

FORECASTING CLIMATE MIGRATION – HOW MUCH DO WE REALLY KNOW?

This fact sheet is part of a series that distils key topics in the climate migration literature into clear and concise summaries, addressing a need expressed by policymakers. Each sheet focuses on a specific subtopic, condensing existing knowledge into an accessible format. It provides an overview of main findings alongside policy-relevant insights. The fact sheets use the term ‘climate migration’ as a broad concept that encompasses various forms of (im)mobility in the context of climate change (see fact sheet on terminology for additional details).

OVERVIEW

Climate migration¹ has gained public attention, often **framed as a looming crisis**, though **evidence** remains **scattered and limited**.⁶ While climate change is likely to continue to influence migration patterns and their underlying drivers, the specifics are highly **uncertain**.^{4,5}

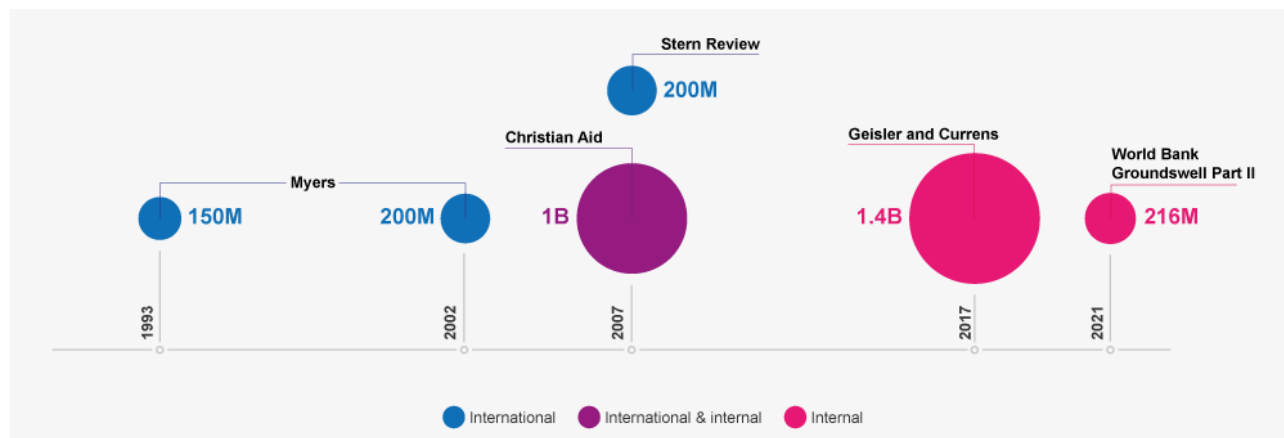
- Climate change leads to **environmental changes** that may impact migration patterns. However, these **can lead to both more and less migration**, depending on the context and on the characteristics of affected individuals.^{7,19}
- The exact impact of **climate change** on various natural phenomena in different regions is often **probabilistic**, **adding uncertainty** to migration outcomes.
- All migration drivers are interconnected and the **impact of climate change on other drivers**, such as socioeconomic factors and conflict, remains **to be further explored**.²⁴

Forecasting climate migration is therefore a difficult endeavour that—given the magnitude of uncertainty—can **lead to widely different estimates**. Figure 1 shows the varying estimates produced by notable global models, which have become increasingly sophisticated over the years.

Key **models’ characteristics** include:

- **Estimation methods:** Gravity models, which use factors like population, economy, and distance to assess the impact on migration, are common but may miss dynamic interactions between environmental effects, individual behavioural factors and policy interventions.^{1,11,26} Agent-based models simulate individual decisions and predict the behaviour of entire systems. They require extensive, often unavailable data and rely on behavioural assumptions.²⁸
- **Climate variables:** Models typically use temperature or precipitation,¹⁷ with recent approaches incorporating also more complex indices, such as the Standardised Precipitation Evapotranspiration Index (SPEI), which is an indicator commonly used to measure droughts.^{1,26}
- **Migration, population, and socioeconomic data:** These data are often drawn from administrative sources that are updated only every few years, missing short-term or short-distance movements. Data can also come from surveys or other sources that may only exist locally or not be representative.¹⁵
- **Time horizon:** Projections vary, commonly targeting 2050 but extending to 2060, 2070, 2100,^{4,27} or in a few cases even 2200.¹²

FIGURE 1. Timeline of Climate Migration Forecasts



Note: The different models use different methods to produce estimates. Estimates are for the year 2050, except for Geisler and Currens (2017) that forecast migration in 2060. All studies reported here are global, except for the World Bank study that excludes North America and Europe.

EVOLUTION OF FORECASTING MODELS

Early models, dating back to the 1990s, drew **direct links** between climate change and large-scale migration, often assuming that populations in severely affected regions would be forced to relocate.^{8,18,22,23} These simplistic approaches **overlooked adaptation** strategies and **other** non-climatic migration **drivers**.¹³ Recent models consider a broader range of factors, reflecting the complexity of climate migration.

Initial forecasts focused mainly on **international migration**, but a relative consensus has emerged that environmental changes are most frequently a driver of very **short distance movements** that are often **internal**,² including rural-urban movements. As a result, **recent models emphasise internal migration**. The World Bank's Groundswell report projects up to 216 million internal climate migrants across six major regions by 2050.¹¹ For example, it predicts that many migrants may leave areas in North-Eastern Bangladesh and Northern India in favour of areas such as Southern India, potentially influenced by factors such as water availability.

Methodological choices, the complexity of interactions between variables, and underlying uncertainty lead to **very different forecasts**.^{4,27} Recent scholarship suggests assessing populations' risk of **exposure** to climate extremes rather than attempting to predict migration.^{10,14} For example, the JRC's CLICIM report estimates that up to 212 million people in Africa could be exposed to adverse climate impacts by 2070.²⁰

Certain areas, known as **migration hotspots**, are expected to see high levels of in- or out-migration by 2050.²⁶ The Groundswell report identifies coastal regions and areas experiencing water or agricultural stress as emigration hotspots, while nearby regions and cities with better

climate conditions are viewed as immigration hotspots.²⁶ Similarly, the African Climate Mobility Initiative and the CLICIM report offer forecasts with **enhanced geographic detail**. Focusing on specific geographical areas could be particularly promising in future studies, as it could allow for a better understanding of diverse local dynamics as well as adaptation potential of vulnerable areas.

Scholars increasingly highlight that climate change may lead to more people being **involuntarily unable to migrate because of lack of resources**.^{3,5,9} While these populations are often overlooked in forecasting models, a study suggests that immobility could increase up to sixfold by 2100.²⁸ Addressing the needs of these populations requires policies focused on humanitarian assistance, in-situ adaptation, and access to migration opportunities.

KEY TAKEAWAYS AND POLICY IMPLICATIONS

- Forecasts of the number of climate migrants are indicative at best; the numbers predicted are very much uncertain and some ignore the fact that in some contexts, migration may even decrease. This is especially the case for broad global models that often fail to capture dynamic interactions.
- Regardless of migration outcomes, policy responses should focus on areas most exposed to climate impacts, addressing local vulnerabilities and strengthening adaptation.
- More timely and detailed data on migration, its drivers, and local contexts is needed to create more accurate and nuanced models

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