

# Compounding and Cascading Climate Hazards' Effect on Migration

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## Abstract

We investigate the idea that accumulated climate hazards, in response to rising greenhouse gases, significantly contribute to sub-national and international migration. Such migration, an agentic expression of mobility, is not universally or uniformly accessible. For example, the absence of mobility access gives rise to involuntary immobility, where constrained populations become “trapped.” Recent literature has made gains in examining the effects of singular categories of climate hazards on short and long-term migration. However, there is the opportunity to analyze the cumulative and interactive effect of an overlapping mosaic of climate hazards on migration. Climate hazards in this study include sudden-onset hazards, such as floods, tropical storms, and wildfires, and slow-onset hazards, such as drought, and anomalous heat waves and cold waves. We sourced these data from four sources of global climate and weather data. Faced with these hazards, people react with a diverse array of adaptative strategies, depending on their circumstances and aspirations. To capture these strategies, this work uses data from the Demographic and Health Survey (DHS) regarding household absenteeism as a proxy for migration. Furthermore, these hazards have a prismatic effect on communities' migration adaptation choices: oftentimes mobility outcomes follow seemingly unintuitive trends. This paper examines whether these mobility responses amplify social and economic inequalities for individuals and households. Assessing the compounding and cascading effects of overlapping climate hazards on mobility clarifies the nonlinear influence these phenomena have on migration dynamics.

## Extended Abstract

There is a bias in migration research: demographic literature in migration can gain significant ground in explaining the forces restricting migration, rather than driving it (Schewel, 2020). Applying a wealth of climate hazard data to different mobility outcomes may better explain economic or social “drivers” of migration, specifically following climatic shocks.

Climatic shocks are typically framed in migration research as catalysts for tipping points in out-migration. This out-migration, in turn, has at times been negatively characterized as overly costly to both origin countries and destination countries. However, there also is a growing perspective in demographic circles contending that migration can be a positive consequence, for both origin countries and destination countries, when viewed as a risk diversification strategy for households and communities (Tagliacozzo et al., 2022) For example, a recent study in community resilience and migration, found migration can positively contribute to adaptations to climate hazards (Benveniste et al., 2020).

This article tries to expand this perspective, framing climatic shocks as 1) one of many larger lenses through which to view migration outcomes, and often indirect in influence 2) not external to the lived experiences of communities in origin countries, but rather integrated and dynamic in their social and economic systems 3) asymmetrical in impact in different regions, and inextricable from ideas in climate justice. Specifically, the third framework involves notions that the Global North is neither harm-free, nor homogenous, and that prescriptive efforts to deem climate-hazardous regions “uninhabitable” are only useful when they preserve dignity by facilitating exchange between science and local knowledge (Boas et al., 2025).

The increase of extreme weather events and drought due to the increase in greenhouse gases has the capacity to displace nearly 200 million people by 2050; that is, in the early 21<sup>st</sup> century the UN International Organization for Migration projected that by 2050, more than one in every 50 people globally will have experienced migration due to climate hazards (Brown, 2008). While climate hazards themselves may have cumulative (that is, long-term) effects on mobility outcomes worldwide, this study focuses on short-term mobility.

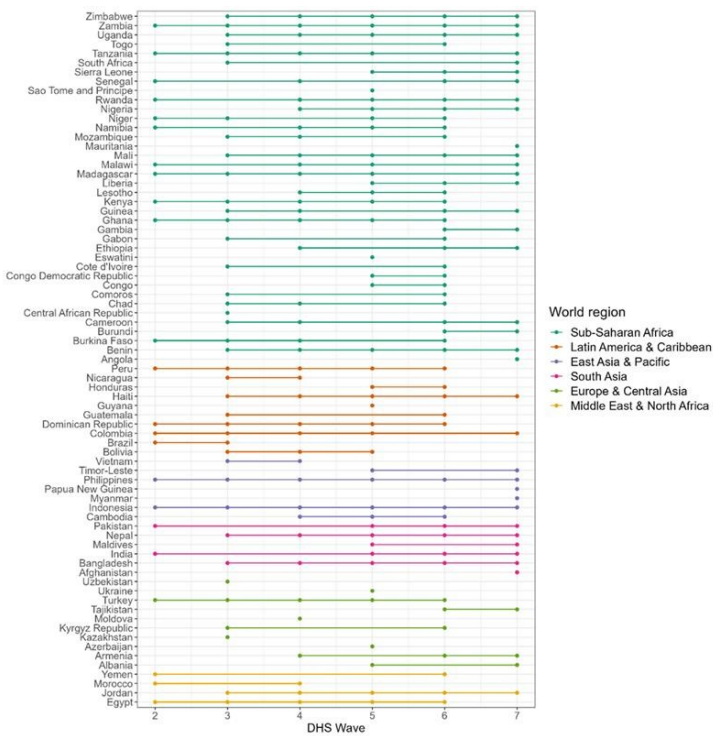
Using household absenteeism in the past 12 months as a proxy for mobility makes this metric particularly suited for measuring short-term mobility. Short-term mobility such as this can look like a single member of a household moving for economic opportunity, or a household sending vulnerable members to more stable locations. This form of mobility also manifests itself as the kind of household adaptation to economic or climatic shocks that assure resilience in the face of these hazards. We expect to find that overlapping and cascading climate hazards decrease this short-term mobility, and in turn, either increase immobility, or increase permanent out-migration of entire households.

The climate hazard data come from four sources. The first is global temperature and precipitation data from the ERA-5 reanalysis of global climate and weather data, hosted by Copernicus. The second is flood data hosted by the Dartmouth Flood Observatory. The third is drought and aridity data developed and hosted by the Spanish National Research Council (CSIC). The fourth is wildfire data hosted by the Global Fire Emissions Database (GFED). All data is geospatial raster data with resolution of at least 0.5x0.5 degrees. This highly granular focus allows for more comprehensive aggregate metrics of climate hazards when combined with subnational and national boundaries. The household absenteeism data comes from the Demographic and Health Survey. The data's scope and resolution enable not only an in-depth assessment of mobility, but also a geographically comprehensive analysis of larger migration trends over time.

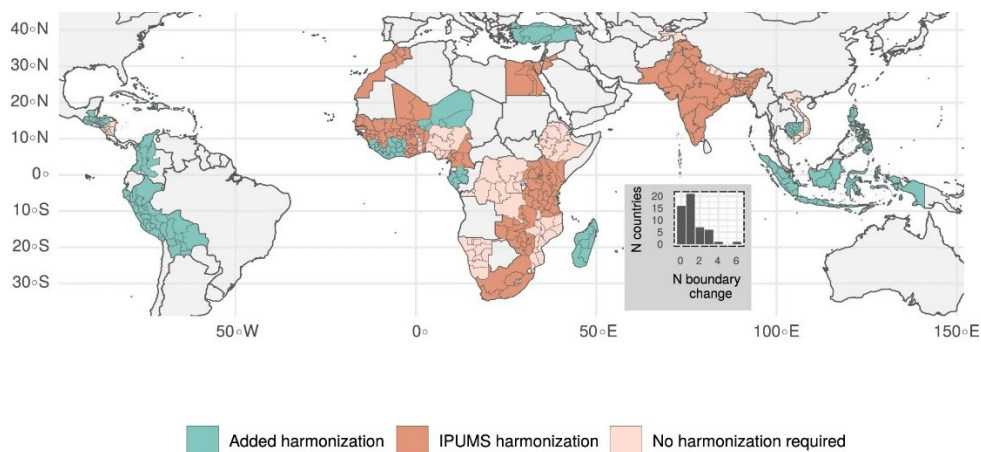
This study will harmonize climate hazard data and aggregate them to the DHS administrative municipal level. The DHS administrative boundaries will also be harmonized to remain constant throughout the data's time range. We will use fixed-effects models to estimate the effects of floods, extreme precipitation, heat waves and cold waves, wildfires, and drought on 12-month mobility. We will include interaction terms to examine the relationship between overlapping hazards. In addition to interaction terms, we will also analyze these relationships while controlling for a range of household variables concerning economic resources and social networks. Oftentimes, extreme weather events and climate change are not the primary reasons for migration: social, economic, and security factors all shape the mobility landscape for households. Households may be stratified on a spectrum of three major branches: resource access, perception of mobility need, and competence to migrate (de Haas, 2021). These three branches will guide our choice for control variables which cover the full breadth of access and ability.

Ultimately, this study will illuminate the overlapping and cumulative impact of specific climate hazards on mobility outcomes at a household level. Over time, these hazards can stratify mobility outcomes based on social and economic pressures and restrictions. Our findings will uncover the way climate hazards can split subnational regions apart on a spectrum of mobility outcomes.

# Appendix



**Figure 1.** Availability of information on DLS in DHS across the different DHS waves for different countries and world regions. The points in the figure indicate that information on the DLS index is available for the respective country and wave. While for some countries, data are available for several periods, for others availability is restricted to one DHS wave only.



**Figure 2.** DHS regions in LivWell consistent across time in 52 countries. **Inset:** number of countries in LivWell by the frequency of regions' boundary change.

## References

- Benveniste, H el ene, et al. "Effect of Border Policy on Exposure and Vulnerability to Climate Change." *Proceedings of the National Academy of Sciences of the United States of America*, vol. 117, no. 43, Oct. 2020, pp. 26692–702. *PubMed Central*, <https://doi.org/10.1073/pnas.2007597117>.
- Boas, Ingrid, et al. "Climate-Induced Redistribution of People Is Not Inevitable." *Environmental Research Letters*, vol. 20, no. 10, Oct. 2025, p. 101001. *DOI.org (Crossref)*, <https://doi.org/10.1088/1748-9326/adfdfd>.
- Brown, Oli. *Migration and Climate Change*. UN, 2008. IOM Migration Research Series. *DOI.org (Crossref)*, <https://doi.org/10.18356/26de4416-en>.
- de Haas, Hein. "A Theory of Migration: The Aspirations-Capabilities Framework." *Comparative Migration Studies*, vol. 9, no. 1, Feb. 2021, p. 8. *BioMed Central*, <https://doi.org/10.1186/s40878-020-00210-4>.
- Schewel, Kerilyn. "Understanding Immobility: Moving Beyond the Mobility Bias in Migration Studies." *International Migration Review*, vol. 54, no. 2, Jun. 2020, pp. 328–55. *DOI.org (Crossref)*, <https://doi.org/10.1177/0197918319831952>.
- Tagliacozzo, Serena, et al. "How Do Population Movements Fit within the Framework of Systemic Risk?" *Progress in Disaster Science*, vol. 16, Dec. 2022, p. 100256. *DOI.org (Crossref)*, <https://doi.org/10.1016/j.pdisas.2022.100256>.