

Beyond Boundaries: Women and the Sundarbans Mangrove Forest.

*A study of the non-migration livelihood
pathways of women in Coastal Bangladesh*



Master's Thesis – Master Sustainable Development- Track International Development

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*"Sundarbans, in a word, is like my mother because Sundarbans protects us from all kinds of calamities here. We are alive because of Sundarbans. [...]
Yes, I consider myself one of these environments.
We don't want to leave our native land"*

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ABSTRACT

Bangladesh is considered one of the most climate-stressed areas globally, sensitive to slow and rapid-onset hazards. Coastal inhabitants face various socioeconomic challenges alongside physical exposure to cyclones and salinity, among other factors. Southwest Bangladesh is also home to the Sundarbans, the world's largest contiguous mangrove forest, crucial for the livelihoods of coastal inhabitants and protection from disasters. However, people's livelihoods are increasingly vulnerable and challenging due to forest degradation, rising environmental stressors, and other socioeconomic drivers. Particularly affected are women, who already face challenges related to access to natural resources and financial or physical assets due to socio-cultural and patriarchal norms, especially in rural areas. Within this context, migration is often chosen as a livelihood strategy, typically carried out by men, leaving women behind, while others voluntarily or involuntarily opt for non-migration despite the risks. Moreover, more women are entering the forest for resource collection and taking on roles traditionally performed by their male counterparts to sustain their livelihoods and develop adaptation strategies. This study investigates the circumstances of women's immobility within mangrove-dependent communities in southwest Bangladesh. It focuses on the intersection between women's relationship with the Sundarbans social-ecological system and its influence on their non-migration livelihood pathways. Drawing insights from social-ecological system theory and feminist political ecology, I applied the sustainable livelihoods framework and conducted a mixed-methods approach to develop this empirical study. The main findings firstly demonstrate how women are shifting their traditional roles to engage in diverse livelihood activities outside their homes and collecting resources, with 80% of sampled women considering staying put. The study also underscores the importance of considering social subsystem interventions in shaping non-migration aspirations and how social actors enhance or deteriorate women's livelihoods. The application of an intersectional lens when studying the correlation between women's livelihood capitals and their migration considerations strengthens the idea that addressing dimensions like access or agency in the field of climate change adaptation and gender is critical to comprehending the livelihoods of non-migrant women and their challenges in resource-dependent communities. Future investigations should delve into women's resource utilisation, the influence of economic and social capital, and the development of the crab business for social and ecological sustainable practices. They should also address the specific challenges posed by increasing salinity and water-related hazards and their impact on women's non-migration aspirations.

Keywords: women, Sundarbans, non-migration, livelihoods, agency

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ABBREVIATIONS

BFD- Bangladesh Forest Department

CNRS- Centre for Natural Resources Studies

ES- Ecosystem Services

FPE- Feminist Political Ecology

GIZ- German Development Cooperation Agency

HH or hh- Household

NGO- Non-Governmental Organization

SES- Social-ecological System

SMF- Sundarbans Mangrove Forest

SW- Southwest

*Note: The author took all the pictures that appear in the thesis. Indicated if otherwise.

1. INTRODUCTION

1.1 General Background

The strength and frequency of natural hazards, such as floods, sea level rise, drought, etc., are increasing due to climate change and land use change around the world (Klepp, 2017; IPCC, 2022), aggravating existing disaster risks in many regions (Wen et al., 2023). Poverty or exposed livelihoods exacerbate vulnerability and the consequences of natural hazards, which are expected to continue increasing in the following years (Ayeb-Karlsson, 2016; IPCC, 2022). As a result, in the last decades, global migration patterns have undoubtedly become highly mediated by environmental drivers (McLeman & Gemenne, 2018).

Bangladesh is considered one of the most climatic-stressed areas of the world, sensitive to both slow and rapid onset hazards (Bernzen et al., 2019; Sharifi et al., 2021). Bangladesh's population density is one of the highest in the world, with 1301/km², with 40% of the population living in poverty (Hassani-Mahmooei & Parris, 2012). Coastal Bangladesh inhabitants, especially, face various socioeconomic challenges hand in hand with physical exposure (Fig.1), as here, 5% of the Bengal Bay cyclones occur (Kabir et al., 2016). Moreover, more than 6 million out of the 43.8 million people (BBC, 2022) living in the coastal zone districts are exposed to salinity, as suggested by a report by the ICCCAD. The districts of Khulna, Satkhira and Bagerhat -southwest Bangladesh- are the worst affected (Khatun et al., 2022).



Figure 1. Exposure of households in coastal districts. Left: effect of river erosion in village near Dacope. Right: embankment system and houses at the right of it in Buri Goalini

The world's largest contiguous mangrove forest, The Sundarbans, stands in Southwest Bangladesh. Bangladesh accounts for 60% of the area of this forest, which is over 10.000 km², and was designated as a UNESCO World Heritage Site in 1997 (Abdullah-Al-Mamun et al., 2017). Mangrove forests are shaped by complex interactions between humans and nature and function as a social-ecological system at the interface of land and sea (Himes-Cornell et al., 2018), acting as the first line of protection against most disasters (Sakib et al., 2015). The Sundarbans mangrove forest provides a wide range of ecosystem services (MEA, 2005), articulating the basis for the nearby dwellers to sustain their

livelihoods through informal and formal access (Mallick et al., 2021). Households in this area depend on these resource extraction activities to be protected from coastal disasters (ibid.). However, following the global trend, the mangrove and the services it provides are experiencing degradation due to land use change and ongoing resource extraction (Goldberg et al., 2020). As a consequence, people's livelihoods are also becoming more vulnerable and challenging, especially for women (Ahmed & Kiester, 2021), and migration of one household member or the whole family is often chosen as a livelihood strategy, or is the result of the inability to adapt (Bernzen et al., 2019). Historically, males have performed migration, leaving women behind and driving them to change their traditional roles to develop their non-migrant livelihoods (Hadi, 2001). Thus, women's livelihoods tend to become highly connected to the Sundarbans' resource availability as they develop their adaptation strategies around the mangrove ecosystem (Roy, 2019).

1.2 Scientific Background

1.2.1 *Immobility and Gender*

Much research has analysed how climate change vulnerability is not gender-neutral (e.g. Denton, 2002; MacGregor, 2009; Sultana, 2014; Reggers, 2019). Women “are likely to be disproportionately affected by climate change because, on average, they tend to be poorer, less educated, have a lower health status and have limited direct access to or ownership of natural resources” (Chindarkar, 2012, p.6). Specifically, women in the Global South are most affected due to the disproportional effect of climate change in this region (Ahmed & Eklund, 2021). Recent years have witnessed a growing academic interest in environmental migration and displacement, often referring to the people who leave their residences in the aftermath or during environmental disasters, known as environmental migrants by the International Organization of Migration (IOM) (Renaud et al., 2011). However, less has been investigated on the people staying put despite being exposed to hazards and living in disaster-prone regions (Mallick et al., 2023).

The way women experience immobility has also been understudied, together with the lack of recognition of their contribution to adaption responses at the household level (Evertsen & Van Der Geest, 2020; Furlong et al., 2022; Khalil & Jacobs, 2021; Lama et al., 2020). Migration of men, however, can have both positive outcomes regarding gender inequalities and negative ones regarding the increase of women's burden in terms of responsibilities (Omolo & Mafongoya, 2019; Skinner, 2011; Tiwari & Joshi, 2016). For non-migrant women in forest resource-dependent communities like the ones inhabiting the vicinities of the Sundarbans, livelihood and adaptation options are compelled to the forest health, affected both by climate change and by the ways its resources are used and managed (Ela et al., 2021)

1.2.2 *Livelihood Challenges in the Sundarbans Mangrove Forest*

The Sundarbans have been buffering the impact of cyclones and other natural disasters for decades, and it has also served as the means of livelihood support for mangrove-dependent communities adjacent to it through direct and indirect ways (Mallick et al., 2021; Sakib et al., 2015). However, during the last decades, it has suffered degradation due to increasing climate change effects (salt intrusion, floods, cyclones, coastal erosion, etc.) and other human-derived causes like overexploitation of resources such as wood, fish, honey or deer (Islam & Bhuiyan, 2018). The latter can also be related to the loss of livelihood opportunities (for instance, fishing) that has led inhabitants to carry out other

activities like mangrove clearing for aquaculture purposes or mangrove logging for construction (Azad et al., 2021). Moreover, the increasing occurrence of natural disasters and uncertainty about them have exacerbated the situation (Uddin et al., 2013). On the other hand, due to the increasing vulnerability and other factors, women are also starting to go into the forest and the surrounding areas as resource collectors (Roy, 2018; Roy, 2019).

1.3 Research Problem

The community livelihood takes place within the Sundarbans social-ecological system (SES) as they are interlinked and interdependent with the Sundarbans ecosystem functioning (Fig. 2), evolving through social and ecological subsystem interactions (Hoque et al., 2017). Within this context, individuals and households choose voluntary and involuntary migration as an adaptation (or survival) strategy (Khatun et al., 2022; Priovashini & Mallick, 2021). As a result of male out-migration, women are to take on roles traditionally performed by their male counterparts to sustain their livelihoods, adding to the household duties or occupations they were already performing. On the other hand, both individuals and households are actively choosing non-migration despite the environmental risks present (Mallick, 2023). Through the Sundarbans Mangrove Forest (SMF) resources and the assistance of external actors, social networks, and other economic resources, people develop adaptation strategies that enable them to continue their livelihood in this area (Hossain et al., 2023).



Figure 2. Local dwellers collecting resources in the river edge of the Sundarbans

There is also the case of people involuntarily staying put due to their inability to find plausible livelihood options elsewhere (Ayeb-Karlsson et al., 2018). The involuntary non-migrants are subjected to high levels of vulnerability, especially women also subjected to challenges related to access to natural resources and financial or physical assets due to the socio-cultural and patriarchal norms existing in Bangladesh, especially in rural areas (Ayeb-Karlsson, 2020). Power relations are an essential factor, especially for women living with their husbands or father-in-law relatives, hindering

their ability to have control over their economic assets or decision-making in livelihood aspirations. On the other hand, non-migrant women can also gain agency in their livelihood decisions, migration aspirations or economic dependency once left behind by their male counterparts (Rashid, 2013).

As vulnerability increases, the services the mangrove forest provides become even more crucial for non-migrants to sustain their livelihoods (Mallick et al., 2021). Notwithstanding, after the destructive cyclones *Sidr* and *Aila* in 2008 and 2009, the loss of resources increased resource extraction from the Sundarbans, hence increasing the pressure on the ecosystem (Kartiki, 2011). On the other hand, particular focus has to be taken on how the extraction dynamics differ among men and women and how the latter might challenge the prevailing gender rules and power relations in place (De la Torre-Castro et al., 2017). Recent studies in coastal Bangladesh have studied the place-based adaptation strategies women are developing (Alam & Khalil, 2022; Khalil & Jacobs, 2021), yet not delving into how they are using the resources both for reproductive work-related activities and potential income-generating ones (Cohen et al., 2016). Besides, several interventions by NGOs (e.g. BRAC, GIZ, CNRS, Ghanamuki Foundation), controversial conservation measures -further described- and co-management plans implemented by the government and other actors are being developed in the SMF, influencing the livelihood strategies (like non-migration) of the people in the community.

Up to now, whilst several studies (e.g. Alam & Khalil, 2022; Sengupta & Samanta, 2022; Furlong et al., 2022) have examined the immobility circumstances of women or how gender plays a role in it within Southwestern Bangladesh, few studies have focused on the intersection between women's relationship with the natural resources in mangrove-dependent livelihoods and its influence on their non-migration aspirations. Hence, this research was designed to explore this intersection and contribute to the field of environmental non-migration and gender. This objective was translated into the following research question and sub-questions:

How does women's differentiated relationship with the Sundarbans social-ecological system influence their non-migration livelihood pathways?

1.1-How do women use the resources from the Sundarbans for their livelihoods in a post-cyclone context and under the new ban scheme?

1.2-How do the interventions and dynamics within the social subsystem influence women's intrahousehold dynamics and livelihood strategies that shape their migration pathways?

1.3-How does the interaction of factors within women's livelihood contribute to their decisions regarding non-migration?

1.4 Scientific and Societal Relevance

The present research will contribute to the recent but increasing field of research on non-migration and climate change with a special focus on women. Moreover, it will apply an intersectional analysis to unravel the power and social dimensions intertwined within women's livelihood under the context of climate change. As the study area is focused on Sundarbans dependent communities, it will provide an understanding of the linkages among non-migration, women and mangrove management, which has not been widely studied. Regarding societal relevance, as climate change consequences are likely to increase, sustainable development research must address the realities and context-specific needs and situations of the people at the forefront of these effects, which are greatly occurring in the global south.

As women are seen to be more vulnerable due to the existing societal and cultural gender norms and roles, this research will focus on and amplify the needs and realities of those women staying put and having to adapt to building resilient livelihoods in these highly exposed areas.

2. THEORETICAL AND ANALYTICAL FRAMEWORK

2.1 Social-ecological Systems

The deep ecology perspective on Resource Conservation ideologies addressed the need for a more local site or bioregion approach, given the historical knowledge of the primal peoples or local communities on natural processes (Luke, 2002). However, the question remains of how to address the problems derived from overexploitation by local communities and the degradation of the ecosystem and its biodiversity. Following the social-ecological system perspective, the reciprocal feedback between systems cannot be dismissed (Berkes et al., 1998). SES are complex adaptive systems of humans in nature comprised of biophysical units or ecosystems, the ecological subsystem. The community livelihood and Sundarbans ecosystem functioning are interlinked and interdependent and evolve through social and ecological subsystem interactions (Hoque et al., 2017). The flow of the ecosystem services (ES) the mangrove forest provides interacts with the social actors (social subsystem) that demand them and the institutions that manage them for their well-being (Folke et al., 2016). Ultimately, the underlying characteristics and integrity of the ecological subsystem or resource base will directly affect the social institutions and the community depending on it (Ostrom, 1990).

The SMF social-ecological system is regulated by institutional interventions addressing resource management strategies at a regional, national and global policy level. Likewise, the social subsystem encompasses a diversity of actors like the aquaculture sector or Non-Governmental Organizations (NGOs), both very present in coastal Bangladesh. Within SES literature, the social elements have prevailed and are weakly addressed, especially lacking a focus on the importance of social diversity and power relations (Fabinyi et al., 2014). The conservation interventions mediated by the Bangladesh Forest Department in the area have been questioned as inconsistent because they tend to overlook the needs of the local dwellers to develop their livelihoods (Iftekhar & Islam, 2004). Especially, regarding the regulation of the open seasons for resource collection, resulting in unlawful practices like off-season fishing, overexploitation of wood resources, and coastal guard bribery.

Besides, Calderón-Contreras & White (2019) proposed to apply the insights of the Theory of Access (Ribot & Peluso, 2003) to the study of SES as a response to the under-theorised mechanism of access control and access maintenance developed by the communities, which ultimately shapes the resilience in response to shocks. Along the same lines, Kibria et al. (2019) addressed in their research the dimension of access ('ability to benefit from') to the ES in the Sundarbans, dividing the '*access control*'-as the power of directing and regulating who can access the resources- and the '*access maintenance*'-capacity of keeping a specific type of resource access open for the future generations, by expending resources or powers-. The access control and maintenance of the Sundarbans resources are mainly enforced by the Bangladesh Forest Department, imposing regulations and distribution of permits, yet also villagers, pirates, police, coast guards, rapid action battalion (RAB), and merchants are involved in them (Kibria et al., 2019). The dimension of access to ES is believed to ensure the community's well-being and conservation of the ecosystem, as resource-dependent communities lack

many alternative livelihood options (Fisher et al., 2014). However, the differences within the communities, especially the agency power struggles at play, crucial when attending to the gender dimension, have been generally masked within the SES literature (Calderón-Contreras & White, 2019; Fabinyi et al., 2014). Therefore, these dimensions are explored by understanding what resources women have access to, how they exercise this access, and in what ways the institutions implement interventions that affect the maintenance of the access and of those resources that will affect the status of the SMF and the future livelihood of the local population.

The application of the SES framework within the analysis provides a holistic understanding of the different challenges and opportunities for the community that are embedded in the complex interaction of the independent ecological and social subsystems functioning across different spatial scales and temporal dynamics (Bollettino et al., 2017; Fischer et al., 2015).

2.2 Feminist Political Ecology & Intersectionality

Feminist Political Ecology

Political Ecology is an essential interdisciplinary sub-field in Geography that emerged in the 1980s by incorporating political analysis into the interaction between societies and the environment (Resurrección, 2017). It serves as an analytical approach that aims to comprehend the influence of power in the unequal access to and control of resources at different scales (Watts, 2015).

Feminist Political Ecology (FPE) theory is derived as a sub-field of Political Ecology questioning and informing gender dynamics as an essential dimension of resource struggle in natural resource-based livelihoods (Elmhirst, 2015). Gender according to Butler (1991) was described as a dynamic process that unfolds across time and space, and is subject to regulation, where individuals repeatedly express and act out its subordination through discourses and practices (Sultana, 2009). The FPE theory was first introduced by Dianne Rocheleau, Thomas-Slayer, and Esther Wangari in their 1996 book *“Feminist Political Ecology: Global Issues and Local Experiences”*. Rocheleau et al. (1996) constructed a framework broadening the analysis of political ecology scholars, configuring gender as a “critical variable in shaping resource access and control, interacting with class, caste, race, culture, and ethnicity to shape processes of ecological change, the struggle of men and women to sustain ecologically viable livelihoods, and the prospects of any community for *sustainable development*” (p4). FPE focuses its concerns on three aspects: the intersectional analysis of social-ecological relationships and gender subjectivities, the recognition of the significance of considering people’s embodied experiences with the different scales of power and decision-making to conduct ‘research from the bottom-up’; and the questioning of knowledge production, governance and policy-making (Resurrección, 2017). Besides, Brinda Rao (1991) debated that “instead of accepting a priori perceptions of feminine roles, there is a need to contextualise women as they respond to complex environmental realities, and to consider how they enter into and engage in social relationships with men within the institutions of their natural resource-dependent societies” (in Resurrección, 2017, p.3).

Within the Sundarbans-dependent communities, the increase in community or individual vulnerability results in more women stepping out of their houses to generate income through resource extraction, challenging the prevailing social norms (Roy, 2019). Notwithstanding, their role as housewives involves a relationship with the surrounding resources for household chores and reproductive activities, highlighting the importance of contextualising women's complex environmental realities

following the FPE principles (Elmhirst, 2015). The FPE approach in the current study considered the intersectional analysis of the themes explored in the research questions. It acknowledged the household and community gender relations, which is key to addressing the multi-dimensional experiences of women in these communities (Resurrección, 2017).

Intersectionality

Although women are targeted in many climate change adaptation programmes and strategies, they generally fail to tackle the existing inequalities and vulnerabilities and consider the specific and diverse needs and concerns of these women (Lama et al., 2021; Roy, 2019). Climate change effects are known to affect men and women differently, especially in the Global South, where women are among the most affected (Ahmed & Eklund, 2021; Nelson et al., 2002; Skinner et al., 2011). These impacts and the induced disasters are not distributed homogeneously across communities, groups, and regions (Ahmed & Eklund, 2021). Therefore, there is a need to assess vulnerability with an intersectional approach (Hancock, 2007; Kaijser & Kronsell, 2013). Intersectionality addresses issues in the debates on adaptation and vulnerability to climate change, where gender and other factors within gender are considered vital elements (Djoudi et al., 2016; Jordan, 2018). It serves as an analytical tool defined as “the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies, and the outcomes of these interactions in terms of power” (Davis, 2008, p.68 in Kaijser & Kronsell, 2013).

Moreover, there is a lack of attention to gender in climate change science, where there is a general simplification of women's experiences of risk compared to men's (Sultana, 2014). The international discourse has generally framed women as the 'most vulnerable group', singled out as the 'climate victims' in need of protection, failing to capture the complexities, power dynamics, and articulation of their needs and rights (Djoudi et al., 2016; Reggers, 2019; Tschakert & Machado, 2012). However, several studies have postulated a convergence between the migration of men and the process of 'emancipation' and 'agency' trajectories undertaken by women who are 'left behind' in rural coastal areas (Djoudi et al., 2016; Khalil et al., 2020; Khalil & Jacobs, 2021; Rashid, 2013). In some instances, through the change of livelihood opportunities following the paths of emancipation and agency (Rashid, 2013), women might take advantage and transform their social-ecological systems (Alam & Khalil, 2022; Sultana, 2014). This could be observed after cyclone *Aila* in southwest coastal Bangladesh, where women, with the help of NGOs, started shifting their activities out of their traditionally gender-defined roles (Khalil & Jacobs, 2021). Nevertheless, the structural inequalities related to market access and sociocultural and patriarchal norms in Bangladesh will act as an important barrier hindering their abilities and tools for present and future adaptation (Ahmed & Eklund, 2021; Bhatta et al., 2016; Gioli & Milan, 2018).

This study explored women's (non)migratory livelihood in a vulnerability context by conducting a nuanced analysis of the intersection of the power relations within their household and regarding other women, their access level to the assets, external aid and ecosystem services, and factors like religion or education.

2.3 Non-migration

Environmental Non-migration

A great part of the literature on migration and climate change has focused on the out-migration processes carried out by households or individuals in natural-hazardous prone areas (like Bangladesh) (Ahsan et al., 2014; Klepp, 2017; McLeman & Gemenne, 2018). Historically, migration has acted as an adaptation strategy for people living under vulnerable livelihood conditions and high climatic risk (Mallick & Schanze, 2020) or as the driving force of new *in-situ* adaptation strategies (Leal, 2016; Williams et al., 2015). However, during the past years, there has been an increase in research focused on environmental non-migration within the environmental migration discourse (e.g., Alam & Khalil, 2022; Balgah & Kimengsi, 2022; Koubi et al., 2022; Mallick, 2023) that was introduced with the work of Black et al. (2013).

Environmental migration or non-migration is the choice of an individual or group that is influenced by the capabilities and aspirations that, in turn, will determine whether the mobility choice is voluntary or involuntary (Mallick & Schanze, 2020). Within the capability-aspiration framework, *capability* can be defined as “the various combinations of functioning (beings or doings) that the person can achieve based on their political and economic context” (Sen, 1992 in Mallick, 2023, p.11), for instance, the resources or skills they own to either migrate or stay put. The *aspiration* involves a psychological and behavioural process related to the individual or group's desires, wants, or needs that cannot be fulfilled without the proper capabilities (Khatun et al., 2022). Hence, migration (or non-migration) is not always an option even when aspiring to do so, hence becoming an '*involuntary non-migrant*' (Lubkemann, 2008), already conceptualised as '*trapped population*' or '*left-behind*' in the migration studies (Ayeb-Karlsson et al., 2018).

Until now, relatively few studies have explored the dimension of the '*voluntary non-migrants*' that, despite the challenges and risks they face, consciously decide to stay put in their region (Mallick et al., 2023). Likewise, '*involuntary non-migrants*' can become long-term voluntary when their adaptation capacity increases their ability to cope with future climatic risks or vice versa (Khatun et al., 2022). As described by Khatun et al. (2022), “adaptability is enhanced if voluntary and involuntary non-migrants have the sufficient economic capacity to adjust to changing situations, whereas adequate and sufficient adaptive capacities make non-migrants more resilient to the effects and impacts of the extreme climatic event” (p.4).

Gender and Non-migration

Notwithstanding, even though the field of climate change and non-migration has increased in the past decade, there has been little research investigating the gender implications of non-migration (Furlong et al., 2022). Coastal Bangladesh out-migration is generally carried out by men (Alam & Rahman, 2014; Ayeb-Karlsson et al., 2020) in a context where women are already more vulnerable due to lower participation in the decision-making regarding climate change, lower social and economic status, lower land rights acquisition, and a higher susceptibility to risks like water scarcity or food security (Tanny & Rahman, 2017). Hence, it is pivotal to explore the complexities in the decision-making process to stay put and how the socioeconomic and cultural conditions inform the immobility experience of women (Adams, 2016; Furlong et al., 2022). For instance, Khalil and Jacobs (2021) explored how the “women-to-women neighbourhood relationships influenced the establishment of knowledge-sharing platforms

and work outside of the home through connections with outsiders (i.e., NGOs) and enhanced place-based adaptation based on local natural resources” (p.10). Another dimension researched in this field, and where a gender lens is also required, is the human-place relationships. Different concepts have been discussed within different disciplines like *place attachment*, *place identity* or *sense of place*, which ultimately shape how individuals experience, perceive, or connect with the place they inhabit (e.g., Furlong et al., 2022; Rabbani et al., 2022). For instance, Khalil and Jacobs (2021) explored the place-based adaptation of women, describing place attachment as “an affective bond or link between people and specific places, consisting of three dimensions, i.e., person, place, and process” (p.2).

2.4 Analytical Framework

For the analytical framework (Fig. 3), this thesis employs a modified and adapted version of the Sustainable Livelihood Approach (SLA) (DIFD, 1999; Scoones, 1998). For the framework design, I take into consideration the work of Natarajan et al. (2022) that reformulated the framework, acknowledging the flaws and strengths of the original SLA in a context where globalisation, environmental change, lack of state support and natural resource extraction is increasingly impacting the rural livelihoods and their integration in the global market (ibid.). It also incorporates the SES framework (Folke et al., 2005; McGinnis & Ostrom, 2014) as the grounding framework.

The concept of 'livelihoods' can be understood as how people live, both with material and social resources, to secure the basic needs of everyday life (De Haan & Zoomers, 2005). Livelihood research significantly contributes to a comprehensive understanding of the diverse and multi-faceted nature of the livelihoods of rural small farmers in the global South (Ayeb-Karlsson et al., 2016; Biswas & Mallick, 2020; Manjur et al., 2014; Roy, 2019). It needs an interdisciplinary approach encompassing a holistic understanding of the connections between various livelihood activities.

The original Sustainable Livelihood Framework (SLF) identified five forms of capital and assets (social, human, economic, natural, and physical) that interact in complex ways (Scoones, 1998), here adapted to the ones in Fig. 3. In natural resources-dependent rural communities, the livelihood capitals are highly related to place-based resources, and access to them ensures that their basic needs are met to secure their livelihood outcome (Getzner & Islam, 2013; Khalil et al., 2020). For instance, as investigated by Pearson et al. (2019), mangroves appeared to be the underlying foundation upon which the rest of the livelihood capitals are sustained. It also follows the argumentation of the SES framework considering the integrity of the ecosystem as the basis for the livelihood resilience. On the other hand, from a gender perspective, social capital and its subdimensions (bonding ties among women and outsiders, women network and knowledge sharing, social norms, etc.) influence their adaptation capacity (e.g., Omolo & Mafongoya, 2019; Pearson et al., 2019; Phan et al., 2019).

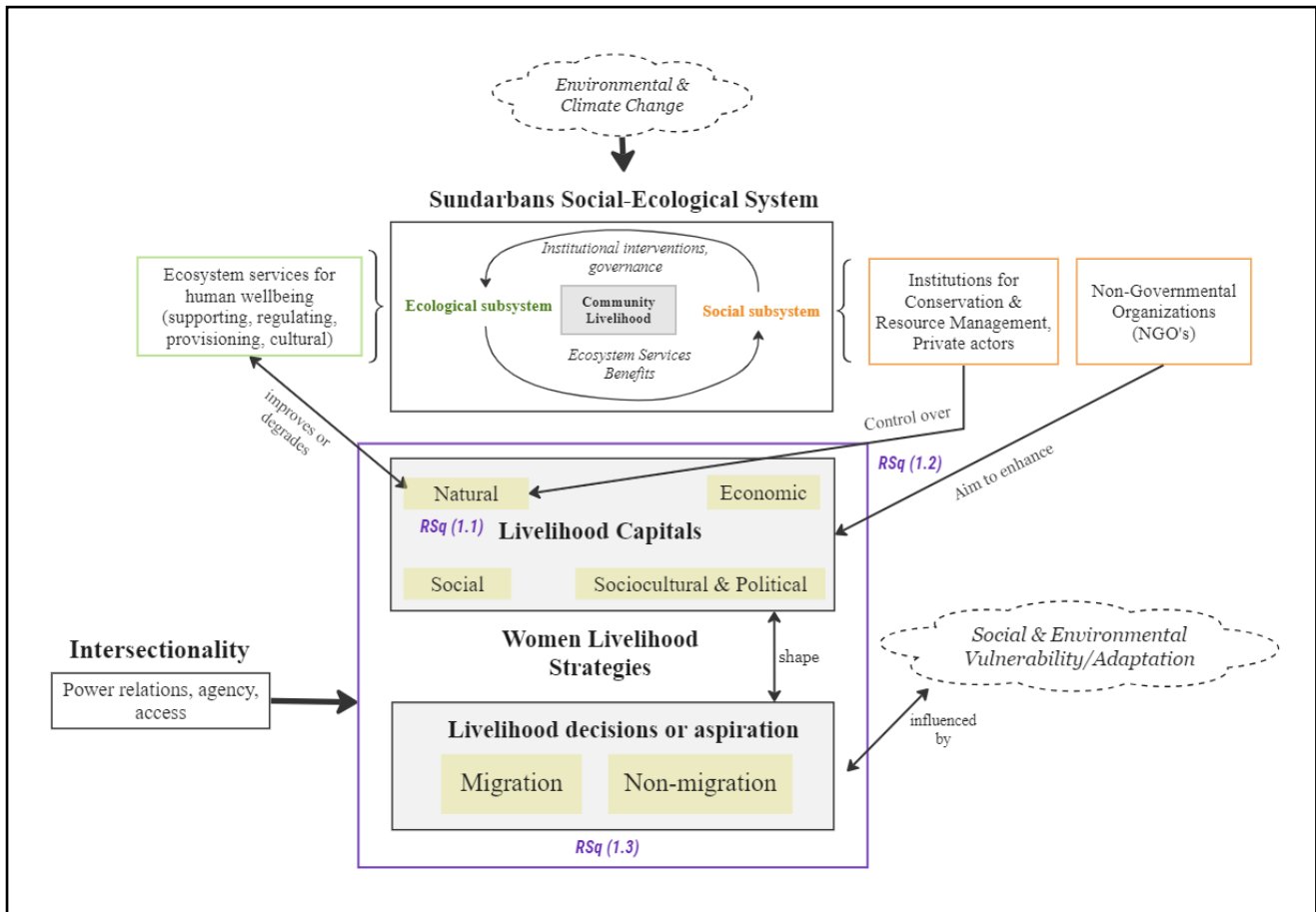


Figure 3. Analytical framework. Authors elaboration. Sustainable Livelihood Framework adapted from Natarajan et al. (2022) and Scoones (1998). The social-ecological framework was simplified and adapted from Folke et al. (2005) and McGinnis & Ostrom (2014). Note: The dimensions surrounded by a dotted line indicate that they are not directly addressed in this study but helped to contextualise the studied factors. The subquestions are indicated in purple colour. Source: Author's illustration

The Sundarbans mangrove forest and surroundings provide the environmental context and ecosystem services where the communities ground and shape their livelihood, ensuring their basic needs (Mallick et al., 2021). How generations have interacted with the mangrove has been shaped by different factors and circumstances that have been influenced by the relational power and assets which have evolved through generations (Khalil & Jacobs, 2021). The intersectional approach in this research aims to put factors like the socioeconomic situation, religion, and other power factors among women and regarding men and their influence on women's livelihood at the centre of the analysis (Kaijser & Kronsell, 2013).

The centre squares' connection with the social subsystem (yellow squares) "highlight that livelihoods cannot be smoothly computed from capitals, without better understanding how the latter are (re)produced and changed through human action embedded in wider society's socioeconomic and political structures and a local environmental context." (Natarajan et al., 2021, p.11). The social subsystem incorporates the institutions, policies, norms, social groups, and private and public actors. It represents the micro and macro processes locally, nationally, and globally (Natarajan et al., 2021). At a local level, NGOs are helping to transform the livelihood pathway of women who stay in the area, as they are developing stronger social networks among them and acquiring novel capacities for adaptation and, in some cases, emancipation from the sociocultural norms that have hindered their ability in their past (Khalil & Jacobs, 2021). On the other hand, decisions taken by national (and global)

institutions regarding mangrove conservation and management plans can also affect the rural livelihoods in hand with large-scale investment in commodities like shrimp farming or mangrove mud crab (Islam & Bhuiyan, 2018; Hossain et al., 2021). The ecological subsystem (green square) is connected to the natural capital to highlight the relevance of the mangrove forests in sustaining livelihood capital and strategies through the provision of ecosystem services directly affected by the integrity of the ecosystem functions (MEA, 2005). The different capitals will shape the non-migration decisions in the short- and long term (Mallick, 2023). Migration and non-migration act as a way for people to secure their livelihoods, as in the case of Bangladesh, yet the ability to do so is highly mediated by gender (Khalil et al., 2021; Evertsen & Van Der Geest, 2019). Likewise, the different livelihood options are shaped by the degree of dependence on the mangrove or the impact of remittances.

3. STUDY AREA AND METHODOLOGY

3.1 Study Area

The thesis was carried out in Southwest Coastal Bangladesh under the Khulna Division. This area has been under study by previous research in the field of climate change and mobility (e.g., Biswas & Mallick, 2021; Braun et al., 2019; Hossain et al., 2023; Kartiki, 2011; Roy, 2018), and increasingly also the research of the linkages with gender (e.g., Alam & Khalil, 2022; Boas et al., 2022; Everstsen & van der Geest, 2020). People's livelihoods in the region are highly dependent on natural resources of the surrounding ecosystem (Mallick et al., 2020), yet degrading increasingly due to the unplanned expansion of the shrimp farming industry as seen in other parts of the world (FAO, 2020; Goldberg et al., 2020; Hamilton, 2020). This area is also impacted by hazards like flooding, temperature variation, droughts or salinity intrusion, which will only increase unpredictably due to the consequences of human-induced climate change (IPCC, 2020; Rahman et al., 2013). They are also at high risk of exposure to tropical cyclones, like *Sidr* and *Aila* in 2009, after which numerous studies conducted post-cyclone research (e.g., Kartiki, 2011; Mallick et al., 2011; Sakib et al., 2015) and more recently in 2019-2020 cyclones *Bulbul* and *Amphan* (Alam & Chakraborty, 2021).

Several unions (under which villages are found at the administrative level) inhabit the adjacent edges of the Sundarbans (Fig. 4) and have built their livelihoods around the resources this ecosystem provides and its services, as studied by Getzner and Islam (2013). Adams et al. (2016) and Adams et al. (2018) thoroughly defined different SES in southwest and south-central Bangladesh as depicted in Figure 5. Hence, for the current thesis, I will focus on two villages within the SES defined by Adams et al. (2016) as the “*Sundarbans dependent zone*”. The two adjacent villages under study were Buri Goalini and Munshiganj, in Buri Goalini Union, under Shatkira district.



Figure 4. Picture taken from Buri Goalini. The Sundarbans Mangrove Forest is identified in the background.

The Buri Goalini area has developed the soft mud crab cultivation business in the last decade to the detriment of the shrimp farm business. In contrast, Munhsiganj has not yet engaged fully in it. These villages are directly exposed to cyclones and depend on the mangrove ecosystem and river to sustain their livelihoods. They are located next to Sundarbans Mangrove Forest and directly depend on the resources from the river and the forest. Both villages comprise 490 households, based on the available community report from 2011 (BBS, 2011). According to the Bangladesh Forest Department (BDF) ecological administrative units for the Sundarbans Reserve Forest, the villages belonged to the Shatkira Range. The preliminary fieldwork was conducted in villages in the Chandpai Range, where slightly different social-ecological dynamics were found. Nevertheless, they also belonged to the Sundarbans Dependent Zone, enhancing the understanding of the general struggles and realities of the coastal dwellers before conducting the data collection.

The rationale for choosing these two villages was their high coastal exposure and proximity to the island Gabura Union, where several studies, especially focusing on gender, have been carried out (e.g. Alam & Khalil, 2022; Khalil et al., 2020; Roy, 2019), serving as an important point of reference. Secondly, there is a lack of implementation of the co-management or ecotourism plans by the BDF and NGOs in the Shatkira Range, which have been implemented or will be implemented in the Khulna and/or Chandpai Range (GIZ, 2017). In one of the study villages, the BDF counts with one office; hence, the dynamics between this actor and the local community can also be understood more closely. Preliminary fieldwork was conducted to observe and understand the social and ecological context through informal conversation and testing of the semi-structured interviews and to identify important themes and key actors in the field. Subsequently, I designed the appropriate and most feasible methodological approach for the data collection process accounting with the challenges and ethical considerations.

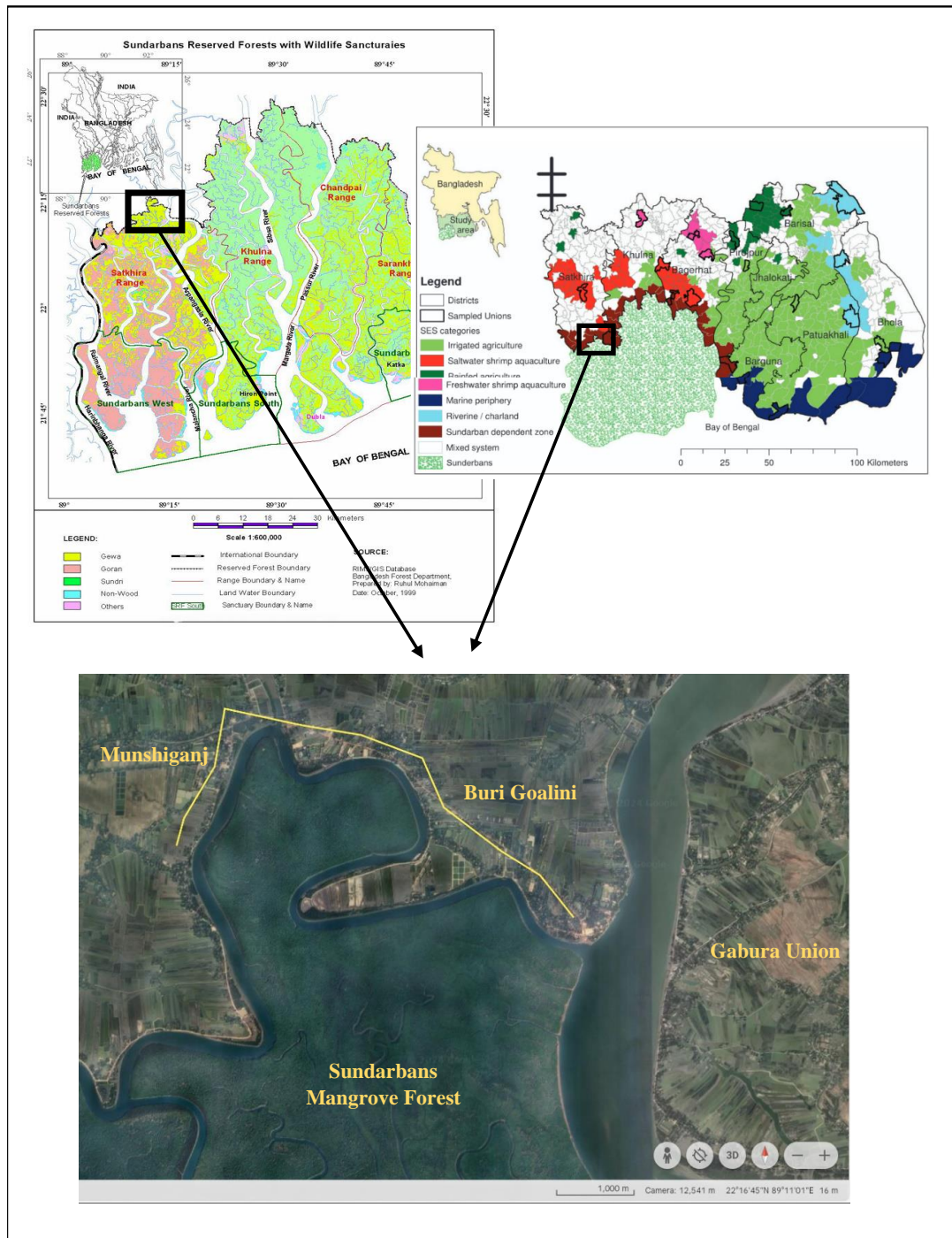


Figure 5. Study Area. Author's elaboration from different sources. Note: The black squares correspond to the study area where the villages are located, indicated in two different maps. Source: The upper right map belongs to Adams et al., 2016. The upper left map was retrieved from the Ramsar Sites Information Service. The image below represents the study area with an approximation of the transect in yellow between the two villages where the survey and interviews were conducted. Source: Google Earth Pro, retrieved 24/02/24.

3.2 Methodological Approach

3.2.1 Data collection process

For the development of the current thesis, an inductive approach was employed to help answer the questions according to the data collection and develop a deeper understanding of the topic. Following

an inductive process involved refining and reshaping the data collection process, allowing a deeper understanding of the research issues (Hennink et al., 2020). Moreover, a case study approach was adopted, which helped develop context-dependent knowledge widely applied in social sciences (Flyvbjerg, 2006). The use of the case study approach for this research, widely adopted for the context of Bangladesh (e.g. Ahmed & Kiester, 2021; Azad et al., 2021; Boas et al., 2022), allowed the comparison with past studies and brought about a further and novel understanding of certain dimensions within the themes at hand. The empirical study was developed between July and September 2023 between Khulna and Shyamnagor.

The study employed a mixed-method approach, obtaining the data through quantitative (household survey) and qualitative (semi-structured interviews, expert interviews, ethnographic observation, literature) methods, which are summarised in Table 1. This approach has been previously employed in the study of resources-dependent communities by, e.g., Ahsan et al. (2022) in Bangladesh, Assan (2014) in Ghana, and Khatiwada et al. (2018) in Nepal, and enables understanding of the complex topic in hand through multiple lenses (Creswell, 1999; Malina et al., 2011).

Qualitative methods

The preliminary qualitative interviews, visits to local NGOs, and field observation led to the development of the quantitative survey and the interview guides. Once the survey data collection was in process, in-depth semi-structured interviews were designed to gain a deeper understanding of the themes covered in the survey (Peel, 2006; Opdenakker, 2006). They were further processed through a triangulation process converging the different sources of information gaining a deeper and more comprehensive understanding of the case study at hand (Carter et al., 2014). The interviews sought to enhance the understanding of the themes covered during the surveys regarding non-migration aspiration, their use of resources, knowledge of the environmental changes and gender aspects within their household and livelihoods. The interview participants lived in one of the villages of the study area. They were selected randomly through different recruitment strategies, mainly the snowballing technique performed after the first interview in each village. By doing so, certain 'hard to reach' participants were interviewed, especially when it referred to women, which was very helpful (Hennick et al., 2020). The qualitative methods (e.g., Khalil & Jacobs, 2020; Rashid, 2013) allow the exploration of more complex issues and are more helpful in identifying and characterising people's perspectives, behaviours and realities or giving voice to marginalised groups, among other reasons (Hennink et al., 2020).

During the interviews, the help of research assistants' acquaintance with the field was required due to the language barriers and their knowledge of the field. On the other hand, several experts from Khulna University were interviewed together with the different actors listed in the table below. These interviews were conducted to document the main narratives regarding the topic at hand by the different actors, which helped to highlight the mismatches between them regarding their interests and objectives in the field and their relationships with the community (Young et al., 2018). Together with the interviews, during all the field research, I engaged in ethnographic observation and documented it in field notes and photographs, some of them presented in the thesis. I engaged in it during my time in Bangladesh to grasp the national sociocultural context, and further during the field visits and throughout the realisation of the interviews to deepen the understanding of the participant's daily lives,

the community dynamics within them and with me, and behaviour of the participants subjected to the religious and sociocultural norms present in the area (Shah, 2017; Tannenbaum & Spradley, 1980).

Quantitative method

Household survey methodology was chosen to statistically analyse the different livelihood and gender indicators that influence women's migration aspirations (Khatun et al., 2022; Mishi et al., 2020; Salam & Bauer, 2020). The approach of only including women in the sample follows that of previous studies like Hadi, 2001; Patel & Giri, 2019 and Rashid, 2013. It allowed me to analyse a wider array of variables and reach more participants, more representative of the population. For the collection of the survey responses, several assistants from local organisations were recruited, accounting for the language barrier and due to their high knowledge of the study area and their people. The questionnaire focused on socio-demographic information about the individual (e.g. education, marital status), general household conditions and characteristics (e.g. construction material, income, drinking water source), livelihood capitals (e.g. economic, social), gender aspects (e.g. agency, decision-making), livelihood strategies (e.g. migration, occupation, work with NGO), and relationship with the Sundarbans (e.g. collection of resources, conservation attitudes).

The survey (See Appendix 2 for the questionnaire) was designed and developed through the KoboToolbox/Collect open-source software platform for data collection, management and visualisation, widely used by various fields, such as humanitarian aid, research and development (e.g. Ahmed et al., 2020; Dauenhauer et al., 2018; Lakshminarasimhappa, 2021; Nampa et al., 2020). The tool was developed by the Harvard Humanitarian Initiative (KoboToolbox, n.d) and allowed the collection of the survey responses by the assistants by using Android Smartphones offline, which further uploaded the responses to the platform, allowing the constant check of potential problems or misunderstandings during the data collection process. This novel approach is a project-based platform and it was selected due to the web-based form builder and the key feature of collecting the data offline. Likewise, it is highly intuitive and does not require high technical skills (Bokonda et al., 2020). It allowed the survey to be in English and Bengali to facilitate the mutual understanding between the researcher, the assistants, and the participants. The survey responses were checked and exported in Excel and CSV for data analysis.

To determine the number of households needed for the sample, I employed the Probability Proportional to Size (PPS) method for a confidence level of 95% confidence and 7% margin of error, with a total of 150 households surveyed. I divided the sample into two subgroups (stratified sampling) corresponding to the two selected villages, yet the analysis did not intend to compare them. For each village, the survey collection followed a random sampling due to the lack of available municipality data to conduct it otherwise. The data collection was conducted on different days and at different times of the day to account for the possible absence of women who were collecting resources, which is also dependent on the tides.

Table 1 Summary of methods employed

METHODOLOGY	Research questions	PARTICIPANTS	DESCRIPTION
Quantitative			
Household (HH) survey* ¹ (n= 82 questions)	All	N=150 HH <ul style="list-style-type: none"> N= 87 HH in Munshiganj Village (Munshiganj Union) N= 63 HH in Buri Goalini Village (Buri Goalini Union) 	<ul style="list-style-type: none"> The household survey was conducted by several assistants acquainted with the field area. The survey was conducted using Kobo Toolbox for Android. The households were selected randomly, and only one woman in the household was asked to complete the survey.
Qualitative			
Semi-structured interviews* ²	1.1, 1.2, 1.3	N=12 interviews	<ul style="list-style-type: none"> Eight females: four from Buri Goalini and four from Munshiganj Four males: two from Buri Goalini and three from Munshiganj The interviews were conducted in the household of the participants or the house of their acquaintance. The participants were chosen with certain criteria (age, marriage status, education level) to try to capture diverse information. The age span of the participants goes between 24 and 62 (M=40) to understand different perspectives based on the age.
Expert interviews (informal interviews) * ³	1.1, 1.2	N=5	<ul style="list-style-type: none"> Informal interviews were conducted with five expert professors from Khulna University to understand the context. They belong to different departments hence acquiring different perspectives on the topic.
Stakeholder interviews (semi-structured* ⁴ and informal)	1.1, 1.2	N=5	<ul style="list-style-type: none"> Several stakeholders present in the field of study were interviewed to understand their work in the field or their role in the functioning of the SES. NGOs: Solidaridad Network (informal), GIZ (semi-structured), Centre for Natural Resources Studies (CNRS)-<i>Protibesh Project-USAID</i> (informal). Assistant Conservator of Forest (ACF)*⁵ representing the Forest

	<p>Department for the Sundarbans Range of Shatkira (semi-structured).</p> <ul style="list-style-type: none"> • Soft shell crab business representative: informal interview with the owners of Aquamax which has been present in the study area since 2015.
Field observations	<ul style="list-style-type: none"> • Preliminary fieldwork in Chadpai Range • Fieldwork in Shatkira range, both in the villages of study and other areas

Literature review

**Note 1, 2, 3 and 4: The survey, the interview guides, the interviewees and the experts' descriptions can be found in the appendix*

**Note 5: The respondent only gave consent to transcribe the interview for analysis purposes, hence the transcription is not publicly available*

3.2.2 *Reflection on methodological limitations, ethics, and positionality*

Methodological limitations

The chosen methodology for the empirical research brought forth several advantages, albeit accompanied by certain limitations to be considered. In particular, implementing in-depth interviews proved instrumental in offering participants the space to share unforeseen insights, thereby mitigating assumptions in interpreting quantitative data. However, it is important to acknowledge the potential drawbacks regarding the language barrier and the reliance on interpretation during interviews, which could have inadvertently created a distance between the researcher and participants. It might have led to the loss of information and mutual understanding. The interviews, however, helped to provide a deeper comprehension than relying solely on survey data.

A limitation of the survey questionnaire lies in the lack of distinction in the voluntariness of the migration consideration and did not specifically attend to the capabilities. However, this underscores the necessity for future research to delve into these dimensions within the theme of the current study. Additionally, excluding men in the survey sample did not allow for exploring differences with men as commonly done. Nevertheless, it was intentionally based on research needs and theoretical considerations. This approach was driven by the goal of understanding women as a heterogeneous group with diverse livelihood strategies with intersectional dynamics (Huynh & Resurrección, 2014), a perspective sometimes lacking in studies on climate change and gender (Djoudi et al., 2016).

Although half of the survey sample identified with the Hindu religion, the parallel execution of both methods prevented a proportional representation of Hindu participants, leading to an oversight in capturing the religious ratio in the interviews. Furthermore, several factors influencing the relationship with the Sundarbans and the conservation figures, such as the corruption, bribery schemes or piracy existing in the area as previously documented, were not adequately addressed. However, the absence of ecotourism and co-management projects in the area emphasises the critical need to investigate this community's livelihood and socioenvironmental struggles, avoiding the perpetuation of potential marginalisation in research and external interventions.

Moving forward, further research should consider applying focus group discussion, both with women-only groups and mix-gender groups, to delve deeper into gender dynamics, potential shifts in socio-

cultural norms, and the individual and collective knowledge in relationship with the Sundarbans. This extended approach will contribute to a more nuanced understanding of the complex interplay between climate change, gender dynamics, and social-ecological realities in the southwest Sundarbans region.

Ethical considerations

Regarding the ethical considerations (Hennick et al., 2020), following the Netherlands Code of Conduct for Research Integrity and Utrecht University's regulations, a consent form (Appendix 1) was read to the participants, including the information about the project, and the request for consent to record and transcribe the interviews, prior to the completion of the surveys and the interviews. All the participants gave verbal consent. Likewise, the faces of men and women appearing in the pictures throughout the thesis were previously asked for consent, and when denied or absent, their faces were not clearly included in the pictures. All the interviews were anonymised, and no compensation was provided to the participants who voluntarily contributed to the research.

Positionality

Furthermore, as a qualitative researcher, I engaged in the reflection, positionality, and assumptions of the methodologies and how they evolve during the research process (Corlett & Mavin, 2018). It was key “to recognise how the mindsets, attitudes and biases of the researcher (*myself*) and participants were pertinent to what was uncovered and valued in the process” (Biggs et al., 2021, p.217). Concerning the interviews, to follow the local protocol and cultural setting, a male assistant accompanied my assistant and me during all the interviews, keeping our distance and allowing us freedom of work with the participants. My interpretation assistant was a female to create a safer space when conducting the interviews with women, especially inside the households. I intended to dress according to social norms in the interviews and ethnographic observation in the field.

However, the ethnographic process and the overall research are not without biases derived from my positionality and embodied subjectivity as a white Western European researcher. These had to be constantly addressed and reflected upon to minimise their influence on the fieldwork dynamics and interpretation of findings. I was raised in a low religious sociocultural background influenced by progressive and (western) feminist ideologies, which shaped my worldviews and had an influence on the way I handle the experiences in the field, especially regarding the sociocultural context in which women in this rural area are raised in (Berger, 2013). It especially had an influence on the way I initially interpreted the gender dimensions, such as the power relationship between men and women, or my encounter with realities such as child marriage or men telling the women participants to cover their heads while talking with me. Living for two months in Bangladesh together with Bengali people not involved in the research allowed me to share my perspectives and experiences in the field with them. It further helped me to understand the sociocultural setting that women inhabit, reduce the biases of my research, and develop a more comprehensive approach with the local dwellers during the data collection and analysis process.

Concerning interpersonal reflectivity (Hesse-Biber & Leavy, 2005), I had to be aware that the participants in the study area are often visited by NGOs, which provide them with assistance. Hence, my position as an independent researcher had to be clarified several times to avoid misunderstandings concerning my purposes and biases regarding their vulnerability. Still, this dynamic sometimes led to contradictory information during the interviews regarding the actual help they received from these NGOs and their needs. Moreover, the participation in the interviews of one woman who is highly

connected with NGOs that further acted proactively as the gatekeeper looking for more participants raised tensions among the people receiving less assistance than her when seeing us with her. Several men also questioned us why we talked with women about the forest, yet did not interfere any time in the interviews. Since few researchers such as my own (white western female) come to this area, I was perceived with high levels of curiosity, and the local people expressed their willingness to talk and share spaces with me, making me aware of my positionality when entering the community.

3.2.3 Data analysis

Firstly, the interviews were translated from Bengali to English, retaining the style and colloquial language as much as possible, and then transcribed. They were uploaded and processed with the NVivo software. In order to develop the codes, inductive and deductive strategies were employed, refining them while analysing the interviews. The deductive codes were derived from the main topics covered in the survey, derived from the literature and theory. The inductive ones were identified for emerging topics like the perception of the environment and socio-environmental struggles or the (in)voluntariness behind the (non)migration aspirations. The codebook and code tree can be found in Appendix 6.

Statistical analysis

Afterwards, for the analysis and visualisation of the quantitative data, I employed the statistical R software found in the ‘comprehensive R archive network’ (CRAN) (De Micheaux et al., 2013). Then I employed Excel to present the main tables results. Firstly, I conducted a general descriptive statistical analysis for all the variables (numerical, categorical, integer) in the survey and selected the relevant information to present in the results. I then selected the binary (yes/no) variable called ‘migration consideration’ as the dependent variable for the subsequent steps. The question asked was: *Have you considered migration as a livelihood strategy for the future?*

To answer the *sub-question 1.2*, I selected the independent variables representing the livelihood capital indicators and explored whether there was a correlation with the dependent variable. For the categorical variables, I employed the Chi-square test of independence between the *yes* and *no* groups to check whether there was a statistically significant difference (correlation). Besides, I used the Fisher’s Exact Test for some of the variables to obtain the odds ratio of that correlation. For the numerical variables, the *t-test* testing tool was employed, aiming to find the statistical mean difference between the group that did not aspire to migrate and the one that did for factors such as the monthly income. All the significance levels were set at the 5% level.

To answer *sub-question 1.3* and the overarching question, I further carried out a Binary Logistic Regression, following part of the methodology employed by Khatun et al. (2022), Mallick et al. (2020) and Manjur et al. (2014). The binary logistic regression model aimed to account for the influence of the selected predictors and control variables on the likelihood of migration, i.e., the dependent variable with a binary outcome of whether the woman aspires to migrate or not. The model (see equation for logistic model below) assessed the log of odds of the outcome variable for each of the explanatory/predicting variable levels compared to the reference level.

$$\log \left(\frac{p}{1-p} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

Where:

p = is the probability of considering migration (outcome 1, against not considering it, 0)

$\text{Log} \frac{p}{1-p}$ = log of the odds ratio of considering migration

β_0 = intercept

β_x = coefficient representing the change (increase if >0 , decrease if <0) in the odd ratio of considering migration for one unit change in the predictor variable when the rest variables are constant.

* $\text{Exp}(\beta_x)$ = exponentiated odd ratio representing the factor by which the odd change for one-unit increase in the predictor

X_x = each of the variables

Several explanatory variables were initially considered, yet some presented multicollinearity; hence, only three explanatory variables and two control variables were selected. To assess the multicollinearity of the selected variables, I employed the Variance Inflation Factor (VIF), and the values for the combination of each variable were always below 5, hence considered acceptable. I also employed the Cramer's V to measure the level of association, which also resulted very low. The variables were chosen based on the correlation identified in the previous statistical steps and their relevance to addressing the non-migration aspirations of women in their relationship with the SMF from an intersectional lens. The explanatory variables were the mean monthly income of the household, the collection of resources from the forest (yes/no), and the level of asset control within the household. The control variables were the religion of the respondent and the gender composition of the household (number of women).

I developed 11 logistic models combining the variables differently, the last being the 'Full Model' with all the variables. I did so to understand not only the influence of the variables in the odds of migration but also how the joint effect of the different variables leads to interactions that modify their individual contribution. Applying the intersectional lens was vital to consider and unravel these influences among variables and their impact on non-migration, sometimes overlooked when studying the livelihood of women in resource-dependent communities. These models were analysed through a contextual understanding provided by the qualitative data, providing a more comprehensive interpretation of the findings.

4. RESULTS

4.1 Women and the Sundarbans Mangrove Forest in Buri Goalini and Munshiganj

4.1.1 Sociodemographic characteristic of the sample

Table 2 displays the socioeconomic characteristics of the survey respondents in this study. The sample was almost equally divided into the two adjacent villages of Buri Goalini and Munshiganj. The most common age group was the middle-aged one between 26 and 45 years old (67.3%), and the average education level was between levels 3 and 4, not reaching the minimum compulsory level in Bangladesh of level 8 (Badruzzaman & Mian, 2015). A standard deviation of almost the same average exists, yet low schooling or illiteracy levels exist. The low education level was also reflected during the semi-structured interviews, where seven of the 12 interviewees (including males) were illiterate regardless of age. More than half of the respondents followed the Hindu religion (55.3%) and Islam (40.7%). Most of the women (93%) were married and were the wife of the head of the household.

Regarding the women whose husbands left them behind, 9.3% answered affirmatively. Concerning their primary occupation, 82% of women claimed to be housewives, followed by 11% of resource collectors. However, 70% of the participants also performed one additional occupation or more, mainly 'other', which could be attributed to activities like poultry raising or gardening, as demonstrated during the interviews. Almost 9% also said to collect resources as an additional occupation. Interestingly, results show that nearly 94% of them collected fuelwood for cooking, and 44% said to collect resources, showing that they might not always perceive this activity as an occupation as it is related to the daily life task of cooking. The results of these occupations or livelihood activities show more detail on how resourceful women in this area are, even though they are sometimes seen as solely housewives or unable to diversify their options.

Table 2 Sociodemographic characteristic of sample. Source: Survey

Survey Sample			Gender=female N=150		
<i>Individual</i>	<i>Percentage (%)*</i>	<i>Value(SD)* [Min-Max]</i>	<i>Household characteristics</i>	<i>Percentage (%)*</i>	<i>Value(SD)*[Min-Max]</i>
Age			Roof		
Between 18-25	5.3		Brick	0.7	
Between 26-45	67.3		Goalpata	7.3	
Between 45-65	27.3		Other	13.3	
Education level**		3.46 (\pm 2.83) [0-10]	Tin	78.7	
Religion			Wall		
Hindu	55.3		Bamboo	4	
Islam	40.7		Brick	1.3	
Other	4		Mud	12	
Marital status			Other	13.3	
Divorced/separated	1.3		Tin	49.3	
Married	92.7		Wood	20	
Widowed	6		Drinking water source		
Relationship with household head			Other	49.3	
Daughter	0.7		Pond/river	23.3	
Head	5.3		Supply water	10	
Spouse of son	1.3		Tube well	17.3	
Wife	92.7		Type of cooking source (multiple choice)		
Lives with husband			Electric	0	
Yes	90.7		Gas	2	
No (<i>left-behind</i>)	9.3		Concrete Stove	0.7	
Main occupation			Traditional mud stove	99.3	
Business	0.7		Steel	0	
Handicraft	1.3		Number of household members		4,6 (\pm 1.26) [2-8]
Housewife	82		Monthly income (BDT)		6,777 (\pm 3,183) [1,500-20,000]
Other	5.3		Received Remittances	33	
Resource collector	10.7				

Additional occupation type (multiple choice)***	
Business	1.3
Crab farm	2
<i>Crab farm + Resource collector</i>	1.3
Farmer	0.7
Handicraft	6
<i>Handicraft+ Resource collector</i>	1.3
Other	47.3
<i>Other +Resource collector</i>	1.3
Resource collector	8.7
Village	
Buri Goalini	42
Munshiganj	58
Years in the village	21.76 (\pm 10.8) [4-57]

*Where applicable

**Primary level (class 1–8), Secondary level (class 9–12), compulsory until class 8

***70% (N=105) of the women claimed to have an additional occupation

Regarding the household characteristics, almost 78% have a tin roof and 49% tin wall, which is also the type of house materials employed in the houses provided by the government post-disaster, as seen during the fieldwork and the interviews. The drinking water sources change during the year seasons. However, as the main source, almost half of the women respond 'other', which was later understood to be collected rainwater via the drums given by NGOs (Fig. 6). It was followed by 23% of women drinking water from ponds or rivers, generally affected by salinity and other pollution issues. Almost all respondents used the traditional mud stove for cooking, which needs fuelwood to work, demonstrating the high dependency on this resource for daily household activities. The average household size is 4.6 members, slightly higher than the national average of 4 (BBS, 2022). Finally, the average monthly income is 6,777 (BDT), with a slightly high standard deviation demonstrating inequality between the respondents. When asked about remittances, a factor widely studied in migration studies, 33% of the respondents answered affirmatively. Moreover, the participants' high level of loan borrowing must be considered.



Figure 6. Left: Water drum for rainwater collection provided by an NGO. Right: pond of water of one interviewed women

The characteristics of the sample concerning the level of decision-making at an individual and household level were mainly moderate to low within the different factors. At a household level, the perceived level for most women was ‘moderate’ for the decision on meal distribution (63.3%), children's education (56%), and economic expenditure (64.7%). Likewise, for most women (68.7%), the male head decided how to use the natural resources, followed by 24.7% decided jointly by both. The perceived level of control by the women in the sample regarding their livelihood strategies was for almost half of them (48%) ‘little’, a second level above ‘no control’-, followed by ‘neutral’ (26.7%) and ‘some control’ (22%). These findings illustrate the underlying gender norms and power dynamics within which women cultivate their livelihoods and negotiate the patriarchal context in which they reside.

4.1.2 Women's use of natural resources in a changing SES

During the interviews and within the survey, questions about their interaction with the environment and the perceived environmental changes were asked. The questions considered the last five years, when several cyclones impacted the area and a new access ban scheme was implemented for the SMF. These considerations aim to understand how the increase in post-cyclone vulnerability and the ban affect their collection. Likewise, it supports the idea that a combination of multiple factors affects the changes in household income or potential livelihood alternatives.

When addressing if the respondent was collecting more resources now than five years ago, 45% answered affirmatively. This result could be attributed to the increase of women going out of the household work to the river and the forest, as reported by one participant when asked about this issue, "now goes more people. Earlier only men went and now both men and women go. Chopping wood, catching fish". In this regard, we could not affirm that there is a generalised increase in the collection of resources in the community, as this factor is only studied among women. However, some respondents and experts attributed this change in dynamics, on the one hand, to the impoverishment of the households and the need for another source of income. On the other hand, some women whose husbands had become ill or left them behind also had to take over this livelihood activity, as they also often lacked the skills or knowledge to perform other non-forest-dependent activities. Figure 7 displays the type of resources women collect in the forest and the river, together with the percentage of women

processing resources and having access to the market. Some women collect only one type, whereas others collect a diversity of them.

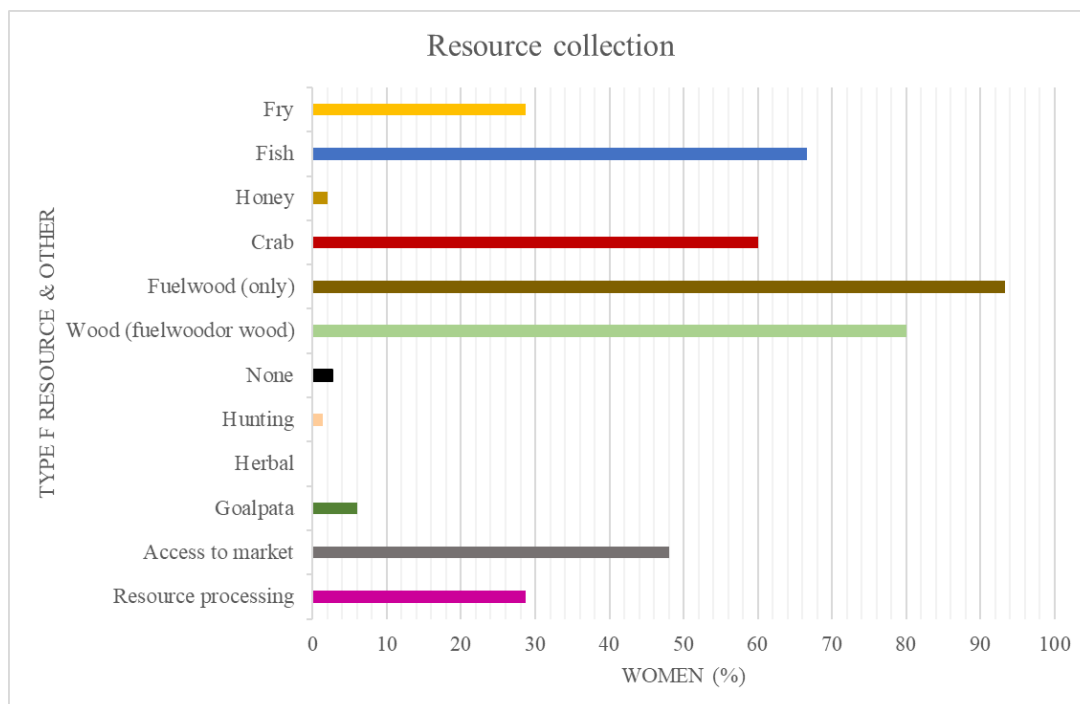


Figure 7. Types of resources collected by the women in the survey sample. Some women collected more than one resource, hence it is presented as the % of women that collect each type of resource.

Almost all the women in the sample collected fuelwood, generally used for household activities like cooking, mostly performed by women. This fuelwood is constituted by different parts of the mangrove species such as the fruits, leaves, limbs or the seedlings (Fig. 8). The regeneration and growth of the mangrove species density depends on the seedling process as described by the report GoB (2019). Therefore to perform effective regeneration and conservation plans, it is crucial to attend and understand how and which species women collect for their household chores and find ways that consider both the livelihood needs and conservation aspiration. A high number of women collected fish (67%) and crab (60%), both products generally sourced for income generation. The latter also highly connected with the aquaculture sector of the soft-shell crab business, as highlighted during the empirical data collection. Collection of fries (small fishes and prawns) is also common among the sample, with 30% of women collecting them. Interestingly, almost 30% of women were also engaged in the processing of resources, generally overlooked when attending the livelihood options, as it does not have a direct economic compensation to them.



Figure 8. Fuelwood collection. 1: Old woman collected fuelwood. 2: Woman showing her kitchen powered by different types of wood. 3: Women carrying the collected fuelwood through the street. 4: Mangrove seedling and limbs drying out in the street. 5: Mangrove seed

For instance, Figure 9 (left) shows a woman processing the seeds of the Gewa tree (*Excocaria agallocha*) which are used to feed the cattle. Nevertheless, the processed products could serve as an income generation activity, as some of them shared during the fieldwork, highlighting the need to work on the linkages between women and the market. One example is the production of pickle (seasonal product) made with the fruits (Fig. 9, right) from different species like the Kewra tree (*Sonneratia apetala*). One woman shared that she collected these fruits with two other women with whom she shared the profit by selling this pickle to the market or NGOs. The Kewra season takes place during the monsoon months (July-September), matching with months the Government has implemented the total ban on the forest, potentially affecting this collection or resulting in ‘illegal’ collection if entering the forest. Interestingly, this woman was also engaged in tailoring yet could not sell this product into the market. A total of 48% of the women respondents had access to the market, a relatively high number considering the social notion that women stay home.



Figure 9. Left: Old women processing the seeds of Gewa (*Excocharia agallocha*) used to feed cattle. Right: Seeds from Kewra tree (*Sonneratia apetala*) used to make pickle

When considering if the restrictions affected their occupation, only 25% answered that they did. This result needs to be analysed together with the proportion of women collecting resources from the forest (43%) or the river (91%), which are the ones directly impacted by this restriction at an individual level. In contrast, they also performed activities like resource collection, poultry raising or handicrafts, among others. This number shows that they might not be affected as much because they are not following the ban entirely and are now collecting more. On the other hand, the increase in collection from the forest can imply an increase in the dependency on the forest by the households, which could also increase the long-term vulnerability of the households and the women.

"After the storm, I go more to the forest.[...]The houses were all destroyed in the storm, the people of the house got sick, so we went to the forest more."- Woman Munshiganj

The income from the forest can also display insights into the dependency on the forest and vulnerability to environmental hazards affecting this livelihood from forest resource extraction. In the last five years, for 83% of the respondents, the income from the forest had decreased. This result, however, does not imply that the increase is coming from other sources, but instead could show how the shift to an increase of forest resource collection is not increasing income due to the higher number of people extracting.

"I could collect earlier. Now there are more widows, so less is collected. Besides, the forest is closed for five or six months, so I cannot collect it."-Woman Munshiganj

The research also wanted to grasp how women (and men during the interviews) perceive environmental changes and how they feel affected to understand the contextual environmental vulnerability. Regarding the perception of changes in the rain, flooding or heat, 80% answered that they did perceive some of them, which was also shared during the interviews:

"The temperature is changing; the weather is changing. Through these temperature changes and weather changes we understand that the climate is changing now."-Woman 50 years old, Buri Goalini

"Five years ago, it was less hot now it is hotter. Now the temperature is very high. [Extra Person]Now the environment is bad."- Woman 56 years old, Buri Goalini

The conversations with the experts and the literature showed how salinity had become the major environmental stressor in the area due to several factors, but especially after the *Aila* and *Sidr*, together with the aquaculture impacts on the soil. One old woman reported: "When we were young, there was no salinity in this area, the soil was sweet, and we used to cultivate a lot of paddies. [...] Back then we used to cultivate crops twice a year. I used to cultivate paddy twice a year."

Overall, a high proportion of women were collecting different types of resources, inside and outside the forest, for household chores like fuelwood and for income generation like crab and fish. However, restrictions were disrupting their collection and the income from the forest was decreasing, while non-extraction activities like agriculture continued to be affected by the increasing salinity and recurrent cyclones. Access to the market and recognition of activities like resource processing seemed to require attention from social actors like NGO.

4.2 Social interventions, Livelihood Capitals, and Non-migration

4.2.1 Social actors' interventions in the community and with women

A variety of social actors present in the area influence the interaction between the community and the environment, which cannot be overlooked when addressing the livelihood strategies chosen by the dwellers, especially when applying a gender perspective. The social system was explored locally, within the political boundaries of the two villages, focusing specifically on the interventions affecting the study area yet acknowledging the interactions with regional and global actors. Figure 10 summarises the main actors identified in the social subsystem shaping the access and dependency on the Sundarbans resources, enhancing or hindering the livelihood strategies options, and affecting the gender dynamics in the area. The actors that were interviewed are highlighted in orange. The NGOs considered were working in the study area, like the Centre for Natural Resources Studies (CNRS), but also working at different levels of interventions, like the German Development Cooperation Agency (GIZ). The aquaculture sector represents the leading private sector actor.

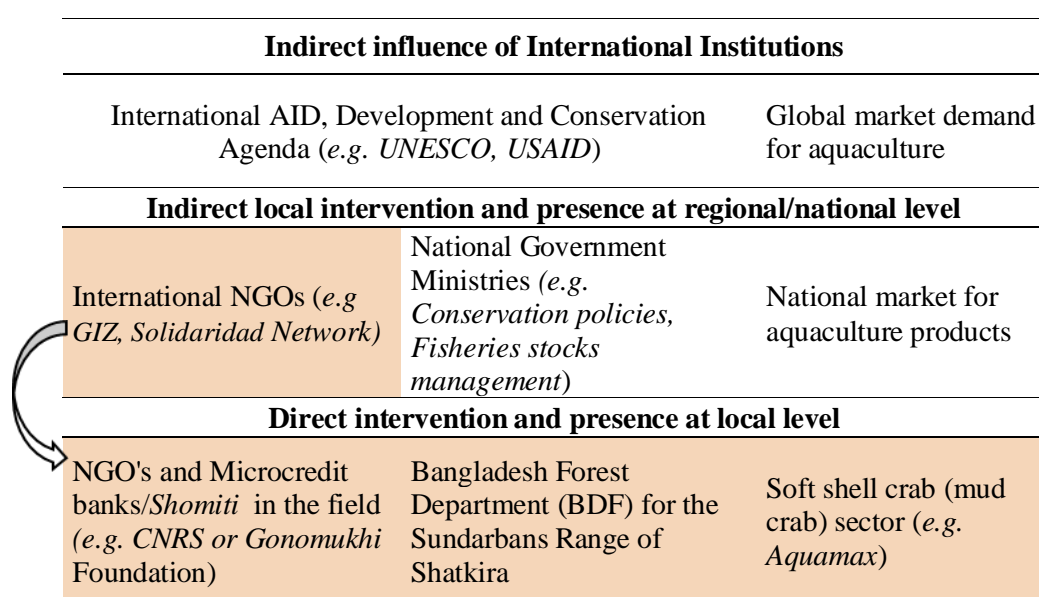


Figure 10. Summary actors identified in the study area

Aquaculture - Crab farming

The aquaculture sector has historically been present in Bangladesh (Rahmad et al., 2020), focusing on shrimp farming in the coastal areas. This sector has brought livelihood opportunities but also has contributed to the salinity of the area, one of the leading environmental problems suffered by the communities in the study area, as expressed by some of the KU experts. However, this business has not fulfilled the expected potential due to diseases, remoteness, and lack of modern pond infrastructure (Jahan & Islam, 2016). In detriment of it, the soft-shell crab or mud crab (*Scylla serrata*) business, a new aquaculture business, is growing exponentially in the area, as observed during the field visits (Fig.11), with a high focus on the international market. One of the leading companies working in the area since 2015 (when this business started) was informally interviewed during the research further to understand the development of this sector in the area and, if so, how it is influencing the livelihood opportunities in the area. Likewise, the topic was explored with the interviewees. This sector appears to employ directly (especially women) and indirectly people in the community, and it directly depends on the mangrove forest for the crabs, which are collected by the community and sold afterwards to the companies or farmers, where they continue the farming and processing of the crabs. Opinions differed on whether it benefits the community or not, as one participant shared, *“It is good for some and not for others. Some of the people gain and some lose.”*



Figure 11. Women working in the soft shell mud crab company (Aquamax) farm.

Their presence in the area also presented an opportunity to witness changes in the region, for instance, observing an increase in husbands letting their wives work in the last 8 years. Likewise, they observed an increase in the influx of people from the urban areas looking for job opportunities. Notwithstanding, even though they appear to be a potential livelihood opportunity, from a conservation standpoint, the potential impact both on the community (due to the increase of salinity) and the mangrove (due to overexploitation of one crab hatcheries) should not be overlooked, if the expansion of this business continues.

NGO interventions

Local and internal NGOs in coastal Bangladesh follow a long history of interventions (Eriksen et al., 2021; Khalil & Jacobs, 2021), with a diverse range of focus like post-disaster relief, training and capacity building livelihood diversification, or environmental awareness. The expert interviews and fieldwork revealed that the NGO's financial and asset-based assistance is especially higher in the aftermath of natural disasters like cyclones when international AID funds increase.

There have been (and are ongoing) regular interventions for promoting environmental awareness, conservation of the mangrove forest, and diminishing illegal extraction practices. They aim to reduce the resource extraction and illegal practices in the SMF and the river by the people in the community. The NGOs developing these programmes, such as the Protibesh project conducted by the CNRS and funded by the USAID, claimed to promote a gender approach intervention. However, these talks are mainly directed at women, who paradoxically are the ones who extract fewer resources in comparison with their male counterparts. The interviewed NGOs expressed that working with women will transfer their knowledge and conservation concerns to their husbands.

“Women want the forest to be better. And it is very easy to convince women about all these things but men usually do not want to keep the forest well and it is difficult to convince men about these things. Men are destroying more forests.” -CNRS

The survey included several questions about the respondents' involvement or attendance in conservation programmes or the mangrove restoration project and their trust in this type of intervention. It also included questions about their perception of the importance of the Sundarbans for their livelihood and the consequences of the extraction on the Sundarbans' future. A minority of women (11%) indicated they had been involved in these awareness programmes, yet 37% of the women in the interviewed households had access to conservation information. Almost 80% of the women had a 'moderate' trust in this programme, with 11% having a high trust in it. When the participants were asked *how important it was for them to preserve the Sundarbans*, there was also a general majority of women considering the conservation of the SMF as very important (29%), fairly important (24%) and important (45%). Moreover, when asked in the survey *if the Sundarbans will disappear if the way of collecting resources from Sundarbans continues*, 74% answered affirmatively.

These results suggest that these programmes influenced women's environmental concerns.

“Sundarbans is very important for us. Without this forest, we would have drowned in storms and floods and all our houses would have been destroyed. We get oxygen from plants, if that oxygen did not come from this Sundarbans, we would not survive.” -Woman of Buri Goalini

However, the narratives and discourses on conservation are based on Western epistemologies, as demonstrated when asked about the topic during the interviews, when one woman reported *how climate change is happening now and how waters are rising*. These programmes overlook the women's understanding of the environment and fail to explore the complexity of the human-nature relationship in this context. An example is the misunderstanding of the relationship between resource extraction and climate change, echoed by one of the participants: *“Yes, I understand that earlier we used to cut the trees of Sundarbans so natural calamities would have hit more. And now we go less, so the storm is less”*. Likewise, the establishment of this body of knowledge hinders the engagement of local perceptions of the effects of climate change on their lives, which could highly improve resource management and adaptation strategies. The Forest Department commented on how the honey

collectors are perceiving changes in the honey availability, which is shifting and not matching with the official open season. The NGOs are not focusing on these local relationships between the resource users (mainly men) and the environmental changes.

On the other hand, NGOs in the field have been involving some women in training aiming at livelihood diversification and promoting empowerment among them, especially *after cyclone Ayla, when more men allowed their wives to participate to cope with the high vulnerability of the household* (CNRS interview). Among the survey respondents, 32% claimed to have been involved in some training by the NGO in the last 10 years (Fig. 12), generally related to poultry raising, vegetable cropping, handicrafts or climate change adaptation. Notwithstanding, only 43% of them continued the activity learned in those training. This result raised questions on the real impact of these programmes and their objectives on livelihood diversification and capacity building, which was highlighted by several of the interviewed experts from Khulna University.



Figure 12. Left: Woman showing her crop garden. She became a resource collector after her husband got ill. She got training in various skills from NGOs, yet she did not continue all of them. Before, she was only a housewife. Still her husband takes all the decisions. Right: A left-behind woman's handcraft workshop. She felt self-sufficient and empowered since her husband left. She wanted to stay put.

Concerns were raised about how these NGOs are not impacting women's livelihood, for instance, by not focusing on an integral plan on education, the real basis for livelihood diversification (experts interviews). On the other hand, these training or environmental awareness meetings and programmes are facilitating safe spaces for women to discuss other social issues like early marriage and child marriage (GIZ interview), one of the factors impeding girls' education in the region (UNICEF, 2023).

The access to these programmes seems unequal among the community, as the survey and the interviews suggested. Opposing experiences were shared with some respondents receiving a high diversity of training by different NGOs and others not receiving any help or training as they claimed. The comments below illustrate this reality, supported by the social tensions observed when conducting the fieldwork interviews between one woman highly connected with several NGOs and other individuals around the village who feel left behind from these programmes and perceived this inequality unfair.

"I worked with Sushilan, worked with Keran, worked with CCTV, CRNS. Since 2007. [I got] training on climate change adaptation. I have received training from the NGO, now I do not even go myself [into the Sundarbans] and convince everyone around so that they also do not go to the Sundarbans without harming the Sundarbans."-Woman Buri Goalini

*"No, they see the condition of the houses, the poor, but they don't notice. No one goes from one place to another. No one gives a damn because we don't want anything from them. No one appreciates being poor.[...] I am willing to go [to a training if it is announced]-
Woman in Munshiganj*

A recurrent theme in the interviews was a sense amongst interviewees that NGOs also provided access to credit via loans or microcredits and other non-financial material resources like water drums for rainwater collection. This financial and material help is primarily given in times of hardship and post-disaster moments, resulting in a perceived dependency on the help from these NGOs to reduce their vulnerability and for adaptation dedication-making processes like non-migration. The constant intervention and presence of NGOs presumably led to contradictory information given during the interviews concerning the respondents' state of vulnerability or the actual help they received, with all the respondents expressing that not enough help was given to them, regardless of their participation in training or acquisition of other resources.

"On the other hand, the NGO does not work in any way and does not give us any help or cooperation. If I don't get it, how can others get it? I got only one job and got that house. [extra person] Why don't others get it because you don't get it? Be satisfied with what you have got." Woman Buri Goalini

SMF resource use and management

To better understand the main management policies implemented in the SMF that directly affect the local communities, literature and reports on the topic were reviewed together with interviews held with the BDF and the GIZ. This research focused on the latest management plans and restrictions involving the community or directly affecting their livelihood.

The management, conversion, and conservation of the SMF have been characterised by a paradigm shift in the last 240 years, with four main periods described by Hossain et al. (2021), divided into the "conversion for agriculture from 1780 to 1875; timber production for revenue and control for theft 1876 to 1951; inventory based management 1952 to 1992; and integrated management & co-management, and project-based overlapping management 1993-2020" (ibid. p.1). This research focused on the last and ongoing management paradigm, during which several projects have been implemented employing national and international funding. During these last decades, the SMF has gone through a process of degradation despite the forest policies, management plans, and laws enacted, primarily due to the poor implementation capacity, as described by Iftekhar & Islam (2023). Likewise, the dichotomies between the forest conservation policies (mainly the *Forest Act* in 1927 and *Forest*

Policy in 1994), shrimp farm industry policies (primarily the *National Shrimp Policy* in 2014) that rely on the resources for the national economy yet did not account for the dynamics of the ecosystem and the ways dwellers use the resources. Therefore, this mismatch has become a threat to the long-term functionality of the mangrove forest and potentially a social trap (Ishtiaque & Chhetri, 2016). Moreover, the new and increasing challenges to livelihoods resulting from the intensification of the environmental degradation processes often occur in gendered ways (Emlhirst, 2015), as shown by Roy (2019) or Sultana (2011).

'Co-management of the Sundarbans Mangrove Forests for Biodiversity Conservation and Increased Adaptation to Climate Change Project (SMP) (2010-2020)'. (GIZ)

Regarding the latest plans implemented in the SMF, the GIZ was essential in collaborating with and supporting the Bangladesh Government. They have worked on and supported implementing the plan towards the 'Co-management of the Sundarbans Mangrove Forests for Biodiversity Conservation and Increased Adaptation to Climate Change Project (SMP)', which started in 2011 and finished in approximately 2019. This plan aimed to enhance the coordination among the relevant actors, improve the participation of resource users in co-management, and strengthen the capacity of the BDF for the management and conservation of the Sundarbans, with a particular focus on gender (GIZ, 2017). The conversation with the Forest Officer revealed that this plan was not implemented in the study area range. However, they were *currently forming two 'co-management committees' involving the representatives of the villages and consisting of 20-40 members where there are from different Government Offices like fisheries, police, RAB, BGB and so on.*

On the other hand, following the trend in many forest-dependent communities, less-extractive diversification activities like ecotourism are being proposed (Afonso et al., 2021; de Koning et al., 2011; Mallick et al., 2021; Spalding & Parret, 2019). Based on empirical data obtained from field observations and informal discussions with relevant experts, an ongoing comprehensive master plan for ecotourism in the Sundarbans was identified. The GIZ guides the formulation of this pilot project plan. The plan outlines a community-based ecotourism pilot project in the Chatpai Range (Fig. 5), near Mongla Port, with replicable potential in other ranges. The plan aims to shift from predominantly national tourism to international tourism, promoting biodiversity conservation and involving local communities in Protected Areas. The project also aims for capacity-building initiatives targeting local dwellers' involvement as guides, cooks, and artisans, focusing on marketing Sundarbans products, subject to certification. However, several challenges arise, including power holding and power relations with the BDF, insufficient grassroots commitment with the locals by the BDF, poor alternative income opportunities for the impoverished population, and political irregularities affecting co-management structures. The project, however, is developing guidelines, encouraging tour operators to promote environmental awareness, and establishing an information and interpretation centre in Mongla to showcase tourism options and local products. Regarding the study area located in the Shatkira Range, the role of ecotourism is underemphasised despite a changing landscape with an increasing number of so-called eco-cottages. EU investments in ten eco-cottages resulted in only two of them being functional due to a lack of business and sustainable plans, raising concerns about potential overexploitation and failures regarding community involvement.

Restrictions after 2020 (June-July-August)

During the preliminary fieldwork, concerns were expressed among the individuals about the latest three-month total ban on the entry into the forest for fishing, travel, tourism or resource collection from June 1st to August 31st implemented by the Government in the year 2022, a decision that was taken on July 28th of 2020, as described by several newspapers (Siddique, 2022; UNB, 2022). Even though the Government planned to compensate the families during this ban period, the compensation has not reached all the affected families, or they have been very scarce. This ban adds to the normal functioning of the resource collection periods (Fig. 13), which follow each resource's available season, aiming to reduce overexploitation during breeding seasons (See Mallick et al., 2021 for seasonal dependency on the resources).

Although the ban aims to preserve the Sundarbans, "the state has always attempted to conserve forest by taking monopolistic measures and imposing strict regulations" Iftexhar & Islam (2004, p.9). Therefore, the survey, interviews, and experts' interviews delved into how this ban affects the resource collectors and their families, especially women—likewise, seeking the experts' and involved social actors' opinions on the ban and its effects on the community. A prevailing view amongst the experts was that even though the ban aims to preserve the forest, *it is failing to capture the livelihood of local communities as they are finding it difficult to find other options*, resulting in even higher levels of vulnerability among them. To illustrate, 65,3% of the survey respondents felt affected by these restrictions, and only 24% received the food package compensation. Regarding the compensation, the BFD representative commented that *"currently there is no compensation. Now we have to arrange that. The Government will arrange some compensation, like food, and help for them for these three months. It is actually under process. The name of that is some official procedure as we are not the fisheries department, and they are engaged in fishing activities and more like that"*. The implementation process of this total ban has come with criticism by experts suggesting that it has been arbitrary with no consultation with the resource users, co-management organisations, or the scientific community, overlooking the need for a balance between conservation and livelihood of the communities. Moreover, it was suggested by some experts that his ban came to be as a reaction to the UNESCO World Heritage after the remarks given to the Bangladesh Government due to the potential threat of the Rampal Power Plant to the integrity of the SMF (UNESCO, 2016).

"Well, actually any river of Sundarbans, any kind of activity is banned, but actually there are some... If we stop these kind of activities around the boundaries, this kind of thing is inhuman because they can't live. Most of the people are living beyond the poverty line, that's why, they have to live from hand to mouth or, you know... I think you have already visited the field and see their houseworks, and they're very poor, and if you stop it totally, they can't live. That's why. But if we want then we can stop this also. Yeah, but I think besides the boundary it is not much harmful. So the sundarbans as here are preventing them from going inside inside."-BDF

Notably, around 73% of the women agreed with the reasons behind the restrictions, showing a high level of conservation awareness. However, for most women who collected resources, there is no alternative option, and they lack any compensation, so even agreeing with the ban, they continue to collect.

To depict this, the survey and the interviews included two questions on the collection frequency during the permitted and the ban season (Fig. 13), which showed a decrease in the collection during the ban season yet showed that most of them still depend on this livelihood option all year round.

Only 25% of the respondents answered that they never go during the ban months, whereas 33% still go daily and 41% weekly. There is though, a decrease as during the open season 70% of the respondents goes daily and 29% weekly.

Overall, the different actors' interests and interventions impacted women's livelihood and intrahousehold relations by providing diversification trainings, increasing environmental awareness, or providing job opportunities, influencing their capacity and aspiration to stay put. However, simultaneously, the lack of co-management plans, the latest restrictions, lack of structural interventions and insufficient alternatives to resource collection are highly affecting their livelihood, potentially increasing their aspiration to migrate.

4.2.2 Women's livelihood capitals and (non)migration pathways

The dependent variable of this research is the consideration of migration as a livelihood strategy in the near or mid-future. To measure this aspect, I asked, "Have you considered migration as a livelihood strategy for the future?". This question did not discern explicitly between the capability to do so or not, hence intending to capture the overall willingness to migrate. The responses to these questions were: 'yes' and 'no'. Therefore, within the subset of women whose responses indicated a lack of consideration for migration as a viable livelihood option, it is plausible that some of them aspire to migrate but lack the capabilities to do so (e.g. enough capital, relatives elsewhere), making them part of a 'trapped population' or involuntary non-migrants. Of the 150 women who completed the survey, a minority of participants (20%) indicated that they consider migration a future livelihood option. An independent-sample t-test analysis was employed for the numerical variables, and the Chi-squared Test of Independence and Fisher's Exact Test were used for the categorical variables. Table 3 displays the livelihood capitals and some gender aspects correlated with the migration considerations¹ of the respondents.

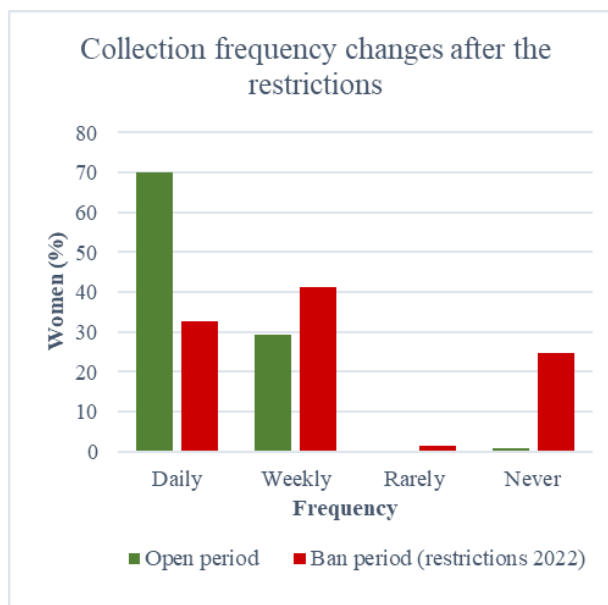


Figure 13. Percentage of women in the survey collecting resources during the open periods and during the ban period implemented in 2022

¹ Attention be paid to the difference between migration *consideration* and migration *aspiration*. When there is a correlation or association with the migration *consideration*, it refers to either staying put or migrating, since not always a more specific result can be explained by the correlation test results. Whereas referring to an association or correlation with a migration *aspiration* it refers to the willingness to out-migrate in the future.

Table 3 Different livelihood capital indicators and their relationship with the migration consideration

Capital	Variables	Question Asked	Measurement	Test Statistics	Level of Analysis	Qualitative Code Quote
Social	<i>Born in village</i>	Were you born in this village?	Binary (Yes/No)	X-squared = 18.381, p-value = 1.808e-05 F test Odds ratio=7.43	Individual	<i>"I was born in this Buri Goalini."- Woman</i>
	<i>Women collaboration for profit sharing in the community</i>	Do you collaborate or cooperate with other women in the community to share the profit?	Binary (Yes/No)	X-squared = 38.132, df = 1, p-value = 6.611e-10 F test odds ratio = 17.83	Community	<i>"Then this was one aspect and there were several other social issues was also discussed. Like once you have their group, there are several things that can be discussed like this early marriage, child marriage. And environmental awareness, many other issues that can be tackled, many of them really become. Some of them become champions and many became members also, so that created quite some leadership in the in the community. That has quite some impact also."-GIZ Bangladesh</i>
	<i>Women friendship</i>	How important in your life is your friendship with other women in the village?	Likert Scale (very little, little, moderate, high, very high)	p-value = 0.1088	Community	<i>"Yes, we can, we all did it together once before, some money was deposited, when there was a problem, he would take money from here and it would be repaid later. Now the association is broken."-Woman</i>
	<i>Belonging to an NGO</i>	Do you belong to any NGO?	Binary (Yes/No)	p-value = 0.3683	Individual	<i>"Yes, I have NGO associated membership [They provide a book which tells that I am a member of that NGO]. Ganamukhi Shomiti is its name."-Woman</i>
	<i>Belonging to Shomiti*</i>	Do you belong to a women's only cooperative (Shomiti)?	Binary (Yes/No)	p-value = 0.3677	Individual	<i>"Yes, I am in three Shomiti now."- Woman</i>

Economic Savings	Do you have savings?	Binary (Yes/No)	X-squared = 9.7623, p-value = 0.001781 F test odds ratio = 3.88	Individual	<i>"Yes, I am in "Shomiti". I have borrowed money.[...]. I have been saving since one-and-a-half years. Now it appears that we are poor people, we need 5000 TK in times of danger, now if I don't get these five thousand TK from the people of the village, then I have to take a loan from my association, then after recovering from the danger, I have to repay the association slowly in instalments."-Woman</i>
<i>Land ownership</i>	Do you have land?	Binary (Yes/No)	X-squared = 46.328, p-value = 1e-11 F test odds ratio = 86.6	Individual	<i>"No, there is only the land of the house. The land area of the house is 5 katha."-Woman</i>
<i>Income (monthly income of the household, income from the forest)</i>	What is the monthly income of the HH?, How much of your weekly income comes from the resources you collect?	Numerical in BDT (Tk)	t = -4.101, p-value = 0.0001823	Individual	<i>"We have no monthly income now. Sometimes I have to borrow and I run the family and when I make 200 or 300 takas in a week it goes like this." Woman</i>
<i>Expenditure on food</i>	How much do you spend weekly on food?,	Numerical in BDT (Tk)	t = -4.2047, p-value = 0.0001554	Individual	<i>"Takes about fifty to sixty taka per day. Drinking water is 20 TK a day but for cooking and bathing, a total of 50-60 TK is required to buy water."-Woman</i>
<i>Access to the credit NGO</i>	Do you have access to credit from NGO?	Binary (Yes/No)	p-value = 0.05387	Individual	<i>"Yes in 'Ganamukhi Shomiti' we save 10-20 TK a week. [Also] received from World Vision NGO. [They] gave me 14.000 TK. About five years ago."-Woman</i>
<i>Access to credit by local lenders</i>	Do you borrow loans from local lenders (Mahajan)?	Binary (Yes/No)	p-value = 0.05081	Individual	<i>"Now many times we have to run on interest money. [...] You have to take money from someone and then you have to pay him profit again. For</i>

	<i>Receipt of remittances</i>	Do you receive remittances?	Binary (Yes/No)	p-value = 0.107	Individual	<i>example, if you take 2000 taka, you have to pay 200-taka profit. It means you have to pay interest."-Man "Yes, [my son] has gone to Khulna and is working as a daily wage earner there. [He doesn't give me anything of his earning]"-Woman</i>
	<i>Housing conditions</i>	What is the construction material used for walls? What is the construction material used for the roof?	Single choice (mud, bamboo, tin, tally, brick, wood, thatch, goalpata*2, concrete, other)	Wall: X-squared = 17.439, p-value = 0.003738 ; roof: p-value = 0.063	Individual	<i>"Before there were no houses. Now after the government gave me this house, I live here."-Woman</i>
	<i>Drinking water sources</i>	What is the source of drinking water?	Single choice (supply water, tube well, pond/river, string, other)	X-squared = 45.669, p-value = 6.67e-10	Community	<i>"We catch rainwater and drink it.[...] Rainwater does not run throughout the year. [We] drink pond water. It is not always possible to buy water. And if you want to buy water, you have to go to Munshi Ganj."-Man</i>
Natural	<i>Resources collection from the forest</i>	Do you enter Sundarbans to collect/extract resources?	Binary (Yes/No)	X-squared = 12.26, p-value = 0.0004629 F test odds ratio= 4.86	Individual	<i>"We collect wood, fish and honey from the Sundarbans.[...] I cook with wood"-Woman</i>
	<i>Resources collection from the river</i>	Do you collect resources from the river or edge of the forest?	Binary (Yes/No)	p-value = 0.6233	Individual	<i>" I used to catch fish and bring wood for cooking.[...] No, I didn't bring the crab. I used to bring only fish fry."-Woman</i>
	<i>Frequency of collection in open season</i>	How often do you collect resources during the permitted season?	Single choice (Daily, Weekly, Monthly, Rarely, Never)	p-value = 0.1966	Individual	<i>"Yes go, catch the little fish I have to eat something to survive if I don't work, how my mother and I will survive. [...] Not going to Sundarbans has done good for us, but if poor people can't go to Sundarbans, it is very difficult to survive". Woman</i>
	<i>Frequency of collection ban season</i>	How often do you collect resources during the ban season?	Single choice (Daily, Weekly, Monthly, Rarely, Never)	X-squared = 19.98, p-value = 0.0001714	Individual	<i>"I fish in Sundarbans but now I stay at home because Sundarbans work is closed."-Man</i>

	<i>Agree with restrictions</i>	Do you agree on having the restrictions?	Binary (Yes/No)	X-squared = 4.634, p-value = 0.03134 F test odds ratio = 4.14	Individual	<i>"Yes, if it is closed [sometimes] it is a little problem but if it is closed for two months in a year it is not much problem. 90% of people here are poor and we all have to survive. But I do not agree with this closure of three months to four month. [...] We do not cut any trees and do not kill fish. [...] We all fish with fishing net `not with poison]"-Woman</i>
Socio-cultural and Political	<i>Involvement in political activities</i>	Do you join/ take part in any demonstration or protest?	Binary (Yes/No)	X-squared = 4.1743, p-value = 0.04104 F test odds ratio = 2.80	Community	-
	<i>Access to information related to conservation of Sundarbans</i>	Do you and/or other women in your household have access to information about the sustainable use of natural resources from the Sundarbans?	Binary (Yes/No)	X-squared = 7.0687, p-value = 0.007844 F test odds ratio = 3.20	Community	<i>"Sundarbans is very important for us. Without this forest, we would have drowned in storms and floods and all our houses would have been destroyed. We get oxygen from plants, if that oxygen did not come from this Sundarbans, we would not survive."-Woman</i> <i>"Yes we go [to the meetings for protection of the Sundarbans]. Meetings are good. [They are held] by forest division. Small fish cannot be caught, wood cannot be cut, these things [they] say. The forest should be saved [because] it protects from storms. [If we continue to take resources from the Sundarbans like this] it will be destroyed."-Woman</i>
	<i>Involvement in conservation activities</i>	Are you involved in environmental activities like restoration or informative meetings?	Binary (Yes/No)	X-squared = 51.088, p-value = 8.833e-13 F test odds ratio = 56.08	Community	<i>"Yes we go [to the meetings for protection of the Sundarbans]. Meetings are good. [They are held] by forest division. Small fish cannot be caught, wood cannot be cut, these things [they] say. The forest should be saved [because] it protects from storms. [If we continue to take resources from the Sundarbans like this] it will be destroyed."-Woman</i>
	<i>Trust in conservation initiatives</i>	How much do you trust these initiatives?	Likert Scale (Very little, little, moderate, high, very high)	X-squared = 18.94, p-value = 7.715e-05	Individual	<i>"[about the meetings] I listen and speak to them. We also talk to them. [These meetings are] good for us because we can learn a lot".-Woman</i>

	<i>Opinion on Sundarbans natural resources importance</i>	How important do you believe the natural resources from the Sundarbans are for sustaining your livelihood?	Likert Scale (not at all important, slightly important, important, fairly important, very important)	X-squared = 9.166, p-value = 0.02716	Individual	<i>"What do we mean by Sundarbans, our livelihood, Sundarbans is our everything. Sundarbans is everything we eat and live.[...] Sundarbans is like a mother to us."-Woman</i> <i>"Yes, i received training from "Ganamukhi". I raise poultry, we sell them to the people of the village.[...] I went to that meeting [organised by the Forest Department]. [Are NGOs training you or helping?] When we fall into any danger, we take money from them to get out of that danger and then repay them in instalments. [...] It will be good to know something and learn something. Many people don't know much, what is known can be learned and then you can work from it." -Woman</i>
	<i>Received training from institutions (NGO)</i>	Have you being involved in any training of NGO in the last 10 years?	Binary (Yes/No)	X-squared = 27.116, p-value = 1.916e-07 F test odds ratio= 9.74	Individual	<i>"I have five sons and one daughter married and one daughter is special."-Man</i> <i>I keep it [the money i earn] to myself because I do the household chores. [In the house]my husband drives, but he discussed with me. My decision is the real decision basically. We both discuss and take the decision."-Woman</i>
Agency and power dimension & intersectionality	<i>Number of females in the household</i>	How many women live in the HH?	Numerical	t = -3.3154, p-value = 0.001707	Individual	<i>I keep it [the money i earn] to myself because I do the household chores. [In the house]my husband drives, but he discussed with me. My decision is the real decision basically. We both discuss and take the decision."-Woman</i>
	<i>Level of control of assets</i>	Do you have control over your household assets?	Likert Scale (No, little, moderate, high, complete)	X-squared = 13.163, p-value = 0.01051	Individual	

<i>Decision-making children education</i>	Do you participate in decision-making of your children education-related issues?	Likert Scale (No, little, moderate, high, complete)	X-squared = 12.196, p-value = 0.01595	Individual	<i>" I studied up to class six. I have three daughters and one son. The eldest daughter has studied up to class ten, the middle daughter has studied up to class eight, and the younger daughter has also studied up to class seven. [Then they were] drop out, married. I gave these three people in marriage. [...]No, my son is not studying. My husband is sick, can't earn. That's why me and my son go to work. We work and run the family. "-Woman</i>
<i>Decision-making on meal distribution</i>	Do you take decisions regarding regular cooking?	Likert Scale (Very little, little, moderate, high, very high)	X-squared = 21.332, p-value = 0.0002721	Individual	<i>" A decision is taken after discussion with all the family members."- Women " Yes. [All decisions are mine]. Yes [The money and authority is in my hands] We are five, I have a mother. {He lives with his wife, two children and his mother. He doesn't allow his wife to go inside the forest or outside the community. He makes all the decisions in his family and controls the money.}"-Man</i>
<i>Decision-making on family expenditure</i>	How are your decisions prioritized regarding household expenditure?	Likert Scale (Very little, little, moderate, high, very high)	X-squared = 22.43, p-value = 0.0001645	Individual	<i>"No, nothing has changed. No [women are not allowed to speak], my husband is sick and helpless, but I have to ask him what I have to do. Yes [i can do anything for myself], but I have to ask. He used to work in the forest. But the waist bone is broken then can't earn any more. No, [i didn't go out when my husband was not sick]"-Woman</i>
<i>Level of control livelihood strategies</i>	How much control do you believe you have over made decisions related to your livelihood strategies?	Likert scale (no control, little control, neutral, some control, total)	p-value = 0.2607	Individual	

<i>Opinion women decision making livelihoods and resources</i>	To what extent do you believe women should have the freedom to make independent decisions about their livelihoods and resource use?	Likert scale (not at all, a little, moderately, quite a bit, completely)	p-value = 0.0527	Community	<i>"No, women [of my house] don't go [to the Sundarbans for work]. Yes, it seems right to me [that women should not go out]. But if I tell about my family then I will say that I love them a lot, I will eat less and still don't send out the ladies of the house."-Man</i> <i>" I sell in the market. We catch the fish and sell it to them; they pay a price that way. Yes, that is what they do [make more profit]. They will sell it from us, and they will profit from it, and then they will sell it again. This is how it goes."-Woman</i> <i>"I can't study like that, I can only sign."-Woman</i>
<i>Negotiation economic opportunities</i>	How often can you negotiate with organization members or NGOs about your economic opportunities?	Likert Scale (Very Rarely or Never, occasionally, sometimes, often, always or very frequently)	p-value = 0.536	Community	<i>" I am about 24 years old"-Man</i>
<i>Level of education</i>	What is your level of education?	Numerical (class level)	p-value = 0.314	Individual	
<i>Age/generations</i>	Age of the respondent?	Single choice (under 18, 18-25, 26-45, 45-65, more than 65)	p-value = 0.1811	Individual	
<i>Religion</i>	Religion of the respondent?	Islam, Hindu, Christian, other	X-squared = 16.909, p-value = 0.0002129	Individual	-

Note: **Shomiti*: refers to organizations or groups, which can differ based on the context. In this case referred to organizations in the villages

*² Goalpata: is the *Nypa fruticans*, a trunk-less palm species which grows naturally along the river banks of the Sundarbans

Economic capital

The indicators selected to analyse the economic capital were savings, land ownership, income (monthly income of the household, income from the forest), expenditure on food, access to the credit NGO, access to credit by local lenders, receipt of remittances, housing conditions, and drinking water sources.

The comparison of **monthly household income** (BDT) between women considering migration as a future livelihood strategy (mean=8883 BDT) and those who did not (mean= 6250 BDT), was conducted using a t-test, revealing a significant difference (p.value<0.01). The t-value (-4.101) indicated that women not considering migration have a lower average monthly income than those considering it. Similarly, a significant difference in weekly income from collected resources was found between the two groups (mean for migration consideration = 914.17 BDT; mean for non-migration consideration = 91.88 BDT) with a negative t-value (-6.08) and a small p-value (<0.01), suggesting lower forest income for women not considering migration. These results suggested a motivation to stay among those with lower overall income and less income from the forest. The findings implied that having more economic capital may lead to considering migration for better livelihood opportunities elsewhere. Interestingly, women with lower income from the forest were the ones not considering migration, possibly because they have alternative livelihood options. However, it has to be contemplated that some women not considering migration may desire to do so but lack the economic and social capital to do so.

"No, we don't want to go anywhere else. Neither do they [my children]. This is our native land and we can adapt to this environment and survive in hardship. Which is the trouble of going somewhere else. [If the Sundarbans would be closed completely] No, even if you don't want to go out, you have to spend your life doing something. [Extra Person] If the government or any NGO gives us some help so that we can live happily here, it could be better. If we get help like this, then we have no desire or hope to leave from here."

Woman, Buri Goalini

Interestingly, there was no statistically significant correlation between the migration consideration and neither the **access to credit from NGOs** (p.value= 0.05) nor the **access to loans from local lenders** (p.value= 0.05). It is apparent that having (or not having) access to these economic sources does not influence the likelihood of considering migrating. However, having **savings** (p.value<0.01) showed a significant correlation with a higher likelihood of migration. It brings attention to the influence of economic security or lower vulnerability as an essential factor for the respondent to consider when migrating to another area.

"No, I'm not going anywhere. No, where will I go? [Regarding the contact with the migrating relatives] Yes [we are in contact], but we have a problem going there. It costs a lot of money. If I get support from the outside, then I will go there" - Man, Munshiganj

Surprisingly, the correlation analysis revealed that receiving **remittances** was not statistically significant in influencing the likelihood of considering migration (p.value=0.107). Despite one-third of respondents receiving remittances, the majority did not consider migrating, suggesting that while remittances may play a role in the decision to stay, it is not statistically significant. This underscores

the need to explore additional factors explaining why women with or without remittances may choose not to migrate.

On the other hand, although only 10% of respondents owned **land** at a household level, a strong association was found with the likelihood of migration ($p.value < 0.01$). Counterintuitively, almost everyone who owned land considered migrating. While owning land might be expected to imply a desire to stay for stability, it could be linked to higher economic capital, providing the means to migrate voluntarily. Alternatively, owning land might involve renting it out, generating income that enables migration. The absence of land could signify higher vulnerability and a lack of livelihood assets, potentially hindering the ability to migrate even if there is a desire to do so

The source of **drinking water** had a significant correlation ($p.value < 0.01$) with the migration consideration, highlighting the importance of water scarcity and salinity in the area.

"We catch rainwater and drink it.[...] Rainwater does not run throughout the year. [We] drink pond water. It is not always possible to buy water. And if you want to buy water, you have to go to Munshi Ganj." - Man, Buri Goalini

Overall, the indicators of income, savings, land ownership, housing conditions and drinking water were correlated with the migration consideration. The staying motivation specifically correlated with those with less monthly income, less income from the forest, lack of land, and lack of savings. Surprisingly, access to credit and loans and the reception of remittances were not correlated with migration considerations.

Social capital

The indicators selected to analyse the social capital were being born in the village, women's collaboration for profit sharing, women's friendship, belonging to an NGO, and belonging to a *Shomiti*.

A statistically significant association ($p.value < 0.01$) was identified between **being born in the village** and considering future migration. Notably, women in the study typically migrated from their birthplace for marriage purposes, with 84% being born elsewhere. Therefore, it should not be directly related to place attachment, previously considered an essential factor associated with voluntary non-migration. Within the social capital dimension, the **social relationships** among the



Figure 14. Two women in the edges of the Sundarbans

women (Fig. 14) and with outsiders (NGO) did not reveal statistically significant correlations with a higher likelihood of migrating. Regardless of NGO affiliation, *Shomiti* membership, or perceptions of women's friendship, most respondents were not contemplating migration. These findings align with prior research on how social capital may influence attachment to a specific place.

On the other hand, when asked about **collaborating with other women** in the community to share the profit, a statistically significant correlation with the likelihood of migration was observed ($p.value < 0.01$). Among the 15% who answered yes, 70% considered migration, compared to 11% among those who did not collaborate with other women. This finding might be linked to the economic benefits of the grassroots-level women groups emerging distinct to *Shomiti* or an NGO structure, as observed in the preliminary fieldwork and fieldwork. This suggests the potential significance of self-formed women groups within the community, not directly depending on external actors like NGOs.

Overall, being native to the village and collaborating in women's profit sharing were correlated with a migration aspiration. The indicator related to women's friendship and their belonging to NGOs or *Shomiti* had no correlation with the migration consideration.

Natural capital

The indicators selected to analyse the natural capital were the collection of resources from the forest, collection of resources from the river, frequency of collection in open season, frequency of collection ban season, and if they agree with the restrictions (implemented in 2022).

A significant correlation ($p.value < 0.01$) was found between **collecting resources from the forest** and the migration consideration. The odds ratio suggested that women engaged in forest resource collection are about 4.9 times more likely to be migrants. This result may be linked to the barriers and restrictions the Government implemented, pointing towards a more vulnerable future as forest income diminishes, a correlation previously addressed in the economic capital.

"I wanted to go [to the Sundarbans] because the baby couldn't eat. [My] husband could not go. Husband is ill. Husband has become weak. [If the Sundarbans would be closed completely] Yes, if there is no way, I will leave."-Woman Munshiganj

However, it needs to be acknowledged that the forest resources could also be for subsistence purposes. Resource collection is an important income source for those respondents, and they might be more driven to migrate as they do not have other livelihood options in the area. When inspecting this association with the **collection of the resources from the river**, there is no significant association ($p.value = 0.62$), probably because almost all the participants collect resources from the river (Fig. 15).



Figure 15. Women fishing in the river of the Sundarbans

The analysis of resource dependency and migration consideration revealed interesting patterns when examining the **frequency of resource collection during the permitted and banned seasons**. While there was no association with collection during the permitted season (p -value=0.162), a significant association emerged during the banned season (p -value<0.01). Despite seasonal variations, one-third of respondents collected resources daily during the banned season, highlighting the high dependency on ecosystem resource.

The impact of the recent restrictions and increased awareness programs on resource use influenced the likelihood of considering migration. Although two-thirds of participants **agreed with the restrictions** and demonstrated environmental awareness, this ban acceptance was statistically associated with the migration consideration (p -value<0.05). This suggests a tendency to consider migration despite endorsing conservation measures, indicating that respondents, while supportive, still struggle to meet their livelihood needs without relying on forest resources.

“Not going to Sundarbans has done good for us, but if poor people can't go to Sundarbans, it is very difficult to survive. [...] Yes, you [the government] have forbidden it for our good. If the government would provide any help [since] going to Sundarbans is prohibited at this time and we cannot go [...] so if the government wants to give any help, then we could have survived this period well without going to Sundarbans.”-Woman

Buri Goalini

Overall, a higher dependency on the forest, represented by the indicators of forest resources collection, collecting during the ban season, and agreeing with this ban (despite the hardships), appeared to be correlated with the migration aspiration. No correlation was found with river collection or with collection during open seasons.

Socio-cultural capital

The indicators selected to analyse the sociocultural capital were involvement in political activities, access to information related to the conservation of Sundarbans, involvement in conservation

activities, trust in conservation initiatives, opinion on Sundarbans natural resources' importance, and if they received training from institutions (NGO).

Involvement in both conservation activities (restoration or informative meetings) and **political activities** (demonstrations or protests) exhibited a significant correlation with the migration consideration (both $p.value < 0.05$). There was a likelihood of migration when engaging in these activities. Besides, about one-third of participants reported **access to information about the sustainable use of natural resources** from the Sundarbans, a lower number than expected from NGO and Forest Office statements. However, a significant association was found between this access to environmental information and the migration consideration ($p.value < 0.01$). Despite only 11% participating in these workshops, nearly all desired to migrate.

The data suggested that women adapted to sustainable resource use and restrictions more than their male counterparts. However, their primary income generation, often resource extraction, leaves them with limited alternatives, potentially influencing a desire to migrate for more livelihood options. Notably, the **level of trust in conservation programs** and the **perceived importance of the forest** also impacted migration considerations ($p.value < 0.01$), with a tendency to consider migration increasing with higher trust in these initiatives.

Overall, when women were not involved in any conservation or political activity or exposed to environmental awareness, there was a correlation with the staying consideration. The trust in the environmental programs seemed correlated with the migration aspiration.

Agency in decision-making and intersectionality

The indicators applied to capture the gender dimension and highlight the intersectional considerations were the number of females in the household, level of control of assets, decision-making on children's education, decision-making on meal distribution, decision-making on family expenditure, level of control of livelihood strategies, opinion on women deciding on their livelihoods and resource use, level of negotiation of economic opportunities, level of education, age and religion.

Religion appeared to be correlated with the migration consideration ($p.value < 0.01$). The respondent's most present religion was Hinduism (55%), followed by Islam (40.7%) and other (4%). Even though Bangladesh has a majority Muslim population, this coastal area is also home to the indigenous peoples of the Munda community, who follow their religions and some practices of Hinduism. They are also a marginalised community that finds more difficulties in finding places to inhabit elsewhere.

The **gender composition of the household**, measured by the number of women, was significantly correlated with the willingness to migrate ($p.value < 0.01$). Those who did not consider migration tended to have fewer women in the household ($t = -3.31$). This correlation may be linked to the perceived burden of women in families, influenced by socio-cultural norms and economic requirements, such as marriage dowry. Consequently, more women in the household might imply more difficulties in staying put as women tend to work less than their male counterparts.

When addressing the decision-making within the household and the migration considerations, there was a significant correlation between the migration consideration and the level of decision-making regarding **regular cooking** ($p.value < 0.01$), **the level of participation in decision-making of the children's education** ($p.value < 0.05$), and the **level of prioritisation of their decisions regarding household expenditures** ($p.value < 0.01$). The level of **control of assets** showed a statistically significant moderate association with the migration ($p.value < 0.05$). Within the most answered level,

being the ones perceiving a 'moderate' and then 'little' control, the non-migration consideration was much higher (84% and 79%, respectively) than the one to migrate. The following quote illustrates the need to attend to the dimension of agency and power relations as they do not necessarily shift when women start working outside their households. It was shared by a woman with several livelihood options who also received training from NGOs when asked about women's freedom of choice:

"No, nothing has changed. No [women are not allowed to speak], my husband is sick and helpless, but I have to ask him what I have to do. Yes [i can do anything for myself], but I have to ask. He used to work in the forest. But, the waist bone is broken then can't earn any more. No, [i didn't go out when my husband was not sick]". Woman Munshiganj

Overall, when attending to intersectionality aspects and agency, the indicators correlated with the migration consideration were religion, the household gender composition, the level of decision-making power regarding regular cooking, children's education and household expenditures, and the level of control of assets.

4.3 Interactions between dependency on mangrove resources, agency, and economic capital, and staying motivations

Following the previous statistical analysis, different variables from Table 3 were selected to capture intersectionality indicators influencing the dependent variable of migration consideration. Several logistic regression models were built aiming to understand how the interaction between the women and the SMF-dependent livelihoods shape their non-migration aspirations (Table 4). Stepwise analysis was conducted to avoid multicollinearity between variables and this process resulted in the variables shown in Table 4. The eleven best-fit models are displayed, the last one being the full model capturing all the variables to assess how the chosen variables affect the consideration of women not migrating as a livelihood strategy through the coefficient estimates and odd ratio. The variables were divided into the predictors and control variables. The dependent variable did not differ between voluntary and involuntary aspiration.

The factors chosen that aim to predict the (non)migration aspirations are the **monthly income of the household** (to address the socioeconomic status of the family the woman lives in), the **collection of resources from the forest** (portraying the access of the women to the forest resources and their underlying forest dependency), and the **control of household assets** (representing the decision-making power within the household between the members). To follow an intersectional lens, two other control variables were implemented in some of the models: **religion** and the **number of women in the household or household gender composition**. Out of the five variables considered, both the predictors and the control variables have a significant association with the odds of considering migrating at least in one of the models. Nevertheless, the association significance for some variables varied depending on the model.

Table 4 Logistic Regression Models

Hypothesis (H0)	Variables	Monthly Income	Resource collection from the forest	Control of assets				Women in family			Religion	
		Bangladeshi taka (BDT)	Yes	High	Little	Moderate	No	2	3	4 or more	Islam	Other
There is no association between monthly income and the likelihood of migration.	Model 1 B Sig. Exp(B)	2.56E-04 0.00024 *** 1.00										
There is no association between forest resource collection and the likelihood of migration.	Model 2 B Sig. Exp(B)		1.594 0.000453 *** 4.924									
There is no association between the level of asset control and the likelihood of migration.	Model 3 B Sig. Exp(B)			0.693 0.600 2.000	-1.316 0.213 0.268	-1.640 0.117 0.194	-17.570 0.990 2.34E-08					
The inclusion of resource collection does not improve the model's ability to predict migration beyond the effect of monthly income	Model 4 B Sig. Exp(B)	2.71E-04 0.000436 *** 1.00	1.634 0.000810 *** 5.124									
The inclusion of the level of asset control does not improve the model's ability to predict migration beyond the effect of monthly income.	Model 5 B Sig. Exp(B)	2.86E-04 0.000358 *** 1.00		-0.287 0.838 0.750	-2.031 0.06233 0.131	-1.888 0.074841 0.151	-18.550 0.989 0.00					
1. Changes in monthly income do not have a significant impact on the odds of migration when accounting for the effects of resource collection and asset control	Model 6 B	2.87E-04	1.654	-0.857	-1.826	-2.149	-18.480					

2. Changes in resource collection do not have a significant impact on the odds of migration when accounting for the effects of monthly income and asset control.		Sig.	0.000858 ***	0.001697 **	0.5875 34	0.124	0.067144 .	0.989						
3. Changes in asset control do not have a significant impact on the odds of migration when accounting for the effects of monthly income and resource collection.		Exp(B)	1.000	5.228	0.425	0.161	0.117	0.000						
The control variables do not contribute significantly to predicting migration beyond the effects of assets control.	Model 7	B			-0.201	-2.917	-2.297	-19.688	2.479	3.364	4.263	2.221	- 16.97 7	
		Sig.			0.915	0.0519	.	0.118	0.992	0.0882 4.	0.02391 *	0.01126 *	0.00018 ***	0.994
		Exp(B)			0.818	0.054	0.101	0.000	11.929	28.905	71.023	9.217	0.000	
1. Changes in resource collection do not have a significant impact on the odds of migration when accounting for the effects of assets control and control variables.	Model 8	B											- 15.79 6	
		Sig.			1.657 0.005044 **	-0.608	-2.357	-2.135	-19.630	1.604	2.504	3.333	2.394	0.995
		Exp(B)			5.242	0.544	0.095	0.118	0.000	4.974	12.229	28.008	10.954	0.000
2. Changes in assets control do not have a significant impact on the odds of migration when accounting for the effects of resource collection and control variables.	Model 9	B	1.48E-04						1.44	2.20	3.48	1.50	-15.68	
		Sig.	0.05489	.					0.19	0.04625 *	0.00895 **	0.00582 **	0.99	
		Exp(B)	1.00						4.24	8.98	32.39	4.48	0.00	

<p>1. Changes in asset control do not significantly impact the odds of migration when accounting for the effects of monthly income and control variables.</p>	<p>Model 10</p>	<p>B</p> <p>1.80E-04</p> <p>0.04424 *</p>		<p>-0.99 -3.21 -2.45 -20.48</p> <p>0.5979 0.02952</p> <p>3 * 0.08814 . 0.99135</p>	<p>2.23 3.10 4.14</p> <p>0.1165 0.03247 0.01336</p> <p>6 * *</p>	<p>1.81 -16.75</p> <p>0.994</p> <p>0.00367 ** 1</p>
<p>2. Changes in monthly income do not significantly impact the odds of migration when accounting for the effects of assets control and control variables.</p>		<p>Exp(B)</p> <p>1.000</p>		<p>0.371 0.040 0.086 0.000</p>	<p>9.263 22.265 62.490</p>	<p>6.098 0.000</p>
<p>1. Changes in monthly income do not have a significant impact on the odds of migration when accounting for the effects of resource collection, assets control, and the control variables</p> <p>2. Changes in resource collection do not significantly impact the odds of migration when accounting for the effects of monthly income, assets control and control variables.</p> <p>3. Changes in assets control do not have a significant impact on the odds of migration when accounting for the effects of monthly income, resource collection and control variables.</p>	<p>Model 11- 'Full Model'</p>	<p>B</p> <p>1.61E-04</p> <p>1.598</p> <p>0.00885 **</p> <p>0.08638 .</p> <p>Exp(B)</p> <p>1.000</p> <p>4.943</p>		<p>-1.302 -2.612 -2.294 -19.980</p> <p>0.4959 0.07911</p> <p>9 . 0.114 0.992</p>	<p>1.413 2.278 3.268</p> <p>0.299 0.101 0.05597 .</p>	<p>-</p> <p>15.73</p> <p>0</p> <p>2.053</p> <p>0.00176 ** 0.995</p> <p>7.791 0.000</p>

Note reference levels:

Women in the family = 1, control of assets = Complete, religion = Hindu, monthly income of the household = 0 and resource collection from the forest = No.

Significance : Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Dependent variable:

Migration consideration (Yes/No)

The **resource collection** in the forest was significant in all the models regardless of the consideration of other predictors. There was a high correlation between access to the forest and willingness to migrate. Women who collected resources from the forest, compared to the ones who do not, were between 4.92 and 5.24 times more likely to consider migration in all the models. This positive association persisted significantly for all the models, demonstrating the relevance of forest dependency in the (non)migration decisions. The complete model 11 explained the unique contribution of the resource collection in the forest to explain the likelihood of migration consideration. This association might be related to the latest restrictions imposed by the Government and the difficulties the resource user families are finding to meet their needs, as shared by one woman, "*Earlier, we used to go to the forest, [we] used to earn from it. It is not happening anymore because the side is closed*". However, it was particularly how several women resource collectors shared their will to stay trying to develop new strategies if the ban continues, as exemplified in this quote:

" Where else can I go? I will not go anywhere. [If the Sundarbans would be closed completely] I will try to become a day labourer. Where do we leave? We have nowhere to go."

This finding also highlighted the need to target women highly dependent on the forest and provide tools, skills, and training to reduce their vulnerability. The men interviewed showed a higher aspiration to migrate compared to women, as the latter have much more difficulties, hence willing to stay put and adapt on-site.

The coefficient associated with the variable **monthly income** was significant ($p\text{-value}<0.001$) for models 1,4,5, and 6, indicating evidence of an association between monthly household income and the log odds of considering migration. For instance, for model 1, only considering this variable, the small magnitude of the coefficient and odds ratio suggested that the impact of the monthly income on the odds of considering migration is very modest for a one-unit increase in monthly income. The statistical significance, however, indicates that this effect is unlikely to be due to random chance. The significance of this variable jointly with all the rest in model 11 was minimal ($p\text{-value}>0.05$). Therefore, the additional predictors like resource collection explained the diminished effect of income. Interestingly, this association is high when considering both the level of asset control and the resource collection (model 6).

The **level of control of assets** or decision-making within the household negatively affected the odds of considering migration, i.e., more likely to consider non-migration. The chi-squared showed a moderate correlation between the variables ($p\text{-value}<0.05$), where 84% of the women with 'moderate control' and 78% of the women with 'little control' considered no migration. However, when building the logistic regression models, only model 9 was significant at 0.05, where it was jointly modelled with the monthly income and the intersectionality variables. Women with 'little' control compared to the ones with 'complete' control are more likely to consider non-migration. Therefore, even though there was a correlation, the association was null for model 1 but changed and increased when addressing it with the control variables and other predictors. The lower level of control of assets and the non-migration consideration might be associate to a low level in the general decision making resulting from the household power relations among men and women.

“Yes. [All decisions are mine]. Yes [The money and authority is in my hands] We are five, I have a mother. [He lives with his wife, two children and his mother. He doesn't allow his wife to go inside the forest or outside the community. He makes all the decisions in his family and controls the money.]”-Man, Munshiganj

The control variables **religion and gender composition of the hh** were included in the models to account for potential confounding or moderating effects, aiming to include the intersectionality lenses in the model. Adding these variables ensured that the effect of the other predictors was assessed after accounting for differences in the religion and influence of the number of women in the hh.

The effect of women in the household significantly changed when adding forest resource collection, implying the interaction between those variables. The relationship between the number of women in the household and the migration consideration seemed to be influenced by the resource collection from the forest (models 8 and 11). The data (Table 5) showed how the increase in the number of women in the respondent's household entailed an increase in the % of women collecting resources from the forest. Although there was no significant correlation (at $p.value < 0.05$) between the two components, when looking at the migration aspiration, there seemed to be more women going to the forest when the number of women in the hh increases. This relationship could be attributed to the low number of income generation members as women are generally staying home, hence resulting in the need of some of them to go out to forest. There is an increase in the odds of considering migration in hh with 3 and 4 or more women in comparison with hh with only 1 woman. This association is specifically significant for models 7, 9 and 10.

Table 5 Percentage of women collecting resources from the forest based on the number of women in the household

Gender composition	Resources Forest No	Resurces forest Yes	Total	Resources No (%)	Resources Yes (%)
1	21	6	27	77.8	22.2
2	32	26	58	55.2	44.8
3	28	28	56	50.0	50.0
4 or more	4	5	9	44.4	55.6

The control variables might capture part of the effect of monthly income on migration consideration, as in Model 9 when modelling the monthly income with the two control variables, its significance decreases. In model 10, where the variable "control of assets" was added, both monthly income and a level of control of assets became significant. It suggested that, in the model encompassing various variables, both monthly income and control of assets individually contribute to explaining the likelihood of migration consideration. Notwithstanding, the association of the control of assets is negative.

The consistent significance of the religion 'Islam' in all the four models containing the control variable religion suggests that regardless of other predictors included, there is evidence that individuals identifying with Islam, as opposed to Hinduism (the reference level), are associated with a likelihood in the odds of considering migration. This likelihood goes from 4.48 (model 9) to 10.9 (model 8) times

more likely to do so. The Model 11-or Full model-, considering the 5 variables (both control and predictors), indicated that the resource collection from the forest and the religion (Islam in comparison to Hinduism) are key predictors that contribute significantly to explaining migration consideration. The latter highlights the crucial effect of addressing this research from an intersectional perspective.

Overall, the variables chosen to understand how the indicators and their interaction shape the (non)migration aspiration were the monthly income, the collection of resources in the forest and the control of household assets. The control variables representing the intersectionality were religion and the gender composition of the household. All of them are significantly associated with the odds of migrating in at least one of the models yet varying or disappearing within the other models. These results highlighted the relevance of considering the interplay among predictors and understanding their joint impact on (non)migration. Monthly income showed a statistical significance in some models, indicating that this effect is unlikely to be due to random chance. The additional predictors, like resource collection, explain the diminished effect of income. Interestingly, this association is high when considering both asset control level and resource collection. Regarding the level of control of assets, women with 'little' control compared to the ones with 'complete' control are more likely to consider non-migration in one model jointly with the monthly income and the intersectionality variables. Resource collection and Islam religion appeared to be the key predictors explaining the odds of considering migration as they have a generally high association in all the models. However, it is still crucial to consider the variables mentioned earlier.

5. DISCUSSION

5.1 Women's differentiated livelihood strategies and relationship with the Sundarbans.

Challenging the prevailing sociocultural norms

Following several disasters and the increase of slow-onset degradation like salinity of the environment, the women in the sample had increased their resource collection in the last decade, regardless of increased protection measures in the forest, as previously documented (Ahsan et al., 2017; Khalil & Jacobs, 2021; Roy, 2019). Even though this finding cannot be extrapolated to all the community dynamics, as there is insufficient information in the sample regarding the male resource collection pattern, it draws our attention to the importance of considering how women engage and develop their relationship with the SMF resources.

The research results on women's occupation in the sample showed that 80% of the sample identified themselves as 'housewife' even while engaging in additional activities. Notably, 43% of women were going into the forest, and 91% collected resources from the river, in contrast to the idea of men as the only ones entering the forest (Roy, 2019). The results on the type of collected resources could be attributed to the gender division of labour in social-ecological seascapes, particularly in tasks like fuelwood collection performed by all women in the sample. De la Torre-Castro et al. (2017) study in Tanzania supported this observation, emphasising that for certain cultural settings with given household duties for women, women tend to "prioritise working areas close to home and subsistence activities that provide food on the table" (p.10). They also highlighted the androcentrism in coastal resource management, where women's identities are largely tied to traditional reproductive roles.

Even though the results showed how women have been involved with the collection of resources in the forest and the river for the last few years, a man in the area questioned: “*why we would talk with women about the forest and the river if they knew nothing about it*”. However, historical engagement in such activities has also provided women with comprehensive knowledge of local forest resources (Wan et al., 2011).

Following this line of discussion, the findings demonstrated women’s significant livelihood diversity (Fig. 16) by engaging in activities such as collecting resources, raising poultry, gardening, handicrafts or crab farming. Nevertheless, there seemed to be a common misconception or oversight among key social actors regarding the shift in women's livelihood activities towards more extract-intensive ones. This observation aligns with existing literature on the subject of gendered livelihood in resource-dependent communities (De La Torre-Castro et al., 2017; Hapke & Ayyanketil, 2018; Khatiwada et al., 2018; Smith, 2014).



Figure 16. Men and Women working the briks in Buri Goalini

The livelihood diversification process carried out and experienced by women plays a role in challenging the gender system and patriarchal norms (e.g. Lawless et al., 2019; Smith, 2014; Stacey et al., 2018). These norms and rules are being slowly re-negotiated through interaction with external actors like NGOs in a context of adaptation (Khalil & Jacobs, 2021; Khalil et al., 2020). Roy (2019) corroborated how, in the post-cyclone context of *Aila* and *Sidr*, “many women are challenging long-established practices and beliefs by engaging in income-generating activities inside the forest rather than in their home” (p.13). Nevertheless, a high proportion of men often disagreed with these changes within the study, as one interviewee remarked, “*women go more now than before [to the forest], and I think it is bad*”. They also discouraged their wives or daughters from working outside the home, as one male highlighted, “*I will eat less and still don't send out the ladies of the house.*” Hence, the results on household and individual levels of decision-making illustrated that despite engaging in resource collection and diversifying their activities through training provided by NGOs, the lower agency level still prevails among women in the community, as shared explicitly by one woman during the interview (refer to section 4.2.2).

Therefore, it is important to recognise how women's agency differs at the individual household and community levels when addressed through livelihood capitals and strategies, intersecting with other factors like education level, religion, or poverty level (Lawless et al., 2019). This individual agency intersects with socially prescribed constraints, including physical mobility, affecting women's access to resources and livelihood options, as noted by Lawless et al. (2019) and by Sultana (2014) in the context of climate change from an FPE perspective. As described by Boudet et al. (2013), there is a

distinction between the *available* set of livelihood opportunities to engage with and the *capacity* women have to exercise choice between those options (Lawless et al., 2019). However, subjectivities given a specific ecological context can be negotiated. Thus, women might take advantage of the transformation of the social-ecological system by changing their livelihood opportunities (Ahmed & Fajber, 2009).

Linking these challenges with the external interventions, current interventions often align more with the so-called 'gender reinforcing' or 'gender accommodating' approaches, unintentionally benefiting from or acknowledging existing power imbalances without challenging them, potentially perpetuating inequalities (Lawless et al., 2019; Sayer & Campbell, 2003). Most of the actors interviewed did not recognise women as resource collectors or shared that only men enter the forest, despite the data showing the opposite. Moreover, their programs were generally involving only women. It is important to attend to the way women develop new livelihood strategies, engage in organisations, and act as the breadwinners while sustaining traditional gender roles related to unwaged domestic and reproductive work (Mies, 1989), and unpaid activities like resource processing (Wan et al., 2011). The introduction of new opportunities, coupled with existing responsibilities, may create a heavier burden for women, impacting their ability to participate in adaptation activities or benefit long-term from NGO training in non-extractive income generation activities, particularly for women left behind (Khalil & Jacobs, 2021; Cohen et al., 2016). It is important to note the need for development projects to adopt a 'gender transformative approach,' as Stacey et al. (2019) emphasised, which aims to challenge the local gender norms through the livelihood enhancement programs that NGOs implement. Nevertheless, gender-transformative programs in Bangladesh are already paving the way for new opportunities, offering valuable insights and serving as models for present and future interventions in the field (Douthwaite et al., 2015)

5.2 Mismatches between land use management, resources users' needs and NGO interventions

The empirical data found a diverse approach of interests regarding the SES among the actors such as conservation and sustainable management by the BDF -and to some extent by the NGOs-, economic interest by the aquaculture sector, post-disaster aid and livelihood diversity programmes by NGOs and diverse scientific interest by academia. This institutional diversity is required to govern complex systems like the one at hand effectively (Ostrom, 2005). However, the study found an apparent mismatch among the strategies, interests and actions, which are failing to provide a resilient and adaptive ground for the communities to develop their livelihoods to a certain extent. For instance, the resource users manifested how the restrictions were taken unilaterally by the BFD without the stakeholders' participation. This is increasing their vulnerability as their livelihood is highly dependent on these resources, as shown by Mallick et al. (2021). On the other hand, respondents noted a continuous rise in the harvest of aquatic resources in the Sundarbans (Fig. 17), a trend observed by Hossain et al. (2021) between the years 2001-2019. This rise could be explained by the collection increase after the devastating cyclones of the last decades, especially by women and the migrant people coming from nearby areas to extract the resources. The latter also exposes the local community to intangible competition (Hossain et al., 2023).



Figure 17. Working boat and fishing nets

Besides, observations revealed the intensification of land-use changes around the Sundarbans, particularly towards the soft-shell crab business, indicating a conflict between biodiversity conservation and unsustainable economic growth, ignoring ecosystem limits (Martín-López et al., 2011). This sector, dependent on the mangrove ecosystem, is experiencing an increasing international demand (Jahan & Islam, 2016). The sector's growth, especially after *Aila*, has notably improved the livelihoods of the marginalised Munda Community yet contributes to increased salinity, a major environmental stressor in the area, as shared by all the participants and experts (Roy, 2018; Chen & Muller, 2018; Mahmuduzzaman et al., 2014). Rahman et al. (2020) explored the mud crab fishery's potential to provide alternative livelihoods, stressing the necessity for a strategic plan considering crab population conservation. The reliance on wild crabs raises concerns about over-exploitation, which could disrupt the ecological networks of the Sundarbans (Rahman et al., 2020).

In accordance with the results regarding the impact of NGOs in women's livelihood development, previous studies (Eriksen et al., 2021; Khalil & Jacobs, 2021; Khalil et al., 2020; Kartiki, 2011) have demonstrated the role of NGOs in providing alternative livelihood options and post-disaster relief in southwest coastal Bangladesh. One unanticipated result was the high predominance of environmental awareness programs and workshops for forest conservation funded by international institutions. The current multilateral sustainable development agenda is starting to shift towards and recognise 'gender' as a crucial aspect of understanding how climate change affects the communities and developing effective interventions and responses at the different levels (Skinner, 2011). Following this shift, most of the projects on environmental awareness programs appeared to be directed at women based on the empirical findings. The argumentation by the NGOs for directing these programs to women followed the notion that women would influence their male counterparts to consider more sustainable practices. The promotion of women's caring attitudes towards the Sundarbans' resources in these interventions resonates with the criticism given by feminist scholars on many development projects of this kind targeting women as caregivers for the environment (Sultana, 2014). These scholars believe that women are portrayed simultaneously as victims and saviours, which could imply a new burden upon them

(Agarwal, 2000; Masika, 2002). With this study, I support how the perpetuation of this stereotype can overshadow women's agency to adapt to climate change through their daily agency and create barriers to the potential inclusion of men in these gender-aware programs, often overlooking the unequal social relationships between genders (Skinner, 2011).

On the other hand, the findings on women's perception of the SMF's importance did evidence the programs' influence on their views and interactions with the forest and its resources. This finding is somewhat contrary to that of Mallick et al. (2021), who reported a low threat perception regarding the future of the Sundarbans. In contrast, the results showed that a large number of the respondents were concerned about it. This could be attributed to the focus mainly on women, illustrating the discourse changes among the (female) population, as Mallick et al. (2021) study sample also included males. Roy (2019) also confirmed how women who were cyclone survivors "preferred to earn an alternative non-forest source of income in order to protect the forest from human intervention" (p. 13).

The results on how women perceived the forests demonstrated how the narratives disseminated by external NGOs and Western perspectives are shaping the viewpoints of the local population. The impact of external narratives may be attributed to factors such as limited education, leading to a tendency within women to undervalue their own knowledge. This fosters the belief that outsiders possess 'real knowledge' and their own inherently correct perspectives (Roy, 2019). When collaborative co-creation is absent in understanding environmental changes, potential gaps can arise, overlooking how women interact with and perceive the changes in their surroundings (Hiwasaki et al., 2014). This approach fails to identify women's needs and challenges amid environmental degradation and potentially hinders the effective implementation of sustainable management and adaptation strategies (Cornwall, 2003; Khalil et al., 2020). For instance, the prevailing discourse on climate change, primarily influenced by NGOs and governmental discourses, tends to overshadow local observations of shifts in honey production phenology—a likely consequence of climate change. External actors often neglect to prioritise community voices in crafting more suitable management strategies that account for these changes, aligning with broader top-down goals of forest preservation (Berkes et al., 2000; Martin et al., 2016; Raymond et al., 2010).

Therefore, further research is necessary to deeply understand the synergies between external, expert, and local knowledge. This understanding is crucial for fostering interventions that effectively adapt and conserve, benefiting the forest and the community.

5.3 The diverse influence of the livelihood capitals in the non-migration aspiration

Following previous literature (e.g. Biswas & Mallick, 2021; Hossain et al., 2023; Khatun et al., 2022; Mistri, 2019), the present study was designed to determine the characteristics of non-migrant women in SW Bangladesh through the sustainable livelihood framework attending to the livelihood capitals that influence the aspiration to migrate or to stay put.

Some of the findings aligned with previous research on non-migration and livelihood capitals; however, most of these studies do not focus solely on women. Consequently, some results seemed contradictory, highlighting the nuanced nature of women's livelihoods and the decision-making process regarding (non)migration. It became evident how these processes are influenced by factors beyond the capitals. This discussion is elaborated in detail hereafter.

In this study, women expressing a non-migration aspiration tended to have lower monthly income, less income from the forest, and a lack of land and savings. The regression models highlighted that higher monthly income is associated with a migration aspiration, aligning with Avila-Foucat and Rodríguez-Robayo's (2018) suggestion that livelihood diversification requires economic assets and political and institutional facilitation. Despite not exploring the diversity of financial capital's impact on adaptive capacity within this research, the diversity of income sources, as noted by Meinzen-Dick et al. (2011), may enhance adaptive capacity. In this study, contrary to Habib et al. (2023) findings, having savings is associated with the likelihood of migration, potentially explained by households with savings being less inclined to diversify livelihoods, as suggested by Ahmed et al. (2018) and Jiao et al. (2017). The results of this study, thus, suggested that this inclination to migrate could stem from having the financial capability to pursue livelihoods elsewhere.

One interesting finding was the significant association between women collecting resources from the forest and the aspiration to migrate, stressing the importance of this activity in shaping livelihood strategies. Despite several assumptions that can be inferred from this result, it needs to be interpreted cautiously due to the intricate intersections of gender aspects and resource utilisation. Ahsan et al. (2017) explored how there was an increased dependency on the Sundarbans in the aftermath of extreme climatic events, similar to the potential effects in the study area, especially after the devastating tropical cyclones in 2019 and 2020, *Bulbul* and *Amphan*. Notwithstanding, Khatun et al. (2022) found a significant impact on respondents' psychological views and resource dependency on non-migration decisions, differing from the present research, which showed a significant association between forest resource collection and migration aspirations. This divergence may be influenced by the lack of consideration for environmental awareness in Khatun et al. (2022) and the potential impact of the recent controversial restrictions on women's migration considerations, differing from prior research (e.g. Khalil and Jacobs, 2021; Ahsan et al., 2022) conducted before the implementation of these restrictions.



Figure 18. Women collecting resources inside the forest. This picture was taken once the ban was lifted the 1st of September, 2024

This study offers insights on the need to further delve into the intersection of the restriction's effects and environmental awareness, the use of natural resources, and the livelihood adaptive capacity, especially regarding women, due to their differentiated relationship with nature as seen by the high conservation attitudes (Fig. 18). As echoed by Ahammad et al. (2013), Khalil & Jacobs (2019), and Uddin et al. (2013), resources from the ecosystem are crucial for the development of place-based adaptation strategies of women, especially when vulnerability increases in post-cyclones context, often followed by the out-migration of their male counterparts (Alam & Khalil, 2022).

Surprisingly, there was no correlation between access to credit from NGOs or local lenders and migration considerations. In line with this, Kibria et al. (2019) demonstrated that families with limited access to ecosystem services tended to rely more on neighbours for loans, while those with higher access were more prone to borrowing from organisations. Lower access and dependence on the community may foster a stronger sense of social cohesion and an on-site support network (Manig, 1990), potentially reinforcing the non-migration aspiration when not collecting forest resources, as found in this research. The survey did not consider this neighbour's loan network and its impact on non-migration, which could be a crucial factor to investigate in future (non)migration studies in the area. Besides, both Adams (2016) and Khatun et al. (2022) discovered that social ties reduce migration potential through mutual assistance and cooperation, especially in post-disaster contexts. Conversely, Mallick (2023) identified the influence of access to credit on non-migration intentions. Still, the literature indicates that males generally access this income source, emphasising the need to address women's access to livelihood capital.

Similarly, one unanticipated result was that no correlation was found between remittances and migration consideration, challenging the conventional understanding of the role of migrants' remittances in the immobile population, a topic extensively studied by previous authors (e.g. Aminuddin et al., 2018; Hadi, 2001 and Oyebamiji & Asuelime, 2018). The unexpected result suggests that women's diverse investment strategies may have mitigated the impact of remittances on their migration considerations (Sikder & Higgins, 2017). Further research is needed to comprehensively understand how women, who constituted 33% of the sample, choose to invest their remittances and develop adaptation strategies based on their needs, already echoed by Khalil & Jacobs (2021). Additionally, the absence of remittances for left-behind women has been highlighted by Alam and Khalil (2022) as an area requiring investigation.

This study has not demonstrated a correlation between an aspiration to stay put and belonging to an NGO or *Shomiti*. However, the empirical data showed the influence of the presence of NGOs in the field towards an increase in staying motivation association due to their constant assistance. Nevertheless, discussions have been raised regarding the 'assets-only' approaches of traditional aid and development interventions (Bermant, 2008; Gilligan & Hoddinott, 2007) in this type of vulnerable context aiming to solve the problems of the SES from just one dimension (Folke et al., 2002). The focus on long-term and structural challenges like access to education might enhance the ability for livelihood diversification in the long-term and leave the agency for women to voluntarily decide to migrate or not migrate, as Habib et al. (2023) studied.

5.4 Intersectionality, agency, and non-migration

In this research, the non-migration aspirations of women and their relationship with the natural resources from the SMF were examined from the feminist political ecology perspective by using the lens of intersectionality. The results of the current study demonstrated the women's different experiences regarding their use of resources, decision-making power, livelihood opportunities, relationship with other social actors, and ultimately their (non)migration considerations. This comprehensive study and findings highlight the importance of considering the intersectionality lenses in the discourse of gender and climate change adaptation (Djouidi et al., 2016)

For the elaboration of the logistic regression models, two control variables were added that aimed to add the intersectionality consideration, which were the religion of the respondent and the gender composition of the household (number of women). Religion appeared to be a significant factor for the respondents to consider migration in all the models, whereas the gender composition variable positively correlated with the odds of migration in some of the models.

The impact of religion on migration consideration aligns with previous findings suggesting greater dependency on the Sundarbans among Muslims compared to Hindus (Mallick et al., 2021). Although the present research sample had almost equal representation for both religions, the positive association between resource collection and willingness to migrate supports this relationship. For Hindus, the willingness to stay may be influenced by community harmony due to their significant presence (Mallick, 2023). Conversely, existing religious and social networks for Muslims may be easier to find elsewhere due to their majority nationwide, contributing to information exchange for migration purposes (Rahman, 2022; Mistri, 2019). On the other hand, Czaika (2013) examined how perceived social inequality among ethnicities may impact migration propensity, advocating for further research on religious inequalities, a factor somewhat influencing the current study. This finding may be partially attributed to the presence of the marginalised indigenous Munda (Adivasi) Community in the region, partly engaged in Hinduism and potentially influencing the high Hindu representation in the sample (Roy, 2018). Additionally, Biswas & Mallick (2020) noted that being Hindu and owning aquaculture farms leads to a higher likelihood of diversity, potentially enhancing adaptive capacity for non-migration. However, caution is advised in assuming similarities across studies, as land ownership, a factor mainly attributed to men, may introduce gender-specific nuances.

One somewhat unexpected outcome is the correlation between the gender composition of households and the likelihood of migration, particularly driven by women's involvement in forest resource collection. The models revealed a positive association, indicating that an increase in the number of women in the household is linked to a higher percentage of women engaging in collecting forest resources. Despite larger household sizes typically being associated with income source diversification (Ahmed et al., 2018), the results suggested that the number of women might negatively contribute to adaptive capacity, challenging conventional assumptions on adaptation and diversification (Cohen et al., 2016; Denton, 2002; Oluwatayo, 2009). The dependency ratio, previously discussed by Joarder & Hasanuzzaman (2008), plays a crucial role in migration decisions, offering a potential explanation for the observed connection between gender composition and migration. It is crucial to consider factors such as the absence of males in some households due to seasonal or permanent migration (Rashid, 2013) not captured by the survey. Future research should explore how gender composition influences women's livelihood development as they move beyond traditional roles, considering the impact of the

changing agricultural landscape on female labour demand, as highlighted by Ahmed et al. (2008), Habib et al. (2023) and Kebede et al. (2014). This discussion brings attention to the need to target households with more women, addressing their migration tendencies and the potential vulnerability leading to early marriages and educational deprivation, as noted by White (2016).

Furthermore, Sultana (2014) noted the concurrent challenges of climate change and gendered power structures in South Asia, emphasising the need to analyse resource use—and non-migration aspirations in this research—through the lens of power relations and intersectionality. The current study revealed correlations between decision-making within households regarding cooking, children's education, and expenditures, and the consideration of migration, supporting findings by Ahmed and Kiester (2021), Jordan (2018), and Sultana (2009). This highlights the importance of addressing power relations, social differences, and gender inequalities as root causes of vulnerability to environmental stressors. Unlike previous research, this study explored the influence of power in unequal resource access and control and its impact on migration aspiration, contributing to understanding social-ecological relationships in the context of non-migration and gender (Furlong et al., 2022).

The regression model findings showed the correlation between asset control and migration aspiration, revealing the intricate interplay of these variables in non-migration, especially when examined alongside other factors. A lower level of control is linked to a higher likelihood of staying put, aligning with insights from Kaijser and Kronsell (2014) on the differentiated experiences of women under climate-related stresses. In the realm of non-migration and immobility, where the aspiration-capabilities framework (Carling & Schewel, 2017) is applied to address voluntariness (Gruber, 2021; Khatun et al., 2022; Mallick et al., 2023), there might arise a potential limitation. This framework may not adequately capture how power relations among household and community members influence decision-making and how changes in these dynamics could impact voluntariness over time. This lack of intersectionality might overlook women's true capabilities and aspirations, a concern that Jordan (2018) and Pemberton et al. (2021) raised.

Addressing gender dynamics and power relations in environmental struggles reveals often overlooked aspects within the climate change and gender discourse (Djoudi et al., 2016). For instance, the hidden gendered consequences of rising salinity in the Sundarbans (Chen & Muller, 2018), one of the main environmental problems identified in the area by the community respondents and the interviewed experts. The post-2010 increase in salinity has impacted crop production, resulting in land use changes and affecting drinking water availability. Numerous studies (e.g. Iftekhhar & Islam, 2004; Islam et al., 2018; Islam & Bhuiyan, 2018; Roy, 2018) have described salinity's impacts on livelihoods in coastal Bangladesh. Chen & Muller (2018) highlighted the link between soil salinity and internal and international migration, emphasising its weight on people's livelihoods. Additionally, salinity affects drinking water reliability, quality, quantity, and accessibility, which is particularly challenging for women (Few, 2003; Rabbani et al., 2009).



Figure 19. Women cleaning the dishes in the water pond next to her household

Access to safe water relies on factors such as land or tube well ownership and affiliation with water committees or NGOs, which correlates with migration aspiration, as evident in the empirical data (Sultana, 2011). Women, primarily responsible for household practices like fetching water (Agarwal, 1992), face challenges when water sources are scarce, impacting their engagement in other activities (Jordan, 2018). High domestic workload often leads to daughters being withdrawn from school (Skakun et al., 2021). Interestingly, Jordan (2018) found that salinity intrusion intensifies the pressure on families to find suitable husbands for their daughters, whose skin is adversely affected by salinity due to higher exposition associated with gender roles (Fig. 19) of washing children, cleansing dishes, etc., influencing perceived attractiveness and potential dowry prospects. Further research should explore the impact of water-related hazards on women's migration aspirations and ways to improve the livelihoods of non-migrant women amidst growing challenges, employing an intersectional lens.

6. RECOMMENDATIONS & FUTURE RESEARCH

This thesis explored the relationship between women and the Sundarbans and how it influences their livelihoods and non-migration aspirations. The study was grounded in the theoretical social-ecological systems framework and employed the livelihood framework for analysis. Additionally, It applied an intersectional lens to investigate the influence of power dynamics between women and men and within the community regarding their migration aspiration.

Some considerations and recommendation for future interventions aiming to enhance the livelihood of non-migrant women:

- ❖ The findings showed the diverse ways in which women organize their livelihoods, including resource collection in the forest. Considering this collection and the influence of caring and reproductive responsibilities on women's livelihood diversification options is crucial for more nuanced interventions. This considerations together with a shift towards *gender transformative* approaches, can lead to more effective and sustainable interventions by NGOs and other actors.

- ❖ The study showed the significant impact of the regulations, emphasising the need to incorporate women's relationships with the Sundarbans in the formulation of conservation policies. This is essential to prevent unintended consequences on their livelihood options, particularly in less direct-income-generating activities like resource processing. Recommendations are made to initiate Sundarbans product valuation projects, strengthening the linkage between women processing these resources and the market. Such projects can also facilitate skill development. Collaboration among stakeholders is vital, such as between NGO training programs and the ecotourism projects that could benefit from local product valuation.

Recommendations for future lines of research

- ❖ It is crucial a more detailed exploration of how non-migrant men and women use the resources in order to integrate this understanding into environmental awareness workshops promoted by NGOs and the forest department for more effective and sustainable resource management.
- ❖ While the analytical framework has seen improvement, there's still room for refinement. Following Natajara et al. (2021) reformulation of the Sustainable Livelihood Framework, the thesis explored how power relations and structural determinants intersected in women's livelihoods. However, it lacks an examination of translocality and the influence of being female-headed household in non-migration decisions, urging further research.
- ❖ This research underscored the influence of external factors, such as the ban scheme imposed by the Government. This emphasizes the significance of considering the social subsystem interventions and the role the actors play within the SES shaping non-migration livelihood.
- ❖ Another area for future work involves integrating the concept of (in)voluntariness into the understanding the women non-migration status. Furthermore, this research has raised questions that require further investigation regarding the influence of certain livelihood capitals on women's non-migration considerations.
- ❖ Regarding economic capital, it would be important to explore how women employ savings and remittances in their livelihood decision-making processes. Additionally, the influence of income source diversity and whether training and the ability to shift between occupations enhance women's adaptive capacity. Concerning social capital, previous studies have addressed the role of NGO presence, women's bottom-up initiatives, and neighbour loan networks when studying place attachment. However, these aspects have not been explored in detail within the non-migration field.
- ❖ Exploring how the relatively novel crab business is developing in the area, would provide with substantial benefits the development of a more sustainable approach benefiting both the women in the community and the crab sector, minimising the potential impacts on the Sundarbans by the overexploitation of this resource.
- ❖ Given the increasing salinity and its recognition as one of the main environmental stressors disrupting coastal livelihoods, especially for women, further work should investigate the effect of water-related hazards on women's migration aspirations. It would also be important to explore ways to enhance non-migrants' livelihoods despite the increasing challenges of a lack of drinking water sources.

7. CONCLUSION

This thesis aimed to empirically explore how women in southwest coastal Bangladesh are developing their livelihoods within the Sundarbans social-ecological system and how their relationships with social actors and livelihood capitals influence their non-migration aspirations. In addressing the complex interplay between women, the Sundarbans, and their non-migration decisions and applying insights from feminist political ecology theory, this study significantly contributes to the field of environmental non-migration and gender, which is still in its early stages.

Focused on answering three research sub-questions, the findings first showed how women also collect resources from inside and outside the forest, both for income generation and household duties. They also demonstrated a high engagement in other livelihood activities, challenging prevailing sociocultural norms that constrain them to remain housewives. Within the surveyed sample, 80% of the women considered non-migration as a future livelihood strategy, an aspiration (or inability to migrate) influenced by the interventions of different actors within the social subsystem, intrahousehold dynamics, and the interaction of various factors within women's livelihoods. The findings indicated an apparent mismatch between the actors' interests in the area, ultimately affecting women's livelihoods. This mismatch is illustrated, for instance, by the effect of the latest government-imposed ban scheme or the lack of structural interventions and insufficient alternatives to manage to stay put. This result underscores the importance of considering social subsystem interventions in shaping non-migration aspirations. Secondly, the results of this investigation showed that the motivation to stay specifically correlated with women having less monthly income, less income from the forest, lack of land, and lack of savings. It highlights the compound influence of economic capital and the diverse ways of capital utilization by women, illustrated also by the lack of correlation with remittances. Environmental awareness programs promoted by NGOs and the Forest Department seemed to have an effect on women's attitudes towards the Sundarbans, influencing their migration consideration due to insufficient non-extractive activities for income generation. One of the most significant findings to emerge from this study resulted from the logistic regression models assessing how the interaction of different factors like resource collection, monthly income, and control of assets shapes the non-migration aspirations of women. In contrast with previous research, collecting resources was associated with considering migration, and the level of asset control or the number of women in the household appeared to influence non-migration aspirations. These findings strengthen the idea that addressing dimensions like access or agency and applying an intersectional lens in the field of climate change adaptation and gender is key to properly comprehending the livelihoods of non-migrant women and their challenges in resource-dependent communities.

The study was not specifically designed to evaluate the voluntariness of non-migration consideration, nor did it explore differences between female-headed households, left-behind women, or differences between men and women. Likewise, implementing other qualitative methods like focus group discussions could have provided a deeper understanding of existing gender dynamics. Notwithstanding these main limitations, the study has set the groundwork for future research in the field of non-migration and gender, raising awareness to develop effective interventions and policies that empower women and foster resilience in the face of environmental changes. Future investigations should deeply explore women's utilization of resources, the influence of economic and social capital, the development

of the crab business for social and ecological sustainable practices, and address the specific challenges posed by increasing salinity and water-related hazards and their effect on women's non-migration aspirations.

8. REFERENCES

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APPENDIX

1. Consent forms

Survey tool

Before conducting the survey, please explain this to the participant

Survey Consent Form

Hello, my pleasure.

First of all, thank you for participating in this survey and collaborating in the development of my research. The name of the researcher (me) is Marta Martínez from Spain, and she is studying for a master's degree in international development at Utrecht University in the Netherlands. The purpose of the research is to investigate how women's livelihood are related to or depend upon the Sundarbans Forest and surroundings.

Before deciding to participate or not, I will read you the consent form and feel free to ask any questions.

If you agree to participate in this survey, you will be asked different questions regarding your household, your daily live activities, the decisions you take, and relationship with the mangrove forest. It is expected to take approximately 30 mins. The survey is anonymous hence your name will not be published, ensuring no individual is identified in this research. There are no direct benefits for you as a participant, but your answers will highly contribute to understand this area and the livelihood of women living here. Participation is voluntary, if you feel uncomfortable or want to stop the survey at any moment you can withdraw from the survey.

After listening to the following statements, do you have any questions?

Thank you for your consent and for your collaboration.

At the end please add:

Thanks for your time and valuable support to my study!

Bangla version

সর্বপ্রথম অনুশোচনা পরিচালনা করার আগে দয়া করে প্রস্তুত হন।

সম্মতি ফর্ম

হ্যালো, আমার প্রত্যাশা।

সবাইকে এই সার্ভেতে অংশগ্রহণ করার এবং আমার গবেষণার উন্নতির জন্য সহযোগিতা করার জন্য ধন্যবাদ। গবেষক (আমি) এর নাম মার্টা মার্টিনেজ স্পেন থেকে, এবং তিনি নেদারল্যান্ডের ইউট্রেখট বিশ্ববিদ্যালয়ে আন্তর্জাতিক উন্নতি পাঠ্যক্রমে মাস্টার ডিগ্রি করছেন। গবেষণার উদ্দেশ্য হলো দেখা কিভাবে নারীদের জীবিকা সুন্দরবন বন এবং পরিবেশের সাথে সম্পর্কিত বা নির্ভর করে। অংশগ্রহণ করার পূর্বে অথবা না অংশগ্রহণ করার পর, আমি আপনাকে সম্মতি ফর্ম পড়বো এবং কোনও প্রশ্ন থাকলে এটা জিজ্ঞাসা করার জন্য আপনাকে মুক্তি দেওয়া হবে।

যদি আপনি এই সার্ভেতে অংশগ্রহণ করার সাথে সম্মত হন, তবে আপনার পরিবারের, দৈনন্দিন জীবনের কার্যক্রমের, আপনি কোনও সিদ্ধান্ত নেওয়ার এবং গভীর জঙ্গল বনের সাথে সম্পর্কের বিভিন্ন প্রশ্ন আপনার প্রশ্ন করা হবে। আনুমানিকভাবে 30 মিনিট সময় লাগতে পারে। এই সার্ভে অবস্থানের এককজনও সনাক্ত না করে, তাহলে আপনার নাম প্রকাশিত হবে না, এই গবেষণাতে কোনও ব্যক্তি সনাক্ত নেই নিশ্চিত করার জন্য।

আপনার প্রশ্নের উত্তর প্রদানের জন্য আপনি অনুমতি দিচ্ছেন এটি স্পষ্ট হওয়ার পরে?

Marta Martinez Fabiani

আপনার সম্মতির জন্য ধন্যবাদ এবং আপনার সংশ্লিষ্ট অনুমতির জন্য ধন্যবাদ।

শেষে যুক্ত করুন:

আমার গবেষণার জন্য আপনার সময় এবং মূল্যবান সাপোর্টের জন্য ধন্যবাদ!

Consent Form Interviews

Hello, my pleasure.

First of all, thank you for participating in this interview and collaborating in the development of my research. The name of the researcher (me) is Marta Martínez from Spain, and she is studying for a master's degree in International Development at Utrecht University in the Netherlands. The purpose of the research is to investigate how women's livelihood are related to or depend upon the Sundarbans Forest and surroundings.

Before deciding to participate or not, I will read you the consent form and feel free to ask any questions.

If you agree to participate in this interview, you will be asked different questions regarding your household, your daily live activities, the decisions you take, and relationship with the mangrove forest. It is expected to take approximately 30 mins. The interview is anonymous hence your name will not be published, ensuring no individual is identified in this research. There are no direct benefits for you as a participant, but your answers will highly contribute to understand this area and the livelihood of women living here. Participation is voluntary, if you feel uncomfortable or want to stop the interview at any moment you can withdraw from the survey.

With the above in mind, I will now ask you a few questions about your consent. I will read a few statements in order to begin the interview:

You consent that:

The interview will be recorded for transcription and analysis purposes (start of recording).

That you be quoted directly- your name will not be published and this interview will respect your confidentiality (All personal information will be anonymized for your security).

Important points:

Notes will be taken throughout the interview

- The transcription and analysis of the interview will be done by me (Marta Martinez).
- You may request a copy of the transcript to verify editing and ensure confidentiality.
- You may contact the researcher, Marta Martinez, for further questions or doubts.

After listening to the following statements, do you have any questions?

Thank you for your consent and for your cooperation.

The interview will now begin. I remind you that you may skip questions, stop the interview or leave the interview at any time you wish.

2. Survey questions

General Information about the household

1. What is the monthly income of the household?
2. Is it enough to maintain your family?
3. How much do you spend weekly on food?

4. How much do you spend on education per year?
5. How much do you spend on health per year?
6. Do you receive remittances?
 - a. If YES, are they enough to cover your expenses?
7. What is the construction material used for walls? (mud, bamboo, tin, tally, brick, wood, thatch, goalpata, concrete, other)
8. What is the construction material used for the roof? (mud, bamboo, tin, tally, brick, wood, thatch, goalpata, concrete, other)
9. What is the source of drinking water? (supply water, tube well, pond/river, string, other)
10. What is the type of cooking? (electric, gas, concrete stove, traditional mud stove, steel)
11. Does your husband live with you?
12. How many migrant members in this house?
13. Were you born in this village?
 - a. If not, how many years have you being living here?

Livelihood capitals & Gender

Economic & Physical Capital

14. What is your main occupation? (housewife, resource collector, farmer, maid, handicraft, crab cultivation, business, other)
15. Do you have additional sources of income?
 - a. If so, which ones? (resource collector, farmer, maid, handicraft, crab cultivation, business, other)
16. Do you have land?
 - a. If so, number of Ha?
17. Do you have access to credit from NGO?
18. Do you have access to loan from local bank or cooperative?
19. Do you borrow loans from local lenders (*Mahajan*)?
20. Do you have a bank account?
 - a. If so, is it a joint account?
21. Do you have savings?

Social Capital

22. Do you join/ take part in any demonstration or protest?
23. Are you involved in environmental activities like restoration or informative meetings?
24. Do you belong to a women's only cooperative (Shomiti)?
25. Do you belong to any NGO?
26. How important in your life is your friendship with other women in the village? (very little, little, moderate, high, very high)

Agency & Power relations at HH level

27. Do you have control over the access to your bank account? (No, little, moderate, high, complete)
28. Do you have control over your household assets? (No, little, moderate, high, complete)
29. Do you need permission from husband or other family members to perform activities outside the house? (not at all, rarely, sometimes, often, every time)
30. Do you feel religious restrictions to go out of the house? (Not at all, rarely, sometimes, often, every time)
31. To what extent can you raise your voice for your needs and rights within the household? (Not at all, rarely, sometimes, often, every time)
32. Do you take decisions regarding regular cooking? (Very little, little, moderate, high, very high)
33. Do you participate in decision-making of your children education-related issues? (Very little, little, moderate, high, very high)

34. How are your decisions prioritized regarding household expenditure? (Very little, little, moderate, high, very high)

Reproductive and Care labor

35. Do you need to take care of the household chores like cleaning, cooking?
36. Do you need to take care of children?
37. Do you need to take care of elder or disable family members?
38. Do you need to be involved in economic activities?
39. Do you need to collect water somewhere else?
40. Do you receive support from your relatives for this?

Livelihood Strategies & The Sundarbans

Natural resources use & Management strategies impact

41. How many members of the household collect resources from the forest or the river?
42. Do you enter Sundarbans to collect/extract resources?
 - a. If so, do you negotiate the pass to enter the forest?
43. Do you collect resources from the river or edge of the forest?
44. How many years have you been involved in resource collection?
45. What of the following resources do you collect? (wood, honey, fish, fry, crab, golpata, fruits/herbal, hunting, none)
46. Do you collect fuelwood for your cooking?
47. Do you collect more resources now than 5 years ago?
48. How often do you collect resources during the permitted season? (Daily, Weekly, Monthly, Rarely, Never)
49. How often do you collect resources during the ban season? (Daily, Weekly, Monthly, Rarely, Never)
50. Do you work processing the resources?
51. Do you have access to the market to sell your products?
52. Do you collaborate or cooperate with other women in the community to share the profit?
53. Do you feel affected by the government restrictions?
54. Do you agree on having the restrictions?
55. Do you receive the food card?
56. Do you think is enough compensation?
57. Has your occupation changed after the restrictions?

Livelihood dependency on the Sundarbans

58. How important do you believe the natural resources from the Sundarbans are for sustaining your livelihood? (not at all important, slightly important, important, fairly important, very important)
59. How much of your weekly income comes from the resources you collect?-num
60. Are you collecting now more than 5 years ago?
61. Has the income coming from the forest resources decreased in the last 5 years?
62. Do you think that someday, Sundarbans will disappear if the way of collecting resources from Sundarbans continues?
63. How important is for you preserving the Sundarbans? (not at all important, slightly important, important, fairly important, very important)

Diversification

64. Have you perceived changes in the rain and flooding or the heat during warm season?
65. If yes, how much these changes affected your livelihood activities in the Sundarbans? (Very little, little, moderate, high, very high)
66. Has your occupation changed after cyclones Sidr and Ayla?
67. Are you actively involved in any programme of conservation and management of the Sundarbans?

68. How much do you trust these initiatives? (Very little, little, moderate, high, very high)
69. Have you been involved in any training of NGO in the last 10 years?
 - a. if so, are you currently doing that activity?
70. Have you considered migration as a livelihood strategy for the future?

Livelihood decision-making & Power relations

71. Who primarily makes decisions about the use of natural resources within your household? (Male Head, Female Head, Jointly by Both, Others)
72. Do you and/or other women in your household have access to information about the sustainable use of natural resources from the Sundarbans?"
73. How much control do you believe you have over made decisions related to your livelihood strategies? (no control, little control, neutral, some control, total)
74. To what extent do you believe women should have the freedom to make independent decisions about their livelihoods and resource use? (not at all, a little, moderately, quite a bit, completely)
75. How often can you negotiate with organization members or NGOs about your economic opportunities? (Very Rarely or Never, occasionally, sometimes, often, always or very frequently)

Socio-demographic

76. Age of the respondent?
77. Religion of the respondent? Islam, Hindu, Christian, other
78. Marital status of the respondent? Married, never married, Widowed, divorced/separated
79. What is your level of education?
80. How many members living in this house?
81. What is your relationship with the head of the household? (Head, wife, son/daughter, spouse of son/daughter)
82. How many women live in the HH?

Thanks for your time and valuable support to my study!

3. Experts descriptions

EXPERTS AT KHULNA UNIVERSITY			
NAME	FIELD OF STUDY	POSITION	RESEARCH INTEREST (based on Khulna University provided data)
Md Sanaul Islam	Soil, Water & Environment	Proffesor at Life Sciences Faculty	Aggregation, aggregate-carbon and aggregate-nutrient dynamics; Assessment, evaluation, and improvement in soil fertility and productivity; Assessment, monitoring, evaluation, and improvement in soil quality and soil health; Estimation, evaluation, monitoring, controlling, and conservation of soil erosion and degradation; Net primary productivity and nutrient dynamics of afforested lands.
Nishad Nasrim	Economics	Phd field of migration, gender and wellbeing.	"I am working on migration, education, health and gender dimensions. Mostly I prefer econometric modeling for analysis. However, I have experiences in both quantitative and qualitative analyses"
Md Nazrul Islam	Forestry and Wood Techonology	Professor	"(...)More specifically, I am interested in the following areas - Transformation of woody and non-woody materials, Life and livelihood of the forest resources dependent people
A. K. Fazlul Hoque	Forestry and Wood Techonology	Professor	Forest Ecology and Management
Md Zakir Hossain	Urban & Rural Planning Discipline	Professor	Climate change adaptation; poverty; vulnerability; resilience; governance; rural development
Waisul Islam	Forestry and Wood Techonology	Professor	Nature-based tourism including coastal and maritime tourism, Community-based ecotourism, Participatory forest practices and management, Co-management approach, Participatory/shared governance, Forest policy, Blue economy, Wildlife conservation and community development

OTHER ACTORS INTERVIEWED			
NAME	TYPE OF ACTOR	METHOD EMPLOYED	BASIC DESCRIPTION
The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Provider of services in the field of international development cooperation and international education work.	Semi-structured interview	GIZ is working in Bangladesh on behalf of the German Federal Ministry for Economic Cooperation and Development and the European Union (EU). The priority areas of cooperation are: energy, climate and urban development Sustainable economic development, education and employment Conserving biodiversity
Solidaridad Network Asia	International network organization with partners all over the world	Informal interview	Solidaridad provides scalable and economically effective sustainability solutions in agriculture and mining sectors in collaboration with governments, businesses and the community
Centre for natural Resources Studies (CNRS)	National NGO	Semi-structured interview	Pro-environmental NGO, implementing community-based environmental restoration projects among others
Forest office the Sundarbans-ACF (Assistant conservator of forest)	Governmental figure	Semi-structured interview	Under the Bangladesh Forest Department, Ministry of Environment, Forest and Climate Change
AquaMAX seafood	Private sector	Informal interview	Soft-Shell Mangrove Crab farm

4. Interviewees description

Semi-structured interviews	Gender	Place interview	Birth Village	Religion	Age	Education Level	Family situation (other family members of the family unit)	Wants to migrate if possible?
1	Woman	Buri Goalini	Buri Goalini	Muslim	30	Class 8	Husband and 2 sons	No (voluntary)
2	Woman	Buri Goalini	Buri Goalini	Muslim	45-46	Class 3/4	Husband, 2 sons, 1 daughter	No (voluntary)
3	Woman+ Her mother	Buri Goalini	Buri Goalini	Muslim	50	Illiterate	Widow (20 yrs ago) , no children	No, she has nowhere to go or anyone to go with (involuntary)
4	Man	Buri Goalini	Buri Goalini	Muslim	56	Illiterate	Wife, 2 sons, 1 daughter	No (voluntary)
5	Man	Buri Goalini	Buri Goalini	Muslim	60-65	Illiterate or very low education	Wife, 5 sons, 2 daughters (1 disable)	Yes if someone would find a job elsewhere (involuntary)
6	Woman	Buri Goalini	Buri Goalini	Muslim	60	Illiterate	Widow (more than 20yrs ago), 1 son and 2 daughters (1 disable)	Yes if restrictions continues (considering for future)
7	Woman	Munshiganj	Bongsipur in Keora Ghat. (16 years ago)	Not applicable	37	Class 7	Husband , 1 son and 1 daughter	Yes, if restrictions continues. They cant because husband is ill. (involuntary non-migrant)
8	Woman	Munshiganj	Munshiganj	Not applicable	40	Illiterate	Widow (20 yrs ago), 1 son	No, she feels has nowhere to go (involuntary)
9	Woman	Munshiganj	Munshiganj	Not applicable	30	Illiterate	Widow (since 20yrs ago?), 3 sons	No, she feels has nowhere to go (involuntary)
10	Man	Munshiganj	Munshiganj	Muslim	34	Class 5	Wife, 2 daughters, mother	No, while he can still collect, and if not, will find another job (voluntary)
11	Woman	Munshiganj	Panakhali(Buri Goalini), 27 yrs ago	Muslim	35	Class 6	Ill husband, 3 daughters, 1 son	No, she is attached to the place and knows how to navigate the place and its possibilities. (voluntary)
12	Man	Munshiganj	Munshiganj	Muslim	24	Illiterate	Wife, 1 daughter	Yes, if he gets help from the outside (involuntary)

5. Qualitative Interviews guides

Interview guide community Buri Goalini & Munshiganj*Opening Questions*

1. How old are you?
2. Where were you born?
 - a. if not here, How long have you been living in this place?
3. Do you have children or do you take care of someone?
4. What is your level of education ?
 - a. if you have children, what is their level?
5. Do you plan to continue their education?

*Key questions***Economic & decision making**

6. What is your current occupation? (If there is) (*livelihood*)
 - a. Why did you choose this occupation?
7. Do you do other activities?
 - a. *prob: like processing, collecting fruits, other generating activities*
8. Do you sell your products in the market?
 - a. if yes, do you find challenges in it?
 - b. if not, why?
9. How much control do you believe you have over made decisions related to your livelihood strategies?
10. How much do you believe women should have the freedom to make independent decisions about their livelihoods and resource use?
If women- Do you feel problems with your family or the community because of working outside the home?
11. What are the sources of income of your family?
 - a. Who controls the money in your household?
 - b. What do you use the earnings for in your family?
12. Do you have to go to collect water somewhere else?
13. Do you receive any remittances?

Social & NGO

14. Do you belong to a Shomiti?
15. if yes, what benefits does it bring you?
16. Do you cooperate with other women to share profits or do resource collection?
17. Do you have the support of your relatives if you have problems due to natural disasters or other problems?
17. Are you get credit from NGOS or borrow loans?
18. Have you been involved in any training of NGO in the last 10 years?
 - a. if so, are you currently doing that activity?
19. How important is for you having the support of the NGO?
20. Has your occupation changed after cyclones Sidr and Ayla?
21. Do you see working in the crab farms as a good income opportunity?

Sundarbans

22. What does the Sundarbans mean to you?
23. *What resources do you get from the forest or the river?*
24. Do you collect now more or less than 5 years ago?
25. Do you use fuelwood for cooking?
26. If yes, will you be willing to use gas?
27. Do you perceive changes in the forest or in the number of fish or plants?
28. And in the climate?
29. How has your life been affected since the ban put in place in 2020?
30. Do you agree there have to be some bans?
31. What do you ask the government to compensate this ban?
32. How included do you feel in the decision making of the management of the resources?
33. How important is for you preserving the Sundarbans?
34. Do you think that someday, Sundarbans will disappear if the way of collecting resources from Sundarbans continues?

Migration

35. Have you consider migrating from here?
36. Why or why not? And where?
37. Why are you staying in this area?

38. If the Sundarbans continues to have more restrictions, would you consider leaving? Or do you have other options?

Interview guide GIZ

Co-Management in the Sundarbans Mangrove Forest Management of the Sundarbans Mangrove Forests for Biodiversity Conservation and Increased Adaptation to Climate Change Project (SMP)

Objectives SMP

1. What conservation tools have been developed?
2. What does 'co-management' entails?
3. How are the last restrictions on logging and resource extraction align with the SMP?

Co management structures

4. Who decides which person to include in this forum? and what is the criteria?
5. How are the people no included here represented in the decisions? One of this per village?
6. Are the resource users that are not involved in the management structures able to participate in this co-management?

Challenges

7. What are the main problems the resource users or other cause in the forest?
8. What are the recognized needs of the resource users in this program?
9. How are they aligned with the conservation strategies?

Project of support

10. What are the activities that can function as alternatives for the resource extraction activities?
11. What specific challenges and needs of women have you disclosed?
12. Do you see improvement on women's participation and decision making after implementation of the project?
13. Have you seen differences on involvement between female that are head of household and the females that live with the husband?
14. In what ways their participation is strengthened?

Interview guide Protibesh/USAID

Introduction

1. Can you tell me your name and position in the organization?
2. What are the projects you are conducting in the field? in the villages of Buri Goalini and Munshiganj?
3. Who and how many people are you targeting?
4. What are your main activities regarding diversification of livelihoods?

Sundarbans

5. Do you work in conservation projects?
6. As you know this area, in your perspective, Are the co-managment efforts to preserve the sundarbans working?
 - a. Why or why not?
7. What do you think would be a better way?

8. To what extent are the community knowledge and needs implemented in the conservation strategies as far as you know?
9. Do you think men and women have different relationship with the environment?
10. What is the relationship between the forest office and the resource users?
11. How could the forest department pursue the conservation activities in a better way?
12. How is the crab cultivation increasement affecting the environment?
13. Is it providing employment opportunities?

Regarding gender and livelihood

14. What are the main problems or challenges found by the communities to be less dependant on the river and forest resources?
15. Have you see changes in the last years on how women involve themselves in economic activites?
 - a. If so, why do think is happening?
16. What is the situation of left-alone women?
17. Reading their decision-making?
18. And their economic Independence
19. What livelihood options are women taking?
20. Is there more people considering migration as an option?

Interview guide Forest Office- ACF (Assistant conservator of forest)

Introduction

Hello,

1. Could you tell me your name and your position?
2. How long have you being working here?
3. Could you tell me about your roles as forest officer?
4. What is the current state of the Sundarbans ecosystem?
5. What are the main problems the Sundarbans is facing?

Conservation plans

6. How have the restrictions changed in the last 10 years?
7. Do you think the conservation plans are working?
8. If not, what do you think as forest officer could work best?
9. Have you been involved in the co-management plans?
 - a. if so, in what ways?
10. How is the relationship between the forest officer and the communities?

Livelihood alternatives

11. In times of restrictions, is people going still to collect resources?
12. Is the forest department offering alternatives for the resource users?
13. Have the Forest department provided any kind of infrastructure in this area?

6. Code tree qualitative interviews

Livelihood capitals

1. Social & Demographic Capitals
 - 1.1 Demographic

- 1.2 Social bonding
 - 1.2.1 Women friendship & collaboration
 - 1.2.2 Relatives & community support
 - 1.2.3 Belonging to organisations
- 1.3 HH characteristics
- 2. Economic Capital
 - 2.1 Occupation
 - 2.2 Other Income sources
 - 2.3 Income in BDT tk of diverse sources
 - 2.3 Access to credit
- 3. Natural capital
 - 3.1 Ecosystem Services
 - 3.1.1 Supporting & Regulating
 - 3.1.2 Provisioning
 - 3.1.3 Cultural
 - 3.2 Access & regulations
 - 3.3 Dependency
 - 3.4 Availability changes
 - 3.5 Environmental vulnerability
- Livelihood strategies & External actors
- 4. External actors influence
 - 4.1 NGO
 - 4.1.1 Training & interventions
 - 4.1.2 Relationship
 - 4.1.3 Access to non-credit resources
 - 4.2 Benefits from loans and credit
 - 4.3 Conservation and environmental awareness programmes
 - 4.4 Crab aquaculture sector
- 5. Livelihood strategies
 - 5.1 Migration
 - 5.1.1 Community migration dynamics
 - 5.1.2 Individual migration aspirations
- 6. Gender dimension
 - 6.1 Education
 - 6.2 Access to the market
 - 6.3 Decision-making HH
 - 6.4 Decision-making community level

7. Code book

CATEGORY	CODE	STRATEGY	DESCRIPTION	EXAMPLE FROM DATA
Livelihood capitals				
1. Social & Demographic Capitals				
	1.1 Demographic	Deductive	Age, Village, time in village, n° of sons & daughters in the HH	<p><i>"I was born in this Burigoalini."</i></p> <p><i>"The age of the first child is 12 years and three months; the age of the second child is five years and three months."</i></p> <p><i>" I am about 24 years old"</i></p> <p><i>"Hormonal problems are there, that's why we don't have any children."</i></p> <p><i>"My age will be 60/65"</i></p> <p><i>"I have five sons and one daughter married and one daughter is special."</i></p>
	1.2 Social bondings	Deductive	Different types of social networks built in the community [e.g. Alam & Khalil, 2022]	
	1.2.1 Women friendship & collaboration	Inductive	How do women perceived or experience their relationship with other women in the area	<p><i>"[Is this association money only for women?] Yes, only for women"</i></p> <p><i>"Yes, we can, we all did it together once before, some money was deposited, when there was a problem, he would take money from here and it would be repaid later. Now the association is broken."</i></p>

1.2.2 Relatives & community support	Deductive	The support women receive from their relatives in case of natural or another type of calamities [e.g. Kibria et al., 2019]	<i>"When we go to the cyclone center everyone helps us with some food."</i>
			<i>"Yes, we are all the same, unable to help anyone."</i>
			<i>"[Do you get any support from the communities?] No, I don't get it from the chairman."</i>
			<i>"People give, they give some rice, they give two to one kg of rice, if they eat some rice, if they are sick, they give ten TK, what else do they give, they don't have money. Apart from this, there is nothing else to give."</i>
			<i>"No, I don't get any kind of support. I do not get any help from people around."</i>
1.2.3 Belonging to organisations	Deductive/Inductive	Belong to an NGO, belong to a Shomiti (of women only or for everyone) [e.g. Khalil & Jacobs, 2021]	<i>"Yes, I am in "Shomiti"."</i>
			<i>" I work a little with various NGOs, grow vegetables. And sometimes I do fish farming."</i>
			<i>"Yes, I have NGO associated membership [They provide a book which tells that I am a member of that NGO]. "Ganamukhi Shomiti" is its name."</i>
			<i>"Our village association is "Ganamukhi"."</i>
			<i>"Yes, I am in three "Shomiti" now."</i>
			<i>"[Are you involved in any village "Shomiti"?:], No"</i>
1.3 charactersitics	HH Deductive	Water source, cooking and land ownership	<i>"We fetch water from a long distance which is about two to three kilometers from here."</i>

"Takes about fifty to sixty taka per day. Drinking water is 20 TK a day but for cooking and bathing, a total of 50-60 TK is required to buy water."

"[drinking water] from rainwater. In summer we have to drink pond water. [...] Yes. we bring it from there[the tanks] but many people in our village take it and it runs out after 5-6 months."

"Keep the rain water in the drum. I drink this water as long as it lasts, and when it runs out, I buy it from outside and drink it. There is water in Munshiganj for 25-taka 30 taka for 1 litter"

"We catch rainwater and drink it.[...] Rainwater does not run throughout the year. [We] drink pond water. It is not always possible to buy water. And if you want to buy water, you have to go to Munshi Ganj."

"There is "Akiz" company near the madrasa, we buy drinking water there for 1000 TK annually."

"No, buy gas from the market. [...] Yes., if there is electricity, it is cooked in a rice cooker."

"I can't go to Sundarbans that much so I can't collect wood, it's very difficult for me to collect cards. So, I can't cook much with wood. I cook with this "Gewa plant" we have "Gewa Plant" here."

"Before there were no houses. Now after the government gave me this house, I live here."

"No, there is only the land of the house. The land area of the house is 5 katha."

2. Economic Capital

2.1 Occupation

Deductive

Main occupation of respondent

"I am a housewife."

"I fish in "Sundarbans" but now I stay at home because Sundarbans work is closed."

2.2 Other Income sources Inductive

Other income sources of the respondent. It can also be understood as the diversity of livelihood strategy for income generation

"I work a little with various NGOs, grow vegetables. And sometimes I do fish farming."

"There are a lot of "Gher" of people. I go there and I work there as a Day Laborer."

" I do housework, I sew kantha"

"I raised my son by working in people's houses, pulling nets in the river"

"I go to the forest, catches fish."

"My main target is business. [...] Selling eggs, selling poultry and selling ice cream would be great for me if I could do it on a bigger scale."

"Yes, I work as a daily wage worker. I work as a day laborer when it is closed.[...] Yes I also do [manual work]. I do I sew, there is a sewing machine."

"When the pass is closed, everyone goes down to the river to catch fish. [And daily labour?] Brick kiln", I go seasonally. [And the farm?] Go sometimes. I go to the things I can do; I don't go to the things I can't."

" Yes, sometimes when money is very scarce, we get some money by selling ducks or chickens or duck eggs."

"Now you always have to go outside to work. Due to scarcity, one has to leave home and go outside to work"

" My sons go to Sundarbans. When Sundarbans is closed, four drive a van, and one runs a tea shop.[...] We don't know how to study, so we can't do the

2.3 Access to credit Deductive

Credit by NGO, loans by local lender or relatives [e.g. Mallick et al., 2020]

work of studying. If we were given some training like garments then we could do that."

" The younger daughter works from home to home in Khulna."

"To say something else, I used to work in people's houses and sometimes I used to work in the field"

"Yes, I took it. From BRAC. [...] Annual loan from BRAC, like 70,000, 30,000. Whatever is needed."

"Now many times we have to run on interest money. [...] You have to take money from someone and then you have to pay him profit again. For example, if you take 2000 taka, you have to pay 200-taka profit. It means you have to pay interest."

"Yes, I am in "Shomiti". I have borrowed money.[...]. I have been saving since one-and-a-half years. Now it appears that we are poor people, we need 5000 TK in times of danger, now if I don't get these five thousand TK from the people of the village, then I have to take a loan from my association, then after recovering from the danger, I have to repay the association slowly in installments."

"Yes, we took loan.[from the] 'Government Poor Fund'. I save this 50-60 rupees."

"Yes, I still have a debt of TK 10,000."

" No, not from any 'mahaja' [local lender]. We all borrow from Shomiti. There is no 'Mahajan' now."

3. Natural capital

3.1	Ecosystem Services	Deductive	<p>Classified based on Ecosystem Services framework developed by the MAE, adapted by Layke et al. 2012. Afterwards adapted to mangrove ecosystem by Afonso et al. 2021.</p> <p>Supporting: Services such as nursery area for estuary species, habitat heterogeneity defined by the diversity of species found in the mangrove.</p>
3.1.1	Supporting & Regulating	Inductive	<p>Regulating: Air quality, regional climate regulation, coastal erosion, groundwater recharge, soil quality, pest regulating. How people is perceiving these benefits</p> <p><i>"Sundarbans is very important for us. Without this forest, we would have drowned in storms and floods and all our houses would have been destroyed. We get oxygen from plants, if that oxygen did not come from this Sundarbans, we would not survive."</i></p> <p><i>"Sundarbans gives us oxygen. Protects from injury, from natural calamities"</i></p> <p><i>"If you go to "Sundarbans" and cut a tree, it will cause damage. "Sundarbans" moderates many storms, from which we get a lot of help."</i></p>

"Yes, you can take shelter under a tree when it rains. Reduces storm volume."

3.1.2 Provisioning	Deductive	Food (fish, fry, crab, etc), timber, fuelwood. What resources are the respondents gathering from the forest.	<i>"We collect wood, fish and honey from the Sundarbans.[...] I cook with wood"</i>
			<i>"[I] bring dry wood and leaves from the Sundarbans."</i>
			<i>"We catch fish, collect honey, in short, we do whatever we can"</i>
			<i>"Earlier in the Sundarbans, I used to cut wood, catch fish, catch crabs, collect honey and do all the things available in the Sundarbans."</i>
			<i>" I used to catch fish and bring wood for cooking.[...] No, I didn't bring the crab. I used to bring only fish fry."</i>
3.1.3 Cultural	Deductive	Place attachment, recreation and tourism, aesthetic and spiritual values, cultural heritage, relationship with forest	<i>"Sundarbans in a word is like my mother because Sundarbans protects us from all kinds of calamities here. We are alive because of Sundarbans. [...] Yes, I consider myself one of these environments....] We don't want to leave our native land"</i>
			<i>"What do we mean by Sundarbans, our livelihood, Sundarbans is our everything. Sundarbans is everything we eat and live.[...] Sundarbans is like a mother to us."</i>

3.2 Access & Deductive regulations

Effect of government latest restrictions, opinion about them. Who has the acces to the SMF resources, either the wife or the husband [e.g. Zohra, 2011]

"The Sundarbans are all ours. Sundarbans is the only way to sustain our life."

"Only my husband does this [collect]. [...] Yes, after effect, think where if we cut our annual income in half, it will have a big effect on our life.[...] We accepted that the government has banned going to the forest in January and February. But we don't want to accept the ban on going for three months during the rainy season. We want the government to lift the ban for us in three months."

"Earlier, we who used to go to the forest used to earn from it, it is not happening anymore because the side is closed"

"Yes, if it is closed [sometimes] it is a little problem but if it is closed for two months in a year it is not much problem. 90% of people here are poor and we all have to survive. But I do not agree with this closure of three months to four month.[...]We do not cut any trees and do not kill fish. [...] We all fish with fishing net `not with poison]"

"Not going to Sundarbans has done good for us, but if poor people can't go to Sundarbans, it is very difficult to survive. [...] Yes, you [the government] have forbidden it for our good. If the government would provide any help [since] going to Sundarbans is prohibited at this time and we cannot go [...] so if the government wants to give any help, then we could have survived this period well without going to Sundarbans.

"Yes, it is better than before. There are more plants in the Sundarbans, and the share of fish is increasing now."

"No, it doesn't sound good to me [the ban]. As you think if we had cut down the big tree there would have been more work under it. [I: The big trees in the forest retain the carbon that the other small trees can't keep even for 50-60 years, don't you think it's a loss for the environment?] Yes, that's right. But we can cut the trees which are withered. The fish in the river can be caught"

3.3 Dependency

Deductive

How much their livelihood depends on the forest and how the use of resources has changed in the last years [add theory, reference]

"Yes, I definitely think doing this will benefit the Sundarbans. When it is forbidden to go to Sundarbans, we will not go to Sundarbans only if we are arranged to work here. Then the Sundarbans will benefit a lot. If different people stop using poison and poison, Sundarbans will be completely new. Due to the poison, the soil, fish, plants and animals of the Sundarbans are all being damaged. So, if you stop using poison, the Sundarbans will become beautiful like a flower."

"Now goes more. Earlier only men went and now both men and women go. Chopping wood, catching fish."

"Yes, we go to the forest. I could collect earlier. Now there are more widows so less is collected. Besides, the forest is closed for five or six months, so I cannot collect it. Yes, it has been very difficult. Yes, I accepted [the ban]. Hard to accept. Because the income has decreased. [any compensation] would be grate."

"My husband has been doing this work since birth because the people of this area earn their living by doing this work"

" After the storm, I go more to the forest.[...]The houses were all destroyed in the storm, the people of the house got sick, so we went to the forest more."

"As we are able to go to the "Sundarbans" to fish, we get many benefits in many ways and even if we don't cut the trees, we benefit. Many times, the trees have to be cut because wood is needed for cooking at home. It appears that if we do not go to the forest, we have no other source of income."

"We need forest. We will be better off if we have forests.[...] I know this myself. If there are forests, we will be better off in many ways. If we don't have forest then we will not be well."

3.4 Availability Inductive
changes

Climate change & natural
disasters effects on the
mangrove resources,
perceptions future of the SMF
[e.g. Mallick et al., 2021]

"90% of people here are poor and we all have to survive"

"Sundarbans is very good. Sundarbans is the only means of earning in our life. If it was open all year we wouldn't have to worry."

"Yes go, catch the little fish I have to eat something to survive if I don't work, how my mother and I will survive. [...] Not going to Sundarbans has done good for us, but if poor people can't go to Sundarbans, it is very difficult to survive".

"I used to get more now a little less. The kind of fish that used to be found in the forest is now gone. [...]The number of the fish has been decreased."

"I could collect earlier. Now there are more widows so less is collected. Besides, the forest is closed for five or six months, so I cannot collect it."

" Sundarbans have benefited. In Sundarbans wood is growing, fish are growing more. And we are lacking and suffering.[...]Yes, that is why Sundarbans are closed and Sundarbans benefited and saved."

" It is decreasing, now going to Sundarbans has stopped, now the helath of Sundarbans has increased a little. If you go to Sundarbans again, it will decrease"

"Yes, it is better than before. There are more plants in the Sundarbans, and the share of fish is increasing now."

"Yes, the forest is good but if we don't go to the forest and cut wood then there will be no problem in the forest. There are shrimps, fishes, crabs, they die after six-seven months, if we can live with these, then it is good for us. And we are not harming the forest."

3.5 Environmental
vulnerability Inductive

Effects of environmental disasters or other hazards upon their livelihoods, with the cyclones of Ayla and Sidr as the point of reference. Especially from a temporal dimension, people referred to changes they perceive in the environmental condition, weather patterns and/or salinity. [e.g. Hoque et al., 2017]

"It [my livelihood] was good before the storm. Yes, it was damaged a lot by the storm. Then we repaired it again, and [got back to the previous state]

"It was good, we were good before. [...] Everything is broken in the storm. Yes, I had to earn money and do it all again. It took five or six years [to manage fixing everything]."

" I grow vegetables but everything is drowning in water. Before the storm we had many possessions, money. Many properties were destroyed in the storm. Now I cannot reach the previous state"

" Climate change impact happening more now. Water rises more now. The tide is rising."

"The temperature is changing; the weather is changing. Through these temperature changes and weather changes we understand that the climate is changing now. (Other interview) Five years ago, it was less hot now it is hotter. Now the temperature is very high. [Extra Person]Now the environment is bad."

"[Old mother] This year is very hot, this year there will be a big disaster. It is a very bad sign for the environment when it gets so hot during monsoon. It was not so hot then. But if there was so much heat then there would have been a big disaster. I would pack everything to go to the cyclone centre. [...]

When we were young, there was no salinity in this area, the soil was sweet, and we used to cultivate a lot of paddy. [...] Back then we used to cultivate crops twice a year. I used to cultivate paddy twice a year."

Livelihood strategies &
External actors

4. External actors influence

4.1 NGO

Dynamics of the community with NGOs via livelihood diversification training, environmental awareness programmes etc. [e.g. Khalil et al., 2020]

4.1.1 Training & Deductive interventions

If the participant receives training from an NGO, the kind of training, and if they are still doing it. Also, the interventions of NGOs in the area, as it is very common the high workload post-disaster in the area. It is related to the diversity of income sources in the economic capital code

"I got training from CCTV NGO. I received training on how to raise poultry.[...] it was good for us because we know how to raise chickens and how to protect the eggs."

"Sometimes when called, everyone gathers in one place and then goes to the meeting [organised by the Forest Department in the village]."

"Yes, i received training from "Ganamukhi". I raise poultry, we sell them to the people of the village.[...] I went to that meeting [organised by the Forest Deparment]. [Are NGOs training you or helping?] When we fall into any danger, we take money from them to get out of that danger and then repay them in instalments. [...] It will be good to know something and learn something. Many people don't know much, what is known can be learned and then you can work from it."

"[Where did you get this idea to cook with "Gewagach"?) In training we were told that trees cannot be brought from the Sundarbans, so we were taught this. If you cut one tree, plant two trees."

"Yes, I got a training on "Bagda" shrimp farming from GIZ."

"The NGO only gave rice. [...] No, we did not get any such help, we did not get any poultry. We don't know how to study, so we can't do the work of studying. If we were given some training like garments then we could do that."

" I didn't get it [training from NGO]. Nothing has been received from the NGO. There is a Fishermen card. [Do you go to any NGO meeting?] No, and everyone got help from the NGOs but they didnt give it to us".

"Yes, I received training on how to grow vegetables. I went to the foresters meeting. I have just planted it and the results are coming."

"Sometimes when called, everyone gathers in one place and then goes to the meeting [of the Forest Department]."

4.1.2 Relationship	Inductive	How does the respondent perceive the NGO regarding the help provided and their access to those resources.	<i>" Yes, we want to live like this but if someone could help us a little our life would be much easier"</i>
			<i>"On the other hand, the NGO does not work in any way and does not give us any help or cooperation. If I don't get it, how can others get it? I got only one job and got that house.[extra person] Why don't others get it because you don't get it? Be satisfied with what you have got."</i>
			<i>"No, they see the condition of the houses, the poor, but they don't notice. No one goes from one place to another. No one gives a damn because we don't want anything from them. No one appreciates being poor.[...] I am willing to go [to a training if it is announced]."</i>
			<i>"[about the meetings] I listen and speak to them. We also talk to them. [These meetings are] good for us because we can learn a lot".</i>
			<i>"I can talk a little bit with everyone so the NGO people involved me in this work."</i>
			<i>"Yes, they ask about the problems and when we tell them and they listen and try to solve problems"</i>
			<i>"Yes of course it be good [compensation from the government]. It is good to work [get a job as compensation instead of money] as we cant go to the forest now."</i>
4.1.3 Access to non-credit resources	Inductive	When NGOs or Institutions provide (non-financial) resources to the community, what is their form?	<i>"We got help from CCT. We got help from CCT."</i>

4.2 Conservation and environmental awareness programmes

Inductive

The outcomes of the conservation strategies and awareness meetings result in new knowledge acquired. What kind of statements and new discourses are these programmes bringing in to the community in regards to the protection of the Sundarbans and their views on these new discourses? It seems to be diverse the impact in women in comparison to men.

"We keep the water in these tanks that you see. I bought these tanks on loan from two "Ganamukhi Shomiti"."

"Yes, it's true that many people buy vans without doing business after getting money and destroy them in accidents. Many others ran away."

" I drink the water from the pond and also drink the water provided by the "Shakti Foundation". [Also] I got the water drum from the "Ganamukhi" organization. It was not given to everyone who had the ability to buy, but to those who could not, it was given through loans to those who could not. Later, we paid off this loan"

"Before [Ayla and Sidr] there were no houses. Now after the government gave me this house, I live here."

[Sundarbans is protected] For our good. [...] We are told not to go to the forest when there are restrictions. They also talk about different things. [Will the forest survive if the extraction continues in this way, or it will be the same?] Yes, nothing happens in the forest. Those who poison are harming the forest, not everyone is harming it.[...] They should be stopped. Out of 100 people maybe 1-2 are giving poison and the rest 98 people are earning well. This is a loss for one or two people."

"Yes, I understand that earlier we used to cut the trees of Sundarbans so natural calamities would have hit more. And now we go less, so the storm is less."

"Sundarbans is very important for us. Without this forest, we would have drowned in storms and floods and all our houses would have been destroyed."

We get oxygen from plants, if that oxygen did not come from this Sundarbans, we would not survive.[...] I have heard this information from various trainings."

"I don't understand anything. I did not receive training on the Sundarbans. [But] Yes, it seems [we need to save the Sundarbans. Sundarbans plants protect us from various natural calamities so we try not to cut the trees and prevent others from cutting them.[How do you know this?] There was a meeting after Ayala, I came to know through that meeting. He gave a task from the meeting."

"Yes we go [to the meetings for protection of th Sundarbans]. Meetings are good. [They are held] by forest division. Small fish cannot be caught, wood cannot be cut, these things [they] say. The forest should be saved [because] it protects from storms. [If we continue to take resources from the Sundarbans like this] it will be destroyed."

"From those meetings we know, how to protect the forest, how many people cut wood in the forest, killing fish means illegal work, we need to prohibit them. [Do you go less to the Sundarbanas after knowing this?] No, I go but if I see any illegal act, I forbid them not to do illegal act.[...] By cutting only dry wood, the number of trees is increasing."

4.3 Crab
aquaculture sector Deductive

The perceived influence of the aquaculture sector on the livelihood of the respondents. This sector has been growing recently, parallel to the decline of shrimp aquaculture. This sector depends on the mangrove resources (crab) and it is also having an influence on

"[Crab farms] are fine. But we don't have that much money to it."

the ecology of the mangrove ecosystem and soil salinization of the area. [add theory, reference]

"It is good for some and not for others. Some of the people gain and some lose."

"Yes, this is a fairly profitable business. Most of the time we bring fish from the Sundarbans and cultivate it. Then we sell it in the big market and sometimes we buy fish and cultivate it and sell it in the market. When we buy from outside and cultivate fish, those fishes are kept at Tk 400 per kg and then we grow them and sell them in the market. My son works in crab company."

"Yes, [crab farming is] a very profitable business. But this year there was no profit. I could not sell the crab abroad. Foreigners are not taking crabs this year.[extra person] Foreigners are buying the fish they are fixing the price themselves. Giving low price, not giving fair price."

5. Livelihood strategies

5.1 Migration

Deductive

Migration is a recurrent livelihood strategy in these vulnerable communities. Can be either out-migration, innmigration in the area, or non-migration (both voluntary

or involuntary). [e.g. Bernzen et al., 2019; Khatun et al., 2019]

5.1.1 Community migration dynamics Inductive

Description of the general dynamics in the town and the migration situation of the respondents relatives.

"Yes, my uncles and cousins are gone. They have moved to Dhaka. They got jobs there and joined different companies. They didn't take the whole family, many of them have their parents and wives here. Many others have left together.[...] No, they don't have any land here.[They left] not because of any disaster, they already have no land. They work in various garment companies and do not need any education."

"Yes, we used to go to the forest together. Now he is driving a "rickshaw" in "Dhaka". Many such friends, relatives have gone."

"Relatives have gone, people from nearby villages. Due to the closure of the "Sundarbans" side, many have left without being able to earn."

"They have gone a lot. There is a possibility that they will return. Some went [for ever], some didn't. Some keep coming back when there is availability for work here"

"Yes, many people have moved out from this area as there is not much work here, they have moved to many places like Dhaka, Khulna. Many have gone to India. Not everyone is gone forever, many come and go. Yes, they [the ones that go to India] come when their visa expires. But the Hindus who go, go forever. Their matter is different."

5.1.2 Individual migration aspirations Deductive

The individual aspiration of migration. Can represent either the will to stay put, the will to migrate with the inability to do so, or the will to migrate (or not) based on the influence of external actors.

"My sons went to Dhaka city but they are not settled there. Because there is a salary of 5000-6000 TK and the money ends when paying house rent. This is not how their family lives, so they have moved [back] again.

"Yes, [my son] has gone to Khulna and is working as a daily wage earner there. [He doesn't give me anything of his earning]"

"Yes, many have gone, when there is no work they go and when there is work, they come again. When the fish season is here, we all come here to catch fish and sell it in the market."

"No, I don't want to leave from here. We don't want to leave our native land. Also my husband is a sick man and we don't want to go anywhere else. [...] if someone could help us a little our life would be much easier."

" I can't do those things [migrating from here]. So, I don't want to go for that. [if the forest would be closed always]then a measure must be taken. Have to buy a van, with a loan from the "Shomiti". "

" No, where else will I go?. [If the Sundarbans would be closed completely]Now I can earn and eat a little better and then I have to suffer a little, what else? I don't have any plan to migrate from this place because that's the other place is unknown place and it is my known place. I can manage something here and many of my relatives had migrated from this place."

"No, I'm not going anywhere. No, where will I go? [Regarding the contact with the migrating relatives] Yes [we are in contact], but we have a problem going there. It costs a lot of money. If I get support from the outside, then I will go there"

"No, we don't want to go anywhere else. Neither do they [my children]. This is our native land and we can adapt to this environment and survive in hardship. Which is the trouble of going somewhere else. [If the Sundarbans would be closed completely] No, even if you don't want to go out, you have to spend your life doing something. [Extra Person] If the government or any NGO gives us some help so that we can live happily here, it could be better. If we get help like this, then we have no desire or hope to leave from here."

" Where else can I go? I will not go anywhere. [If the Sundarbans would be closed completely] I will try to become a day laborer. Where do we leave? We have nowhere to go."

"I don't want to go. And where will I go? no place to go. [If the Sundarbans would be closed completely] Then I will work in the field. Those who have that field, I will try to request them to work, I have to make arrangements."

"If he arranges more money in another place, so that our family can run. Then we can go. But now I can't go to this state"

6. Gender dimension

6.1 Education

Deductive

Respondent level of education and the children education, both for the daughters and the son.

"I studied up to class eight. My elder son is studying in class seven and my younger son is studying in class one."

" I studied up to class five. [My daughters] they study. The elder daughter is studying in class three, and the younger daughter is still very young. There is hope to educate them but we have no income other than the income of the Sundarbans."

" I studied up to class six. I have three daughters and one son. The eldest daughter has studied up to class ten, the middle daughter has studied up to class eight, and the younger daughter has also studied up to class seven."

6.2 Access to the Inductive
market

[Then they were] drop out, married. I gave these three people in marriage. [...]No, my son is not studying. My husband is sick, can't earn. That's why me and my son go to work. We work and run the family. "

"I studied from 3rd to 4th class. Elder son studied up to class 10, younger son passed HSC (Higher Secondary School). The girl studied up to class 10. Then I gave my daughter's marriage."

"I can't study like that, I can only sign."

"I didn't study. I can sign the fingerprint. No [my sons and daughters didnt study]. There was no husband so it was not possible to educate them."

"Those boys have not studied much. Their father died when they were young, so they could not be taught. From childhood, they go to the forest to catch crabs and thus run the family."

" I sell in the market. We catch the fish and sell it to them; they pay a price that way. Yes, that is what they do [make more profit]. They will sell it from us, and they will profit from it, and then they will sell it again. This is how it goes."

" We sell them in "Munshiganj".Yes, gives the right price."

"Local people come from home and buy it.[If ther is the opportunity] yes, I want If there is such an opportunity, I will sell it in the market. [Now] in that way, I can't store anything, I sell what is left after eating, but after eating, the stock is less, so it is not taken in the market."

6.3 Decision-making HH Deductive

Level of agency, control, and decision making power within the household daily decisions, economic asset control etc. [e.g. De La Torre-Castro et al., 2017]

I keep it [the money i earn] to myself because I do the household chores. [In the house]my husband drives, but he discussed with me. My decision is the real decision basically. We both discuss and take the decision."

" Yes. [All decisions are mine]. Yes [The money and auhority is in my hands] We are five, I have a mother. {He lives with his wife, two children and his mother. He doesn't allow his wife to go inside the forest or outside the community. He makes all the decisions in his family and controls the money.}"

"No, nothing has changed. No [women are not allowed to speak], my husband is sick and helpless, but I have to ask him what I have to do. Yes [i can do anything for myself], but I have to ask. He used to work in the forest. But the waist bone is broken then can't earn any more. No, [i didnt go out when my husband was not sick]"

" A decision is taken after discussion with all the family members."

"No, women [of my house] don't go[to the Sundarbans for work]. Yes, it seems right to me [that women should not go out]. But if I tell about my family then I will say that I love them a lot, I will eat less and still don't send out the ladies of the house."

"yes [i have taken all the decisions since my husband died], i have even begged people's houses. I have always made my own decisions. I Work abroad for 6 months and when I come home for the next 6 months make all kinds of decisions. My son makes decisions when I'm not home. I keep [the money] it to myself and give it to my son when he wants it."

6.4 Decision-
making community Deductive
level

Level of control and making
regarding the livelihood
strategies the use of resources
and perceived constraints at a
community level. [e.g. Ahmed
et al., 2018]

"It should not happen but everyone goes to earn some income. [referring to women going to the river and forest to collect resources]"

"No people do not humiliate me and no one insult me as well."

" It would be good [if my wife work], but it is difficult to do it alone. Yes [many wives are doing work], but I don't let [my wife]go, I run the family alone. [Even though is difficult alone] yes, I won't let her go. [...] Earlier there was a lot of scarcity so everyone went to the forest. [Now]There is a shortage but everyone is old so that doesn't go away. [Also]women go more now than before. I think is bad"

"Yes, faced various problems. Some people say why the wife of the house work outside? And different people said different things. Prevented from going to work."

"[Now women go to work, and she thinks is bad]. Women look bad when they go out. [extra person] If the women do not go, the family does not go"

R Scripts

Main R scripts CODES

Hereby i present the main functions codes used for the satistical anylisis. For more details, contact author.

```
#All the codes are performed in the #tidyverse
#check your working directory
setwd("C:/")
getwd()
install.packages("tidyverse")
library (tidyverse) #collection of packages
#import your .csv file to your Global Environment
survey_rawdata <- read.csv("C:/THESIS/STATISTIC ANALYSIS/dataframe.csv", header = TRUE,
sep = ";")
survey_rawdata_no_groups <- read.csv("C:/THESIS/STATISTIC ANALYSIS/dataframe", header =
TRUE, sep = ";")
survey_rawdata_no_groups
#import .csv of the variables description to change names later
#import your .csv file to your Global Environment
variable_description <- read.csv("C:/THESIS/STATISTIC ANALYSIS/dataframe.csv", header =
TRUE, sep = ";")

# MAIN DESCRIPTIVE STATS OF DATAFRAME
dataframe %>%
summary()

#BAR PLOTS for likter variables
dataframe %>%
  ggplot(aes(x=variable 1, fill= variable 2))+
  geom_bar(alpha=0.5, position=fill)+
  theme_bw()+
  labs(x="variable 1",
       y= "variable 2")

#CREATE CONTINGENCY TABLES
# Step 1: Create contignecy table
#CHANGE VARIABLE NAME
contingency_table<- dataframe %>%
```

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```
count(variable1 , migration_consideration) %>%
pivot_wider(names_from = migration_consideration,
             values_from = n,
             values_fill = 0,
            )
#head(contingency_table)

# Step 2: Calculate percentages
#CHANGE VARIABLE NAME
contingency_table<- contingency_table %>%
  mutate(Total = `No` + `Yes`) %>%
  mutate(`Migration No (%)` = (`No` / Total) * 100,
         `Migration Yes (%)` = (`Yes` / Total) * 100)

#CHANGE VARIABLE NAME
contingency_table<- contingency_table %>%
  rename("Migration no" = "No",
        "Migration yes" = "Yes" )
view(contingency_table)

#CHI-SQUARE
dataframe %>%
select(variable1,
        variable2) %>%
table() %>%
chisq.test()

#FISHER TEST
dataframe %>%
select(variable1,
        variable2) %>%
table() %>%
fisher.test()

#T-TEST
dataframe %>%
select(variable1,
        variable2) %>%
t.test(variable1~variable2, data=.,
```

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```
        alternative = "two.sided", #this test is to based on the H we said, could
be " less" or "more"
        paired= FALSE) %>%
#VIF
install.packages("car")
library(car)
# Fit your logistic regression model
dataframe%>%
glm(migration_consideration ~ variable1 + variable2,
family = binomial, data = .)

# Calculate VIF
vif_results <- car::vif(my_model)

#LOGISTIC REGRESSION
# Convert the categorical variable to a factor
dataframe <- dataframe %>%
  mutate(binary_category = factor(binary_category, levels = c("No", "Yes")))

# Fit a linear regression model using tidyverse
lm_model <- dataframe %>%
  glm(numeric_var ~ binary_category, data = .)

#categorical
glm(formula = migration_consideration ~ variable, family = binomial,
    data = .)

# Display summary of the model using broom::tidy
tidy(lm_model)
```