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A future agenda for research on climate change and human mobility

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Abstract

In the past 15 years, research activities focusing on the interlinkages between climate change and human mobility have intensified. At the same time, an increasing number of actors and processes have sought to address human mobility in the

context of climate change from a policy perspective. Hitherto, research has been limited in terms of geographical preferences as well as conceptual and methodological focus areas. This paper argues that to address the evolving policy space, future research on climate change in the context of human mobility needs to become more differentiated, integrated and generalized. This includes concerted efforts to better integrate researchers from the global South, improved cross-linkages between different datasets, approaches and disciplines, more longitudinal and comparative studies and development of innovative qualitative and quantitative methods.

INTRODUCTION

There is both a growing public and policy interest in climate change and its observed or potential impacts on human mobility. In this paper, we use human mobility in the context of climate change (HMCCC) as an umbrella term for all mobility processes ranging from voluntary labour migration to mixed migration and forced displacement. Debates about HMCCC have now become an area of broad and rich research; since the second half of the 2000s, a growing number of studies and research projects have been realized. The year 2022 was the eighth consecutive year in which annual global temperatures reached at least 1°C above the levels of the pre-industrial era (WMO, 2023). Concurrently, the period since 2015 has also witnessed several high-profile migration events, with direct, or perceived implications for Europe and Northern America where influential media and political actors are based. Debate continues about whether, and if so, to what extent adverse consequences of global warming had a triggering effect for instance on the Syrian conflict and the related forced displacement (Selby et al., 2020) or the migrant caravan in the Americas of 2018–19 (Brigden, 2018). While the causal chains remain contested, these phenomena have further increased public attention on the issue of climate change and mobility interlinkages.

At the policy level, a growing number of processes seek to address different facets of HMCCC. These include, inter alia, the Task Force on Displacement under the United Nations Framework Convention on Climate Change (UNFCCC), the Global Compact on Migration (GCM), the Platform on Disaster Displacement (PDD) and regional organizations such as the East African Intergovernmental Authority on Development (IGAD). Furthermore, migration politics are shaped by a complex set of actors within and beyond nation states, and climate change plays an increasingly important role in shaping migration policy priorities. Nevertheless, policymakers and frameworks still struggle to effectively address HMCCC in an effective and timely manner. Bridging the gaps between relevant policy and scientific communities in the field of climate, human mobility and development is challenging as notions and narratives related to human mobility differ significantly (Schraven et al., 2019) and capacity building and policy dialogue continue to be more prominent than measures "on the ground (Huang, 2022).

In the light of current political, scientific and ecological challenges and developments, it is therefore important to take stock of advances in the field and discuss future directions for research on HMCCC. This paper highlights enduring research gaps and challenges but its main goal is to stimulate and contribute to a much needed conversation on a new research agenda on HMCCC for the next decade to meet the needs of states, global policy frameworks and people who are vulnerable to the impacts of climate change. We believe that a central tenet of new research should be that HMCCC concerns people's "capability to choose where to live, including the option to stay, rather than as the act of moving or migrating itself" (de Haas, 2021). We further believe that improved knowledge will be essential in bridging the gaps between media and political discourses about HMCCC, and the lived experiences and empirically documented science on HMCCC.

RESEARCH ON CLIMATE CHANGE AND MIGRATION: RECENT TRENDS AND FINDINGS

Research into climate change and migration has most typically been local, with in-depth cases using qualitative methods. As many as 1737 publications and 694 case studies were recorded in one database by the end of 2020 (Piguet, 2022). Much of this research has investigated droughts, floods, sea level rise, cyclones, storm surges and glacier retreat and normally taken place where needs are most pressing, or where states have been supportive. Quantitative approaches have also been used effectively, with large *n* household surveys to reveal migration histories. For example, panel data from health or demographic surveys has been compared with climate data for potential interferences (e.g. Nawrotzki et al., 2013 for Mexican-US migration; Mueller et al., 2020 for migration in East Africa) and effectively unveiled the drivers and impacts of moving. Studies have also drawn on mixed method approaches combining qualitative and quantitative research methods (Sobczak-Szelc & Fekih, 2020; van der Geest, 2011).

Accordingly, a better understanding on climate change and mobility interlinkages has emerged. The focus of this work has often been on how climate change triggers mobility. Climate factors are now understood and accepted as drivers of mobility, particularly in the context of rural livelihoods and high dependencies on natural resources (Hoffmann et al., 2020; van der Land et al., 2018). However, the exact way that mobility manifests can be very nuanced. Climate change, through an interaction with non-climatic drivers of mobility such as economic, social, cultural, demographic and environmental factors, intensifies or alters existing mobility patterns (Black et al., 2011), but can also lead to new forms of mobility, especially in the case of sea level rise and narratives around 'disappearing islands' (Kelman, 2020). In the case of climate extremes, a further complication is the difficulty in attribution or ascribing a particular event to climate change (James et al., 2019; Thalheimer et al., 2022). Environmental factors are rarely the only, or main drivers of mobility, even in the case of rapid-onset hazards such as floods as risk is socially constructed (Oliver-Smith, 2020). People in places with similar levels of exposure to climate hazards are not equally sensitive or vulnerable, and they cope and adapt in different ways and with a range of mobility destinations, rhythms and outcomes (Warner & Afifi, 2014). Immobile populations are those living in climate risk, who either choose to stay, or else are unable to move and so might be termed "trapped" (Ayeb-Karlsson et al., 2018) although it should be noted that commuting and other short term livelihood related changes in location can still occur (Blondin, 2023).

Despite the rising interest in numbers of people affected by HMCCC, data and projections or scenarios are still imperfect. According to the Intergovernmental Panel on Climate Change (IPCC), in the future there is expected to be an increase in HMCCC but given the complex physical, socio-economic and behavioural assumptions, making projections for future numbers is problematic (IPCC, 2018). Nonetheless, some researchers have begun to respond to this challenge (e.g. Clement et al., 2021; Rigaud et al., 2018).

The impacts of HMCCC have also attracted research interest. Most scholars agree that more voluntary and agential forms of mobility—and in exceptional cases also planned relocation—have the potential to be an important adaptation measure through which vulnerable people can reduce poverty and increase resilience (e.g. Wiederkehr et al., 2018). In contrast, when people are displaced, or trapped (i.e. when they possess less agency), outcomes tend to be worse and might represent a form of loss and damage (Tschakert et al., 2019). It is also necessary to look beyond mobile populations and recognize the challenges and opportunities for households and people who are supported by migrants or who might be left behind (Gemenne & Blocher, 2017). Research has also looked into how policy can and does relate to HMCCC, with work including the evolution of mobility-related policies under the UNFCCC and GCM (Warner, 2018), protection coverage for affected people (Wilkinson et al., 2016) and the potential for national or regional frameworks to address these shortcomings (Corendea, 2016).

THE NEED FOR NEW RESEARCH APPROACHES

Academic conceptualizations of HMCCC are beginning to congregate around "mobilities perspectives" (Wiegel et al., 2019). This framing embraces the inclusion of understudied vulnerable groups and those unable or unwilling

to move, in addition to the impacts of moving or staying. This can lead to a broader and deeper understanding of HMCCC, including the losses and damages or adaptive outcomes it might entail (Afifi et al., 2016; McNamara et al., 2018). Furthermore, it might lead the discourse on HMCCC away from perceptions of it as an issue of security (Bettini, 2013). To do so, we contend that research on HMCCC needs to become more differentiated, integrated and generalized by differentiation, we mean research which addresses a range of disaggregated data and knowledge on different strata of society and regions. By integration, we wish to promote the unification of disciplines, networks and approaches. By generalization, we refer to the ways in which a shared body of literature, theory and methodologies must develop and be exploited to address both outstanding and newly emerging research questions.

Differentiated research

Differentiated research is vital for producing focused and disaggregated knowledge on HMCCC. Several recent meta-analyses (e.g. Cattaneo et al., 2019; Hoffmann et al., 2020; Hunter et al., 2021; Kaczan & Orgill-Meyer, 2020) reflect the need for more varied research in HMCCC. There are research gaps on the particularly vulnerable such as the young, or elderly, but also in terms of access to resources, work, services and impacts on physical and mental health for both mobile and immobile groups. Well-being depends on pre-mobility conditions such as desire to move and existing health systems along with post-mobility interventions such as access to food, shelter and health care upon arrival. Negative effects on immobile and mobile populations' mental health have been reported due to heatwaves, loss of property, livelihood and identity.

The need for more differentiation also affects geographical aspects. There are numerous studies on the Pacific, Vietnam, Bangladesh, India, Mexico and to some extent the countries of West and East Africa. In contrast, there are very few studies on North Africa, Southern Africa, Central Asia or South America. Moreover, most published research is by authors from the Global North (Piguet, 2019). There are also focus areas when it comes to specific climate-related hazards; droughts and floods have been studied more than for instance heatwaves, riverbank erosion or salinity intrusion.

Barriers to producing new knowledge are related to capacity including a lack of researchers who know specific local and vulnerability contexts and insufficient funding, infrastructure or time to carry out and publish research. Accordingly, gaps concerning differentiated data could be considered as predominantly technical in nature and so could be overcome through investment and capacity development. For instance, the creation and better exploitation of regional knowledge platforms would facilitate the comparison between countries, localities and regions, while the experience of COVID-19 has shown the potential for remote fieldwork, and so the possibility of overcoming geographical barriers (Hermans et al., 2021).

Without differentiation of research it is doubtful that the differentiated nature of societies, environments and socio-ecological systems can be fully understood. Moreover, actual or proposed policy frameworks focused on narrower geographical (Oakes et al., 2022) or demographic (UNICEF, 2022) bounds stand a much better chance of gaining traction and contributing to successful outcomes through such research.

Integrated research

When studying interactions within socio-ecological systems, multi- and interdisciplinary research is increasingly perceived as essential; for this reason, future research needs to further integrate data, approaches and disciplines. A multi- or interdisciplinary application of methods holds potential for the robust analysis of qualitative data. Topic modelling for instance is a statistical model which is used to analyse the frequency and distribution of certain key words, bringing together qualitative and quantitative research approaches to identify and assess

key research topics, and how these relate within and across documents (Thalheimer et al., 2021). Qualitative Comparative Analysis (QCA) has the potential to integrate in-depth qualitative and quantitative data and allows complex interlinked influence factors of (im)mobility to be traced systematically at different scales, from local case studies to regional and global meta-analyses (Groth et al., 2020). Similarly, Q method provides a way of understanding how people subjectively conceptualize climate risk and migration (Ayeb-Karlsson et al., 2020; Oakes, 2019; Van der Geest et al., 2019) through the combination of a participatory qualitative process and quantitative factor analysis.

Quantitative and participatory approaches, which can disentangle climate and non-climate drivers, are also developing. Bayesian networks are graphical models which can model complex phenomena in a straightforward manner. Due to this accessibility, they can be effective in allowing policy actors or those affected by the adverse effects of climate change to express their understandings. They show promise for assessing the strength, directional influence and the interplay of direct and indirect migration drivers using conditional probabilities and as such are promising tools to deal with multicausality and uncertainty of complex processes such as mobility. A participatory study of the Ethiopian highlands used Bayesian Networks to unveil the links between environmental perception and to produce recommendations such as how to implement social and water conservation measures (Groth et al., 2021). Probabilistic event attribution and attribution studies are a fast-evolving field of climate science (Otto et al., 2016). The latter have been used in the context of loss and damage and can provide useful insights for HMCCC (Thalheimer et al. 2022).

A range of modelling tools show promise, but to maximize utility and robustness, should be integrated with IPCC Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs). Large-scale spatial analysis by the World Bank used gravity modelling to consider population movements from areas more impacted by climate change, considering RCPS and SSPs (Rigaud et al., 2018; Clement et al., 2021), albeit with the lack of inclusion of adaptative or technological responses identified as a limitation (Selby & Daoust, 2021). Quantitative data have also been effectively integrated with spatial data (Hermans-Neumann et al., 2017; van der Geest et al., 2010). Given their strengths to depict complex decision-making processes, the promise of agent-based models (ABMs) is yet to be realized and for this reason might be better seen as tools of theoretical exploration rather than for understanding real-world problems (Manzo & Matthews, 2014). Nonetheless, progress has been made; for example, a model based on qualitative and quantitative data in Thailand simulated mechanisms of rural mobility, as opposed to predicting numbers of migrants (Entwisle et al., 2016). However, a recent review of ABMs highlighted deaths of models considering return migration, socio-ecological feedbacks as well as little standardization in design (Thober et al., 2018). Modelling could progress through advances in cloud-based geo-spatial modelling platforms such as Google Earth Engine and their integration with big data. Big data present an exciting opportunity to mine a rich source of information. However, it is important to ground big data in fieldwork to provide interpretation, verification and context for analysis and so make the researcher more critical and reflective (Boas et al., 2020). Although it is still early, machine learning offers opportunities for representing the complexities in socio-environmental systems and can be effective when data on the ground is not available or practical to generate (Robinson & Dilkina, 2018).

As the key questions of human–environment interactions cannot be addressed within the confines of a single discipline, integrating knowledge from both the natural and social sciences is critical. Interactive and participatory research methods offer an appropriate method for integrating knowledge from various disciplines. Understanding and refining model assumptions benefits from in-depth exchanges between qualitative scholars and model developers. For example, "groundtruthing" through empirical fieldwork can inform both parameterization and model design. In turn, qualitative research could draw on quantitative and modelling approaches to identify relevant cases for in-depth research. For example, respondent-driven sampling is able to bring a quantitative rigour to the selection of qualitative research participants (Luetz & Havea, 2018).

A major barrier for progress therefore relates to collaboration between disciplines. Integrated research will foster integrated policy. To effectively do so, research must involve political and policy perspectives, including in

setting out research problems and questions. Science also needs to do better in embracing the "other"; qualitative, quantitative and modelling scientists must get out of their comfort zones and work together to set and answer integrated research questions.

Generalization of research

Finally, future research on HMCCC needs to strive for more generalizability. New ways of exploring the linkages among climate factors and human mobility are needed and revisiting more "general" migration theory might provide insights (de Sherbinin et al., 2022; Willekens et al., 2017). Mobility responses in the context of slow-onset environmental hazards are difficult to measure quantitatively due to the indirect link between livelihoods to gradual changes in the climate regime. Longitudinal and comparative studies will be essential in providing data on how such livelihoods are changing with mobility, adaptation or immobility. There are also a wider range of temporal and spatial mobility responses which current data-gathering practices might not address, with the interaction of sudden-onset hazards and slow-onset processes a further complication worthy of research. Certain authors (e.g. Burrows & Kinney, 2016) have raised the question whether mobility related to climate change might intensify competition over resources and conflict, or conflict displacement could lead to competition over resources especially in receiving areas that are already characterized by natural resource scarcity. Others (e.g. Adamo & Curran 2012) argue that resource scarcity may actually promote greater cooperation. However, by considering such interactions, the role of political economy more generally is brought into focus.

Further work is required on the forms of mobility and their contexts, which are experienced by distinct social groups quite differently. This can lead to very different ways of coping, adaptation and longer-term resilience (or the lack thereof). For example, Translocality, existing in two or more places, is understudied as it is multi-layered and arguably limited by a sedentary bias. Mobility continues to be perceived as exceptional, or abnormal by the general public and policymakers of the Global North and sometimes South (Etzold, 2017; Sakdapolrak et al., 2016). Transnational communities maintain social, familial, cultural or economic links across the borders of nation states but still comparatively little is known about the formation and development of their distinct identities in different cultures (Faist, 2010).

This shows the need for intensified research in destination areas. For instance, coastal city areas prone to sea level rise require further analysis focusing on livelihoods, vulnerability and (im)mobility. Such knowledge is essential to promote good practice and effective forms of development cooperation that help to maximize the positive potential of mobility and at the same time help to minimize possible negative aspects such as labour exploitation. Agency cooperation is another understudied area. There is little research on the role that large United Nations (UN) agencies and other organizations such as NGOs play in creating the conditions through which migration takes place and is managed. States may be first and foremost responsible for displaced persons in the vast majority of cases but individual and collaborative efforts of organizations at both the policy- and field-level merit attention, particularly considering the abilities of international organizations to both carry out and counteract state decisions and projects. That Member States are the primary donors to such agencies complicates matters and places a potential strain on future collaborative efforts (Lakeman & Oakes, 2022). Finally, looking at how the migration policies of receiving countries might influence cross-border mobility related to climate change could be a fruitful research topic, and one that has so far received little attention.

While above we have stated the need for differentiated and integrated research, we also feel that a more general approach is warranted to advance HMCCC into a more mature discipline. Through a more fully developed mobilities approach which situates mobility in the wider context it will also be more possible to make enduring and mutually beneficial links with effective policy which is attempting to address climate, mobility and a raft of other environmental, economic and social priorities.

CONCLUSION

Significant progress has been made in the field of HMCCC in recent times. This is true in research but also policy, as an increasing number of actors and processes address a range of aspects within the climate mobility nexus—even if policymakers can remain reticent in comment and action. However, as the discipline of HMCCC is young, it can, will and must continue to evolve. As described here, future research needs to be more differentiated and integrated, but also has to strive for more generalizability. The question of how this should be realized is not straightforward. Broadly speaking, the more people have control over if, when, where and how they move, the more likely they are to have beneficial outcomes. Better knowledge can boost the agency needed for people to make informed decisions with positive results and enable states to act on the recommendations of the UNFCCC Task Force on Displacement by integrating climate change and migration into policies and strategies, thus facilitating orderly, regular and safe migration. To have the maximum impact, scientists need to close the gaps between research, practice and policy professionals. Based on experiences in such projects as "TransRe" (Rockenbauch et al., 2019) or "Where the rain falls," (Warner & Afifi, 2014) an intensified utilization of non-academic communication techniques such as policy reports and briefs, videos and social media alongside academic publishing and dissemination should be realized. In this way, science can contribute to both horizontal and vertical policy coherence. Specifically, it can create further horizontal synergies between mobility, development and climate fora, but also downwards from global frameworks and upwards from national and local levels. Policy-relevant and influencing research will maximize the chance that future HMCCC can have more adaptive outcomes for those moving, in addition to sending and receiving communities.

PEER REVIEW

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Data sharing not applicable - no new data generated: Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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