

The implications of climate-related mobility for human security in Vietnam's Mekong Delta: A scoping review

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December 2022

Suggested citation:

Le P.D., Melgar, A., Savelli, A. 2022. *The implications of climate-related mobility for human security in Vietnam's Mekong Delta: A scoping review*. CGIAR Initiative Report. Hanoi, Vietnam: Alliance of Bioversity and CIAT.

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This work was implemented as part of the CGIAR Initiative on Asian Mega-Deltas and CGIAR Initiative on Climate Resilience. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: <https://www.cgiar.org/funders/>.

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1. Introduction

This review aims to take stock of existing research addressing the complex relationship between climate change, mobility, and human security in Vietnam's Mekong Delta (VMD) region.

The term *mobility* encompasses various movements of individuals or households, nearly all of which are multicausal. As such, mobility outcomes include migration, displacement, relocation, and immobility, each driven by a range of agentic decisions and external stimuli (Ober, 2020). *Climate-related mobility* refers to mobility outcomes that are at least partially influenced by climate change and/or variability. Rather than acting as a primary driver, climate risk often exacerbates non-climate risks (economic, social, political, environmental) to influence mobility outcomes (Black, 2011; McLeman 2021). The temporal, spatial, and motivational dimensions of these movements are diverse. Thus, mobility can be “temporary or long-term, short- or long-distance, voluntary or forced, and seasonal or permanent movement as well as planned relocation” (Rigaud et al., 2018). Agentic decisions about when, where, why, and how long to move are based on individual or household risk calculations (McLeman 2021). As climate impacts are more pronounced in communities whose livelihoods are highly dependent on natural resources, climate often impacts the mobility outcomes of households with high vulnerability and low adaptive capacity (Savelli et al., 2022).

As climate—often through its effect on land, water, and food systems—has direct and indirect impacts on mobility outcomes, consideration must be given to the linkages between climate and human security, which are known as climate security. Human security refers to “the right of people to live in freedom and dignity, free from poverty and despair” (UNGA, 2012). It recognizes that “all individuals, in particular vulnerable people, are entitled to freedom from fear and freedom from want, with an equal opportunity to enjoy all their rights and fully develop their human potential” (UNGA, 2012). Human security comprises seven dimensions: *economic security, food security, health security, environmental security, personal security, community security, and political security* (UNDP's Human Development Report 1994). Human security provides a holistic framework to address cross-cutting challenges to the survival, livelihood, and dignity of all human lives (UNGA, 2012). This comprehensive approach emphasizes the interconnectedness of human security' components resulting threats to wellbeing (OCHA 2010).

The climate security-mobility nexus encompasses the multi-causal, bi-directional and heterogeneous linkages that can, under some circumstances, connect climate change, mobility outcomes, and violent conflict. The climate security-mobility nexus is highly contextual; its characteristics are more dependent on the impact that local political, social, economic, environmental, and demographic variables have on human security than the direct impact of climatic factors. Pre-existing insecurities and structural risk factors significantly shape emergent pathways across geographic contexts (Barnett & Adger, 2007). Common pathways include conflict as a result of climate-related disaster displacement, conflict as a result of scarcity-related mobility, conflict as a result of abundance-related migration, and

conflict as a result of pre-existing tensions and migratory patterns interacting with climate change and/or variability (Savelli et al., 2022).

The study—part of the CGIAR Initiative: Securing the Food Systems of Asian Mega-Deltas for Climate and Livelihood Resilience (CGIAR, n.d.)—explores the linkages between climate-related mobility and human security in Vietnam’s Mekong Delta region. By examining the available evidence through a systematic literature review, the results of previous studies are mapped and analyzed. Evidence gaps and opportunities for future research on climate-related mobility and human security in the VMD are then articulated.

2. Methodology

This study employs an adapted version of the scoping review methodology suggested by (Peters et al., 2015). First, a list of keywords for different thematic categories, including climate and environment, human security, mobility, and the geographic focus, was manually constructed to ensure that relevant areas of climate-related mobility and human security were covered. The full list of categories and keywords used for the search strategy is provided in Appendix 1. A machine-assisted search was performed to identify relevant literature for review. An automated bibliometric scan was conducted to extract relevant peer-reviewed papers from the Web of Science database. To be considered for inclusion, a paper’s bibliography had to include at least one keyword from each of the four thematic categories, and the paper should be published from 2010 onwards. The approach is based on the foundations of bibliometrics analysis, broadly defined as a set of quantitative methods to assess books, articles and other publications. This field has been expanding beyond measuring the impact of academic outputs to include systematic, machine-driven thematic reviews (Carneiro et al, 2022). This analysis draws upon such methodological innovations to explore relevant topics within the climate security debate in the Asian mega-deltas region.

Full records of the resulting citations were exported and the key terms were detected in the text of the abstracts, enabling analysis of combinations of co-occurring keywords to identify relevant literature for the review. Provided the authors were associated with public agencies, established research centers, and/or development organizations grey literature was also considered in the scoping review. Though not peer-reviewed, high-quality grey literature can still provide important insights (Godin et al., 2015). A keyword search query ("Mekong Delta" AND (migration OR displace OR relocation) AND climate AND (security OR conflict") was performed on Google Search, and the first 10 pages of results were manually filtered to identify relevant journal articles, reports, book chapters, and working papers for inclusion.

Once relevant peer-reviewed and grey literature was extracted, a short-list for inclusion was produced. This involved validating the keyword search results, confirming identified literature was published between 2010 and 2022, and ensuring papers focused explicitly on Vietnam’s Mekong Delta region. Papers not meeting any of these criteria were excluded from the review. This strategy yielded 166 publications in total. After screening for inclusion criteria, 40 papers were selected for review and subsequently analysed.

Next, papers selected for review were analyzed in relation to several research questions, including:

- Which methodological designs and data sources have been used to examine the connection between climate-related mobility and human security?
- Where has previous research focused geographically?
- Which groups of people have been the focus of previous research?
- What climate events have been discussed?
- What primary drivers of mobility have been identified?
- Which components of human security were a focus of previous research?
- What conclusions have been reached by previous research?
- What research gaps have been identified?

As each paper was reviewed, key information related to the above questions was recorded. From this dataset, descriptive analyses relating to research methods, geographical focus, social groups, climate factors, mobility drivers, and forms of human security were developed. Finally, these key results were synthesized to generate recommendations for future research.

3. Results and discussion

This section presents main findings of the scoping review in relation to the above research questions.

3.1 Methods and data

A mixed methods approach involving both quantitative and qualitative analysis was most widely used in the literature to study the connection between climate-related mobility and human security in the Mekong Delta of Vietnam. Of the 40 papers analysed, 50% utilized a mixed methods approach, 30% used qualitative methods, and 20% used quantitative methods. On the one hand, specific qualitative methods included literature review, case studies, interviews, focus group discussions, and participatory action research tools (e.g., participatory observation) (Ngo et al., 2020; Dun, 2011; Sudmeier-Rieux et al., 2015). On the other hand, quantitative methods included surveys, statistical analysis, modelling, and regression analysis (Vuong et al., 2022; Huong & Pathirana, 2013; Thi Quyen, 2022). The three most common techniques were surveys, applied in nearly half of the studies (47%), interviews (40%), and literature reviews (35%). While quantitative surveys allow for large quantity sampling—sample sizes in reviewed papers ranged from 50 to 4,400 household (Mekong Migration Network & Asian Migrant Centre, 2013; Quinones et al., 2021)—qualitative interviews help articulate personal perceptions of climate change and build an in-depth understanding of the context, individual decision-making processes, and other micro-factors that shape mobility outcomes (Van der Geest and Nguyen, 2014; Duyen et al., 2021).

Regarding data sources, 50% of papers used primary data, 33% used secondary data, and 18% used a combination of both. Secondary data included previous research, the Government of

Vietnam's Household Living Standard Survey (VHLSS), other census data, and some additional dataset from governmental agencies including line ministries and the General Statistics Office. Regardless of its source, many papers stressed the importance of primary data in understanding the climate security-mobility nexus due to its inherently context-specific nature (Dun, 2011).

3.2 Geographic focus

Research on climate-related mobility and human security in the Mekong Delta has been conducted at multiple geographic scales. While our focus is sub-national, our review included research performed at the global and national levels if it included a partial but specific focus on the Vietnamese Mekong Delta. Research conducted at the provincial level accounts for 33% of papers, followed by community level (23%) and national levels (20%), delta level (18%), district level (5%), and global level (3%). At provincial level, Ca Mau (60%) and Long An (60%) were the most frequent research settings, followed by Dong Thap (58%) and Can Tho (53%) (see Figure 1, below, for a visual distribution). Although Ho Chi Minh City (47%) does not belong to the Mekong Delta region, being the nearest major metropolitan area (with a population greater than five million residents) it is a common destination area for migrants from the VMD seeking work, education, or marriage (Dun, 2011; Ngo et al., 2022). Similarly, Can Tho is the urban heart of the VMD region and also a popular destination for migrants from regional provinces. Thematically, research set in Ho Chi Minh City and Can Tho tended to focus on the living conditions of migrants in receiving areas (Dun, 2011; Ngo et al., 2022; Huong & Pathirana, 2013). In less urban provinces, research was more oriented toward the drivers and impacts of climate-related mobility (e.g., Tran, 2019; Miller, 2020; Koubi et al., 2016; Le & Truong, 2017).

Provinces in the Mekong Delta that have been less frequently studied include Vinh Long (44%), Tien Giang (47%), Hau Giang (47%), Soc Trang (47%), Bac Lieu (47%), and Kien Giang (47%). Nevertheless, according to the General Statistics Office of Vietnam (GSO) (2020), Soc Trang is the province with the highest net migration rate (75%), followed by Hau Giang (61%) and Bac Lieu (52%). Soc Trang and Bac Lieu are coastal provinces vulnerable to sea-level rise, salinity intrusion, and drought (Tran et al., 2021; Steimanis & Vollan, 2022). Surprisingly, even when removing national and globally-focused literature, only two studies included primary data collection related to climate mobility and human security in Soc Trang and Bac Lieu. Thus, additional research is needed to have a complete picture of climate-related mobility in the Mekong Delta (Steimanis & Vollan, 2022).

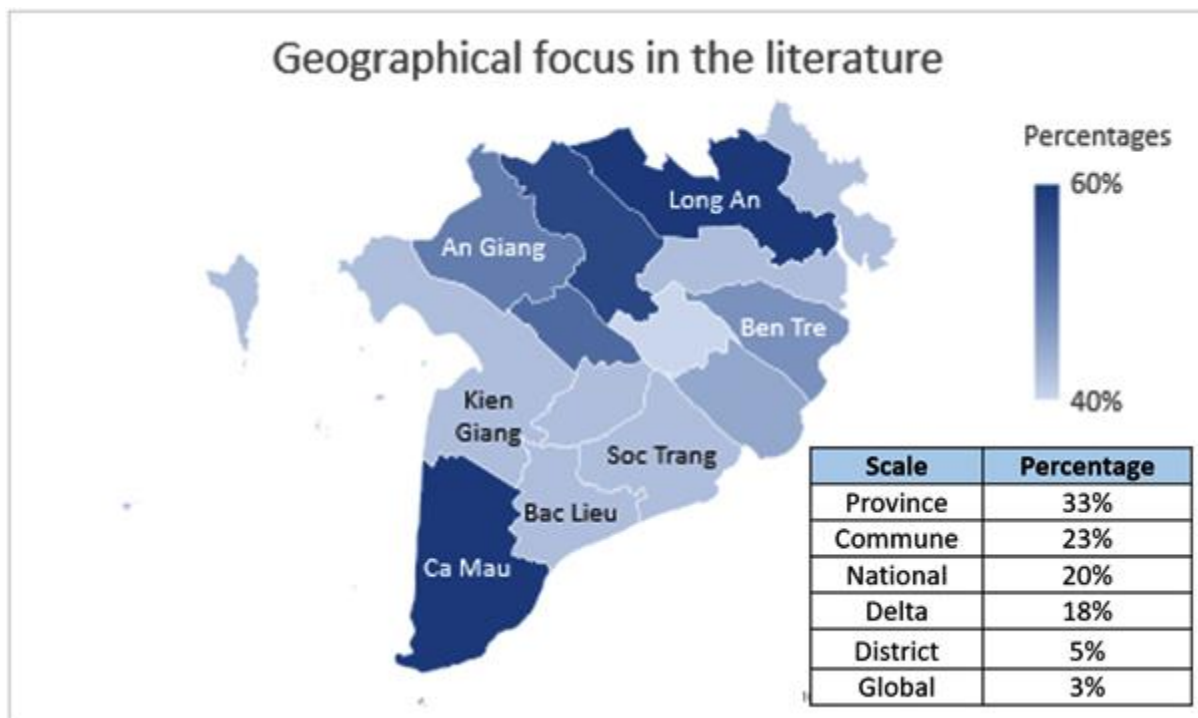


Figure 1. Geographic focus of analysed research papers

3.3 Social groups

A majority of the literature reviewed (65%) was not focused on a specific social group, but on the general population or “households”. This indicates the absence of specific target populations, although some papers differentiate between low-, middle- and high-income households (Entzinger & Scholtenn, 2018; Entzinger & Scholtenn, 2022). Van der Geest and Nguyen (2014), for example, explored how climate-related migration functions as a risk management strategy through an income-group-differentiated analysis of climate impacts and migration drivers in the Upper Mekong Delta of Vietnam.

Twenty percent of the studies reviewed focused on farmers specifically, while mentioning cross-cutting issues about subsidiary social groups, including women and youth. For example, Duyen et al. (2021) discuss gendered labour dynamics among rice farmers and analysed gender-differentiated awareness and adoption of climate-smart agricultural technologies. The authors stress that Vietnam’s economic liberalization and its impact on male labour migration have caused rapid changes in traditional gender roles. As a result, women are increasingly involved in critical on-farm activities like crop selection, post-harvest activities, and general operational management. Specific topics concerning youth addressed the link between the growing demand for industrial labour, rising levels of education, and limited access to technology as factors driving youth migration (Van der Geest & Nguyen, 2014). According to the authors, the increase in rural-urban migration is related to “a desire of younger people to adopt a more urban lifestyle and move away from their rural homes and tedious work in agriculture” (Van der Geest & Nguyen, 2014). Tran et al. (2021) show that farmers in Soc Trang province are severely impacted by the effects of saline intrusion and drought, resulting in dryland losses, environmental degradation, food insecurity, and water-borne diseases. These outcomes also drive youth migration toward cities.

Other studies examined the changing strategies of rice and shrimp farmers in the face of climate change. Lan (2013) explored shifting livelihood strategies, such as rural-urban migration, vis-a-vis the risks associated with shrimp production. Price fluctuations, changing environmental conditions, and disease outbreaks are all elements that contribute to microeconomic instability, and, as a result, mobility outcomes. Tran (2019) also explored links between changing land use dynamics and the out-migration of smallholder farmers affected by rising agricultural production costs, stagnating markets, and changing environmental conditions. Other social groups analysed include factory workers and resettled households (Ngo et al., 2022; Miller, 2020).

3.4 Climate events and mobility

Vietnam's Mekong Delta region is highly vulnerable to a variety of climate hazards, including flood, drought, sea-level rise, and subsidence (Padilla, 2011). Most of the literature explores a combination of climate and environmental stressors rather than addressing a single climate-related factor, often grouping them into slow-onset (drought, sea level rise, salinity intrusion) and sudden-onset (floods and storms) hazards (Koubi et al., 2016; Ngo et al., 2022; Quiñones et al., 2021).

Flooding is the most discussed climate event in the papers reviewed, appearing in 73% of the selected literature. The impacts of flooding on mobility in the Mekong Delta can be direct or indirect. The direct effect is often linked with government resettlement projects to move people away from flood-prone areas of riverbank (Dun, 2011; Miller, 2020). For example, the Government of Vietnam implemented the "Living With The Flood" program, which resettled more than one million VMD residents (Danh & Mushtaq, 2011). Indirectly, recurrent flooding can decrease agricultural productivity or destroy crops, harming the livelihoods of small producers (especially rice farmers) and indirectly driving out-migration or income diversification measures (Dun, 2011; Koubi et al., 2016; Le & Vo, 2021). In extreme cases, vulnerability to flood or other water-related stressors was related to human trafficking into neighbouring areas. Interviewing a Vietnamese medical doctor in Cambodia, Dun (2011) presents anecdotal evidence of Vietnamese girls sold into the sex industry in Cambodia by their families after flooding in the Mekong Delta lead to poverty.

Other climate events explored in the literature include sea level rise (38%), drought (33%), storm (33%), and salinity intrusion (30%). Sea level rise is often discussed alongside other environmental stressors such as flooding, salinity intrusion, and drought. In the dry season, rising sea levels and decreased rainfall intensify salinity gradients in coastal provinces of the Mekong Delta (Smajgl et al., 2015). In the rainy season, sea level rise can cause flooding in lower areas of the region such as Can Tho, Dong Thap, and Long An (Huong & Pathirana, 2013). These climate-related factors negatively affect agriculture productivity and household incomes, potentially driving out-migration in rural households (Mekong Migration Network & Asian Migrant Centre, 2013; van der Geest et al., 2014).

In contrast, other studies find that droughts and salinity intrusion decrease migration rates (Quiñones et al., 2021; Koubi et al., 2016). Using longitudinal household and climate data from

Thailand and Vietnam, Quiñones et al. (2021b) found that two years of successive drought rendered households less likely to migrate outward. As drought decreased financial resources, affected households became more risk averse, which translated to negative migration participation. Similarly, Koubi et al. (2016) found that perceptions of slow-onset events such as droughts and salinity intrusion significantly decrease the likelihood of migration. While Quiñones et al. (2021) argue that migration is inhibited by poverty, Koubi et al. (2016) suggest people might opt to adapt in place rather than migrate outward when experiencing slow-onset and long-term environmental stressors. In situ adaptation strategies such as adopting drought-resistant varieties and plants and investing in irrigation systems are often preferable in this case. Using a choice experiment design, Trinh & Munro (2022) reached a different conclusion; that the combination of drought and salinity intrusion significantly increased the likelihood of migration.

Environmental factors less frequently researched include subsidence (1%) and pollution (1%). These are often considered man-made environmental problems that can exacerbate other climate impacts, such as flooding and salinity intrusion. Minderhoud et al. (2020) projects that continuously increasing groundwater extraction could lead to the displacement of millions in the Mekong Delta due to flooding and/or subsidence by the end of the century. Environmental pollution is often associated with shifting production systems from rice to shrimp farming in the region (Thi & Lan, 2013). Soil and water pollution caused by unsustainable shrimp production may lead to future labour migration due to decreased profitability.

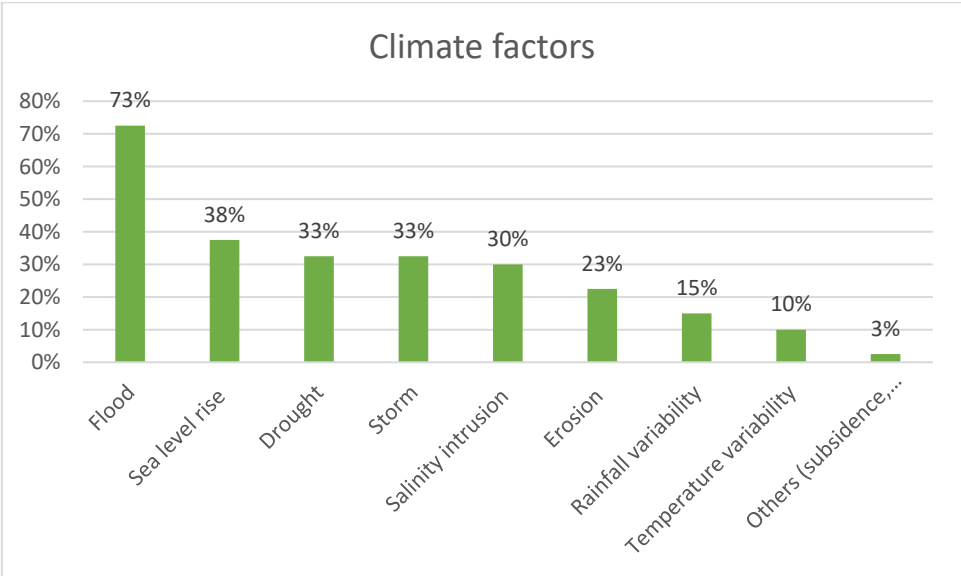


Figure 2. Climate factors discussed in the literature. Note that many papers discuss several factors.

Climate change is rarely the sole driver of mobility outcomes. Many of the reviewed papers recognize that climate factors interact with other drivers to shape migration pathways (Ngo et al., 2022; Dun, 2012; Chun, 2014). The capacity of a household to adapt to climate change is primarily influenced by its socioeconomic status. Poorer households are less able to relocate or successfully adapt in place (Chun, 2014). Impoverished households are more likely than non-poor households to be adversely impacted by climatic stressors, as they lack financial

resources such as land or assets (van der Geest 2014). Due to their limited adaptive and coping capacity, internal migration is a common alternative to in situ adaptation for many individuals and households. Rather than occurring in isolation, climate-related rural-urban migration takes within the context of broader developmental processes such as urbanization, industrialization, and market liberalization (Thi & Lan, 2013).

3.5 Drivers of mobility

Mobility drivers are the factors that influence the movement of individuals or communities. They can be economic (e.g., employment opportunities, income levels), social (e.g., access to public services, marriage opportunities), environmental (e.g., climate-related hazards, ecosystem services), political (e.g., policy incentives, inequality), or demographic (e.g., population density, disease prevalence) (Black et al., 2011). The combination of these factors shapes individual decision processes when faced with risk and, ultimately, resultant mobility outcomes.

Economic drivers of mobility were addressed in 58% of reviewed papers, *environmental drivers* in 53%, and *social drivers* in 15%. Notably, one-third of the papers noted both *environmental* and *economic* factors as significant drivers of mobility. For example, Entzinger and Scholten (2022) explored the positive relationship between climate-related migration and the adoption of innovative professional skills, arguing that migration corridors enable the diversification of local economies. Warner et al. (2010) noted that rice farmers' lack of alternative livelihood strategies in flood-prone areas, along with rising debt and other financial constraints, also influenced their decision to migrate (or not).

When addressing *economic factors* solely, labour demand in industrial centres often appears as a pull-factor incentivizing migration (Duyen 2021; Thi Quyen 2022). Processes such as the liberalization of private industry and land markets have contributed to rapid urbanization in Vietnam (Sudmeier-Rieux et al., 2015). Most literature highlights the bidirectional influence of internal migration and socio-economic development at the local and national levels, and vice versa (Marx & Fleischer, 2010).

Regarding *environmental factors*, some studies framed migration as a risk management strategy in the face of climate change (Warner & Afifi, 2014). Others examine state-led environmental relocation programs (Chun, 2015). There is also evidence highlighting the effects of climate variation on economic activities and general quality-of-life factors as determinants of migration decisions (T. K. O. Le & Truong, 2017).

Social factors are frequently addressed alongside other drivers, such as economic or environmental. Ngo, et al. (2022) examined migration as a strategy for coping with livelihood insecurity in the Mekong Delta, notably in terms of health risks associated with climate variability. Similarly, in Can Tho city's Thanh An commune, environmental change, health risks, and lack of employment opportunities are presented as the main factors driving out-migration from the origin community (Mekong Migration Network & Asian Migrant Centre, 2013).

Rural-urban migration is the primary mobility pattern addressed in the literature. Most movement is internal, which has increased in the past decade due to structural socio-economic transformations in Vietnam (UNESCO, UNDP, IOM, and UN-Habitat, 2018). The migration corridor between the Mekong Delta region and Ho Chi Minh City has been established as one of the most important in the country, not just in terms of human mobility, but also for transfer of goods, commodities, and skills (Entzinger & Scholten, 2022; T. K. O. Le & Truong, 2017). Other studies have focused on government-managed resettlement schemes and relocation programs targeting poor households that are highly vulnerable to climate hazards. Displacement and international migration have been less covered in the literature on climate-related migration (Minderhoud et al. 2020; Kumar et al. 2020). Minderhoud et al. 2020; Kumar et al. 2020).

Immobility is also a focus, with several papers examining how and why inhabitants choose to adapt in situ or migrate. The drivers of migration were explored through surveys and interviews with migrants and non-migrants (Koubi et al., 2016; Quiñones et al., 2021). When faced with climate hazards, Koubi et al. (2016) suggest wealthier households are more likely to adapt in place. Alternatively, poorer families facing climate risks are more likely to migrate due to a lack of adaptive capacity. In contrast, Quiñones et al. (2021) stresses that impoverished individuals may lack the ability to move due to a scarcity of economic resources—a phenomenon proverbially known as “the poverty trap.” In a choice-comparison experimental setting, Trinh & Munro (2022) compared samples of those who moved with those who remained. Variables such as age, financial assets, social network strength, and climate impact magnitude were analysed. Results showed that people who move tend to be younger, better educated, own less land, and have lower incomes. Additionally, larger household sizes tend to anchor people in place. Finally, households are more inclined to migrate when their vulnerability to climate hazards is high. Additional qualitative research is needed to understand how these differences affect individual decision-making processes.

3.6 Mobility and human security

Of the seven dimensions of human security, *economic security* (45%) and *food security* (28%) are most discussed in the literature (Figure 3). Numerous studies indicate a link between extreme climatic events and decreased agricultural productivity, food accessibility, and economic security. Food and economic insecurity are important drivers of mobility outcomes as households dependent on agricultural production must seek alternative food and income sources if productivity declines (Dun, 2011). *Environmental security* was discussed in the literature with less frequency (15%). Other human security components, such as *social* (5%) and *personal* (3%), are rarely mentioned. None of the literature reviewed discussed *political security* issues. Additional research is needed to explore the impact of climate-related mobility on these lesser-discussed components of human security.

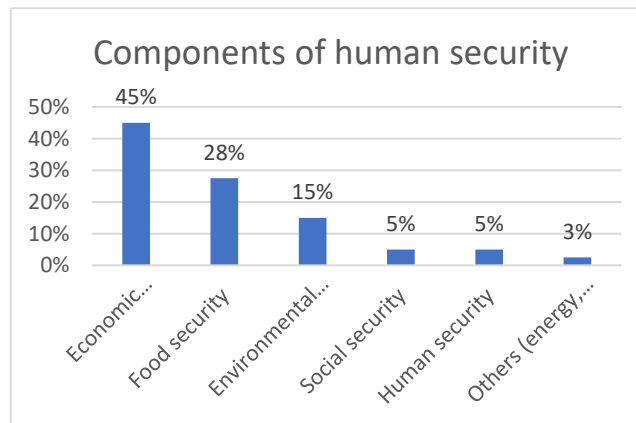


Figure 3. Components of human security discussed in the literature

Generally speaking, the links between climate-related mobility and human security are complex. Low human security is a driver of mobility, which is also an adaptation strategy to adverse climate impacts. Conversely, climate-related mobility can decrease human security, especially when migrants face harsh conditions or cannot access public services in destination areas, or become trapped in place in origin areas. As an economic strategy, mobility can improve human security by diversifying incomes and generating remittances. Some studies also describe rural-urban migration as an important strategy for upward economic mobility. Overall, migration is an essential coping strategy for many households facing overlapping and inter-related climate and human security risks in Vietnam’s Mekong Delta, (UNDP, 2014).

Tran (2019) concludes that agricultural mechanization for rice cultivation increases the instability and unemployment of the poorest farmers. Consequently, out-migration becomes a viable adaptation strategy to avoid becoming trapped in impoverished rural areas (ibid). In addition, Entzinger & Scholten (2022) argues that while financial remittances support basic household needs, non-financial remittances, such as the transfer of knowledge and skills through returning migrants, helps to diversify local economies in origin areas.

Besides these positive impacts, climate-related mobility can sometimes threaten human security. Numerous articles discuss the unintended consequences of government-led resettlement programs aiming to alleviate the impacts of slow-onset environmental hazards (e.g., Chun, 2015; Miller & Dun, 2019). Resettlement programs can expose those affected to new hazards by relocating them to inappropriate places, provide them with poor housing infrastructure, or push them into accepting predatory loans. Ultimately, Vietnam’s “Living With The Flood” program may have created more environmental, social, and economic risks for relocated households than it protected against (Chun, 2015). Regarding migration, Dun (2012) discusses losses in terms of the natural, physical, financial, human, and social capital of migrant households. For Dun, migration is not a direct consequence of increasing salinity intrusion; it is an eventual choice due to the financial hardship inflicted by progressive environmental change. Those who migrated as a result faced new threats to their human security, particularly regarding access to healthcare and education. These findings emphasize the complexity inherent to the climate security-mobility nexus in Vietnam’s Mekong Delta.

4. Research gaps as articulated in the reviewed literature

This section summarizes the research gaps put forth in the papers reviewed, which have been clustered together to illustrate key findings.

4.1 Lack of conceptual clarity

A recurring theme is the need for greater conceptual and theoretical clarity when addressing the complex connections between climate-related mobility and human security in the VMD. According to the Mekong Migration Network and Asian Migrant Centre (2013), these shortcomings make it harder to identify and understand event pathways within the nexus. For example, the wide variety of climatic stressors and geographies covered by migration research obscures our understanding of whether migration is a successful form of adaptation, or the result of a failure to adapt (Warner & Afifi, 2014). Consequently, the literature argues it is important to explore the tipping points and risk thresholds that influence individual decision-making processes in the context of climate-related mobility, as well as to better define the specific role climate plays in shaping mobility outcomes relative to more primary drivers (Warner et al., 2010).

4.2 Data gaps

Data gaps on the climate security-mobility nexus in Vietnam's Mekong Delta impede an adequate understanding of the nexus' operational dynamics. Available statistics from state institutions do not contain a comprehensive record of migration data disaggregated by sex, age, places of origin or destination (IOM, 2017). Additionally, the various types of mobility (migration, displacement, relocation, etc.) are rarely disaggregated in census data (Marx & Fleischer 2010). One of the government instruments to control and monitor migration is a household registration system known as *Ho Khau*. However, large numbers of migrants move without registering, limiting the system's ability to provide accurate statistics (World Bank & VASS, 2016). Hence, in Vietnam there is often a significant gap between official statistics and the true number of people on the move.

4.3 Systemic approaches to climate-related mobility

Recognizing mobility as a spectrum requires analytical frameworks that can link the multiple intrinsic and extrinsic factors driving climate-related mobility. As mobility outcomes are influenced by climate drivers in combination with micro-level (individual), meso-level (households), and macro-level (socioeconomic, historical, and political) factors (Black et al., 2011; Koubi et al., 2016), systemic frameworks and methodological designs are needed to understand human mobility's spatial, temporal, and motivational dimensions. According to Thi Trinh and Munro (2022), using historical data to understand the relationship between climate change and migration flows may not reveal the true drivers of mobility. For example, households may choose to engage in migration due to anticipated future conditions rather

than current or past experiences. Thus, a longitudinal and systems-oriented perspective is vital to developing a more precise understanding of mobility processes.

4.4 Evidence-based research and policy coherence

Evidence from applied and in-person qualitative research, rather than generalized assumptions, are needed to understand people's experiences of everyday risks, and further raise awareness of how social capital, including intra-communal bonds' role and place-based cultural connections, influence mobility outcomes (Miller, 2020; Chun, 2014). Tran et al. (2021) suggest that evidence-based research is vital for developing context-sensitive agricultural techniques that allow farmers to adapt to climate change. Primary data collection is also necessary to carry out comparative studies (Koubi et al, 2016) and inform the design of meaningful multi-level policies.

4.5 Drivers and mobility trends

The interconnected and multi-layered factors shaping mobility processes remain understudied. Mobility outcomes intersect with larger development trajectories, including industrialization and urbanization. While several studies highlight the link between climate change and mobility outcomes in the VMD, they do not always examine the specifics of the relationship (Le Thi Kim and Le Minh, 2017). For example, additional research is required to unpack the effects of climate change on labour and employment dynamics (Thi Quyen, 2022), on the relationship between land-use changes and out-migration processes (Tran 2019), and on the effects of non-financial remittances on building resilience among environmentally vulnerable communities (Entzinger & Scholten 2022).

5. Recommendations for future research

Based on these findings, the research team has developed a number of conceptual, methodological, and practical recommendations for future studies aiming to unpack the complex relationship between climate-related mobility and human security outcomes in Vietnam's Mekong Delta region.

5.1 Moving from human security to climate security

While most research addresses mobility outcomes related to food security, economic security, and sometimes environmental security, a broader spectrum of human security elements requires closer consideration. Though the potential for climate hazards to negatively impact-deltaic agricultural production, and in turn impact local and national food security has been examined, the relationship between nutrition security (at the household level) and mobility outcomes deserves a greater focus in future research. Anecdotal evidence points to how social and physical security is related to climate mobility in the VMD (Dun, 2011). However,

research on how climate-related mobility impacts physical security, including violent conflicts, and social security—especially for immobile populations—is still lacking.

5.2 Additional qualitative research is needed to centre the experiences of vulnerable social groups

Few papers have articulated the implications of climate-related mobility for vulnerable social groups such as women, youth, the poor, and ethnic minorities. These groups are often the worst affected by adverse climate impacts due to having a lower adaptive capacity. Provinces like Soc Trang or Bac Lieu, where many Khmers are located, have been less studied than other provinces in the region. Thus, future studies should employ in-person qualitative research to understand how climate-related mobility impacts these groups. Given the higher likelihood of immobility among groups with less financial resources, research with households or members of households who adapt *in situ* should also be prioritized. Additionally, more research is required to identify households facing overlapping climate hazards. This can provide entry points for reducing the risk and vulnerability of households and inform the creation of multi-hazard early warning systems.

5.3 The climate security-mobility nexus should be understood within the context of agrarian transformation processes

Research in the Vietnamese Mekong Delta suggests that land use changes driven by mechanized agriculture is dispossessing farmers from their lands, endangering livelihoods, and increasing inequality (Tran, 2019). More research is required to unpack the relationship between contemporary agrarian transformation processes and the climate security-mobility nexus. Key variables for examination include state-led and private development strategies that prioritize agricultural intensification, changing land use trends, shifting generational dynamics, the commodification of agricultural production, and the feminization of agriculture. Political economy and political ecology approaches may provide a useful theoretical framework for understanding emerging power dynamics emerging within the context of increasing climate-related mobility.

5.4 Using innovative methods and transdisciplinary approaches to inform policy development

Given the importance of migration to Vietnam's socioeconomic development, policymakers must ensure a safe environment for migrants both in transit and at destination. To this end, it is imperative to fill data gaps and improve conceptual frameworks for understanding human mobility. This includes, for example, improving the quality of censuses and quantitative indicators to track internal migration dynamics and improving housing conditions in urban destination areas (Marx and Fleische 2010). The current *Ho Chau* system is limited to monitoring migration data, and often acts as a barrier for migrants to access public services,

including healthcare and education (World Bank & VASS, 2016). Improved migration data can contribute to reforming the *Ho Khau* system and improving access to services.

In addition, mixed and innovative research methods are needed to provide evidence on the drivers, causal pathways, and mitigating factors that characterize the complex relationship between climate-related mobility and human security. These include methods that incorporate big data, behavioural experiments, participatory assessments, and qualitative comparative analyses. Generally, conceptual frames that understand mobility and development as complementary processes can better position mobility as a normal part of Vietnam's socioeconomic development, rather than as a problem that requires solving.

5.5 Using research outputs to guide policy and program implementation

While research can improve the understanding of climate-related mobility trajectories, it is critical to ensure that these findings transcend academic spheres and reach policymakers. For example, vulnerability and adaptability assessments conducted at sectoral, regional, and community levels to identify at-risk populations can guide policy and program development (UN, 2010). Additionally, although population redistribution and resettlement have been crucial policy concerns in Vietnam, a clear division of responsibilities regarding climate-related resettlement management is still needed (Chun, 2015). For instance, while the Ministry of Natural Resources and Environment (MONRE) oversees climate change planning, the Ministry of Construction, the Ministry of Agriculture and Rural Development (MARD), and provincial People's Committees oversee flood-related resettlement (Chun, 2015). Research outputs can help identify policy loopholes, entry points for “whole of government” approaches, and incentives for policy reforms that empower local institutions and improve response capacity.

6. Conclusion

In this paper, a scoping review was performed to better understand how previous research has examined climate-related mobility and human security in the Vietnamese Mekong Delta. Forty papers were systematically identified and reviewed to answer several research questions and summarize research gaps identified in the reviewed literature. Finally, recommendations for future research were formulated.

The main findings of the scoping review show that a mixed methods approach has been most frequently employed to study the relationship between climate-related mobility and human security in the Vietnamese Mekong Delta. While Ca Mau and Long An were the most researched geographical areas, other climate-vulnerable areas, like Soc Trang and Bac Lieu, were under-studied. Additionally, most of the literature reviewed did not target specific social groups such as women, youth, or ethnic minorities, and only one-fifth of the papers reviewed focused specifically on farming households. The most discussed climate hazards studied are flooding, sea level rise, and drought. Although literature finds mixed evidence of climate impacts on migration, it is widely recognized that climate factors interact with other drivers to shape mobility outcomes. However, the results indicate that economic drivers of mobility

are the most commonly addressed by research, particularly regarding rural-urban labour migration. However, immobility has also received attention, examined mainly through resource inequality and level of adaptive capacity. Finally, the complex link between climate-induced mobility and human security has been most commonly studied through the lens of economic and food security risks.

Based on our results, future research on the climate security-mobility nexus in Vietnam's Mekong Delta region should explore the relationship between nutrition, physical and social security, and human mobility. In addition, more research is needed to identify vulnerable social groups with high exposure and low adaptive capacity. Thus, there is a need to take a wider view on vulnerability dynamics by situating climate security research within contemporary agrarian transformation processes. Understanding these emerging dynamics are key to understanding mobility pathways. Developing innovative, trans-disciplinary methodologies is also necessary. While mobility is generally considered an adaptation strategy, it can also result in maladaptation that threaten human security in origin and destination areas. Therefore, conducting evidence-based research becomes critical to guide the implementation of appropriate programs and policies that provide a safe environment for households engaging in climate-related mobility. In short, studying the climate-related mobility and human security nexus in the VMD is important for better understanding how climate change is exacerbating various components of human insecurity, what mobility dynamics are emerging in this setting, and how policies and programming can be employed to support local and national development.

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Appendix 1. List of keywords used in automated search query

Climate/Environment	Human Security	Mobility	Geography
Acidification	Aid	Departure	Vietnam
Climate	Authoritarian	Displacement	
Climate adaptation	Cohesion	Exodus	
Climate change	Communal	Immigrant	
Climate mitigation	Competition	Immobile	
Climate risk	Conflict	In Migration	
Climate variability	Corruption	Migrant	
Cyclone	Crime	Migration	
Dam construction	Debt	Movement	
Desertification	Deforestation	Out Migration	
Drought	Dispute	Pull factor	
Erosion	Dissent	Push factor	
Evapotranspiration	Environmental degradation	Refugee	
Extreme weather	Ethnic group	Relocation	
Flood	Famine	Remittance	
Groundwater extraction	Fragility	Resettlement	
Heat stress	Gang	Rural - Urban	
Landslide	Grievances	Separated	
Maladaptation	Protest	Trafficking	
Natural disaster	Humanitarian	Trapped	
Natural hazard	Hunger	Urban - Rural	
Pollution	Inequality		
Rain	Land conflict		
Salination	Land degradation		
Salinity intrusion	Land scarcity		
Salinization	Land use		
Sand mining	Landgrabbing		
Sea level rise	Livelihoods		
Subsidence	Malnutrition		
Temperature	Militia		
Typhoon	Minority		
Water logging	Peace		
Water quality	Peacebuilding		
Water scarcity	Poverty		
Precipitation	Community security		
	Economic security		
	Environmental security		
	Food security		
	Health security		

	Personal security		
	Physical security		
	Political security		
	Radicalisation		
	Repression		
	Resource management		
	Security		
	Stability		
	Tension		
	Theft		
	Unrest		
	Vegetation		
	Violence		
	Exploitation		



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