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Sonja Fransen, Alexander Hunns, Tarek Jaber and Teresa Janz

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Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Boschstraat 24, 6211 AX Maastricht, The Netherlands
Tel: (31) (43) 388 44 00

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Climate Risks for Displaced Populations: A Scoping Review

Sonja Fransen* Alexander Hunns† Tarek Jaber‡ Teresa Janz§

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Abstract

Forcibly displaced people are at the forefront of climate emergencies worldwide. This article presents a scoping review of the growing literature on climate risks for displaced populations, with the aim to synthesise current knowledge, highlight gaps, and develop a research agenda that can inform evidence-based policy interventions. The synthesis, based on 29 peer-reviewed journal articles, shows that displaced populations are disproportionately at risk to be negatively impacted by climate hazards, which is largely due to their high sensitivity, limited adaptive capacities and, in some cases, heightened exposure. The geographical scope of reviewed articles is narrowly focused on Southern Asia with a paucity of studies on climate-vulnerable refugee hosting states in Africa, Central Asia and the Middle East. Moreover, the literature heavily relies on case studies, which impedes the generalizability and comparability of findings. We argue for an inclusive and comprehensive climate risk research agenda that systematically maps the exposure of displaced populations to climate hazards, provides theory-driven research on how the social vulnerabilities of displaced populations are shaped by their sensitivities to extreme weather events and their adaptive capacities, and that applies comparative cross-country research that also includes host community populations. An inclusive climate-risk research agenda that takes into account displaced populations is essential for our commitment to the leave-no-one behind global policy agenda.

Keywords: Displaced populations, climate risk, vulnerability.

JEL codes: Q54, O15, O18, Q56, I32

*UNU-MERIT, Boschstraat 24, 6221 AX, Maastricht, NL, s.fransen@maastrichtuniversity.nl, corresponding author
†UNU-MERIT, Boschstraat 24, 6221 AX, Maastricht, NL, hunns@merit.unu.edu
‡UNU-MERIT, Boschstraat 24, 6221 AX, Maastricht, NL, jaber@merit.unu.edu
§UNU-MERIT, Boschstraat 24, 6221 AX, Maastricht, NL, tjanz@merit.unu.edu

1 Introduction

In 2022, the United Nations High Commissioner for Refugees (UNHCR) published an emergency appeal for the urgent support of displaced populations in the Horn of Africa (UNHCR, 2022a). The region, host to approximately 70 per cent of all refugees on the African continent, is experiencing the worst drought in 40 years (WFP, 2022). This drought, combined with rising global food prices, has severely impacted food security, water access, health and livelihoods of refugees and internally displaced persons (IDPs) residing in camps and settlements, as well their host communities, in Ethiopia, Kenya, Somalia - and beyond. In parallel, and partly as a consequence of the drought, new waves of displacement are occurring in the region, increasing the precariousness of the situation and challenging the delivery of aid (UNHCR, 2022b).

This situation in the Horn of Africa is not unique. The sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) confirmed that the frequency and intensity of extreme weather events, such as floods, droughts, heavy rains, storms and extreme temperatures, are increasing worldwide (IPCC, 2022). Low and lower middle-income countries (LMIC) are most vulnerable to the impacts of climate change and suffer greater societal impacts when climate hazards occur. East Africa, Central Africa and West Africa have been identified as 'global hotspots of human vulnerability', followed by highly vulnerable regions in Central America, South Asia and Southeast Asia (Birkmann et al., 2021). The regions predicted to be most affected by extreme weather events associated with climate change are also those that host the highest numbers of displaced populations. An estimated 90 per cent of refugees and 70 per cent of IDPs originate from climate vulnerable countries, which, in turn, host approximately 40 per cent of global refugees (UNHCR, 2021a). According to Birkmann et al. (Birkmann et al., 2021), refugee and IDP camps or settlements are often located in areas where temperatures are high and increasing. Moreover, a paper on the 20 largest refugee settlements worldwide shows how, within refugee-hosting countries, many refugee settlements are in climate-vulnerable areas and face relatively high exposure to extreme weather events (Fransen, Werntges, Comes, Sirenko, & Hunns, 2023).

Over the past years, the international community has become increasingly aware of the climate risks that displaced populations face, as indicated for example by UNHCR's strategic framework for climate action (UNHCR, 2021b). Yet, academic research that addresses the climate risks for displaced populations has only recently started to emerge. An influential body of literature engages with the climate change and migration nexus, with a particular focus on the environmental drivers of (forced) migration (Hoffmann, Dimitrova, Muttarak, Crespo Cuaresma, & Peisker, 2020; Kaczan & Orgill-Meyer, 2020; Piguet, 2010, 2022). More recent scholarship has focused on deepening our understanding of the relationships between migration and environmental change using a mobility perspective (Wiegel, Boas, & Warner, 2019), while others have criticized the conceptualisation of a climate refugee, or environmental refugees (Hartmann, 2010; Wiegel et al., 2019). Yet, there is limited attention to the climate risks experienced by refugee populations. Likewise, the forced migration literature has provided detailed understanding of the livelihoods of refugees, with recent, often critical, perspectives on resilience (Hutchinson & Dorsett, 2012; Krause & Schmidt, 2020; Pasha, 2020) and self-reliance (Betts, 2021; Easton-Calabria & Omata, 2018; Skran & Easton-Calabria, 2020), but with little attention to the extent to which environmental changes pose challenges for refugee livelihoods.

In an effort to provide policy recommendations to mitigate climate risks, recent studies have emerged that look into the exposure of displaced populations (Fransen et al., 2023; Owen, Kruczkiewicz, & Van Den Hoek, 2023), and into the impacts of extreme weather events on displaced populations, infrastructure and aid provision, as well as potential disaster risk reduction strategies (N. Ahmed, Firoze, & Rahman, 2020; Mitu, Jones, Vintges, & Devonald, 2022; Sibanda, Mukwada, & Hansen, 2022; Spiegel & Mhlanga, 2022). So far, however, there is no systematic and comprehensive overview of existing knowledge. To fill this gap, we conduct a scoping review of the emerging literature that addresses the climate risks for, and impacts of these risks on, displaced populations. To guide the scoping review, we draw from the IPCC AR5/AR6 frameworks that consider risk to be a function of exposure, hazards and vulnerability (Ara Begum et al., 2022). We take

a social vulnerability perspective, acknowledging that vulnerability to climate change is a result of cultural, economic, political and power dynamics (Thomas et al., 2019). In our analysis, we study whether, and to what extent, the selected articles address the different dimensions of risk, as well the impacts that climate hazards have on displaced populations and the adaptation and mitigation strategies that are described. The aim of this exercise is to describe current knowledge on the topic, and to identify gaps as well as avenues and directions for future research.

2 Methodology and framework

2.1 Climate risk framework

In this paper, we use the AR5/AR6 frameworks of climate risk developed by the IPCC as a tool to guide our analysis and to understand how, and to what extent, current research addresses the different dimensions of climate risk for displaced populations (Ara Begum et al., 2022). In this framework, the risk of being impacted by climate change results from "dynamic interactions among climate-related hazards, the exposure and vulnerability of affected human and ecological systems, and also responses" (Ara Begum et al., 2022, p.145). We adapted the AR5/AR6 frameworks and focused mainly on the link between climate risk, impact and socio-economic processes (Figure 1). Furthermore, we have grouped together exposure and hazards into one section describing the exposure of displaced populations to climate hazards. Exposure to hazards refers to physical exposure of populations to hazards (natural and human-induced). We adopt the following definition of vulnerability: "the propensity or predisposition to be adversely affected" - which is a function of sensitivity or susceptibility as well as the capacity to cope or adapt (IPCC, 2014, p.5). Sensitivity relates to the extent to which a population is affected by a climate hazard, whereas adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC, 2014, p.118).

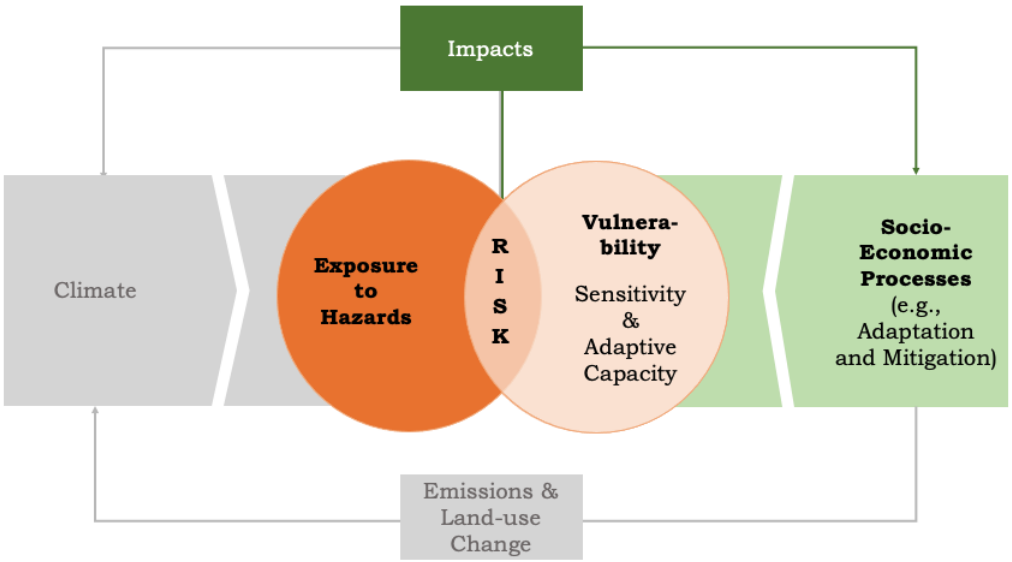

Figure 1: Authors' own illustration, adapted from (IPCC, 2022). Grey elements are not covered in this review.

2.2 Scoping review protocol

Our review protocol was developed in accordance with the guidelines presented by (Peters et al., 2015) and the PRISMA-ScR (Tricco et al., 2018). Peer-reviewed, published literature was identified through PubMed, Embase, Web of Science and Scopus. Search terms were developed and tailored to each database. These covered the following: i) slow- and rapid-onset events, ii) forcibly displaced people, and iii) the concepts included in our climate risk framework (Table 1). The electronic database search was complemented by screening the reference lists of included records for relevant papers.

Records from the four bibliometric databases were imported to Mendeley Desktop, and duplicates were identified and removed. Two independent reviewers conducted title and abstract screening. Deviating verdicts on in- or exclusion of papers were resolved by a third reviewer. The records identified for full text screening were then divided between the three reviewers. Wherever deviations occurred, decisions were reached by consensus among the three reviewers.

Category	**Keywords**
Climate hazards	sea level*, temperature*, precipitation, acidification, salinization, salinisation, glacial retreat, degradation, desertification, global warming, biodiversity, climate*, weather*, natural resource*, greenhouse, flashflood*, flood*, rain*, drought*, landslide*, disaster*, cold*, heat*, storm*
Forcibly displaced people	refugee*, displacement settlement*, displacement camp*, internally displaced people, internally displaced person*, IDP, IDPs, asylum seeker*
Climate risk framework	exposure*, hazard*, impact*, vulnerabilit*, risk*, sensitivit*, adapt*

Table 1: Search terms used in Scopus

2.2.1 Eligibility criteria

Peer-reviewed research articles published before 23rd November 2022 were included in the search. No geographical limits were set. A record was retrieved if it referred to at least one climate hazard among forcibly displaced people and provided information on exposure to climate hazards, their impact, the sensitivities and adaptive capacity of forcibly displaced people, or adaptation measures. The inclusion criteria are presented in Table 2 below. Studies that addressed the drivers of climate-induced migration or the impact of displacement (and encampment) on the environment, as well as those that were not specific to forcibly displaced people, were excluded.

Inclusion criteria	**Definition**
Language	English, French, Arabic and German
Accessibility	Full text available
Content	Slow- or rapid-onset climate hazards
Setting	Community hosting refugees, asylum seekers or IDPs; displacement camps
Population	Refugees, asylum seekers and IDPs
Type	Peer-reviewed research articles

Table 2: Inclusion criteria

2.2.2 Data extraction and analysis

Records were divided among the three reviewers for data extraction. Data were extracted from each record by one reviewer and were later verified by a second reviewer. From the records, the following information were extracted into a Microsoft Excel spreadsheet: the title, author(s), journal name, year of publication, the country where the forcibly displaced people resided, the study population (i.e., refugees, IDPs or asylum seekers), the setting (e.g., community hosting refugees, displacement camp), and any information on exposure to climate hazards, their impacts, the sensitivity and adaptive capacity of the study population, and adaptation or risk mitigation measures.

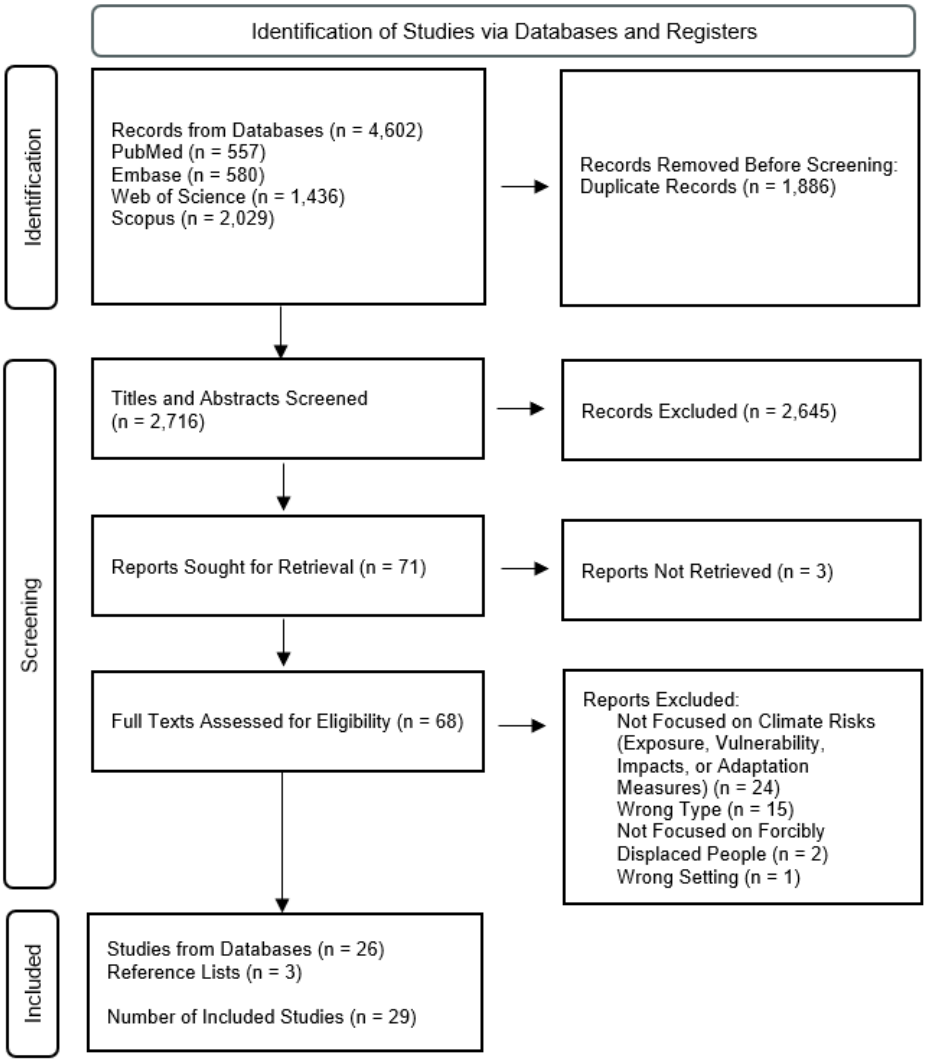

Figure 2: PRISMA flow diagram

The number of identified records is reported through the PRISMA flow diagram. Study characteristics (e.g., population, setting, country) were reported through descriptive statistics. Information on climate hazards and their impacts, as well as sensitivities, adaptive capacities and adaptation measures were narratively

synthesised based on the four concepts derived from our climate risk framework. The database search retrieved a total of 4,602 records. Following the removal of duplicates, 2,716 unique records remained. The titles and abstracts of these records were screened, identifying 71 records for full text screening. Among them, 26 records were included. Reference lists yielded three additional records, culminating in a total of 29 records included in our review (Figure 2 and Table 3 in the Appendix for a full list of included articles).

3 Results

3.1 Descriptive observations

Along with the increasing frequency and intensity of climate hazards, climate risks for displaced populations have recently evolved into a growing research area (Figure 3). Our first record dates from 2012, after which the number of published articles increased over time, with eight of the 29 articles published in 2022. Eight countries across four continents were covered by records in our sample (Figure 4). Consistent with Bangladesh hosting among the world's largest refugee population, slightly less than half (n=13) of articles focus on displaced populations in Bangladesh (Figure 4). Of these papers, ten cover Rohingya refugees residing in the Cox's Bazar refugee camp, with one paper additionally covering Rohingya during their initial displacement in Myanmar. A further two papers cover refugees and IDPs in riverine islands including Bashan Char. Other countries hosting large numbers of refugees were covered, though not proportional to the size of their refugee populations, including Jordan (n=2), Lebanon (n=1), and Kenya (n=1). Six articles address refugees in New Zealand, of which two papers focus on New Zealand and Japan. The remaining records cover Zimbabwe (n=2), Colombia (n=1), Iraq (n=1), Sri Lanka (n=1), and Australia (n=1).

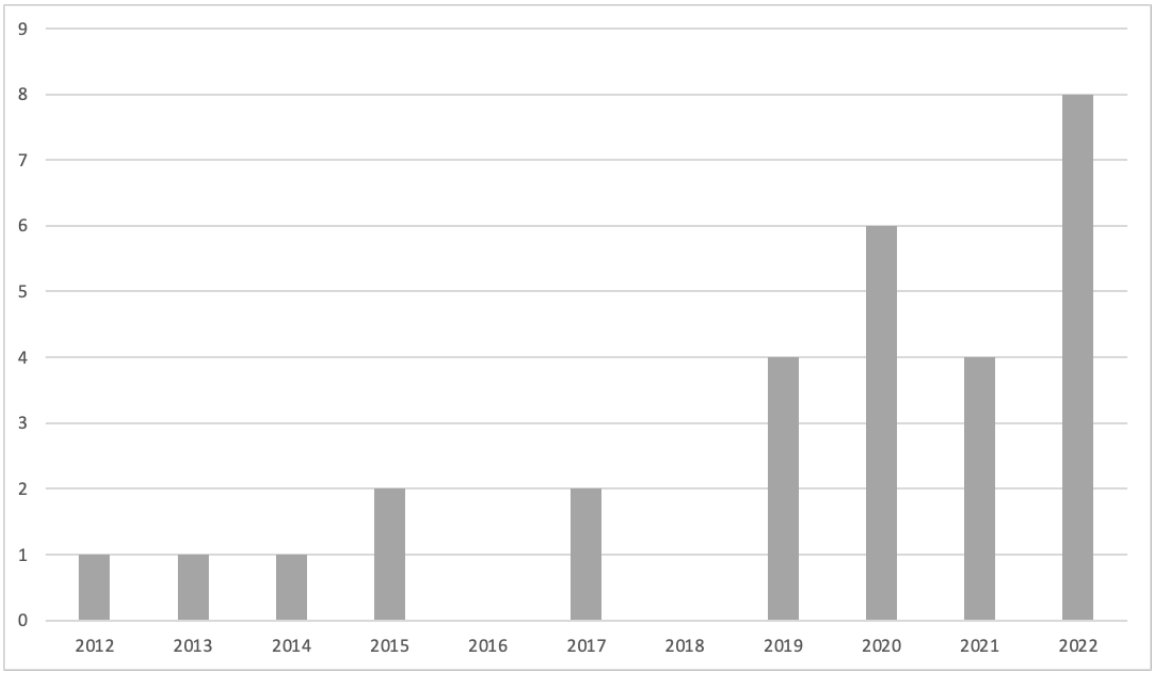

Figure 3: Number of published articles over time. Authors' own calculations.

Methodologies used in the articles were mixed, with a stronger focus on qualitative methods. Approximately half of the included articles used qualitative methods (n=13). These methods included focus group discussions, in-depth interviews, key informant interviews, literature reviews, ethnographic or observational research, or combinations of these qualitative methods. One article included community-based participatory

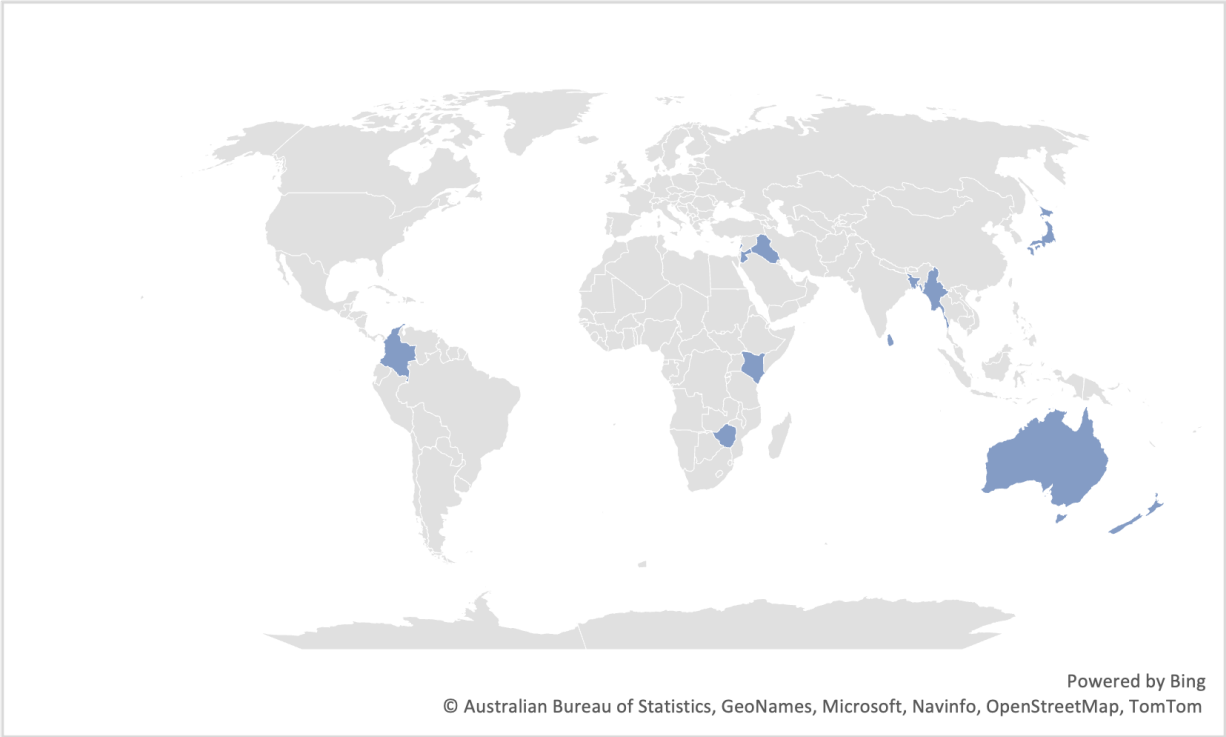

Figure 4: Geographical focus: Countries covered in the sampled articles. Geographical regions were categorised in accordance with the UN Geoscheme (United Nations Statistics Division, n.d.).

methods. Ten articles used quantitative methods, and five articles used a combination of qualitative and quantitative methods. Quantitative methods included household or community surveys, but also machine learning techniques e.g., to predict landslides, Earth Observation (EO) methods, and risk assessments using Geospatial Analysis (GA). The articles were published in diverse journals, representing 50 academic disciplines (a journal can represent more than one discipline). The most frequently represented disciplines were geology, geotechnical engineering and engineering geology, and safety research. Other commonly found disciplines were computer networks and communication, environmental science, sociology and political science, management, monitoring, policy and law, and geography, planning and development. Relatively few articles were published in journals representing anticipated disciplines such as refugee affairs or environmental or earth sciences.

3.2 Synthesis of the literature

3.2.1 Exposure to hazards

Due to its location and lowland topography, Bangladesh is recurringly hit by climate hazards such as intense rainfall from tropical cyclones, monsoons, storm surges, flash floods, landslides, and saltwater intrusion (B. Ahmed, Rahman, Sammonds, Islam, & Uddin, 2020; Alam, Sammonds, & Ahmed, 2020; Zaman, Sammonds, Ahmed, & Rahman, 2020; Emberson, Kirschbaum, & Stanley, 2021; S. Ahmed, Simmons, Chowdhury, & Huq, 2021). Other climate hazards mentioned are riverbank erosion and tidal waves (Chowdhury, Hasan, Hasan, & Younos, 2020), earthquakes (Cook & Foo, 2019; B. Ahmed, 2021), increasing temperatures (Hossain et al., 2022), forest fires (S. Ahmed et al., 2021) as well as sea-level rise (Islam et al., 2022; Mitu et al., 2022).

Cox's Bazar District has the second highest average rainfall in Bangladesh, and 7 per cent and 46 per cent of District is at very high or high cyclone risk respectively (Alam et al., 2020). This exposure in conjunction with its position on a low-lying coastline renders Rohingya refugees CBD susceptible to storm surges and large-scale flash floods and landslides to a greater degree than Bangladesh on average (N. Ahmed et al., 2020; Cook & Foo, 2019). Similarly, refugees in northern Sri Lanka are exposed to floods occurring as the joint result of heavy rain and inadequate irrigation systems (Jayawardana, Priyantha, Magni, & Marincioni, 2019).

In Western Asia, the most prominent climate hazards that refugees and IDPs face include extreme temperatures, extreme precipitation, and landslides. Residents in Jordanian refugee camps Al Baqa'a, Zaatari and Azraq report extreme heat in summer and extreme cold in winter (Albadra, Vellei, Coley, & Hart, 2017; Aburamadan, 2022). In Iraq, IDPs felt that climatic conditions in their residence areas had changed, as they experienced less rainfall, more extreme hot and cold weather conditions, dust storms, recurrent droughts, desertification as well as salinisation of water and soils (Marzouk, Duman, Meier, Khudhur, & Alani, 2022). Syrian refugees living in urban areas in Lebanon are exposed to precipitation-induced landslide risk, while encamped Syrian refugees are 9 to 11 times more likely to experience landslides than refugees in host communities and urban Lebanese more generally (Pollock, Wartman, Abou-Jaoude, & Grant, 2019).

Moving to eastern Africa, Tongogara refugee camp in eastern Zimbabwe is considered to be exceptionally dry with an unusually hot microclimate affected by drought (Spiegel & Mhlanga, 2022). As a result, camp residents have limited access to water (Sibanda et al., 2022). However, as a consequence of Cyclone Idai in 2019, and subsequent cyclones, the camps have experienced heavy rains that induced flooding and caused widespread destruction. Kenya's Kakuma and Dadaab refugee camps, which are amongst the world's largest refugee camps, have experienced similar climate hazards in the past two decades (Younes, Kotb, Ghazala, & Elkadeem, 2022). Heavy rains and severe flooding hit Kakuma in 2006, and Dadaab refugee camp in 2017, respectively. More generally, Younes et al. (Younes et al., 2022) show that only few locations in Kenya are located sufficiently far away from flood, landslide or earthquake risk areas.

Across the Atlantic, IDPs in Colombia face a complex combination of climate hazards, including floods, landslides, droughts, earthquakes or volcanic hazards, not seldom coupled with anthropogenic threats (Few, Ramírez, Armijos, Hernández, & Marsh, 2021). These climate hazards affect both IDP households who move into rural landscapes, as well as IDP households in urban neighbourhoods where incoming migrants build new informal settlements on precarious terrain.

Finally, our scoping review identified a selection of papers on developed countries, in which earthquakes and aftershocks were identified as the main climate hazards. Those studies from Australia, New Zealand and Japan investigate the experiences and coping strategies of refugees, or linguistic minorities, after heat waves and the Canterbury and Fukushima earthquakes between 2010 and 2011, respectively (Hansen et al., 2014; Uekusa & Matthewman, 2017; Marlowe, 2015; Marlowe & Bogen, 2015; Marlowe & Lou, 2013; Osman, Hornblow, Macleod, & Coope, 2012).

Overall, our findings on exposure have highlighted that displaced populations routinely face exposure to climate hazards in a number of different countries. The risks they face vary by region and include all facets of the climate risk spectrum; excessive rainfall or cyclones play an outsized role in creating risk, affecting refugee communities in Bangladesh, Kenya, Zimbabwe, Colombia, and Lebanon. Extreme temperature blight displaced communities in Zimbabwe and Iraq, while less frequent risks such as volcanoes and earthquakes affected groups in Colombia, New Zealand and Japan. The following sections will explore the extent to which forcibly displaced communities are sensitive to these risks.

3.2.2 Impacts of climate hazards

Most articles that were included in the review did not empirically study the impacts of climate hazards on displaced populations but did make passing reference to them. These impacts can be grouped broadly into three main categories: (i) fatalities, injuries, illness or other health consequences, (ii) destruction of property, dwelling, infrastructure or livelihoods, and (iii) psychological stress. A fourth category emerged from the literature; secondary displacement, which affected Rohingya refugees in Bangladesh (S. Ahmed et al., 2021; B. Ahmed et al., 2020) and IDPs Sri Lanka (Jayawardana et al., 2019). However, it had relatively limited representation in the sample under review.

Death and injury to refugees as a result of climate hazards were reported in Bangladesh (B. Ahmed, 2021; B. Ahmed et al., 2020; N. Ahmed et al., 2020; Mitu et al., 2022), Colombia (Few et al., 2021) and New Zealand (Osman et al., 2012). IDPs in Bangladesh also reported that disasters directly impacted their health (Chowdhury et al., 2020). Moreover, landslides were predicted to result in fatalities among Syrian refugees in Lebanon (Pollock et al., 2019). In Zimbabwe, post-disaster water contamination resulted in a shortage of safe drinking water (Sibanda et al., 2022) while women were overcrowded in temporary shelters without access to adequate WaSH services, exposing them to gender-based violence (Sibanda et al., 2022). Climate hazards were also reported to impact mobility and hinder access to basic services, particularly among people living with a disability (Mitu et al., 2022).

Climate hazards were widely reported to result in the destruction of property, dwelling or infrastructure. In Bangladesh, refugee makeshift shelters and IDP dwellings were destroyed (N. Ahmed et al., 2020; Mitu et al., 2022; Hossain et al., 2022), with similar destruction reported in Kenya's Kakuma refugee camp (Younes et al., 2022), Zimbabwe's Tongogara refugee camp (Spiegel & Mhlanga, 2022), IDP settlements in Colombia (Few et al., 2021) and across Canterbury in New Zealand (Osman et al., 2012). Other essential infrastructure including latrines and wells were also affected in Zimbabwe (Spiegel & Mhlanga, 2022; Sibanda et al., 2022). Climate hazards reportedly impacted livelihoods, resulting in crop loss among IDPs in Bangladesh and Iraq (Hossain et al., 2022; Marzouk et al., 2022), while additionally leading to the loss of natural capital including drinking water in Gaibhandha district in Bangladesh (Hossain et al., 2022).

Exposure to climate hazards also placed forcibly displaced people under heavy psychological strain. In Iraq, IDPs bore psychological burdens associated with crop loss as well as the adverse effect of extreme temperatures on mental health and well-being (Marzouk et al., 2022). In New Zealand, Osman et al. (2012) reported feelings of worry, anxiety, fear, helplessness, and disturbing thoughts among refugees in the aftermath of the Canterbury earthquake. In Jordan, children residing in Al Baqa'a camp are faced with playing outside in insecure environments in extreme temperatures or remaining at home for prolonged periods of time (Aburamadan, 2022), with reference made to the psychological burden associated with extreme thermal conditions caused by inadequate shelters (Albadra et al., 2017). Similarly, refugee communities in Australia show elevated mental health issues, exhaustion and tiredness during extreme heat waves (Hansen et al., 2014).

Climate hazards were shown to be responsible for deaths, injuries, psychological stress and damage to property and livelihoods among displaced populations. Death, bodily injuries and illness can be immediate due to the direct impact of the climate hazard, but also in the post-disaster period as a result of water source contamination, or poor sanitation and unsafe conditions in homes and residential neighbourhoods. Loss of property and crops have immediate livelihood consequences for displaced populations, who are often excluded from formal labour markets. Moreover, climate hazards also place an undue mental load on those living in affected areas. Extreme conditions may limit the freedom and opportunities of children (among others); while experiencing disasters weighs as a psychological burden on those affected.

3.2.3 Vulnerability: sensitivity

Factors reported to enhance the sensitivity of displaced populations to climate hazards can be grouped into location, infrastructure, as well as social exclusion factors. First, the majority of displaced populations covered in the studies under review reside in unfavourable geographic locations, such as low-lying coastal areas surrounded by steep slopes (such as Cox Bazar District in Bangladesh), or generally steeply sloped terrain (in Colombia) (Emberson et al., 2021; Zaman et al., 2020; N. Ahmed et al., 2020; B. Ahmed et al., 2020; S. Ahmed et al., 2021; Few et al., 2021). In these locations, populations face high risk from flooding or landslides. However, as studies (Pollock et al., 2019; Few et al., 2021) point out, it is not only geographical location, but the interaction between socio-economic circumstances and hazards that produce greater and more complex sensitivity.

Absorbing the rapid influx of refugees in some locations and accommodating rapid camp expansions has entailed planning and policy inadequacies in many locations and has resulted in poor infrastructure of camps and settlements (Emberson et al., 2021; Zaman et al., 2020; N. Ahmed et al., 2020). For example, in Cox Bazar District, deforestation rendered soil less resilient to landslides and flooding, and reduced available firewood supplies as well as shade areas within the camps, increasing refugee populations' exposure to extreme heat (Mitu et al., 2022). Overcrowding in shelters, flammable construction materials and unsafe electric and gas connections are further factors that make displaced populations sensitive to the impacts of climate hazards (Few et al., 2021). Fragile shelters constructed from plastic sheeting, timber, tarpaulin or bamboo are unable to withstand storms, heavy rains or landslides (in CBD, Bangladesh, and Lebanon) (Alam et al., 2020; Pollock et al., 2019). However, Bashan Char, an island off the coast of Bangladesh used to house relocated Rohingya refugees, demonstrates that sensitivity to similar climate hazards can be ameliorated; concrete houses typically built four metres off the ground and cyclone shelters reduce the sensitivity of the islands' inhabitants (Islam et al., 2022).

In Jordan, the shelters of refugee households in Al Baqa'a, Zaatari and Azraq camps were reported to lack thermal insulation, and air conditioning or heating is often inaccessible due to high energy costs relative to income (Aburamadan, 2022; Albadra et al., 2017). Moreover, the lack of drainage systems and sanitation facilities proximate to water sources can lead to public health crises after climate hazards (Cook & Foo, 2019; Sibanda et al., 2022).

Moreover, there is evidence to suggest that there may be heterogeneous sensitivity to hazards due to social exclusion and socio-cultural factors which interact with natural disasters to turn a climate hazard into disasters (Hansen et al., 2014; Zaman et al., 2020). For example, women and girls are considered to be at greater risk of harm during emergencies, for instance when gender-based violence confines adolescent girls to their typically un-airconditioned homes which can become unbearably hot during summer months (Mitu et al., 2022). Effective evacuation during emergencies may be undermined by risks of gender-based violence, while mobility and access restrictions may place people living with a disability at risk during emergency evacuations. Linguistic isolation among refugee communities also induces greater sensitivity to climate hazards, including greater risk of fatality or property damage (in New Zealand and Japan) (Uekusa, 2019).

From a risk management perspective, short times between warning messages to displaced populations and the occurrence of climate hazards mean that camp residents are not able to respond and evacuate on time, e.g., in Zimbabwe (Sibanda et al., 2022). National preparedness plans for evacuation and disaster risk management including displaced populations, as well as service provision or communication stations in the camp are often absent (Sibanda et al., 2022; Few et al., 2021). Furthermore, where warnings or evacuation notices are present, they are often provided in national languages only, potentially reducing awareness among refugee communities or delaying their evacuation (Hansen et al., 2014; Uekusa, 2019). Isolation of refugee

communities may also have created heterogeneity in recovery; more than four fifths of participants in a post-earthquake study of former refugees in Canterbury did not receive government assistance, with more than two thirds reporting finding information inaccessible (Osman et al., 2012), while poor cultural sensitivity in community agencies compounded refugee sensitivity in some cases (Marlowe & Bogen, 2015). Previous exposure to trauma may have left refugees in Canterbury less able to cope with the earthquake and its aftermath (Uekusa & Matthewman, 2017).

Studies reviewed in this section have highlighted the critically important interactions between forcibly displaced status, policy, socio-economic factors and climate hazards that leaves displaced populations at greater risk than their citizen counterparts. Policy and planning vacuums in large-scale camps such as those found in Bangladesh and Zimbabwe have left refugees vulnerable to the vicissitudes of extreme weather, while in Colombia and Zimbabwe, IDPs and refugees are hard to reach or excluded from risk and disaster management mechanisms. In Asia and Oceania, policies blind to complexities of language groups for forcibly displaced persons leaves them more vulnerable to harm during natural disasters.

3.2.4 Vulnerability: Adaptive capacity

Adaptive capacities of displaced populations may act as a mediator on vulnerability to climate hazards. The literature reviewed as part of this scoping exercise identified three broad categories that impact adaptive capacities: (i) governance/regulatory frameworks (ii) poverty (iii) social capital/community effects. Refugees living in camps are often subject to distinct legal and governance frameworks, which impact their capacities to adapt to climate hazards. Rohingya refugees living in CBD in Bangladesh are placed outside national legal (social) protection frameworks that might otherwise ameliorate climate risk vulnerability (Mitu et al., 2022). Refugees in Bangladesh and Zimbabwe are excluded from formal education and labour markets and face limitations on their freedom of movement (Spiegel & Mhlanga, 2022; B. Ahmed, 2021; Cook & Foo, 2019); as a consequence refugees are largely reliant on humanitarian aid for their livelihoods and to recover from climate shocks, while movement restrictions limit refugee households' ability to take flight during a climate emergency (Spiegel & Mhlanga, 2022; B. Ahmed, 2021; Cook & Foo, 2019). Refugees in CBD in Bangladesh are prohibited from modifying their shelters to be cyclone resistant, while planting trees to provide shade requires authority from camp managers (Alam et al., 2020; Mitu et al., 2022).

In general, the review shows how household economic status and poverty undermine household adaptive capacities. Limited household resources, poor access to credit, and barriers to income-generating activities interact with climate hazards to diminish the adaptive capacity of refugees in Bangladesh (Islam et al., 2022), and additionally prevents households installing modifications such as fans in their dwellings due to the high cost of solar panels for power (Mitu et al., 2022). Economic hardship resulted in IDPs on Bashan Char island engaging in negative coping strategies such as reducing food consumption, begging, taking out loans or working as day labourers (Hossain et al., 2022), while economic hardship interacted with lack of social kinship to reduce health seeking behaviour after climate shocks in coastal Bangladesh (Chowdhury et al., 2020). In Colombia, IDPs often enter their displacement trajectory in poverty, while repeated climate hazards during their displacement, as well as gender-based violence, has excluded IDPs from secure livelihood opportunities. These co-acting economic hardships combine to undermine their adaptive capacity (Few et al., 2021). There is also evidence to suggest that some households are able to adapt to climate hazards. In south-western Bangladesh, some IDPs reported greater water consumption, use of mosquito nets to prevent vector-borne diseases and availability of warm clothes in winter (Chowdhury et al., 2020).

Refugee populations in Jordan, Japan, New Zealand and Australia noted the importance of social bonding or social capital in creating adaptive capacities. In Jordan's Al Baqa'a camp, refugees emphasised how social bonding through regular collective meetings enhances their adaptive capacity and creates a sense of normalcy in the camp (Aburamadan, 2022). However, having to walk long distances in the heat or cold also limits social bonding and interaction, and eventually impedes families' integration in the refugee camp space

(Aburamadan, 2022; Uekusa, 2019) describes how refugee populations in New Zealand show agency and deploy social capital in strategically improvising and in overcoming linguistic barriers in times of disaster. Multilingual children in the refugee community play an essential role in conveying disaster warnings and evacuation information to their elders and other community members (Marlowe & Bogen, 2015). Younger family members used Facebook to communicate with friends and family, local and overseas, about their well-being and the disasters, helping them to alleviate stress and (re-)connect with others. In doing so, they developed durable social networks to depend upon, and which eventually reduced their disaster vulnerability (Uekusa & Matthewman, 2017). Strong family connections and social networks among refugee communities in Australia are considered beneficial to overcome periods of extreme heat, especially for culturally and linguistically diverse communities (Hansen et al., 2014).

Furthermore, refugee communities in New Zealand felt an increased civil belonging after the major earthquakes in 2011, even though this was not sustained in the long term (Marlowe, 2015; Marlowe & Lou, 2013). Next to that, refugees' senses of belonging were mainly attributed to intra-ethnic relationships (Marlowe, 2015). Larger refugee communities reported more stable support systems, and the presence of communal spaces like community centres provided a greater sense of community belonging (Marlowe & Lou, 2013). Spirituality and religious practices were also identified as coping mechanisms after the earthquakes, especially among Somali and Afghani refugee communities in New Zealand (Osman et al., 2012).

Leadership and internal support were further contributors to adaptive capacities. In some cases, community leaders liaised with external organisations to provide their communities with information and support after the earthquakes (Marlowe & Bogen, 2015). Refugees that had experience of disasters prior to their displacement were better equipped to deal with earthquakes in Japan and New Zealand; thanks to the cultural and social capital, practical knowledge, cultural values and mutual support, refugees were better able to adapt to the post-disaster environment without basic services or utilities (Uekusa & Matthewman, 2017; Marlowe & Lou, 2013). Strong social and cultural networks allowed some refugee households to move to unaffected areas close to family in the aftermath of a disaster, or even abroad (Uekusa & Matthewman, 2017).

The abilities of refugee households to adapt to hazards is mediated by governance or regulatory factors, household socioeconomic position and by social or collective capacity. Exclusion from national legislative frameworks renders refugees dependent on humanitarian assistance and isolated from national social protection frameworks. Economic hardship leaves different adaptation measures beyond the financial reach of many households. Deprivation also interacts with other factors to dampen post-disaster health-seeking behaviour in Bangladesh and isolated IDP communities from livelihood opportunities in Colombia. Strong internal community ties bolstered the adaptive capacity of households in the aftermath of earthquakes in Japan and New Zealand. Likewise, social capital and networks were shown to be important sources of adaptive capacity in Bangladesh and Jordan's refugee camps.

3.2.5 Adaptation and risk mitigation strategies

This section synthesises strategies reported in the sampled articles to mitigate climate risks for forcibly displaced populations. These strategies can be distilled into strategies to reduce risk or enhance adaptive capacity at the individual or community level and strategies to improve risk management capacity at the institutional or governance level. Fostering intra-community perceptions of belonging, inter-community cohesion as well as between communities and government agencies was found to be an important source of risk mitigation. In New Zealand, local authority-driven dialogue between refugee and non-refugee communities drives civic participation, self-sufficiency and social relationships would increase the resilience of disaster affected communities (Osman et al., 2012; Marlowe, 2015; Marlowe & Lou, 2013), with young people thought to play an important role in including vulnerable community members in such initiatives (Marlowe & Bogen, 2015). In Colombia, enabling displaced persons to create a sense of 'home' has an impact on feelings

of security, underlining the importance of participatory and communal efforts in designing disaster risk reduction strategies (Few et al., 2021). Risk awareness and preparedness can be enhanced through provision of early warning systems, knowledge on food and medicine storage, and increased literacy (Zaman et al., 2020; S. Ahmed et al., 2021), along with empowerment strategies, risk education campaigns, and basic service provision (Marzouk et al., 2022; Uekusa & Matthewman, 2017). Similar risk communication workshops in Bangladesh were found to increase perceptions of agency and hope, notably among marginalised groups - including women - fostering inclusion and empowerment among refugee communities, creating positive spill-overs from vital knowledge dissemination processes (Lejano, Rahman, & Kabir, 2020).

Livelihood activities, where they are accessible, may provide an additional strategy to offset risks from disasters. Livelihood interventions related to business, farming or livestock, and education and skill development are further encouraged community and household interventions that may improve the adaptive capacity of households prior to and in the recovery from disasters (Islam et al., 2022).

Conducting routine risk assessments and integrating the findings into creating policy and programming as well as camp allocation, design and management is, according to authors, essential. In Lebanon, the current exposure to landslide risk would be best mitigated by a transition to urban habitation (Pollock et al., 2019) while in Kenya spatial analysis would lead to better inclusion of environmental factors in camp site selection (Younes et al., 2022). Creating accurate forecasts of risks including landslides and cyclones is facilitated by cutting edge techniques including machine learning, Earth Observation data and GIS data and would enable humanitarian actors to create response plans and effectively provision appropriate resources in Bangladesh (Emberson et al., 2021; Alam et al., 2020). Investment in forests and their inclusion at the heart of camp planning was also identified as a cost-effective landslide risk reduction strategy in Bangladesh (N. Ahmed et al., 2020). Providing or enabling shelter that is contextually appropriate and adequate is an important risk mitigation strategy. Dwelling loss is both highly disruptive as well as potentially fatal. Durable and contextually relevant shelter is an important strategy identified in Jordan and Bangladesh, along with shelter strengthening kits when appropriate (Islam et al., 2022; B. Ahmed, 2021). Shelter design can be improved through use of local techniques: refugees in Jordan modified their shelters to improve thermal comfort and privacy (Marzouk et al., 2022). Use of collective emergency shelters, provision of essential supplies and enhanced emergency response plans may reduce the risk to life during disasters (B. Ahmed, 2021). In the long-run, a transition to use of renewable energy along with recycling initiatives can increase community resilience (Marzouk et al., 2022).

Creating emergency response plans is essential, however their effectiveness is undermined if they are not inclusive. Cyclone Idai in Zimbabwe highlighted the inadequacy of national emergency response plans, with poor access to WaSH facilities as a result, leading to calls for gender inclusive emergency response plans to be defined through participatory processes (Sibanda et al., 2022). In Colombia, IDPs were found to be excluded from national preparedness (Few et al., 2021) while in New Zealand and Australia refugees were excluded through linguistic isolation (Hansen et al., 2014; Uekusa, 2019; Uekusa & Matthewman, 2017).

Beyond these local approaches, the importance of fulfilment of international commitments and covenants is essential. On-going encampment and exclusion policies in Eastern Africa that do not focus on integration, resettlement or return hamper the ability of refugees to cope with shocks (Spiegel & Mhlanga, 2022), highlighting the need for sustainable, durable policies based on local principles but in line with the Global Compact on Refugees (Spiegel & Mhlanga, 2022). Similarly, integrated, sustainable and long-term solutions to the refugee situation in Bangladesh are essential to dampen the interconnected and overlapping vulnerabilities experienced by Rohingya refugees during their displacement in Bangladesh (Mitu et al., 2022), including but not limited to ensuring safe and legal return to Myanmar (Zaman et al., 2020), granting legal refugee status to refugees in Bangladesh and improved inter-sectoral and inter-agency cooperation (B. Ahmed, 2021; Cook & Foo, 2019).

Overall, the role of building community structures and fostering inter and intra community dynamics was highlighted in the reviewed articles, along with the importance of ensuring communities and individuals are aware of key immediate survival knowledge for food, water and medicine. Many of the adaptation and mitigation strategies described in the sample do not focus on individual mitigation or adaptation strategies. This may reflect the outsized role of institutional or governance factors on refugee lives and livelihoods and the limited resources of refugees for risk mitigation. The authors in our sample urge policy makers to prioritise risk assessments and to integrate findings into policy decision-making to reduce the exposure of refugees to climate hazards. National emergency response plans must include refugees, but also must ensure that they are effectively communicated to communities. Moreover, a fundamental shift in the humanitarian model away from encampment with greater integration in national policy frameworks is identified as a critically important strategy.

4 Discussion

This paper, to our knowledge, is the first to systematically harmonise the disparate literature on climate risks for displaced populations and to create a unified inter-disciplinary knowledge base on the topic. The articles forming part of this review cover a wide variety of geographical regions, populations, methods, and scientific disciplines. The review highlighted how forcibly displaced populations are highly exposed to climate hazards in their settlement areas. Few of the studies conduct primary analysis on meteorological or climatic conditions, instead relying on secondary sources or grey literature published by UN agencies. An important but underrepresented discourse focuses on the extent to which they are exposed to hazards at a greater rate or to a more significant degree than host-community populations living in the same area. While Ahmed et al. (2020) and Cook (2019) argue that the refugee camps in CBD are more exposed to extreme weather events than the rest of Bangladesh (N. Ahmed et al., 2020; Cook & Foo, 2019), Pollock et al. (2019) and Few et al. (2021) find that refugees and IDP households are not disproportionately exposed to climate risks than other households. The relative exposure of displaced populations to climate hazards therefore seems to be highly context-specific. Nevertheless, the literature emphasises that forcibly displaced populations may demonstrate greater vulnerability than host populations and suffer greater impacts because of the vulnerabilities inherent to their displacement, being caught in a 'cycle' of vulnerability, displacement and further marginalisation. As Few et al. state for IDPs in Colombia: "We are not arguing that IDPs are necessarily more exposed to physical risk than non-IDPs in such locations, but we do contend in this paper that their life experience of multiple forms of risk shapes their ongoing vulnerability in complex ways" (Few et al., 2021, p. 3). Camp infrastructure and natural resource management lead to susceptibility to harm during climate hazards, damaging limited WaSH facilities which in turn causes public health hazards. Forcibly displaced populations are often excluded from early warning systems or emergency response plans, while gender-based violence and discrimination placed women and people living with disabilities at further risk. Previous traumatic experiences during displacement may render displaced populations less able to cope with subsequent hazards or disasters. These findings are in line with other studies on climate vulnerability that have shown that the relationship between poverty and climate vulnerability is often bidirectional; those living in poverty are more vulnerable to extreme weather events, which in turn may deepen poverty levels (Hallegatte, Fay, & Barbier, 2018; Hallegatte, Vogt-Schilb, Rozenberg, Bangalore, & Beaudet, 2020).

On top of that, displacement artificially induces a reduction in adaptive capacity in displaced populations as a result of legal exclusion from state infrastructure, protections and provisions. Despite their importance, we observe a large variation in the information that the articles provided on adaptive capacities. Very few studies explicitly mention the terms 'sensitivity' or 'adaptive capacity'. Moreover, the concepts of sensitivity, vulnerability and adaptive capacity are often used interchangeably, leading to a lack of conceptual clarity. Without conceptual clarity and definitional frameworks, comprehensive assessments of exposure, vulnerability and sensitivity will be difficult to accomplish, and the absence of full and comprehensive vulnerability assessments in the sample under review here is testament to that fact. Most articles provide policy advice based on their findings, though recommendations are often not comprehensive, reflecting the fragmented

nature of the analysis reviewed. Several authors call for disaster risk reduction by integrating environmental factors into site selection and by performing risk analyses to inform the allocation of resources, infrastructure, and service provision. Provision of shelter adequate to local climate conditions is highlighted notably in Western Asia and Eastern Africa where displaced populations are exposed to extreme temperatures. Across all regions, access to information, social integration and self-sufficiency of displaced populations was deemed essential. Beyond climate adaptation, papers reviewed called for sustainable and durable solutions for displaced populations, particularly in Eastern Africa and Bangladesh, where the impact on refugee and IDP populations appears more pronounced. Papers further stress the adaptive capacities and resilience of those who are displaced, and how policies/programs should be designed to support these through participatory approaches.

5 Conclusion: Towards A Future Research Agenda

It is well established that the impacts of climate change are unevenly distributed across population groups and geographic locations (Thomas et al., 2019; IPCC, 2022). Differential vulnerability to climate hazards is determined by a complex interaction of economic, historical, and political factors. This review showed that displaced populations are at risk of severe impact during climate disasters as a result of their sensitivity and low adaptive capacity, in combination with, in some cases, greater exposure to risks than other populations. Climate hazards in displacement contexts interact with pre-existing marginalisation and vulnerability to create cycles of deprivation and aid dependency.

This review has also exposed the limitations of the current body of evidence: studies rarely comprehensively examine the exposure, sensitivity and adaptive capacities of displaced populations, with a lack of unified conceptual clarity. Moreover, the distribution of analyses does not reflect either the variety of climate change effects, such as rapid- and slow-onset events, nor the distribution density of refugees globally, or their distribution between camp and non-camp settlements. These findings lead us to call for an inclusive climate risk research agenda that explicitly recognises the enhanced risks that displaced populations face, but moreover covering all forcibly displaced populations, including those in hard-to-reach locations. This research agenda must provide conceptual clarity, harness innovative sources of data and computational methods to quantify the extent of exposure and additionally the magnitude and direction of the relationship between complex socio-economic and socio-political factors on hazard vulnerability.

The future research agenda on displaced populations' climate risks will both simultaneously need to localise and generalise. Despite their common label, forcibly displaced populations exhibit heterogeneity in sensitivities and adaptive capacities similarly to all populations. The role of place-specific research and the importance of recognising the knowledge and agency of displaced populations has been underscored throughout this literature review. However, it is also essential to broaden the scope of research to ensure that a broader spectrum of displacement locations are included and to improve the generalisability of findings. Current literature (at least in LMICs) focuses heavily on camp-based populations. However, approximately half of IDPs and close to four fifths of refugees reside outside camps (Calabria, Jaime, & Shenouda, 2022). Moreover, the geographic distribution of research needs to overlap more closely with the distribution density of refugees globally. East Africa, the Levant and Greece are home to large populations of refugees, yet are underrepresented in, or absent from, our sample. Displaced populations residing in areas ravaged by conflict and instability are similarly absent from current analysis. Lastly, papers reviewed in this study were primarily retrospective. Integrating climate modelling into the policy discourse on displaced populations and their exposure and vulnerability to climate hazards will help build more sustainable displacement settlements in the future, and reduce potential harm to displaced populations.

Policy discourse in the coming decades will be driven in large part by climate change and dealing with its economic, political and geographical consequences. In some parts of the world, including one that is host

to more than half a million refugees, this conversation is even now a reality. As the drought in the Horn of Africa approaches its ignoble third anniversary, encamped refugee populations in Kenya's refugee camps, and displaced populations in South Sudan, Ethiopia and Somalia are counting the consequences. As this trend continues or accelerates, existing vulnerabilities may be exacerbated, and new inequalities are likely to form as exposure to existing and new hazards falls on different populations. For policy dialogues to be effective in delivering sustainable development for all, it is essential to ensure that all populations are included, and that the extent of the complex and intersecting vulnerabilities are taken into account. Ensuring that those who occupy a most precarious but institutionalised position in society are included in climate risk planning is essential to ensure that the 'leave no one behind' principle that underpins the Sustainable Development Goals and Agenda 2030 is upheld.

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Appendix

Author(s)	Year	Title	Country	Population
Aburamadan	2022	Refugee-led socio-spatial organization in Al Baqa'a camp, Jordan	Jordan	Refugees
Ahmed	2021	The root causes of landslide vulnerability in Bangladesh	Bangladesh	Host community, refugees
Ahmed et al.	2020	Machine Learning for Predicting Landslide Risk of Rohingya Refugee Camp Infrastructure	Bangladesh	Refugees
Ahmed et al.	2020	Application of geospatial technologies in developing a dynamic landslide early warning system in a humanitarian context: the Rohingya refugee crisis in Cox's Bazar, Bangladesh	Bangladesh	Refugees
Ahmed et al.	2021	The sustainability-peace nexus in crisis contexts: how the Rohingya escaped the ethnic violence in Myanmar, but are trapped into environmental challenges in Bangladesh	Bangladesh; Myanmar	Refugees; IDPs
Alam et al.	2020	Cyclone risk assessment of the Cox's Bazar district and Rohingya refugee camps in southeast Bangladesh	Bangladesh	Refugees
Albadra et al.	2017	Thermal comfort in desert refugee camps: An interdisciplinary approach	Jordan	Refugees
Chowdhury et al.	2020	Climate change impacts and adaptations on health of Internally Displaced People (IDP): An exploratory study on coastal areas of Bangladesh	Bangladesh	IDPs
Cook	2019	Towards 'shared' and 'complex' disaster governance in Bangladesh: The 2017 Rohingya Exodus	Bangladesh	Host community, refugees
Emberson et al.	2021	Landslide Hazard and Exposure Modelling in Data-Poor Regions: The Example of the Rohingya Refugee Camps in Bangladesh	Bangladesh	Refugees
Few et al.	2021	Moving with risk: Forced displacement and vulnerability to hazards in Colombia	Colombia	IDPs
Hansen et al.	2014	Extreme heat and cultural and linguistic minorities in Australia: Perceptions of stakeholders	Australia	Immigrants, refugees
Hossain et al.	2022	Climate change induced human displacement in Bangladesh: Implications on the livelihood of displaced riverine island dwellers and their adaptation strategies	Bangladesh	IDPs
Islam et al.	2022	Sustainable Livelihood for Displaced Rohingyas and Their Resilience at Bhashan Char in Bangladesh	Bangladesh	Refugees
Jayawardanaa et al.	2019	Disaster resilience among war-affected people resettled in Northern Sri Lanka: Challenges revisited	Sri Lanka	IDPs, host community
Lejano et al.	2020	Risk Communication for Empowerment: Interventions in a Rohingya Refugee Settlement	Bangladesh	Refugees
Marlowe	2015	Belonging and Disaster Recovery: Refugee-Background Communities and the Canterbury Earthquakes	New Zealand	Refugees

Author(s)	Year	Title	Country	Population
Marlowe & Bogen	2015	Young people from refugee backgrounds as a resource for disaster risk reduction	New Zealand	Refugees
Marlowe & Lou	2013	The Canterbury Earthquakes and refugee communities	New Zealand	Refugees
Marzouk et al.	2022	Assessment of Perceptions of Climate Change and Its Causes and Impacts on Mental Health and Psychosocial Wellbeing among a Group of Internally Displaced Persons in Iraq	Iraq	IDPs
Mitu et al.	2022	Climate Risks and Truncated Opportunities: How Do Environmental Challenges Intersect with Economic and Social Disadvantages for Rohingya Adolescents in Bangladesh?	Bangladesh	Refugees
Osman et al.	2012	Christchurch earthquakes: how did former refugees cope?	New Zealand	Refugees
Pollock et al.	2019	Risk at the margins: A natural hazards perspective on the Syrian refugee crisis in Lebanon	Lebanon	Refugees
Sibanda et al.	2022	Disaster (Un)preparedness under cyclone Idai: Revisiting women activities in water and sanitation at tongogara refugee camp, Zimbabwe	Zimbabwe	Refugees
Spiegel & Mhlanga	2022	Refugee Policy Amidst Global Shocks: Encampment, Resettlement Barriers and the Search for 'Durable Solutions'	Zimbabwe	Refugees
Uekusa	2019	Disaster linguicism: Linguistic minorities in disasters	New Zealand; Japan	Immigrants, refugees
Uekusa & Matthewman	2017	Vulnerable and resilient? Immigrants and refugees in the 2010-2011 Canterbury and Tohoku disasters	New Zealand; Japan	Immigrants, refugees
Younes et al.	2022	Spatial suitability analysis for site selection of refugee camps using hybrid GIS and fuzzy AHP approach: The case of Kenya	Kenya	Refugees
Zaman et al.	2020	Disaster risk reduction in conflict contexts: Lessons learned from the lived experiences of Rohingya refugees in Cox's Bazar, Bangladesh	Bangladesh	Refugees

Table 3: Articles included in scoping review

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2023-01 *Can international mobility shape students' attitudes toward inequality? The Brazilian case* by Cintia Denise Granja, Fabiana Visentin and Ana Maria Carneiro
2023-02 *Demand-led industrialisation policy in a dual-sector small open economy* by Önder Nomaler, Danilo Spinola and Bart Verspagen
2023-03 *Reshoring, nearshoring and developing countries: Readiness and implications for Latin America* by Carlo Pietrobelli and Cecilia Seri
2023-04 *The role of product digitization for productivity: Evidence from web-scraping European high-tech company websites* by Torben Schubert, Sajad Ashouri, Matthias Deschryvere, Angela Jäger, Fabiana Visentin, Scott Cunningham, Arash Hajikhani, Lukas Pukelis and Arho Suominen
2023-05 *More than a feeling: A global economic valuation of subjective wellbeing damages resulting from rising temperatures* by Stephan Dietrich and Stafford Nichols
2023-06 *Was Robert Gibrat right? A test based on the graphical model methodology* by Marco Guerzoni, Luigi Riso and Marco Vivarelli
2023-07 *Predicting social assistance beneficiaries: On the social welfare damage of data biases* by Stephan Dietrich, Daniele Malerba and Franziska Gassmann
2023-08 *Related or unrelated diversification: What is smart specialization?* By Önder Nomaler and Bart Verspagen
2023-09 *Breach of academic values and digital deviant behaviour: The case of Sci-Hub* by Giulia Rossello and Arianna Martinelli
2023-10 *The effect of lobbies' narratives on academics' perceptions of scientific publishing: An information provision experiment* by Giulia Rossello and Arianna Martinelli
2023-11 *Making impact with agricultural development projects: The use of innovative machine learning methodology to understand the development aid field* by Lindsey Moore, Mindel van de Laar, Pui Hang Wong and Cathal O'Donoghue
2023-12 *Green windows of opportunity in the Global South* by Rasmus Lema and Roberta Rabellotti
2023-13 *The green and digital transition in manufacturing global value chains in latecomer countries* by Rasmus Lema and Roberta Rabellotti
2023-14 *Impact of prestigious-STEM Education of corporate board members on innovation effort: Evidence from India* by Rituparna Kaushik, Sourabh Bikas Paul and Danilo Spinola
2023-15 *Reducing environmental impact through shared ownership: A model of consumer behaviour* by Francesco Pasimeni and Tommaso Ciarli
2023-16 *Welfare losses, preferences for redistribution, and political participation: Evidence from the United Kingdom's age of austerity* by Patricia Justino, Bruno Martorano and Laura Metzger
2023-17 *Inequality, social mobility and redistributive preferences* by Isabel Günther and Bruno Martorano
2023-18 *Automation-induced reshoring and potential implications for developing economies* by Hubert Nii-Aponsah, Bart Verspagen and Pierre Mohnen
2023-19 *Ethnic spatial dispersion and immigrant identity* by Amelie F. Constant, Simone Schüller and Klaus F. Zimmermann
2023-20 *Public R&D and Growth: A dynamic Panel VECM Data Analysis for 14 OECD Countries* by Thomas H.W. Zieseme by r

2023-21 *Innovation and the labor market: Theory, evidence and challenges* by Nicoletta Corrocher, Daniele Moschella, Jacopo Staccioli and Marco Vivarelli

2023-22 *Revisiting Schumpeter in Europe: Place-based innovation and transformative industrial policy* by Luc Soete and Johan Stierna

2023-23 *Identification of Fourth Industrial Revolution technologies using PATSTAT data* by María de las Mercedes Menéndez, Önder Nomaler and Bart Verspagen

2023-24 *Expectations and the stability of stock-flow consistent models* by Huub Meijers, Joan Muysken and Giulia Piccillo

2023-25 *Critical minerals and countries' mining competitiveness: An estimate through economic complexity techniques* by Jorge Valverde Carbonell, María de las Mercedes Menéndez, and Carlo Pietrobelli

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2023-31 The effect of government cuts of doctoral scholarships on science by Giulia Rossello

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