

level rise is similar under different emission scenarios^{1,29} (Fig. 1a,b). In the second half of this century and beyond, projections of sea-level change increasingly diverge^{1,29,30}. As we approach this mid-century mark, we should have a better understanding of the emissions and sea-level trajectories that the world will follow for the remainder of the twenty-first century and beyond, and thus be in a better position to account for adaptation interventions and migration in that more distant future (Fig. 1c).

In all cases, representing the feedbacks of policy, population and sea level will be imperative as we build comprehensive models capable of guiding policy. These refinements hinge on the convergence of international organizations, governments, advocacy groups and scholars of various disciplines working to deliver timely and purpose-specific information on coastal risk, adaptation policy and evolving migration dynamics. □

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References

- Clark, P. U. et al. *Nat. Clim. Change* **6**, 360–369 (2016).
- Rigaud, K. K. et al. *Groundswell: Preparing for Internal Climate Migration* (World Bank, 2018).
- Bell, A., Calvo-Hernandez, C. & Oppenheimer, M. *Socio-Environ. Syst. Model.* **1** <https://doi.org/10.18174/sesmo.2019a16102> (2019).
- Black, R. et al. *Glob. Environ. Change* **21**, S3–S11 (2011).
- Werner, A. D. & Simmons, C. T. *Groundwater* **47**, 197–204 (2009).
- Strauss, B. H., Ziemiński, R., Weiss, J. L. & Overpeck, J. T. *Environ. Res. Lett.* **7**, 014033 (2012).
- Tebaldi, C., Strauss, B. H. & Zervas, C. E. *Environ. Res. Lett.* **7**, 014032 (2012).

- Curtis, K., Fussell, E. & DeWaard, J. *Demography* **52**, 1269–1293 (2015).
- Bernstein, A., Gustafson, M. & Lewis, R. J. *Financ. Econ.* <https://doi.org/10.2139/ssrn.3073842> (in the press).
- Chen, J. & Mueller, V. *Nat. Clim. Change* **8**, 981–985 (2018).
- Clemens, M. J. *Econ. Persp.* **25**, 83–106 (2011).
- Amuedo-Dorantes, C., Puttitanun, T. & Martinez-Donate, A. *Demography* **50**, 1067–1091 (2013).
- Ratha, D. *Leveraging Remittances for Development*. Migration Policy Institute Policy Brief (June 2007).
- Amirault, D., De Munnik, D. & Miller, S. *Can. J. Econ.* **49**, 1035–1056 (2016).
- Hallegatte, S. et al. *Clim. Change* **104**, 113–137 (2011).
- Nicholls, R. J. & Cazenave, A. *Science* **328**, 1517–1520 (2010).
- Norfolk's Zoning Ordinance Executive Summary <https://www.norfolk.gov/DocumentCenter/View/36605> (accessed 17 May 2018).
- Adams, H. & Kay, S. *Environ. Sci. Pol.* **93**, 129–138 (2019).
- Barnett, J. et al. *Nat. Clim. Change* **4**, 1103–1108 (2014).
- Healy, A. & Malhotra, N. *Am. Political Sci. Rev.* **103**, 387–406 (2009).
- Hauer, M. E. *Nat. Clim. Change* **7**, 321 (2017).
- Desmet, K. et al. *Evaluating the Economic Cost of Coastal Flooding*. Working Paper no. 24918 (National Bureau of Economic Research, 2018).
- Arndt, C. et al. *Clim. Change* <https://doi.org/10.1007/s10584-019-02428-3> (2019).
- Jenkins, K., Surminski, S., Hall, J. & Crick, F. *Sci. Tot. Environ.* **595**, 159–168 (2017).
- Smajgl, A. et al. *Nat. Clim. Change* **5**, 167 (2015).
- Filatova, T., Volnov, A. & van der Veen, A. *Environ. Model. Softw.* **26**, 179–190 (2011).
- Haer, T., Botzen, W. & Aerts, J. *Environ. Sci. Pol.* **60**, 44–52 (2016).
- McLeman, R. A. *Glob. Environ. Change* **21**, S108–S120 (2011).
- Clark, P. U. et al. *Nat. Clim. Change* **8**, 653 (2018).
- Oppenheimer, M. et al. in *Special Report on Oceans and Cryosphere in a Changing Climate* Ch. 4 (IPCC, 2019).

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Author contributions

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Climate migration myths

Misleading claims about mass migration induced by climate change continue to surface in both academia and policy. This requires a new research agenda on 'climate mobilities' that moves beyond simplistic assumptions and more accurately advances knowledge of the nexus between human mobility and climate change.

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International migration and climate policy assumes that anthropogenic climate change already is, and will increasingly be, a major driver of mass migration from the Global South to the Global North. The

UNFCCC explicitly specifies the need to avert, minimize and address climate displacement¹, while the UN Security Council warns of mass climate migration and the subsequent risk of aggravating

conflicts². Although the potential for climate change to disrupt livelihoods and threaten lives is real, these policies reinforce a false narrative that predicts large numbers of 'climate refugees'. This self-referencing

narrative in scientific literature and policy reports has the consequence of entrenching climate migration as a looming security crisis without an empirical scientific basis³.

Instead of being challenged, this emphasis on securitization (presenting climate change and migration as a security risk) is actively being perpetuated by public funding schemes for scientific research intended to inform national, regional or international policy development. In doing so, these funding policies use the justification of avoiding harm to destination areas in order to keep climate migrants in their places of origin⁴. A recent EU Horizon 2020 funding call for research on climate change and migration was symptomatic of this securitization agenda, reflecting political demands rather than research gaps to alleviate “migration pressures at the source”⁵. Similarly, a Horizon 2020 research funding call from 2015 used the example of climate migration to illustrate the “real threat” of Third Country climate-driven crises to European security⁶.

The influence of this narrative is considerable, with ‘climate-induced migration’ now a common rationale for measures to strengthen and protect national and regional borders in the Global North. For example, the EU migration agenda aims to protect borders “with the intent to keep people in their places and minimize migration”⁷. The US Department of Defence names intra- and interstate migration associated with climate change as responsible for negative human security effects in destination countries⁸. Similarly, Australia is pursuing a policy of territorial control, by either keeping borders closed or extending Australian law to ‘off-shore’ processing on Pacific island countries⁹.

New international science funding schemes, such as the forthcoming call for research on Human Migration and Global Change by the internationally funded Belmont Forum and successor programmes to the EU Horizon 2020, can help in rethinking climate change and migration by offering scientists an opportunity to take a new look at what constitutes global mobility. If such opportunities are not taken, there is a danger that migration policy will continue to be based on weak scientific evidence that reinforces the self-perpetuating myth of climate change migration as a looming security crisis.

A fresh approach is therefore needed, one that enables science to actively help to shape public funding schemes for scientific research that properly captures the complex, mobile and interconnected nature and key challenges of climate change and migration. We offer the following research agenda to

achieve that aim, consisting of six priorities to help science policy to move beyond its securitized outlook.

Research priorities

First, research and research funding must enable the assumption that climate change causes mass human migration to be interrogated, rather than simply reinforcing it. There is already considerable evidence that migration is not solely driven by climate change. It is instead influenced by a mix of climatic, socio-economic, cultural and political factors¹⁰. Even when climate change does play a role, it remains difficult to determine the extent of its influence. For instance, when people have to move in the event of a cyclone, it is not always clear to what extent the cyclone can be attributed to climate change¹¹. Moreover, a lack of measures, such as early warning systems, building codes and cyclone shelters, also contributes to shaping mobility. This means that categorizing climate migrants as distinguishable from ‘non-climate migrants’ is not empirically possible in most, if not all, circumstances. As a consequence, predictions of mass climate-induced migration are inherently flawed¹².

Second, the term migration does not capture the diverse ways in which people do or do not become mobile in response to a changing climate; the term should therefore be avoided. Some people may temporarily (or even seasonally) move, while others may permanently relocate to nearby urban centres^{11,13}. Regardless, mobility commonly involves relatively short distances, meaning that people typically move within their country or region¹¹. Many may also face the problem of not being able to move to safety, while others do not want to move even when facing significant risk to their own well-being¹¹. To capture this diversity, research should shift its attention from climate migration to climate mobilities. Such a programme would encompass the multiple forms, directions and multiplicities of human movement in the context of climate change, as well as the transformative character of mobility and its impact on places of origin, transit and destination^{13,14}. It would also focus on the movement of people in more neutral (and therefore analytical) terms — avoiding assumptions that mobility is unidirectional or monocausal, or inherently positive or negative.

Third, new research supported by scientific funding programmes should examine and address climate mobilities as the new normal, rather than the exception. Movement and migration are inherent to the highly interconnected world we live in and

a standard element of social life¹⁵. As such, mobility will necessarily be part of the range of responses available to those affected by climate change¹¹. Instead of asking whether climate change causes human mobility, research should focus on whether (and if so, how) climate change will alter existing interconnections and human mobility patterns under different scenarios of global warming and mitigation and adaptation policies, and how these are in turn shaped by existing mobilities.

Fourth, it is crucial to fund and engage in research that goes beyond attempts to quantify and model new mobility resulting from climate change. Current climate migration models typically reinforce linear ‘crisis’ or ‘mass’ migration assumptions¹⁶. The news media and policy alike tend to interpret the results of these models incorrectly. For example, they often refer to the maximum figures of a range as ‘predictions’, which in turn may be used to support the politics of border securitization. Policy should instead rely on research that better accounts for the nonlinear complexity of mobility in the context of climate and social change in its evidence base¹³.

Fifth, research needs to better include affected populations in climate mobilities research. Multiple knowledge systems, such as local and indigenous knowledges, exist both among mobile populations and in destination areas, and should be included to build a stronger evidence base. The solutions to the challenges posed by climate change — whether they imply increased mobility or not¹⁷ — should be developed and formulated with the close involvement of affected populations. With better funding opportunities, indigenous organizations representing populations involved in mobility associated with climate change can lead indigenous research, or participate in co-developed research. This is important if the complexity of climate mobilities is to be captured, particularly its interconnectedness with related policy areas such as indigenous rights and human development.

Finally, research on climate mobilities needs to shift part of its focus from climate-sensitive sending areas to destination areas. Whether or not such mobility becomes a political or humanitarian problem depends on the policy choices by home, host and transit states and involved organizations, not on the mobility itself. As discussed above, global migration policy is defined by the strict border policies of popular migration receiving areas. These border policies are in turn shaped by an increasing fear of migrants among many citizens, such as in several European countries, the United States, Brazil, Australia and elsewhere¹⁸. To

expand beyond the securitization of climate-related mobility, research with the support of funding agencies also needs to focus on how to overcome the profound fear of the other. This requires new and further collaborations across social science research into belonging, the acceptance of difference and identity, and the important political, cultural and historical attributes of destination areas.

Keeping the questions open

Border securitization in current global, regional and national politics has infiltrated science policy. It is biasing public discourse and scientific and policy debates, despite the paucity of supporting evidence¹⁹. To move beyond the securitization of climate-related migration, a new research agenda is needed. Our six priorities offer a substantially different agenda on climate mobilities that prioritizes exploration, rather than minimization, of the complexity of the connections between human mobility and climate change.

A new research agenda requires funding agencies to move their focus away from a securitized outlook, allowing for more nuanced science policy on climate mobilities to emerge. A first step in this direction can be achieved, for example, through Human Migration and Global Change under the Belmont Forum fund, coordinated by Future Earth, which actively relies on academic feedback to help shape its funding priorities. The six climate mobilities priorities also speak to Horizon 2020 successor programmes, such as possible EU Mission-oriented Research and Innovation funding schemes and other future, publicly funded programmes at the national level.

Instead of having policy dictate the priorities of science, resulting in self-perpetuating false claims about climate-induced migration, the science policy process needs to allow careful and critical evidence-seeking research to indicate the main challenges ahead. In doing so, a climate mobilities research agenda can help to ensure that policy addresses the right issues from the outset. □

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References

- Nash, S. L. *Glob. Policy* **9**, 53–63 (2018).
- Boas, I. *Climate Migration and Security: Securitisation as a Strategy in Climate Change Politics* (Routledge, 2015).
- Betts, A. & Pilath, A. *J. Int. Relat. Dev.* **20**, 782–804 (2017).
- Piguet, E., Kaenzig, R. & Guélat, J. *Popul. Environ.* **39**, 357–383 (2018).
- Horizon 2020 Work Programme 2018–2020 Part 12—Climate Action, Environment, Resource Efficiency and Raw Materials (European Commission, 2018); <https://go.nature.com/31Upkvp>
- DRS-22-2015—Ethical/Societal Dimension Topic 3: Impact of Climate Change in Third Countries on Europe's Security (CORDIS, European Commission, 2015); <https://cordis.europa.eu/programme/rcn/665095/en>
- Trombetta, M. *J. Crit. Stud. Secur.* **2**, 131–147 (2014).
- National Security Implications of Climate-Related Risks and a Changing Climate RefID 8–6475571 (United States Department of Defense, 2015); <https://go.nature.com/2obMFuL>
- Suliman, S. *Globalizations* **13**, 638–652 (2016).
- Black, R. et al. *Glob. Environ. Change* **21**, S3–S11 (2011).
- Foresight: Migration and Global Environmental Change (UK Government Office for Science, 2011); <https://go.nature.com/31A0Xmr>
- Gemenne, F. *Glob. Environ. Change* **21**, S41–S49 (2011).
- Wiegel, H., Boas, I. & Warner, J. *Wires Clim. Change* <https://doi.org/10.1002/wcc.610> (2019).
- Sakdapolrak, P. et al. *Erde* **147**, 81–94 (2016).
- Urry, J. *Mobilities* (Polity, 2007).
- Missirian, A. & Schlenker, W. *Science* **358**, 1610–1614 (2017).
- Arnall, A., Hilson, C. & McKinnon, C. *Clim. Policy* **19**, 665–671 (2019).
- Foner, N. & Simon, P. (eds) *Fear, Anxiety, and National Identity: Immigration and Belonging in North America and Western Europe* (Russell Sage Foundation, 2015).
- Baldwin-Edwards, M., Blitz, B. K. & Crawley, H. *J. Ethn. Migr. Stud.* **45**, 2139–2155 (2019).

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