frontiers | Frontiers in Climate

TYPE Original Research
PUBLISHED 14 March 2023
DOI 10.3389/fclim.2023.1125936

OPEN ACCESS

EDITED BY
Andreas Neef,
The University of Auckland, New Zealand

REVIEWED BY
Sonja Fransen,
Maastricht University, Netherlands
Monika Mayrhofer,
University of Vienna, Austria

*CORRESPONDENCE
Dennis Mombauer
✉ dennis@slycantrust.org

SPECIALTY SECTION
This article was submitted to Climate Mobility, a section of the journal Frontiers in Climate

RECEIVED 16 December 2022
ACCEPTED 24 February 2023
PUBLISHED 14 March 2023

CITATION
Mombauer D, Link A-C and van der Geest K (2023) Addressing climate-related human mobility through NDCs and NAPs: State of play, good practices, and the ways forward. *Front. Clim.* 5:1125936. doi: 10.3389/fclim.2023.1125936

Addressing climate-related human mobility through NDCs and NAPs: State of play, good practices, and the ways forward

Dennis Mombauer[1]*, Ann-Christine Link[2] and Kees van der Geest[2]

[1]SLYCAN Trust, Colombo, Sri Lanka, [2]United Nations University-Institute for Environment and Human Security (UNU-EHS), Bonn, Germany

Climate change is altering human mobility patterns across the globe, particularly in climate-vulnerable developing countries. With increasing recognition of the complex interlinkages between climate change and human mobility, governments and subnational authorities have begun to address this nexus in planning and policy processes, including Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). To better understand how human mobility is integrated into NDCs and NAPs, we analyzed 171 NDCs and 40 NAPs, and conducted 20 semi-structured interviews and 16 workshops and webinars. We find that human mobility is increasingly featured in NDCs, but only few countries propose concrete interventions to address adverse effects or promote adaptive aspects of human mobility. The study also finds that many countries primarily focus on mobility as a risk, challenge, or problem while some have incorporated positive aspects of mobility (e.g., migration as an adaptation strategy). Through six concise case studies, the paper focuses on good practices from specific NDCs and NAPs that can enhance the integration of human mobility in a range of priority policy sectors for adaptation and loss and damage. To move forward, interviewees and workshop participants emphasized the need for adequate finance, institutional capacities, and data to strengthen the integration of human mobility into NDCs and NAPs. There is a need to identify and better understand potential policy interventions at the local, national, and global level, and to assess their impact and map potential synergies.

KEYWORDS

human mobility, climate change, climate change adaptation, Nationally Determined Contributions (NDCs), national adaptation plans (NAPs), loss and damage, climate mobility, planning and policy

1. Introduction

Climate change is shaping the patterns of human (im)mobility and related decision-making on the individual, household, community, municipal, sector, and national level worldwide, particularly in climate-vulnerable developing countries (Afifi et al., 2016; Martin et al., 2022). The interlinkages between climate risks, migration, disaster displacement, planned relocation, and other forms of human (im)mobility are complex, systemic, and cross-cutting (Table 1) (Thalheimer et al., 2021). Climate change is often considered a "risk multiplier" (Black et al., 2011), intersecting with political, economic, social, and demographic factors. Together, these factors intensify vulnerabilities as well as conditions of poverty and food insecurity that affect human (im)mobility. Rapid-onset events tend to lead to more temporary and short-distance migration, whereas slow-onset events tend to lead to more

TABLE 1 Forms of human (im)mobility.

Form of mobility	Definition	Examples
Migration	Permanent or temporary movement of persons away from their usual residence. If not indicated otherwise, the term migration includes both internal and international migrants. (adapted from International Organization for Migration (IOM) definition)	• Rural-urban migration • International labor migration • Seasonal, cyclical, or circular agricultural migration • Transhumance/pastoralism
Disaster displacement	The movement of persons forced or obliged to flee or leave their home or place of habitual residence to avoid the impacts of a disaster or sudden climate-related shock. (adapted from United Nations High Commissioner for Refugees (UNHCR) definition)	• Temporary disaster displacement • Protracted disaster displacement • Permanent disaster displacement
Planned relocation	Permanent relocation of persons, assets, or infrastructure away from exposed places. (adapted from IOM definition)	• State-led planned relocation • Community-driven planned relocation
Immobility	Persons or communities who are unable (involuntary immobility) or unwilling (voluntary immobility) to move away from their place of usual residence. (adapted from Mixed Migration Center)	• Trapped populations • Failure to evacuate • Involuntary immobility • Voluntary immobility

permanent and long-distance migration (McLeman and Gemenne, 2018). Most migrants stay within their own countries, while those who cross state borders tend to go to neighboring countries. This pattern is shaped by economic, social, and cultural attachment. Migration from regions in which households and communities have high levels of exposure to climate-related hazards and low levels of adaptive capacity increases as climate change intensifies (Boas et al., 2019). This is particularly the case in countries where a large part of the population works in subsistence agriculture (Hoffmann et al., 2020). While the predominant discourse emphasizes the negative outcomes of human mobility, positive outcomes also exist (Elliott, 2010; Gemenne and Blocher, 2017; Sakdapolrak et al., 2019). Positive outcomes of mobility, such as migration as adaptation through, for example, livelihood diversification, tend to be linked to human mobility that is safe, orderly, and regular, involving some type of anticipation and planning (Vinke et al., 2020). Nevertheless, whether or not individuals or households can use migration as an adaptation strategy depends on the reasons why they leave their homes, the circumstances in which they move, and the conditions they face at their destination, which can lead to increased vulnerabilities when migration fails to secure peoples' livelihoods (Warner et al., 2012; Evertsen and van der Geest, 2020). Personal characteristics such as gender identity, race, disability, health, age, or education level also determine the outcome of migration.

Due to the increasing pressure of climate change on human livelihoods and countries, subnational authorities have begun to recognize and address the previously described nexus of climate change and human mobility in their planning and policy processes (Oakes et al., 2022). This includes local and national climate change adaptation, risk management, and development frameworks, but also commitments and processes under the United Nations Framework Convention on Climate Change (UNFCCC), such as Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs).

NDCs are vehicles through which Parties to the Paris Agreement articulate their commitments toward the achievement of the long-term goals presented in the Paris Agreement, embodying the efforts by each country to reduce national emissions and adapt to the impacts of climate change (UNFCCC, 2015). Parties also committed to preparing and submitting NDCs every 5 years starting from 2015, representing the bottom-up commitments and, therefore, the highest ambition of each Party. The NDCs build on the Intended Nationally Determined Contributions (INDCs). At COP 20 in 2014, all Parties were invited to communicate information on adaptation or to include a component on adaptation in their INDCs (UNFCCC, 2015).

The NAP process was established at the Conference of the Parties (COP) 16 in 2010 under the Cancun Adaptation Framework to identify medium and long-term adaptation needs and to develop and implement strategies, programs, and plans to address those needs (UNFCCC, 2011). Based on the Cancun Adaptation Framework (as outlined in FCCC/CP/2010/7/Add.1), which established the NAP process primarily for least developed countries and invites other developing country Parties (Par. 15 and 16) to use the same modalities to develop their own NAPs. NAPs build on the National Adaptation Programmes of Action (NAPA), established in 2001, to help LDCs respond to their urgent and immediate adaptation needs (UNFCCC, 2002). NAPs have two objectives: (1) to reduce vulnerability to climate change impacts by increasing adaptive capacity and building resilience and (2) to facilitate the integration of climate change adaptation into relevant policies, plans, and processes, particularly development planning (UNFCCC, 2012).

Policy approaches to address the impacts, vulnerabilities, and compound or cascading risks associated with different forms of human mobility are currently not adequately understood or systemically implemented (IOM, 2018). However, progress has been made in recent years. As key national documents, NDCs and NAPs can be important vehicles to mainstream human mobility into national policy frameworks and catalyze solutions across all sectors and levels. NDCs and NAPs are vital instruments for identifying, communicating, and addressing countries' mid- and long-term needs and priorities related to mitigation, adaptation, and loss and damage and also serve as financing vehicles for the aforementioned endeavors. Both the NDC and the NAP process can address human (im)mobility issues related to climate change in two ways, first, by alleviating pressures related to migration, averting displacement, and reducing the need for planned relocation, and second, by supporting migration as adaptation (Warner et al., 2014).

A few reports have already focused on the integration of human mobility into NDCs and NAPs; however, these mainly emphasize

how integration can be improved by providing guidelines and toolkits and do not analyze how human mobility actually features in the current generation of NDCs and NAPs (Warner et al., 2014; IOM, 2016; Fransen et al., 2019; IOM, UNDP, and UNEP, 2021; Martin et al., 2022). To address this gap, this study assesses the state of play, good practices, and ways forward simultaneously. We define good practices as those who take a balanced few of human mobility by first of all describing what the human mobility term refers to, by accounting for all relevant types of human mobility, and by focusing on not just negative outcomes but also positive outcomes and opportunities. The mentioned list of good practices is incomplete and provides a short overview of cases where this balanced view of human mobility is integrated.

Based on a detailed analysis of NDCs and NAPs submitted to the UNFCCC, this paper explores how human mobility has been integrated into adaptation and loss and damage components of these processes, what categories of interventions are included, how human mobility connects to critical sectors, and how mobility considerations can be better incorporated into the NDCs and NAP process, including groundwork, preparatory elements, formulation, implementation, monitoring, and reporting. Furthermore, we pay specific attention to spatial differences in the integration of human mobility into NDCs and NAPs.

When human mobility is well-integrated into NDCs and NAPs, these processes can play an essential role in enhancing the protection of people on the move as well as individuals left behind by contributing to adaptive responses, resilience-building, and measures to address climate-induced loss and damage. However, only a minority of the NDCs and NAPs submitted to the UNFCCC include human mobility in their commitments and actions. Of those NDCs and NAPs that do integrate human mobility, most tend to focus on the adverse outcomes of human mobility, such as informal settlement, and rural depopulation, instead of opportunities and potential positive outcomes, such as migration as adaptation, reduced expose and vulnerability, successful relocation, and the use of remittances for supporting adaptation in migrant source areas. Additionally, only some of the NDCs and NAPs account for the rising numbers of people who are unable or unwilling to move away from areas of high climate risks or where habitability thresholds are being approached.

This paper explores three key questions to identify the state of play as well as the potential for enhancing the integration of human mobility into NDCs and NAPs:

1. To what extent and in which ways do NDCs and NAPs currently consider and address different forms of human mobility, and do spatial differences in the integration of human mobility exist?
2. What are the fundamental categories of mobility-related actions in NDCs and NAPs, and how do they connect to the priority sectors for adaptation and loss and damage.
3. Where are the needs and opportunities for strengthening the integration of human mobility into NDCs, NAPs, and other national policy frameworks?

TABLE 2 Overview of research activities.

Activity	Number	
Analysis of policy documents	NDCs	171 (submitted in 2019–2022)
	NAPs	40 (submitted in 2015–2022)
Workshops	In-person	5 (2020–2022)
	Online	11 (2020–2022)
Semi-structured interviews	Online	20 interviews with 33 stakeholders (governments, CSOs, UN agencies, and experts in the field)

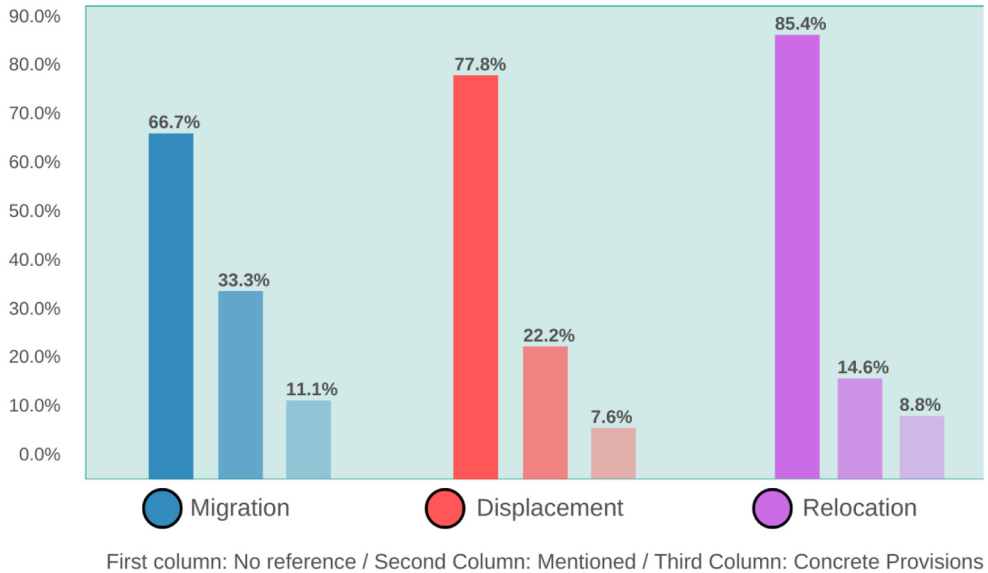

FIGURE 1
Percentage of NDCs that do not reference (first column), mention (second column), or contain concrete provisions (third column) related to migration, displacement, and planned relocation. NDCs containing concrete provisions are also counted under mentions (SLYCAN Trust, 2022).

To address the first and second questions in more detail, three brief case studies for NDCs (Papua New Guinea, Vanuatu, and Zimbabwe) and three case studies for NAPs (Fiji, Ethiopia, and Guatemala) will be presented to highlight existing "good practices" of integrating human mobility into national policy frameworks.

2. Methodology

Our methodologies involved multiple approaches, including literature research, an analysis of second and updated NDCs as well as all NAPs submitted until December 2022, in-person and online workshops, and online interviews (Table 2). The analysis involved the identification of percentages, categories, and examples of considerations and commitments related to human mobility. Based on a list of keywords and phrases compiled through a preliminary literature review, stakeholder inputs, and previous research conducted by SLYCAN Trust, mobility considerations (grouped under migration, displacement, and relocation) were identified in NDCs and NAPs and analyzed using CATMA 6.5.3 (Table A7). Furthermore, the analysis focused on identifying the priority sectors of human mobility integrations in submitted NDCs and NAPs not only to learn from case studies but also to identify action and support needs related to human mobility. Additionally, insights from in-person and online workshops conducted by SLYCAN Trust in 2020–2022 covering topics such as integrating human mobility into climate policies and action, and addressing loss and damage were collected and implemented in this paper.

As part of the project "Global Guide and Toolkit on Integrating Human Mobility from a rural livelihood perspective into NAPs and NDCs," funded by the Food and Agriculture Organization (FAO) and conducted by the United Nations University of Environment and Human Security (UNU-EHS), 20 semi-structured online interviews with 33 stakeholders were conducted. The interviewed stakeholders included representatives from governments, civil society organizations (CSOs), UN agencies from seven selected case study countries (Argentina, Bangladesh, Ethiopia, Fiji, Guatemala, Nepal, and Zimbabwe), and global experts on climate policy, human mobility, and rural livelihoods. The seven case study countries were selected based on their diverse geographic, climatic, and environmental diversity, differences in how existing NDCs and NAPs integrate human mobility as well as existing connections to relevant stakeholders in each country. The questions of the semi-structured interviews covered the nexus of climate, human mobility, and rural livelihoods, as well as context-specific needs, barriers, and possible approaches to overcome previously identified barriers when integrating the nexus into NDCs and NAPs. The interviews were recorded for internal purposes, transcribed, and relevant sections were integrated into section seven.

3. Incorporating human mobility into NDCs

In line with Article 4, paragraph 12 of the Paris Agreement, a total of 194 Parties have submitted their first, second, or updated Nationally Determined Contributions to the UNFCCC from 2016

TABLE 3 Categories of mobility-related actions in NDCs.

Category of action	Examples from submitted NDCs
Enhancing public awareness and participatory processes	• Raising awareness of the impacts of climate-related migration on customary land. (Papua New Guinea) • Conducting comprehensive consultations with climate-induced migrants and their host communities. (Papua New Guinea)
Enhancing data and closing evidence gaps	• Broadening climate vulnerability assessments of ecosystems to include a comprehensive evaluation of at-risk human settlements and related infrastructure to protect potential climate refugees. (Belize) • Exploring assessments of gender and social inclusion for relocation and resettlement. (Papua New Guinea)
Enhancing policy coherence and vertical or horizontal integration	• Building coherence between NDCs and NAP to comprehensively address human mobility and settlements. (Grenada) • Strengthening policy linkages and actions on climate change, migration, and disaster risk reduction. (Uganda)
Engaging in regional and international processes	• Engaging in the potential adoption of regional agreements, frameworks, and policies on forced displacement and human mobility caused by climate change. (Antigua and Barbuda) • Participating in discussions and negotiations under WIM to specify actions that address and minimize loss and damage, including slow-onset and extreme weather events that cause forced displacement and migration. (Paraguay)
Strengthening early action and planning	• Developing long-term workforce development plans and strategic livelihood plans to help people move up and out into good employment opportunities and prepare for managed urban migration. (Malawi) • Enhancing early warning systems through better information management coordination of responses to reduce exposure of key vulnerable groups and allow for their relocation ahead of impacts. (Zimbabwe)
Protecting and supporting people on the move, families staying behind, and host communities.	• Ensuring that adaptation measures anticipate and meet the health and gender needs of displaced people, including humanitarian response and strengthening assistance/social protection programs for women and vulnerable groups. (Seychelles) • Ensuring continued access to basic health and medical services, including postsexual assault treatment and care relating to sexual and reproductive health and chronic illness, as well as nutrition advice and information, for climate-displaced people, people at risk of displacement, internal migrants, people living in informal settlements, communities relocating to new locations, and host communities. (Vanuatu)
Preventing movement through adaptation and resilience-building	• Enhancing water resources and job opportunities in climate-affected areas to limit rural exodus. (Senegal) • Accessing targeted financing to build coastal resilience and minimize the risk of coastal community displacement. (Timor-Leste)
Developing guidelines and tools	• Developing guidelines on the impacts of climate change on human mobility in line with related national instruments. (Chile) • Developing community/human relocation guidelines and assessment tools while building capacities for the relocation of communities as an adaptation strategy. (Solomon Islands)
Utilizing mobility as an adaptation strategy	• Relocating highly vulnerable communities and implementing the concept of "building back better." (Fiji) • Conducting comprehensive consultations with climate-induced migrants and their host communities to prepare for relocation. (Papua New Guinea)

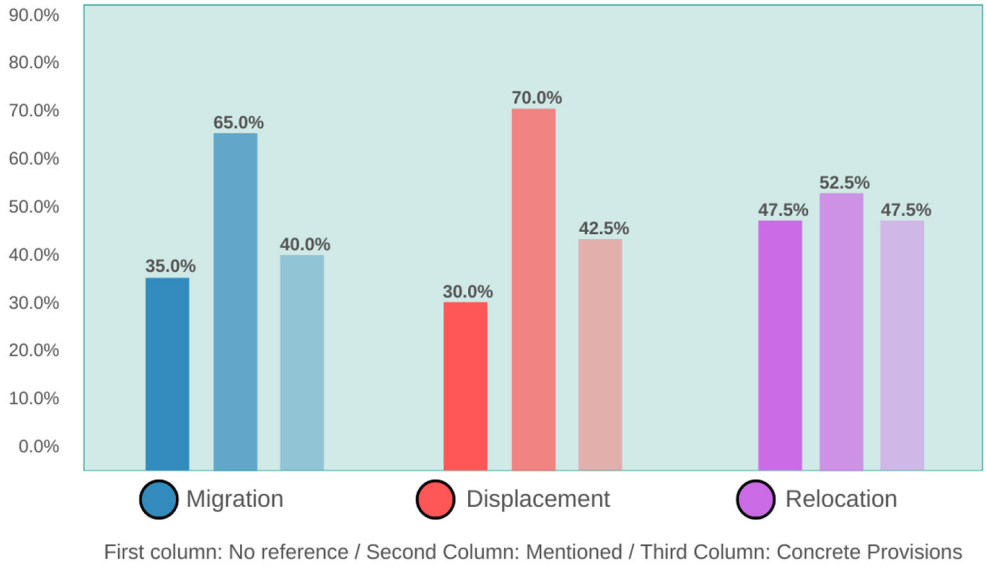

FIGURE 2
Percentage of NAPs that do not reference (first column), mention (second column), or contain concrete provisions related to (third column) migration, displacement, and planned relocation. NAPs containing concrete provisions are also included under mentions (SLYCAN Trust, 2022).

to 2022 (UNFCCC, 2015). The initial NDCs are supposed to be updated with enhanced ambition every five years (i.e., in 2020, 2025, 2030, etc.), but due to the COVID-19 pandemic, many submissions for the 2020 window got delayed. As of December 2022, 171 second or updated NDCs have been submitted as part of the second round, representing 88% of Parties to the Paris Agreement (the complete list of analyzed NDCs can be found in the Annex).

In the first round of submitted NDCs, a study undertaken by undertaken by the International Organization for Migration (IOM) found that only 20% of (I)NDCs submitted by 2016 contained any provision related to migration (IOM, 2016). A similar mapping carried out by the Task Force on Displacement under the Warsaw International Mechanism (WIM) and IOM in 2018 found the same ratio of 20% among a total of 193 submissions at that time (IOM, 2018).

Out of the new or updated NDCs submitted by 171 Parties in 2019–2022 (up to December 2022), 41.5% reference human mobility in some way (list of analyzed NDCs in Annex). Figure 1 displays the percentage of NDCs that either mention, make concrete provisions, or do not reference migration, displacement, and relocation. The most common form of human mobility referenced in NDCs is migration, which is mentioned in one-third of all NDCs and addressed through concrete commitments in one-tenth (11%). When attempting to examine whether NDCs predominantly reference internal or international migration, no proper quantitative assessment was possible since the majority of NDCs and NAPs do not define mobility terminology. However, the usage seems to be broadly in line with the definitions set out in Table 1. If NDCs and NAPs do define the term migration, they often refer to internal migration. Moreover, displacement features in 22% of all NDCs, with 7.6% containing commitments. Finally, relocation is only present in 14.6% of NDCs, and only 8.8% include related commitments.

Most NDCs reference and address human mobility as a problem or challenge, often in the context of climate risks, vulnerable groups, and communities, or causes of conflict. This finding is in accordance with the current literature on framing migrants and displaced and relocated people in policy documents or debates (Elliott, 2010; Farbotko, 2018; Durand-Delacre et al., 2021). Accordingly, most commitments and actions focus on avoiding or reducing adverse impacts and maladaptive aspects of climate mobility. The second main category of actions focuses on providing protection and support for those affected, i.e., migrants and displaced persons as vulnerable groups in need of shelter, livelihood opportunities, or healthcare. However, some countries have included provisions beyond this "negative" view of human mobility, aiming to utilize mobility as an adaptation strategy and strengthen the benefits and potential synergies of migration or relocation.

The most common actions related to human mobility in NDCs are presented in Table 3 (an extended version can be found in the Annex). They can be categorized as those related to awareness building, data and evidence, policy coherence and integration, regional and international processes, anticipatory planning, protection and support, resilience-building, and, in some cases, mobility as an adaptation strategy.

In the following, three NDCs (Papua New Guinea, Vanuatu, and Zimbabwe) will be presented as brief "good practice" to explain how these countries are already integrating human mobility into their national climate planning. *Papua New Guinea* has the only NDC with a dedicated adaptation section on climate-induced human mobility (Government of Papua New Guinea, 2020). This priority has already been established in the first NDC. The section mentions many different and relevant forms of human mobility, such as migration, displacement, and relocation. The commitments in the NDCs related to the integration of human mobility cover awareness creation, data collection (gender

TABLE 4 Categories of mobility-related actions in NAPs.

Category of action	Examples from submitted NAPs
Enhancing data availability and closing evidence gaps	• Developing a research roadmap for climate change, accounting for the relationship between climate change and rural-urban migration. (South Africa) • Developing a long-term research plan and related tracking indicators with institutional partnerships and funding streams on the nexus of climate change, migration, and conflict. (South Sudan)
Enhancing policy coherence and vertical or horizontal integration	• Incorporating internal migration and displacement into adaptation planning and integrated management in the water sector. (Chad) • Strengthening capacities of sub-national development planning processes to integrate human mobility issues. (Fiji)
Engaging in anticipatory planning and scenario development	• Creating new possible areas for relocation based on their productive and social viability. (Chile) • Developing contingency and resilient development plans for displacement of populations and organize simulation exercises. (Democratic Republic of the Congo)
Strengthening the enabling environment	• Developing and implementing policies that reduce the need for mobility and effectively manage mobility to promote empowered migration. (Saint Lucia)
Protecting and supporting people on the move, families staying behind, and host communities.	• Providing food assistance and livelihood support (e.g., agriculture, gardening, fishing, and livestock) for displaced persons and host communities through training, distribution of inputs or tools, cash transfers, business skills development, and construction of community warehouses. (Chad) • Providing support for preserving or re-establishing non-economic values that may be impaired during human mobility. (Saint Lucia)
Preventing movement through adaptation and resilience-building	• Scaling up efforts to strengthen coastal boundaries of urban centers and rural communities through hybrid or nature-based solutions to reduce risks and the need to relocate. (Fiji) • Promoting livelihood diversification for vulnerable groups to reduce rural-urban migration. (Kenya)
Utilizing mobility as an adaptation strategy	• Reordering human settlement patterns, urbanizing precarious settlements, providing social housing, regularizing land-tenure issues in the social interest, and promoting the settlement in empty urban spaces. (Brazil) • Arranging voluntary resettlement or migration opportunities for vulnerable communities and supporting them through social safety nets, asset creation, access to credit, and livelihood diversification. (Ethiopia)

and social inclusion assessments, consultations with migrants and host communities), development, and planning (construction of buildings and infrastructure, government relocation plans, preparatory activities for relocation).

Vanuatu's revised and enhanced first NDC can be considered one of the most progressive NDCs in integrating human mobility (Government of Vanuatu, 2022). The NDC mentions three of the four types of human mobility directly (migration, displacement, and relocation) and immobility indirectly by emphasizing the importance of targeting people with disabilities due to their lower ability to evacuate safely in cases of disasters. Vanuatu has six commitments regarding human mobility in the following priority areas: loss and damage, health, and people with disabilities. Vanuatu's NDC is also one of the few that acknowledges the direct connection between climate and human mobility by using the term "climate-displaced people." Furthermore, for each target, the NDC provides a specific policy reference, a link to Vanuatu's National Sustainable Development Plan, the most relevant SDGs, the level of conditionality of finance required from developed country Parties, and the overall financial envelope to meet the target by 2030 successfully. Making the costs of implementing each commitment transparent does not only indicate the great depths of the analysis but makes these commitments more concrete and tangible.

Zimbabwe's NDC also acknowledges climate's direct and indirect impacts on migration (forced and voluntary) and displacement patterns in the country (Government of Zimbabwe, 2021). Zimbabwe takes a balanced view of human mobility by recognizing the potential positive and negative outcomes of human mobility by using the terms "voluntary" and "forced" migration. On the one hand, Zimbabwe emphasizes the importance of voluntary seasonal migration in search of livelihood opportunities and remittance flows from Zimbabwean emigrants for society and the economy (8% of its total GDP in 2019). On the other hand, the NDC acknowledges issues associated with developing illegal and unplanned settlements due to increasing numbers of voluntary and displaced people and refugees due to climate change and conflict (forced migration). Since 2010 the number of refugees in Zimbabwe has doubled mainly as a consequence of slow-onset migration from ecosystem degradation and environmental events. At the same time, Zimbabwe recognizes migrants as marginalized groups which are exposed more directly or indirectly to climate-related hazards, emphasizing this group's need for support.

4. Incorporating human mobility into NAPs

A total of 40 countries have submitted National Adaptation Plans to the UNFCCC from 2015–2022 to December 2022 (list of analyzed NAPs in Annex). Out of these, the vast majority (82.5%) reference human mobility. Disaster displacement is the type of human mobility which is referenced most often. However, there are considerable differences between the number of NAPs that simply mention human mobility (82.5%) and those that contain concrete provisions (70%).

Figure 2 displays the percentage of NAPs that either mention, make concrete provisions, or do not reference migration, displacement, and relocation. While 65% of NAPs mention climate-related migration, only 40% include actions or commitments related to it. Similarly, disaster displacement is mentioned in 70% of NAPs, but only 42.5% include actions or commitments. In the case of planned relocation, almost every

TABLE 5 Integration of any type of human mobility and specific types (migration, displacement, and relocation) in NDCs and NAPs by region out of the total analyzed NDCs and NAPs.

Region	Any human mobility		Migration		Displacement		Relocation	
	NDCs (%)	NAPs (%)	NDCs (%)	NAPs (%)	NDCs (%)	NAPs (%)	NDCs (%)	NAPs (%)
Africa	18	40	15	35	9	35	2	20
Asia-Pacific	11	18	9	10	6	18	6	15
Europe & North America	3	0	2	0	2	0	2	0
Latin America & Caribbean	10	25	8	20	5	18	5	18
Overall	42	83	34	65	22	71	15	53

NAP that mentions this (52.5%) also contains concrete provisions (47.5%).

Similar to NDCs, the submitted NAPs tend to view human mobility as a negative outcome of climate change. NAPs also recognize migrants, displaced persons, and relocated communities as vulnerable groups and focus their mobility components and actions on supporting these vulnerable groups. Compared to NDCs, the analysis indicates a greater emphasis on policy coherence and integration with subnational and sectoral planning processes, as well as a focus on proactive and anticipatory planning for expected future mobility and potential actions to manage it. The NAPs also strongly emphasize national action and the enhancement of the domestic policy and planning environment rather than connections to regional and global processes.

The most common actions related to human mobility in NAPs can be categorized as those related to data and evidence, policy coherence, policy integration, anticipatory planning (primarily focused on planned relocation), enabling environment, protection and support, resilience-building, and, in some cases, mobility as an adaptation strategy (Table 4). An extended version of Table 4 can be found in the Annex.

In the following, three country NAPs (Fiji, Ethiopia, and Guatemala) will be presented as brief case studies to explain how these countries are already integrating human mobility into national climate planning. *Fiji* communicates in its NAP the goal of facilitating safe, regular, and responsible migration and mobility of people, which is in line with the Global Compact for Migration (Republic of Fiji, 2018). It also includes two adaptation measures that consider human mobility, one of which focuses on strengthening the capacity of sub-national development planning processes to integrate human mobility. With the publication of the "Displacement Guidelines—In the context of climate change and disasters" and the "Planned Relocation Guideline—A framework to undertake climate change-related relocation" 2 years after the NAP, the country was able to put the aforementioned action goals into practice. Consequently, Fiji is one of the few countries where measures related to integrating human mobility in NAPs have already been put into practice.

Ethiopia displays a balanced view of human mobility in its NAP by emphasizing that climate change, specifically increases in temperature and droughts, heatwaves, and storms, can have adverse human mobility outcomes, such as making individuals or households more vulnerable or leading to displacements (Federal Democratic Republic of Ethiopia, 2019). At the same time, Ethiopia's NAP also recognizes positive outcomes, for example, seasonal labor migration as an adaptation strategy and possibility to diversify income which otherwise tends to solely depend on agriculture. Accordingly, Ethiopia aims to increase adaptation success by arranging voluntary resettlement and migration opportunities for vulnerable communities and promoting safety nets, asset creation, access to credit, and livelihood diversification.

Guatemala is one of the only countries with a whole chapter in its NAP explicitly dedicated to the nexus of climate and human mobility (Government of Guatemala, 2018). In this chapter, the country accounts for almost all relevant forms of human mobility, such as forced displacement, voluntary migration, and planned relocations shaped by climate change. The three primary needs include (1) assistance and support of migrants; (2) reducing displacement by reducing vulnerability and enhancing resilience; and (3) facilitating migration from high-risk areas and developing processes for planned relocation. Furthermore, Guatemala considers its chapter and working plan on the nexus of climate and human mobility as a contribution to its commitment under the WIM. Also, it links its NAP to other existing and relevant frameworks, such as the Paris Agreement, the Sendai Framework, and the Nansen Initiative, which is an important step toward combining and connecting efforts of related frameworks and initiatives

5. Spatial comparison of integration in NAPs and NDCs

Considering a spatial lens in analyzing human mobility integration in NDCs and NAPs adds an important dimension. We decided to calculate the percentage of NDCs and NAPs out of the total of analyzed NDCs and NAPs which integrate any type of human mobility for the following four regions: Africa, Asia-Pacific, Europe & North America (including Turkey and Russia), and Latin America & Caribbean (Table 5). We also determined for each region the percentage of integration of the specific types of human mobility (migration, displacement, and relocation) for the NDCs and NAPs that do integrate human mobility out of the total of NDCs and NAPs. For all regions, except Europe & North

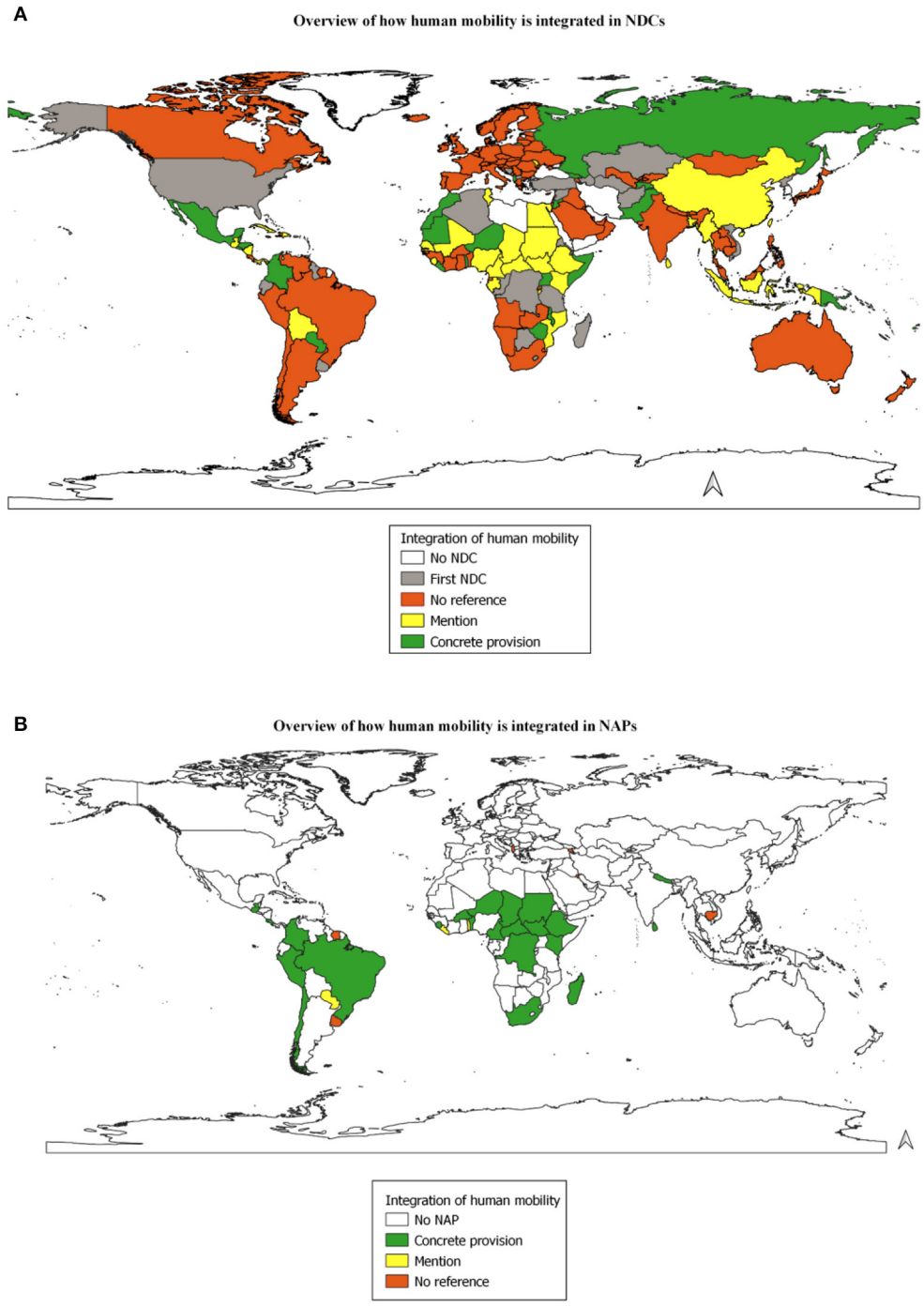

FIGURE 3
Overview of human mobility is integrated in **(A)** NDCs and **(B)** NAPs.

America, the percentage of human mobility in general and the specific types is higher in NAPs. This can be linked to the fact that NAPs focus on adaptation which applies very well to the human mobility context, whereas in NDCs, adaptation can but does not have to be incorporated. Migration is most referenced in the NAPs of Africa, displacement is most referenced in the NAPs of Asia-Pacific and Latin America & Caribbean, whereas relocation is most referenced in NAPs of Africa. These results are discussed in greater depth at the national level in the paragraph after the next one.

Furthermore, in Figure 3, the integration of human mobility in NDCs and NAPs at the country level is displayed. What stands out is that predominantly countries in the Global South integrate human mobility in their NDCs and NAPs. However, NAPs are a special case since so far, predominantly countries of the Global

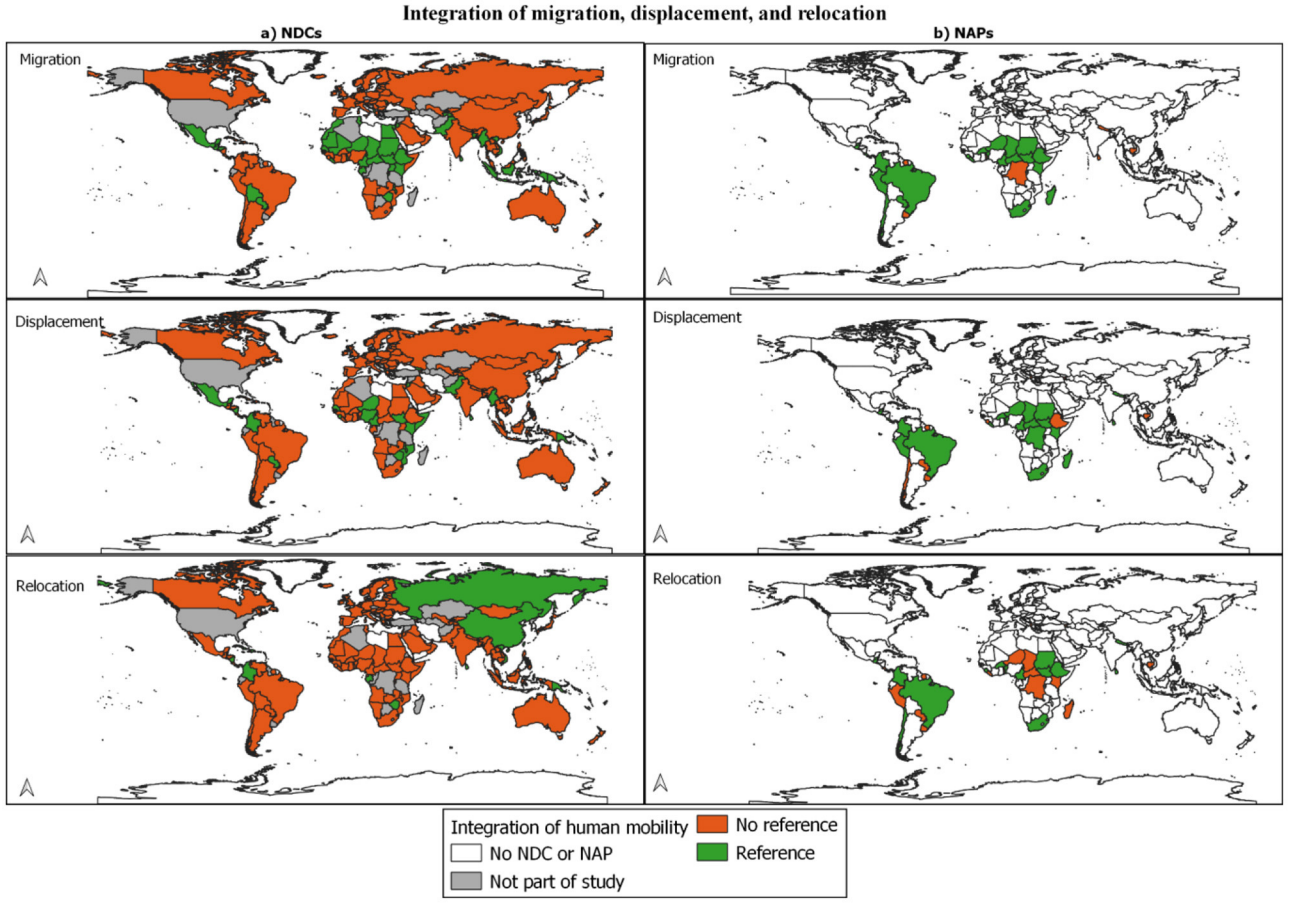

FIGURE 4
Integration of migration, displacement, and relocation in **(a)** NDCs and **(b)** NAPs.

South, except for Albania and Armenia, have submitted NAPs. When comparing NDCs and NAPs, one can also detect that more concrete provisions are made in NAPs. For NAPs, it is mainly the countries in Africa and Latin America which provide concrete provisions. Additionally, we examined that if countries integrated human mobility in their NDCs, it is often the case that they also integrate human mobility in their NAPs. At the same time, there are also cases exist where human mobility was not integrated into NDCs but into NAPs. This phenomenon applies mainly to countries in South America (e.g., Brazil, Chile, and Peru).

Next, we split up the reference of human mobility by mobility type, migration, displacement, and relocation in NDCs and NAPs at the national level (Figure 4). Here, we detect that migration and displacement are not mentioned in the Global North for NDCs. For both NDCs and NAPs, migration is most often referenced in African countries. This high level of integration is linked to high levels of especially internal migration in African countries as well as high levels of vulnerability and low levels of resilience due to the high dependence on agriculture for livelihoods (Rigaud et al., 2021). Displacement is referenced in some countries of all regions except Europe but specifically close to the equator. This can be associated with the strong climatic and environmental pressures experienced by countries close to the equator, forcing those countries to integrate displacement into their policies to address L&D (IDMC, 2022). Moreover, relocation is the main type of human mobility mentioned in the Global North (Russia) and, as expected, also coastal areas and islands. The latter result is based on the high risk of sea level rise experienced by coastal areas and islands, which has forced many affected countries and islands to find possible approaches, such as relocation, to adapt or address L&D (Bongarts Lebbe et al., 2021).

We also determined the number of human mobility types referenced in NDCs and NAPs at the national level (Supplementary Figure 1). Here, we examine a similar picture as in the previous section. More NAPs than NDCs integrate multiple types of human mobility. 13 NAPs (6 Africa, 3 Asia & Pacific, 3 Latin America, and 1 Caribbean) and 13 NDCs (6 Asia & Pacific, 4 Caribbean, 2 Europe & North America, and 1 Africa) even integrate all three types of human mobility. Countries in the Global North either do not integrate human mobility or only mention one type, whereas countries of the Global South mention many different types of human mobility. This result is linked again to climate extremes being more severe in countries of the Global South, resulting in different types of human mobility becoming relevant as an outcome of climatic and environmental changes (IPCC, 2022).

TABLE 6 Priority sectors and links to human mobility.

Priority sector	Links to human mobility
Agriculture	• Loss of agricultural livelihoods and food security leading to seasonal migration or rural exodus. • Crop failure and decreased yields caused by temperature increase and rainfall variability lead to permanent or seasonal out-migration from farming communities. • Climate-related events change fish migration patterns, which can become a driver of seasonal migration for coastal communities or alter existing patterns and dynamics. • Out-migration of farmers and agricultural labor can lead to food insecurity and loss of livelihoods for community members staying behind (e.g., women or the elderly). • Youth out-migration due to loss of overall resilience and attractiveness of rural agricultural areas and livelihoods. • Climate impacts and long-term processes related to livestock, precipitation, and pasture can cause changes in pastoralist movement patterns. • People on the move due to climate change can be affected by food insecurity, (micro) nutrient deficiencies, and lack of dietary continuity, leading to chronic or long-term health impacts.
Water resources	• Drought, water scarcity, and groundwater depletion can become drivers of migration. • Flooding and hydrological disasters can cause displacement. • Need to ensure access to safe drinking water and sanitation for people on the move.
Human health	• Migration can lead to adverse impacts on health and wellbeing. • People on the move need access to continuity of healthcare and psychosocial support. • Need to create awareness and provide support on hygiene and sanitation for displaced persons.
Ecosystems, biodiversity, and natural resources	• Loss of ecosystem services can act as an additional driver of migration. • There is a potential for conflict around natural resources between host communities and those on the move. • Informal settlements, unplanned settlements, and urban sprawl connected to migration can degrade and fragment habitats and natural ecosystems. • Agroforestry, zero deforestation, and valuation of associated products can bring social benefits and reduce climate-related out-migration.
Human settlements	• Climate-related human mobility can result in informal settlements, especially in urban and peri-urban areas. • Climate change can destabilize land ownership and management, which can hamper economic development and increase internal migration. • Inundation of low-lying human settlements due to sea level rise can lead to migration or relocation toward the interior and higher ground. • Hydrological disasters and other climate-related extreme weather events can cause displacement or force communities to temporarily or permanently relocate. • Climate-related damage to or loss of housing can cause displacement or out-migration to earn remittances for reconstruction. • Need to identify safe and suitable locations for resettlement or relocation. • Need to provide adequate housing (e.g., sanitation, utilities, services, transport) and employment and skill development opportunities for migrants and displaced populations. • Informal or unplanned settlements, which migrants or displaced people often populate, can be vulnerable to floods, storms, and other climate-related impacts. • Illegal and unplanned settlements can pose social, economic, and administrative challenges and generate natural resource-use conflicts.
Coastal and marine	• Displacement due to coastal flooding is connected to rising sea levels and climatic change. • Out-migration to urban centers lowers the resilience of coastal communities and leaves behind vulnerable groups (children, youth, women, the elderly, and the poor).
Gender-related considerations	• Male out-migration connected to climate change can lead to many female-headed households and additional burdens on women staying behind. • Women and girl children often face additional threats and insecurities during migration or displacement. • Climate-related population movements can alter the social structure of communities and negatively affect social cohesion.

6. Human mobility connections in NDC and NAP priority sectors

The analysis of NDCs and NAPs found that human mobility is most often referenced in or linked with several key sectors. Table 6 provides an overview of some of the most common connections to human mobility in these sectors based on a synthesis of contents and references within the submitted documents. The agriculture sector, water resources, human health, natural ecosystems, human settlements, and the coastal and marine sector are the ones that tend to be linked to different forms of mobility. In addition, cross-cutting considerations related to human mobility that are recurring throughout the NDCs and NAPs include livelihoods, food security, land ownership, the informal economy, gender, children and youth, the elderly, skill development, social protection, risk management, as well as, to a lesser degree, education, awareness creation, human rights, regional or international collaboration, and access to finance and financial literacy for migrants.

Many country submissions identify direct or indirect links between climate change and their national priority sectors. Extreme weather events and sudden shocks are mentioned, but also slow-onset events and long-term impacts related to livelihoods, ecosystem services, habitat shifts, human health, infrastructure, and housing. Regarding cross-cutting considerations, gender, age, and poverty are often mentioned as intersectional risk factors that need to be addressed through social protection and building

adaptive capacities. However, several countries have also included commitments related to the empowerment of women as well as gender and intergenerational equity, assigning a more active role and positive potential to women and youth.

The strong linkages of human mobility to different sectors highlight the importance of considering processes and policies in these sectors during the development and implementation of NDCs and NAPs. In many NAPs that include human mobility, this vertical and horizontal integration is already part of the intended actions, for example, by connecting adaptation planning to the water, housing, urban planning, or labor sector or by linking it to development planning, relief programs, livelihood support, education, and social protection. Similarly, processes on the national or subnational level should align with climate commitments to harness synergies and ensure a coherent policy framework that mainstreams climate mobility considerations.

7. Needs and opportunities for integrating human mobility into NDCs and NAPs

Even though the findings from this paper suggest a rising awareness of climate change as a driving or influencing factor of human mobility, the interviews with experts in the field revealed that—similar to Indigenous and rural communities, disabled people, and women—migrants, displaced, relocated, and immobile people also tend to often not be adequately integrated into climate policies. Based on the insights from the interviews, the three biggest challenges which limit the integration of human mobility into national policies such as NDCs and NAPs are (1) lack of finance, (2) lack of institutional capacity of in-charge ministries, and (3) lack of data and evidence. Even though NDCs and NAPs provide an opportunity for countries to access funding, stakeholders working on NDCs and NAP have highlighted that funding processes tend to be bureaucratic and time-consuming. According to stakeholders, even when funding is accepted, funding amounts are often insufficient to support a thorough planning and implementation process for integrating human mobility into NDCs or NAPs.

Regarding the second biggest challenge, the lack of capacity of the in-charge ministries, stakeholders pointed out that the work on NDCs or NAPs is often added to the ministries' day-to-day obligations without providing additional workforce or monetary compensation. Limited capacities of the in-charge ministries increase the difficulties of coordinating various sub-national entities and their different policies. Moreover, line ministries, which are essential contributors to the NDC and NAP process, are less able to contribute since they tend to have limited capacity and expertise regarding the technical aspects of climate change compared to larger ministries such as the Ministry of Economy or the Ministry of Agriculture. Power asymmetries and different interests of ministries also contribute to the preference of the leading ministries to work in silos. Changing governments and associated priorities and commitments also hinder long-term strategic planning, especially regarding the critical NDC and NAP phases of monitoring, evaluation, and learning (MEL). In the interviews, many stakeholders highlighted limited multi-stakeholder engagement and opportunities to provide input in the NDC and NAP processes. While almost all the insights provided by the stakeholders from the different countries were similar, large differences in the importance of the nexus of climate and human mobility were reported. A few countries viewed this nexus as a top priority whereas many neglect migration as a possible adaptation strategy. This could be due to the assumption that migration and displacement are not yet visible and urgent enough to be recognized as the country's top priorities or due to a lack of context-specific data on the nexus of climate and human mobility.

The third biggest challenge, lack of data, is an issue strongly linked to a lack of technology, infrastructure, and expertise in data science. Data on human mobility flows and stocks, especially on internal migration and immobility, as well as reasons for migration, is limited. Consequently, data on the nexus of climate change and human mobility is even rarer due to the complex and context-sensitive character of this nexus. This is the case because the transboundary dimension of human mobility is complicated to assess, not only due to data but also due to political issues. During the interviews, the stakeholders also emphasized the need to improve data on remittances since remittances have great societal and economic importance not only for migrants and their families but also for their home countries' national economies. Furthermore, data on MEL from current NDCs or NAPs is lacking.

The stakeholders also stressed that the COVID-19 pandemic further intensified the previously mentioned data needs and challenges. The pandemic hampered data availability issues by making data acquisition more difficult due to widespread lockdowns and infected staff.

Another adverse effect of the COVID-19 pandemic was that some groups in society, such as rural and indigenous communities, were further excluded from the NDC and NAP process. Their underrepresentation in the policy process increased during the COVID-19 pandemic due to predominantly online participation, which requires internet access which is often limited in these communities. Besides increasing difficulties in reaching and integrating all parts of the society, the face-to-face political dialogue was also reduced, which increased the issue of stakeholders, ministries, and governments working in silos, making the NDC and NAP development but also implementation less effective.

The stakeholders also emphasized potential areas of improvement for the current NDC and NAP processes. They highlighted that these processes need to become more practical by focusing on capacity building of developing and implementing ministries, promoting vertical and horizontal integration, and strengthening the focus on MEL. To achieve this, MEL processes need to be robustly integrated into budgets or plans. Accordingly, it is also critical to account for power regimes and actively create room for female stakeholders. To enhance implementation, sectoral or provincial NAPs provide an opportunity to better engage sectoral and local institutions in the process, allowing for a more concrete and accessible implementation of the plan. Regarding the lack of data, inclusive, participatory, and standardized approaches, and methodologies must be developed for data collection and monitoring. This should also allow for integrating local institutions

(research institutions, universities), NGOs, CSOs, and affected people or communities. Data could then be utilized to raise awareness about the nexus of climate and human mobility in relevant ministries, the general public, and local communities. Furthermore, national programs must bridge the gap to the local level, since this is the level where implementation is taking place. Additionally, beyond in-charge ministries working in silos, NDCs and NAPs are often treated separately, representing an inefficient use of resources. Therefore, in-charge ministries need to invest in connecting the NAP and NDC process through, for example, data- and knowledge-sharing mechanisms, inter-ministerial coordination bodies, or multi-stakeholder engagement processes.

Based on the interviews with relevant stakeholders, the authors view NDCs and NAPs as opportunities to change the narrative of "victimhood" of climate- and conflict-affected communities by empowering them and supporting them to become more resilient and adapted. Toward this goal, NDCs and NAPs can emphasize supporting migrants, displaced and relocated persons, and immobile people in the pursuit of stability by strengthening safe, regular, and dignified migration. To allow for safe, regular, and dignified migration, female, male, and non-binary migrants need to be supported in their decision-making of where and how to migrate, promoting formal routes of migration. This can be achieved by capacity-building opportunities specifically targeted toward migrants, displaced or relocated people with a specific focus on women, allowing them to acquire the job skills they need to improve their current livelihood situations. Another emphasis should be placed on making remittance flows safer, easier, and more effective, which will help to support the families that stay behind as well as the home economies of migrants. Lastly, to prevent working in silos, not only among stakeholders, and ministries, but also among governments and countries, a platform or network which collects and exchanges "good" and "bad" practices in the field should be established to increase the effectiveness of the NDC and NAP process.

8. Conclusion

The findings of this paper suggest an increasing awareness of the importance of climate change as a driving or influencing factor for human mobility across the globe. Twice as many NAPs compared to NDCs reference human mobility (42, 83%). In comparison, NAPs make three times more provisions than NDCs to address some aspect of migration, displacement, or planned relocation (21, 70%). Out of the NDCs that mention human mobility, most refer to migration, followed by disaster displacement and planned relocation. In the NAPs that mention human mobility, displacement is referenced most often, followed by migration and planned relocation. Compared to the first round of submitted NDCs, the updated and revised submissions include more references and commitments related to human mobility. Many countries focus on mobility as a risk, challenge, or problem or on migrants as vulnerable groups. However, some other countries have also incorporated positive aspects of mobility, for example, as a potential adaptation strategy under their NDCs and NAPs (e.g., Ethiopia, Fiji, Malawi, Papua New Guinea, or Zimbabwe). Furthermore, more NAPs and NDCs account for not just one type (e.g., migration) but several types of human mobility (e.g., displacement and relocation), highlighting the many direct and indirect links between climate and migration by using terminologies such as "climate-induced migration" (Papua New Guinea) or "climate-displaced people" (Vanuatu).

The submitted NDCs and NAPs indicate a broad range of opportunities for incorporating human mobility across different sectors and stages of the NDC and NAP process. Key categories of actions are related to enhancing the evidence base, creating awareness, strengthening policy coherence (vertical or horizontal integration), anticipatory planning and early action, building resilience to prevent involuntary mobility, facilitating mobility as an adaptation strategy, developing guidelines and plans, and, last but not least, protecting and supporting those affected by climate-related human mobility. Most of these actions are connected to the most common priority adaptation sectors in the submitted NDCs and NAPs, such as food systems, human health, water resources, sanitation, natural ecosystems, human settlements, coastal and marine areas, and cross-cutting considerations. To facilitate better integration of human mobility into NDCs and NAPs, stakeholders have identified the need to enhance finance, institutional capacities, as well as data and evidence.

Limitations of our study include the lack of a detailed analysis of whether human mobility is considered mainly a positive or negative outcome of climate change or if a balanced view is taken. Additionally, because not many NDCs and NAPs specifically define the used terminology on human mobility, a degree of ambiguity in classifications is introduced. Consequently, it would be interesting to assess the positive, negative, or balanced view of integrating human (im)mobility in NDCs and NAPs in greater detail. Further research is also required to analyze NAP readiness proposals and ongoing NAP formulation processes, evaluate the impact of implemented interventions related to human mobility, as well as to identify relevant indicators and metrics which could connect to global and regional processes such as the Global Compact on Migration, the Global Goal on Adaptation, the Global Stocktake, the Sendai Framework on Disaster Risk Reduction, or the SDGs. NDCs and NAPs are not the only national documents that can contain information on human mobility or outline actions to address it. There is a need to conduct further research on this thematic area. This should occur at the country level to map the interconnections between these documents and processes under the UNFCCC and the Paris Agreement on the one hand and national, subnational, and sectoral policies and plans on the other. These documents and processes relate to climate change, development, disaster management, urban planning, social protection, education, labor, and many more.

This paper simultaneously assessed the state of play, good practices, and ways forward when it comes to integrating climate-related human mobility through NDCs and NAPs. The insights gained from this analysis can and should also be applied to other climate policy frameworks. Even though we determined an increasing awareness of human mobility in climate policy frameworks, countries who are updating NDCs or developing new NDCs and NAPs must pay close

attention to not just integrating human mobility but also providing concrete provisions since the intensity and frequency of extreme events that threaten the livelihoods of many inhabitants are increasing.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

DM analyzed and coded the NAPs and NDCs and wrote the NAP and NDC analysis sections. A-CL conducted and analyzed the interviews and wrote the section on the needs, challenges, opportunities, and case studies. DM and A-CL equally contributed to the abstract, introduction, and conclusion parts, while KG contributed to conceptual development and reviewed, edited, and refined the overall document and all major sections. All authors contributed to the article and approved the submitted version.

Funding

The Food and Agriculture Organization of the United Nations funded the project on "Integrating human mobility from a rural livelihoods perspective into NAPs and NDCs: A Global Guide and Toolkit" which was conducted by UNU-EHS, and which was instrumental for developing the argument for parts of this paper based on the 20 interviews conducted.

Acknowledgments

The authors acknowledge the precious work of Anna Maria Bezerra de Mello Cárcamo and Erin Roberts in conducting the expert interviews as well as the work of SLYCAN Trust's Research & Knowledge Management division on compiling data on the submitted NDCs and NAPs.

Conflict of interest

DM was employed by SLYCAN Trust.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fclim.2023.1125936/full#supplementary-material

References

Afifi, T., Milan, A., Etzold, B., Schraven, B., Rademacher-Schulz, C., Sakdapolrak, P., et al. (2016). Human mobility in response to rainfall variability: opportunities for migration as a successful adaptation strategy in eight case studies. *Migrat. Develop.* 5, 254–274. doi: 10.1080/21632324.2015.1022974

Black, R., Bennett, S. R. G., Thomas, S. M., and Beddington, J. R. (2011). Climate change: migration as adaptation. *Nature* 478, 447–449. doi: 10.1038/478477a

Boas, I., Farbotko, C., Adams, H., Sterly, H., Bush, S., van der Geest, K., et al. (2019). *Enhancing NDCs: A Guide to Strengthening National Climate Plans*.

Bongarts Lebbe, T., Rey-Valette, H., Chaumillon, É., Camus, G., Almar, R., Cazenave, A., et al. (2021). Designing coastal adaptation strategies to tackle sea level rise. *Front. Marine Sci.* 8, 1640. doi: 10.3389/fmars.2021.740602

Durand-Delacre, D., Bettini, G., Nash, S. L., Sterly, H., Gioli, G., Hut, E., et al. (2021). "Climate migration is about people, not numbers," in *Negotiating Climate Change in Crisis*, eds S. Böhm, S. Sullivan (Open Book Publishers), 63-81. doi: 10.11647/obp.0265.06

Elliott, L. (2010). "Climate migration and climate migrants: what threat, whose security?," In *Climate Change and Displacement: Multidisciplinary Perspectives*. London: Hart Publishing.

Evertsen, K. F., and van der Geest, K. (2020). Gender, environment and migration in Bangladesh. *Climate Develop.* 12, 12–22. doi: 10.1080/17565529.2019.1596059

Farbotko, C. (2018). Climate change and national security: an agenda for geography. *Aust. Geographer*. 49, 247–253. doi: 10.1080/00049182.2017.1385119

Federal Democratic Republic of Ethiopia (2019). *Ethiopia's Climate Resilient Green Economy*. Available online at: https://unfccc.int/sites/default/files/resource/Ethiopia-NAP.pdf (accessed February 16, 2023).

Fransen, T., Sato, I., Levin, K., Waskow, D., Rich, D., Ndoko, S., et al. (2019). *Enhancing NDCs: A Guide to Strengthening National Climate Plans*. WRI Publications. doi: 10.46830/wrirpt.19.00021

Gemenne, F., and Blocher, J. (2017). How can migration serve adaptation to climate change? Challenges to fleshing out a policy ideal. *Geograph. J.* 183, 336–347. doi: 10.1111/geoj.12205

Government of Guatemala (2018). *Plan de Acción Nacional de Cambio Climático: PANCC Secunda Edición*. Available online at https://www4.unfccc.int/sites/NAPC/Documents/Parties/Guatemala%20NAP%20small.pdf (accessed February 16, 2023).

Government of Papua New Guinea (2020). *Papua New Guinea's Enhanced Nationally Determined Contribution 2020*. Available online at: https://pacificndc.org/sites/default/files/2020-12/PNG%20Enhanced%20NDC%202020_3.pdf (accessed February 16, 2023).

Government of Vanuatu (2022). *Vanuatu's Revised and Enhanced 1st Nationally Determined Contribution 2021–2030*. Available online at: https://unfccc.int/documents/578782 (accessed February 16, 2023).

Government of Zimbabwe. (2021). *Zimbabwe Revised Nationally Determined Contribution*. Available at https://unfccc.int/sites/default/files/NDC/2022-06/Zimbabwe%20Revised%20Nationally%20Determined%20Contribution%202021%20Final.pdf (accessed February 16, 2023).

Hoffmann, R., Dimitrova, A., Muttarak, R., Crespo Cuaresma, J., and Peisker, J. (2020). A meta-analysis of country-level studies on environmental change and migration. *Nat. Climate Change* 10, 904–912. doi: 10.1038/s41558-020-0898-6

IDMC (2022). *Global Report on Internal Displacement: Children and Youth in Internal Displacement*. Available online at: https://www.internal-displacement.org/global-report/grid2022/ (accessed February 16, 2023).

IOM (2016). *Migration in the Intended Nationally Determined Contributions (INDCs) and Nationally Determined Contributions (NDCs), IOM*. Available online at: https://publications.iom.int/books/migration-intended-nationally-determined-contributions-indcs-and-nationally-determined (accessed February 16, 2023).

IOM (2018). *Mapping Human Mobility and Climate Change in Relevant National Policies and Institutional Frameworks.* IOM. Available online at https://unfccc.int/sites/default/files/resource/20180917%20WIM%20TFD%20I.1%20Output%20final.pdf (accessed February 16, 2023).

IOM, UNDP, and UNEP (2021). *Integrating Migration into Environment and Climate Change Interventions.* Available online at: https://www.undp.org/publications/integrating-migration-environment-and-climate-change-interventions (accessed February 16, 2023).

IPCC (2022). "Summary for policymakers," In: H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, eds. *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, p. 3–33. doi: 10.1017/9781009157940.001

Martin, M. A., Boakye, E. A., Boyd, E., Broadgate, W., Bustamante, M., Canadell, J. G., et al. (2022). Ten new insights in climate science. *Global Sustain.* 5:e20. doi: 10.1017/sus.2022.17

McLeman, R., and Gemenne, F. (2018). *Routledge Handbook of Environmental Displacement and Migration, Abingdon, Oxon.* New York: Routledge. doi: 10.4324/9781315638843

Oakes, R., van der Geest, K., and Corendea, C. (2022). "Any port in a storm? Climate, mobility, and choice in pacific small island developing states," In: Kent, A. and Behrman, S., eds. *Climate Refugees: Global, Local and Critical Approaches.* London and New York: Cambridge University Press. p. 249–60. doi: 10.1017/9781108902991.013

Republic of Fiji (2018). *Republic of Fiji National Adaptation Plan: A Pathway Toward Climate Resilience.* Available online at: https://www4.unfccc.int/sites/NAPC/Documents/Parties/National%20Adaptation%20Plan_Fiji.pdf (accessed February 16, 2023).

Rigaud, K., Sherbinin, A., Jones, B., Arora, A., and Adamo, S. (2021). *Groundswell Africa: A Deep Dive on Internal Climate Migration in Tanzania*. Washington, D.C.: World Bank Group. doi: 10.1596/36446

Sakdapolrak, P., Smith, L., Tripathy Furlong, B., Turhan, E., Warner, J., Zickgraf, C., et al. (2019). Climate migration myths. *Nat. Climate Change.* 9, 901–903. doi: 10.1038/s41558-019-0633-3

SLYCAN Trust (2022). *Scoping Paper: Integrating Climate-Related Human Mobility into Nationally Determined Contributions and National Adaptation Plans. Human Mobility in the Context of Climate Change #5, SLYCAN Trust*. Available online at: https://www.slycantrust.org/knowledge-resources/integrating-human-mobility-into-nationally-determined-contributions-and-national-adaptation-plans (accessed February 16, 2023).

Thalheimer, L., Williams, D., and van der Geest, K. (2021). Advancing the evidence base of future warming impacts on human mobility in African drylands. *Earth's Future* 9, 1–10. doi: 10.1029/2020EF001958

UNFCCC (2002). *Report of the Conference of the Parties on its Seventh Session, Held at Marrakech from 29 October to 10 November 2001*. Available online at: https://unfccc.int/sites/default/files/resource/docs/cop7/13a01.pdf (accessed February 16, 2023).

UNFCCC (2011). *Decision 1/CP.16 of The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, United Nations Framework Convention on Climate Change.* Available online at https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2 (accessed February 16, 2023).

UNFCCC (2012). Slow onset events. *Technical Paper*. Available online at: https://unfccc.int/resource/docs/2012/tp/07.pdf (accessed February 16, 2023).

UNFCCC (2015). *The Paris Agreement, United Nations Framework Convention on Climate Change.* Available online at https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf (accessed February 16, 2023).

Vinke, K., Bergmann, J., Blocher, J., Upadhyay, H., and Hoffmann, R. (2020). Migration as adaptation?. *Migrat. Stud.* 8, 626–34. doi: 10.1093/migration/mnaa029

Warner, K., Kälin, W., Martin, S. F., Nassef, Y., Lee, S., Melde, S., et al. (2014). *Integrating human mobility issues within National Adaptation Plans.* Bonn: UNU-EHS.

Warner, K., Van der Geest, K., Huq, S., Harmeling, S., Kusters, K., de Sherbinin, A., et al. (2012). *Evidence from the Frontlines of Climate Change: Loss and Damage to Communities Despite Coping and Adaptation.* United Nations University-Institute for Environment and Human Security (UNU-EHS).