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Disruption, not displacement: Environmental variability and temporary migration in Bangladesh

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ABSTRACT

Mass migration is one of the most concerning potential outcomes of global climate change. Recent research into environmentally induced migration suggests that relationship is much more complicated than originally posited by the 'environmental refugee' hypothesis. Climate change is likely to increase migration in some cases and reduce it in others, and these movements will more often be temporary and short term than permanent and long term. However, few large-sample studies have examined the evolution of temporary migration under changing environmental conditions. To address this gap, we measure the extent to which temperature, precipitation, and flooding can predict temporary migration in Matlab, Bangladesh. Our analysis incorporates high-frequency demographic surveillance data, a discrete time event history approach, and a range of sociodemographic and contextual controls. This approach reveals that temporary migration declines immediately after flooding but quickly returns to normal. In contrast, high temperatures have sustained positive effects on temporary migration that persist over one to two year periods, while migrations decrease during extended periods of extreme precipitation. Building on previous studies of long-term migration, these results challenge the common assumption that flooding, precipitation extremes, and high temperatures will consistently increase temporary migration. Instead, our results are consistent with a livelihoods interpretation in which long-standing household livelihood strategies (both temporary migration and agriculture) are disrupted by environmental variability.

1. Introduction

Among the potential social costs of climate change, involuntary human migration is one of the most discussed and feared. A common framing envisions the mass displacement of large numbers of vulnerable "environmental refugees" who move permanently to distant destinations (Myers, 2002). However, this narrative is increasingly being challenged by a growing body of empirical research which finds that climatic effects vary considerably over space and can even reduce migration by removing necessary household resources (Bohra-mishra et al., 2014; Gray and Mueller, 2012a,b; Gray and Wise, 2016; Hunter et al., 2013; Mueller et al., 2014; Nawrotzki and Bakhtsiyarava, 2017). Largely lost in this debate is the fact that the vast majority of population mobility occurs over small spatial and temporal scales, movements which are difficult or impossible to measure with traditional large-sample data sources (Coffey et al., 2015). These short-distance and short-term moves are an element of many sustainable household livelihood strategies in low-income countries (Ellis, 2000) and have also been noted anecdotally to serve as important coping strategies for environmental shocks (McLeman and Hunter, 2010).

To examine this complex relationship, our analysis builds on a growing number of studies that have linked large-sample migration data sources to external environmental datasets in order to measure environmental effects on migration while controlling for potential confounders (Fussell et al., 2014). This approach advances beyond earlier approaches by addressing the multicausal nature of migration, recognizing that environmental shocks can contribute to "everyday mobility", and avoiding the need to label a subset of migrants as environmentally-induced (Martin et al., 2014; Scoones, 2000). Similar techniques have been used to investigate the effects of climatic variability (Bohra-mishra et al., 2014; Gray and Mueller, 2012b; Henry et al., 2004; Hunter et al., 2013; Jennings and Gray, 2014; Mueller et al., 2014; Nawrotzki and Bakhtsiyarava, 2017), natural disasters (Gray and Mueller, 2012a; Gray et al., 2014; Halliday, 2006), and land quality (Gray, 2011; Gray and Bilsborrow, 2014; Hunter et al., 2014). To date, however, only a handful of studies have used these approaches to

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investigate short-term migration (Gray, 2011; Hunter et al., 2014), incorporated high-frequency data from demographic surveillance sites (Hunter et al., 2014; Jennings and Gray, 2014), or applied these approaches in South Asia (Gray and Mueller, 2012a; Mueller et al., 2014), despite the region's well-deserved reputation for vulnerability to environmental shocks (IOM, 2010).

To address these substantive and methodological gaps, we link demographic surveillance data on temporary migration from Matlab, Bangladesh for 200,000 individuals over an 18-year period to monthly biophysical data on riverine flooding, temperature, and precipitation. This socio-environmental dataset allows us to estimate discrete-time event history models of temporary migration as a function of environmental variables while controlling for potential socio-demographic and contextual confounders. Low-lying, densely populated, and agricultural, Bangladesh is broadly considered to be one of the places where climate change will first devastatingly impact livelihoods and migration. Thus, the Bangladesh context can provide us with early evidence of patterns we may observe in other similarly socio-environmentally situated countries over the next hundred years. In our research, we find that environmental variability plays a disruptive, rather than displacing, role in temporary migration, further complicating attempts to view this process through the lens of "environmental refugees". We show that migration decreases with riverine flooding in the short-term, while migration increases with temperature and decreases with precipitation extremes in the medium-term. These findings suggest a livelihoods-centered mechanism wherein long-established household income strategies (both temporary migration and agriculture) are disrupted by environmental variability.

2. Analyzing environmentally-induced temporary migration

In the growing literature on climate vulnerability and environmentally-induced migration, Bangladesh is widely considered to be ground zero for these processes (IOM, 2010). In this region, population exposure to environmentally-related disasters is high and has well-documented negative effects on various dimensions of population well-being (Banerjee, 2007; Del Ninno, 2001; Khandker, 2007; Mueller and Quisumbing, 2011). Probing beneath the surface of these claims, however, the evidence for widespread environmentally-induced migration in Bangladesh is actually rather thin. Several qualitative and small-scale studies have witnessed mobility related to flooding or coastal storms, but in most cases the vast majority of moves were short-term and temporary (Findlay and Geddes, 2011; Kartiki, 2011; Mallick et al., 2017; Mallick and Vogt, 2014; Paul, 2005; Paul and Routray, 2010; Penning-Rowsell et al., 2013; Rahman et al., 2015). A small number of demographic and econometric studies have also attempted to evaluate these claims, but, as described below, the majority of these studies suffer from significant methodological limitations.

Among these studies, Gray and Mueller (2012b) used longitudinal data over a 15-year period from 1,680 households in 102 communities to examine the impacts of aggregate self-reported shocks on long-term migration while controlling for spatial and social confounders. This analysis revealed positive effects of crop failure on migration and few effects of flooding, but this analysis did not incorporate biophysical measures of environmental shocks or address temporary migration. Joarder and Miller (2013) used data from a cross-sectional survey of 1,770 households in 26 villages to investigate the effects of household shocks on environmental migration, but this study was significantly limited by the small number of study sites, the absence of longitudinal data, and a reliance on self-classification of both shocks and environmental migration. Iqbal and Roy (2015) used district-level data on climate, agricultural production and net migration to show that climate-linked increases in production had a weak positive effect on net migration, but the research was limited by the use of indirect methods to estimate net migration (Iqbal and Roy, 2015). Most recently, Lu et al. (2016) used a large dataset of call records from mobile phones to examine population mobility associated with Cyclone Mahasen. Their analysis successfully documented short-term mobility in the hours before the storm, but was not able to document longer-term changes (Lu et al., 2016).

These studies illustrate both the opportunities and challenges of using large-sample data sources to directly measure environmental effects on migration. Our goal is to use a novel data source to answer basic empirical questions about environment and migration in rural Bangladesh: Does envrionmental variability displace migrants, and who is most vulnerable to these processes? To do this we draw on high-frequency demographic surveillance data on 200,000 individuals over an 18-year period, which combines the high frequency of call records (e.g., Lu et al., 2016) with the longitudinality of panel surveys (e.g., Gray and Mueller, 2012b). In addressing these questions, we also contribute to the larger literature on envrionmentally-induced migration, which has given relatively little attention to temporary migration or high-frequency data sources.

3. The Bangladesh context

Bangladesh is located on a low-lying deltaic floodplain and climatically governed by the southeast monsoon weather regime. Over a fifth of the land of Bangladesh is flooded for approximately half the year, and sometimes as much as two-thirds of the land becomes uninhabitable during years when riverine flooding is an extreme weather event rather than a seasonal fluctuation (Mirza, 2002). As a result of the highly variable environment, the country is generally recognized as exceptionally vulnerable to climate change (Yu, 2010). Further exacerbating the gravity of these concerns is the high dependence of the population on rural livelihood strategies. The rural population comprised over two-thirds of the total population of Bangladesh as of 2014 (UNDESA, 2014). The agricultural sector provides employment for over 60% of the rural labor force and agriculture is the primary livelihood strategy of many households (Melorose et al., 2006). Traditionally, three types of rice (Aus, Aman, and Boro) and wheat have been the most cultivated food crops in rural Bangladesh. Rainfall variability and extreme temperatures have been found to harm crop performance for these staple crops (Ruhul Amin et al., 2015). Likewise, in years of excessive flooding, many crops are destroyed and planting of new crops is delayed by water lingering on fields. The timing and extent of environmental events such as flooding and drought can therefore have a massive impact on the overall economy, as well as the food security and general well-being of Bangladeshi (Mirza, 2002).

However, the relationship between agriculture and livelihoods is changing. Bangladesh is a rapidly developing and urbanizing country. Between the years of 1970 and 2010, the proportion of the population living in a city increased from 7.6% to 30.5% (UNDESA, 2014). Similarly, the proportion of the GDP coming from agriculture declined from 32% in 1981 to 25% in 2000 (Shahabuddin and Quasem, 2002). Through migration, urbanization, infrastructural growth, and globalization, a growing number of people work outside the agricultural sphere. Many of these people are still members of agricultural households, though, reflecting an increase in livelihood opportunities and, subsequently, household livelihood diversification (Toufique and Turton, 2016).

Across Bangladesh, migration and mobility have become an integral part of rural livelihood strategies. In some cases, this means commuting daily for work; in others, migrants are away for months or years, seasonally or permanently relocating. Cyclical temporary migration is a common livelihood strategy for rural Bangladeshi households who must cope with agricultural and environmental variability (Afsar, 2003). Remittances provided by household members who have temporarily migrated to the city can help temper the impact of unstable crop prices and high interest rates on rice bought on credit during the hunger season.

The study location, Matlab, is located in south-central Bangladesh