaka from a one meter rise in sea-level is estimated to be \$80 billion (IPCC 2001a).

LDCs are less able to adapt to climate change than DCs since they are poorer, less advanced technologically, and most importantly, are highly agricultural, hence depend much more crucially on the environment for livelihoods than DCs. At the same time, Table 1 indicates that LDCs are expected to be hit harder by climate change-induced rises in sea level. The likelihood of climate change-induced migration is therefore higher in LDCs than in DCs. Since many LDCs also exhibit ethnic-religious and socioeconomic animosities, the possibility that this migration may lead to or intensify conflict in the future cannot be overruled. This possibility has important policy implications.

Public Policy Implications

Scholars generally expect that climate change will have costly effects, assuming no mitigation. The extent of the damages is not fully known, but we know that mitigating climate change is costly. In this light, it seems two policies are possible: "wait and see," or act now under the assumption that things might get worse. This section seeks to evaluate which of these policies to pursue in the context of migration and conflict.

Analysts typically employ historical data for similar circumstances in order to learn about operating forces and

the ability of policies to deal with them. While it is important to be careful when using history as a basis for policy analysis, it is generally assumed that historical data may inform us about the future, *ceteris paribus*. I described the operation of the forces of environmental migration and conflict in three cases. Logically, as environmental degradation led to ecomigration and conflict in these three cases, climate change-induced environmental degradation may also do so, assuming no mitigating measures are taken. The previous section suggested that climate change may spur large population movements. Yet we saw that public policy can alleviate pressures of ecomigration. Which public policy approach, then, should we take in order to minimize climate change-induced migration and conflict?

Today, many migrants move from one LDC to another (Martin and Widgren 2002; Lohrmann 2000) and almost all internally displaced people are in LDCs (USCR 1999, 2002a), but existing data and estimates suggest that if given a choice, migrants from LDCs will probably choose to relocate to DCs. For example, since 1986 about 400,000 new immigrants legally entered the US each year, and 500,000–1,000,000 foreigners changed their status from illegal or temporary visa to legal permanent resident each year; about 90% of these people are originally from LDCs (Yearbook of Immigration Statistics 2005). About 1.1–1.8 million aliens have been deported from the US each year since 1996, almost all of whom are from LDCs (Yearbook of Immigration Statistics).⁸ It is estimated that since 2000 about 850,000 people successfully entered the US illegally each year, and 500,000 did so in Western Europe. Almost all of these migrants are from LDCs (Passel 2006; Suau 2006; Hatton and Williamson 2002).

Facing growing immigration pressures, the DCs have intensified restrictions on legal immigration from the LDCs since the 1990s (Wood 2001; Lohrmann 2000); in 2006 the US began building fences along its border with Mexico. Is this the appropriate approach to deal with ecomigration? In considering this question, it is useful to recall Hardin's metaphor (1974). Rich people live on a few fully-equipped and relatively empty lifeboats (the DCs, many of which are not densely populated, e.g., the US). Poor people live on many partially-equipped lifeboats filled to capacity (the LDCs, many of which are densely populated, e.g., Bangladesh). The rich boats face three choices: admit all the poor people, admit some poor people, or reject everyone. If they were to admit everyone, they would sink, that is, the DCs could not absorb hundreds of millions of migrants from the LDCs that may eventually attain the standard of living in the DCs. If they were to admit some people, who should be excluded? If they were to reject

everyone, they might face unwieldy pressures. The poor people also face three choices: move from one poor boat to another (move between LDCs), change places inside their boat (move within LDCs), or sneak onto a rich boat (enter DCs illegally).

This metaphor has essentially been ignored by DCs. This is awkward, since the movement of people across and within boats can promote inter-boat conflict. As discussed, the LDCs will likely experience more climate change-induced migration and conflict than DCs, but the fallout may expand beyond LDCs. Large-scale ecomigration could increase international tensions, perhaps instigating terrorism recruitment. For example, as climate change progresses, many people may be driven from China's inundated coastal zones. China might then demand compensation, arguing that while it is the second (or even the first) driver of climate change, the US has historically been by far the leading driver of climate change and its per capita contribution to the problem is much larger than that of China. The US, China might argue, should pay for at least some, if not most, of the damages. Ecomigration-induced conflict could also upset the political stability of the allies of DCs in the developing world, drawing DCs into the fight. Of course, ecomigration does not have to lead to conflict, and localized conflicts generally may not spread. However, history suggests that these possibilities cannot be overruled.

All this shows the need for public policy. In fact, public policy might save the day as it did in the US in the 1930s or since late 2005. But the problem LDCs face differs crucially from the ones the US has faced; LDCs can hardly adapt to climate change-driven environmental calamities on their own, but DCs tend to ignore this fact. While this approach is ethically dubious, as the DCs are the chief source of the greenhouse emissions that cause climate change, the issue goes beyond ethics. Historically, extreme income inequalities, such as between DCs and LDCs, led to violence (e.g., the French or Russian Revolutions). The current situation is more dangerous, since some LDCs have, or try to obtain, weapons of mass destruction. Add to that grievances over ecomigration and you get a volatile situation.

Economic growth in LDCs may solve the problem, lowering the dependence of LDCs on the environment for livelihood and funding expansion of environmental regulation and cleanups. However, growth in LDCs will also raise their demand for energy and, given current technology, accelerate climate change. In response to this dilemma, I advocate a 5-part approach: (1) Stimulate economic growth in LDCs in order to reduce their dependence on the environment and enable investment in development and enforcement of environmental regulations and cleanup plans; (2) Promote lower population growth in LDCs in

⁸Deported aliens include those arrested upon entry or on US soil, and (before 2004) criminals.

order to reduce the pressure on the environment; (3) Offset economic growth in LDCs with contraction in DCs, keeping the rise in greenhouse gasses in check; (4) Begin adapting for climate change now in places prone to conflict and ecomigration; and (5) Fund these activities by using DC funds, since the DCs over-reliance on fossil fuels created most of the current problem. This step could be achieved, for example, by raising taxes in DCs and investing the revenues in LDCs.

Naturally, the implementation of this plan may not be easy. Since socioeconomic-ecological processes can be slow, the benefits of these five steps may take time to show up. There also may be problems of international collective action, as countries try to shift their own burdens of adjustment to others. These difficult issues require separate analyses. To be sure, humanity will probably continue to muddle around for some time and stress on the biosphere will rise. My plan might be ultimately initiated in response to some massive crisis, but a crisis also might cause large, irreversible damages. While human ingenuity may yet save the day, it seems that our best reason for optimism is the fact that in the past, humans found solutions to some large problems. One cannot know if this pattern will continue. In the end, then, whether DCs accept my plan depends on their attitude toward risk. While exact figures are not available, I believe the expected cost of climate change-induced ecomigration and conflict will likely rise quickly, assuming no mitigation. This supports adoption of my plan sooner, rather than later. As the saying goes, it is better to be safe than sorry.

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