

Livelihood & Socio-Economic Study On Sundarban Area: A Brief Research Review

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Abstract

This paper provides a comprehensive analysis of the interplay between local livelihoods and socio-economic issues faced by over 4.5 million inhabitants in the Sundarbans, a UNESCO World Heritage Mangrove Ecosystem. It highlights traditional livelihoods reliant on natural resources, such as agriculture, fishing, forestry and tourism, while delineating the socio-economic challenges including high poverty rates, limited access to healthcare and education along with recurrent natural disasters like cyclones. These factors exacerbate the vulnerabilities of local communities, particularly as climate change introduces rising sea levels and increased salinity that threaten agricultural productivity and freshwater availability. The paper also emphasizes the urgent need for sustainable solutions by exploring the socio-economic landscape, understanding the interconnections among various livelihood patterns and outlining potential pathways toward resilience. It underscores the importance of integrated support systems that address both environmental challenges and socio-economic disparities. Through recent research findings, the review suggests that innovative adaptive strategies, community-based approaches and stronger policy interventions are vital for fostering sustainable livelihoods. Emphasis is placed on empowering marginalized groups, particularly women and ensuring active community participation in disaster preparedness and sustainable agricultural practices. Finally, it advocates for collaborative partnerships among local communities, government bodies and NGOs to implement culturally appropriate interventions that enhance resilience and improve the quality of life for residents. This integrated approach is crucial for sustainable development in the Sundarbans, addressing both ecological vulnerabilities and the socio-economic realities faced by its communities.

Keywords: *Sundarbans, Livelihoods, Socio-Economic Challenges, Climate Change, Environmental Vulnerabilities, Natural Resources, Community Resilience, Sustainable Development*

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I. Introduction

The Sundarbans, one of the largest mangrove forests in the world, spans across southern Bangladesh and the eastern coast of India, covering approximately 10,000 square kilometers. This UNESCO World Heritage Site is renowned for its rich biodiversity, including species such as the Bengal tiger, saltwater crocodiles, and a wide variety of fish and crustaceans [1]. Ecologically significant, the Sundarbans also play a vital role in protecting coastal areas from storm surges and cyclones, while serving as a major resource base for the livelihood of over 4.5 million people living in its vicinity [2].

Livelihoods in the Sundarbans are intricately linked to the region's natural resources. Fishing, honey collection, and agriculture are the primary means of sustenance for local communities. The mangrove forests provide timber, fuel, and non-timber forest products (NTFPs), which are crucial for many households [3]. However, these traditional livelihoods are under severe strain due to multiple socio-economic challenges. High poverty rates, inadequate access to healthcare & education, and recurrent natural disasters like cyclones and tidal surges pose significant threats to the well-being of the population [4]. Furthermore, climate change has exacerbated these challenges, with rising sea levels and increased salinity intrusion negatively affecting agricultural productivity and freshwater availability [5].

The purpose of this review is to examine the livelihood patterns and socio-economic challenges facing the people of the Sundarbans. By drawing on recent research, this paper aims to provide a comprehensive understanding of the region's socio-economic landscape, analyze the impacts of environmental factors on livelihoods and suggest pathways toward more sustainable and resilient livelihood options for the communities in this fragile ecosystem.

In this paper, *Section-II* provides an in-depth analysis of livelihood practices and the associated challenges faced by communities in the Sundarbans. *Section-III* presents a comprehensive review of the socio-economic conditions prevalent in the region. *Section-IV* examines the impacts of climate change and natural

disasters on the Sundarbans and their implications for local populations. *Section-V* explores the role of government and NGO interventions aimed at fostering resilience and sustainable development in Sundarban Area. Finally, the *Conclusion & Recommendations* section offers insights and proposals for addressing these ongoing challenges in Sundarbans.

II. Livelihood Practices And Challenges In The Sundarbans

The Sundarbans, with its unique ecological and geographical features, supports a variety of livelihood practices that sustain the local communities. These practices are largely dependent on the region's natural resources, and while they offer economic sustenance, they are also vulnerable to environmental and socio-economic challenges. This section explores the major livelihood sources in the Sundarbans' *Agriculture, Fishing & Aquaculture, Forestry & Non-Timber Forest Products (NTFPs)* and *Tourism*, while highlighting the challenges faced by local populations in maintaining these livelihoods.

Agriculture: Agriculture is one of the primary sources of livelihood for the people in the Sundarbans, though the region's agricultural productivity is limited by several environmental factors. The alluvial soil deposited by rivers like the Ganges and Brahmaputra is fertile, but salinity intrusion due to tidal flows and rising sea levels presents significant obstacles to farming [6]. As a result, local farmers are primarily engaged in growing salt-tolerant crops such as rice (particularly indigenous varieties like *Kharif* rice), vegetables and pulses during the monsoon season [7]. Despite the potential for productivity, agricultural activities are highly seasonal and dependent on erratic monsoons, which contribute to food insecurity in the region. Furthermore, small-scale farmers face a shortage of arable land due to frequent water-logging and soil degradation caused by saltwater intrusion [8]. The lack of access to modern farming techniques, agricultural inputs like quality seeds & fertilizers and the absence of organized irrigation systems further hinder agricultural development in the different areas of Sundarban.

Fishing & Aquaculture: Fishing is another vital livelihood in Sundarbans, with rivers, creeks, and estuaries forming a lifeline for communities dependent on aquatic resources. A significant portion of the population engages in capture and culture fisheries, targeting species such as prawns, crabs and various freshwater & brackish water fish [9]. Crab harvesting, in particular, has become an increasingly important source of income due to its high market value, especially in export markets. Small-scale fishers in Sundarbans rely heavily on traditional fishing techniques, using nets, traps and manual labor to capture fish from the wild. However, the region's fishing industry is increasingly under pressure from overexploitation, illegal fishing activities, and the degradation of aquatic habitats caused by pollution and climate change [10]. Additionally, the periodic occurrence of cyclones and tidal surges not only damages fishing infrastructure but also leads to the loss of valuable equipment and reduced fish stocks, further impoverishing already vulnerable fishers.

Aquaculture has emerged as an alternative to traditional fishing in some parts of the Sundarban, with farmers cultivating prawns and fish in brackish water ponds. While this practice provides a more stable source of income, it is not without risks. Many aquaculture systems are threatened by the increasing salinity of water and the spread of diseases, which can wipe out entire crops of prawns or fish [11].

Forestry & Non-Timber Forest Products (NTFPs): Forestry & the extraction of non-timber forest products (NTFPs) are also crucial livelihood activities in Sundarbans, particularly for marginalized communities. Honey collection is one of the most traditional and valued practices in the region. Local honey collectors, known as *Mouals*, venture deep into the mangrove forests to harvest wild honey, which is both consumed locally and sold in markets [12]. Other NTFPs include the collection of fuel-wood, timber and leaves for medicinal purposes. Wood gathering, although important for household energy needs, poses sustainability challenges as overharvesting threatens the fragile mangrove ecosystem. The risk of attacks from Bengal tigers, snakes, and crocodiles further exacerbates the dangers faced by forest-dependent communities [13]. Although the government has introduced forest management practices to conserve resources, the enforcement of these measures remains limited, leading to continued deforestation and environmental degradation.

Tourism: Tourism is a relatively new and emerging source of livelihood in Sundarban, driven by the region's biodiversity and unique ecosystem. Ecotourism initiatives have been promoted as a sustainable way to generate income while preserving the environment. Local communities are increasingly involved in offering boat rides, guided tours and home-stays, which provide employment opportunities in a region where few alternatives exist [14]. However, tourism in the Sundarbans is still in its nascent stages, and its potential remains largely untapped due to inadequate infrastructure, poor accessibility and a lack of promotional activities. Additionally, there is concern that unregulated tourism may lead to ecological degradation and negatively impact wildlife and habitats, particularly if not managed in an environmentally sustainable manner.

The livelihoods in the Sundarbans face numerous challenges, many of which are compounded by the region's ecological vulnerabilities and socio-economic issues. Climate change, in particular, is a pressing concern. Rising sea levels and increasingly frequent natural disasters such as cyclones (e.g., Cyclone Aila in 2009 and Cyclone Amphan in 2020) have devastating impacts on agriculture, fisheries, and other livelihood activities [15]. These events not only destroy crops and infrastructure but also displace communities, pushing them further into poverty.

The lack of access to markets is another major challenge. Due to the remoteness of the Sundarbans, many farmers and fishers struggle to transport their goods to larger markets, resulting in low returns on their products. This is compounded by a lack of investment in infrastructure such as roads, storage facilities and cold chains, which are necessary for transporting perishable items like fish and vegetables [16]. Furthermore, the presence of wildlife such as Bengal tigers and crocodiles poses a constant risk to those who rely on the forests and waters for their livelihood. Human-wildlife conflict is a significant issue, with many honey collectors, fishers and wood gatherers losing their lives each year due to wildlife attacks [17].

III. Socio-Economic Conditions In The Sundarbans

The Sundarbans, one of the largest mangrove ecosystems in the world, is home to approximately 4.5 million people who depend heavily on its natural resources for their livelihoods. However, the socio-economic profile of these communities reflects deep-rooted challenges that impact their quality of life. This section provides an in-depth analysis of key socio-economic factors such as *Income & Poverty*, *Education*, *Health*, *Migration* and *Gender Issues* in the Sundarbans.

Income & Poverty Levels: The income distribution in the Sundarbans is highly uneven, with most of the population engaged in subsistence-based activities like agriculture, fishing, honey collection and small-scale forestry. Due to the region's remoteness and vulnerability to natural disasters, incomes are generally low and precarious. The prevalence of poverty is stark, with a significant portion of the population living below the poverty line. It was reported that, more than 40% of households in the Indian Sundarbans are classified as poor, with many suffering from seasonal unemployment during the lean agricultural months [18]. This unemployment arises mainly due to the region's dependence on monsoon-fed agriculture, which leaves people without work during the dry season. Additionally, frequent natural disasters, such as cyclones and tidal surges, exacerbate the vulnerability of these communities, often wiping out crops, fishing equipment, and livestock, thus pushing families deeper into poverty [19]

Education: Education in the Sundarbans faces significant challenges, with literacy rates generally lagging behind national averages. Although efforts have been made to improve school enrollment, many children, particularly in the rural parts of the Sundarbans, do not have access to quality education due to inadequate infrastructure and the remoteness of many villages. According to a study, the literacy rate in the Sundarbans is around 63% to 65%, which is lower than the state average in West Bengal [20]. School infrastructure is often underdeveloped, with many schools lacking proper buildings, teaching staff and educational materials. Seasonal migration and frequent natural disasters further disrupt children's education, as many families are forced to relocate temporarily, and schools often serve as emergency shelters during floods or cyclones [21]. Consequently, dropout rates remain high, particularly among girls, due to social norms, poverty and the need for children to contribute to household income.

Health: Access to healthcare in the Sundarbans is limited and inadequate, particularly in remote areas. Most healthcare facilities are located far from the villages, and there is a lack of trained medical professionals and medical supplies. The region is prone to waterborne diseases, such as cholera, diarrhea and dysentery, due to poor sanitation and the use of contaminated water sources. Malnutrition is another pressing issue, especially among children and pregnant women. According to a study, malnutrition rates in the Sundarbans are high, with a significant percentage of the population suffering from anemia and other nutrient deficiencies [22]. Additionally, frequent natural disasters, such as cyclones and floods, exacerbate health problems by destroying essential infrastructure like hospitals and water supply systems. In the aftermath of these disasters, outbreaks of diseases like malaria and dengue become more common, further straining the already limited healthcare services [23].

Migration: Out-migration is a common coping strategy for many families in the Sundarbans. Faced with limited local economic opportunities, many people migrate to cities such as Kolkata or Mumbai in search of better-paying jobs. This migration, often seasonal, helps supplement household income, but it also has profound effects on the socio-economic fabric of Sundarban communities. Migrant workers usually take on low-paying jobs in construction, domestic work, or small-scale industries, sending remittances back to their families.

However, the absence of a significant portion of the working-age population has long-term social consequences. Not only that, out-migration leads to a loss of skilled labor in the region, leaving behind women, children and the elderly, who are more vulnerable to poverty [24]. Moreover, migration disrupts traditional family structures and social cohesion, as families are often split across urban and rural areas, making it difficult to maintain social ties and cultural practices.

Gender Issues: Gender disparities are prevalent in the Sundarbans, particularly in the areas of education, employment and income. Women play a significant role in the livelihood activities of the region, especially in agriculture, fishing and forest-based activities like honey collection. Despite their contributions, women are often paid less than men and face limited access to resources and decision-making power within their households and communities. However, women in the Sundarbans are more likely to be engaged in informal, low-wage labor, and they are disproportionately affected by poverty and unemployment [25]. Gender disparities in education are also stark, with fewer girls attending school compared to boys due to social norms that prioritize male education and the economic need for girls to contribute to household labor [26]. Additionally, women bear the brunt of the health and nutritional challenges in the region, as they are often responsible for caring for sick family members while also facing malnutrition themselves. Efforts to promote gender equality in the Sundarbans are still limited, with many women lacking access to resources like credit, land ownership and vocational training [27].

In summary, the socio-economic conditions in the Sundarbans reflect a complex interplay of poverty, limited access to education & healthcare, gender disparities and the pressures of out-migration. Addressing these issues requires a comprehensive approach that integrates livelihood support, improved infrastructure and gender-sensitive policies to create a more sustainable and equitable future for the region's inhabitants.

IV. Impact Of Climate Change And Natural Disasters In The Sundarbans

The Sundarban region, home to millions of people and the world's largest mangrove forest, is extremely vulnerable to the impacts of climate change and natural disasters. This subsection explores how these factors have influenced the livelihoods and socio-economic conditions of the local communities, focusing on key issues such as *Cyclones & Storm Surges* and *Rising Sea Levels & Salinization*, as well as the adaptive strategies employed by residents to cope with these challenges.

Cyclones & Storm Surges: The Sundarban region is regularly exposed to powerful cyclones, which have devastating consequences for agriculture, fishing, and overall livelihoods. Two of the most notable cyclones in recent memory are *Cyclone Aila* (2009) and *Cyclone Amphan* (2020). *Cyclone Aila* caused extensive damage to infrastructure, inundated large swathes of agricultural land with saline water and led to the displacement of over 2.3 million people. Farmers lost crops, fishers were unable to go to sea due to damaged equipment, and many lost their homes plunging the already impoverished population into deeper economic hardship [28]. *Cyclone Amphan*, even more powerful than Aila, further exacerbated these vulnerabilities, causing estimated losses of over USD 13 billion across India and Bangladesh. In the Sundarbans, the cyclone breached embankments, flooding agricultural fields with saline water and disrupting drinking water supplies [29]. The repeated exposure to such extreme weather events has resulted in a cycle of poverty, where communities struggle to recover before the next disaster strikes.

Rising Sea Levels & Salinization: One of the most severe long-term consequences of climate change for the Sundarbans is rising sea levels, which lead to salinity intrusion into both agricultural land and freshwater sources. Salinization has drastically reduced crop yields, particularly for traditional crops such as rice, which cannot tolerate high salt levels [30]. The result is food insecurity, with farmers unable to rely on their land to produce enough for subsistence or sale. In addition to affecting agriculture, salinity intrusion has contaminated freshwater sources, making it difficult for communities to access safe drinking water. The over-reliance on groundwater extraction to meet drinking and irrigation needs is unsustainable, as rising sea levels continue to push saltwater further inland [31].

Local communities in the Sundarbans have developed a range of adaptation strategies to cope with these climate-related challenges. Farmers have begun shifting to salt-tolerant crop varieties, such as saline-resistant rice, which can withstand higher levels of salinity [32]. In some areas, farmers are also diversifying into aquaculture, particularly shrimp farming, which thrives in saline conditions, although this has environmental trade-offs, including further degradation of freshwater ecosystems. Moreover, reliance on external disaster relief has become a critical coping mechanism.

Non-governmental organizations (NGOs) and government agencies have played an active role in providing emergency support after major disasters. However, while these relief efforts offer temporary respite, they are not sustainable long-term solutions, and greater emphasis on building resilience within communities is

necessary [33]. In a single word, the combined effects of cyclones, rising sea levels and salinization have created significant barriers to sustainable livelihoods in the Sundarbans. Adaptive strategies, though innovative, remain limited in their capacity to address the full scale of these challenges. For sustainable development in the region, stronger policy support and investment in long-term resilience-building measures are crucial.

V. Government And NGO Interventions In Sundarbans

The socio-economic conditions and livelihoods of communities in the Sundarban region have been shaped significantly by government policies and non-governmental organization (NGO) interventions. This subsection reviews the role these entities play in improving livelihoods, focusing on key *Government Programs*, *NGO Activities* and the *Limitations that Affect the Overall Impact of these Initiatives*.

Government Programs: One of the most significant government initiatives in the Sundarban region is the *Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)*, which provides 100 days of guaranteed wage employment per year to rural households. MGNREGA has been instrumental in offering a safety net for vulnerable communities, particularly after natural disasters like cyclones, by providing temporary employment and stabilizing household incomes [34]. The scheme has also helped in creating infrastructure such as embankments and rural roads, which are essential for protecting coastal areas from erosion and flooding.

Another key program is the *Integrated Coastal Zone Management (ICZM)* project, which aims to protect coastal areas from environmental degradation while promoting sustainable livelihoods. The ICZM project in the Sundarbans focuses on improving disaster preparedness, strengthening embankments, promoting sustainable farming practices, and developing eco-tourism to diversify income sources for local communities [35]. These initiatives play a critical role in mitigating the risks posed by climate change and natural disasters.

NGO Activities: Non-governmental organizations have been pivotal in providing disaster relief and supporting long-term development efforts in the Sundarbans. After cyclones like Aila and Amphan, NGOs such as the Sundarban Social Development Centre (SSDC) and Action-Aid mobilized quickly to provide emergency shelter, food, and medical care to affected populations. Beyond immediate relief, NGOs have worked on promoting healthcare, education, and alternative livelihoods like fish farming and handicrafts, which provide more resilience in the face of environmental challenges [36].

NGOs also play a crucial role in capacity-building within local communities, training residents in disaster preparedness and climate-resilient agricultural techniques. These efforts help strengthen community resilience, ensuring that people are better equipped to recover from natural disasters and adapt to long-term changes in their environment.

Limitations of Interventions: Despite the positive impacts of these interventions, both government and NGO efforts face significant challenges. One of the major limitations is funding. Many government programs, including MGNREGA, suffer from delayed wage payments, which undermine their effectiveness [37]. Similarly, NGO projects often rely on limited and intermittent funding, which constrains their ability to implement long-term solutions.

Additionally, there are implementation gaps in government policies, particularly in infrastructure development projects. Weak coordination between different government agencies and delays in project execution has hampered the effectiveness of initiatives like ICZM [38]. These challenges highlight the need for better coordination, sustainable funding models, and more efficient delivery mechanisms to ensure that interventions reach the most vulnerable populations.

VI. Conclusion And Recommendations

This review of the livelihoods and socio-economic conditions in the Sundarbans highlights the severe challenges faced by local communities due to environmental degradation, climate change, and natural disasters. The conclusion summarizes key insights and proposes actionable recommendations for improving livelihoods, with a focus on sustainable alternatives, policy interventions and community-based approaches.

The Sundarbans, highly vulnerable to climate change, faces severe livelihood challenges. Recurrent cyclones like *Aila* (2009) and *Amphan* (2020) have devastated agriculture and fishing, the region's main income sources. Rising sea levels and salinization have further degraded farmlands and drinking water, while inadequate healthcare, education and poor disaster preparedness worsen socio-economic conditions. To improve livelihoods, sustainable alternatives like eco-tourism, climate-resilient farming and integrated agriculture-aquaculture systems are vital. Sustainable shrimp farming and honey production also offer income opportunities without depleting resources. Long-term improvement in the Sundarbans requires comprehensive policy reforms, prioritizing healthcare, education and disaster preparedness. Strengthening healthcare infrastructure, providing clean water and building stronger embankments are essential to address public health and reduce vulnerability

to extreme weather. Community involvement is key, with capacity-building in disaster preparedness, sustainable farming, and alternative livelihoods critical to resilience. Empowering women and marginalized groups can have transformative effects. Partnerships between local communities, government, and NGOs will ensure culturally appropriate interventions, fostering resilience and improving quality of life for Sundarbans residents.

References

- [1] Sarkar, S. K. (2022). Sundarban Mangrove Wetland (A Unesco World Heritage Site): A Comprehensive Global Treatise. Elsevier.
- [2] Sen, H. S., & Ghorai, D. (2019). The Sundarbans: A Flight Into The Wilderness. *The Sundarbans: A Disaster-Prone Eco-Region: Increasing Livelihood Security*, 3-28.
- [3] Singh, A., Bhattacharya, P., Vyas, P., & Roy, S. (2010). Contribution Of Ntfps In The Livelihood Of Mangrove Forest Dwellers Of Sundarban. *Journal Of Human Ecology*, 29(3), 191-200.
- [4] Bhowmick, D. (2024). Political Ecology Of Climate Change In Sundarbans, India: Understanding Well-Being, Social Vulnerabilities, And Community Perception. *Environmental Quality Management*, 33(3), 371-382.
- [5] Islam, S. N. (2019). Sundarbans A Dynamic Ecosystem: An Overview Of Opportunities, Threats And Tasks. *The Sundarbans: A Disaster-Prone Eco-Region: Increasing Livelihood Security*, 29-58.
- [6] Mandal, U. K., Maji, B., Mullick, S., Nayak, D. B., Mahanta, K. K., & Raut, S. (2019). Global Climate Change And Human Interferences As Risk Factors, And Their Impacts On Geomorphological Features As Well As On Farming Practices In Sundarbans Eco-Region. *The Sundarbans: A Disaster-Prone Eco-Region: Increasing Livelihood Security*, 405-437.
- [7] Padhy, S. R., Dash, P. K., & Bhattacharyya, P. (2022). Challenges, Opportunities, And Climate Change Adaptation Strategies Of Mangrove-Agriculture Ecosystem In The Sundarbans, India: A Review. *Wetlands Ecology And Management*, 30(1), 191-206.
- [8] Mandal, U. K., Mandal, S., Lama, T. D., & Burman, D. (2021). Innovative Approaches For Agriculture In Coastal Fragile Ecosystem In India. In *Innovations In Agriculture For A Self-Reliant India* (Pp. 421-464). Crc Press.
- [9] Hoq, M. E. (2008). *Sundarbans Mangrove: Fish And Fisheries*. Graphic Media, Dhaka, Bangladesh.
- [10] Das, M. A. H. U. A. (2009). Impact Of Commercial Coastal Fishing On The Environment Of Sundarbans For Sustainable Development. *Asian Fisheries Science*, 22(1), 157-167.
- [11] Chowdhury, A., Prakash, R., Bhattacharyya, S., & Naz, A. (2023). Role Of Ponds As A Local Practice In Mitigating Salinity Intrusion Threats At Coastal Aquifer: A Case Study From Sundarban Biosphere Reserve, India. In *Indigenous And Local Water Knowledge, Values And Practices* (Pp. 287-306). Singapore: Springer Nature Singapore.
- [12] Mukherjee, K. S. (2022). Pandemic 2020 And Its Effects On The Tourism Industry And The Livelihood Of Households Of The Sundarbans, India. In *Domestic Tourism And Hospitality Management* (Pp. 175-189). Apple Academic Press.
- [13] Mehta, M. (2019). *Conserving Life: Forest Imaginaries And Competing Values In The Sundarbans Forests Of India* (Doctoral Dissertation, London School Of Economics And Political Science).
- [14] Sarkar, S., Bardhan, S., & Sanyal, P. (2019). Community Perception Towards Tourism Development In The Indian Sundarbans: Case Study Of Jharkhali Island. *International Journal Of Engineering Research & Technology*, 8(12), 526-540.
- [15] Edmonds, C., Mehta, M., Noy, I., & Banik, P. (2021). The Climate-(Ir) Resilient Society Of The Indian Sundarbans: Tropical Cyclones, Sea Level Rise, And Mortality Risk. In *The Palgrave Handbook Of Climate Resilient Societies* (Pp. 1-30). Cham: Springer International Publishing.
- [16] Mal, S., & Bhabai, B. (2022). Indian Sundarbans: Waterlogging And Salinity Problems And Managements. *Agriculture & Food E-Newsletter*, 115(12), 1.
- [17] Das, C. S. (2017). Analyzing Human-Wildlife Conflicts In Sundarban. *State Of Art Report On Biodiversity In Indian Sundarbans*, 325-340.
- [18] Mistri, A., Das, B., Mistri, A., & Das, B. (2020). Occupational Issues In Sundarban. *Environmental Change, Livelihood Issues And Migration: Sundarban Biosphere Reserve, India*, 41-70.
- [19] Mukherjee, N., & Siddique, G. (2024). *Impact Of Climate Change In The Indian Sundarbans Region*. Springer.
- [20] Mondal, B. K. (2015). Spatial Exploration Of The Literacy Intensity Of Sundarban. *Зборник Радова Географског Института "Јован Цвијић" Сану*, 65(1), 107-120.
- [21] Dutta Gupta, T., Chakraborty, A., & Danda, A. A. (2021). Confronting Cascading Disasters, Building Resilience: Lessons From The Indian Sundarbans. *Obs Res Found*, 297.
- [22] Panda, S., Sadhu, C., Pramanik, G., Pahari, S., & Hossain, J. (2016). Concerning Public Health Situation Of Under-Nutrition In Children And Anemia In Women In Indian Sundarbans Delta: A Community Based Cross-Sectional Investigation. *Bmc Nutrition*, 2, 1-10.
- [23] Kabir, R. (2014). *The Impacts Of Cyclones Sidr And Aila On The Health Of The Coastal People Of Bangladesh* (Doctoral Dissertation, Middlesex University).
- [24] Basu, A., Chattoraj, D., & Bhattacharjee, A. (2024). Climate-Change Induced Out-Migration And Resultant Women Empowerment: Glimpses Of Resilience From Indian Sundarbans. In *Homelessness To Hope* (Pp. 125-147). Elsevier.
- [25] Molinari, N. (2017). Intensifying Insecurities: The Impact Of Climate Change On Vulnerability To Human Trafficking In The Indian Sundarbans. *Anti-Trafficking Review*, (8).
- [26] Roy, S. (2020). Transforming Gendered Lives And Livelihoods In Post-Disaster Settings In The Bangladesh Sundarbans Forest. *Climate Change, Hazards And Adaptation Options: Handling The Impacts Of A Changing Climate*, 463-479.
- [27] Tripathy, B., Mondal, T., & Raha, S. (2024). Role Of Self-Help Groups In Women Empowerment: With Special Reference To Coastal Area Of Sunderban, West Bengal. *Sgsh Publication*.
- [28] Mallick, B., Rahaman, K. R., & Vogt, J. (2011). Coastal Livelihood And Physical Infrastructure In Bangladesh After Cyclone Aila. *Mitigation And Adaptation Strategies For Global Change*, 16, 629-648.
- [29] Mujeri, M. K., Mujeri, N., Mujeri, M. K., & Mujeri, N. (2021). Unexpected Challenges: Covid-19 And Cyclone Amphan. *Structural Transformation Of Bangladesh Economy: A South Asian Perspective*, 249-273.
- [30] Dasgupta, S., Sobhan, I., & Wheeler, D. (2017). The Impact Of Climate Change And Aquatic Salinization On Mangrove Species In The Bangladesh Sundarbans. *Ambio*, 46, 680-694.
- [31] Basu, A., Nandy, G., & Kar, N. S. (2021). Evaluating The Viability Of Shrimp Aquaculture To Impede Climate Change In The Sundarbans: Experiences From Bangladesh. In *South Asia And Climate Change* (Pp. 156-188). Routledge India.
- [32] Mistry, A. H. (2022, August). Soil Salinity Effects On Traditional Agricultural Practices In Three Coastal Rural Villages Of Indian Sundarban, West Bengal. In *Transforming Coastal Zone For Sustainable Food And Income Security: Proceedings Of The*

- International Symposium Of Iscar On Coastal Agriculture, March 16–19, 2021 (Pp. 1043-1058). Cham: Springer International Publishing.
- [33] Mondal, D., Chowdhury, S., & Basu, D. (2015). Role Of Non Governmental Organization In Disaster Management. *Research Journal Of Agricultural Sciences*, 6(2), 1485-1489.
- [34] Kattumuri, R., & Ravindranath, D. (2014). Sustainable Growth And Climate Change: Evolution Of India's Strategies. In *The Global Development Of Policy Regimes To Combat Climate Change* (Pp. 75-106).
- [35] Pitchaikani, J. S. (2020). Integrated Coastal Zone Management Practices For Sundarbans, India.
- [36] Ghosh, A., Dana, S. S., Sharma, A., Sahu, P. K., Basu, D., & Goswami, R. (2022). Perception Of Fishers About Livelihood Developmental Interventions By Various Gos And Ngos In Indian Sundarbans: A Comparative Study. *Indian Journal Of Fisheries*, 69(1).
- [37] Pal, S., Ghosal, M., Biswas, M., Chatterjee, A., Mondal, P. P., & Hazra, S. (2024). Is Sundarban Coming Out Of Abject Poverty As The Government Pursues Sustainable Development Goals?. *Geojournal*, 89(2), 77.
- [38] Yousuf, A. H. (2023). Integrating Ecosystem–Based Management And Marine Spatial Planning For Sustainable Ocean Governance In The Bay Of Bengal.