

# Climate change and adaptation through the human security lens: insights from the Mekong Delta

Climate change poses significant threats to the livelihoods of farmers, particularly in coastal regions where drought, salinity intrusion and weather variability reduce crop yields and increase poverty. While climate adaptation strategies aim to mitigate these impacts, they do not necessarily translate into positive outcomes. Through a scoping literature review and in-depth interviews, the paper investigates different domains of human (in)security and their interactions in the context of significant climate change impacts and relatively rapid adaptive responses within the Vietnamese Mekong Delta. The analysis shows that not only several critical manifestations of insecurity arise due to climate change impacts, but also unexpected human insecurity and potential conflict risks can happen as the result of climate adaptation activities. We conclude that a holistic understanding and mainstreaming of human security into adaptation planning and implementation for the region is important and requires more attention from both research and policy perspectives.

**Keywords:** climate change, climate security, human security, climate adaptation, Mekong Delta, climate variability

## Introduction

As the climate continues to change, livelihoods of many, particularly farmers who rely on agricultural activities, are increasingly threatened by its adverse impacts. In coastal areas, drought and salinity intrusion can reduce crop yields and affect income from agricultural production (Mills et al., 2022). Increasing temperatures and unpredicted rainfall contribute to the spread of pests and diseases (Do and Ho, 2022). These challenges not only affect farmers' income but also undermine their resilience, exacerbating poverty and food insecurity in vulnerable rural areas.

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Climate change adaptation strategies are important in response to the adverse effects faced by farming communities. These strategies include actions aimed at reducing vulnerability and enhancing resilience to climate-related hazards, e.g. the adoption of salinity-resistant crop varieties, improved water management techniques and diversification of livelihood options (Paik et al., 2020; Ha et al., 2018). However, while adaptation efforts try to mitigate the impacts of climate change, they do not necessarily translate into positive outcomes. In some cases, poorly designed or implemented adaptation measures may inadvertently exacerbate vulnerabilities or create new risks, leading to maladaptation (e.g. Milman and Arsano, 2014; Schipper, 2020).

In this paper, we examine the impacts of climate change and adaptation through the lens of human security, defined as ‘a condition in which people and communities have the capacity to respond to threats to their basic needs and rights, so that they can live with dignity’ (O’Brien and Barnett, 2013, 375). Human security encompasses seven dimensions: economic security, food security, health security, environmental security, personal security, community security and political security. Empirical research on climate change impacts largely focuses on sub-domains of human security such as economic security and food security. It is undeniably valuable to look at one or two single elements of human security in the context of climate change. However, there are multiple connections between these sub-domains and there is still a lack of research looking from these multiple perspectives of climate change impacts and their implications for climate adaptation (O’Brien and Barnett, 2013; Adger et al., 2014). By adopting a multidimensional approach, we can better understand the diverse ways in which climate change impacts people’s lives and livelihoods, as well as the effectiveness of adaptation strategies in addressing these multifaceted challenges. Thus, this paper seeks to fill this gap in the literature by providing a comprehensive analysis of the multidimensional impacts of climate change and adaptation on human security.

The paper uses the Vietnamese Mekong Delta (MKD), a region located in Southern Vietnam and also the most downstream area of the Mekong River, as a case study. The MKD is predicted to experience a warmer, wetter and more volatile climate that poses potential economic challenges to local livelihoods (Lange and Jensen, 2013). The region is an agricultural hub and home to 20 million people, and is expected to be severely affected by multiple climate-related hazards: sea level rise, coastal erosion, salinisation, flooding and droughts (Balica et al., 2014; Nguyen et al., 2021; Parker, 2020). Climate insecurity is expected to increase and will have consequences for the long-term stability and sustainability of the delta in different aspects such as economy, demography and social cohesion. In this context, understanding and foreseeing climate impacts on different aspects of human security are of special importance, both for the policy making process and for investments in adaptation.

The question of how climate insecurity arises, what constitutes climate insecurity in this context, and what interventions are needed to divert the system away from these pathways towards climate resilience, is largely open.

This paper will contribute to this debate in three ways. First, we review current knowledge on the impact of climate change and adaptation on different dimensions of human security. By doing this, we will provide an inventory of human security threats, the possible consequences and dangers, and hypothetical pathways to instability. Second, we will report on the results of exploratory data collection in the Mekong Delta on how human security threats are perceived by inhabitants of the Mekong Delta. We will discuss data from the field in relations to what we learned from the literature. And lastly, we propose a research agenda on climate change and human security for the Mekong Delta. The example of Mekong Delta is also relevant for other coastal and delta areas of the world that are threatened by the impact of climate change and variability.

## Conceptual framework

The concept of human security has been developed and discussed by different disciplines using diverse methods (Alkire, 2003; Inglehart and Norris, 2012). The key idea of the human security concept in most disciplines is centring on the protection of individuals and communities, their basic needs and freedoms. The United Nations General Assembly (UNGA, 2012) defines human security as ‘the right of people to live in freedom and dignity, free from poverty and despair’. The human security approach has four principles: it is people-centred, comprehensive, context-specific, and prevention-focused (UNGA, 2012). According to UNDP’s Human Development Report 1994, human security encompasses seven dimensions: economic security, food security, health security, environmental security, personal security, community security and political security (UNDP, 1994).

Following Adger et al. (2021), we group these dimensions into three main categories: economic, environmental and social. This categorisation is based on the following rationale: food and economic securities are both directly linked to livelihoods; personal, community and political represent social connections of individuals; environment and health are both environmental-based factors. All these groups are also affecting each other in a feedback loop, collectively shaping human security. When climate change influences one dimension of human security, it can disrupt the equilibrium of the entire system. Affecting one dimension can lead to a breakdown in another dimension. For example, climate change-related hazards such as drought can lead to environmental problems such as water scarcity and pollution. Then water scarcity leads to lower agricultural productivity, affecting food availability and economic security. Water scarcity can also lead to personal and community violence in certain

cases when conflicts arise over access to scarce resources. In general, this interconnect- edness can introduce significant risks that need to be addressed with a more holistic framework such as human security.

The interlinkage between climate change, adaptation and human security is complex. Adger et al. (2014) suggest that climate change affects human security through undermining human livelihoods, compromising culture and identity, triggering undesired migration and weakening state capacity to ensure the basic conditions for human security. To minimise the negative consequences of climate change and extreme weather events, different climate adaptation and mitigation strategies have been implemented at all levels from global, national to individual. Some literature points out that as climate adaptation policies are more broadly executed, it is also more likely to increase the risk of unintended adverse effects. A study conducted in Ethiopia (Milman and Arsano, 2014), shows that implementing an adaptation programme leads to contradictory impacts for human security; or migration as a climate adaptation strategy affects human security of migrants and increases the conflict risk in the destination area (Adger et al., 2021). Therefore, the climate change and human security connection also needs to take into account the intended and unintended impact of climate adaptation on human security and its implications for different groups in society. In Figure 1, we outline the conceptual framework used to analyse the impact of climate change and adaption through the human security lens.

Besides, it is crucial to recognise that other factors are equivalently important in analysing climate–human security nexus including context and external actors such as

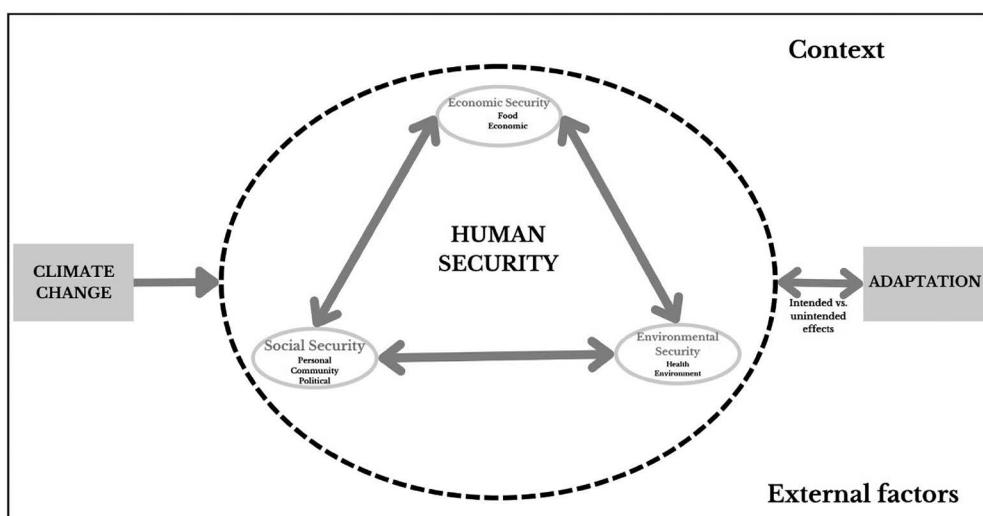


Figure 1 Climate change and adaptation through the human security lens

states and geo-politics. The context refers to local socio-economic conditions, governance structures and cultural practices which influence how communities experience and respond to climate change. External actors, including state governments and international organisations, play a significant role in shaping climate policies and providing resources for adaptation and mitigation. Geopolitical considerations, such as regional stability, river basin management and international relations, further complicate the climate–human security relationship. These factors can either enhance or undermine efforts to address climate-related risks, highlighting the need for a comprehensive and context-sensitive approach to human security against the backdrop of climate change.

## Context and methods

### Context

The Mekong Delta, characterised by biologically productive ecosystems that are beneficial to crop and aquacultural production, is the main production area for many crops and aquaculture in Vietnam. Although the MKD only accounts for 12 per cent of Vietnam's land surface and 19 per cent of the total population, the region contributes 50 per cent of total national rice production, 65 per cent of aquacultural production and 70 per cent of fruit production (Government of Vietnam, 2017). While the Government of Vietnam has always prioritised rice production as rice is the number one food crop and the pillar of food security (Connor et al., 2021; Mills et al., 2022), aquaculture and horticulture are receiving increasing attention. The Resolution 120 on Sustainable and Climate-Resilient Development of the Mekong Delta of Vietnam issued in November 2017 marked the move from a rice-centred to a more diversified aquaculture–horticulture–rice agricultural policy.

In terms of climate change scenarios for MKD, the average temperature will increase by 1.7–1.9 degrees by the end of this century compared with the period 1986 to 2005. Total rainfall will also increase by 7–20 per cent (Tran et al., 2016). The sea level is expected to rise by approximately 55 cm by 2100. Since most of the MKD area is only approximately 1 metre above sea level and some parts are already below sea level, continuing sea-level rise will cause serious inundation and salinity intrusion risks for the MKD in the future (Minderhoud et al., 2019). In addition, extreme weather events such as drought, floods, typhoons and storm surges are expected to become more frequent. Being the most downstream part of the Mekong River, the Delta is also vulnerable to changes in the environment and infrastructure in the upper part of the river. For example, hydropower dam construction in upstream countries can alter water flow and affect ecosystems of the downstream area (Boretti, 2020; Dang et al., 2016). Changes in the quantity and timing of the water flow in combination with a decreasing precipitation level in the entire Mekong River basin may lead to severe

drought and salinity intrusion (Loc et al., 2021), especially in El Nino years, which have negative impacts on livelihoods in the MKD.

## Data and methods

The study uses data from both secondary and primary sources. First, we went through a scoping literature review, aiming at taking stock of the literature on climate and adaptation impacts on human security in the MKD. Literature was searched through the Web of Science, a well-known bibliography database that allows quick scan of bibliographies. The keyword string consisted of climate-related terms, security-related terms, combined with geographical focus. The full keyword string was: ('Climat\* variability' OR 'climat\* change' OR 'climat\* adaptation' OR 'environmental change' OR 'global warming' OR rainfall OR precipitation OR drought OR flood OR 'sea-level rise' OR weather OR disaster OR temperature) AND (security OR Grievance OR conflict OR Inequality OR violence OR tension OR unrest) AND 'Mekong Delta', to be searched in topic, title and abstract. The search yielded 86 journal articles, of which 32 articles were selected for further analysis after a carefully manual check to verify the relevance of geographical focus and topic. Also, other relevant documents found using the snowballing technique were added to strengthen the literature pool.

Next, we complemented the literature review with insights from the first author's fieldwork in the Mekong Delta from July to August 2022. The fieldwork was conducted to explore climate change impacts and adaptation activities in the region. The data collection focused on three coastal provinces of the MKD: Soc Trang, Tien Giang and Bac Lieu. These provinces are vulnerable to climate change and variability such as sea level rise, salinity intrusion, drought and flood. We did 39 qualitative interviews with a purposive sample of stakeholders including farmers, non-farm individuals, community leaders and agricultural and irrigation officials. Table 1 provides a summary of participants' characteristics. We particularly focused on farmer's livelihood and agricultural production since they are most vulnerable to climate risks in the MKD. The interviews were conducted face-to-face using a semi-structured interview guide developed on the basis of the literature review. Interview questions covered a range of topics including household and community livelihood strategies, natural resource management, climate change perceptions, perceived impacts and climate adaptation strategies. After the study's objectives had been explained clearly to participants, their informed consent was obtained verbally. The collected data was analysed using ATLAS.ti 22. The results from the qualitative analysis were then combined and compared with findings from the literature review for a comprehensive understanding of the research topic.

**Table 1 Summary of participants' characteristics**

Category	Sample size	Gender	Average age	Ethnicity*	Main activities
Farmer	22	Female: 7 Male: 15	53	Khmer: 11 Kinh: 11	Rice Rice and vegetable Rice shrimp Vegetables Shrimp
Non-farm individual	3	Female: 1 Male: 2	49	Kinh: 3	Construction worker Catering service Motorbike taxi
Community official	10	Female: 2 Male: 8	38	Khmer: 3 Kinh: 7	Community authority Agricultural management
District official	2	Male: 2	55	Kinh: 2	Agricultural management
Sluice gate manager	2	Male: 2	45	Kinh: 2	Water management

\*Note: Khmer – minority, Kinh – majority

## Results: the case study of Mekong Delta

### Climate change impacts on human security in the Mekong Delta

In this section, we apply a human security lens to analyse current knowledge on climate change impacts in the Mekong Delta, by discussing the impact of climate change and variability on different elements of human security. This allows us to capture the specific effect of climate change on single elements, while acknowledging that these elements are interrelated to each other as they are important parts of human well-being.

### Strong attention given to economic and food security

Economic security refers to protecting basic income from work or a social safety net, and food security is defined as securing the accessibility and affordability of basic food. Both findings from the literature and interview indicate that strong attention is given to economic and food security. Climate change and variability have been significantly affecting the economic condition of people living in the MKD through, for example, reducing agricultural production and damaging infrastructure. Given the importance of agricultural export for the MKD economy, unfavourable climate conditions can significantly affect the economic security of people here by reducing agricultural production and income.

Farmers, whose incomes depend on agricultural production, are among the most vulnerable groups. Reduced income from agriculture leads to economic insecurity and increases out-migration to urban areas. In addition, climate change and extreme weather events such as extreme floods, cyclones and typhoons destroy infrastructure such as bridges, roads and housing. Several studies consider climate change and variability affecting food security in the MKD (Ho et al., 2022; Schneider and Asch, 2020; Vuong et al., 2023). Crop yield in MKD is predicted to suffer a remarkable decrease by 2.2 to 5.6 per cent by 2030 and 6.3 to 12.0 per cent by 2050 (Ho et al., 2022). As the most important agricultural production region in Vietnam, the MKD plays a critical role in ensuring national food security. But agricultural production in the MKD is vulnerable to climate change impacts and extreme weather, threatening national and individual food security. Flood, drought and salinity intrusion are common factors affecting rice and other crops (Ho et al., 2021; Parker et al., 2019).

Interviewees provided vivid examples of these impacts:

In early 2020, a severe drought happened, nearby canals and rivers dried up. I almost lost all of my agricultural production and income. (Interviewee 22, Tien Giang)

More frequent rains and storms affected our rice and onion productions, so income from agriculture reduced significantly. (Interviewee 4, Soc Trang)

Our interviews reveal that economic security appeared to be the most important climate-related concern for many farmers. Interviewees in Tien Giang shared their experience of drought and salinity intrusion in 2015 to 2016 and 2019 to 2020 which heavily affected their rice production and household's agricultural incomes. Others in Soc Trang and Bac Lieu mentioned more recent experiences of how increasing rainfall and storms impacted their livelihood. Several farmers in the region reported concerns over the increasing cost of fertiliser, fuel and other production inputs, coupled with fluctuations in output prices. These problems create additional challenges to ensure the profitability of agricultural production, especially for small-scale farmers. Nevertheless, it is interesting that although several farmers reported climate-related events negatively affected their production, few of them considered food insecurity as a severe issue that they are facing.

As the economic conditions of the community have improved compared to previous years, food insecurity is less of a problem for people living here. (Interviewee 23, Soc Trang)

Mainuddin et al. (2011) argue that since the rice production per capita in the MKD is higher than the rice consumption per capita, which also tends to decrease over time, climate change would not affect the capacity of the rice sector to feed the increasing population in the MKD itself. Other literature claims that the government's obsession

with food security leads to the rice-first policy prioritising rice and undermining the potential of higher-value and nutritious crops such as fruits, vegetables and shrimp (Nguyen et al., 2018). Horticultural and aquacultural products are also rich sources of micronutrients and protein, contributing to the nutrition security of the region. These products can also be affected by climate change impacts. Climate change and variability are deemed to increase diseases (e.g. white spot syndrome virus in shrimp) and damage the aquatic environment (e.g. water pollution (Do and Ho, 2022)). But in general, insufficient research exists regarding the impacts of climate change on food systems and nutrition, especially in terms of food access, utilisation and stability, which is also ignored by our interview respondents.

### Environmental security: water security is an emerging issue

Environmental security can be promoted by protecting local and global resource systems from degradation. In the MKD, climate change and variability may affect environmental security through changing ecosystems, land subsidence, water scarcity, mangrove forest degradation and pollution. Although anthropogenic factors such as the constructions of infrastructure, economic development, population growth, agricultural intensification, etc. are considered the main drivers of ecosystem degradation in the MKD (Tran et al., 2021), climate change and variability are contributing to accelerate this process (Garschagen, 2016). Natural hazards at the basis of climate change impacts force the government and individuals to implement prevention and control measures such as building dykes, dams and sluice gates (Chapman et al., 2016), which often violently interfere with local ecosystems. Using satellite imagery to capture the environmental change in the area around the Ba Lai irrigation dam for example, Veettil and Quang (2018) find that the water quality of the Ba Lai River has decreased and has become more polluted after the dam construction. Diminishing water quality leads to a gradual degradation of aquatic resources, which in turn affects farmers' livelihoods depending on these resources. This squares with the perception of local farmers. For example:

We did not have enough water for agricultural production as well as domestic consumption during the drought period in early 2020. (Interviewee 2, Soc Trang)

Water from the canal is so polluted that I can't even use it for my shrimp production. (Interviewee 21, Bac Lieu)

Our interviews reveal that water scarcity and pollution are prominent concerns of local people. Farmers reported the lack of water for agriculture production and domestic consumption during the droughts in 2016 and 2020. Water quality is also among farmer's concerns. Canal water in the area around sluice gates is often polluted



Figure 2 Picture of salinity barrier gate and surrounding environment

and has a bad smell because it is not refreshed. Figure 2 shows the difference in the environment inside and outside the salinity barrier gate during our fieldwork.

Besides sea-level rise, groundwater extraction for agricultural and human consumption causes serious land subsidence problems in coastal areas of the MKD (Ha et al., 2018; Minderhoud et al., 2019). Erban et al. (2014) suggest that the region will have to face between 0.35–1.4 metres of land subsidence by 2050 if the current groundwater pumping rate does not reduce, leading to increasing flooding risks. Groundwater extraction also contributes to increasing salination because the pressure of freshwater decreases. In addition, hydropower dams in upstream countries affect water flow and sediment transport to the MKD. As a result, freshwater scarcity is increasingly becoming an issue for MKD in the dry season, compounded by the effect of drought and salinity intrusion (Vo et al., 2017). Other threats including intensive land use, use of chemicals and pesticides in rice farming and aquaculture, and upstream pollution are also causing water pollution and are affecting the MKD environment and ecosystem (Doan et al., 2020; Le et al., 2018).

Health security for a developing country like Vietnam is usually linked to poor nutrition and hygiene, leading to infectious and parasitic diseases such as dengue fever

and diarrhoea (Phung et al., 2016). Climate-related health issues in the MKD mainly originate in climate shocks (e.g. floods, typhoons, heatwaves (Hoang et al., 2018)) and environmental impacts (e.g. water pollution). According to the Emergency Events Database, floods are the disasters that cause the highest number of disaster-related deaths in the Mekong Delta. In addition, extreme temperatures such as heatwaves affect the mortality rate and hospitalisation numbers (Phung et al., 2016). The risk of hospitalisation increases by 1.3 per cent and is especially higher for infectious diseases and respiratory diseases, if the temperature increases by 1°C (Phung et al., 2016). Climate change also increases hospitalisation due to foodborne diseases through the reduction of water quality and availability. In addition, climate change impacts are claimed to affect mental health in the MKD, particularly slow-onset hazards such as salinity intrusion and drought (Khong et al., 2020).

Weather change makes me get sick more often. (Interviewee 19, Bac Lieu)

One farmer noted the impact of weather conditions on his health, but he is among the few respondents in our interviews noticing negative effects of climate change and extreme weather events on their health. This might suggest that the impact of climate change and variability on health is less visible to local people as compared to what is reported in the literature.

### Dispersed evidence of social security issues in the context of climate change

Social security encompasses personal, community and political securities. Personal security refers to physical violence threats, which can take different forms such as domestic violence, crime and war. Literature on the impact of climate change and variability on personal security in the MKD is still nascent. The linkage between climate impacts and the personal element of human security can be indirectly explored through climate adaptation and mitigation policy and implementation. For instance, building water infrastructure to mitigate sea-level rise and saline intrusion impacts may lead to several tensions and conflicts (Pham et al., 2020; Warner, 2023; Hoanh et al., 2014). Focusing on the area around Ba Lai irrigation dam as part of the water management project in Ben Tre, Ngo et al. (2022) find that conflicts emerged after the dam construction between aquacultural and agricultural production households, among aquacultural farmers and between local authorities and aquacultural farmers. Climate impact on human security is also often embedded in social issues. A shrimp farmer noted:

When the water level in the rice field was too high due to lengthy rainfall, rice farmers pumped out water from their fields to the common canal. Without knowing that, we used the water from the canal for our shrimp fields, our shrimp died because chemicals used for rice production contaminated the water. (Interviewee 10, Bac Lieu)

On the other hand, climate impacts on domestic violence and gender equality are less evident in the region. Research finds that women are generally more vulnerable to climate impacts than men in developing countries (Eastin, 2018). Quang (2022) suggests that economic insecurity risks, which might stem from climate events, can fuel domestic violence. However, it is necessary to find more evidence of climate and adaptation impacts on gender equality as well as personal security in the MKD.

Community security means being secured as part of a group that is providing a cultural identity and a set of values to its members. In the MKD, the impact of climate change on community security is probably the clearest in the case of ethnic relations. Ethnic minorities are among the most vulnerable groups to climate change impacts. Studying the transition to rice-shrimp farming in the MKD, Poelma et al. (2021) found that farmers belonging to the Khmer minority are less resilient to climate change due to lack of technical knowledge and capital. This lack of adaptive capacity in turn makes them more vulnerable to future climate change and unfavourable weather events. Many interviewees in our study belong to the Khmer minority. They reported strong effects of climate change and extreme weather events on their agricultural production and livelihood. In addition, they usually have lower adaptive capacity due for instance to the lack of capital and a culture-driven aversion to risk.

We (Khmer people) do not like taking risks, so we prefer to continue growing rice to change to shrimp farming. (Interviewee 8, Soc Trang)

Khmer farmers also shared that many of their neighbours and family members have migrated to look for opportunities in the city.

Political security means that basic human rights should be protected in society. Past literature in general does not investigate the impact of climate change on political security in the region maybe because Vietnam and the Mekong Delta have had a high degree of political stability over the last 40 years. Vietnam is a communist country where only the Communist Party forms the government. One of the advantages of a single-party country is that the socio-political condition of the country is relatively stable, creating the necessary condition for economic growth. However, since the central government has the ultimate power, policymaking and policy implementation processes are usually top-down. This top-down policymaking may create contradictions and grievances among local community if policies do not fit with the local context or go against local interests. The case of dam construction mentioned above is such an example. Thus, if climate events such as drought, flood and salinity intrusion continue to affect the region, in the long-term political security could be impacted if adaptation policies are not well-tuned to local contexts and interests.

### *Interlinkages between different security dimensions*

Understanding the effect of climate change on different dimensions of human security

is crucial but recognising that all these security dimensions are connected and interact is even more important. The interaction between economic, environmental and social securities in the MKD is characterised by complex feedback loops. Climate change, in combination with other factors such as groundwater extraction and upstream activities, leads to water scarcity and salinity intrusion that affect agricultural production and cause crop failures, increasing economic insecurity (Paik et al., 2020; Mills et al., 2022). This in turn can lead to increased poverty and inequality (Givental and Meredith, 2016). These issues may cause grievances and conflict among community members, creating social insecurities (Nguyen-Van-Quoc et al., 2023). Social insecurity creates unfavourable conditions for the government to address environmental problems such as water scarcity and salinity intrusion, thus perpetuating the cycle of insecurity.

A particular example of this feedback loop in the MKD is the out-migration phenomenon. According to national statistics, 1.3 million people migrated out of the Mekong Delta in the last ten years, which is more than the population of one province in the region. In all data collection locations, out-migration is reported as significant, and most people move away to work as labourers in industrial zones such as Binh Duong and Dong Nai provinces. People often state that improving their economic condition is the motivation for them to migrate; however, climate impact can be an underlying reason (Ngo et al., 2022).

Some villages in our district were almost abandoned because everyone went to other places. Agricultural production was no longer profitable for them, so they left their agricultural land fallow. (Interviewee 38, Soc Trang)

Decreasing agricultural yields and increasing risks due to climate change contributes to reducing farm income that pushes people to migrate to look for other opportunities and income sources (Mills et al., 2022). Migration is often considered an adaptation strategy, but it can also create unexpected human insecurity risks such as lack of access to health care and education in receiving areas (Collins et al., 2017). In addition, migration can also be a source of conflict risk in the receiving area (Le et al., 2022; Savelli et al., 2023).

Generally, existing literature for the Mekong Delta tends to focus on climate impact on one or two single dimensions of human security. While this approach provides valuable insights, it overlooks the comprehensive understanding of how climate change affects human security holistically in the region. A more integrated perspective is needed to fully capture the complex interactions and feedback mechanisms between economic, environmental and social securities in the face of climate change.

The evidence from literature and primary data points out that climate change and variability can generate different potential human insecurity risks in the MKD. The linkage between climate change, variability and human insecurities are more often indirect than

direct. Besides, vulnerable groups such as poor farmers, ethnic minorities and women are also more threatened by climate-induced human insecurity risks. Adaptation measures are necessary to minimise the risks and improve the livelihood of these groups.

### Climate adaptation and human security in the Mekong Delta

Climate adaptation strategies are expected to reduce the impacts of climate change and improve human security. Yet, this might not always be the case. In this section, we will discuss different climate adaptation strategies implemented in the MKD and the sometimes-unexpected impacts on human security.

In the Mekong Delta infrastructure development and adapted agricultural production strategies have been used to mitigate climate change impacts and improve people's livelihoods (Nhung et al., 2019). These options are usually referred to as hard policy and soft policy options (Smajgl et al., 2015). Large-scale water infrastructure such as sea-dykes and sluice gates are built in several coastal provinces in the Mekong Delta to control salinity intrusion and keep fresh water for crop production. A number of these have been implemented in the Mekong Delta since the 1990s. To name a few, the Quan Lo-Phung Hiep project in the Ca Mau peninsula funded with loans from the World Bank, the water management project in Ben Tre province funded with Japanese loans, and most recently, the Cai Lon-Cai Be water management project covering six provinces in the Mekong Delta, funded from the government budget. These projects invested a large amount of money in building large-scale estuary sluice gates in many river mounts in the regions. Apart from preventing saltwater intrusion, the projects were expected to create more stable and sustainable conditions for agricultural production and contribute to freshwater supply, especially during the dry season.

While it is irrefutable that large-scale water infrastructure has resulted in benefits to farmers and contributed to food and economic security, possible negative consequences for environmental and personal security emerged. Evidence shows that dam construction negatively affects biodiversity, estuaries and the ecosystem at large (Ngo et al., 2022; Veettil and Quang, 2018). In addition, tensions and several conflicts have emerged related to these dams as mentioned in the previous sections on personal and community security. Research suggests that for climate change adaptation, the government should seek more nature-based solutions, such as soft options, as they are often more flexible and less intrusive, before continuing to build more dams and sea-dykes (Tran et al., 2021).

Regarding the soft option, a gradual shift happens from an exclusive focus on rice to a more diversified agricultural system (Nguyen et al., 2020). The government's Resolution 120, issued in 2017, stated that agricultural production should be based on market demand and focus on quality rather than quantity of agricultural production. At the local level, interviews with farmers show that they are actively involved

in adaptation activities. Together with governmental climate adaptation strategies, farmers also actively shape their own adaptation behaviour. For example, many rice farmers in Go Cong Dong district, Tien Giang province actively transformed part of their rice lands to horticulture cultivation after the salinity and drought in 2020. They stated that vegetables and fruit trees require less fresh water than rice as they are also more tolerant to salinity.

Farmers in Bac Lieu prefer to practice a combination of rice and shrimp farming as a measure to adapt to salinity intrusion. Nevertheless, abandoning conventional farming for other farming systems may have unintended negative consequences such as oversupply in the shrimp market, technical issues related to shrimp production such as diseases (WSSV e.g. white spot syndrome virus) the loss of mangrove forests and the reduction of biodiversity (Leigh et al., 2017). These issues can have implications on environmental and economic dimensions of human security through, for example, incurring ecosystem degradation and lower shrimp price and profit.

## **Discussion and conclusion: towards a research agenda for the Mekong Delta**

Our paper analysed relevant literature and qualitative interviews to advance the understanding of the security implications of climate change and variability for the Mekong Delta of Vietnam. Future impacts of climate change and variability are unavoidable for the MKD, despite global efforts in mitigation. However, most individuals today experience insecurity as a result of daily worries rather than the fear of a global catastrophe. Analysing the direct and indirect impacts of climate change and variability on different elements of human security in the MKD provides a regional overview and suggests some items for a future research agenda.

### **Holistic human security approach for exploring pathways from climate change to conflict risks**

Our review points out that past research largely focuses on the climate change impacts on subfields of human security such as food security, water security and health security. Nevertheless, there is not much that brings all those dimensions together, hence we are awaiting a comprehensive understanding of the human security implications of climate change and variability in the MKD. It is really important to establish the linkages between these various domains of human security not only because human security matters in itself, but also because a degrading situation could potentially turn into instability and violent conflict.

Currently, little evidence exists on pathways from climate change towards conflicts, but a number of long-term threats can be identified. Thus, it is crucial to better under-

stand the dynamics and connections between the various domains of human security, in order to prevent conflict rather than deal with it after it breaks out. As climate security receives increasing attention, a human security lens can help a climate security focus take a human-centred rather than a state-centred focus. For the MKD, it means more research should focus on vulnerable groups such as small-scale farmers, ethnic minorities and women, to establish how the different domains of human security combine and contribute to their vulnerability and to investigate the trade-offs between climate change and adaptation and mitigation policies. A human security lens also allows us to look at vulnerabilities to climate change in a broader economic, social and political context, and helps us identifying research and policy gaps in climate change and adaptation impacts.

### Human insecurities related to climate (mal)adaptation

As climate change and vulnerability continue to affect the MKD in several forms, climate adaptation is happening at different levels from national to individual levels. Climate adaptation measures bring numerous benefits to local communities; however, several trade-offs need to be taken into account (Ho and Shimada, 2021; Karpouzoglou et al., 2019). Analysing human insecurities related to climate adaptation measures could help deepen the understanding of current and potential trade-offs, especially for these vulnerable groups that one has to consider when applying these measures. In addition, one must be aware of the risk of maladaptation, i.e. the situation when adaptation measures create more risk and vulnerability to climate change (Schipper, 2020; Jafino et al., 2021). Identifying maladaptation measures and exploring their human insecurity implications are equally important to make sure that we will not make the same mistake in the future. This can also allow climate actions to become more effective in fostering peacebuilding (Nadiruzzaman et al., 2023).

### Understanding the linkage between climate change, human security and migration

Given the high levels of out-migration in the MKD, it is crucial for research and policy to better understand the root causes and consequences of this phenomenon. By carefully examining the complex connection between climate change, human security and migration, policymakers can design and target interventions that address underlying issues that drive people to leave their homes, and enhance community resilience. These measures will also allow better management of the migration process and minimise negative impacts on both the MKD and receiving areas.

### Identifying the tipping points when climate-induced human insecurity turns into conflict risks

The Mekong Delta can be considered as a peaceful area where no major conflict has happened in the last 40 years, but the region is still vulnerable to everyday conflicts. Our study found evidence of small-scale resistance and protests, and grievances among farmers in the MKD as the results of conflict of interests during the climate adaptation process. Yet, at present, it is unclear what are the tipping points when climate-induced insecurities are likely to escalate into conflicts. Ex-ante analysis such as modelling and foresight planning are the current methods to identify these tipping points. However, these approaches need much more refinement. Qualitative studies such as bottom-up ethnographic research can help to understand the perspective of vulnerable groups and the social and political processes leading to these tipping points and the root causes of conflict risks in the region.

### The trade-off between short-term and long-term consequences of climate actions

Short-term measures, such as immediate relief efforts and infrastructural changes, can provide immediate benefits and alleviate urgent issues. However, these actions might not address the root causes of climate vulnerabilities and could lead to negative long-term effects. For example, building a dam might solve immediate water scarcity but could disrupt downstream ecosystems and communities in the future. On the other hand, long-term strategies, such as investing in renewable energy, reforestation of mangroves and sustainable agriculture, aim to create a resilient and sustainable environment. These actions often require substantial upfront investments and may not yield immediate benefits, but they are crucial for ensuring enduring human security and mitigating future climate impacts. Balancing these short-term and long-term perspectives is essential for effective climate policy. Policymakers must navigate these trade-offs carefully, considering the immediate needs of communities while also investing in sustainable long-term solutions to build resilience against future climate challenges.

In conclusion, current research is still looking in a fragmented manner at climate change impacts and lacks a synthetic and integrated approach to better understanding the consequences of climate risk and how to mitigate or respond to them. Therefore, a human security lens covering all the various aspects can help to advance climate change, vulnerability and adaptation research. Climate adaptation strategies and programmes should also take into account potential human insecurities related to maladaptation that can lead to grievances and conflict risks.

There are various other areas that need further discussion and elaboration to really develop a comprehensive research agenda for understanding climate security in the MKD. This can be done, for example, by developing new methodologies to assess climate risks or by looking more closely at the connection between climate security and gender, or climate security and migration. The complex interaction between climate change and contextual factors also needs to be taken into account. An integrated approach is needed in designing policies and programmes. Just as it is suggested that policies and programmes in conflict-affected countries need to integrate climate sensitivity into their design, climate adaptation programmes in peaceful countries need to be conflict-sensitive in order to avoid unintended negative impacts and should actively contribute to building peace.

## Acknowledgements

We would like to thank Stephanie Hobbis, who reviewed and provided valuable comments to improve the manuscript. The first author thanks all local coordinators and interview participants who supported her during fieldwork. The authors also thank two anonymous reviewers and the editors of *International Development Planning Review* for their thoughtful feedback throughout the review process. This work was carried out with support from the CGIAR Initiative on Climate Resilience, ClimBeR and the CGIAR Initiative on Fragility, Conflict, and Migration. 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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