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Amplification or suppression: Social networks and the climate change—migration association in rural Mexico

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ABSTRACT

Increasing rates of climate migration may be of economic and national concern to sending and destination countries. It has been argued that social networks—the ties connecting an origin and destination—may operate as "migration corridors" with the potential to strongly facilitate climate change-related migration. This study investigates whether social networks at the household and community levels *amplify* or *suppress* the impact of climate change on international migration from rural Mexico. A novel set of 15 climate change indices was generated based on daily temperature and precipitation data for 214 weather stations across Mexico. Employing geostatistical interpolation techniques, the climate change values were linked to 68 rural municipalities for which sociodemographic data and detailed migration histories were available from the Mexican Migration Project. Multi-level discrete-time event-history models were used to investigate the effect of climate change on international migration between 1986 and 1999. At the household level, the effect of social networks was approximated by comparing the first to the last move, assuming that through the first move a household establishes internal social capital. At the community level, the impact of social capital was explored through interactions with a measure of the proportion of adults with migration experience. The results show that rather than *amplifying*, social capital may *suppress* the sensitivity of migration to climate triggers, suggesting that social networks could facilitate climate change adaptation in place.

1. Introduction

Climate change is of global concern but has differential local impacts due to variation in exposure, sensitivity, and adaptive capacity across settings (Adger et al., 2005). The latest projections of the Intergovernmental Panel on Climate Change (IPCC) suggest that profound changes in the climatic system during the 21st century will likely be felt hardest by households in developing countries that strongly depend on agricultural production (IPCC, 2013, 2014). Households in lower-income contexts more likely lack the means to protect against adverse climate events using technological buffers (Gutmann and Field, 2010; Huq et al., 2003).

Rural Mexican households are particularly vulnerable to climate change. Although not entirely dependent on agricultural production, this livelihood activity contributes up to two-thirds of rural Mexican household income (de Janvry and Sadoulet, 2001). Because of its small, often non-commercial scale, much of Mexico's rural agricultural sector lacks even the most basic technological buffers to climate change. For example, in 2001 only about one quarter of permanently cropped land was irrigated (Carr et al., 2009). Due to the lack of technological buffers, climate and weather events have led to major economic losses within the agricultural sector (Saldana-Zorrilla and Sandberg, 2009). Adding to this, the liberalization of the Mexican economy has increased household sensitivity to changes in climate and market conditions (Eakin, 2005).

Under conditions of climate change-related livelihood insecurity, households engage in various forms of livelihood diversification. Families may reduce nonessential expenditures, adopt new livelihood activities, use formal and informal credit, or draw on public assistance (Gray and Mueller, 2012). Alternatively or in conjunction, families may send a member elsewhere to access alternative income sources, resulting in remittances to the origin household (McLeman and Smit, 2006). While temporary labor migration in the context of climatic vulnerability is often directed

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toward nearby urban areas, households may also send members abroad. The New Economics of Labor Migration (NELM) theory (Stark and Bloom, 1985) suggests that, in the absence of functioning insurance (e.g., crop insurance) and capital markets (e.g., to obtain credit to buy equipment or install irrigation systems), international destinations may be preferred as their economic and climatic conditions are often less correlated with those in the sending area (Massey et al., 1993).

Despite this advantage, international migration is a costly venture and across much of the Global South climate shocks are generally *not* associated with international but rather with shorter-distance, internal movement (e.g., Henry et al., 2004; Massey et al., 2010). Rural Mexico, however, constitutes an exception to this pattern given the long history of cross-border labor flows to the United States. Consistent with the NELM theory, a number of studies find a direct relationship between precipitation decline and Mexico-U.S. migration (Feng and Oppenheimer, 2012; Hunter et al., 2013; Munshi, 2003; Nawrotzki et al., 2013). On the whole, however, this work finds a highly situated climate-migration relationship, in which associations largely emerge for particular regional contexts depending on factors such as historical climatic conditions (Nawrotzki et al., 2013), the history of migration (Hunter et al., 2013), and urbanization levels (Feng and Oppenheimer, 2012).

Recently, a number of authors have stressed the importance of social networks connecting origins and destinations for the climate-migration association (Adamo and de Sherbinin, 2011; Bardsley and Hugo, 2010). Such networks may operate as "migration corridors" with the potential to amplify climate-related international migration (Bardsley and Hugo, 2010; p. 249) since, it is argued, even small environmental triggers may spur large-scale migration. However, migrant networks may also provide information and resources that increase in situ adaptive capacity and thus could reduce or suppress the climate-migration association. Understanding whether migration-receiving hubs will face increasing or decreasing rates of immigration due to climate change may be of economic and national concern to sending and destination countries.

Social networks are a key facilitator of U.S.-bound migration from rural Mexico and provide aspiring migrants with knowledge about the migration process as well as connections to the destination's labor markets (Massey and Aysa-Lastra, 2011; Davis et al., 2002; Fussell, 2004; Massey and Riosmena, 2010). Because many communities across rural Mexico have well-established migration corridors (Durand and Massey, 2003; Massey et al., 2002; Hamilton and Villarreal 2011), Mexico presents a suitable case to study the potential of social networks influence on the climate-migration association.

In this paper, we explore the moderating effect of social networks on the climate-migration relationship using climate data with a more refined spatial resolution than much prior work on Mexico–U.S. migration (e.g., Hunter et al., 2013; Nawrotzki et al., 2013). In addition to rainfall effects, we also examine the influence of temperature, a factor largely ignored in the Mexican climate-migration literature despite its significant impact on crop yields (Lobell and Field, 2007) and resulting agricultural income (Mueller et al., 2014). We employ a set of 15 climate change indices proposed by the Expert Team of Climate Change Detection and Indices (ETCCDI) to capture the impact of nuanced differences in temperature and precipitation extremes (Alexander et al., 2006). Making use of these climate change indices, we examine the role of social networks on migration to the U.S. from rural Mexico in response to climate change.

2. Data and methods

2.1. Data

We combined detailed migration histories and sociodemographic data from the Mexican Migration Project (MMP) with daily temperature and precipitation data obtained from the Global Historical Climate Network-Daily (GHCN-D) (version number: 2.93-upd-2012082407), compiled and made publically available by the National Oceanic and Atmospheric Administration (NOAA). The MMP has collected data across different Mexican locales since 1982

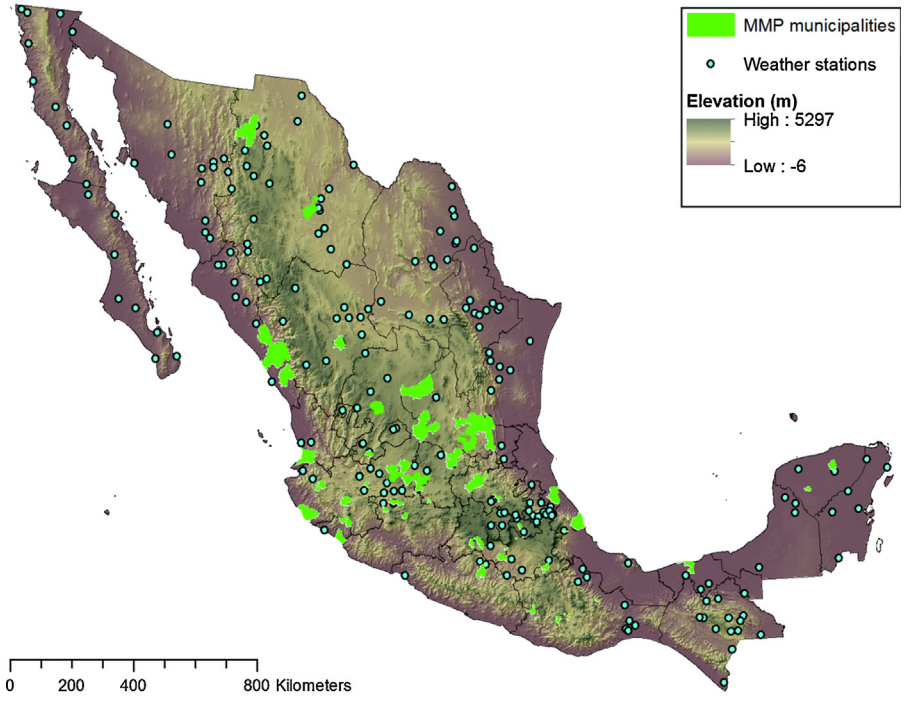

Fig. 1. Location of rural MMP municipalities and weather stations distributed across Mexico.