



# Examining rural Sahelian out-migration in the context of climate change: An analysis of the linkages between rainfall and out-migration in two Malian villages from 1981 to 2009



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## ABSTRACT

Subsistence farmers in Sahelian Africa are highly vulnerable to the rainfall effects associated with climate change. Permanent or temporary out-migration can provide an individual or family the opportunity to mitigate against these effects. One major challenge to quantifying the impact of climate change on out-migration is lack of appropriate spatial and temporal data. Out-migration data must be adequately detailed to include both long- and short-term departures. The climate data must provide fine scale, community-specific detail. To examine the climate variability as a factor of out-migration we examine individual- and community-level responses using highly detailed, full migration histories of 3150 individuals with fine-scale rainfall data. Using this multi-method approach we examine the probability of out-migration as well as out-migration duration and destination as they relate to locally measured rainfall. The results suggest that out-migration behavior does not generally change because of reductions or variation in the rainy season.

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## 1. Introduction

Climate change in the form of warming and increasingly variable precipitation will force subsistence farmers around the world to respond in ways that are not yet well understood. Given the extensive poverty, limited infrastructure and dearth of economic opportunities, perhaps no other community on earth is as vulnerable to the negative effects of increased rainfall variability, a key component of climate change, as subsistence farmers in sub-Saharan Africa (Hulme, 2001; Nielsen & Reenberg, 2010). Based on historical evidence, one potential response is out-migration – where farming families or individuals from farming communities will leave their origin community (Kniveton, Schmidt-Verkerk, Smith, & Black, 2008; McLeman & Smit, 2006; Nawrotzki, Riosmena, & Hunter, 2013). These moves can be either permanent or short-term, domestic or international (Henry, Schoumaker, & Beauchemin, 2004; Hunter, Murray, & Riosmena, 2011). The underlying motives to migrate may reflect an individual's goal to create a

new life in a community more resilient to climate change impacts. As part of the environmental scarcity hypothesis (Hunter, Luna, & Norton, 2015) out-migration may serve more as a coping strategy from families to diversify livelihoods and to outsource the feeding costs of some of their members (Eakin, 2005; Ezra & Kiros, 2000, 2001; Findley, 1994).

While out-migration in sub-Saharan Africa has been actively researched in a number of different settings and over different time-periods, inconsistent results support the importance of empirical research in this area. One of the primary limitations to developing a comprehensive theory and understanding of the linkages between out-migration and climate is the lack of appropriate data and empirical analyses (Gemene, 2011). In particular, studies evaluating individual-level variation like gender and age, as well as studies that investigate individual migration behaviors in a cultural context where circular migration is already well established are extremely limited (see Black et al., 2011; Hunter et al., 2015; Carr, 2005). Investigating the ways in which people rely on out-migration in communities where circular migration exists are important because they challenge different biases (see Castles, 2010) that may be related to ideas that migration is a problem. Data covering relatively long periods of time and

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documenting migration in rural, poor communities where circular migration is common is unusual. Gathering detailed and long-term series of migration data is beyond the scope of the standard country-level population data collection programs (primarily the Demographic and Health Survey data) or censuses which are focused on cross-sectional collection efforts. Data from thoroughly detailed individual migration histories, including men's and women's experiences, is ideal but generally only covers relatively short time periods (see Henry et al., 2004).

In this research we aim to contribute to the growing body of studies focused on climate and out-migration through an examination of the migration dynamics in a delineated rural area in southeastern Mali. We focus on the individual out-migration behaviors of both men and women in the community, as well as the aggregate community out-migration dynamics. We use detailed migration histories, recorded by life history surveys (N ~3150) to measure migration. To measure the changes in climate as a proxy for community resources (agriculture), we focus on inter- and intra-annual rainfall variability – the most significant environmental parameter impacting people in West Africa (Brooks, 2004; Hulme, 2001; Nielsen & Reenberg, 2010). The connection between rainfall and migration behaviors is examined over a period of 28 years, 1981–2008, the period covered by the rainfall and migration data. This period of time contains one of the most extreme droughts in the history of modern Sahelian Africa (the drought of 1984) as well as periods of less severe water shortages and periods of adequate and relatively consistent rainfall.

## 2. Background

A firmly established hypothesis in research focused on coping strategies in cases of economic stress, particularly as it relates to environmental stressors (droughts, floods, etc.), is that there will be an increase in out-migration, particularly among men (see McKenzie, 2003, Skoufias, 2003, Mortimore, 1989, as well as the 2001 World Bank framework). In rain-fed agricultural areas where major or minor food deficits may occur as a result of annual variability in crop yields corresponding to inconsistent rainfall patterns, out-migration may provide one vital and flexible coping strategy (Guilmoto, 1998; Hampshire & Randall, 1999; Reardon, Matlon, & Delgado, 1988; Roncoli, Ingram, & Kirshen, 2001; Henry et al., 2004). If a family sends a few members to earn money in other near or distant communities, those out-migrants are able to send money back to their families of origin or are able to return with goods needed by the household.

Droughts, floods or other climate events may serve as “push” factors, especially for young men – presumably in search of resources to aid their families in times of crises – but possibly also for women and children as a way of reducing the local resource demands (Findley, 1994; Hampshire, 2002; Henry et al., 2004; Roncoli et al., 2001). Further, out-migration destinations and durations may also be impacted by climate or weather events (Findley, 1994). On one hand, destinations with labor demands might draw individuals who are facing resource constraints. Alternatively, and consistent with Lee's classic push-pull migration model, costs associated with the travel to the communities may be too great of an obstacle to overcome and might reduce the out-migration of the poorest people (Findley, 1994; Lee, 1966; Nelson, 1983). Given that traveling greater distances brings greater costs, it is probable that years where families are resource constrained, out-migration destinations may be nearer to the sending community. Consistent with nearness of the destination community, the length of time of an out-migration, or even the permanence of the out-migration, can potentially be impacted by the weather event. After a series of poor rainfall seasons or following a major drought or

flood, individuals could permanently relocate to a new community in an effort to adopt a new type of livelihood that is less weather dependent (Findley, 1994; Henry et al., 2004).

Temporary out-migration (as a component of circular migration) is an institution in the Sudano-Sahelian region (Cordell, Gregory, & Piché, 1996; Guilmoto, 1998; Piché & Cordell, 2015). Temporary out-migration has become an integral part of family economy in many settings, and is well established in many rural West African populations. Here, people in agricultural communities move for work during the dry season when labor demands on their own fields are less. These people often come back to the village during the rainy or harvest seasons for agricultural activities. Temporary out-migration is a strategy used by many families to diversify the sources of economic resources, an example of livelihood diversification, and to adjust to economic crises or constraints or unusual needs and can involve short-term moves to urban areas or to rural villages that are closer in geographic proximity.

Temporary out-migration in many of these communities frequently occurs in years without drought or other identifiable environmental event (Ezra, 2001; Hertrich & Lesclingand, 2012a). In fact, research of the 1984 drought and temporary out-migration in Mali has indicated that this major drought did not actually cause an overall increase in out-migration, but it did cause an increase in the number of short duration out-migrations to nearby communities (Findley, 1994). Findley (1994) suggests that the reasons for these behaviors may be because communities had already reached a maximum level of out-migration and so rather than increasing the level of out-migration during times of strife, people modified their behaviors to reduce associated costs and risks. This research provided important insight into the ways that communities accustomed to out-migration responded to drought but, because of data limitations at the time of analysis, relied on no place specific rainfall data and a short time series of out-migration behaviors. In this research we aim to build on research by Findley and other and advances scientific understanding of migration and climate using a more detailed time series of out-migration and rainfall data. The data allow us to look at behavioral change over time and with attention to annual variability in season quality.

## 3. Approach and hypotheses

The livelihoods diversification framework is part of a broader theory that suggests that households may send individuals to invest their labor into other markets as part of a household risk diversification strategy (Hunter et al., 2015). We use this framework to investigate the relationship between rainfall variability and out-migration in two agriculture-dependent Malian villages where temporary out-migration is well established. We hypothesize that in poor rainfall years the communities under study will experience either an increase in out-migration or changes in migration behaviors, as migrants and their families seek opportunities to diversify their income sources and reduce risk. Ultimately, we aim to apply the livelihoods framework in a way that acknowledges the specific culture, history and uniqueness of the communities under study while also contributing to the ongoing discussions of environmental push-factors in rural, rainfall dependent communities. Key to this project is our consideration of “how people apprehend, negotiate, and transform their local context in a manner that links environment to migration” (Carr, 2005, pg 929). By developing a rainfall index reflecting West African farmer's experiences and perceptions of climate change we aim to create a contextually relevant and fine-temporal scale measure of seasonal rainfall variability that will provide insight into how people apprehend and respond to their environment. The focus on within-season weather

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