



# Predictive modelling

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**Empirical modelling techniques are the only way to effectively simulate migration resulting from a complex combination of pressures and opportunities.**

There is considerable uncertainty in predicting climate change-induced migration. Firstly, we do not know the extent and magnitude of the climate

changes responsible for pushing and pulling migrants. Secondly, the individual contexts, perceptions and behaviour of those affected by

climate changes vary considerably. An agent-based modelling (ABM) technique can be used to simulate the relationship between the influence of environmental factors, climate variability and change and migration. According to the rules created for a particular simulation,

each 'agent' (representing a person or a household) assesses its personal situation, the climate risk, its ability to act, and the behaviour and views of others and then makes appropriate decisions to achieve its aims.

One advantage of ABM is the understanding that a series of interactions between individuals may result in more complex outcomes than could have been predicted by aggregating the behaviour of many individuals. ABMs are therefore an effective means of analysing the behaviour of individuals who interact but may think and act differently from each other and who also exhibit newly emerging traits. An important feature in the context of climate change is the capability of an ABM to allow scenarios to be simulated for which historical analogues (e.g. experience from past climate events) do not exist.

### Migration

In developing an ABM to simulate the impact of climate change upon migration, it is important to consider the influence of social structures, institutional influences and the actions of individuals. When perceived risk from climate change is greater than a specified threshold, the individual considers adaptation and the options available – which may include adaptation or migration, or a

maladaptive strategy such as denial or ineffective livelihood adjustments.

The basic cognitive process that each agent undertakes in consideration of climate stimuli, and the resulting selection of adaptation strategies, underpins the formation of the ABM. However, the individual context of each agent's unique combination of experiences, biases, assets and perceptions defines the differences among individual agents and their different responses to both environmental stimuli and the actions of others.

In order to refine the attributes of the agents and the rules of their interaction within an ABM, detailed country-specific knowledge is required.<sup>1</sup> With adequate data from which to develop the rules of interaction and thresholds for action of agents, the response of a community to a given or forecast climate scenario may be undertaken to provide a simulation of how that community will respond on the individual, household and community level. By developing an ABM from comprehensive data, the degree to which recent migratory movements have been affected by climate stimuli can be assessed and the influence of climate isolated from the multiple drivers behind migration.

Developing a model to simulate existing migrant flows provides an opportunity to investigate both the sensitivity of drivers of migration to climate and the thresholds and ranges of climate conditions that lead to migration. As a result of these findings, such a model can also be used to identify scenarios where there is a significant likelihood that communities and individuals will migrate. This could lead to an agent-based modelling approach that can produce a more detailed prediction of the number of people driven to relocate as a result of environmental conditions than has previously been possible.

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1. For more details, including information on the existing model for Burkina Faso, please see [www.informatics.sussex.ac.uk/users/cds21/publications/](http://www.informatics.sussex.ac.uk/users/cds21/publications/)