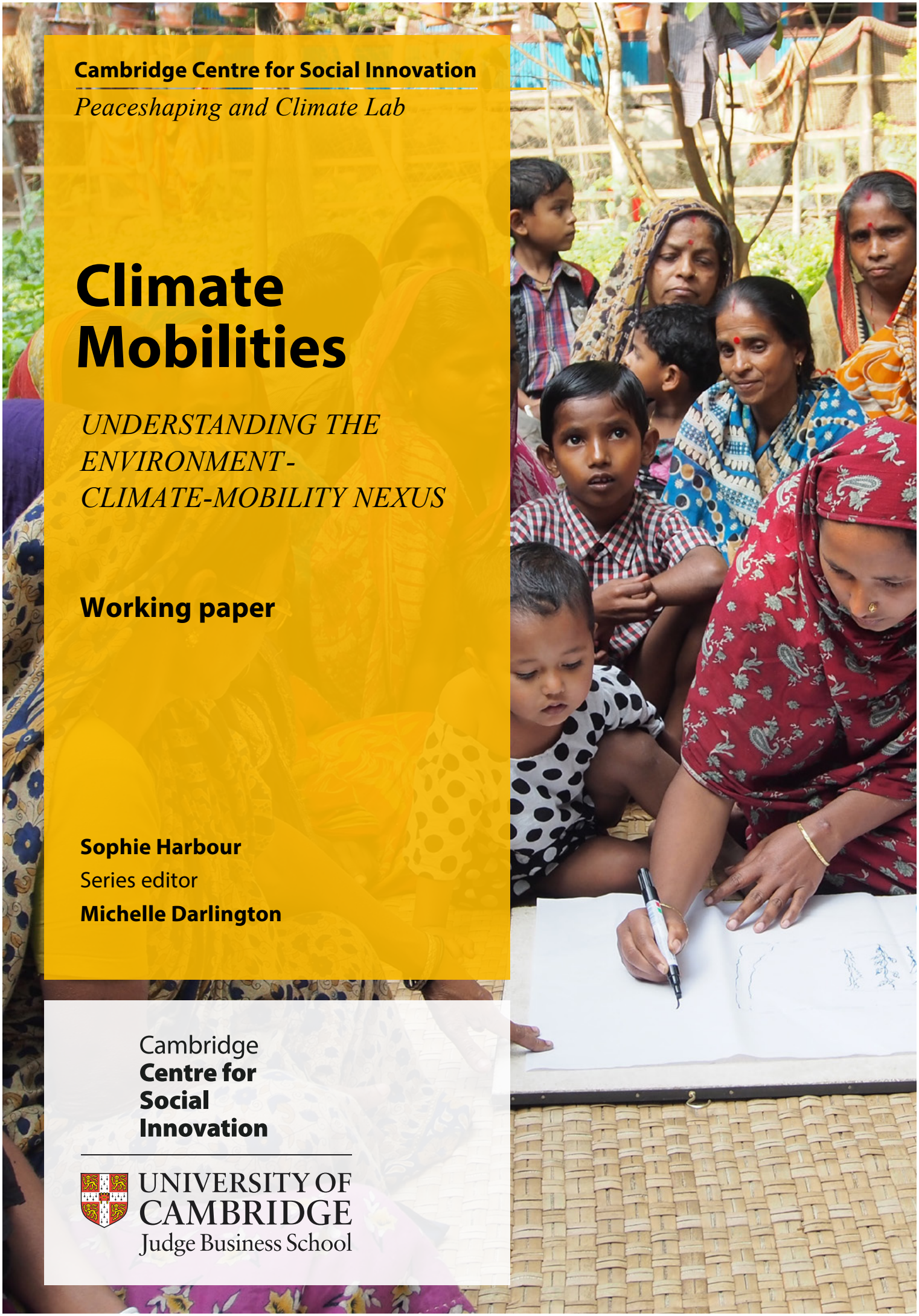

Cambridge Centre for Social Innovation

Peaceshaping and Climate Lab

Climate Mobilities

UNDERSTANDING THE ENVIRONMENT-CLIMATE-MOBILITY NEXUS

Working paper

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Series editor

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Cambridge
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UNIVERSITY OF CAMBRIDGE
Judge Business School

Front cover image: Participatory mapping exercise in Jhalokhati, Bangladesh, see page 31. Photo by Sarah Castine / CC BY-NC-ND 2.0

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The Cambridge Centre for Social Innovation at Cambridge Judge Business School serves as a platform for research and engagement with social innovators, academia, and policymakers in the UK and globally. Its primary focus is to understand, promote, and collaborate with social innovators while supporting the creation of social ventures and projects.

Social innovation develops creative and practical solutions to complex social challenges. While many social innovators work in non-profits, they are increasingly found in government and corporations. As sector boundaries blur, social innovation now happens at their intersection. That's why our Centre focuses on leadership for social change—wherever it takes place.

The Cambridge Peaceshaping and Climate Lab is an initiative of the Cambridge Centre for Social Innovation (CCSI). It aims to stimulate research, facilitate knowledge transfer, and support organisations and practitioners working at the intersection of peace and climate.

The Lab fosters an interdisciplinary space for collaborative action, addressing the overlaps between climate change and human conflict. We explore research, build partnerships within and beyond academia, and take a proactive approach—focusing on resilience building and adaptation rather than reliance on outdated, reactive policies.

Climate-related shifts continue to drive conflict, placing pressure on existing structures, resources, and networks designed to prevent and mitigate crises. Our work is guided by the belief that inclusive social innovation—rooted in and inspired by local knowledge—ensures societies are better equipped to respond to climate challenges across diverse contexts.

This paper is part of a series of working papers commissioned by the Cambridge Peaceshaping and Climate Lab, addressing the need for academic rigour in evidence-based innovation for climate and conflict challenges.

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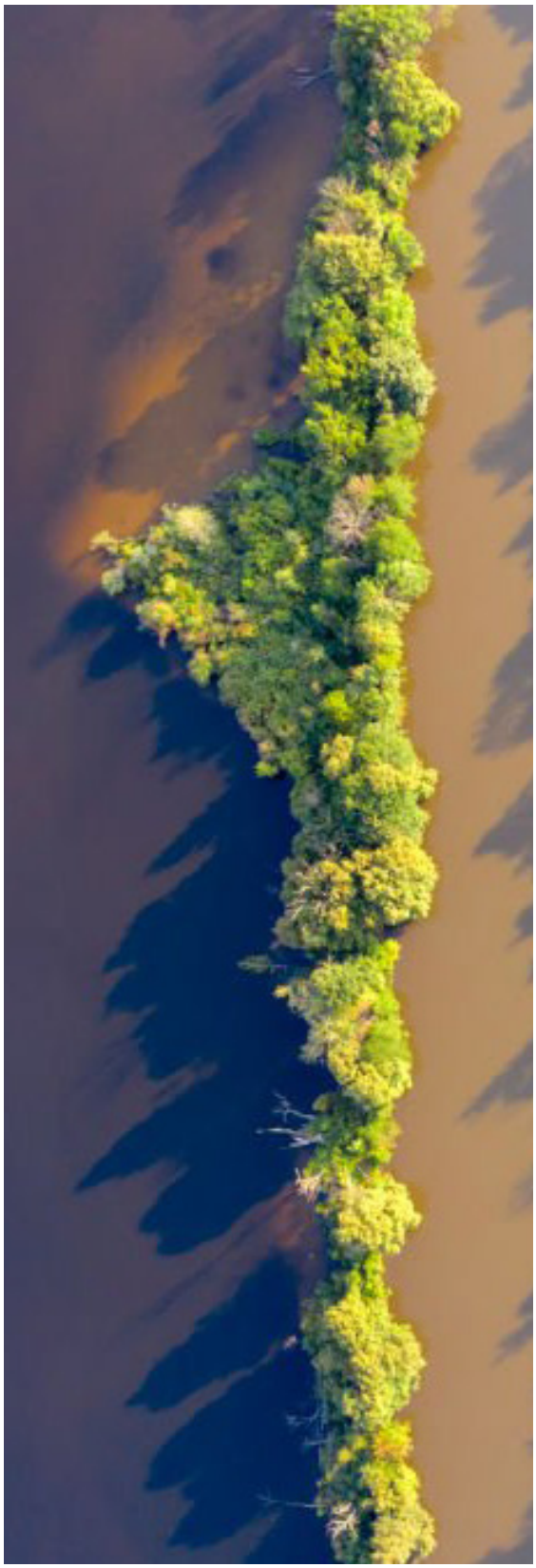



Climate mobility in all its forms is fast emerging as one of the most complex and pressing puzzles of environmental, climatic and nature-based changes.

EXECUTIVE SUMMARY

'Humans are born migrants: our evolution is fundamentally linked to the act of migration, to moving from one place to another and adapting to that environment'.

In 2007, in *Origins: An Atlas of Human Migration* Russell King said: 'In a sense, humans are born migrants: our evolution is fundamentally linked to the act of migration, to moving from one place to another and adapting to that environment'. In her recent book, *The Next Great Migration* (2020), Sonia Shah takes this claim even further: migration is not merely a human cultural tendency, but a biological imperative of all life on earth, and, in opposition to modern-day framings of migration as a crisis to be averted, it is the key answer to the survival and flourishing of all forms of life. Echoing this, Megan Daniels' extensive historical and archaeological endeavour *Homo Migrans* (2022) shows how while 'migration might be conceived of as physical movements of humans from one place to another…on a deeper level it should press us to recognize movement and mobility as basic organizing forces of human and all earthly reality, as hidden as it often seems within that reality (or denied by certain members of that reality)' (Daniels 2022: 18).

Today, migration is noted as the 'human face' of climate change (Gemenne 2011: 225; Rigaud et al. 2018) and the climate mobilities perspective is emerging to form "a body" – not just a body that reacts with panicked movement but one that can be caught in various structural failures or can take on different forms of agency to enact adaptions for itself and others. In other words, climate mobility encapsulates far more than migration and people are continually adopting 'a portfolio of responses' to climate and environmental change (Caretta et al. 2023).

While mobility should be normalised, the various experiences of climate mobility have the potential to undermine human safety and welfare, with displacement in particular threatening 'the totality of people's human rights and the well-being of communities and States' (Miron 2023: 7-8).

As such, climate mobility in all its forms is fast emerging as one of the most complex and pressing puzzles of environmental, climatic and nature-based changes.

Unsurprisingly, the past two decades have brought a considerable surge in the amount of research done on the relevant issues, generating a rich body of literature. Even so, this is still an area of research in its infancy, and the overall volume of research and number of researchers working actively in this field are small in comparison with longer-established disciplines and subdisciplines in the natural and social sciences (McLeman, 2013: 210).[1] In addition, the fragmentation of the research and the absence of complete, cohesive and organised data on populations, movement patterns and climate impacts contributes to poor information and a lack of transparency (Xu & Famiglietti, 2023).

This review tracks the key developments and themes in this emerging literature, both across climate mobilities more broadly and then with a focus on the centrality of water to the climate-mobility-environment nexus. It demonstrates how paucity in data and inclusive empirical work hinders our ability to design, implement and share effective interventions for protecting against current and future vulnerabilities; how siloes of research and practice, which do little to engage local communities, belittle efforts to address climate challenges; and how urgent attention must be given to the proactive establishment of climate resilient communities by drawing on indigenous knowledge, people-centred funding, and flexible policy making. Ultimately, widespread and communicative cross-collaboration and partnerships are required from the most global to the most local level and from the most distinct of disciplines to the most diverse of stakeholders.

This academic review is commissioned by the Cambridge Peaceshaping and Climate Lab (CPCL). Established in January 2024, the Lab endeavors to stimulate versatile research, facilitate effective knowledge transfer and support informed practitioner action to address the challenges of modern peacebuilding. As an interdisciplinary space, the CPCL prioritises bridge-building and collaborative action to respond to the impacts of climate change on human conflict. In doing so, it aims to provide as relevant and cross-cutting an environment as possible for understanding the contemporary context within which we must confront these evolving challenges. The movement of people, internally and internationally, is a part of this context.

KEY FINDINGS

Paucity in data

Paucity in data and inclusive empirical work hinders our ability to design, implement and share effective interventions for protecting current and future vulnerabilities.

Siloes of research and practice

Siloes of research and practice, which do little to engage local communities, belittle efforts to address climate challenges.

Need to establish climate resilient communities

Urgent attention must be given to the proactive establishment of climate resilient communities by drawing on indigenous knowledge, people-centred funding, and flexible policy making.

INTRODUCTION

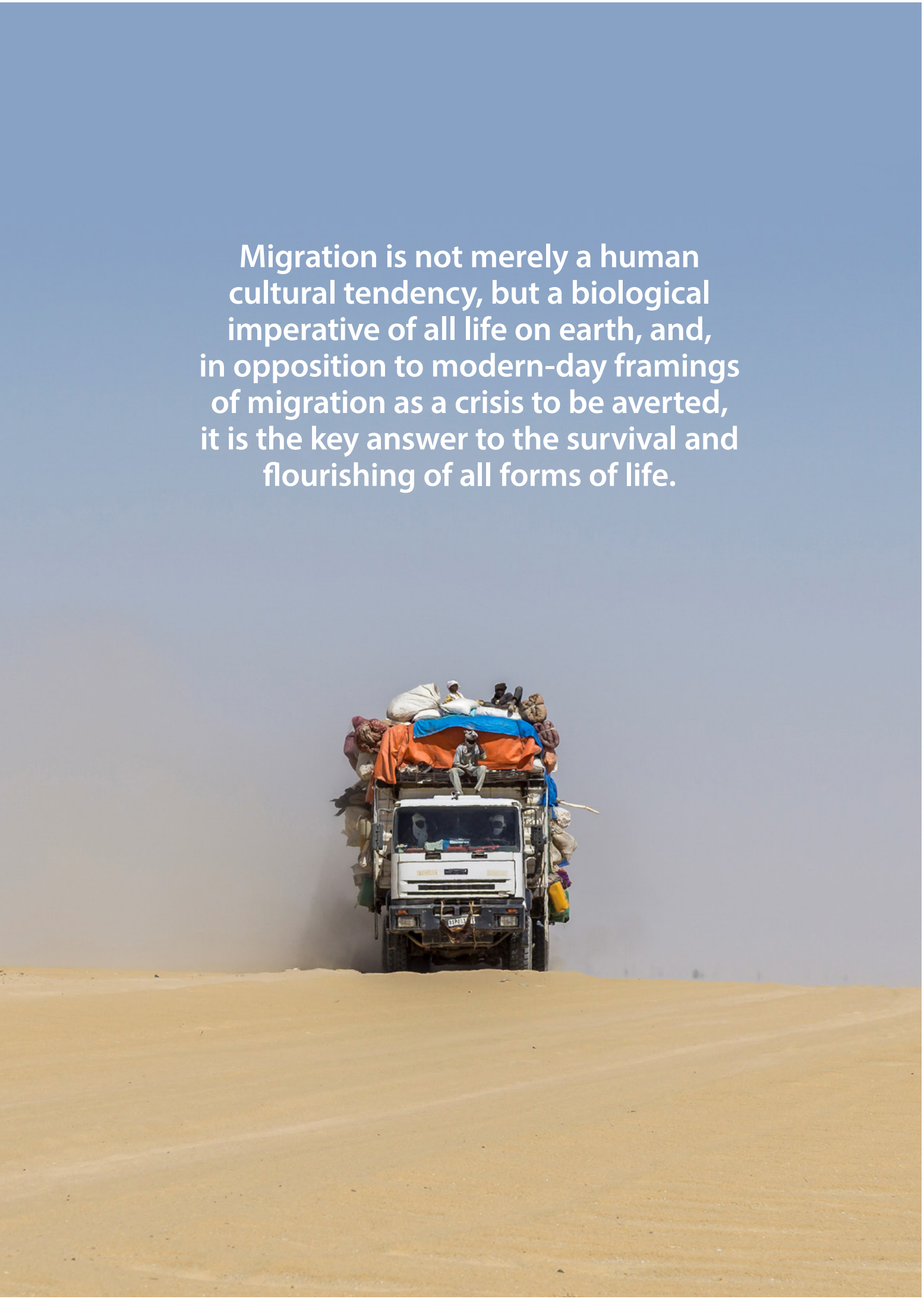
'Climate mobilities' has emerged as a term to encapsulate a broad range of experiences linked to the interrelationship between climate change and human movement.

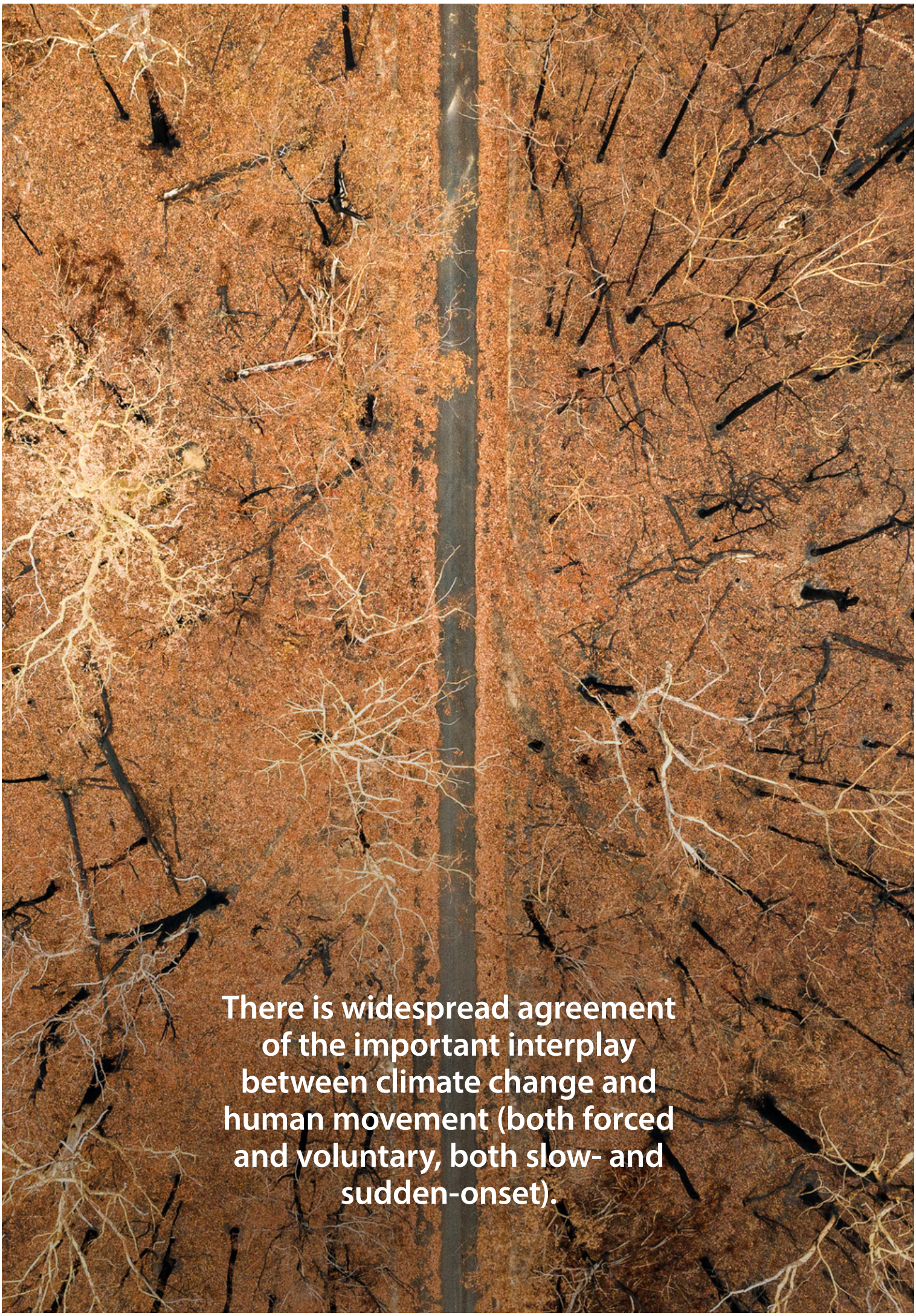
Many leading organisations continue to refer to 'climate migration' which, according to IOM, is a subset of 'environmental migration' where the change in the environment is due to climate change (IOM 2019: 31), but in academic literature and scientific publications there is a noticeable shift to a 'climate mobilities research agenda' which focuses not only on drivers and outcomes of migration but on 'the practices, motives, and experiences of mobility and immobility in the context of environmental change' (Cundill et al. 2021; Wiegal, Boas & Warner 2019: 1).[1] The terminology across disciplines is still mixed, and international reports, scientific and academic research, government initiatives and practitioner tools, use mobility and migration together.[2]

The field exploring the environment-climate-mobility nexus is interdisciplinary and global, as the most recent reviews of literature have suggested (Adger et al. 2024b). Following their example, this review continues to track key debates of, gaps in, and responses to the subject of climate mobility. It includes a broad review of literature including priorities for future research (Section A), an account of why water is an important focus (Section B) and a selection of recommendations for practitioners (Section C).

Sahara, Chad.

Migration is not merely a human cultural tendency, but a biological imperative of all life on earth, and, in opposition to modern-day framings of migration as a crisis to be averted, it is the key answer to the survival and flourishing of all forms of life.





There is widespread agreement of the important interplay between climate change and human movement (both forced and voluntary, both slow- and sudden-onset).

A | SCOPE OF THE LITERATURE

The links between changes in climate and patterns of human movement have rapidly attracted attention in the last decade. The subject is now a common priority for researchers, policymakers, governments, and international organisations.

1 | REASONS FOR CLIMATE MOBILITY RESEARCH

There is agreement across the academic world that the relationship between climate and mobility prompts challenges which require dedicated research and specific action. There are several, overlapping reasons why:

RECOGNITION OF LINKS/EVIDENCE

There is widespread agreement of the important interplay between climate change and human movement (both forced and voluntary, both slow- and sudden-onset).

Comments on climate and migration began to circulate internationally as early as 1992 (IOM, 1992) but, initially, there was hesitancy to adopt a focus on the interplay between the two. There was little consensus on whether the subject deserved recognition as a distinct area of migration studies and there were questions over the conceptualisation of climate change as a primary cause of forced movement (Black, 2001). Debates over terminology also hampered the development of a focused and cohesive discussion (Gemenne 2011; Laczko & Piguet, 2014: 2).[3] Some even explicitly called for the rejection of the subject as a field of study.[4]

These debates have not subsided, but the literature documenting the relationship between climate change and human movement is now extensive and, since 2006, has been growing in number exponentially (Milán-García et al. 2021).[5] It is a feature of the work of authoritative organisations on the themes of migration and climate separately, like the International Organisation for Migration (IOM) and the Intergovernmental Panel on Climate Change (IPCC 2022; IPCC 2023).[6] [7] Governments and international organisations have gradually compiled dedicated reports to present and explore the links (Jäger et al. 2009; Foresight 2011; Asian Development Bank 2012; Adger et al. 2014; Rigaud et al. 2018; Clement et al 2021) and scholars, academics and researchers have documented the global effects and begun synthesising existing research across disciplines (Laczko & Piguet 2014; Ionesco, Mokhnacheva & Gemenne 2016; Cattaneo et al. 2019; Milán-García et al. 2021). This is done both generally and in regard to specific dimensions – e.g., Black et. al (2013) focus on climate disasters.[8] Future research frontiers and priorities are actively identified (Simpson et al. 2024; Adger et al. 2024a).

THREATS AND VULNERABILITIES

There are evident threats to human safety and the creation or exacerbation of vulnerability that stem from both the mobility and immobility of people and groups.

In a 2014 report, the IPCC suggested that climate change impacts would pose one of the greatest threats to people, ecosystems, and development goals over the coming decades (IPCC 2014a). By the time of the 2023 report, approximately 3.3 to 3.6 billion people were living in contexts that are highly vulnerable to climate change and many of these changes are shown, with a high confidence level, to reduce food and water security, hinder efforts to meet Sustainable Development Goals (SDGs), and compromise welfare and economic institutions (IPCC 2023: 5). Within this, displacement and involuntary migration are already generating and perpetuating vulnerability (UNHCR 2021; IPCC 2022: 11) and scientific studies have repeatedly identified mass displacement and migration as among the most devastating impacts of climate change-induced flooding, cyclones, and droughts (Islam, 2022). Studies are also increasingly identifying the risks that the inability to move creates in populations (Adams & Kay 2019).

In light of the influence of climate change on patterns of movement, reports exploring specific statistics on 'climate migration' have become popular. Some, such as the Internal Displacement Monitoring Centre (IDMC), show estimated displacements already occurring (IDMC, 2022) and others, such as the World Bank, have produced projections of future forced migrations (Rigaud et al., 2018; Clement et al., 2021).[9] [10] Even those who critique alarmist and apocalyptic narratives, are adamant that action and attention is necessary (Bettini

2013; Miron 2023). In Bettini's words, 'gilding the bitter pill [of the threat of climate change] would be an act of irresponsibility, denial or intentional deceit' (Bettini 2013: 63).

There are also links between climate mobility and other issues of international prominence such as conflict and health. In the case of conflict, many early narratives and policy debates linked 'mass migration' predictions to 'climate conflict' (Hartmann 2011; Boas 2015). The problematic consequences of these links are challenged and scholars urge for more nuanced approaches (see below). Nonetheless, the interrelationship between climate change, human movement and conflict has gradually encouraged more in-depth research (Reuveny 2007; Raleigh et al. 2008; Burrows & Kinney 2016; Fröhlich 2017; Abel et al. 2019).[11] The consideration of conflict also sits within the context of debates about how to 'redefine' security in an age of climate change (Hardt 2021; Kameyama & Takamura 2021).[12] In the case of human health, a field of study specifically exploring how health impacts are mediated via migration and displacement is a growing area of research (Schwerdtle et al. 2020; Schütte 2017; Shultz et al. 2019; Parrish et al. 2020; Orcutt et al. 2020).[13] Other notable interwoven issues include unemployment (Mueller, Gray & Hopping 2020; Liu & Lin 2023).

CONTEXTUALISATION AND COMPLEXITY

There are efforts to contextualise numerical projections and to account for the immense complexity of climate shifts, mobility and migration patterns, and the interplay between the two.

Numerical predictions and projections have generated both public and media attention and prompted international action in the face of severe threats to people globally. At the same time, they have contributed to a sense of impending crisis, worrying 'apocalyptic' narratives and a 'securitisation' of responses (Boas 2015)(Boas et al. 2019).[14] Not only have such projections been reviewed and questioned (Gemenne 2011) and criticised as 'guesswork' (Kolmannskog 2008), the consequences of such narratives, in which climate migration is a 'threat', generate concern (Hartmann 2010; Gemenne 2011). This has prompted scholars to urge for both context and caution in alarmist projections and spurred research to understand the complexity of the interrelationship between climate and mobility/migration. Since 2010, there has been a notable shift (a 'critical turn') in theoretical debates to introspection and discourse analysis (Veronis et al. 2018). In addition, the majority of scholarship in the field now treats migration as one among many strategies *of* adaption, tackling the narrative that migration is a threat that needs to be 'mitigated' or 'prevented' (McLeman 2016; Vinke et al. 2020)

Current understandings of migration and mobility are primarily influenced by a shift in attitudes *towards* migration rather than a shift in migratory behaviour itself (Isayev, 2017: 11-12). In part, we owe this to the way in which media and other discourses have portrayed the topic: weaponising emotion, constructing harmful racial and foreigner categories, and dehumanising migrants.[15] We also owe it to the deep historical and colonial ties to the framing of migration (i.e., 'sedentary bias' as coined by Bakewell (2008)).[16] To counter this, scholars try to contextualise migration, historicise trends, and portray 'a migration-centered view of human history' (Daniels 2022).[17]

It is not just the calls for nuance prompted by harmful narratives that characterise the complexity of climate mobility research.

More generally, the drivers, impacts and features of human mobility are inherently complex and multifaceted (McAdam & Wood, 2023). Migration studies has long documented the various, interwoven factors which feed into how and why people move (Hugo 1996; Tacoli, 2011).[18] Black et al (2011) have outlined a framework of five 'families of drivers' which includes economic, political, social, demographic and environmental drivers and these continue to be the primary groupings used in the development of new frameworks (Parrish et al. 2020). The difficulty in attributing movement solely to climate change is recognised by leading governmental reports on the subject (Foresight 2011) and further complicated by the multifaceted nature of climate change itself (i.e., fast/sudden versus slow onset (Parrish et al. 2020). Deterministic accounts must thus be challenged (Gemenne 2011; Horton et al. 2021: 1279). Researchers continue to present new potential conceptual models for identifying and understanding the drivers of migration (Parrish et al. 2020).

Finally, on the definitional point – debates to define terms relevant to climate mobility continue to be heated and some scholars will call for establishing common typologies for better research amidst such complexity, as Gemenne (2011) has done. At the same time, arguments over terminology can sometimes be unproductive and draw attention away from the primary duty to simply treat vulnerability as it presents (Durand-Delacre 2023).

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2 | METHODOLOGIES IN CLIMATE MOBILITY RESEARCH

There has been a clear, steep rise in the number of scientific publications since the early 2000s and this has prompted continued efforts to track the variety of methods employed; leading to several systematic reviews specifically from a methodological perspective. Updating his 2010 review, Piguet (2022) provides a useful overview of the trends in research methods in scientific publications addressing the environment-climate-migration nexus. This complements narrower syntheses (Borderon et al., 2019; Cattaneo et al., 2019; Ferris, 2020; Kaczan & Orgill-Meyer, 2020; Maretti et al., 2019; McLeman, 2018; Veronis et al., 2018), methodological overviews (Berlemann & Steinhardt, 2017; Fussell et al., 2014; Safra de Campos et al., 2017; Ty Miller & Thai Vu, 2021), meta-analyses (Beine & Jeusette, 2021; Hoffmann et al., 2020; Šedová et al., 2021), strictly qualitative methods reviews (Gemenne 2018) and strictly quantitative reviews (Hoffmann, Šedová & Vinke 2021).

General challenges include: underdeveloped bridging of empirical study and theoretical development (especially discourse analysis) (de Sherbinin et al. 2022; Veronis et al 2018) and limited availability of suitable data at appropriate spatial and temporal levels (Gemenne 2011; Eklund et al 2016; Neumann & Hilderink 2015; Parrish et al. 2020). This latter challenge is exacerbated by the paucity and incompatibility of datasets (Parrish et al. 2020).

MODELLING

Migration modelling has a long history with the primary intention being to observe current migration flows and predict future migration flows (see Klabunde & Willekens, 2016). Since the inclusion of environmental and climate factors, modelling techniques are being reviewed and questions are being raised over how to design accurate and effective models (Gemenne 2011; McLeman 2013).

The requirement for more refined and nuanced models are evident. In particular, a current trend is incorporating behavioural and agent-based approaches into modelling techniques to improve the understanding of thresholds (popularly called 'tipping points') in climate migration scenarios.

Building on research by Adger et al. (2009) and Bardsley and Hugo (2010), McLeman (2018) demonstrates how thresholds can shift outcomes from incremental to non-linear and suggest that the ability to identify and avoid thresholds that tip climate migration into a non-linear state will be a growing concern to policy makers and planners at all levels.[20] Although thresholds are highly context specific, difficult to proactively identify, and only one feature of a broader set of influences in climate adaption and migration processes, they are an important way to practically plan for and organise responses to climate changes (McLeman 2018).

The calls for testing methods like agent-based modelling (Kniveton et al. 2008; Gemenne 2011) are now being answered at speed (de Sherbinin 2014; Kniveton et al. 2011; Smith 2014; Klabunde & Willekens 2016; Adams & Kay 2019). This 'human side' of modelling (Adams and Kay, 2019) comprises approaches which aim to tackle the complex challenge of perceptions in decision-making. Perceptions play a significant role in climate migration decision-making (see Lee et al. 2015; Semenza et al. 2008; Weber 2010).[21] These lines of enquiry are fundamental given that the decisions of a few individuals can trigger non-linear flows of the larger population (i.e., even modest changes can have an impact on the behaviour of others)(McLeman 2018: 329-330). The consensus is that when taken as a whole, 'inclusive histories, sociohistorical models, and migration and complexity all push us to conceive of more encompassing research agendas to characterize and understand movement' (Daniels 2022: 18).

QUALITATIVE AND QUANTITATIVE

Qualitative and quantitative data and analysis are important for understanding and responding to different climate mobilities. Quantitative research is crucial for answering questions of how many people may move or not move so as to resource and capacity build. Qualitative research is crucial for revealing decision making and reasoning of populations faced with challenges and accommodating complexity.

We need robust research which includes reliable and accurate numbers and complementary quantitative and qualitative methods.

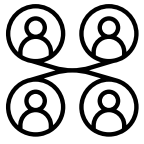
Accurate numbers

As mentioned, the consequences of numerical predications are one of the most controversial features of climate migration debates.[22] The ability to generate reliable and accurate estimates and predications remains challenged by lack of definitional clarity (Biermann & Boas 2010)[23], gaps in data collection (Brown 2008), under-refined statistical systems (Gemenne 2011; McLeman 2018), a lack of transparency in methodological approaches (Gemenne 2011: S46), relying on numbers that do not account for action to reduce emission and incorporate adaption strategies (Gemenne 2011), and accounting for uncertainties (Gemenne 2011).

More refined and nuanced models are required.

Quantitative research is crucial to resource and capacity build.

Qualitative research is crucial for revealing decision making and reasoning of populations faced with challenges and accommodating complexity.



Future research must be interdisciplinary rather than multi-disciplinary.

Accurate numbers are important not just to prevent 'alarmist' tendencies, but also for programming of assistance and mobilisation of resources, including funding (Crisp, 1999).

Accurate numbers are not just important to prevent 'alarmist' tendencies. Practically, the programming of assistance and mobilisation of resources, including funding has, and continues to, depend on accurate numbers (Crisp, 1999).

In 2011, Gemenne reviewed the literature and suggested that in the 'current state of our understanding of environmental migration, it is probably impossible to provide a reliable and accurate global estimate' (Gemenne 2011: S47). While models continue to be refined and researchers are working at speed, this remains a challenge.

Robust and complementary qualitative and quantitative data (informed by theory)

The majority of research on climate mobility has been qualitative and a significant proportion of this has been case study based (Gemenne 2018). A recent systematic review of the research on climate migration between 1990 and 2019 suggested a range of methodologies have been used but, ultimately, 82% used qualitative methodologies, 9% quantitative and 9% used mixed methods (Ghosh & Orchiston 2022).[24]

The 'robustness' of quantitative studies have been continually challenged which perhaps explains the skew towards qualitative methods. Some examples of early 'robust' quantitative studies include the works of Massey et al. in Nepal (2007) or the works of Henry et al. in Burkina Faso (Henry and Boyle, 2003, Henry and Piché, 2004). Researchers are working actively to identify and refine conceptual models to help improve the applicability to quantitative studies and the ultimate transferability of knowledge (Parrish et al. 2020). Such quantitative research needs to be complemented by and tested against qualitative and empirical research (Gemenne 2011) especially as a more valuable root for policy making applicability (Boano et al 2008).

There are also recent efforts to understand how migration theory more broadly is used in empirical studies (e.g., see a review by de Sherbinin 2022). Theory is crucial for 'understanding processes we observe in social-ecological systems because it points to a specific locus of attention for research, shapes research questions, guides quantitative model development, influences what researchers find, and ultimately informs policies and programs' (de Sherbinin 2022: 1).

INTERDISCIPLINARY

The nature of climate mobility studies is already evidently multi-disciplinary but this has so far compromised methodological cohesion because each scientific discipline—be it epidemiology, economics, political sciences or anthropology—brings its own intrinsic assumptions and methodologies (Eklund et al. 2016; Parrish et al. 2020). To correct for this, future research must be interdisciplinary rather than only multi-disciplinary (Veronis et al 2018)).

3 | DIMENSIONS OF CLIMATE MOBILITY

A recent large-scale review of climate migration literature identified four dimensions of climate mobility (to help quantify migration): societal, temporal, spatial, and agency-based (Parrish et al 2020).

INTERNAL AND INTERNATIONAL (SPATIAL)

Before the 21st century, international migration was the predominant area of study (Hugo 1996; Massey et al. 1999; Zlotnik 1999; Castles, De Haas & Miller 2014) including in early formulations of involuntary immobility (Carling 2002).[25] This is in part explained by the popularity of the concept 'environmental refugees' which exploded onto the scene in the 1970s and 80s (Suhrke 1994).

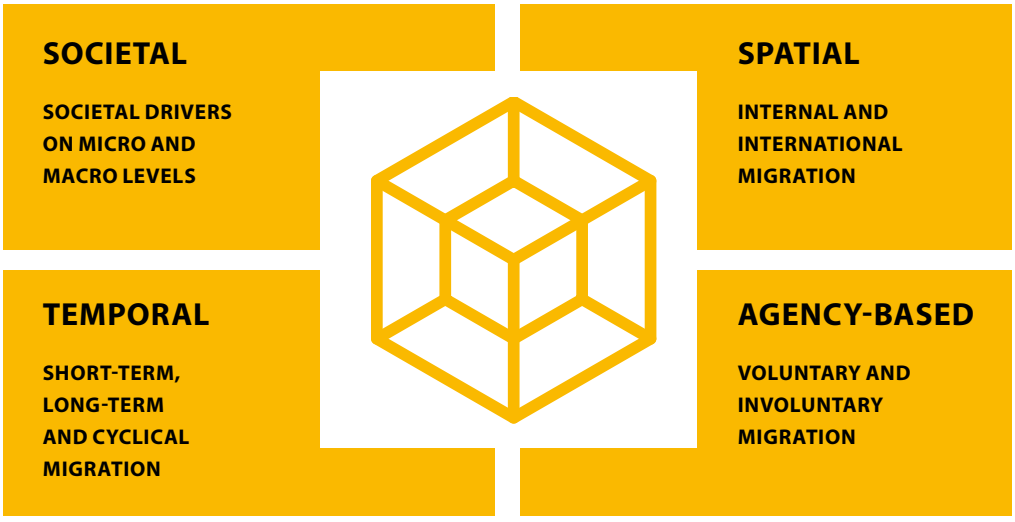
International migration continues to be a focus of study (e.g., Hugo 2005; Nawrotzki and Bakhtsiyarava 2017; Wesselbaum & Aburn 2019) and certain frameworks look at both internal and international migration (Black et al 2011).[26] In terms of future priorities, the lack of proper data and modelling capabilities for international migration continues to call for attention (Cattaneo et al 2019). At the same time, a focus on internal migration and mobility has begun to outstrip the attention to international movement.

There are a few reasons why internal migration has been the predominate focus in recent years: it constitutes the largest quantity of migrants and types of mobility (IOM 2020; IPCC 2022); the links between international migration and climate change are more complex to draw and accurate data is more difficult to establish[27]; and emphasising the dominant migration trends and effects as being internal instead of international is intended to tackle harmful crisis narrative (as explored in section 1).[28] At the same time, some scholars argue that a focus on internal movement should not sideline discussions of responsibility or be allowed to 'alienate' the issue from certain populations (i.e., it is something that happens 'over there' to 'those people') (Durand-Delacre, 2023). This concern makes sense – cross-border migration is the traditional domain of international human rights, refugee studies, human security debates (e.g., see Kaldor Centre Principles on Climate Mobility; McAdams & Wood 2023) but consideration of internal migration and mobility in these are only beginning to be probed more thoroughly.

VOLUNTARY AND INVOLUNTARY (AGENCY-BASED)

Clear cut categories between voluntary and involuntary migration have never been easy to define (Hugo 1996). Many who have reviewed estimates and projections have continued to push for clarification in this regard (Gemenne 2011), but emerging narratives continue to blur the distinctions between voluntary and involuntary movement (IDMC 2018). Involuntary (displaced) versus voluntary (migration) movement exists on a continuum upon which the line between choice and lack of choice is very ambiguous (Piguet 2018). For simplicity, the four dimensions below encapsulate a range of experiences related to human movement in the context of climate changes. It is important to remember that these are not firm distinctions and considerable overlaps and blurring continues to exist. These dimensions accommodate increasing recognition of both involuntary and voluntary 'immobility' alongside involuntary and voluntary 'mobility'.[29] [30]

'Involuntary mobility', popularly called 'displacement' and sometimes 'forced migration' is involuntary, unforeseen and often a consequence of



THE FOUR DIMENSIONS OF CLIMATE MOBILITY

sudden-onset climate events such as storms, floods or wildfires (Adger, De Campos & Mortreux 2018). These kinds of 'disaster displacements' have some of the most severe and harmful effects on vulnerable populations (UNHCR 2017). Since 2017, more people have been displaced within their own countries by sudden-onset disasters than by conflict—sixty-one percent compared to thirty-nine percent (IDMC 2019). There is no systematic data on cross-border displacement in this context, but there is evidence that most people remain in countries within the same geographical region (IDMC 2018).

'Voluntary mobility' includes considerations of migration as adaption (see Section 5) and the concept of 'planned resettlement/relocation' (Ferris & Bower 2023). Planned relocation is included by international organisations in their reports on the key dimensions in mobility – alongside two others – migration and displacement.[31] It is also becoming a focus of case studies (e.g., Rwanda's Rweru model green village (Dale 2023)[32] and appears in recent reviews of the literature as one of a fast-emerging category in research (Zickgraf, 2019).

'Involuntary immobility', has come to be popularly described as 'trapped populations' (Foresight 2011; Black & Collyer 2014; Grecequet et al. 2017; Lustgarten 2020a; McLeman 2016; Transiskus & Bazarbash 2024). This vulnerability is garnering increasing attention because research suggests these groups may be amongst the most vulnerable to the impacts of climate change (Foresight 2011; Ayeb-Karlsson et al. 2018; Caretta et al. 2023).

'Voluntary immobility', reflects experiences of those who actively choose to stay where they are despite climate vulnerabilities. It challenges the perception that immobility is only the experience of those who have fallen into 'poverty traps' (Ayeb et al. 2018: 563). Funafuti, Tuvalu is a popularly used and investigated expression of this kind of 'immobility' (Mortreux & Barnett 2009; Noy 2017) as well as the Pacific Islands more generally (McAdam 2023). In this category, voluntary immobility is often described as an act of defiance and a specific choice (politics of place)(Farbotko & McMichael 2019). Yet factors can be as distinct as cultural attachment (Farbotko 2023) or politicized views on climate change (Munoz 2024).

The overlap between these four dimensions speaks to the need for better and more nuanced understandings of, and modelling for, agency. The different psychological responses to climate change and its perceived proximity continue to be studied (Brügger et. al., 2015).[33] The decision of each individual to migrate may also carry different levels of human agency because such decisions are due to an aggregation of micro-level (typically household or individual) and macro-level (societal) drivers. As such, 'each potential migrant has their own unique profile of factors and drivers' (Parrish et al. 2020: 3067-3068). Some authors have begun to include a 'decision making nexus' in their research (for e.g., see Xu & Famiglietti, 2023: 15) while agent-based modelling (ABM) is garnering interest (see Section 2.1).

SHORT-TERM, LONG-TERM AND CYCLICAL (TEMPORAL)

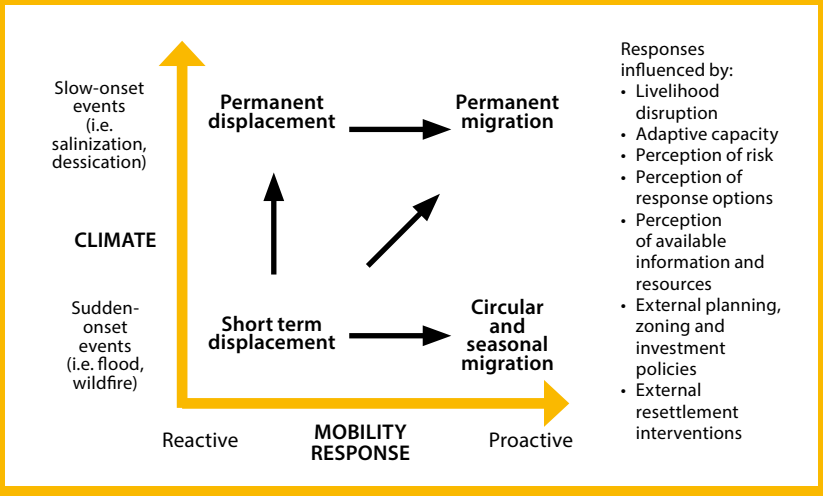
When people move, voluntarily or involuntarily, they can do so for a short period of time, a long period of time or as a part of a cyclical movement pattern (such as seasonal). In relation to international migration, the UN recommendations (UN 1998) distinguish between temporary displacements (less than three months), short-term migration (between three months and one year) and long-term migration (more than one year).[34] In this sense, short -term or even temporary migration can encapsulate seasonal or regular movements (Kabir et al. 2018). At the same time, the latter does have specific characteristics that make it unique (e.g., when considering the practices of nomadic and semi-nomadic pastoralists (Huho et al. 2011; Hermans & Garbe 2019)).

To depict the spatiotemporal continuum of both migration and displacement, Adger, de Campos and Mortreaux (2018: 30) map the figure below.

Displacement in the figure below is principally an unforeseen involuntary movement of populations from residence as a consequence of weather-related events. Migration involves deliberate and planned movement associated with changing attractiveness of places.

Despite temporality being an important dimension of mobility, when compared to the spatial, or geographical, aspects it has received much less attention in the academic literature (Fussell et al. 2014), especially when it comes to internal migration (Kabir et al. 2018). In addition, given the growing complexity of how we understand mobility, immobility and decisions to move, these temporal aspects will require continued revision and focus.

THE TEMPORAL ASPECTS OF MIGRATION AND DISPLACEMENT FOR SUDDEN- AND SLOW-ONSET CLIMATE EVENTS



(Adger, de Campos & Mortreaux 2018)

Involuntary (displaced) versus voluntary (migration) movement exists on a continuum upon which the line between choice and lack of choice is very ambiguous. (Piguet 2018)

Since 2017, more people have been displaced within their own countries by sudden-onset disasters than by conflict. (IDMC 2019)

4 | TYPES OF CLIMATE MOBILITY

While qualifying that any demarcations must be contextualised as continuous variables, Parrish et al. (2020) present five key categories of 'environmentally-induced migration': forced migration (displacement), adaptive migration (voluntary[35]), proactive migration (local or national government decision, also 'planned resettlement'), trapped populations (i.e., involuntary immobility) and immobility (i.e., voluntary immobility).

These types, described in more detail in Section 3, are reiterated by most, if not all, literature. Some though, will often group together the second and third, and the fourth and fifth types listed above. For example, in a review of literature, Cattaneo et al. (2019) identifies three possible outcomes of climate-related events (both slow- and sudden-onset) and these are human mobility (adaption including individual and planned relocation), displacement (forced) and immobility (trapped and immobile).

SUMMARY OF THE FIVE CATEGORIES OF MIGRATION AND THEIR GENERAL QUALITIES DEFINED IN TERMS OF THE FOUR DIMENSIONS OF CLIMATE MOBILITY: SOCIETAL, TEMPORAL, SPATIAL AND AGENCY LEVELS

	Type of Migration	Societal Level	Temporal Level	Spatial Level	Agency Level
1	**Forced displacement**	Macro	Short term	Short distance	Low
2	**Migration as an adaptive response**	Micro	Varied	Varied	Varied
3	**Planned resettlement**	Macro	Permanent	Short distance	Low
4	**Trapped**	Micro	Varied	n/a	Low
5	**Immobile**	Micro	Varied	n/a	Medium/High

(Parrish et al. 2020)

5 | PRIORITIES FOR FUTURE RESEARCH

Despite growing evidence of the links and impacts, there is still considerable fragmentation in research, literature and action. Given that, up until 2011, 'academic discussions on environmental change [had] been…almost completely silent on the role of migration' (Black et al. 2011: S3), the state of affairs is understandable. This has prompted researchers and academics to address gaps and push to generate more comprehensive, nuanced data. Specific focuses now include the following.

Slow- versus sudden-onset events[36]

Current figures and discussions when it comes to the attention and action of international organisations, especially where focus is given to the growing vulnerability of populations, are often associated with sudden-onset events (such as torrential rains, floods, cyclones, earthquakes and volcanic eruptions) (IPCC 2022; IDMC 2023; UNHCR 2021). This is because the consequences of these events are highly visible and, simultaneously, because the links between slow-onset events and human movement are less tenable and require complex supporting data (Neumann & Hilderink 2015; Parrish et al. 2020; IDMC, 2023; IPCC, 2022). Despite disaster displacements having a much larger geographical footprint in recent years (having been recorded in 148 countries and territories), the IDMC suggests that we are still missing a 'significant part of the picture, given that displacement triggered by slow-onset hazards linked to climate change is still largely unaccounted for' (IDMC, 2023: 117). This is especially the case when it comes to understanding how decision-making in response to climate change takes place (Koubi et al 2016).

Some researchers suggest that because the true speed of climate change varies geographically, there can be no definitive definition for fast- or slow-onset (Parrish et al. 2020: 6041). Nonetheless, organisations and researchers are beginning to focus on slow-onset events. For example, The World Bank 2018 report *Groundswell Part I* was the first of its kind to introduce slow-onset climate impacts into a model of future population distribution and their focus on slow-onset continues in their *Groundswell Part II* report (Rigaud et. al. 2018; Clement et al. 2021).[37]

The quantity, diversity, and quality of recent literature is encouraging but to account for blind spots, future research should be encouraged to focus on understudies regions, like South America and coastal regions in African countries (including urban settings as origin points and not just destinations); to use longitudinal studies so as to account for complex temporal spatial dynamics and develop an understanding of long-term impacts of out-migration; to expand methodological tool boxes to include techniques like Fuzzy Cognitive Mapping (FCM) which can help analyse climate mobility from the perspective of the population concerned; and to utilise gendered,

We are still missing a 'significant part of the picture, given that displacement triggered by slow-onset hazards linked to climate change is still largely unaccounted for.' (IDMC, 2023: 117)

inter-generational, and intersectional approaches from the social sciences to understand power dynamics and inequalities at play (see Zickgraf (2021a)).

Nuanced modelling and development of measurements

Over-simplified approaches to complex subjects generate unhelpful (if not harmful) data which is irrelevant to policy and scientifically unsound. Debate on how to inject the right amount of nuance into research and modelling approaches remains fierce but it is clear that there are widespread efforts to combat climate determinism and top-down approaches which minimise 'the potential for human agency to find creative, locally appropriate solutions' (Horton et al. 2021: 1279)(see also Black et al 2011). The development of more comprehensive, agent based and nuanced data is accelerating (refer to Section 3 for more detail).

Objectives for future research include continuing work to understand and map how old and new 'drivers' of migration interact (Parrish et al. 2020) and the potential of 'pull' factors in climate migration (Berg 2002; McLeman 2013); to develop metrics to evaluate migration outcomes by migrants and migrant households including the measurement of migration's effects over time and to identify the determinants underlying long-term success or failure with a focus on well-being (Tubi & Israeli 2024); to privilege 'human-centred' perspectives (e.g., Transiskus & Bazarbash 2024); and more broadly to historize climate change and the experiences of human mobility (e.g., Mann 2023; Rahman 2013; Daniels 2022).

Migration as adaptive and maladaptive

'Migration as adaption' describes a potential type of adaptation individuals or households may undertake in response to climatic hazards (McLeman and Smit 2006; Tacoli 2009; Black 2011). It has developed as a significant theme across all regions.[38]

Migration scholars have long used the term adaptation to discuss the ability of migrants to integrate into destination communities (e.g., David 1969) but not necessarily as an underlying rationale for the act of migration itself. Before 2011, most estimates on climate migration did not account for adaptation strategies (Gemenne 2011). Recent reviews show that the majority of papers looking at recommendations now take a 'migration as adaption' approach, where the migration is a potential solution and not just something to be solved, controlled or prevented (see Veronis et al. 2018: 59). In part, this is also driven by the argument to see migration as a strategy, among many, rather than an outcome (McLeman 2018: 323; Vinke et al. 2020).[39]

'Migration as adaption' can be useful if we can understand the conditions which make it an effective option or a necessary one (Simpson, 2024).[40] In this vein, some research is exploring 'planned resettlement' as a proactive strategy by governments (McAdam & Ferris 2015). There is also momentum behind incorporating adaption as an instrument to enhance climate resilience *in* an area rather than exclusively as a strategy of movement outside of the area (Geddes et al. 2012; Vinke et al. 2020; Entzinger & Scholten 2022). There is also momentum behind incorporating adaption as an instrument to enhance climate resilience in a specific area rather than seeing it exclusively through the lens of movement *out* of the area (Geddes et al. 2012; Vinke et al. 2020) and to recognise it as a means for promoting social and economic development (Entzinger & Scholten 2022).

At a micro level, there are complications in understanding when and how 'migration-as-adaption' is enacted – while tempting to see it as a process triggered by rational decision makers, various limits and constraints exist on the agency of those who would adapt (Inderberg and Eikeland 2009). There is an emerging consensus, and repeated support for, the argument that there is a preference for *in situ* adaptions which, if proven insufficient are then balanced with other adaption strategies, of which migration is just one (MacLeman et al. 2021; Caretta et al. 2023; De Longueville et al. 2020; Wiederkehr et al. 2018; Baldwin et al. 2019; Boas et al. 2022; Cundill et al. 2021).

The fixation of 'migration as adaption' is also beginning to draw criticism – as researchers argue we need 'fundamental changes' to the migration-as-adaption literature and a shift away from binary perspectives (Sakdapolrak et al. 2024; Tubi & Israeli 2024). This includes 'a more thorough engagement with the temporalities and scope of migration's effects on adaptation, greater attention to the trade-offs that are integral to migration as adaptation, and a shift to analytical frameworks that consider maladaptive effects alongside successful ones' (Tubi & Israeli 2024).

On this note future research has several key contributions to make. First, the binary view that migration is *either* adaptive or maladaptive, rather than a combination of the two, hinders the ability of policymakers and practitioners to develop interventions which maximise potential of adaption while minimising negative effects (Tubi & Israeli 2024). Researchers should develop frameworks and metrics that can more effectively identify these simultaneous potentials. Second, the reasons why and how households decide to migrate is a gradually expanding body of empirical research (see Caretta et al. 2023: 4). Focus should continue to be placed on understanding *perceptions* of climate risks and changes and using mixed methods to do so (Brüning & Piguet 2018). Further, the question of how objectives and goals are prioritised, how the risk to values are perceived, and how trade-offs are produced and negotiated must also be addressed (Sakdapolrak et al. 2024). Third, people migrate not only to adapt, but for various other reasons (economic, social, cultural, political) and these have implications for the adaptive potential of migration (Porst & Sakdapolrak 2018). The interplay between these factors requires further attention. Finally, the relationship between *in situ* adaption and migration strategies, while there is developing consensus, remains open to further questions. For example on the influence of *in situ* adaptions on the chances of successful relocation and people's willingness to migrate, and on the possibilities of combining *in situ* strategies with relocation programs (Jamero et al. 2019).

A mobilities perspective

The shift to a 'climate mobilities' perspective or a 'climate mobilities research agenda' is done purposively to incorporate a more inclusive set of experiences and realities relating to human movement in the context of environmental change (Wiegel et al. 2019). These experiences include the inability of people to move (involuntary immobility (Black et al. 2013)) or their conscious decisions not to (voluntary immobility (Schewel 2019; Simpson et al. 2024) as well as more regular, seasonal forms of movement and micro-scale 'everyday' mobilities (Wiegel et al. 2019; Safra de Campos et al. 2017).

This mobilities perspective is becoming increasingly popular and it sits in line with calls for a more critical approach to studying climate migration and the calls for a focus on climate justice because it emphasises a relational understanding which privileges not only individual characteristics and resources but the embeddedness of these activities in power relations spanning simultaneously local, regional, and global scales as well as the differential capabilities of people (Wiegel et al. 2019).

With this mobilities perspective as a base, future research should trace different types of mobility to enrich the understanding of the interrelationship between *differential* im/mobilities (e.g., Boas, 2019; Schapendonk &

Steel, 2014). Specific focus should be given to the experiences of immobility given the suggested 'mobility bias' which impoverishes our understanding of why, when, and how people migrate (Schewel 2019; Zickgraf 2021b). Despite the substantial policy issues raised by experiences of immobility, 'there is only a small amount of empirical work specifically targeting such populations' (Zickgraf 2019). Future research should address this bias and incorporate immobility into migration research with attention to how it is as 'diverse and ongoing a phenomenon as moving' (Hjälm 2014: 578–79). Part of this will include exploring the reality of 'ambivalent immobility', whereby the categories of voluntary or involuntary do not hold (e.g., Transiskus & Bazarbash 2024).

Finally, a mobilities perspective is intended to contribute to 'normalising' some aspects of human movement (both to tackle problematic narratives – see Section 1.3 – and to encourage flexible strategy design and policy making). As a part of this, the political influences on and narratives around climate mobility need further investigation (Parrish et al. 2020; Munoz 2024; Bettini 2014; Durand-Delacre 2023; Farbotko & McMichael 2019; Farbotko 2023; Noy 2017).[41] In parallel, researchers must remain conscious of how their research will be used by decision-makers and political actors and to what end (Bettini 2014).

Geographic spread of research

Despite rhetorical shifts, many analyses remain focused on 'the Global South' and neglect high-income countries in discussions. While it is fundamental to prioritise the most vulnerable, it is important to reflect climate mobility as a global issue. This concern was vocalised by the IPCC when they reported in a 2014 assessment that 'the unequal distribution of publications presents a challenge to the production of a comprehensive and balanced global assessment' (IPCC 2014b: 38).

Recent reviews of the literature show that the focus of study is still overwhelmingly low-income countries while the source of research is in high-income countries (Klingelhöfer et al. 2020; Milán et al. 2021; Piguet et al. 2018). This neglects both the vulnerability of people and places in the 'Global North' (e.g., Houston et al. 2021; Tate et al. 2021; Gober et al. 2016) and the benefit of the local framing that would come from projects and research initiated in low-income countries.

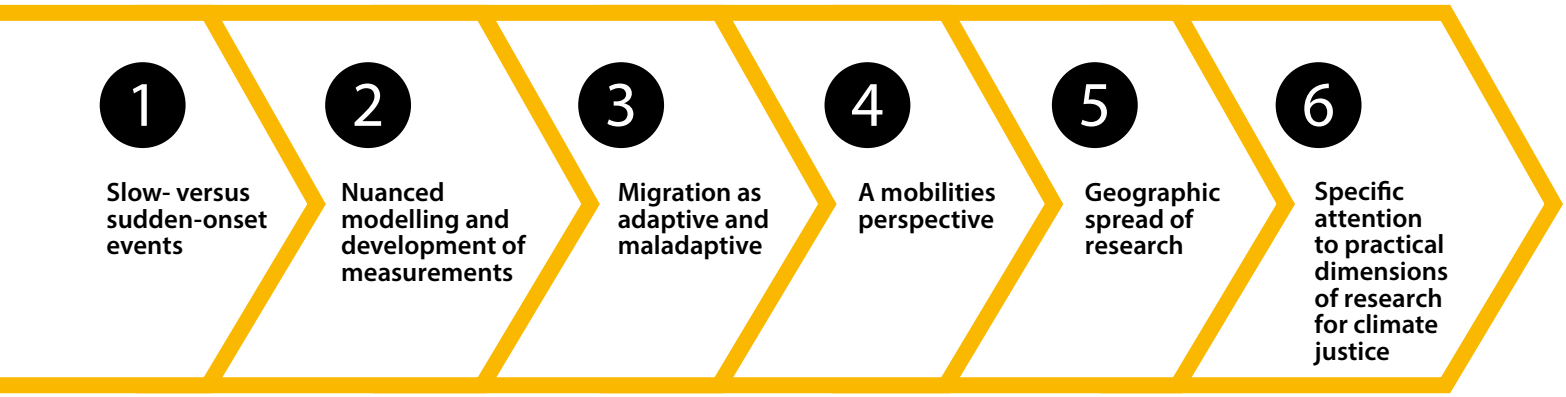
Future research should actively work to diversify this spread by both funding researchers based in the South (of which there are many) and by encouraging researchers in the North to include Northern countries in comparative and multisided field research (Piguet et al. 2018).

Specific attention to practical dimensions of research for climate justice

An emerging term, 'climate justice', underpins the need to include the environmental dimension in all decision-making (regardless of the corresponding discipline) with a legal framework that allows for action in the event of neglect (Beauregard et al 2021; Milán et al 2021).[42] While it is a contested concept (Newell 2021), it can be important for considerations of social justice, sustainable futures and questions of responsibility (Ahmed 2018).

If climate justice is to be successfully incorporated as a foundation of climate action, researchers and academics must make concerted efforts to engage more meaningfully with mainstream theory-informed studies of politics and policymaking, the processes of which are still consistently seen as a 'black box' (Biesbroek et al. 2015; Morrison et al. 2019). It is only with a more thorough understanding of how policy processes really work that environmental scholars will be able to champion recognitional, procedural, and distributive forms of climate justice (Cairney et al. 2023).

RESEARCH PRIORITIES



Porlock Marsh, UK.


Many of the most significant environmental and societal changes in the future are likely to manifest through impacts on water cycles and water scarcity.

B | WATER AND CLIMATE MOBILITY

Sustainable and effective water management is one of the most pressing challenges of global and local governance.

1 | WATER AT THE CENTRE

Effective water management in the face of contemporary realities (including growth in human population, climate change and conflict) has garnered attention from researchers, international organisations and governments alike. In this broader context, sustainable and effective water management is one of the most pressing challenges of global and local governance because, not only does it underpin food and human security more generally, but 'managing water is an exceptionally difficult and complex policy challenge' (Damania et al. 2017: ix). Many of the most significant environmental and societal changes in the future are likely to manifest through impacts on water cycles and water scarcity (Caretta et al 2022) and the dependence on and cascading effects of human-water systems are seen in many places (Rocha et al., 2018; Xu et al., 2021). Given that predicted intensity in changes to water cycles have been demonstrated by state-of-the-art models (Rodell & Li 2023), the urgency for understanding and acting is clear.[43]

The centrality of water, and the urgency to address how we manage it, is also evident by the 'flood' of recent reports from the World Bank (Zaveri et al. 2021; Browder et al. 2021; Andres et al. 2019; Damania et al. 2017), the European Commission (Bisselink et al. 2020) and the UN (UNEP 2022; UNESCO 2020; UN Water 2019). International coalitions (and calls for action) are emerging.[44] While the water dimension has been a feature of earlier international measures (e.g., FAO 2011), recent years have seen an acceleration of report publication and heightened attention on the issue in the context of climate and environmental change.

Academic and scientific research themed around 'hydroclimatic' changes is growing accordingly in momentum (Caretta et al. 2023). Water has been central in various scopes of the literature concerning frontiers in science and research on the environment-migration nexus ((e.g., Flood risk (Hauer et al. 2024; Vestby et al. 2024; Kakinuma et al. 2020), low or extreme rainfall (Fransen et al. 2024) and water resources (Zickgraf et al. 2024)) and is the inclusion of it on research agendas is only expanding.[45]

The complications that water poses are neatly summed up by Damania et al. (2017: ix):

Water is simultaneously a basic right, a natural resource, a fundamental input in all economic activity, and, at times, a source of destruction and devastation. Managing a resource with these multiple and sometimes conflicting attributes presents wicked challenges that lead water experts and policy makers to disagree on how best to manage, protect, and distribute it.

International actors, national and local governments and policymakers across the board must now balance the trade-offs between short-term, uncoordinated measures to respond to immediate water needs, and long-term measures needed to address structural water issues. These fine balancing acts will require comprehensive and integrated data, well-informed strategies for long term resilience building, and a strongly interconnected but flexible collection of international, national and local actors and policies.

2 | WATER AND MOBILITY

Aside from its broader importance, water is also at the heart of why many people choose, or are forced, to move. Whether because of sudden-onset and headline grabbing events or more 'slow drip' processes (Stoler et al. 2021; Stoler et al. 2022), the ubiquitous influence of water is interwoven into many experiences of climate mobility.[46] Importantly, the relationship is not unidirectional and human mobility both shapes and is shaped by water systems.

One useful way of framing the experiences of water and how they contribute to mobility is by distinguishing between 'too much' water, 'too little' water, and water that is 'too dirty'.

Too little

Droughts (both hydrological and meteorological) significantly influence peoples' decisions to move (Xu & Famiglietti, 2023; Stahl et al. 2024). Although seasonal migration has been an enduring feature of various communities' reactions to dry seasons (Huho et al. 2011; Hermans & Garbe 2019), severe droughts will disrupt this (Joshi & Dongol 2018) and other factors, like border disputes or state closures, will impact these coping strategies (Turton 2011). With effects on food security in particular, droughts have been linked to both short-term human mobility (Black et al., 2011; Linke et al., 2018), as a solution to diversify income, and long-term migration (Borgomeo et al., 2021; IDMC, 2020). They can increase incentives to settle closer to rivers (Zaveri et al., 2021), as floodplains often have easier access to water resources, or closer to cities (Jayawadhan, 2017), as urban areas typically offer alternative labour opportunities (see Ceola et al. 2023). Indirectly, economic shocks and conflicts associated to droughts are also known to trigger human mobility (Cattaneo et al., 2019; Hoffmann et al., 2020).

Photo by Bidgee / CC BY-SA 3.0

Too much

Floods can occur due to temporary rains, seasonal monsoons, or infrastructure failure and they often overwhelm built environments (especially those which have been built to inhibit natural protections against such circumstances). They commonly leave households with few options (Stoler et al. 2022). As with droughts, they have severe consequences on agriculture and, in their wake, people must navigate not only potential food insecurity, but changing water availability and quality, disrupted or destroyed infrastructure, and destabilised access to work (Adelekan 2010).[47] While they are a key driver of displacement, floods can also restrict movement in complicated ways (Findlay 2012; Chen et al. 2017; de Koning & Filatova 2020).

Sea level rise is another form of 'too much' water and is a predominant part of climate change research within and beyond the theme of migration (Mimura 2013; Nazarnia et al. 2020; Hauer et al. 2020). While it generates considerable academic attention and there is a tendency for it to draw focus, there are emerging suggestions that there is little evidence of migration related to it actually occurring (Mortreux et al. 2023).

Too dirty

The quality of water, when compared to the headline grabbing effects of floods and droughts, is often neglected. Poor water quality, however, causes significant health problems, affects livelihoods and puts food security at risk by contaminating agriculture. It contributes to why people move and it threatens those who are unable to do so. It demands attention given: the complex impacts of water quality on health and other sectors; the accelerating nature of influences on water quality, variable rainfall and industrialisation; and the universal impact of such challenges (Damania et al. 2019).

The ubiquitous influence of water is interwoven into many experiences of climate mobility.[49] Importantly, the relationship is not unidirectional and human mobility both shapes and is shaped by water systems.

Overlapping experiences and future research directions

The way in which these experiences may influence one another are also evident. As droughts push people to urban areas or closer to river beds, for example, they increase human exposure to floods, either pluvial, fluvial or coastal (Ceola et al. 2023). In other words, reactions to 'too little' water, exacerbate our vulnerability to 'too much'. Similarly, poor infrastructural design can heighten the adverse effects that floods, storms and droughts have on the quality of water; triggering severe health consequences (Kouamé et al. 2022).

Across these dimensions, the influence of climate shifts in the form of precipitation and evaporation changes are concerning (Konapala et al. 2020; Pfahl et al. 2017; Fischer & Knutti 2016). These changes will be felt in all corners of the world. A review of the literature suggests that, ultimately, there will be less frequent rain, but when it does rain it will be heavier (Stoler et al. 2022). This combined with the complex way the experiences of too much, too little and dirty water are interwoven means it is time to unravel the interplay between human mobility and hydrological extremes (Ceola et al. 2023; Kreibich et al., 2022; Ward et al., 2020) and to take action to mitigate serious harm and prepare for climate resilient communities.

As with the broader study of the environment-climate-mobility nexus, considerable gaps remain in terms of geographical and empirical research and data on the interplay between the three experiences of water and their relationship to human movement. For example there is a lack of study on inland and freshwater hydroclimatic change-induced migration (Caretta et al. 2023); on mobility patterns in the drying river basins, watersheds and the melting cryosphere of the Global North (Nicu & Fatorić 2023); on the role of natural resources (Cundill et al. 2021; Zickgraf et al. 2022); on planned relocation in circumstances of floods, droughts, and extreme precipitations (Caretta et al. 2023)[48], and on the role of gender and other identities in shaping experiences of water and migration (Sultana 2010; Irbık 2022). Finally, rather than just 'slow-onset' events, the water lens draws attention to *chronic* experiences of water insecurity faced by households and exacerbated by climate change. Experiences which remain understudied (Stoler et al. 2022).

From a practical and policy making perspective there is an emphasis to focus on better integrated water resource management and governance (Suhaeb et al. 2024). These societal, economic and political components typically lack integration across spatial scales, especially in relationships between surface and ground water systems. Other current focuses include efforts to foster water resilience in both rural and urban environments; to build political coalitions (Andres et al. 2019), to explore mechanisms from community empowerment programs and microfinancing (Andres et al. 2019), to recycle wastewater (World Bank 2019), to implement farmer-led irrigation programmes (Izzi, Denison & Veldwisch 2021), to bolster flood resilience measures (Kakinuma et al. 2020) and to incorporate intergenerational water planning (Macpherson et al. 2024). Extensive policy recommendations can also be found in recent publications of international organisations such as *Ebb and Flow* by the World Bank (Zaveri et al. 2021:122-135).

CASE STUDY PROTECTION AND RETURN MONITORING NETWORK, SOMALIA

Photo by Tobin Jones / CC0 1.0

IDP camp near the town of Jowhar, Somali, 2014.

PROTECTION AND RETURN MONITORING NETWORK, SOMALIA

PRMN is a collaborative project for monitoring displacement. It mobilises local capacity to gather information, offering valuable insights for addressing climate mobility challenges. The project tracks displacements caused by conflict and natural disasters, forced returns, and related protection issues. Partners include the Red Cross Red Crescent Movement, universities, INGOs, UN agencies, governments, donors, and network initiatives.

Since 2006

Coordinated by Norwegian Refugee Council and UNHCR

In 2022, PRMN recorded 1.8m IDPs

EXISTING WORK

The PRMN is commended for its strong coordination and regular participation from partners. This enhances data collection strategies and ensures interventions are responsive to the needs of affected populations.

The network's insights inform humanitarian responses and policy decisions.

Comparable initiatives include:

- The Durable Solutions Initiative (DSI) in Ethiopia
- The Displacement Tracking Matrix (DTM) by the International Organization for Migration (IOM)
- The Internal Displacement Monitoring Centre (IDMC)

POTENTIAL FOR DEVELOPMENT

Collaborative partnerships with local communities, like PRMN, leverage traditional knowledge and participatory governance models. This builds resilience and encourages proactive responses to climate-related challenges. There is strong potential for this model to be expanded to cover more regions or additional types of displacement events.

Enhanced funding, increased use of technology (e.g., mobile data collection tools), and integration with broader international networks could further improve its reach and impact, making it a vital resource for global humanitarian efforts in tracking displacement due to conflict, climate change, and natural disasters.

C | RECOMMENDATIONS FOR PRACTITIONERS

As academic and scientific research probes gaps, practitioners must continue to act with partial, developing and even contested understandings of climate mobility.

As a consequence, practitioner action at all levels should endeavour to be more collaborative, transparent and flexible. In general, to reflect the complexity described above, migration policies and action must be intertwined rather than shaped in isolation from each other (Caretta et al. 2023). Some action that may aid in proactive responses to the challenges of climate mobility include the following themes.

RECOMMENDATION 1

DEVELOP COLLABORATIONS AND PARTNERSHIPS BASED ON A MEANINGFUL CLIMATE MOBILITIES PERSPECTIVE

Collaboration and coordination needs to be improved at all levels and across a diverse collection of actors. A lack of collaboration between stakeholders, especially those directly involved, undermines the efficiency of planned interventions (e.g., Kouamé et al. 2022)

Most stakeholders agree on international responsibility and the need to adopt a global approach to the challenges climate change poses for human mobility (Veronis et al. 2018). At the same time there is continued critique of international frameworks and concern that any expectations for meaningful engagement may be misplaced (e.g., see Nagra (2017) on the Oslo Principles). Others are adamant about the specific role that development actors must play within the international community and the cooperation required between them (Martin et al. 2021).[50]

Practically, examples of key global collaborations are emerging (e.g., the Water and Climate Coalition[51]). These should be strengthened and mimicked. Multi-stakeholder partnerships are a component of this collaboration and their establishment should be at the forefront of any action to tackle the adverse effects of climate im/mobility. Practitioners should take lessons from research on successes and failures in different contexts (e.g., Chawla 2022) and from current initiatives (e.g., Durable Solutions Initiative (DSI)).[52] Lessons should also be taken from long standing projects like the Protection and Return Monitoring Network (PRMN) in Somalia which is well-respected for its ability to show strong coordination and regular participation of partners in coordination mechanisms (Norwegian Refugee Council/UNHCR 2021).

The collaborations that are established must incorporate a mobilities perspective, not just in a terminological sense but in the design and implementation of policy. Some scholars have noted that while there has been a shift in rhetoric (an adoption of the use of the terminology of climate mobilities), many international actors have merely incorporated it into already existing strategies and funding mechanism (i.e., their framing has changed but their strategies have not) (Durand-Delacre, 2023).[53] In order to tackle the unique challenges of climate *mobility*, our approaches to adaptation, disaster reduction, and support for livelihoods and resilience need to be rethought (Durand-Delacre, 2023). A mobilities perspective advances this goal by foregrounding daily practices and heterogeneous needs (Wiegel et al. 2019). Doing this facilitates collaboration efforts between diverse local, national and international actors and helps build trust and confidence in programmes and interventions.

RECOMMENDATION 2

TACKLE 'EMPTY TALK' AND FOREGROUND STRUCTURAL AND POLITICAL ISSUES FOR EFFECTIVE POLICY AND ACTION

There are several issues that hinder proactive and effective policymaking. These prevent the gap being filled that currently exists between inclusive policy processes, equitable contributions and just outcomes, and actual policy implementation. These challenges include 'empty talk' by powerful political actors whereby there is considerable discussion (even pronouncement) of the need for action and the severity of the challenges, but few concrete steps taken. Practitioners can address this by continuing to maintain pressure for action by championing, for example, visible international collaborations like the Water and Climate Coalition mentioned above.

At the same time, the influence of systematic causes should be accounted for. These mean gaps would persist even with the efforts of sincere and energetic policymakers (Cairney et al. 2023) and more concerted political will. Systematic hindrances to effective climate action can include rigid and complex policy processes and solidified siloes which separate policy, research and practice. Practitioners should thus work alongside researchers to 'de-mystify' policy processes (Biesbroek et al. 2015; Morrison et al. 2019) and work to increase flexibility. Platforms which support more productive communication between policy, research and practice should be bolstered and expanded.

The 'political' dimensions of climate mobility are varied. There is both the kind of political will just mentioned that can help or hinder coordinated action at differing levels; there is 'politicisation' of narratives around climate change and migration (both harmful and complex); and there is political agency in the demonstrations of some communities to remain in place. All of these dimensions are a challenge for practitioners to navigate but recognition of their influence, and their diversity, is an important first step.

RECOMMENDATION 3

COMPLIMENT INDIGENOUS KNOWLEDGE AND EMPOWER LOCAL PARTICIPATION

It is necessary to centre local action and recognise indigenous knowledge in order to understand climate mobilities and to design and implement effective responses (both in the immediate and for long-term resilience). This includes tackling top-down methods and climate determinism to support 'the potential for human agency to find creative, locally appropriate solutions' (Horton et al. 2021: 1279)(Also see Black et al 2011). The contribution of indigenous knowledge to understand and manage environmental change more broadly is well documented (Agrawal 1995; Mercer et al. 2007; Shaw et al. 2009) but, on the ground, there continues to be disjuncture and poor coordination and integration efforts.

This is harmful not just for the design of future programmes and policies but for ensuring that interventions are taken up when they can be effective.[54] One key challenge for practitioners is not only to connect different actors to different 'knowledges' but to figure out *how* to integrate traditional knowledge, which, as a consequence of being a socially constructed process shared within a community, is far less formalised, recorded or standardised. But the *value* given to traditional knowledge by indigenous people should not be taken lightly in its potential influence for action and adaption (Walshe & Nunn 2012).

Some examples of specific strategies (which are context specific but inform action in similar areas) include: ensuring and supporting the survival of different local knowledges (Walshe & Nunn 2012; Beckford et al. 2010; Kingsley et al. 2013); working with traditional institutions of governance which are critical for mobilising people (Kamara et al. 2018), understanding communities' relations and interactions with their environment when it comes to early warning systems (Audefroy & Sánchez 2017) and learning about local perceptions of 'uninhabitability' to better understand decision-making (Farbotko & Campbell 2022). Other lessons can be taken from already well-respected and ongoing projects like the Protection and Return Monitoring Network (PRMN) in Somalia which commended for its ability to mobilise and leverage local capacity in data collection (Norwegian Refugee Council/UNHCR 2021).

All of these examples are underpinned by championing participatory governance and local engagement as a key strategy to incorporate this knowledge and capacity (Suhaeb et al. 2024). Active participation speaks to the calls for climate justice from many researchers, a contested concept that has seen considerable uptake but also only superficial engagement with formal policymaking and practical implementation (Cairnery et al. 2023).

RWANDA'S GREEN MODEL VILLAGE

The Model Green Village is located in Rubaya, in the Gicumbi District of Rwanda. The project resettles families of internally displaced people (IDPs). The families selected for relocation were chosen by the Rwandan government, with a focus on households from high-risk, disaster-prone areas, particularly those vulnerable to landslides and floods. The families were identified based on their exposure to environmental hazards, and the relocation was part of Rwanda's broader strategy to improve living conditions through sustainable development and climate resilience efforts.

Since 2011

Resettled 43 families

Funded by Rwanda, UNDP, and other partners

Plans to replicate the initiative

EXISTING WORK

Residents are provided with sustainable housing and ecofriendly technologies to improve their living conditions and resilience. The village integrates sustainable practices such as biogas, rainwater harvesting, and reforestation to ensure a sustainable livelihood for the families.

Practices like terracing also enhance agricultural productivity. This model has significantly improved the living conditions, income, and food security of the local population.

POTENTIAL FOR DEVELOPMENT

Rwanda has plans to scale up this initiative. The success of the Rubaya village has inspired efforts to replicate similar ecofriendly and sustainable development projects across the country. The goal is to enhance climate resilience, improve livelihoods, and promote environmental conservation.

The Model Green Village serves as a good example of 'Naturebased solutions' (NbS). These address societal challenges by integrating biodiversity and restoring ecosystems to support human safety and resilience.

Lake Ruhondo, Rwanda.

CASE STUDY RESETTLEMENT, RWANDA

CASE STUDY ADAPTIVE CAPACITY BUILDING, PAKISTAN

Gilgit-Baltistan, Pakistan.

ADAPTIVE CAPACITY BUILDING IN PAKISTAN

This research project evaluated financial literacy programs as a component of building community resilience in Gilgit-Baltistan, a region highly vulnerable to climate change (Ali et al, 2023).

Programs were designed to enhance the ability to plan for and respond to climate-related challenges. This included managing remittances and using financial tools to enhance community resilience. This was combined with disaster risk reduction to help improve adaptive capacity.

Conducted 2016–2017

Savings for flood-related needs rose from 13.5% to 69%

A collaboration with WWF Pakistan

EXISTING WORK

The interventions in the study had significant positive impacts on the adaptive capacity of the remittance-receiving households.

Key outcomes included increased household savings, improved financial literacy and improved disaster preparedness.

The program focused on and contributed to long-term resilience by encouraging the proper use of remittances for both disaster preparedness and livelihood diversifications.

POTENTIAL FOR DEVELOPMENT

The findings of this study support the need for targeted intervention in regions that rely heavily on remittances and face significant climate risks.

The study highlights the importance of guiding households in properly utilising remittances for both short-term needs and long-term resilience planning. This could be applied in similar migrant-sending regions worldwide.

The approach of combining financial literacy with communitybased disaster preparedness can serve as a model for other disasterprone areas . These strategies could be integrated into national and regional development strategies.

RECOMMENDATION 4

SUPPORT AND ENGAGE IN PROACTIVE SUSTAINABLE DEVELOPMENT AND RESILIENCE BUILDING

While it is immensely difficult for practitioners given the evolving circumstances and rapid manner with which urgent needs arise (especially through climatic disasters), they must prioritise proactive resilience building. Global attempts to create climate-resilient societies are underway (see Brears 2020) and sustainable development is a key theme (Adger et al. 2024a; 2024b). Continued proactive approaches are required. Resilience building should emphasise both people-focused and infrastructure-focused approaches.

A key part of this is informed by the recommendation above, incorporating indigenous knowledge and empowering local communities through participatory mechanisms. These components are fundamental to any potentially successful and sustainable programme.

Another key part of this is taking advantage of emerging technologies which can help engineer more sustainable and environmentally-focused infrastructure development. For example, Nature based solutions (NbS) address societal challenges with a focus on the fundamental role of biodiversity to support human safety and wellbeing. They protect, sustain and restore crucial ecosystems that underpin this diversity. NbS incorporate a wide variety of strategies and have developed from different bodies of scientific research as well as practice and policy including ecosystem-based approaches (EbAp) (e.g., Balehegn et al 2019; PISCES/WWF 2012; UNEP/CBD 2004) and green infrastructure (GI) or blue-green infrastructure (BGI) (Monteiro et al. 2020; Ghofrani et al. 2017; Gupta & De 2024).

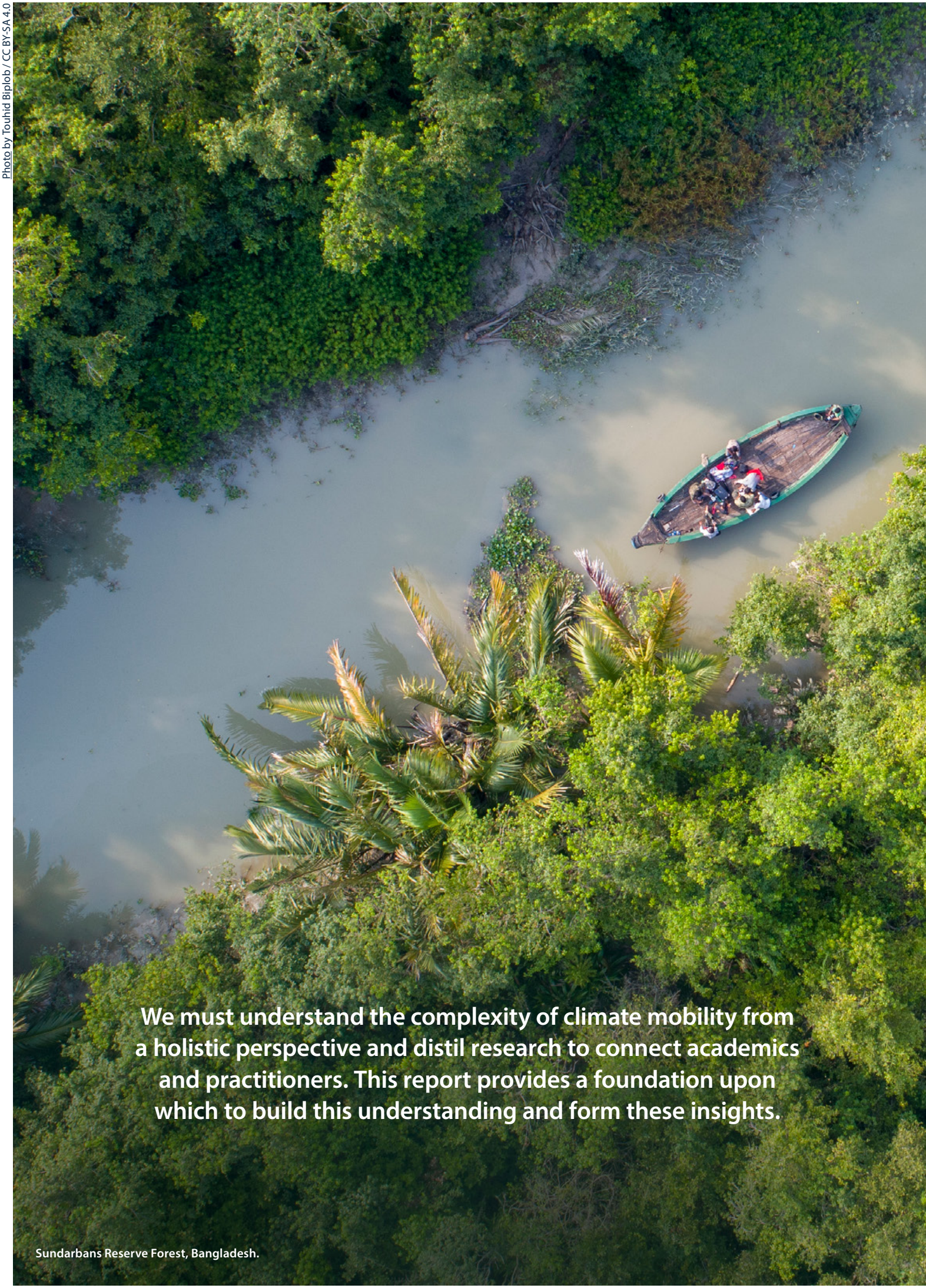
Practitioners should champion NbS by joining or establishing relevant frameworks, supporting knowledge-base improvements and platform exchange, and implementing necessary financing instruments (see EEA 2021 for examples of each).

A final part of the resilience theme focuses on support for capacity building and the strengthening of adaptive capacity, both for people and places (Cattaneo et al. 2019). One potential intervention in this vein is a focus on the role of financial remittances in community resilience. Capacity building in the forms of financial literacy can improve resilient planning strategies and practices (e.g., Ali et al. 2023) and support for networks of 'non-financial remittances' can also enable committees to build their own resilience (e.g., Entzinger & Scholten 2022). Further, training and education for communities following severe climatic events can reduce negative consequences (e.g., informing hygienic practices following flood experiences can significantly mitigate adverse health impacts (Kouamé et al. 2022)).

Finally, practitioners should always remain wary of the impacts of adaption in the context of social and economic inequalities (e.g., McLeman, Schade & Faist 2015)

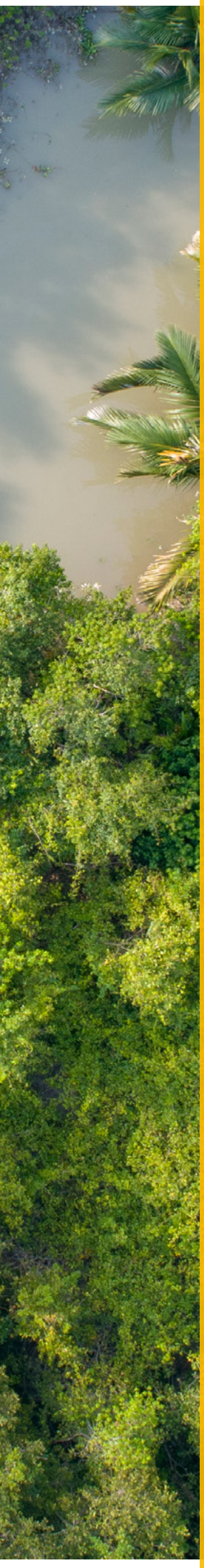
All of these priorities and recommendations are underpinned by arguments that we must continue to actively mitigate climate change (Cattaneo et al. 2019) given the near universal consensus in scientific literature on the responsibility of our current model of production and energy consumption on planet-wide climatic alteration (Cook et al. 2013; 2016). Ultimately, we need engagement between scientists and decision makers (including governments and humanitarian agencies) at all points of intervention design and implementation (Parrish et al. 2020). This should be broadened to encourage the inclusion other academic disciplines (e.g, critical discourse theory).

Planning for participatory rangeland management, Fentale, Afar Region, Ethiopia, 2015.



We must understand the complexity of climate mobility from a holistic perspective and distil research to connect academics and practitioners. This report provides a foundation upon which to build this understanding and form these insights.

Sundarbans Reserve Forest, Bangladesh.

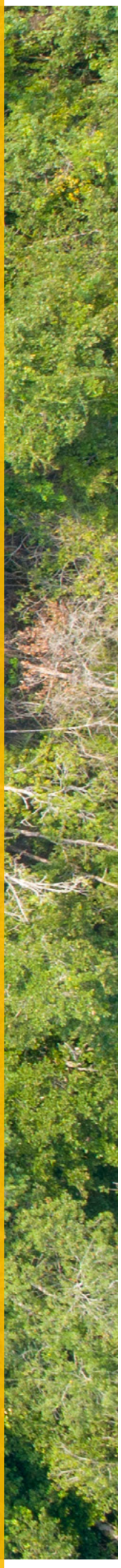


CONCLUSION: A NOTE ON CLIMATE MOBILITIES AND CONFLICT

There is an intricate link between experiences of climate mobility and conflict.

While some demonstrate that conflict is a consequence of a collection of factors, of which one may be environmentally-induced migration (see Veronis et al. 2018: 54), others focus on how conflict itself may generate environmental change and contribute to people's needs to move (e.g., Selby and Hoffmann 2012; Solomon et al. 2018). Still others, guided by how inconclusive and extensive the complications are in mapping the conflict-climate-mobility nexus, urge experts to consider cases where conflict is avoided and identify factors that contribute to peace development and cooperation (Gemenne etal. 2014; Scheffran and Battaglini 2011). Atop this context, international narratives on the subject have begun to shift towards the concept of human security and securitisation. This has been both popular and controversial (Durand-Delacre et al. 2021; Veronis et al. 2018: 55; Kita & Raleigh 2018) and debates about how to 'redefine' what security means are ongoing (Hardt 2021; Kameyama & Takamura 2021).

While one aim of the mobilities perspective is to contextualise human movement and to dispel harmful crisis narratives, including that 'mass migration' leads to violent and ongoing 'climate conflict' (Hartmann 2011; Boas 2015), it is not to trivialise the serious impacts that different pressures of climate mobility can have on ongoing and future conflicts. The CPCL addresses the intersections of climate and conflict in order to foster resilient and sustainable practices of, and collaborations for, peace. As a part of this, we must understand the complexity of climate mobility from a holistic perspective and distil research to connect academics and practitioners. This report provides a foundation upon which to build this understanding and form these insights.



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ENDNOTES

1 See Wiegel, Boas and Warner (2019) for an overview of the 'mobilities perspective' and Veronis et al (2018) for discussion of a 'mobility turn'. A mobilities approach provides the opportunity to unpack and illuminate more nuanced, everyday forms of mobility that escape traditional migration lenses (Boas et al. 2019; Zickgraf 2021a). In 2006, Sheller & Urry reflected on a shift to a 'mobilities paradigm' in social sciences more broadly (Sheller & Urry 2006; see also Urry 2007). There are several arguments for why the term mobility is more appropriate than migration (see Sakdapolrak, Borderon & Sterly 2024; Boas et al. 2019, 2022; Foresight 2011)

2 For more detail on debates regarding terminology see section 1.1 and the appendix.

3 Debates on terminology are often spurred by contexts of 'climate scepticism and raging anti-immigrant sentiments' (Hiraide 2023: 267). For more on these kinds of debates in terminology see Hoye et al. (2024) and appendix.

4 'Environmental change' was far more popular to study than 'climate change' when it came to migration – how and why these differ and overlap is a continuing challenge for synthesizing literature and research on the subject.

5 In the Web of Science and Scopus databases.

6 The IOM, established in 1951 within the UN system, is the leading intergovernmental organization in the field of migration. It has generated a wealth of resources on the subject of climate, environment and migration since the 1992 report and now features a dedicated *Environmental Migration Portal* (see https://environmentalmigration.iom.int)

7 The IPCC is the leading global source on climate science and has been charged, since its inception in 1988, with distilling, for international policy makers, the scholarship on climate change, its impacts, and opportunities for mitigating the dangerous accumulation of GHGs. The IPPC produces a large number of reports available on its website www.ipcc.ch.

8 Other recent academic projects like *Climig* show the impetus to collect and distill the insights from this rapidly developing scholarship. In 2020, a group of researchers created *Climig* as the first comprehensive bibliographic collection of resources specifically concentrating on migration, the environment and climate change which currently boasts 1412 articles. Access it at: https://climig.com

9 The IDMC report estimated that 2.6 million people were displaced in sub-Saharan Africa in 2021 due to climate-related disasters, such as ongoing droughts and severe flooding due to erratic rainfall patterns in parts of East Africa and the Horn countries (IDMC, 2022).

10 The World Bank suggest that by 2050—in just three regions—climate change could force more than 143 million people to move within their countries (Rigaud et al., 2018).

11 Reuveny's work in 2007 received 371 citations (Milán-García et al. 2021). For a review of environment-migration-security-conflict nexus see Veronis et al. (2018: 54-56).

12 Hardt (2021) looks specifically of debates to adopt climate change into the agenda of the United Nations Security Council but her work comes from a special issue on 'Climate Change and Security', edited by Yasuko Kameyama and Yukari Takamura and published in *Politics and Governance*, 9(4). Available at: https://www.cogitatiopress.com/politicsandgovernance/issue/view/268

13 Early tendencies included investigating 'ecological public health' (Lang & Rayner 2012).

14 For an overview of how 'apocalyptic' narratives have framed the discussion around climate and mobility see Bettini (2013).

15 For example, studies like Arcimaviciene and Baglama (2018) have found that 'most of the media narratives [in the US and EU] contribute to further developing the central bias of migration by means of metaphorical delegitimization that is discursively construed through the binary opposition between "them" and "us"'. For more examples of these trends see Taylor (2021) and Montagut & Moragas-Fernandez (2020). See also Baldwin (2016) for the racialised nature of these discourses and of the 'security orientation' in general.

16 This is further supported by evidence of the uneven geography of research on environmental migration (Piguet et al. 2018).

17 This argument is not exclusively related to climate mobility and migration but is a trend in migration studies more broadly. It also focuses, for example, on 'cultural migration' (Adger et al. 2024a) as scholars like Stephen Greenblatt have riled against the myth of 'fixity' of culture and argued for a far more free flowing understanding founded on 'cultural mobility' (Greenblatt 2009). And reflects the 'mobility turn' in social sciences (Sheller & Urry 2006).

18 An early distinction was between 'minimalists' and 'maximalists', with the latter arguing for a causal link between environmental change and migration and the former adamant of the multi-causality of migration (Suhrke 1994: 475-479). This distinction has continued to be used (Veronis et al 2018) and while the debate continues (Gemenne 2011), only a few sources support a maximalist position (Veronis et al 2018: 62).

19 For example, studies like Arcimaviciene and Baglama (2018) have found that 'most of the media narratives [in the US and EU] contribute to further developing the central bias of migration by means of metaphorical delegitimization that is discursively construed through the binary opposition between "them" and "us"'. For more examples of these trends see Taylor (2021) and Montagut & Moragas-Fernandez (2020). See also Baldwin (2016) for the racialised nature of these discourses and of the 'security orientation' in general.

20 Other research using thresholds: Boano et al (2008).

21 '…[I]ndividuals' perceptions and assessments of the potential costs and benefits of a particular decision can be highly subjective, are often factually inaccurate, and complicate the ability of the outside observer to anticipate particular outcomes.' (McLeman 2018: 328)

22 It is important to mention this because research like Myers (1993) continues to be cited in the most recent overviews of new scientific studies (Reimann et al 2023) – even if only in an introductory way.

23 Though some have also noted that even when legal definitions exist (as with refugees), these problems are not immediately eradicated (Gemenne 2011: S46)(Crisp 1999).

24 Two points to note – one is how skewed the emphasis on qualitative has been in recent years (i.e., it was not always as balanced and the rapid uptake has provided the majority of qualitative research) and two, this systemic review only ProQuest as a database (and English language papers) – other major databases should be included to provide an even more accurate picture. A bibliometric review by Milán-García et al. (2021) uses Web of Science (WoS) and Scopus between 1999 and 2019 (but they do not review methodological trends).

25 Though there are also examples of references to and interest in internal migration much earlier than this (Ravenstein 1885).

26 See Veronis et al. 2018 for a review of literature on international climate migration.

27 This has prompted a call for attention on proper data and modelling capabilities for international migration (Cattaneo et al 2019). While the causal links between 'climate change' and international movement' are far more difficult, perhaps even impossible, to establish, the tracking of 'numbers' of people that do actually move internationally is far easier to do because of border control and monitoring systems – in this sense it is easier to gather numerical data on international migration but less clear how to associate this to climate-based movement whereas internal migration can be more challenging to numerically track with accuracy (see Brown 2008: 25) but what movement (or lack of movement) is evident is easier to link to environmental or climate based shifts.

28 In a more nuanced approach to this latter point, Khattab and Mahmud (2019) also demonstrate how much international migration happens between countries in the 'global south' rather than simply, as many alarmist narratives tend to suggest, between the 'global south' and the 'global north'.

29 Schewel (2020) includes a third category, 'acquiescence', which describes the simultaneous incapacity to leave and the aspiration to remain in place, the "non-resistance to constraints" (Schewel 2020: 8). She also provides a review of the literature on immobility.

30 Some early reflections on immobility include Black and Collyer (2014) and Black et. al. (2013)

31 For example: on the IOM website (https://environmentalmigration.iom.int/human-mobility-unfccc); in the World Bank's *Groundswell report* (Rigaud et al. 2020); and in a 2013 publication by the UN University's Institute for Environment and Human Security (Warner et al 2013)).

32 For an global dataset of indepth case studies on planned relocation see Bower & Weerasinghe's (2021) *Leaving Place Restoring Home* report.

33 For a systematic review of International trends in public perceptions of climate change over the past quarter century see Capstick et. al. (2014).

34 Reviews of these recommendations, as of 2021, are underway (see IOM 2022).

35 Caveated by the statement that it may not be truly voluntary in light of recent research reports (IDMC 2018).

36 The IPCC distinguishes between 'slow-onset' and 'extreme' events (IPCC 2023: 6; IPCC 2022: 16), the IDMC distinguishes between 'slow-' and 'sudden-' onset disasters/hazards (IDMC 2023: 31, 40), the World Bank distinguishes between 'slow-' and 'rapid-' onset events (Clement et al. 2021: xi). In some migration systems approaches, this is characterised as direct versus indirect effects (Bardsley & Hugo 2010).

37 Also see the UNHCR story map on displaced people which now recognises the impact of direct and sudden onset events but also indirect drivers of displacement (https://storymaps.arcgis.com/stories/065d18218b654c798ae9f360a626d903).

38 For a list of different regional studies on an increase in migratory movements that are a result of attempts to adapt to the environment see Milán-García et al. (2021: 2).

39 McLeman (2018) in particular situates 'migration' as a strategy that households consider when attempts at *in situ* adaption are no longer sufficient. It should be noted that there is some emerging research that questions this chronological characterisation of *in situ* adaptions, at least as it relates to mass migration (Jamero et al. 2019).

40 Some studies are suggesting that without mobility, by 2080–2100, unprecedented heat from global warming could leave one-third of the global population outside the niche of thermal habitability for humans (Lenton et al. 2023).

41 This should include a variety of understudied political dimensions such as the role of theology and religion (Baldwin 2014; Fair 2018).

42 Opportunities for exploring climate justice from a legal perspective include the 'Loss and Damage' breakthrough agreement at COP27. The potentials of this are being explored (Åberg & Jeffs 2022; Tietjen & Gopalakrishnan 2023; Kraal et al. 2023). However, refugee law and frameworks are relevant but alone they are not enough – many impacts/affects/people will not be covered by this (McAdam, 2023). In addition, there has been a recent downturn in publication of legal articles, perhaps signalling an exhaustion of the debates (Veronis et al 2018). Despite the contested and difficult nature of designing and implementing such frameworks, a shift to focus on 'policy and governance' may provide an opening for legal scholars and practitioners.

43 For a detailed review of the change detection and trend analysis methods used to assess hydroclimatic variables see Teegavarapu (2018).

44 See https://www.water-climate-coalition.org/about/

45 For a useful resource on research on all aspects of water security and scientific research, see WIRE's Water journal (https://wires.onlinelibrary.wiley.com/journal/20491948)

46 As Stoler et al (2022: 2) succinctly demonstrate water has always played an important role in environmental migration through drought, flood, disaster, or pollution. In their words: 'Our earliest ancestors may have been "rain chasers" while nomadic (Finlayson, 2014); effective forms of terrestrial mobility then allowed both the global spread of Homo sapiens and the capacity to mitigate drought (and other disaster) once communities settled and grew. The Mayan city of Tikal may have been abandoned over time due to toxic contami- nation of city reservoirs during droughts (Lentz et al., 2020), and in China, the ancient Shu Civilization may have des- erted towns due to a combination of climate change and an earthquake-induced flood (Wen et al., 2013)'. Also see Stoler et al (2022) for a succinct discussion of the theoretical links between water and migration.

47 Because of their effects on infrastructure, flood hazards are a particular concern for researchers and organisations, in urban environments (Hanlon et al. 2021; IPCC 2021; Visser-Quinn et al. 2019; McClymont et al. 2024).

48 By comparison, there is burgeoning evidence on planned relocation and managed retreat due to sea-level rise (e.g., Hauer et al. 2020; McMichael & Katonivualiku 2020)

49 As Stoler et al (2022: 2) succinctly demonstrate water has always played an important role in environmental migration through drought, flood, disaster, or pollution. In their words: 'Our earliest ancestors may have been "rain chasers" while nomadic (Finlayson, 2014); effective forms of terrestrial mobility then allowed both the global spread of Homo sapiens and the capacity to mitigate drought (and other disaster) once communities settled and grew. The Mayan city of Tikal may have been abandoned over time due to toxic contami- nation of city reservoirs during droughts (Lentz et al., 2020), and in China, the ancient Shu Civilization may have des- erted towns due to a combination of climate change and an earthquake-induced flood (Wen et al., 2013)'. Also see Stoler et al (2022) for a succinct discussion of the theoretical links between water and migration.

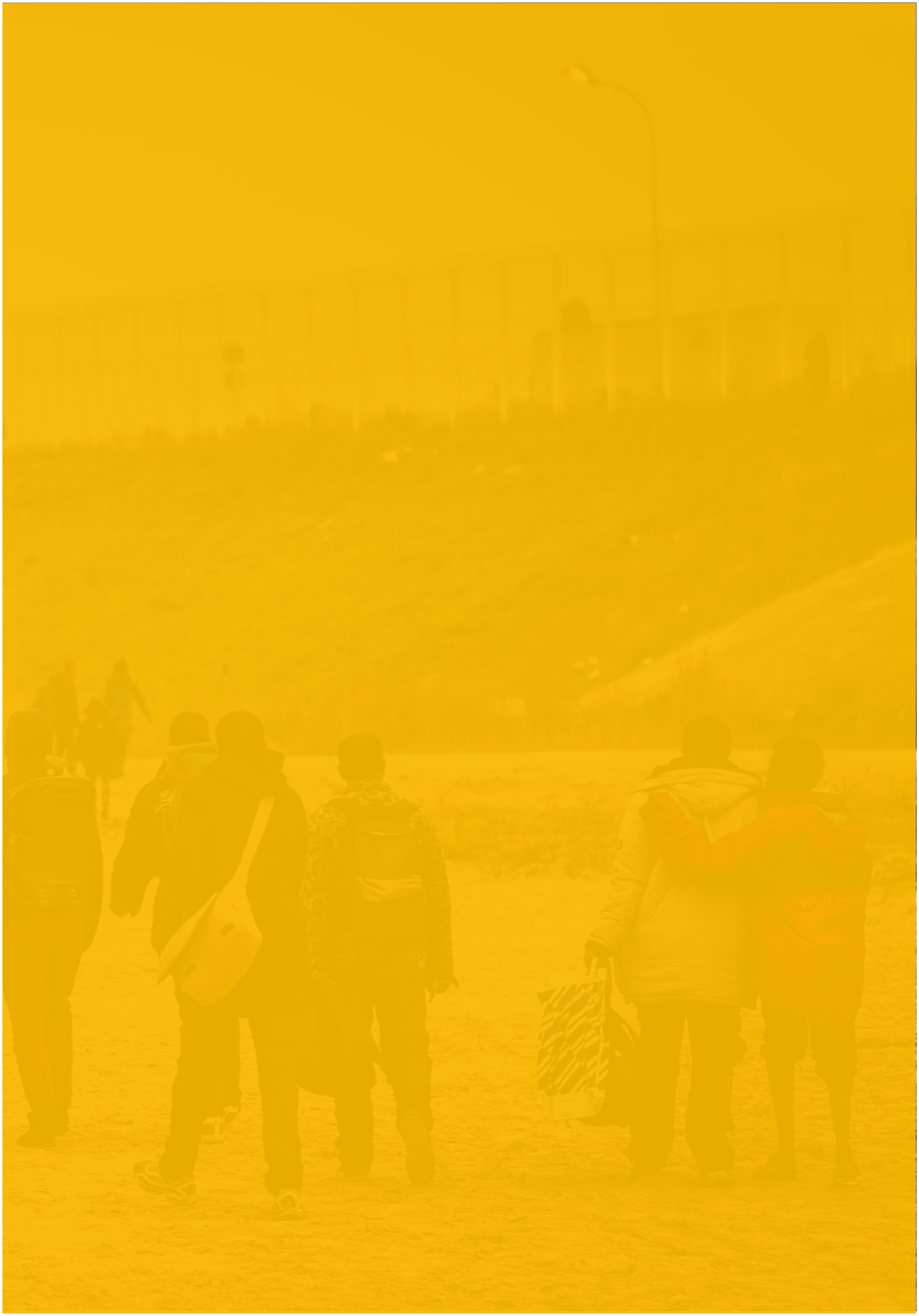
50 Especially under the theme of 'sustainable development'. See the Proceedings of the National Academy of Sciences (PNAS) special feature on Migration and Sustainability (Adger et al. 2024a; 2024b). It should also be noted, however, that some reviews have concluded we much more evidence on the effect of development assistance (Cattaneo et al. 2019).

51 See https://www.water-climate-coalition.org

52 See DSI Ethiopia - https://ethiopia.un.org/sites/default/files/2020-01/DSI%20Ethiopia%20low%20res.pdf

53 Some international organisations may be able to tackle this critique (e.g., The Global Centre on Adaption https://gca.org/)

54 For an example of this see Chidanti-Malunga (2011) on how farmers have preferred local interventions with mostly indigenous elements (to governmental and external interventions) in places like the Shire Valley (Malawi).



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