

# Migration : The drivers of human migration

Warnings about torrents of forced migrations owing to climate change make headlines. Now research shows that this is an oversimplification.

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For many years, the issue of 'environmental migration' witnessed a surprising disequilibrium between sensationalist media coverage predicting floods of refugees<sup>1</sup> and a paucity of sound empirical research. Writing in *Nature Climate Change*, Kniveton and colleagues<sup>2</sup> consider internal and international migration within and from Burkina Faso. They show that in this very vulnerable and largely rural society, rainfall variations do indeed impact on seasonal migration, but always in conjunction with other socio-demographic drivers. According to their simulations of the impacts of climate change up to 2045, migration could increase or decrease depending on the climatic and demographic scenarios.

Although migrations resulting from environmental drivers figured

prominently in the works of the pioneers of migration studies, they came to be considered as archaisms over the course of the twentieth century. Such migrations were seen as vestiges of humanity's difficulties in coping with natural forces, soon to be overcome by technological progress<sup>3</sup>. At the beginning of the 1990s, it therefore came as a surprise to migration scholars when predictions that millions of people could be displaced by hurricanes, droughts, flooding and sea-level rise appeared in the climate change literature<sup>4,5</sup>. Little systematic research had actually been done and there was much vagueness surrounding the underlying mechanisms involved, the number of people potentially affected and the geographical zones concerned<sup>6</sup>. Since then, a body of research has accumulated

to overcome this gap. Its aim is to question the role and weight of environmental drivers in already-occurring displacements and to build scenarios for the future<sup>7</sup>.

In their research, Kniveton *et al.*<sup>2</sup> contribute to this trend in an innovative way by using agent-based modelling (ABM)<sup>8</sup>. The central idea of ABM is to identify the rules of behaviour that lead individuals (agents) to decisions in a context of multiple stimuli — here, the whole spectrum of drivers going from economic incentives to social networks or climate hazards. A computer simulation then allows observation of the outcomes of different scenarios on a population of agents over time. ABM takes into account the differences between agents' attitudes according to, for example, gender. It also considers that rationality of individuals can be limited by factors such as their level of information. ABM also models the feedback effect of agents' migration on the attitude of their peers towards migration. This allows the nonlinearities of behaviour to be simulated. The purpose of ABM is then — in line with the pioneer work of Nobel Prize-winner Thomas Schelling on intra-urban migration and ethnic segregation — to link 'micromotives and macrobehaviours'<sup>9</sup>.

The researchers proceeded in two steps. They first calibrated their model on the basis of a retrospective household survey conducted during the 1990s: Burkinabe households were asked to remember their past migration over the period 1970–1994. The survey allowed differentiation of the probabilities of migration among 4,449 individuals according to socio-demographic characteristics (age, gender, marital status). Kniveton and colleagues<sup>2</sup> also used information about family connections to include social interactions: by hypothesis, individuals are more likely to migrate if a significant proportion of their peers have done so. They also considered the impact of rainfall levels on migration. This first step allowed the researchers to check the model's ability to represent the reality of migration.



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On the road between Niamey and Benin's border (Niger). In Sahel, mobility is a traditional coping strategy in times of hardship.

At this point, the researchers ran their model into the future on the basis of climate scenarios (above-average, normal or below-average rainfall in the different regions of Burkina Faso) and demographic scenarios of population growth. The simulations illustrate how drier conditions substantially enhance migration only because of a complex chain of causalities between rainfall, population growth and social networks. Taken in isolation, the impact of the climate factors remains non-significant.

The processes that lead an individual to migrate in response to climate signals are much more complex than the segregation processes studied by Shelling and, arguably, also than many other phenomena addressed in ABM<sup>10</sup> studies. Given such complexity, the socio-demographic processes as well as the rules of behaviours taken into account in Kniveton and colleagues' model remain simplistic. At this stage, additional research is needed to confirm the promising perspectives

opened up by ABM. A much deeper theoretical understanding of the migration decision-making processes at stake and more extensive household surveys are needed. This should help in drawing conclusions on the existence of behaviours regular enough to allow mathematical formalization. Nevertheless, Kniveton and colleagues' findings<sup>2</sup> represent a breakthrough in the literature linking climate change and human migration. As noted by the researchers: "The development of an agent-based model investigating the impact of rainfall variability on migration serves as a heuristic device to understand the characteristics of aggregate migration behaviour in response to climate change and variability." Population displacements linked to climate change represent a major challenge for the future. A better understanding of such processes is a central task for migration studies. Kniveton *et al.* show that ABM can significantly improve this understanding. The study confirms

the role of ABM as a methodological toolkit and opens up a fascinating research programme.

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## References

1. Sachs, J. Climate change refugees: As global warming tightens the availability of water, prepare for a torrent of forced migrations. *Scientific American* (June 2007).
2. Kniveton, D. R., Smith, C. D. & Black, R. *Nature Clim. Change* **2**, 444–447 (2012).
3. Piguet, E. *Ann. Assoc. Am. Geogr.* (in the press).
4. IPCC *Climate Change: The IPCC Impacts Assessment* (eds Tegart, W. J. McG., Sheldon, G. W. & Griffiths, D. C.) (WMO, UNEP, 1990).
5. Stern, N. *The Economics of Climate Change* (Cambridge Univ. Press, 2007).
6. Black, R. *New Issues in Refugee Research — Environmental Refugees: Myth or Reality?* (UNHCR, 2001).
7. Piguet, E., Pécoud, A. & de Guchteneire, P. (eds) *Migration and Climate Change* (Cambridge Univ. Press, 2011).
8. Gilbert, N. *Agent-Based Models* (Sage, 2007).
9. Schelling, T. C. *Micromotives and Macrobehavior* (Norton, 1978).
10. Heppenstall, A. J., Crooks, A.T., See, L. M. & Batty, M. (eds) *Agent-Based Models of Geographical Systems* (Springer, 2011).