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Required citation: Escribano, P. and D.P. Ganddini (2024). Climate change, food insecurity and human mobility: Interlinkages, evidence and action. In: *World Migration Report 2024* (M. McAuliffe and L.A. Oucho, eds.). International Organization for Migration (IOM), Geneva.

ISBN 978-92-9268-707-6 (PDF)

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PUB2023/047/L*/7

7 CLIMATE CHANGE, FOOD INSECURITY AND HUMAN MOBILITY: INTERLINKAGES, EVIDENCE AND ACTION[1]

Introduction

Climate change is widely considered an "existential threat to humanity", in the words of United Nations Secretary-General António Guterres.[2] Its impacts are being increasingly felt, albeit unevenly, by communities and countries worldwide.[3] In recent years, different editions of the World Migration Report have explored the linkages between human mobility, the environment and climate change, accompanying the growth in scientific literature devoted to this topic,[4] with specific focuses on migration as adaptation,[5] and on the links between slow-onset climate change and migration.[6] The Intergovernmental Panel on Climate Change (IPCC) notes that:

> since AR5 [the fifth assessment report of 2014] there is increased evidence that climate hazards associated with extreme events and variability act as direct drivers of involuntary migration and displacement and as indirect drivers through deteriorating climate-sensitive livelihoods.[7]

Extreme environmental events – both attributable and non-attributable to climate change – have contributed to a rise in food insecurity worldwide. Multiple causes underpin food insecurity, including lack of food, lack of purchasing power, inadequate distribution and poor use of food at the household level.[8] The number of people worldwide considered to be experiencing acute food insecurity and in need of urgent assistance rose to over 257 million in 2022, a 146 per cent increase since 2016.[9] In light of this increase, and the worsening impacts of climate change, there is an urgent need to assess the connections between climate change, food insecurity and human mobility worldwide.

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[1] Pablo Escribano, regional migration, environment and climate change specialist, IOM; Diego Pons Ganddini, assistant professor, Colorado State University.

[2] United Nations News, 2018.

[3] Pörtner et al., 2022.

[4] Together with seminal works such as Afifi et al., 2013; Black et al., 2011; Black, 2001; Dun and Gemenne, 2008; Myers, 1993.

[5] Oakes et al., 2019.

[6] Traore Chazalnoel and Randall, 2021.

[7] Pörtner et al., 2022:52.

[8] FAO et al., 2013.

[9] FSIN and Global Network Against Food Crises, 2023. As noted there, these figures must be understood in a context of expansion of the total population assessed. Phases 1 to 5 of the Food Security Phase Classification/Cadre Harmonise framework include: phase 1: none/minimal; phase 2: stressed; phase 3: crisis; phase 4: emergency; phase 5: catastrophe/famine.

What do we mean by "climate change" and "food insecurity"?

The IPCC defines climate change as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes".

The Food and Agriculture Organization of the United Nations (FAO) defines "food insecurity" as a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development, and an active and healthy life. It may be caused by the unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food at the household level. Food insecurity, poor conditions of health and sanitation and inappropriate care and feeding practices are the major causes of poor nutritional status. Food insecurity may be chronic, seasonal or transitory.

Sources: FAO et al., 2013; IPCC, 2022.

Measuring the impact of climate change on food insecurity is a complicated task. Extreme climate events can cause food insecurity and are rendered more common due to climate change; however, the causal relationships between food insecurity and anthropogenic climate change are still limited by a lack of long-term data and the complexity of food systems.[10] The unequal globalization of food supplies, including crop species production, supply and transportation, along with the specialization of the food industry, renders direct attribution virtually impossible.[11] Non-climatic factors that have an impact on global food security, including the global COVID-19 pandemic,[12] and conflict – such as the ongoing war in Ukraine – also need to be recognized.[13]

Human mobility, used here as an umbrella term, is a multicausal phenomenon, that often derives from a wide variety of factors interacting with each other.[14] This umbrella term includes forced and voluntary forms of movement that can occur in the context of climate and environmental change. This terminology is aligned with the ongoing contribution of IOM,[15] which has developed comprehensive working definitions of key terms relevant to the climate–migration nexus (see Appendix A). These definitions are not normative, nor are they internationally agreed upon, but they seek to provide a broad framing of the topic for working purposes. This is particularly useful when discussing human mobility in the context of sudden- and slow-onset climate impacts, as mobility can take many forms and can be linked to multiple interacting factors.

[10] Bezner Kerr et al., 2022.

[11] Campi et al., 2021.

[12] Grosso, 2022.

[13] Montesclaros and Sembiring, 2022.

[14] United Kingdom Government Office for Science, 2010; McAuliffe and Ruhs, 2017.

[15] See, for example, IOM, 2021a; IOM, 2022.

In the context of the current climate emergency and rising food insecurity, this chapter explores the interlinkages between climate change, food insecurity and human mobility, highlighting the complexities of the relationships between the three concepts in multiple scenarios. The next section assesses the different ways that climate change and food security influence human mobility, under what circumstances and through what channels. The following section explores the extent to which migration and human mobility form part of the solution to address climate change impacts and food security scenarios. The final section discusses approaches for developing policies and practices that have the potential to manage increasing risk, especially those impacting the most vulnerable communities. We include migrant voice text boxes throughout the chapter to underscore the human impacts at the local level.

From climate change to food insecurity: Compounding and direct drivers of human mobility

The impacts of climate change on food insecurity and human mobility are nuanced and complex, as highlighted in Figure 1. Extreme processes associated with climate change, including sudden- and slow-onset events and environmental degradation,[16] have the potential to affect food systems at every level of the supply chain. In parallel, global food insecurity has dramatically increased during the last 10 years, partially as a result of changes in the climate, but also due to an increase in conflict (both frequency and intensity) and economic slowdowns, compounded by the effects of the COVID-19 pandemic.[17] Direct impacts of climate-related events on food security are most visible with sudden-onset disasters (such as hurricanes or floods), which tend to destroy community infrastructure or damage agricultural landscapes.

Slow-onset climate events usually associated with anthropogenic climate change (such as drought, rising sea levels, or land degradation), although less visible, also contribute to food insecurity by altering livelihoods and reducing population well-being, usually over a long period of time.[18] The direct and indirect impacts resulting from sudden- and slow-onset climate events are often compounded by social vulnerabilities, as in the case of food insecurity. Extreme and subtle climate events associated with climate change can be both direct and indirect drivers of migration and can, therefore, affect human mobility in a non-linear way.[19]

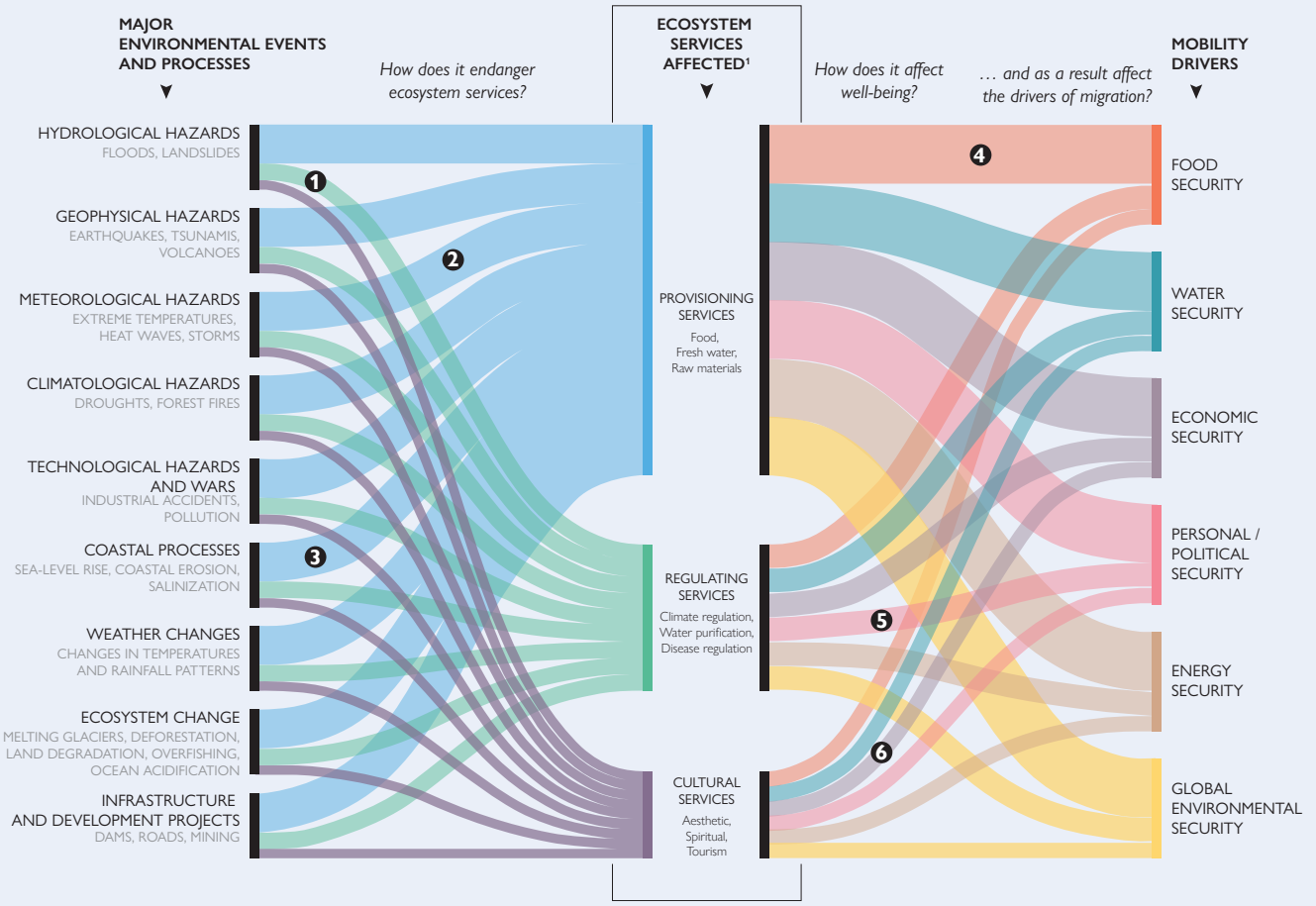
[16] See key terms in Appendix A.

[17] FAO et al., 2021.

[18] Pörtner et al., 2022.

[19] Ibid.

Figure 1. Links between environmental change, ecosystems and human mobility



EXAMPLES:

1. Cyclone destroying mangrove > jeopardizing protection from future hazards
2. Loss of agricultural land > crop yield decrease
3. Sea level rise and salt-water intrusion > freshwater resources affected
4. Loss of crops > famine and malnutrition
5. Epidemics > public health risks (and potential social unrest)
6. Tourism affected > job losses

[1] Ecosystem services are the direct and indirect contributions of ecosystems to human well-being. These services are grouped into four categories: Provisioning, Regulating, Cultural, and Supporting services. Supporting services, as overarching services, are not represented in this diagram.

The arrows' width does not represent an exact number (this is a conceptual diagram).

Source: Millennium Ecosystem Assessment (2005) © IOM (Mokhnacheva, Ionesco), Gemenne, Zoï Environment Network, 2015

When it comes to identifying both the impacts of climate change on human mobility, and the causes of changes in climate, a key challenge is current, natural climate variability. Climate variability – including variability that operates at interannual and decadal scales – can mask or enhance the current effects of human-induced changes in the climate system. Additionally, while some of the impacts of climate change have been associated with both food insecurity and human mobility, it remains difficult to isolate climate factors from other dynamics (such as non-climatic environmental processes, or social, economic and political factors).

The IPCC framework defines climate risk as the interaction between climatic hazards, climatic exposure and climatic vulnerability. Following this definition means that when assessing exposed food systems, climate risk analysis must consider the vulnerabilities of the exposed populations (including their sensitivity to the hazard and their adaptive capacity). These vulnerability factors include income level, access to land and land tenure security, the fragility of food production systems, access to water for irrigation, access to information, and loss and damage from sudden- or slow-onset climate events.[20] Food systems exposed to climate hazards in vulnerable contexts are therefore at risk of experiencing several climate stressors, "with the largest effects being decreased crop yields and livestock productivity, as well as declines in fisheries and agroforestry in areas already vulnerable to food insecurity."[21]

While studies in various countries suggest a link between rainfall variability and food insecurity, creating conditions for increased migration in vulnerable areas,[22] research in African regions note that the intertwined impacts of global heating and social, economic and political factors on human mobility is not automatic but remains diverse.[23] The range of impacts of climate hazards on human mobility is further explored in the next sections, where case studies of conditions of heightened vulnerability suggest multiple scenarios of climate-driven mobility. Within these scenarios, the IPCC recognizes the following potential outcomes: adaptive migration (as a relative choice at the individual and household level); involuntary migration and displacement, planned relocation and immobility.[24]

Sudden-onset climate hazards

Sudden-onset disasters impact people's lives profoundly, often without warning, making the most basic of needs difficult or impossible to meet for entire communities. There are many different examples of how climate-related floods, hurricanes, wildfires and other sudden disasters have resulted in food insecurity. Floods affected food security, for example, in several locations in Africa between 2009 and 2020.[25] In some countries of South Asia (such as Bangladesh, India and Pakistan), extreme floods are becoming more frequent and are expected to increase in magnitude as well, causing heavy damage to rice plantations, affecting mostly vulnerable minorities of the population.[26]

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[20] Bezner Kerr et al., 2022.

[21] Fanzo et al., 2018.

[22] Warner and Afifi, 2014.

[23] Schraven et al., 2020.

[24] Cissé et al., 2022.

[25] Reed et al., 2022.

[26] Mirza, 2011.

In 2022, Pakistan suffered what the Prime Minister called the worst floods in its history, destroying thousands of hectares of farmland, significantly impacting food production in the country and driving almost a quarter of that year's global disaster displacements.[27] In Nigeria, a study revealed that floods increased the number of food insecure households by 92.8 per cent, turning communities into food insecure sites, further delaying developmental goals.[28] In Afghanistan, a study found similar results, suggesting that increased exposure to flooding decreased calorie and micronutrient consumption, with other associated impacts on household income even after the flooding event.[29]

Migrant voices

"We are now struggling. Many years ago, things were better. We knew when the rains would start and end, but now nobody knows…. Rainfall was very favourable in the last 10–20 years compared to today. One could cultivate small parcels of land and harvest a lot. Today, the rainfall is very unpredictable; we would rather farm larger land sizes and harvest little…. Because of a severe drought, my family and I moved permanently to the river some distance away. But this was difficult because of fighting going on in that area and eventually we moved because of it" (Woman from the Sudan, Fugnido Camp, Ethiopia).

Source: Tamer et al., 2012.

Hurricanes have also been associated with a rise in food insecurity in Haiti, with severe impacts being correlated with moderate to severe household hunger.[30] In the United States, hurricane Harvey had a impact on food insecurity, with different groups affected differently; in particular, it had a stronger impact on displaced persons.[31] Surveys in Ghana have also highlighted the impact of wildfires on food insecurity, both in terms of transitory food insecurity in the lean season following a crop-destroying wildfire, and in the long term, through negative effects on soil productivity.[32] In Sahelian countries such as Mali, Senegal and Burkina Faso, rainfall variability and the early cessation of rainfall are linked to food security threats and food deficits.[33]

[27] Cabot, 2022; IDMC, 2023.
[28] Akukwe et al., 2020.
[29] Oskorouchi and Sousa-Poza, 2021.
[30] Kianersi et al., 2021.
[31] Fitzpatrick et al., 2020.
[32] Kpienbaareh and Luginaah, 2019.
[33] Schraven et al., 2020.

Slow-onset climate hazards

Just as is the case with the effects of sudden-onset hazards, the effects of slow-onset hazards like drought or rising sea levels (usually associated with the long-term influence of global temperature increases) can only be properly understood if we take an integrated approach to understanding their cross-scale interactions with food security and human mobility.[34] Growing evidence points to drought as the main cause of shortage in world grain production,[35] and drought remains an important driver of human mobility in sub-Saharan Africa, South Asia and South America.[36] The vulnerability associated with drought in these locations will be different according to the social, geographical and temporal contexts of those affected. An assessment in the Middle East revealed that drought events impact agricultural production and food security, but that food security in this region is also affected by livestock health, population growth and the availability of agricultural products.[37] Slow-onset climatic processes have been associated with both international and (especially) internal mobility, with case studies identifying populations leaving areas affected by various slow-onset hazards.[38] For instance, in the Americas:

> rural to urban migration in Northern Brazil, or international migration from Guatemala, Honduras and El Salvador to North America, are partly a consequence of prolonged droughts, which have increased the stress of food availability in these highly impoverished regions.[39]

Identifying the impacts of climate change on drought frequency and food insecurity requires acknowledging that rural and urban areas may experience hazards differently and may have different coping mechanisms.[40] In detangling the complex relationships between food security, drought and migration, it is important to acknowledge the anticipated increased frequency of extreme heat events in urban areas that threaten habitability in tropical and semi-arid regions of the world.[41]

Migrant voices

"It's really sad to see it. We are facing droughts and it makes it so difficult for us to grow our traditional foods like breadfruit. You can see from the distance that the sea is covering the land and pretty soon we will not be able to grow there. I am a strong believer of 'if there's a will, there's a way' because we don't want to lose our land, we want to protect it by any means available to us." (Nika, mayor of the remote outer atoll of Likiep in the Marshall Islands).

Source: IOM, 2022.

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[34] He et al., 2019.
[35] Gottfriedsen et al., 2021.
[36] Pörtner et al., 2022.
[37] Hameed et al., 2020.
[38] Pörtner et al., 2022.
[39] Castellanos et al., 2022.
[40] Sam et al., 2019.
[41] Dodman et al., 2022.

Aside from drought, rising sea levels and related effects have the potential to heavily impact food production and food security in coastal areas, such as in Bangladesh, where dedicated adaptation efforts are required to limit disasters.[42] In coastal Cameroon, rising sea levels affect crop productivity and output through coastal erosion, flooding of coastal lowlands and saltwater introduction.[43] Small island developing States are particularly exposed to sea-level rise; analysis in Kiribati, for instance, has highlighted that "rising sea levels, salinisation of aquifers, coastal erosion, changing biodiversity, increasingly frequent 'king tides' and drought" are increasing, affecting the well-being and food security of local populations.[44]

Although food insecurity partially derived from disasters remains a global challenge, its intensity is felt differently, as it intersects with multiple other variables.[45] Food insecurity particularly threatens smallholder farmers in developing countries around the world, due to their limited adaptative capacity and dependence on subsistence agricultural outputs for consumption.[46] In these cases, food insecurity is embedded in larger vulnerability dynamics that incorporate differentiated climate-related risks. The vulnerability of people encountering food insecurity is not evenly distributed: factors such as gender and age shape people's experiences. Children are more likely to suffer from malnutrition, for instance, and, as a result of traditional gender disparities, women and girls are likelier to have poorer capacities to cope with climate change.[47] Human mobility outcomes further depend on the different impacts of various hazards. Climate-vulnerable households can be affected by both sudden-onset hazards like floods and by slow-onset hazards like rising sea levels, further complicating risk assumptions.[48]

Multicausality of human mobility

The multicausality of climate change, food insecurity and human mobility, as well as the relationships between them, are very complex. Available evidence suggests that different levels of food security are related, at least partially, with the decision to migrate, and that they remain heavily shaped by gender and income levels.[49] In some cases, food insecurity directly links climate disasters with the decision to migrate. However, food insecurity itself may be impacted by other factors, including social inequalities among affected communities, which shape individuals' vulnerability and climate sensitivity levels.[50] In the central dry zone of Myanmar, for instance, food insecurity and flood risks are a function of income, food production systems, transportation and access to water for irrigation, in addition to loss and damage from floods and droughts.[51] In Chile, studies in the semi-arid region of Monte Patria highlighted that "uneven resource access, limited political bargaining power and the perceived impossibility to earn a sufficient income in the agricultural economy are locally considered as more important reasons for engaging in mobilities than considerations about climate change"; in particular, households and workers use preexisting labour migration channels to take themselves out of the municipality and towards the construction sector, to achieve higher education or to work in the mining industry.[52]

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42 Awal and Khan, 2020.

43 Abia et al., 2021.

44 Cauchi et al., 2019.

45 Cissé et al., 2022.

46 Nkomoki et al., 2019.

47 Bezner Kerr et al., 2022; Bleeker et al., 2021.

48 Rosalia and Hakim, 2021.

49 Smith and Floro, 2020; Smith and Wesselbaum, 2022.

50 Samim et al., 2021; Warner and Afifi, 2014.

51 Boori et al., 2017.

52 Wiegel, 2023.

The intersection of climate impacts, displacement and conflict dynamics in the Lake Chad Basin has been well documented. There, reduced access to resources, compounded by the impacts of climate change, have strong impacts on livelihoods and food security, creating conditions for conflict and driving mobility.[53] But climate change–migration–conflict dynamics are highly contextual: in Ghana, for instance, non-climatic and ecological conditions reinforce potential climate-induced conflicts, triggering migration and farmer–herder conflicts.[54] And in Colombia, Myanmar and the United Republic of Tanzania, migration appears to be driven by structural vulnerabilities in areas with low resilience, and food security emerges "as a product of environmental changes (droughts and floods), [and] as a mediating factor detonating violent conflict and migration in vulnerable populations".[55]

Migrant voices

"We come from the Izabal Department of Guatemala. We come from a rural community. I work in agriculture, sowing corn. There was also an okra plantation at some point. We mostly work on our land. We live on basic grains, crops, and from selling our products to buy the sustenance of our children, living day to day. When a disaster strikes, we are vulnerable. With these storms that came, these hurricanes [Eta and Iota in November 2020] we were hugely hit, which left us more vulnerable than we were. We are in a situation where we don't know where to go".

Source: IOM, n.d.

In Guatemala's Dry Corridor area, coffee cultivation, dependence on low-skilled labour and poverty levels are associated with food insecurity. In addition, the impact of consecutive drought, ill health and lack of income to buy medicine further exacerbate vulnerability.[56] In Guatemala, the majority of very poor and poor households in the Dry Corridor area acquire their food by purchasing it with income derived from working at coffee farms or in the sugar cane industry (more than 80%), while some grow it (less than 5%) and some collect it from wild sources (1–10%),[57] showing the intricacies and non-linearities of the climate–food security–migration nexus, and entry points for adaptation to avoid food insecurity outcomes (see the figure in Appendix B).[58] However, a recent study in Guatemala suggests that climate (for example, exposure to drought) is not the main variable directly associated with the decision to migrate.[59] Similarly, in Honduras modest prices are paid to small-scale coffee farmers, which are then used to buy food. Hondurans in those areas are affected when coffee prices decrease, such as when international coffee prices hit historic lows in September 2018, with an impact on international migration to the United States.[60] The impact of climate change on food security through a reduced availability of wild plant food sources has been assessed in southern Africa as a cause for concern under high emission scenarios.[61]

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53 Ehiane and Moyo, 2022.
54 Issifu et al., 2022
55 Morales-Muñoz et al., 2020.
56 Beveridge et al., 2019.
57 See FEWSNET, 2016.
58 Pons, 2021.
59 Depsky and Pons, forthcoming.
60 Reichman, 2022.
61 Wessels et al., 2021.

Estimating future impacts

Estimating future patterns of climate change-induced migration remains challenging, in part because sudden- and slow-onset climate events have not been considered in many of the models of climate migration, except for the Groundswell Report, which addresses water scarcity, declining crop productivity and rising sea levels as drivers of migration.[a] A useful summary is provided in the IOM paper prepared for the Twenty-eighth Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28).[b] With increased global mean temperatures as a consequence of greenhouse gases produced by industrialized countries, tipping points triggering mobility among low-income households may emerge.[c] Some of the current models projecting migration changes do not necessarily capture these "tipping points" of climate phenomena that influence climatic conditions, like El Niño Southern Oscillation (ENSO), that account for a great portion of climate variability in several regions of the world. Future migration models tend to focus on the potential impact of long-term trends of water availability for crops and crop yields, mostly considering temperature and precipitation variables. These models have limited applications for predicting rapid-onset disasters potentially related to food security outcomes and human mobility, as in the recent case of Eta and Iota in Central America.[d]

[a] Clement et al., 2021.
[b] IOM, 2023.
[c] Cissé et al., 2022.
[d] Shultz et al., 2021.

Immobility and poverty traps

While climate change is clearly linked to food insecurity and increased mobility, as the previous section has shown, climate hazards and food insecurity do not inevitably lead to the increased mobility of affected populations. In different scenarios, climate hazards can result instead in increased immobility, with distinct socioeconomic implications. In a region of Guatemala, for instance, a study found "no correlation between migration to the US and severe food insecurity in households, but the correlation became significant if the level of food insecurity was moderate, suggesting that families in extreme hardship did not have the resources to migrate."[62] In many settings, immobility is driven by multiple factors, including the availability of resources, gender dynamics and place attachment, in a continuum ranging from "people who are financially or physically unable to move away from hazards (i.e. involuntary immobility) to people who choose not to move (i.e. voluntary immobility) because of strong attachments to place, culture, and people".[63]

Looking at international movements, future projections suggest that climate change can induce "decreases in emigration of lowest-income levels by over 10% in 2100 and by up to 35% for more pessimistic scenarios including catastrophic damages".[64] In Zambia, vulnerability to climate change acts for some groups as a barrier to migrate, as "poor districts are characterized by climate-related immobility".[65] Persistent poverty means that some families cannot bear the financial cost of migration, and therefore remain trapped in climate-vulnerable areas. In Bangladesh, residents of climate-vulnerable villages who would like to relocate from their current residence are sometimes

[62] Castellanos et al., 2022.
[63] Cissé et al., 2022, drawing upon Carling's (2002) concept of "involuntary immobility".
[64] Benveniste et al., 2022.
[65] Nawrotzki and DeWaard, 2018.

unable to do so because of financial barriers, lack of access to information, lack of social networks and unavailability of working-age household members.[66] In these circumstances, well-planned and supported climate mobility, including relocation, may enable increases in well-being and positive outcomes.

Migrant voices

"Extreme weather from the North took my house, washed it away. I was left living in sand, right now my house is made of sand and sheet metal that I had made, but we have nowhere to go. We are poor, we are poor people" (Ricarda Flores, in Tabasco, México).

Source: Ortuño, 2022.

The complexities of mobility discussed above are important because they nuance a simplistic view of human mobility as a natural consequence of climate change impacts and food insecurity. As summarized by the IPCC, "specific climate events and conditions may cause migration to increase, decrease or flow in new directions".[67] Similarly, it would be inadequate to surmise that food security adaptation efforts in a particular region or in response to a particular event will automatically lead to reduced mobility. Climate adaptation and food security policies can offer alternatives and resources to members of exposed households, who may opt to engage in safer and more regular forms of migration. In northern Thailand, research has shown that, given local circumstances and migration trajectories, successful climate adaptation interventions do not prevent migration.[68] Furthermore, the most food-insecure populations are not likely to have the capacities and resources to migrate. Evidence suggests that migration is "mostly driven by structural vulnerabilities and unsustainable development pathways".[69] As a result, and as discussed in later sections, the objective of policy approaches should not be to prevent migration, but to address adverse drivers and enable migration as a possible choice that allows for achieving global development goals, rather than treating migration as a necessity undertaken to avoid calamities.

Food insecurity and climate change: To what extent can migration be part of the solution?

In the past, adaptation to both slow-onset and sudden-onset climatic hazards was perceived mostly as a local-level process of adjustment that reduced vulnerability to climate variability and change.[70] More recently, empirical case studies have emerged that highlight how some affected individuals, households and communities have used migration as an autonomous and spontaneous adaptation tool when climate change adversely affects habitability, climate-dependent livelihoods, or food security.[71] In anticipation of displacement or in the face of displacement, some governments have also put into practice planned relocation programmes, with variable results, such as in the

66 Siddiqui et al., 2017.

67 Cissé et al., 2022.

68 Rockenbauch et al., 2019.

69 Gautam, 2017; Mazenda et al., 2022.

70 Nicholls et al., 2017.

71 Gemenne and Blocher, 2017; Wiederkehr et al., 2018; Porst and Sakdapolrak, 2018.

Caribbean.[72] The relationship between migration and adaptation in the context of climate change is nuanced, and outcomes are indeed diverse and complex:

> Properly supported and where levels of agency and assets are high, migration as an adaptation to climate change can reduce exposure and socioeconomic vulnerability (medium confidence). However, migration becomes a risk when climate hazards cause an individual, household or community to move involuntarily or with low agency (high confidence). Inability to migrate (i.e. involuntary immobility) in the face of climate hazards is also a potential risk to exposed populations (medium confidence).[73]

The outcomes of migration as adaptation depend upon the circumstances of the individuals or households engaging in human mobility, and on the involvement and agency of the migrants, regardless of the reasons for migration.[74] Evidence suggests that the better off the individual or household is socioeconomically, the better the outcomes for the sending and receiving communities and households.[75] However, displacement associated with limited agency – once adaptation in place is no longer successful, or when government actions are insufficient and when climate impacts surpass the coping capacity of vulnerable communities – can yield negative outcomes in terms of loss of livelihoods and overall well-being.[76] Evidence also indicates that displacement in these cases is usually associated with unanticipated and profound loss.[77]

Adaptive migration: What does the evidence say?

Migration appears as a coping or adaptation option among other strategies when households are confronted with the impacts of climate hazards.[78] Communities faced with socioeconomic challenges at home may keep searching for work opportunities elsewhere as a viable livelihood pathway, more so when faced with structural poverty, limited access to land and land ownership, and in the face of detrimental climatic conditions affecting their crops.[79] In low- and middle-income countries, adaptive migration seems more likely to be from rural to urban.[80] Long-term international migration to high-income countries from low-income countries suggests that households and individuals migrate to realize financial opportunities and increase household income in the country of origin via remittances.[81] From a food security perspective, migrant communities from around the world provide income to the communities of origin to buy food through remittances.[82] Evidence suggests that these mobilities in South Asia have promoted climate resilience in sending communities.[83]

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72 IOM, 2021b.

73 Pörtner et al., 2022.

74 McInerney et al., 2022; Dodman et al., 2022.

75 McInerney et al., 2022; Cissé et al., 2022.

76 Castellanos et al., 2022.

77 Ayeb-Karlsson et al., 2022; Turton, 2003.

78 Traore Chazalnoel and Randall, 2021.

79 Gautam, 2017.

80 Cissé et al., 2022.

81 McAuliffe and Triandafyllidou, 2021.

82 Crush and Caesar, 2017.

83 Cissé et al., 2022.

Remittances help households to adapt as well as facilitate agricultural adaptation, which ensures greater food security.[84] In northern Thailand, adaptation innovation in small-scale farming has been related to translocal migration networks.[85] In Nepal, remittance-recipient households are more likely to invest a part of their savings in flood preparedness if the women staying behind have access to capacity-building interventions that aim to strengthen autonomous adaptation measures such as precautionary savings and flood preparedness.[86]

Families with access to remittances can adapt better to livelihood and food crises in comparison to families that do not have access to remittances.[87] In India, studies show a strong influence of climate impacts on internal migration from Rajasthan, Uttar Pradesh and Madhya Pradesh, with most remittances being used for daily consumption of goods, including food.[88] In Burkina Faso, even where rainfall variability has a negative impact on food security, remittances are found to enhance food security.[89] In Bangladesh, evidence indicates that households adapt to climate stressors by combining local-level adaptation measures with the migration of one or a few members of their households.[90]

Adaptive migration should not substitute for investment in adaptive capacity-building in situ. However, with adequate support and inclusion in guiding strategies, it certainly has the potential to benefit communities in exposed locations to build adaptive capacity, and thus support the 2030 Sustainable Development Goals. Such an approach faces many challenges. For instance, the outcomes of migration as adaptation are largely mediated by the perception of migrants in the receiving communities and by how policy approaches seek to shape these perceptions. Projections of large numbers of migrants, increasing in future climate scenarios, can cause a misinterpretation of the scale of migration, leading to xenophobia and triggering potential security concerns, despite little evidence that migrants pose security threats at State or international levels.[91]

Research has focused more on understanding how migration and environmental change relates to climate assessments at the origin of the migrating communities, and less on the receiving communities.[92] Research on migration from Zimbabwe to South African cities suggests that migrants face a high level of malnutrition upon arrival, associated with the difficulties of accessing regular income and the opposition of receiving communities to their presence, often resulting in limited access to regular income.[93] These scenarios raise key questions for further research to understand how rapidly growing cities can feed their populations, including those affected by climate hazards.[94] In addition, there is a need to understand how the current policies that promote seasonal migration (for example, the movements of agricultural migrant workers) ensure food security to the migrants after arrival.[95] However, this is the context of the broader issue about the extent to which seasonal labour migration arrangements involving

[84] Tacoli, 2009.
[85] Rockenbauch et al., 2019.
[86] Banerjee et al., 2019.
[87] Ezra, 2001.
[88] Bharadwaj et al., 2021.
[89] Tapsoba et al., 2019.
[90] Siddiqui et al., 2017.
[91] Cissé et al., 2022.
[92] Findlay, 2011.
[93] Crush and Tawodzera, 2017.
[94] Crush, 2013; Mususa and Marr, 2022.
[95] Weiler et al., 2017.

climate-affected origin communities (such as small island developing States) can actually be considered an adaptive solution to climate hazards.[96]

Without adequate adaptation interventions and urban planning, the infrastructure of urban centres receiving climate-related migrants will also be at increased and compounding risk, including the risk of failure in the face of sudden-onset disasters. This is due to increased exposure to climatic events in these urban areas, but also due to low adaptive capacity in place (for example, in expanding informal settlements in risk-prone urban areas).[97] Migrants arriving in coastal cities may be vulnerable to rising sea levels.[98] Different large urban centres are already exposed to water scarcity, a situation that can only worsen without adaptative action as water demand rises in line with the arrival of new migrants and with increasing climate change impacts.[99]

Another important and recent area of research interest on adaptive migration is the evaluation of transitional food security. There is a need to undertake further research to document the food security situation of migrants during their journey.[100] Earlier research revealed that climate hazards affect migrants on the move who suffer from food insecurity, such as migrants in transit through Mexico to the United States.[101]

Although mobility together with the use of remittances as a form of adaptation has been used by some to minimize vulnerabilities, there is also evidence that, in some contexts, this kind of migration is maladaptive. Studies have highlighted, for example, the potential impact of remittances on changes in land use, including deforestation and forest degradation, resulting in further environmental damage.[102] In three locations of north-eastern Cambodia, for example, "migration causes labour shortages and welfare issues, but does not necessarily improve food security", possibly appearing as a maladaptive option to climate change, in that the responses end up creating more vulnerability.[103] Other studies in India find that changing social structures as a result of migration and the prevalence of traditional gender roles have actually worsened food security outcomes for women-headed households, offsetting gains in women's autonomy.[104] The diversity of experiences and migration outcomes in terms of climate adaptation and food security requires carefully crafted policies that address the situation of the most vulnerable, prevent forced movements, and leverage the positive impacts of mobility for climate adaptation and food insecurity at a local level.

Prevention and preparedness: Evidence for policies

Policymakers need to consider a responsive approach to ensure that policies address the complex interactions between mobility, climate and food security. Paying attention to research and emerging evidence – especially when that research questions, confirms or dismisses underlying assumptions – enables policymakers to better understand how climate risks can translate into food insecurity, and how this may or not result in different outcomes, including displacement and involuntary immobility. The potential positive impacts of mobility on food security can also be

96 Kitara and Farbotko, 2023.
97 Cissé et al., 2022.
98 C40 Cities and McKinsey Sustainability, 2021.
99 He et al., 2021.
100 Aragón Gama et al., 2020.
101 Orjuela-Grimm et al., 2022.
102 Mack et al., 2023.
103 Jacobson et al., 2019.
104 Choithani, 2019.

better understood and leveraged if attention is paid to the different ways that it affects various groups, including migrants themselves, their households and communities of destination. Failing to acknowledge such nuances may mean that underlying causes of food insecurity are overlooked, potentially leading to policies resulting in poor or even counterproductive outcomes.[105] Complex analyses are required to avoid oversimplifications such as assigning the full causality of food insecurity to climate change.[106]

Climatic risk and income volatility exist everywhere, but they are particularly challenging for poor populations in developing countries: "risk is costlier for households close to subsistence, because a small negative shock can rapidly transition into malnutrition and underdevelopment traps".[107] Successful interventions to address food security and support climate adaptation require deep and inclusive engagement with local vulnerability contexts, as well as understanding and addressing local shocks that affect particular populations either continuously or simultaneously.[108]

Current policy frameworks on climate change and human mobility

Many policy frameworks seek to address the complexities behind climate change and human mobility.[109] As the main international framework addressing the governance of international migration, the Global Compact for Safe, Orderly and Regular Migration provides specific recommendations regarding disasters, environmental degradation and climate change.[110] The Global Compact identifies food security as an area of work for States to "minimize the adverse drivers and structural factors that compel people to leave their country of origin", while recommending the adoption of adequate policies and mechanisms to enable safe migration pathways in the form of "admission and stay of appropriate duration based on compassionate, humanitarian or other considerations for migrants compelled to leave their countries of origin owing to sudden-onset natural disasters and other precarious situations" and "solutions for migrants compelled to leave their countries of origin owing to slow-onset natural disasters, the adverse effects of climate change, and environmental degradation".[111]

With regard to climate change governance, one of the outcomes of the Twenty-seventh Conference of the Parties to the United Nations Framework Convention on Climate Change in Sharm el-Sheikh, Egypt (COP27), was the agreement to establish institutional arrangements to set a fund for loss and damage compensation under the Sharm el-Sheikh Implementation Plan. These arrangements were informed by gaps in the current funding landscape, including in terms of "displacement, relocation, migration, insufficient climate information and data".[112] This system potentially offers an opportunity to begin to manage the impact of climate change on the most vulnerable households, and to address the losses and damage incurred not only as a result of climate change but also as a result of the subsequent mobility and immobility. The work on human mobility under the United Nations Framework Convention on Climate Change is undertaken by the Task Force on Displacement under the Warsaw International Mechanism on Loss and Damage, but more effort is needed to mainstream mobility in adaptation

[105] Zavaleta et al., 2018.

[106] Sandstrom and Juhola, 2017; Jacobson et al., 2019.

[107] Demont, 2020.

[108] Hoffmann, 2022.

[109] See Table 1.1 of the Groundswell report for a description of the most relevant frameworks (Clement et al., 2021).

[110] United Nations General Assembly, 2018.

[111] Ibid.

[112] UNFCCC, 2022.

planning. To this end, different countries have started to integrate mobility dimensions in their adaptation planning, which bodes well for the future.[113]

Considerations of human mobility have also been increasingly incorporated into the disaster risk reduction agenda, under the umbrella of the Sendai Framework for Disaster Risk Reduction. There, human mobility is considered both in terms of evacuations and planned relocation, but the vulnerabilities of migrant populations are also noted, and the need to integrate migrant contributions in disaster risk reduction is highlighted.

These approaches are underpinned by the 2030 Sustainable Development Agenda, which establishes the importance of considering the situation of migrants and vulnerable communities. While no specific goal addresses directly the climate–migration nexus, it is a topic relevant to several different objectives, notably those surrounding food security and hunger, resilient communities, migration policies and climate issues. Human-rights-based approaches to the climate–migration nexus have also progressed rapidly in recent years, including through the catalysing role of the Nansen Protect Agenda on cross-border disaster displacement, the integration of disasters into the Guiding Principles on Internal Displacement (and the more recent Action Agenda on Internally Displaced Persons), and various regional approaches to the question of rights and climate mobility.[114]

To be successful, policies on the climate–food security–migration nexus need to consider the availability of resources for action, and to envision the conditions under which migration can be a viable coping strategy.[115] Poor and impoverished communities sometimes lack the resources necessary to adapt, even when they may have information and intention to do so. Policy frameworks – and their implementation – accordingly have to recognize enabling factors and institutional environments that facilitate policy adoption (and reduce obstacles to implementation), including institutional capacity and governance, leveraging expertise from various areas of government action.[116] Policies oriented towards local, national and international governance can all influence the outcomes of climate-related mobilities.[117] In addition, policies intended to promote food security in climate-vulnerable countries should extend beyond merely technical and economic aspects of agriculture, and also address sociocultural dimensions,[118] including efforts to incorporate traditional knowledge and diverse gender perspectives.[119]

Designing inclusive policies

Approaches that address links between climate hazards and food security by incorporating lessons from Indigenous knowledge and by paying attention to local context can help to shape inclusive policy.[120] For instance, studies in Aceh Province of Indonesia have shed light on the use of traditional buildings made of drifting logs; these buildings can be used both under normal conditions and also during floods, as a mechanism to maintain household and communal activities and protect community food supply needs, which are increasingly under threat due to shortages of raw materials and relocation away from the river.[121] Similarly, in the field of financial inclusion, localized

[113] SLYCAN Trust, 2022.
[114] Bellinkx et al., 2022.
[115] Gemenne and Blocher, 2017; Bosetti et al., 2021.
[116] Traore Chazalnoel and Randall, 2021.
[117] Cissé et al., 2022.
[118] Mosso et al., 2022.
[119] File and Derbile, 2020.
[120] He et al., 2019.
[121] Bakhtiar et al., 2021.

and contextualized interventions have been shown to be better able to reduce the probability of food shortages.[122] There is much more to learn from local and Indigenous knowledge, not only in order to be more inclusive, but also to be successful in sustainable ways.

Critical reviews of adaptation interventions have highlighted the diversity of outcomes that they can have on vulnerability, including some unintended negative consequences:

- Interventions can reinforce vulnerability through elite capture of processes, with reliance on powerful insiders and disregard for affected populations' perspectives, including the exacerbation of conflict and tensions;
- Interventions can redistribute vulnerability, for instance, shifting risk in coastal areas, affecting access to resources for different groups and reshaping power dynamics;
- Interventions can create new sources of vulnerability, by addressing a short-term risk while introducing new long-term problems, such as undertaking poorly planned relocation exercises.[123]

Evidence also indicates that policies are more effective when they include gender-responsive capacity development.[124] Policies that focus on enhancing farmer education levels, empowering women, promoting generational knowledge exchange, and providing emergency food support in the lean season or following extreme weather events have proven successful to improve local adaptation.[125] Case studies in Mali, Bangladesh, Asia's lowlands and Central America highlight, with local nuances, the added value of contextualized interventions and gender mainstreaming with affected populations; however, mobility components are not always integrated in these approaches.[126]

Information alone is not enough. Solutions must also be financed.

Evidence and information play a key role in ensuring climate resilience, and remain an important axis of priorities to address food insecurity in subsistence agriculture settings. However, reviews have also found a relatively limited application of analytical outputs in African agricultural development, indicating a need for more locally relevant information products combined with practical support.[127] Information availability (for example, climate forecasts and agricultural best practices) is therefore not enough, as this information needs to be based on local needs and must be supported by funding provided to local actors so they can implement evidence-based solutions. Case studies in Central America show that regions where the livelihoods of communities are based on climate-sensitive subsistence crops tend to have fewer resources to promote innovation and action for adaptation;[128] in such cases, even when locally relevant information is available, therefore, adaptation and innovation will be impossible, or at best only slowly implemented.

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[122] Karki Nepal and Neupane, 2022.

[123] Eriksen et al., 2021.

[124] Bezner Kerr et al., 2022.

[125] Alpízar et al., 2020.

[126] For Mali, see Traore et al., 2022; for Bangladesh, see Kashem et al., 2014; for Asia's lowlands, see Ismail et al., 2013; for Central America, see Alpízar et al., 2020.

[127] Ziervogel and Zermoglio, 2009.

[128] Bouroncle et al., 2017.

The development of early warning systems has received strong political backing in recent years, and different models have been developed for their application in vulnerable areas, such as Kenya's arid north, taking into consideration local circumstances and famine risks.[129] Drought early warning systems measure and report on key drivers of drought, "with the preferred use of meteorological and remotely sensed drought indices."[130] Scope remains to improve the usefulness of such systems by orienting indexes towards local circumstances, development approaches and human welfare.

To be successful, food security approaches that are based on agricultural innovation and new technology must consider existing capacities and the potential to further embed existing power asymmetries based on the different resources available to manage climate risks.[131] In sub-Saharan Africa, increased efforts are required to address the technological needs of adaptation, given the "minimal documentation of current applications and prospects of digitalization for sustainable agricultural practices in Africa, particularly in an increasingly urbanized era".[132] Leading developmental agencies are pursuing other approaches to food security as well, in order to manage climate risk associated with food production for adaptation in place. These include forecast-based finance, microinsurance programmes and anticipatory actions.[133] The financial sustainability, implementation and adoption of these types of programmes by stakeholders under climate change are still under investigation, given the uncertainties of climate scenarios and the increasing climate hazards worldwide as they relate to financial risk distribution.[134]

Addressing power asymmetries, land distribution and human mobility

The prevailing model under which the globalized food industry produces food is primarily aimed at increasing food security from the individual to the national and international levels. But the complexities around the climate–food security–migration nexus require us to question this model. Evidence suggests that it has resulted in the alienation of large populations in developing countries from the means of production – including access to land – and in promoting policies that contribute to environmental degradation.[135]

The prevailing model has resulted in further entrenching systemic power asymmetries, such as a reduced role for smallholder farmers. When considering food production and human mobility dynamics, unequal access to land, limited coping capacities of smallholders, and exclusion and discrimination dynamics can become significant drivers of displacement.[136] Studies undertaken in South-East Asia, for example, have found that the rise of megaplantations and their associated power dynamics have led to human and non-human displacement in multiple landscapes.[137] Similar processes have been identified in Guatemala, where studies found that "in the northern provinces of Petén and Quiché, 36% and 63% of oil palm expansion occurred over former basic grain farmland, while 16% and 22% displaced fallow land, and 17% and 12% displaced tropical forests, just between 2010 and 2019".[138] Thus, in this case, the expansion of the oil palm industry disrupted local food systems in areas of subsistence agriculture and

[129] Mude et al., 2009.
[130] Belesova et al., 2019.
[131] Bouroncle et al., 2017; Pons, 2021.
[132] Balogun et al., 2022.
[133] WFP, 2019.
[134] Elerts, 2019.
[135] Al-Sayed, 2019.
[136] Carte et al., 2019.
[137] Kenney-Lazar and Ishikawa, 2019.
[138] Hervas, 2021.

displaced local populations. And in northern Ghana, studies have shown that uncertain land ownership has negative consequences for food security, which is in turn linked to migration as a coping mechanism.[139]

There are promising practices to address food insecurity at the local level and prevent displacement. These include promotion of land tenure security of adequate agricultural land; farmer empowerment groups; gender-responsive components; and the expansion of dietary diversity through crop diversification and agroforestry initiatives. In Zambia, for instance, "policies supporting livestock development programs such as training of farmers in animal husbandry, as well as policies increasing land tenure security and empowerment of farmers groups, have the potential to enhance household food and nutrition security".[140] Securing the land tenure of indigenous groups has been identified as a critical priority to prevent environmental degradation and to improve food security outcomes of vulnerable communities.[141]

Policies centred on human well-being

Forward-looking policy responses can also be designed to acknowledge that human mobility is likely to increase in upcoming years due to the rate of environmental change and associated food and water crises,[142] and that will consider the potential vulnerability of immobile populations. Preparing future migrants and communities can reduce migrants' vulnerabilities, increase the positive outcomes experienced by origin and destination communities, and ensure the fulfilment of human rights, particularly given the potential protection gaps that migrants will face without adequate policies in place. This has been emphasized in numerous statements and resolutions by human rights bodies around the world, with a recent example highlighting the important role of State actors:

> Faced with migrant workers and others who mobilize for reasons directly or indirectly associated with climate change, States must guarantee due process during the procedure leading to the recognition of their migratory status, and in any case guarantee their human rights, such as the safeguard of non-refoulement while their status is determined.[143]

Policies are also needed to protect migrant communities and promote the fulfilment of their human rights, both while in transit and once they arrive at their destinations. As in-country rural to urban migration compounds with international migration to urban centres, the expansion of safe housing will continue to be a focus of new policies.[144] Policies in this arena need to consider access to public assistance for recently arrived migrant communities. Evidence suggests that non-citizens and children of non-citizens are more likely to be exposed to high levels of food insecurity and require specific attention.[145] Work is increasingly being done to examine the mental health impacts of environmental hazards and mobility, including through prevailing gender dynamics. These were important issues after Hurricane Katrina in the United States, and also in the framework of rural–urban migration processes in Jamaica,[146] for example.

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[139] Nara et al., 2020.

[140] Nkomoki et al., 2019.

[141] ILC, FAO and GLTN, 2021.

[142] Carney and Krause, 2020.

[143] IACHR and REDESCA, 2021.

[144] C40 Cities and McKinsey Sustainability, 2021.

[145] Carney and Krause, 2020.

[146] Bleeker et al., 2021.

The well-being of seasonal and temporary migrants in the agricultural sector should also be a greater focus of human-centred policies. Different analysis of the well-being of agricultural migrant workers, in particular in the context of the COVID-19 pandemic, have shed light on the prevalence of conditions of vulnerability and of human rights abuses.[147] A comprehensive approach to the food security–human mobility nexus in the context of climate change requires that authorities and employers improve the conditions of migrants in the agricultural sector. These migrant workers – as demonstrated during COVID-19 – can be some of the most essential contributors to the fundamental functioning of societies around the world, and yet they can be some of the most marginalized and exploited.[148]

Migrant voices

"It gives me much shame to be without food. One is always thinking of how to get what one needs for tomorrow. For example, if I buy a chicken, I always divide it in half, half for one day, and half for the next day. So yes, one is worried that food will run out." (Migrant woman who arrived in the United States).

Source: Carney and Krause, 2020.

All of these examples demonstrate that, as discussed above, the outcome of any particular instance of climate mobility is highly dependent on the circumstances in which that movement takes place.[149] It is extremely dangerous, even in the attempt to justify and promote climate action, to simplify the narrative around climate change and migration. Doing so risks "occlud[ing] the multiple forces that lead young Sahelian migrants", in one particular instance, to emigrate, and diverts attention from potential responses.[150] Similarly, an analysis of United Kingdom media shows an oversimplification of climate change mobility, removing it from context, with the potential to augment xenophobic voices and undermine integration and social cohesion.[151] In order to mobilize resources for climate adaptation and food security interventions, discourses that leverage potential negative reactions towards migrants must be prevented.

147 Caxaj et al., 2022.
148 McAuliffe et al., 2021.
149 Oakes et al., 2019.
150 Ribot et al., 2020.
151 Sakellari, 2019.

Conclusions

Recent research on the climate–food security–migration nexus showcases the complexities of the relationships between the three phenomena. In many instances, food insecurity fuelled by worsening climate extremes indeed appears as an underlying driver of migration; however, the relationship is complex. Food insecurity is driven by multiple factors, among which climate change plays an important part by adding further pressure on existing systems and communities. Yet multiple examples show how climate extremes cannot be considered the sole drivers of food insecurity or migration, given prevailing power dynamics, fragilities in governance, structures of globalized food production and other social factors. Furthermore, different adaptation strategies can often be employed before households opt for migration. Migration also takes many forms, depending on the context in which it occurs, with variable outcomes in terms of adaptation and food security. In some cases remittances appear to contribute to better climate adaptation and food security results; in other examples, local dynamics prevent these achievements, in an overall framework where internal migration can result in worsening situations and international migration pathways remain scarce and difficult to access for the most vulnerable populations.

This complexity informs the identification of potential areas for policy development to prevent catastrophe and support resilience by improving the outcomes of food security interventions, addressing the adverse drivers of migration and considering the situation of migrants in transit and at destination. Research and evidence point to the need for highly contextual interventions that address inequality and related power dynamics, including from a gender perspective, leverage local and Indigenous knowledge, and carefully assess possible maladaptive consequences for vulnerable populations. Policymaking on climate migration is evolving quickly, under the umbrella of innovative research and guiding international frameworks, notably the Global Compact for Migration and the adaptation and loss and damage tracks of the United Nations Framework on Climate Change. As it does so, attention to human rights obligations and practices are critical to bridge protection gaps for the most vulnerable. In this setting, oversimplifying discourses – for example, discourses that remove agency from migrants and leverage potential fear of migration to justify climate action and food security interventions – risk advancing xenophobic messages.

With this in mind, and considering the multiple interactions between climate change, food security and human mobility, potential non-exhaustive areas of intervention can be identified to advance an innovative agenda that targets the situation of the most vulnerable:

- It is crucial to assess the multicausality of shocks by recognizing the intricacies of the connections between climate change, food security (and food insecurity), and human mobility at large. The assessment must give adequate attention to local realities, gender dynamics, power asymmetries, and the conditions in which climate change exacerbates existing challenges. Policies that fail to address local social and economic realities may create climate adaptation strategies that reproduce, rather than alleviate, vulnerabilities.
- It is also necessary to assess the impacts of migration on both the receiving and sending communities, as well as the impacts on the communities and individuals that remain in place. This assessment should consider the ongoing and expected transition from rural to urban areas (within and across political boundaries) and the level of preparedness that exists in receiving communities, in terms of their legal frameworks and climate change adaptation plans. Any agenda that emerges from this assessment can be informed by emerging research carried out in different geographies, and has the potential to identify enabling conditions that can lead to positive migration outcomes – in terms of climate adaptation and food security – depending on local circumstances.

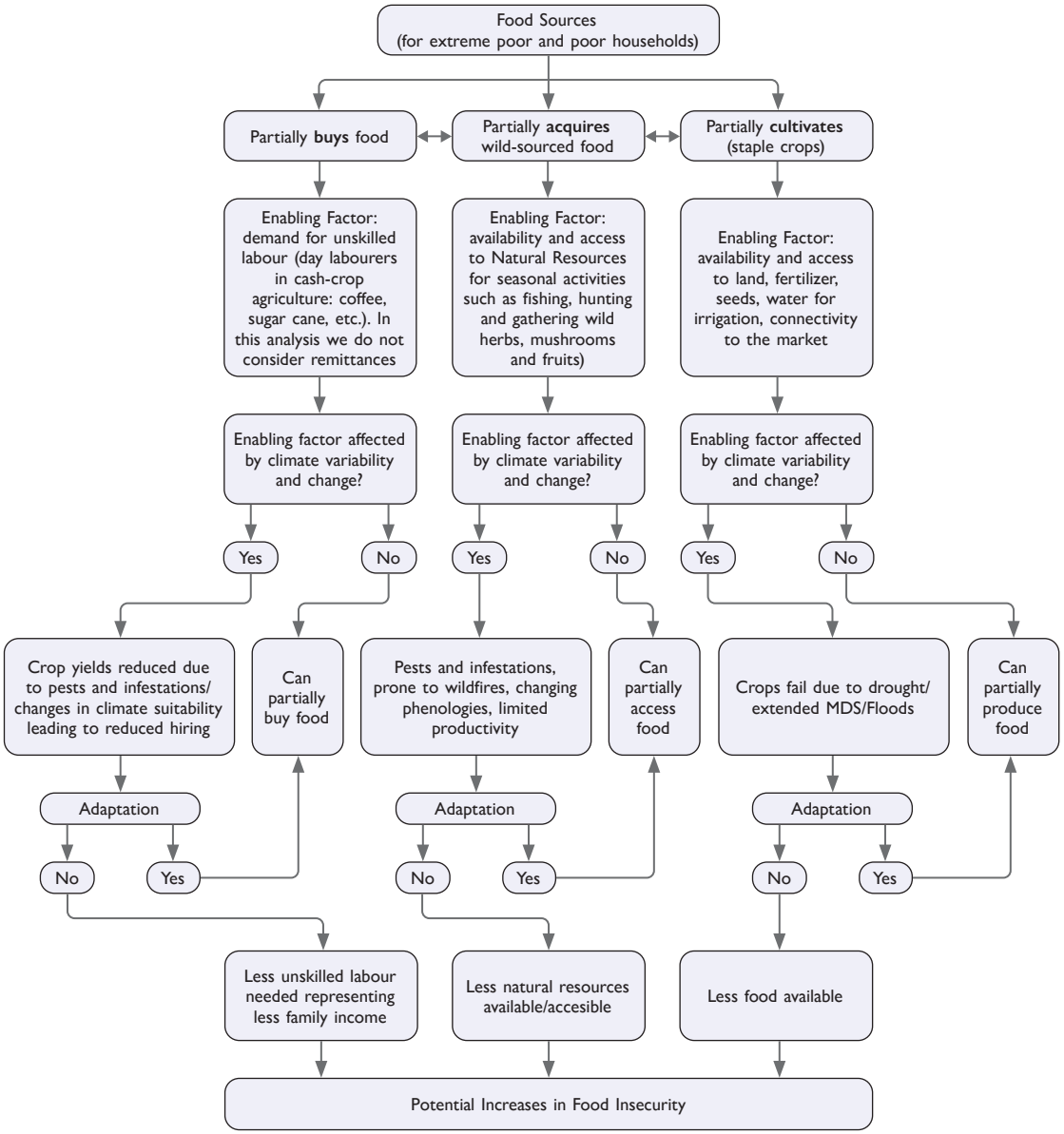
- Evidence and information, however, is not enough, and the role of climate finance in practically supporting disaster risk reduction and other preventative and adaptation strategies is critical to putting evidence and knowledge into action. Resources on the ground are needed to enable people to successfully face future climate change impacts, whether they remain in place or move in response.
- Finally, innovative solutions need to analyse the local contexts of vulnerability, and place human well-being at the forefront of those solutions, considering migration as a viable mechanism to manage climatic risk. The role of the food industry in delivering policies aimed at reducing global hunger can be revisited in line with multiple practices affecting community well-being, reducing food security and directly driving displacement. Policies oriented towards innovation and technology for climate risk management need to be assessed to recognize the limitations they impose on smallholder farmers and on smallholders' ability to innovate, when resources for action are limited. This process, however, should not try to refit these considerations into old policies, but rather should begin a new, in-depth, inclusive process with affected communities.

Appendix A. Key definitions

Environmental migration	is the movement of persons or groups of persons who, predominantly for reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are forced to leave their places of habitual residence, or choose to do so, either temporarily or permanently, and who move within or outside their country of origin or habitual residence.
Climate migration	is a subcategory of environmental migration; it defines a singular type of environmental migration, where the change in the environment is due to climate change. Migration in this context can be associated with greater vulnerability of affected people, particularly if it is forced. However, migration can also be a form of adaptation to environmental stressors, helping to build resilience of affected individuals and communities.
Trapped populations	do not migrate, yet are situated in areas under threat … at risk of becoming "trapped" or having to stay behind, where they will be more vulnerable to environmental shocks and impoverishment.
Planned relocation	in the context of disasters or environmental degradation, including when due to the effects of climate change, is a planned process in which persons or groups of persons move or are assisted to move away from their homes or place of temporary residence, are settled in a new location and provided with the conditions for rebuilding their lives.
Slow-onset events	The impacts of climate change include slow-onset events and extreme weather events, both of which may result in loss and damage. Slow-onset events, as initially introduced by the Cancun Agreement (COP16), refer to the risks and impacts associated with increasing temperatures; desertification; loss of biodiversity; land and forest degradation; glacial retreat and related impacts; ocean acidification; sea-level rise; and salinization.
Adaptation	Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Mitigation	Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior.

Note: The source for each of these definitions can be found by following each hyperlinked term.

Appendix B. Pathways of food security for poor and extreme poor farmers in Guatemala



Source: Pons, 2021.

This diagram shows how climate variability and climate change can affect the sources of food for very poor and poor households in Guatemala's Dry Corridor area. It accounts for individuals who buy their food, grow their food, or acquire their food from wild sources. It also identifies entry points for adaptation mechanisms in each case to avoid food insecurity. Very poor and poor households generate their income from casual labour as "unskilled labour", such as on coffee farms, and acquire additional food from natural sources such as forests or water bodies. Food security is achieved through a combination of the different pathways.[152]

[152] Pons, 2021.

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