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Salinity's Shadow: Sustainable Modular Resilience for the Munda Community, Satkhira

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Abstract:
Bangladesh is gifted with abundant natural beauty, with rivers, woods, seas, plains, hills, haors, and canals. However, due to its tropical climate, it is prone to several natural calamities, including excessive salinity in coastal areas. Sundarban is one of these coastal areas where reside the Munda community which is one of the 33 ethnic groups of Bangladesh. Originating from India, Mundas depend on the Sundarbans for both livelihood and religious aspects and consider the Sundarbans as their mother nature. However, poverty and calamities limit their participation in social activities and access to necessities like food, education, and healthcare. This paper aimed to evaluate the difficulties the Munda community faces due to salinity and create a modular structural system sympathetic to local culture and more cost-effective local resources that would be more resilient to natural disasters. This paper studied the lifestyle and livelihood of the affected Munda community of Burigoalini, Satkhira. This paper finds the available construction materials' quality and resilience in connection to saline impacts and local housing characteristics. Also, it focuses on the historical, cultural, and existential aspects of an ethnic group that is facing the risk of extinction.

Keywords: Salinity, Ethnic Munda Community, Cultural preservation, Modular housing, Sustainability.

Introduction

Bangladesh is a naturally enriched country. She is ornamented with rivers, various forest types, sea, plain lands, hills, haors, canals, etc. The natural elements and tropical climate consistently invite various natural disasters such as tornadoes, floods, cyclones, excessive salinity, landslides, earthquakes, etc. Naturally the elements, the tropical climate and the disasters of the country influence certain types of livelihoods, lifestyles and settlements. So basically, these disasters and the lifestyle of the people of this small country are attached in the same string. These disasters act on all the basic needs of humans, undoubtedly on housing. Housing not only means a durable physical structure but also a place that creates a sense of security, ensures a healthy environment for the residents, helps fulfill daily human activities, and should be surrounded by community-based utilities and services. All these can fall apart when hit by a disaster. Amidst all these disasters, one of the most widespread and expansive problems is salinity. Bangladesh has been working on this particular issue for a while now. Excessive salinity happens when the salt in soil and water increases more than the safety level, resulting in hostile conditions for humans and their lifestyles. The coastal lines of Bangladesh are affected by this problem severely. Lands of Coxs Bazar, Teknaf, Satkhira, Patuakhali, Borguna, Barisal, Jhalakathi, Pirojpur, Jessore, Narail, Gopalganj and Madaripur districts are affected by different degrees of salinity. (Dasgupta et al., 2014) Our survey was conducted in Shyamnagar Upazila, Satkhira, an area with critical conditions of salinity. This coastal area is also bordered by the largest mangrove forest, Sundarbans. As our survey intended to determine salinity's effect on human life and their settlements, we pinned down an indigenous community named "Munda". Within the Sundarbans mangrove biological zone, this ethnic group can be found. They can be found in Khulna, Jessore, Joypurhat, and primarily in the Shyamnagar Upazila (Roy, S.2022: 31-41). They rely on the ecology for their survival and way of life and live near the Sundarbans mangrove forest. This led us to observe the impacts of salinity on

their health, living conditions, building materials and durability, eating habits, drinking water availability, and many more.

The paper aimed to evaluate the difficulties the Munda community faces due to salinity and create a modular structural system sympathetic to local culture and more cost-effective local resources that would be more resilient to natural disasters. This paper studied the lifestyle and livelihood of the affected Munda community of Burigoalini, Satkhira. This paper finds the available construction materials' quality and resilience in connection to saline impacts and local housing characteristics. Also, it focuses on the historical, cultural, and existential aspects of an ethnic group that is facing the risk of extinction.

1 Literature Review

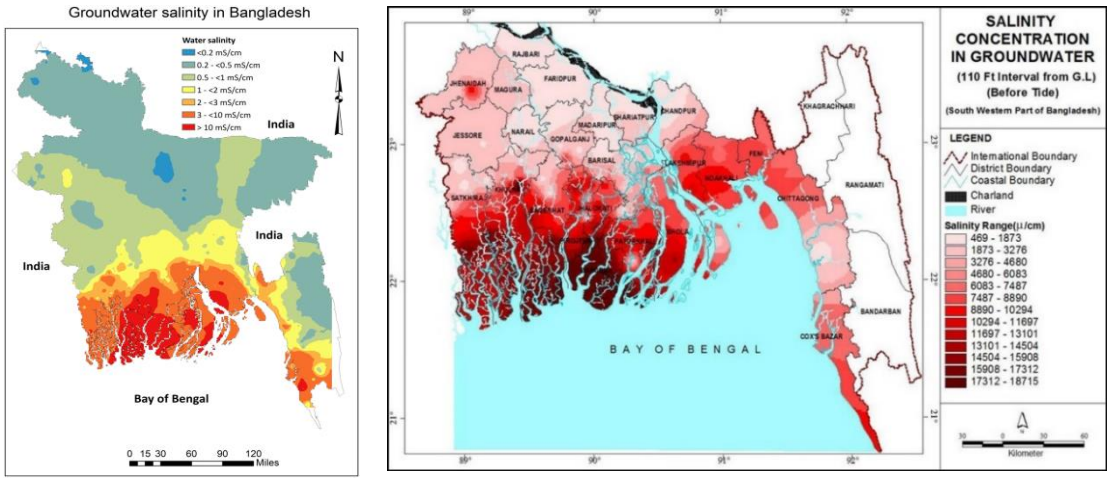


Figure 1: locations where the mean sea level has dropped below the groundwater level (BADC, 2011)

There are about 33 ethnic communities in Bangladesh, among which Munda is one of them (Knowledge World, 2005). They are sometimes referred to as socially disadvantaged lower-caste individuals. They are also referred to locally as "Buno," "Kooli," "Santal," and "Sardar."

They may be found in Khulna, Jessore, and primarily in the Shyamnagor upazila and Joypurhat, which are both close to the Sundarbans. They rely on the ecology for their survival and way of life and live close to the Sundarbans mangrove forest.(Md. Kamrul 2012)

1.1 Salinity Situation in Bangladesh

Bangladesh Agricultural Development Corporation (BADC) has successfully identified the present state of underground salinity. According to their study, the southern-west portion (Satkhira, Khulna, Bagerhat, Potuakhali) has the most amount of salinity in groundwater. In these locations, there is compelling evidence linking high salt consumption to several chronic conditions. (WHO, 2006)

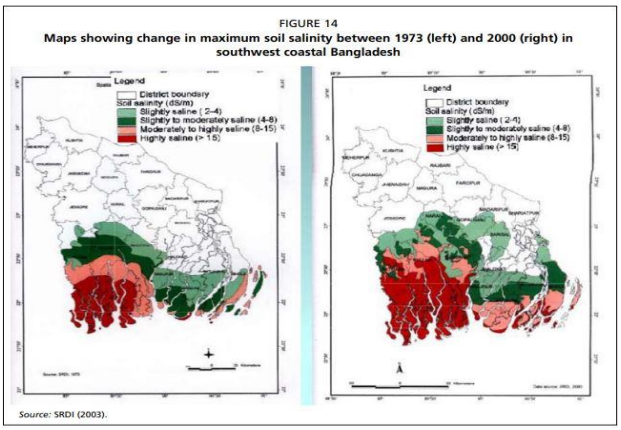


Figure 2: Maximum salinity of southwest coastal Bangladesh of 1973 and 2000.(Hossain,M . Hasan,M)

2.1.1 Sufferings from Salinity

Human suffering can be categorized into physical, mental, economic, and social (Anderson 2013). The increasing salinity intrusion in the coastal belt is increasing people's hardship day by day.

1. **Physical Sufferings:** Salinity causes major physical problems, such as kidney and skin diseases, hair loss, diarrhea, and gastroenteritis.
2. **Mental sufferings:** A strange amount of fear, hopelessness, and distress is seen among the salinity-affected people.
3. **Economic sufferings:** Containing fresh drinkable water from a long distance and collecting them in containers causes great economic suffering for the people of coastal areas
4. **Social sufferings:** The ultimate and direct sufferings caused by salinity in unemployment. The prevalence of salinity is behind it. There are other social sufferings directly caused by salinity, like discrimination by normal people against salinity-affected people.

1.2 Munda Community in Satkhira

From this discussion of salinity, we can understand the adverse effects that salinity has on nature and the people living in it. As Satkhira is the most salinity-affected area of Bangladesh, we elected an indigenous community of that area named Munda, which suffered from the salinity issue for our study.

2.2.1 History of Mundas

According to HRCBM study, the Mundas were transported from Ranchi of Jarkandh and Bakura, Nagpur, Birbhum, Purulia, Saotal Pargona, and Medinipur districts of the west Bengal of India to the erstwhile East Bengal and present-day Bangladesh. First, the Mundas were introduced to what is now Bangladesh by the kings of Naldanga, a district in Jhinaidah (formerly Jessore) in Kaliganj. They served as clubmen, sometimes called 'lathial' locally, in the kings' homes. Secondly, the British rulers moved them to erstwhile East Bengal to produce the indigo plants following the collapse of the Santal uprising in 1850. Thirdly, to create human habitation in the areas close to the Sundarbans, the landowners of the south-western region sent them to Bangladesh to cut the Sundarbans and build embankments to prevent saline water from entering the cultivable land. Most knowledgeable people strongly support the third idea of coming to Bangladesh. Despite abolishing the zamindar system, the Munda people stayed put in Ranchi. (Das M 2002) (Fr. Luigi Paggi S.X 2003) (Munda K 2018)

2.2.2 Social Status of Mundas

Due to landlines and ongoing poverty, there are no opportunities to participate in gatherings, processions, meetings, arbitrations, trials, or other social activities. There are no chances for accessing food, nutrition, education, healthcare, learning new skills, or other necessities. (Das M 2002) (Huda S.,2022) (Munda K 2018)

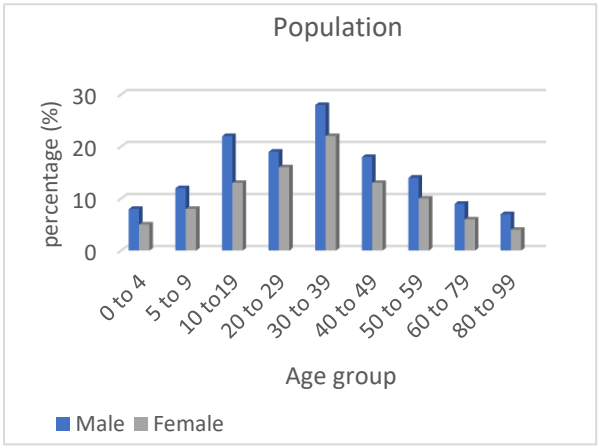
Table 1: Social problems faced by Munda peoples (Huda, Shaiful 2021: 484)

Types of problem	Frequency	Percentage
Education	210	63.64
Water	330	100
Housing	305	92.42
Health care	310	93.94
Social Discrimination	320	96.97
Writing own method	330	100
Entertainment	325	98.48
Religious Institute	330	100
Knowledge about digital Bangladesh	315	95.45

Table 2: Social situation of Munda people (Huda, Shaiful 2021: 484)

Social Layer	Frequency	Percentage
Low	330	100
Middle	0	0
High	0	0
Total	330	100

2.2.3 Demographic Data: Population



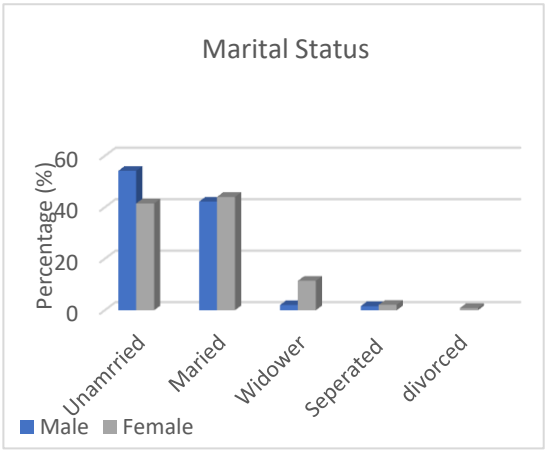


Figure 3: Population rate of Munda people in Satkhira Figure 4: Marital status Of Munda in Satkhira

The graph shows that the age group of 30 to 39 dominates the population. However, the aged group of the community varies widely from 0 to 98 which was one of our considerations.

In the case of the marital situation of the community, the cast is an important catalyst. So, to maintain cast, they marry within their community or from another community, which creates mobility in the population.

2.2.4 Literacy Rate

Almost all members aged up to 30-35 are literate, at least receiving education up to primary level. All the children of the area go to school, despite the lack of transport availability. There is also a free primary school funded by UKAID and with the help of the Manusher Jonno Foundation under SAMS, the Mundas speak an unwritten language known as "Mundary/ Nagri/ Sadri" that they developed independently. It appears that this language is a mash-up of Bengali, Urdu, Hindi, and Persian. (Fr. Luigi Paggi S.X 2003) Unfortunately, they do not have any curriculum in their language, which might be a reason for the backwardness of education among the previous generations.

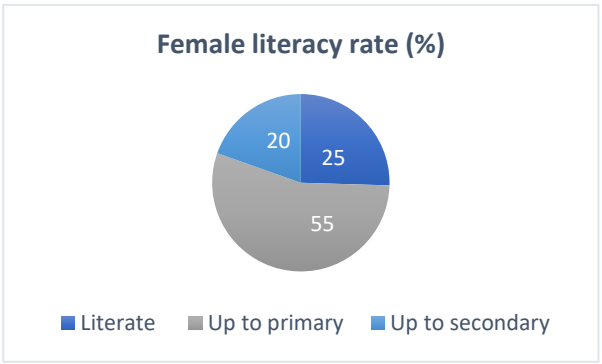


Figure 5: Female literacy rate of Munda in Satkhira Figure 6: Free primary school by UKAID

2.2.5 Occupation

Cutting the Sundarbans to make cultivable land was Munda's primary livelihood in the past. Also, they had to build embankments to shield the cultivated land from salt water. (Das M 2002) (Md.Kamrul 2012) Their current jobs involve fishing, earthmoving, and farming on other people's properties. These tribes' men and women perform day labor on other people's property. They do difficult tasks like earth cutting. In rivers and ponds close to the Sundarbans, they both capture fish. They use spars to hunt birds. In order to seek tortoises, they uproot vegetation from the ground. Some of them collect snails and shells. Some of them also cultivate by renting out other people's land. (Das M 2002, Munda K 2018, Md.Kamrul 2012).

Table 3: Occupation of Munda people

Occupation	Frequency	Percentage
Farmer	45	13.64
Day Labor38	128	38.79
Seasonal Labor	108	32.73
Carpenter	18	5.45
Other	31	9.39
Total	N-330	100

(Huda, Shaiful 2021: 484)

2.2.6. Family Type

Most nuclear families are created when the middle-aged male is capable enough to build his own house adjacent to his parental home. So most of the nuclear families originated from a single family living around a shared courtyard. Though of financial situation and to support their parents, they tend to live in a joint family more, so they extend or moderate the existing house to accommodate extended family.

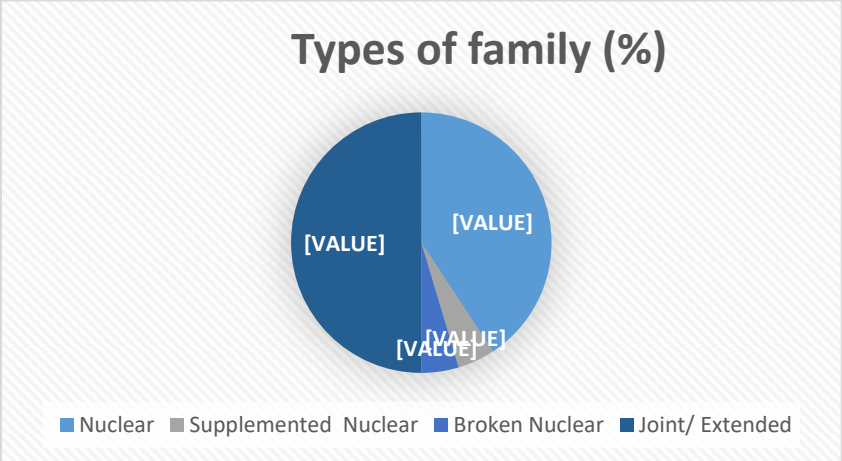


Figure 7: Types of Munda family in Satkhira

2.2.7 Housing Pattern of the Munda People

Only extremely poor people now live in the soil-walled huts with a rice-straw roof in the Munda region in South-West Bangladesh. A rice straw roof only requires labor costs (Das M 2002) (Fr. Luigi Paggi S.X 2003) (Sarkar S 2018) (Kamal, M 2010). However, such a roof does not last more than a rainy. The majority of Munda people can only afford to have this roof on their homes. Every one of their homes has a unique name for

1. Kitchen, which they refer to as "Haisal Ghar." They contend that it is preferable to have it face west.
2. The chamber is known as "Sutek Ghar." Ideally, it should face south.
3. The 'Bam Ghar' is the name of the residence where the cows are housed.
4. The residence known as the "house of worship" is the one in which the idol or image of "Thakur" is maintained. It would be great if this home faced south. (Munda K 2018, Kamal, M 2010)

2.2.8 Traditional Housing Type

After talking with them about their housing types, we created three prototypes of typical traditional houses that were previously built by them. Built materials were mainly local materials, such as mud, soil, gol pata, bamboo, and other woods from Sundarbans. Some common features of those houses were a Dawa (veranda) in front of the house, a kitchen, and a toilet outside the main house (attached or separated).

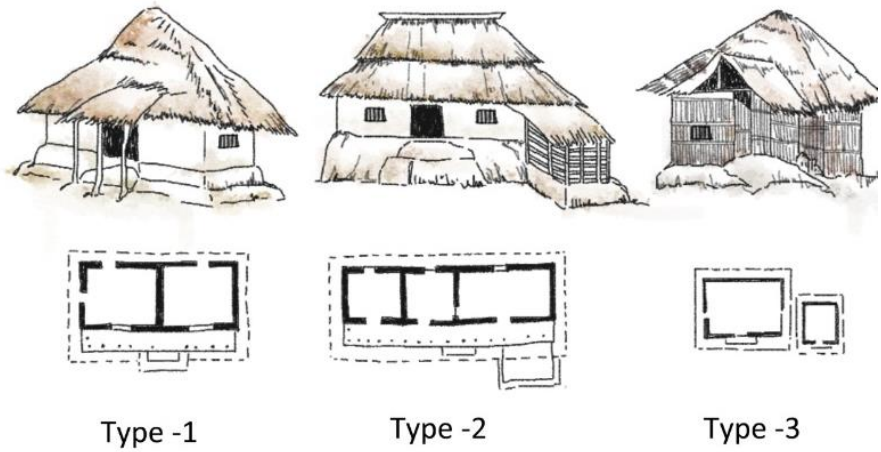


Figure 8: Traditional Housing type with plan

2.2.9 Building Materials

Sundarban is the primary supplier of building materials to the Munda people. They obtain local building materials from the Sundarban, such as golpata, bamboo, and wood. They also construct with goran, gorjon, and keura wood which are common trees of the mangrove. So, Sundarban is where the building materials come from because they can be found easily, affordable, and sustainable to the existing climatic conditions.

2.2.10 Vegetation

Because of salinity in soil and groundwater, many trees and crops that require fresh water cannot grow here. Cattle grass is scarce in this area. The only source of vegetables is grown in the loft (macha) and on the roof.

Figure 9: Types of plants in study area Burigoalini

2.2.11 Cultures of Munda People

Indigenous Munda people assert their religious practices are distinct from those of other ethnic groups. The Sun-Spirit, the moon, and the stars—translated as "Sing Bonga"—are believed to be living witnesses of their cult. Special reverence is paid to the "Karam tree," which shielded and hid their ancestors while they fled the enemy. (Huda, Shaiful 2021: 484).

As the whole Sundarban region, they also revere several Hindu gods and pray to "Bon Bibi," the forest's patron god. (Das M 2002)(Fr. Luigi Paggi S.X 2003). They frequently perform a variety of additional rituals (Puja), including the following: Mage Puja, Karam Puja, Shoshi Puja, Sharul Puja, Gohil Puja, Gram Sara Puja, Pahari Puja, Bura Buri Puja, Valua Puja, Kali Puja (they arrange the traditional Hindu Kali Puja), Hari Puja, Durga Puja, and Tusu (Lakshmi) Puja (symbol of perfection). (Das M 2002)(Munda K 2018). In the many festivals and rituals, the Munda only practice a few festivals and rituals such as Pahari/Dangri Kharam Puja, Karam Puja, Sarul Puja, Natun Khaoa Puja, Valua/Velva Puja, and Sohrai Puja. The pujas are performed in full Mova style (Munda K 2018)(Sarkar S 2018) (Kamal, M 2010)(Munda K 2012)(Munda RD, Manki RS 2009).

The Munda people's cultural practices are distinct from other ethnic groups. There are still many different traditional dances and tunes. In the Munda community, Jhumur, Khemta, and Tusu songs and dances are well-known. The Mundas also believe in ghosts (Bhut) and spirits, both good and malevolent, and they invoke them to heal the sick or harm others. They said that Ojhara was haunted by spirits. When he is unable to feed the ghost personally, he places it on another person's neck. (Munda K 2018)(Kamal M, Barman V 2010)

2.2.12 Sundarban Adibasi Munda Sangathan, (Sams)

The organization SAMS was established in 2003, and at the beginning of its establishment, SAMS always worked for the betterment of the Munda people. SAMS is not only an organization, but it also works in different socio-economical aspects like education, health, sanitation, awareness of Munda people to their rights, and so many works. Every month, our organization SAMS publishes a magazine named “Masik Munda Barta”. SAMS always uplifts all types of Munda people activities, and in this process, SAMS impresses Munda people’s livelihood patterns.

1.3 Case Study

Disaster Resilient Habitat: An Alternative to Cyclone Shelters, UNDP Bangladesh

• Location: **Adarshagram, Padmapukur, Shyamnagar, Shatkhira**

• Architect: **architects from BRAC University, Bangladesh**
• Client: **Cyclone Affected local people of Adarshagram**
• Design: 2009
• Completed: 2010
• Area of a single unit: **130 sq feet**
• Number of units: **43**

Figure 10: Adarshagram, Padmapukur, Shyamnagar, Satkhira

Cyclone Aila in 2009 affected the coastal region of Shaymnagar, Satkhira, and destroyed a huge number of houses along with livestock and human lives as well. UNDP, along with the help of DoA, BRAC, took the non-profit project to help the lives affected by Aila.

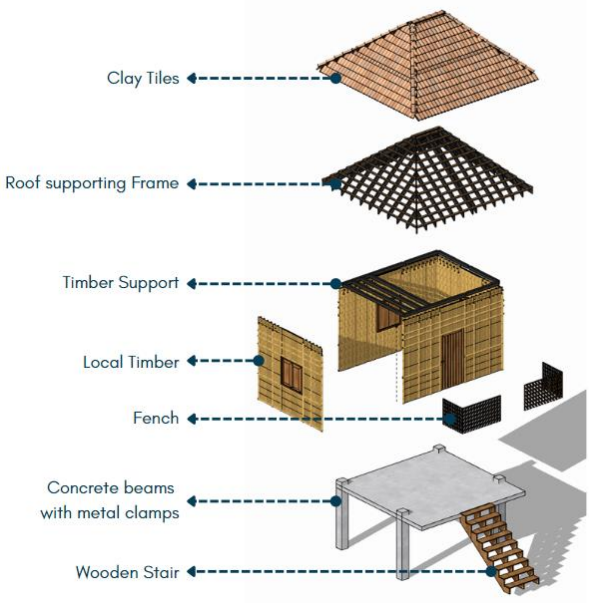


Figure 11: Exploded view of the structure

Local People were involved in the construction of the houses. The main objective was to first create a single-unit house by the locals so that they learn and create the nest houses themselves. In Adarshagram, a total of 43 homes, as well as a new school to replace the one that was destroyed, will be constructed. The sturdy wood frame structure was built using the talents of boat builders or homeowners, but the concrete construction was overseen by engineers and completed by skilled workers, student volunteers, and local men and women.

The homes, which were 10 feet by 13 feet tall and stood 8 feet tall, were supported by four concrete columns and reinforced concrete beams placed high above flood level. The beneficiaries preferred an above-ground building with room underneath for future alterations and additions. Stones were utilized in place of bricks and a particular chemical to make the concrete saline-resistant. Additionally, additional spaces were provided to stop steel bars from rusting and swelling because of saline.

2 Methodology

The majority of the study's data and information were qualitative. Data have been gathered from primary and secondary sources to meet the study's goals. Fieldwork has been used to gather primary data, most of which is qualitative. Secondary data sources are books, journals, research papers, and reports. Websites on the internet are used to gather data about pertinent subjects. In-depth key informant interviews, as well as group discussions with locals, were used to gather pertinent information on the topic at hand. For the study, primary data and information collected by questionnaire have been compiled and analyzed.
By addressing the following three study issues, this article helps to comprehend the social dynamics caused by salt in Bangladeshi coastal areas:

a) How is salinity affecting the Munda Community of Shyamnagar, Satkhira?

b) What is the present scenario of their lifestyle, culture, and housing conditions?

c) How can we provide a disaster-resilient and adaptable housing module that preserves the Munda culture?

Following are the key steps that were taken considering these three research questions-

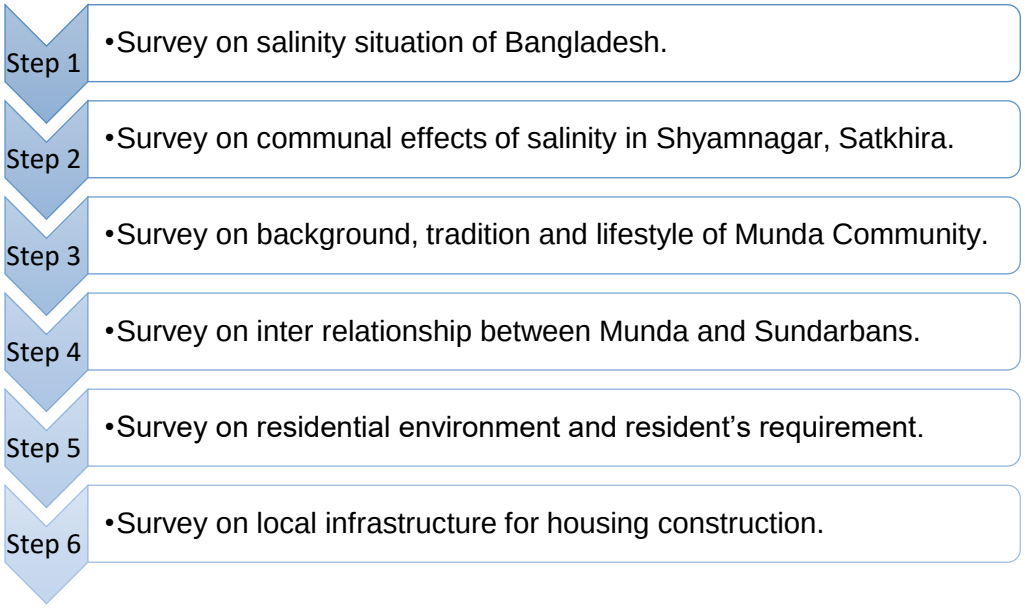


Figure 12: The key steps that were taken considering the research questions

Firstly, the salinity scenarios of Satkhira and data related to salinity were collected from different papers, organizations, and websites. Effects of salinity on the Munda community were collected from a field survey.

The diverse history, culture, and tradition of the Munda people and their connection with the Sundarbans were collected from a field survey in the target area. Mainly, the elderly people provided the information. Different article and papers on the Munda people were reviewed.

A few surveys were conducted on 1) the local residential environment and requirements, 2) the local infrastructure for housing construction, and 3) the local building standards and methods in order to determine the best way to construct a long-lasting home for low-income residents in Bangladesh's southern coastal region. Current masterplan, housing type, material usage, availability of materials, material supply infrastructures, road network, etc., were collected from the field survey.

3 Discussion

3.1 Housing Prototype

Every year, millions of lives are put in peril, and the property of impacted people throughout the world is destroyed by the pervasive and horrific phenomena known as natural disasters. Among other problems brought in by natural disasters, one of the most considerable problems is the loss of shelter. According to the United Nations High Commissioner for Refugees, 70.8 million people were forcibly displaced internationally in 2018. (Das M 2002) (Fr. Luigi Paggi S.X 2003) and approximately 14 million people are relocated annually on average. (Munda K 2018) The numbers are more frightening in Bangladesh. For instance, Cyclone Sidr, which struck the Satkhira-Khulna-Bagherhat area on November 15 with 260 km/h winds and a 6 m tidal wave and caused around 4406 fatalities and over 55,009 injuries, was the most destructive of the disasters. Over 500,000 houses were demolished, and over 900,000 were significantly damaged, affecting an average of 27 million people across 30 districts. (Huda, Shaiful 2021: 484) Everyone has the right to adequate housing for their health and well-being because it is an essential human requirement, much like food and clothing. In disaster-prone places, it is crucial to have a disaster-proof home. These communities, however, do not enjoy this luxury, and disasters routinely decimate them. Consequently, about a million homes are significantly damaged by disasters every year, with half of them being entirely demolished. The loss of a home and other possessions leaves the poor more susceptible to similar disasters, and owing to financial limitations, they are unable to reconstruct themselves. In case of our considered disaster, Salinity, building houses to save the materials and structure from the effect of salinity in soil and water while maintaining traditional patterns and ensuring all the facilities is the prime target. Building disaster-resistant dwellings is needed because these will secure their lifestyle in these disaster-prone areas. The following sections will cover the planning, construction, and design elements that will increase the house's durability, hand in hand with other considerations.

3.2 Consideration

The salinity in the soil and water has a significant impact on the materials used in the area's dwellings. However, the problem is to use materials that are locally available, modest in cost, and quickly repairable. Aside from the materials, the structure must be well-built and capable of holding the shelter together in the face of any natural disaster. Keeping all of this in mind, we planned to create a housing type that addressed the following issues:

- **Local materials:** In the case of rural housing, the use of local materials is essential. They can be found easily during construction and especially for reconstruction if disaster affects them. It will minimize the cost. Also, as they are familiar with these materials, they will know how to use and maintain them. The target will be maximization of the use of these same materials, which was previously used to be more durable in the proposed housing prototype
- **Minimizing the effects of salinity:** The main target of building this disaster-resilient housing, is to save safe shelter from saline water and soil. The common effects of salinity are that it reduces the material's longevity and makes it fragile and easily breakable. To protect the materials from those effects and introduce ways and structures to increase stability and durability is one of the primary considerations. Such as raising the floor level, using seashell concrete as the main structural element, etc.
- **Maintaining tradition:** As our targeted people are from an ethnic group that is slowly decreasing in numbers, it was crucial to maintain their traditional housing elements and offer a house that respects their lifestyle. The patterns are also developed based on their family types, significant housing part etc.
- **Durability:** Salinity mostly affects the materials and reduces its lifetime compared to other areas. The target is to protect the materials from this effect and increase the lifetime of the shelter. It will also help reduce costs as durable materials will not need regular replacement or fixing.
- **Low cost:** Our selected community is comprised of low-income people, so we had to look into the cost of building the prototype. Mostly, we used local materials for that. We also looked into the

durability of the structure, where the cost can be like an investment since durable material will help reduce replacement or fixing costs in the future.

- **Stability:** Our site is located in such an area where cyclones and floods are also a regular calamity besides salinity. So, the prototype is designed to survive other calamities, too, and features are added to not only increase the building's stability but also a protection shelter in the roof, which can be used as storage at other times.
- **Post-disaster housing reconstruction:** After a disaster, it is crucial to consider resilience in terms of housing components for post-disaster housing rebuilding. The first point to consider is minimizing the effect as much as possible. Secondly, such materials should be used that can be easily found and have uncomplicated construction methods.

3.3 Plan

4.3.1. Zoning:

The typical house plan is designed with the local spatial requirements in mind and contains storage areas on the floor as well as in the ceiling. The ceiling storage can be used as a refugee floor at the time of flood. The tradition of dawa (veranda) was maintained with easy circulation from the rooms, though the plinth level is uplifted up to 3.5 ft. Front dawa holds a macha ensuring cultivation of macha vegetables, which was provided considering the effects of salinity on food. This dawa can also be used as storage, chicken coop and living space if needed. The bathroom and kitchen, as usual, were provided at the back of the house to maintain privacy. Also, in the case of clusters and extended modules, the bathroom and kitchen can be shared between multiple families.

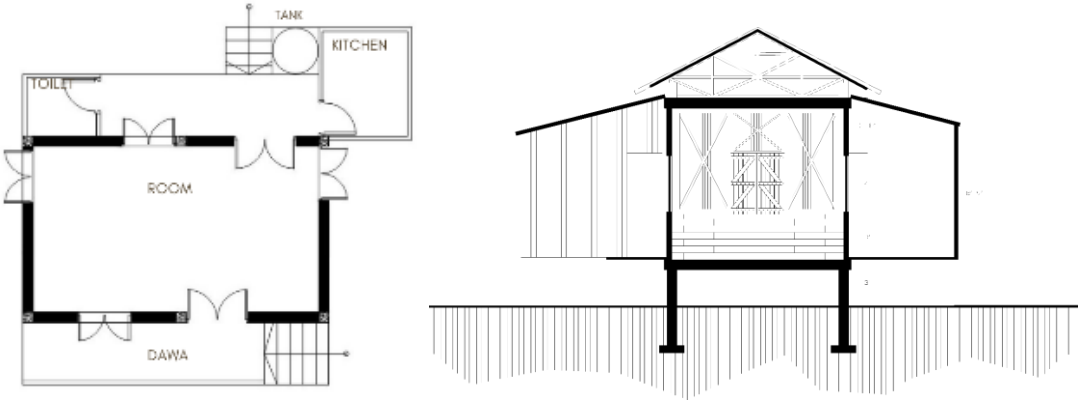


Figure 13: Prototype 1 plan and section (single family)

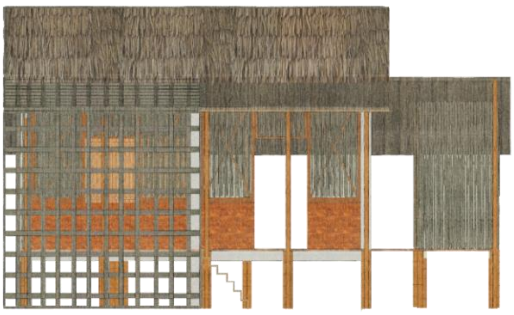


Figure 14: Front Elevation

Figure 15: Back Elevation

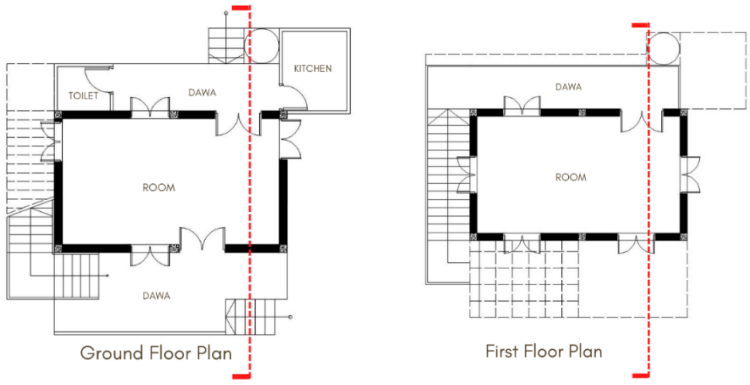


Figure 16: Prototype 2 plan (single-family extended house)

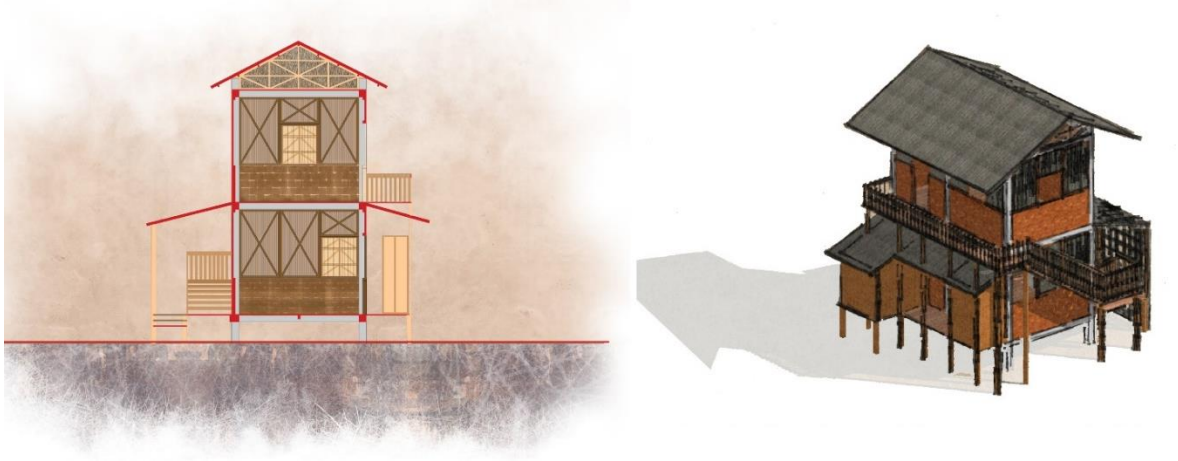


Figure 17: Single Family house (extended)

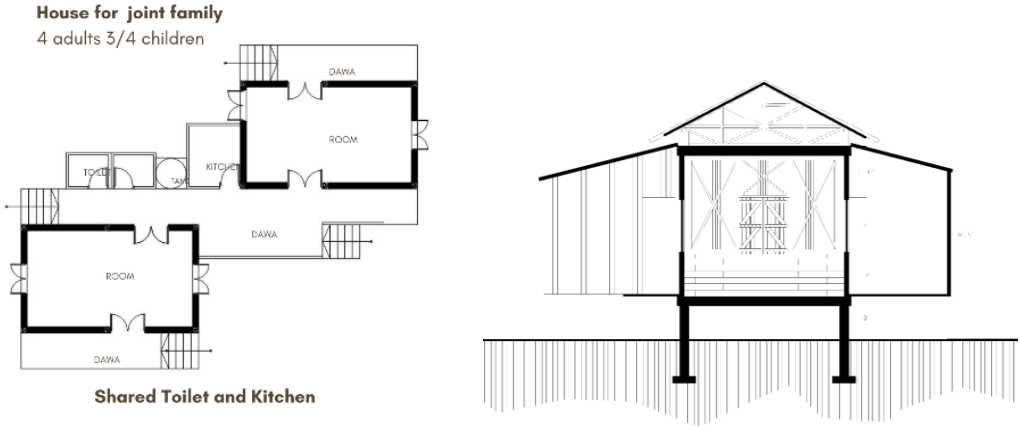


Figure 18: Prototype 3 plan and section (Large family)

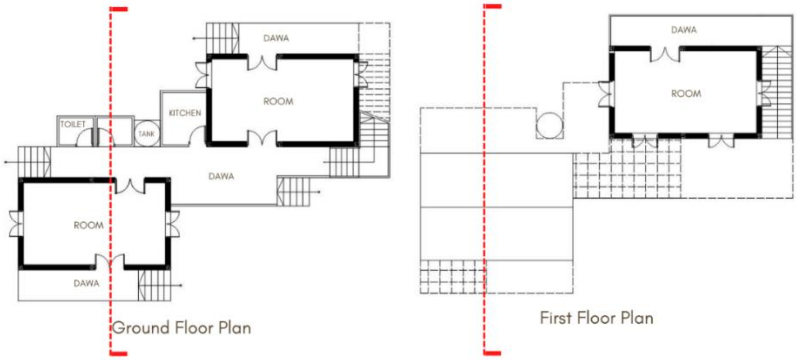


Figure 19: Prototype 4 plan (Large family extended)

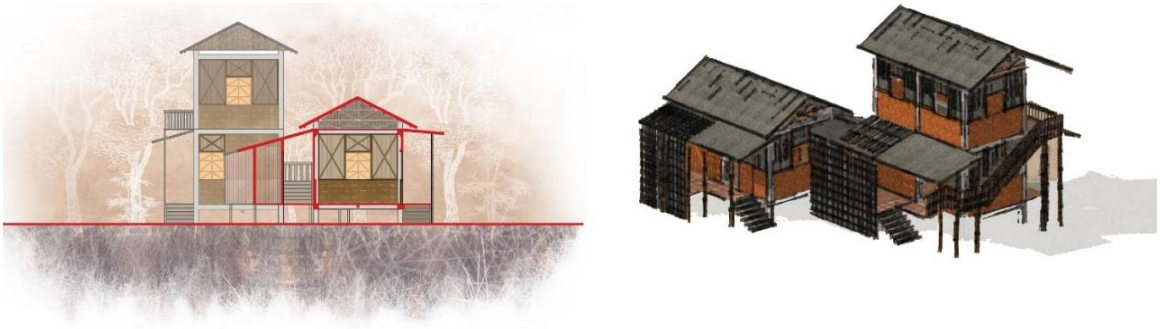


Figure 20: Prototype 4 (Large family extended)

3.4 Materials

We have chosen the materials as per the requirements of low cost, easily available and durable. Also, we have given attention to maintain their traditional housing outlook to avoid making them feel unfamiliar. Muli bamboo infill in the modular system adds contextual essence and makes the structure approachable to local Munda's.

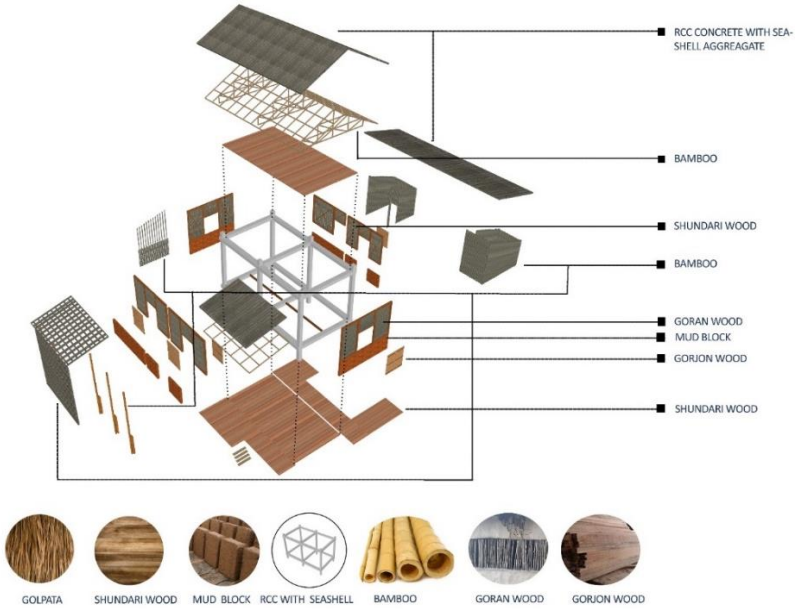


Figure 21: Exploded axono with materials

3.5 Joint Details

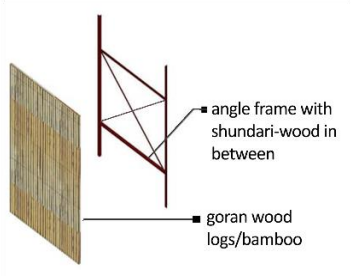


Figure 22: Cross bracing module details

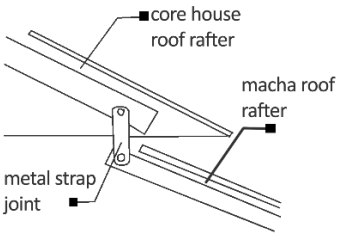


Figure 23: Two roof joint

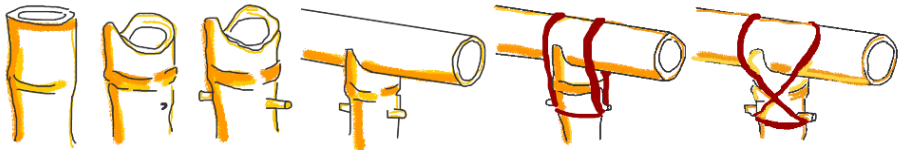


Figure 24: Galvanized Tie

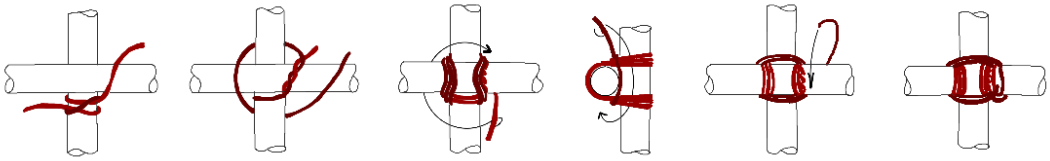


Figure 25: Lashing tie

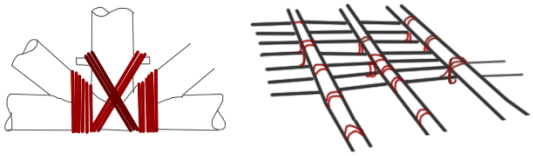


Figure 26: Bamboo joint for truss and roof skeleton

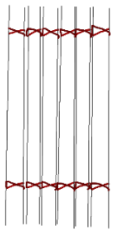


Figure 27: Joints in walls

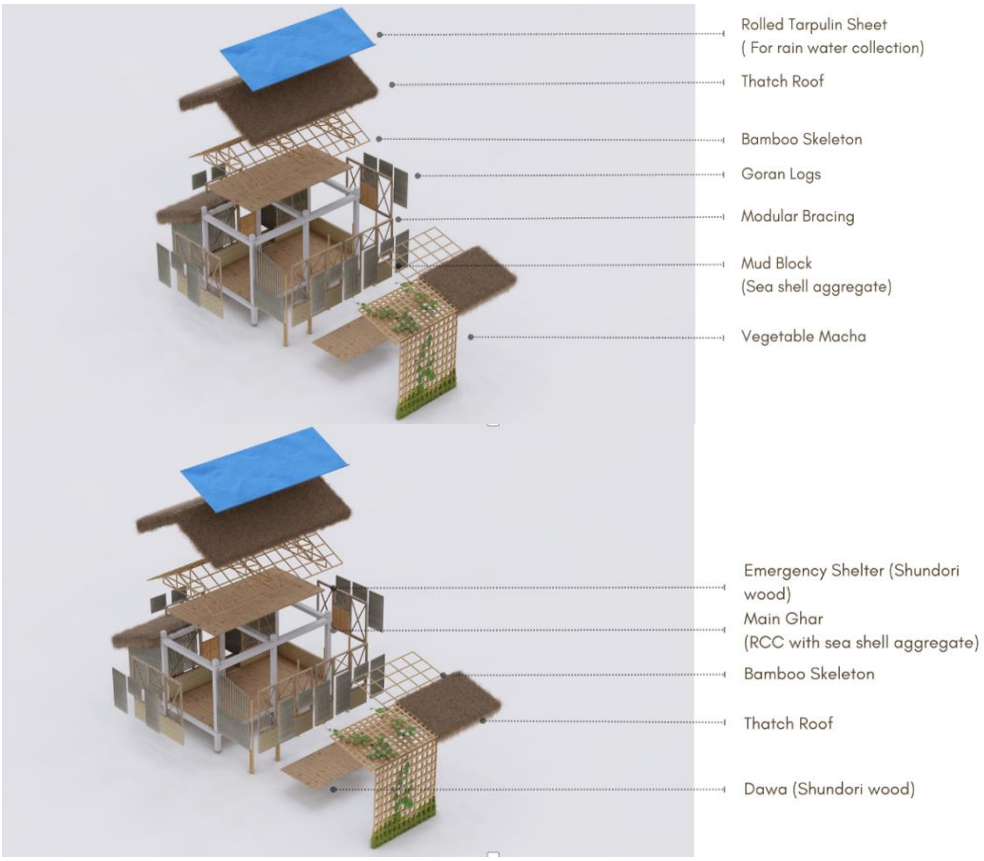


Figure 28: Exploded axono with materials

3.6 Structural Details

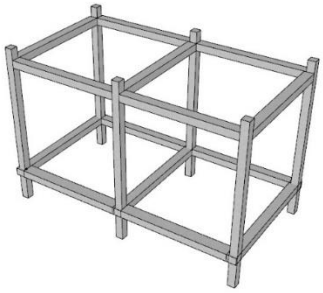


Figure 29: Concrete structure of column- beam

Figure 30: Roof skeleton

4 Conclusion:

Due to severe salinity and frequent natural disasters, the Munda population in the Sundarbans coastal region of Bangladesh confronts several difficulties. They heavily rely on the Sundarbans for their livelihood and spiritual practices, considering it their natural haven. However, their ability to participate in society and their overall wellbeing are hampered by poverty and restricted access to necessities like food, healthcare, and education because of salinity.

The purpose of our study was to assess how salinity affected the Munda population in the Satkhira region of Burigoalini. We looked into the durability and quality of the building materials that were on the market and how salt affected dwellings. We also highlighted the community of Munda's historical, cultural, and existential characteristics, which are at risk of extinction.

Considering all these situations, we designed an economical, cost-effective, and disaster-resistant modular structural system to solve these issues. By offering the Munda people safe and environmentally friendly housing options, this approach hopes to protect their traditional identity.

The results highlight the necessity of supporting and intervening specifically to help the Munda community. The implementation of environment-friendly housing options that take salinity into account was our main priority. By doing this, it will be possible to safeguard the distinctive way of life and cultural heritage of the Munda people while promoting a more resilient and just future for them.

Acknowledgments

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