Evaluating Climate-Related Migration Forecasting Models

Climate Change Foresight Research

Background

Climate change will have significant impacts on all aspects of human society, including population movements. In some cases, populations will be displaced by natural disasters and sudden-onset climate events. In other cases, climate change will slowly reshape the economic, social, and political order, which will influence how and where people migrate. Planning for the wide spectrum of future climate-related impacts on mobility is a key challenge facing development planners and policymakers.

Human migration brings challenges and opportunities to both sending and receiving societies. Migration is a key adaptation strategy vulnerable households can use to cope with climate change; the money migrants send home enhances the resilience of households staying in origin areas. Destination societies will experience benefits or strain from in-migration depending on key investments—in housing, jobs, infrastructure, and social services. Planning for these investments requires an understanding of where people might go.

This project evaluated prevailing and promising modeling approaches for forecasting climate-related migration for the next 30 years. We reviewed 20 forecasting models relevant to USAID's strategic interests and analyzed 9 models in-depth to better understand the strengths and weaknesses of different modeling approaches. Our report benefited from the insight and expertise of eight climate-related migration experts and modelers.

The State of Climate-Related Migration Forecasting

Forecasting climate-related mobility is a relatively new endeavor. Building on the longer history of population and migration modeling, climate-related migration models are distinguished by including climate and environmental variables as core data inputs. The majority estimate the effects of slow-onset shifts in precipitation, temperature, or sea level on internal or international migration trends. At this point, none estimate trapped populations, though this is an area of growing concern. Prevalent approaches include agent-based models, gravity and radiation models, general equilibrium models, and statistical extrapolation approaches. They have been applied at the global, regional, national, and sub-national level.

Modeling experts caution that at this stage of model development, numerical projections to 2050 should be seen as notional at best. Modeling migration is fraught with uncertainty and adding the dimension of climate change only compounds that uncertainty. Early modeling efforts generally assumed a linear, cause-and-effect relationship in which climate-induced drought, rising sea levels, or natural disasters result in the movement of affected populations. Research now shows that climate change has a more indirect and often non-linear relationship with migration, whereby a climate stress leads to different migration outcomes depending on the development context and the socioeconomic status of a given household. In some cases, climate change impacts may suppress mobility, particularly in low-income countries.

Key challenges to improving climate-related migration forecasting models include the lack of reliable and accurate migration data; difficulties incorporating non-climate-related drivers of migration, particularly political, social, and cultural factors; unknowns regarding what major tipping points may impact climate change in the future and the ability of humans to adapt to climate change via breakthroughs in technology or coordination.

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Key Takeaways

- **The field of climate-related migration forecasting is still in its infancy.** Experts urged caution in using numerical estimates to inform policy and programming. Instead, they suggest that models are better suited to explore a set of 'what if' scenarios and policies oriented towards encouraging best-case outcomes.
- **Short-term projections tend to be more accurate than long-term estimates.** The accuracy of models degrades with the time horizon. When using gravity or radiation models to project future population distributions, for example, projections in the 1-, 5-, or 10-year range are more likely to be reliable than those forecasting to 2050 or 2100.
- **Climate change will affect migration, but its effects are often indirect.** Climate impacts are heavily mediated by non-climate-related factors (e.g., political, economic, social, technological, and cultural). To improve forecasting models, we need more foundational knowledge about climate-development-migration interactions and potential cascading effects.
- **Differences by gender and marginalized populations are not yet a strong focus of forecasting models.** Statistical extrapolation approaches and agent-based models have begun to explore these differences more robustly. Targeted data collection efforts that capture migration aspirations, plans for adaptation and migration, and migration behavior in climate-stressed contexts will contribute to more nuanced forecasting specific to gender and marginalized populations.
- **The scenario-based approach is preferable to single cause-effect models** precisely because of the uncertainty surrounding many inputs and outcomes. The full spectrum of future scenarios—based on a range of potential climate, development, and policy futures—should be considered when utilizing forecasts.
- **Modelers are well aware of the limitations of existing approaches, and they are making consistent efforts to push the field forward.** The field is moving quickly, and many of the most interesting advancements in the field have not yet been published.

Policy Implications

Exposure modeling can highlight populations most vulnerable to climate change. Exposure models overlay climate-related hazards on a population distribution map to identify at-risk groups. They do not forecast where people will move yet remain a useful tool to address climate-related migration, particularly when natural and social scientists collaborate to provide more granular estimates of exposure and vulnerability to climate change. Development assistance in at-risk regions may include 1) facilitating in-situ adaptation recognizing that many households will prefer to stay in their home communities; 2) facilitating migration, whether seasonally or permanently; and 3) expanding access to housing, employment, and services in urban areas and major cities neighboring climate-stressed regions, as distress migrants tend to move shorter distances.

Significant data collection improvements are needed to enhance forecasting. These improvements include investments in statistical bureaus to increase both the frequency and accuracy of census data collection, investments in longitudinal (ideally, panel) surveys to capture migration and immobility dynamics in local contexts and for different social groups, and investments in innovative ways to track migration and displacement following sudden-onset events (e.g., cell phone data). USAID could also consider adding questions about migration aspirations, plans, and ability into monitoring and evaluation surveys. This data would expand the evidence base and help assess the impact of development interventions on migration decision-making in climate-stressed regions.

Foresight exercises may help policymakers anticipate future climate-related migration better than forecasting models alone. Convening discussions with modelers, migration scholars, natural scientists, development practitioners, and other stakeholders may lead to a more comprehensive assessment of potential future mobility trends and better inform policy and programming for a given region. Migration and regional scholars can identify gaps or inaccuracies in the inputs or assumptions of forecasting models and offer caveats about the applicability of the models' findings for particular populations or sub-regions. Natural scientists can offer greater insight into differences in exposure and risk at the household or community-level.