Violent conflicts suppress climate-related mobility in Africa

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Abstract

As climate change intensifies and conflicts persist across many regions, millions of people currently face overlapping crises with implications for migration. Prior research on climate-related migration has typically examined the impacts of climatic hazards and conflict in isolation, without accounting for their interplay. Yet, different distressing events can interact, producing compound effects that exacerbate the risks faced by affected populations. These interactions can lead either to heightened levels of forced migration or to increasing immobilization. In this study, we use georeferenced Demographic and Health Survey (DHS) data from Africa to measure short-term mobility, which we operationalize as the absenteeism of household members within the past 12 months. We combine these data with information on the occurrence of climatic hazards and various types of conflicts in respondents' regions of residence, derived from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP) and the Uppsala Conflict Data Program (UCDP). Using comprehensive fixed-effects models, we find that droughts and floods are associated with increased household mobility. However, these effects are suppressed in times of conflict, when households appear to reduce their mobility, likely due to a desire to remain close to family members and constrained opportunities for movement. The influence of conflict on mobility is particularly strong in areas where violence has recently resumed or remains pervasive. Our findings highlight the importance of considering the compound and context-specific interactions between environmental stress and conflict when analyzing mobility responses and for designing targeted humanitarian and adaptation policies that address the intertwined nature of different risks.

Extended Abstract

The world is currently confronted with multiple, overlapping crises (Knutti et al., 2016; Martin et al., 2013). The increasingly severe impacts of climate change coincide with rising sociopolitical instability, geopolitical tensions, and violent conflicts, all of which undermine people's capacities to cope with and adapt to threats (IPCC, 2022). Together, these developments heighten vulnerability and erode resilience, particularly among already marginalized populations. One critical dimension of these interconnected challenges concerns human mobility. In 2024, the UNHCR reported that more than 130 million people were forcibly displaced worldwide, with many of them residing in areas simultaneously affected by extreme climatic events and sustained conflict (IDMC, 2025; UNHCR, 2025). While migration has long been recognized as a key response to both environmental stress and insecurity, the ways in which these drivers interact to shape mobility patterns remain insufficiently understood (Cattaneo et al., 2019; Hunter & David, 2009; Hunter, 2005). Existing research has typically analyzed the effects of climatic hazards and violent conflict in isolation, overlooking their potential interplay and the compound impacts they may have on affected populations.

A number of studies have shown how climatic threats can result in displacement and contribute to increased migration in different parts of the world (Bohra-Mishra et al., 2017; Coniglio & Pesce, 2015; Gray & Mueller, 2012; Gray & Wise, 2016; Hermans & McLeman, 2021; Hoffmann et al., 2023; Koubi et al., 2016; Mani et al., 2019; Nawrotzki et al., 2017; Piguet, 2012). At the same time, there is no automatism at play (Boas et al., 2019; Schewel, 2020). Not everyone affected becomes mobile, and climatic risks and related impacts can also lead to increased immobility by undermining households' abilities and willingness to move, potentially trapping populations in vulnerable and high-risk environments (Carling, 2002; Zickgraf, 2018, 2021). A range of drivers and moderators, including contextual and personal factors, are important in shaping mobility patterns and outcomes, and these underlie the great heterogeneity in household responses observed (Black, Adger, et al., 2011b; Czaika & Reinprecht, 2022; de Haas, 2021; Hoffmann et al., 2022).

Conflict constitutes a crucial factor that can moderate and amplify the impacts of climatic stress on populations and their mobility. While the implications of climate change in politically fragile and conflict-affected settings are receiving growing attention, there remains a critical need to understand how these interacting forces jointly shape migration dynamics (Bosetti et al., 2018; Savelli et al., 2023; Thalheimer & Webersik, 2022). Existing evidence suggests that climate and non-climate risks can reinforce one another, creating compound risks that exacerbate vulnerability and constrain people's capacity to respond effectively (Buhaug & von Uexkull, 2021; von Uexkull & Buhaug, 2021). In conflict-affected areas, the destructive impacts of violence, such as weakened governance, economic disruption, and damaged infrastructure, can intensify the consequences of climatic hazards, leaving households with fewer resources and options for adaptation or movement (Fjelde & von Uexkull, 2012). At the same time, insecurity and violence may suppress mobility altogether by limiting safe routes, reducing access to social networks, or encouraging people to stay close to family members (Benveniste et al., 2022; Carling, 2002; Cundill et al., 2021; Debray et al., 2022; Farbotko, 2018; Zickgraf & Perrin, 2016). Despite the high likelihood of such interactions, empirical studies that systematically capture and quantify these compound effects remain scarce (Pescaroli & Alexander, 2018; Phillips et al., 2020; Zscheischler et al., 2018).

To address this gap, this study analyzes the effects of three climatic hazards (flooding, drought, crop failures) on short-term migration patterns in Africa and examines how conflict moderates these relationships. We draw on georeferenced Demographic and Health Survey (DHS) data from 17 African countries between 2005 and 2019 (Appendix Figure A1) (DHS, 2019; Vaessen et al., 2005), a region heavily affected by overlapping climatic risks and characterized by persistent and, in many cases, protracted conflicts (O'Loughlin et al., 2012). The DHS data, comprising approximately 370,000 household-year observations, provide detailed information on the absenteeism of household members within the past 12 months, which we use as a proxy for short-term mobility (Appendix Figure A2). This measure captures seasonal and other temporary forms of labor-related movement, where household members leave for a period of time but remain part of the household unit (Gray & Thiede, 2024). We combine these data with information on different conflict types from the Uppsala Conflict Data Program (UCDP) and on climatic impact events from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP), focusing specifically on the impacts of flooding, droughts, and crop failures (Högbladh, 2019; Warszawski et al., 2014).

To capture different dimensions of conflict exposure, we constructed various transformed variables (Appendix Figure A3). The first is a binary indicator denoting whether any conflict event occurred in a given region-year. The second variable, termed conflict status, distinguishes whether a conflict year in a region represented the onset of a new conflict, the continuation of an ongoing one, or the renewal of conflict after a period of peace. To determine this, we calculated the number of consecutive years of peace preceding each conflict year. If conflict occurred for the first time or after at least two years without violence, it was classified as "new" or "renewed," respectively; if it persisted from the previous year, it was classified as "ongoing." Years without any recorded conflict were labeled as "peace." When aggregating the data to the harmonized region-year level, we assigned each region a single, dominant conflict status. Since some regions may experience multiple conflict types within the same year, we applied a prioritization rule to reflect the most consequential type of conflict. We assume that new conflicts have the strongest potential impacts on populations and mobility. Consequently, these were given the highest priority, followed by renewed and ongoing conflicts. This means that even if only a single renewed conflict occurred in a region during a given year, the region-year was classified as "renewed."

Climate data are drawn from the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP 3a), which integrates harmonized data and models across multiple sectors, including agriculture, water, ecosystems, and health, to assess climate change impacts over time (Hempel et al., 2013; Warszawski et al., 2014). The ISIMIP framework provides standardized outputs across models and scenarios, enabling consistent comparison and aggregation of results (Appendix Figures A4 and A5). Flood exposure is measured using the 100-year flood event dataset available at a 15 arcmin spatial resolution. Floods are defined as events in which the water depth reaches at least 10 cm. The data are aggregated to the DHS administrative level and normalized by land area, allowing for comparison across differently sized administrative units. Flood exposure is quantified as the proportion of the administrative unit's area affected by such flood events. Drought exposure is available at a 30 arcmin by 30 arcmin resolution and measured as the number of months within a year in which the soil moisture in the top soil layer (0–100 cm) is equal to or below the 10th percentile of the historical monthly distribution. This measure captures the persistence and severity of drought conditions experienced in each administrative unit. Crop failure data, available at a 30-minute by 30-minute resolution, combine annual yields for maize, rice, soy, and wheat. Crop failure

is defined as a negative crop yield shock greater than 20% compared to the long-term average within a given administrative unit, represented as a binary variable. All climate variables are aggregated to the DHS administrative district-year level. To facilitate comparability across predictors, the flood and drought variables are standardized using z-scores, while the crop failure variable is included in binary form. This standardization allows estimated coefficients to be interpreted as the effect of a one standard deviation increase in flooding or drought severity and enables direct comparison across climatic stressors.

We employ fixed-effects models to estimate the effects of the three climate hazards on short-term mobility and include interaction terms to examine how conflict moderates these relationships across African contexts. Recognizing that mobility decisions are shaped by a range of social, economic, and institutional factors beyond conflict and climatic extremes and that even in highly insecure settings, traditional migration determinants such as social networks and economic factors remain influential, we incorporate an extensive set of household- and district-level control variables in our analysis. At the household level, we control for the share of household members with high employment status, engagement in agriculture, secondary educational attainment, and overall wealth, as well as whether the household is located in a rural or urban area. At the district level, we complement the DHS data with several contextual indicators derived from external data sources, including measures of income inequality and human development. Specifically, we use subnational estimates of the Gini coefficient, which captures the degree of income inequality (ranging from 0 for perfect equality to 1 for perfect inequality), and the Human Development Index (HDI), a composite measure of achievements in health, education, and economic well (Chrisendo et al., 2024; Kummu et al., 2018). To account for broader structural and institutional conditions, we further include controls for population size and a measure of liberal democracy (Coppedge et al., 2016) which reflects the extent to which political systems guarantee electoral competitiveness, civil liberties, and the rule of law. These factors are essential, as governance quality and institutional strength can influence both the capacity of governments to respond effectively to environmental and conflict-related crises and the freedom individuals have to move in response to such compounded risks.

Our preliminary results show that environmental hazards and conflict are systematically linked with many households in the dataset experiencing compounding risks (Appendix Figure A6). We furthermore find that violent state-based conflict systematically moderates how households respond to climatic shocks through short-term mobility (Appendix Figure A7 for the example of flood events). In the absence of conflict, exposure to floods and droughts tends to increase household mobility, suggesting that environmental stress often triggers temporary migration as an adaptive strategy. However, in conflict-affected regions, these effects are significantly dampened or even reversed, indicating that violence constrains people's ability to move in response to environmental stressors. This suppression effect is particularly pronounced in areas where conflict has recently resumed, highlighting how renewed violence increases insecurity, disrupts migration networks, and creates barriers to mobility. A similar pattern is observed for crop failure, with households in conflict zones exhibiting markedly lower levels of short-term mobility compared to those in peaceful areas. These findings suggest that environmental and conflict-related risks can interact in important ways, with conflict effectively reducing household's likelihood of temporary movement. While conflict may constrain short-term mobility, it may also induce longer-term migration, such as the movement of entire households, which is not captured by our current

dataset. In ongoing work, we are exploring how mobility responses vary by household demographics and socioeconomic characteristics, which may help explain heterogeneity in responses to combined environmental and conflict stress. We are also examining differences across socioeconomic, geographic, and cultural contexts to better understand how the interplay between climate shocks and conflict shapes mobility patterns at a more granular level.

Our contributions to the field are twofold. First, we expand the study of conflict and disaster impacts by moving beyond data that focuses exclusively on displacement, such as internally displaced persons (IDPs) or refugees, to analyze broader human mobility patterns. Our measure allows us to specifically measure shorter-term movements, which are often used by household to adapt and cope in the context of environmental stress (Hoffmann et al., 2022; Hunter, 2005). Second, we emphasize the compound and cumulative impacts of stress on migration responses, shedding light on the sustained and interacting impacts of conflict and environmental change that are frequently overlooked in empirical analyses. By examining these dynamics at the subnational and household level, our study provides novel insights into how climate shocks and conflict jointly shape mobility outcomes across diverse African contexts.

It is important to note that our mobility measure, which is defined as the absenteeism of household members in the past 12 months, is particularly suited to capturing short-term, labor-related mobility, but less reflective of longer-term migration or full-household displacement. Accordingly, rather than indicating a general reduction in all forms of migration, our findings point more specifically to a decline in short-term adaptive mobility, potentially because households are either unable to move or are forced to migrate collectively as entire units. These results suggest that conflict can undermine adaptive migration responses to climate shocks by constraining both the capacity and security necessary for movement. An out-of-sample predictive test further indicates that including interaction terms between conflict and climate hazards improves model performance, supporting the relevance of analytical compound risk frameworks.

Taken together, our findings underscore the complex and context-specific nature of mobility in crisis settings, where climatic hazards may exert push pressures while conflict simultaneously restricts certain forms of movement. This duality generates a fragmented landscape of vulnerability in which some populations may move, while others remain trapped in high-risk environments (Mallick & Schanze, 2020). Addressing these challenges requires integrated humanitarian, peacebuilding, and climate adaptation strategies that recognize the intertwined nature of environmental and security risks, enhance mobility as an adaptive strategy, and strengthen resilience among populations exposed to overlapping crises (Black, Adger, et al., 2011a; Black, Stephen, et al., 2011).

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Appendix

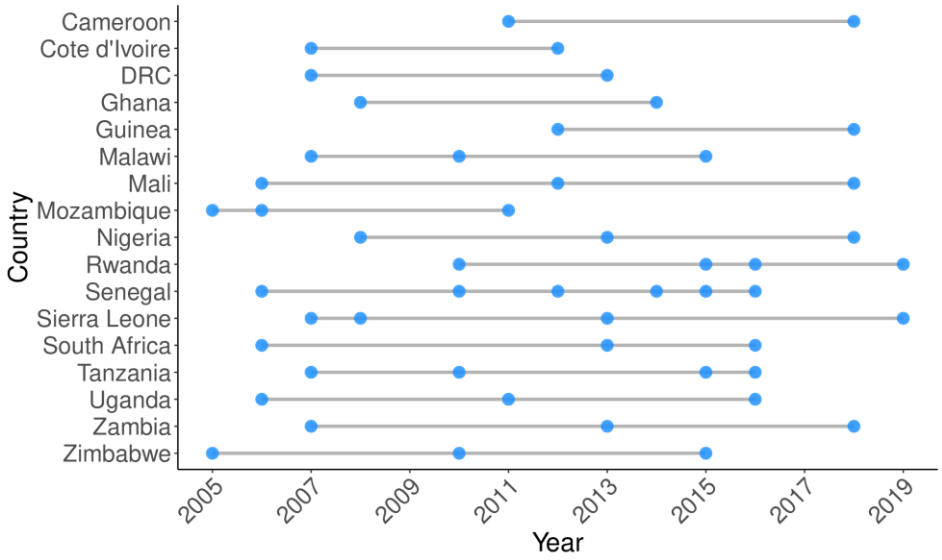

Figure A1. Overview of countries and waves in the DHS dataset. The data contain information from 17 African countries with observations ranging from 2005 to 2019.

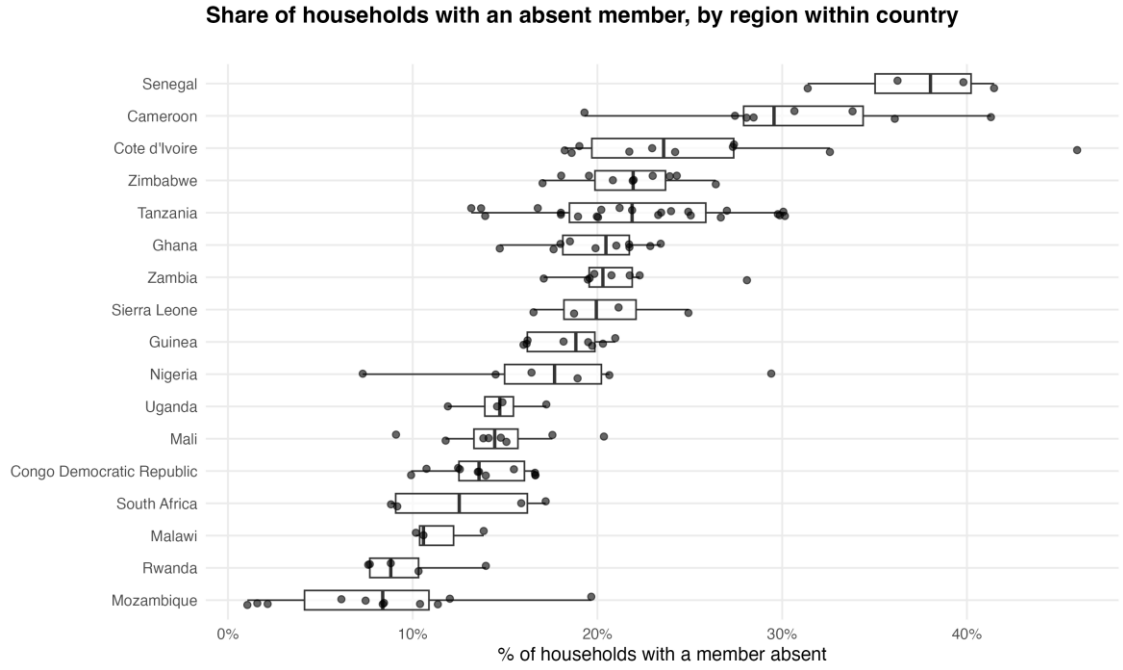

Figure A2. Share of migrant households with at least one household member absent across subnational regions in the countries included in the DHS sample.

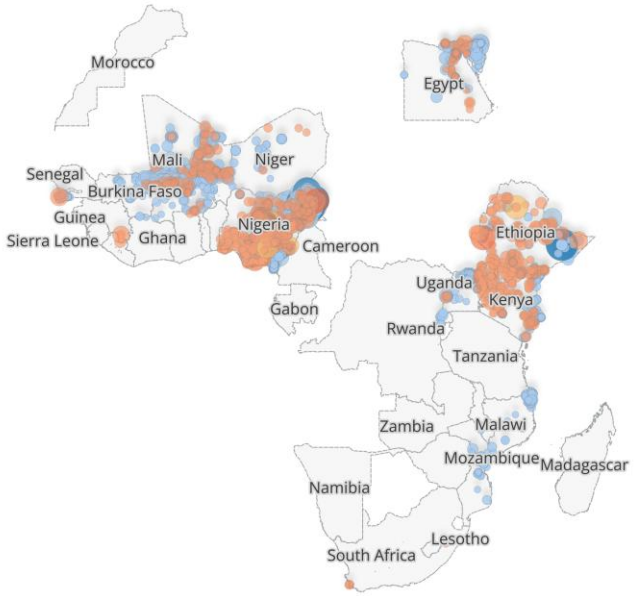

Figure A3. Distribution of conflict events across the countries in the DHS sample.

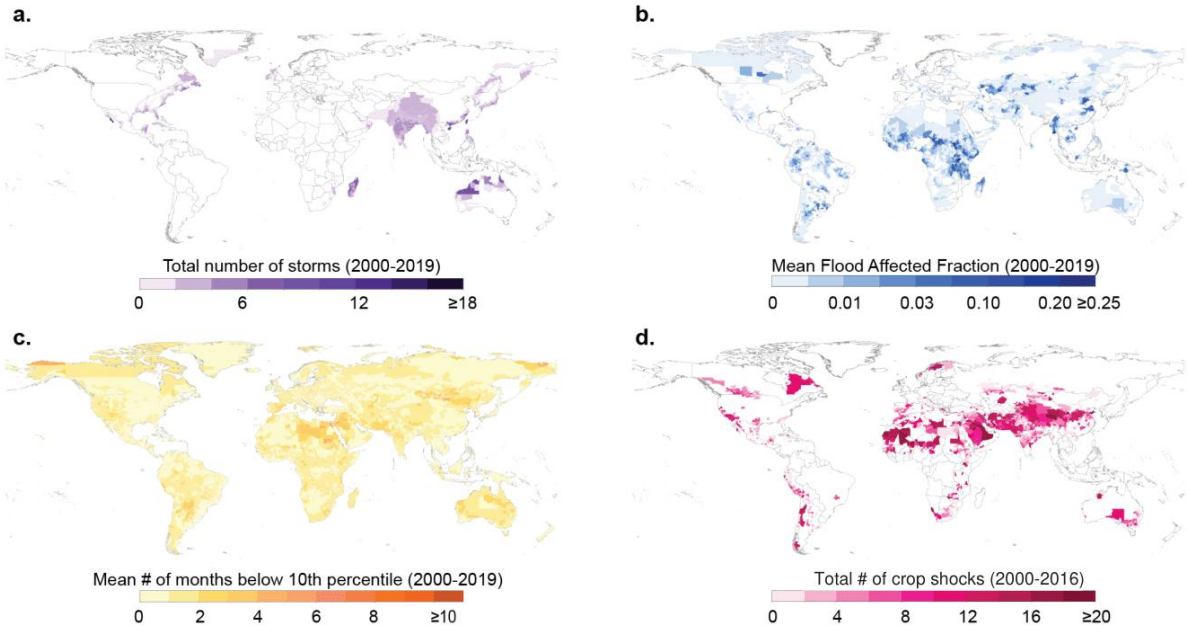

Figure A4. Maps showing spatial distribution of environmental hazards. Our analysis focuses on the impacts of severe storms, flooding, drought, and crop shocks.

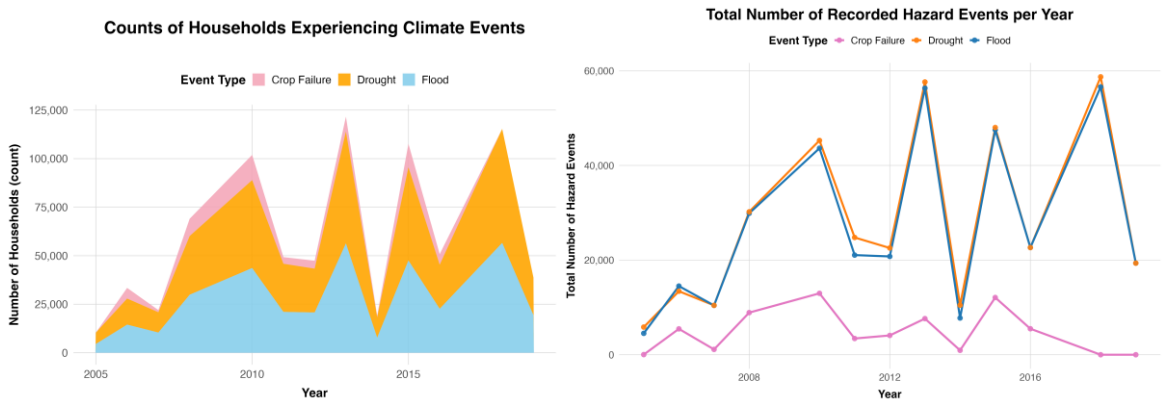

Figure A5. Temporal trends showing changes in environmental hazards over the observation period. The left panel shows the number of households in the DHS sample living in areas affected by one of the hazards. The right panel shows the total number of hazard events recorded across the grid cells across Africa.

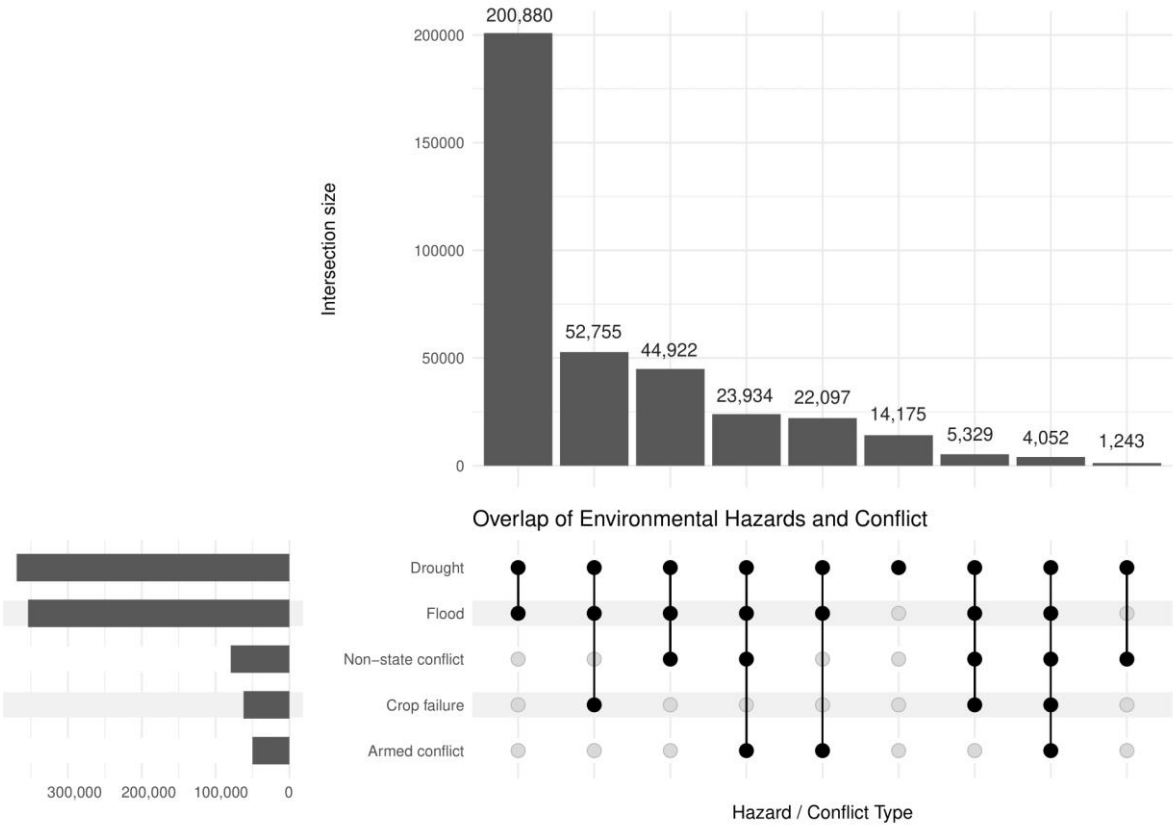

Figure A6. Overlap between the different environmental hazards and conflict events among 370,472 surveyed households across our selected countries in Africa. Nearly all households were affected by multiple stressors rather than a single event. About 54% (200,880 households) experienced both floods and droughts, and roughly 14% (52,755 households) were simultaneously affected by all major hazards. Around 12% faced floods, droughts, and non-state conflict or state-based conflict, while 1% (4,052 households) experienced all hazard and conflict types.

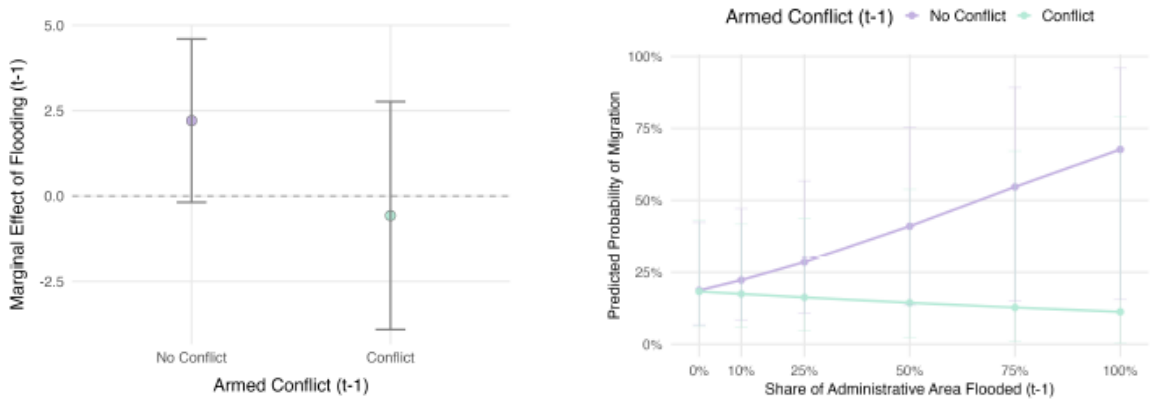

Figure A7. Marginal effects of flooding on the probability that a household has an absent household member and interactions with conflict. The left graphs show the aggregated effects, the right graphs by intensity of the flooding events recorded.