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Local Wisdom:
Indigenous Practices for Mitigating Disaster Loss

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Indigenous Practices for Mitigating Disaster Loss

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Foreword

Many people in Bangladesh are vulnerable to the effects of disasters and climate change. Almost every year they face natural hazards of different kind. In Khulna region, a wide range of hazards including cyclones, storm surges, floods, water logging and salinity threaten the lives and livelihoods of coastal communities. Scientific data on weather patterns and water movement has become less reliable, as climate changes exacerbate or change the effects of the disasters.

Women and men living in disaster-prone areas over a number of generations have accumulated knowledge of their environment and have identified techniques to either minimize or mitigate the consequences of disasters. These techniques are referred to as "indigenous knowledge", a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a group of traits that encompass language, naming and classification systems, resource use practices, ritual, spirituality and worldview.

Indigenous knowledge is a valuable source of information and can be a key contributor to reducing risk in local areas. The United Nations has recognized this as a key element of Priority 3 of the Hyogo Framework for Action, which focuses on education and knowledge. One of the key activities identified under this priority action is information management and exchange, and highlights the use of "relevant traditional and indigenous knowledge and cultural heritage" to be shared with and adapted to different target audiences.

In order to strengthen the capacity of households and communities to manage the effects of disaster and climate change, PROSHAR contracted a study to collect local wisdom in the three project areas: Sarankhola, Batiaghata and Lohagara upazilas.

The study has the potential to reinforce local coping mechanisms that can help people and communities better prepare for managing future disasters. It is hoped that the local wisdom captured in this report will benefit a wide audience who are faced with the challenges of rapid onset or chronic disasters.

I would like to convey my sincere thanks to NIRAPAD and technical specialists, for their contributions. I hope that readers will gain insights that will help them to understand the value of indigenous knowledge to reduce risks caused by disasters and chronic conditions caused by climate change.

Marie Cadrin
Chief of Party, PROSHAR
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A special thanks to Mr. Md. Joynal Abedin, Ms. Khaleda Akter and Mr. Abonindra Chandra Karmaker for their support to organize field visits at Batiaghata, Lohagara and Sarankhola. We would also like to thank the field staffs of Shushilan, Muslim Aid and CODEC for supporting the study team in collecting data from field. We would like to offer a sincere thanks to the community people who gave their valuable time to participate in this study.

Our appreciation goes to all the participants of the consultative and validation workshops for making them successful. We are thankful for their valuable suggestions and feedback during the workshop. NIRAPAD would like to recognize the contributions of the research papers and relevant documents that assisted us in conducting the study. We would also like to extend our gratitude to the people who would finally utilize the study findings.

Kazi Shahidur Rahman
CEO
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Chapter 1: Introduction

1.1 Background

The entire coastal region of Bangladesh and the Khulna Division in particular are exposed to numerous natural hazards that threaten the lives and livelihoods of local communities. Cyclones, storm surges, floods, riverbank erosion, water logging and salinity intrusion are worsening as a result of riverbed siltation and other impacts of climatic change. In recent years, Cyclone Sidr (2007) and Cyclone Aila (2009) claimed the lives of an estimated 3,700 people and devastated infrastructure, livelihood opportunities and household assets in the area. Despite this fact, existing institutional structures and national capacities have been shown to be effective at preventing and mitigating the impacts of natural hazards. For example, the multi-hazard early warning system (EWS) in the Khulna Division showed a return of nearly US $41 in benefits for every US $1 invested over a 10-year period, according to a 2009 World Bank report. Additionally, non-structural measures such as investing in cost-effective, community-based solutions such as flood forecasting have been successful.

Through their interminable struggle to recover from recurrent disasters, people in these areas have gained practical knowledge, or "indigenous knowledge,"to cope with local hazards. Indigenous knowledge is a valuable source of information and a key factor in reducing disaster risks in local areas. The United Nations has included indigenous knowledge within Priority 3 of the Hyogo Framework for Action—its 10-year plan to make the world safer from natural hazards. One of the key activities identified under this priority action focused on education and knowledge, emphasizes the importance of information management and exchange, and highlights the use of "relevant traditional and indigenous knowledge and cultural heritage" to be shared with and adapted to target audiences.

The Program for Strengthening Household Access to Resources (PROSHAR), with funding support from USAID and additional contributions from the Government of Bangladesh, operates in the Lohagara, Batiaghata and Sarankhola upazilas (or sub-districts) in the Khulna Division. The program's goal is to reduce food insecurity of the most vulnerable households in impoverished areas of the coastal region where malnutrition is common. The understanding that indigenous knowledge is a valuable resource to local populations, empowering communities and enhancing the capacity to better prepare for and manage future disasters is an underlying principle of PROSHAR. PROSHAR has commissioned this study to investigate indigenous knowledge based practices surrounding local disaster coping mechanisms in the three afore-mentioned districts. PROSHAR intends to integrate study findings into program interventions through replication and scaling up.

1.2 Purpose of the Study

The purpose of the study is to reinforce the use of indigenous practices and knowledge in local early warning systems, household water management, livelihood techniques and health and nutritional practices that help target populations cope with hazards. The PROSHAR project area covers the Lohagara, Batiaghata and Sarankhola upazilas in the Khulna Division. The target groups include farmers, fisherman, pregnant and lactating mothers, adolescent girls, elderly people and persons with disabilities.

The specific objectives of the study are:

- To identify indigenous knowledge based practices surrounding early warning systems, water management, livelihood techniques and health and nutrition maintenance employed by people in the target districts to cope with hazards.
- To assess opportunities, challenges and strategies for replication and scaling up of these practices in the target region.

1.3 Scope and Limitations

To a large extent, the scope and limitations of the study were determined by the opportunities and constraints present in the PROSHAR intervention plan. The scope did not include comprehensive documentation of indigenous knowledge based practices; instead, the study sought to identify a critical mass of practices for replication through PROSHAR intervention. Field work was conducted solely in the PROSHAR intervention areas—the Lohagara, Batiaghata and Sarankhola upazilas in the Narail, Khulna and Bagerhat districts, respectively. Although Interactive Group Discussions (IGDs) for consultation were conducted in all 23 unions (the smallest administrative units of local government) of these three upazilas, they were limited to two in each—one comprised of both men and women, and the other exclusively of women. It is unlikely to get a comprehensive list of indigenous knowledge based practices through only two IGDs, and therefore, the practices identified inevitably reflect the priorities and biases of the participants.

The study focused primarily on indigenous knowledge based practices and did not explore knowledge that did not result in practical applications. For example, reports of specific animal behavior, such as frogs croaking or ants moving their eggs, used locally to forecast heavy rains or flood, were not investigated because the knowledge did not trigger any preparedness action.

Furthermore, the study was limited to practices relating to four areas: early warning, water management, livelihood and health and nutrition, as defined by the goals of PROSHAR. Early warning practices were defined as those actions that people in the community take to minimize loss of life and assets in anticipation of disaster. Water management practices included only those activities aimed at ensuring access to water for domestic use in times of crisis. Practices relating to the use, supply and storage of water for purposes other than household consumption (e.g., agriculture) were not examined. Practices for livelihood were defined as those applied by the community for income generation and meeting basic needs during disasters. Last, health and nutrition practices included those that seek to prevent and cure hazard induced illnesses and ensure nutrition during post-disaster periods.

Additionally, practices not directly connected to disaster risk or loss management—for example, the use of herbs to treat headaches or indigenous tools for irrigating crop fields—were not included in the study even though they related to the four areas. Moreover, disaster risk reduction practices promoted through development or institutional intervention, such as oral rehydration therapy to manage diarrhea and cyclone warning signals, were not explored. Finally, the study did not include practices already documented and integrated into the development program, such as homestead raising as flood proofing, or making portable chulas (stoves) for use during disasters.

1.4 Structure of Document

This report is divided into eight chapters. A description of each follows:

Chapter 1: Describes the purpose and objectives, as well as the scope and limitations of the study, and outlines the document's structure.

Chapter 2: Lays out the process of the study, including the frame of reference, methodologies and corresponding strategies, as well as tools and techniques used to capture field findings.

Chapter 3: Includes a summary of the study area's demographic and geographic features and hazard profile. It also delineates the conceptual framework of indigenous coping practices and contains the analytical framework of the study, explaining the criteria for inclusion and replication of practices.

Chapter 4: Describes local practices found in the Khulna region used to protect life and assets under the preparedness and early warning category. Each of the cases follows a general format including the name of the practice, its objective, materials needed, its process, underlying principle, replicability, inference and scaling up requirements.

Chapter 5: Documents local practices for ensuring quality and quantity of water under the water management rubric. Each of the cases follows a general format including the name of the practice, its objective, materials needed, its process, underlying principle, replicability, inference and scaling up requirements.

Chapter 6: Details local practices under the livelihood classification for maintaining income during times of crisis. Each of the cases follows a general format including the name of the practice, its objective, materials needed, its process, underlying principle, replicability, inference and scaling up requirements.

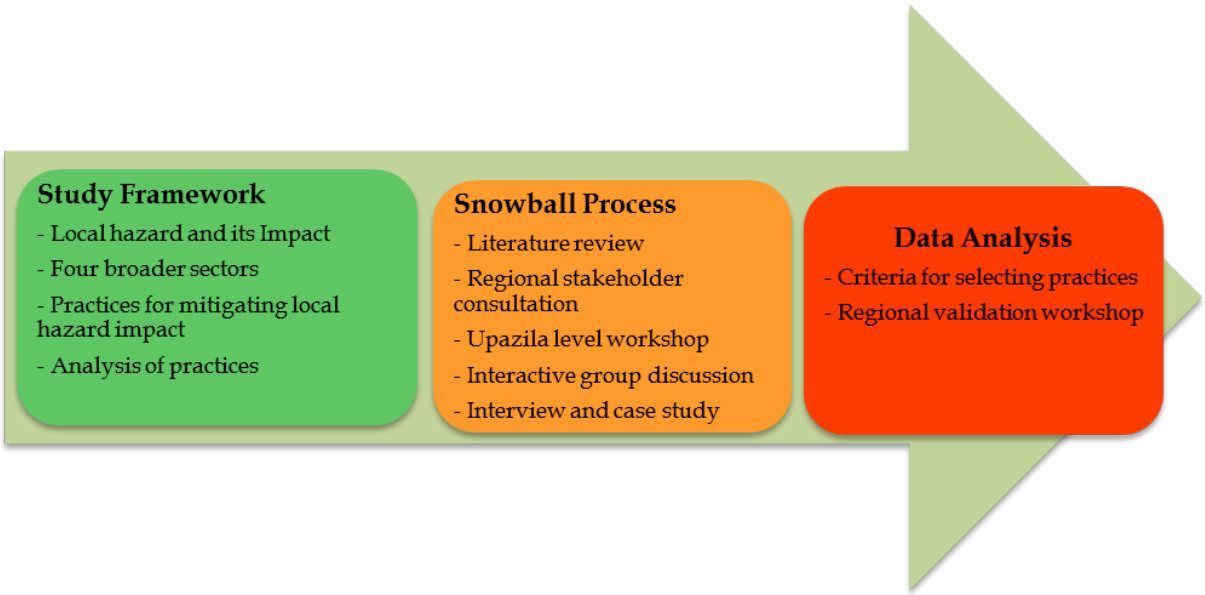
Chapter 7: Local practices for maintaining health and nutrition under the health and nutrition grouping are included. Each of the cases follows a general format including the name of the practice, its objective, materials needed, its process, underlying principle, replicability, inference and scaling up requirements.

Chapter 8: Includes the summary and conclusion, emphasizing that indigenous practices often provide viable, innovative methods for filling mainstream development gaps, but cautions that these are often experimental, context specific and not always replicable. Indeed, these practices alone do not represent a panacea for communities' disaster vulnerability.

Chapter 2: Study Approach and Methodology

2.1. Overall Process

This chapter will discuss the study framework, and procedures for sampling, data collection and analysis. The study was carried out using a chiefly qualitative approach, but on a few occasions employed quantitative analysis. The study process is divided into three complimentary building blocks: 1) developing the framework of the study; 2) the "snowball sampling" process of gathering field information; and 3) the analysis, validation and triangulation of findings.



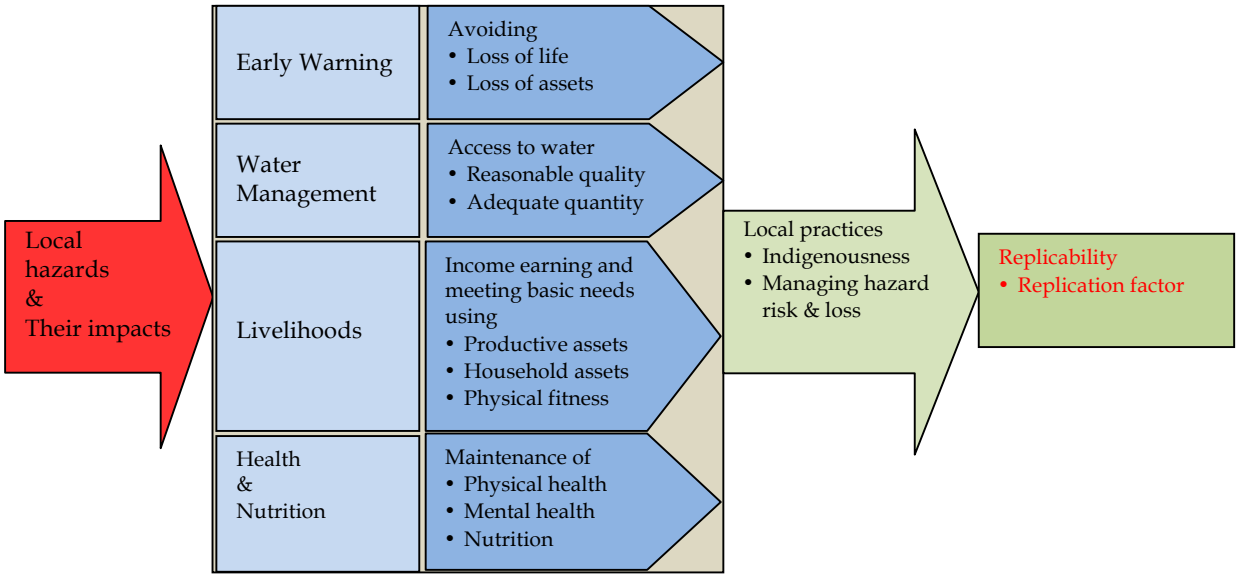
2.2 Study Framework

The objective of the study was to understand and document the principles that underpin indigenous practices applied by communities in their efforts to cope with local hazards and their impacts. This understanding would in turn help researchers, practitioners and stakeholders identify best practices among indigenous coping mechanisms, and promote those in a wider context to manage risk environments.

A framework, developed at the onset of the study, explains the study conceptually, delineates its scope and limitations, illustrates the different components and their relationships and describes the procedure and its logic. The framework informed the procedures used in determining local hazards and their impacts in the target regions, and indicated the required tools and process for collecting, sorting and prioritizing data.

In order to link the findings with the objectives of the PROSHAR intervention, the study was divided into four areas: 1) early warning systems; 2) water management practices; 3) livelihood techniques; and 4) health and nutrition practices. Early warning refers to avoiding loss of life and assets by predicting and responding to shocks and stresses; water management includes access to water of reasonable quality and quantity; livelihood techniques refer to income earning and meeting basic needs through the use of productive and household assets as well as physical fitness; finally, health and nutrition denotes any safeguards against ailments, including maintaining physical and mental health and nutrition.

The framework also specifies a set of criteria and indicates an analytical framework for systematic evaluation of the data to identify the primary data required and the criteria for assessing the "indigenousness" or local acceptance of the practice, and potential replicability



of each practice.

2.3 Snowball Sampling Process

This study uses exponential discriminative snowball sampling. Snowball sampling asks subjects to recruit other subjects from among their acquaintances. The researcher then asks those nominated to refer others, and continues in the same way, until a sufficient number of participants is obtained.

The chain referral process allows researchers to reach populations that are difficult to sample employing other methods. Simplicity and cost-efficiency are its main advantages, while the main disadvantage is that researchers have little control over the process; representativeness of the sample is not guaranteed, and sampling bias is a concern.

Snowball sampling is a non-probability sampling technique used by researchers to identify potential subjects in studies where participants are hard to locate.

2.3.1 Literature Review

At the beginning of the study an extensive literature review—including national and international publications, books and documents published by academia, government agencies and non-governmental organizations (NGOs)—was conducted. These were valuable sources for understanding and analyzing as well as developing a strong hypothetical base.

After reviewing available and relevant literature, a convincing trend was found, which was used to guide the study as it moved forward. A total number of 65 indigenous practices with coherent relationships to disaster risk reduction were isolated through the literature review. A list of these practices follows in the text box below.

List of indigenous practices from literature review

- Heavy rain in Ashar-Shraban (monsoonal months) – forecasting flood
- Heavy rain in Bhadra-Ashwin (autumn) – forecasting flood
- Frogs croaking – forecasting rain
- Snakes emerging from pits and burrows – forecasting rain
- Ants moving eggs – forecasting rain
- Insects (e.g., mosquitos and dragon flies) biting more than usual – forecasting rain
- Doves entering dwellings – forecasting rain
- Densely clustered stars in the sky in Ashar-Shraban – forecasting rain
- Heavy formation of clouds in the south – forecasting rain
- Clouds moving south to north – forecasting rain
- Clouds moving rapidly from west to east - forecasting flood
- River water color turning muddy – forecasting flood
- Measuring water levels with jute stems – used to monitor flood levels
- Winds blowing north to south in Jyastha (summer) – forecasting riverbank erosion
- Recurring visits of river terns in Poush-Magh (winter) – forecasting riverbank erosion
- Strong wind blowing, north to south in Chaitra-Baisakh (spring/summer) – forecasting cyclone
- Hot wind blowing – forecasting cyclone
- Abnormal behavior of fishes in the sea – forecasting cyclone
- Clouds rushing from north to south – forecasting rain
- Violent upward and downward motion of clouds – forecasting cyclone
- Sea clouds observed to be "disheveled" – forecasting cyclone
- Storing dried cow dung cake – mitigating flood impact
- Storing dry fish in deep pits – mitigating cyclone impact
- Tying roofs to large trees – mitigating cyclone impact
- Replacing poles and repairing houses in Falgun-Chaitra (spring) – mitigating storm impact
- Using floats and plastic containers as lifesavers – preventing loss of life
- Building houses on raised platforms – avoiding inundation
- Dismantling structure for houses – minimizing loss due to riverbank erosion
- Raising of dwelling plinths – protecting against inundation
- Lease arrangement for homestead – temporary shelter
- Gola ghar - food grain store – food preservation
- Sidol- dry fish, arum and turmeric mixture – food preservation
- Growing creepers – adaptation
- Growing vegetables on plinths – mitigating flood impact
- Raised platforms for firewood - mitigating flood impact
- Keeping seeds in earthenware pots - seed preservation
- Keeping vegetable seeds in colored glass bottle - seed preservation
- Keeping seeds in khurang (bamboo pots) – seed preservation
- Using organic manure – adaptation
- Growing plantains on homestead – mitigating storm impact
- Conservation of tall grasses (kashban) – preventing soil erosion
- Hati – raised dwelling areas – mitigating flood impact
- Murta cultivation and weaving shitol pati (mats) – adaptation
- Using traps for fishing – adaptation
- Growing screw-pine (kewra) – adaptation
- Using golpata tree for roofing –adaptation
- Harvesting salt from sea water – mitigating cyclone impact
- Preserving salt in deep pits wrapped in plastic sheets – mitigating losses due to storm surge
- Building houses with higher plinths and lower roofs – mitigating storm impact
- Using dew to ensure soil moisture – adaptation
- Building gail bandha bandh (mini embankment) – mitigating flood impact
- Growing vegetables on floating beds – mitigating water logging
- Using grami to recover inundated paddy – mitigating flood impact
- Using cow dung to preserve rice – adaptation
- Storing melons on raised platforms – food preservation
- Using upli (husking lever) for husking – adaptation
- Preparing seed beds on homestead – mitigating flood impact
- Cultivating rice using double transplantation – adaptation
- Keeping pumpkins in hanging nets - food preservation
- Covering fields with dry grass or straw – adaptation
- Making fishing tools using bamboo – adaptation
- Bamboo portable vegetable beds – adaptation
- Ridge and furrow method for vegetable cultivation – adaptation
- Keeping domestic animals on raised platforms during flood – mitigating flood impact
- Fixing molom (extra plunk) in boats – adaptation
- Burning red chili to keep away snakes – mitigating flood impact
- Using water-hyacinth/tree branches in ponds for fish culture – adaptation

2.3.2 Regional Stakeholders Consultation

Findings from the literature review were analyzed further in a daylong consultation workshop held in Khulna. Participants were selected from regional level stakeholders with diverse backgrounds and fields of work that included representatives from government agencies, NGOs, academia, civil society and the media. The review probed whether and to what extent these practices prevail in the region, explored additional practices and determined the areas in which they are applied.

2.3.3 Upazila Level Workshops

Regional consultation was followed by three upazila level workshops held in Batiaghata, Sarankhola and Lohagara. Much like the regional level workshop, participants were selected from among stakeholders in each respective area and included representatives from government agencies, NGOs, academia, civil society and the media. The focus was on determining specific practices that prevail in specific upazilas, identifying the communities in which they are reproduced, as well as their variations and adaptation.

2.3.4 Interactive Group Discussions

After the upazila level workshops 46 Interactive Group Discussions (IGDs) were conducted at the union level. Two IGDs (one including the community at large and one exclusively with women) took place in each union. Discussions were conducted applying a previously developed open-ended questionnaire, which provided specific and vital information about the practitioners and how and to what extent each practice is related to indigenous knowledge and disaster risk reduction. A total number of 101 items were isolated through IGDs, and a total of 46 practices were identified through this process for developing case studies.

List of indigenous practices provided by IGDs

Forecasting cyclone
- Observing wind speed and size of waves in deep sea
- Strong wind from the east during Baisakh-Jaystha (summer)/ Kartika-Agrahayan (late fall)
- Crabs climbing on houses
- Vata fish coming near the river ghat
- Dense clouds forming in the sky
- Heron flying in flocks
- Many dogs barking together
- Crows crowing in the night

Saving lives during storm, flood & boat capsize
- Keeping extra floats in fishing trawlers
- During storms, staying in one corner of the room
- When in Sundarbans, always keeping gamcha (towel) and a length of rope
- Saving food/ household items during storm / flood
- Before storms, keeping dry food in a pot and burying

Minimizing or recovering losses caused by hazard
- Keeping jute stalks on platforms covered with plastic sheets
- Laying a row of bricks around plinths
- Keeping tools (plough/yoke) on raised platforms
- Keep food, utensils and documents on raised platforms
- Using anchors and rope to secure boats and trawlers
- Using jute stalks to build houses
- Putting fish feed in one place of a flooded pond
- Selecting crops for cultivation considering rainfall and temperature
- Sowing seeds in wet ground without tilling
- Using social relationships to get food aid
- Seed/food preservation and crop cultivation
- Keeping vegetable seeds in

Treatment for headache
- Massage with mustard oil mixed with onion juice or salt
- Applying paste made from ahanuddi leaves
- Applying paste made from ripe tamarind

Treatment of dysentery
- Fried thankuni and Jia leaves, take orally
- Syrup from soaking bark of jam treem chopped dalim in water and adding crystal sugar
- Fried telakuchi leaves
- Ground dalim and garmani leaves, taken orally
- Chopping plantain plant, collecting its juice to drink
- Juice of thankuni leaves and dalim
- Fried bale leaves, taken orally

Treatment of other diseases
- Fever – juice of shishabda root and tulsi leaves, taken orally with honey

Chicken pox/measles –

List of indigenous practices provided by IGDs

- Before a storm, submerging household items in ponds
- Keeping utensils/food items in a bag tied to a pillar
- Wrapping important documents with polythene and keeping on elevated shelf
- Submerging boats before a storm
- Saving houses from storms
- Hanging weights from the four corners of the roof during cyclone season
- Tying roofs to mud walls
- Tying roofs of houses with veranda and mud walls to pegs fixed to ground
- Placing bamboo on the roof and tying
- Installing extra poles for the house in cyclone season
- Protecting livestock from storms
- When cyclone is imminent, taking animals to safe place
- Untying animals when cyclone is imminent

Collecting and storing water

- Keeping banks of ponds protected
- Collecting rain water using plastic sheets
- Keeping climbing fish in water container
- Putting small amount of raw turmeric in rain water storage container
- colored glass bottles
- Keeping rice and pulses in earthenware jars
- Using lamps as insect traps
- Using old net to grow creepers
- Placing alum in water
- Use of net to make poultry houses
- Growing vegetable seedlings in hanging pots

Treatment for scabies

- Making paste with turmeric and neem leaves, applied topically to skin
- Mixing mustard oil with turmeric paste and applying topically to skin
- Making smoke with wet straw and keeping hands and legs in the smoke (prevention)

Treatment for coughs and colds

- Babies: Mixing turmeric with breast milk
- Adults: Grinding durba grass and tulsi leaves and mixing with honey, taken orally

Treatment for injury & bleeding

- Juice of garman leaf, applied locally
- Juice of arum, applied locally
- Juice of ganda leaf, applied locally
- Juice of durba grass, applied locally
- Juice of akanda leaf, applied locally
- Juice of josory leaf

Treatment for thunderstorm swoon person

- Make loud noise for breach of thunderstorm swoon

ingesting the juice of karalla leaves

Treatment for body ache

- Mixture of turmeric paste and lime, rubbed on the body
- Rub with mustard oil and pinch of salt, taken orally
- **Eye infection** – applying juice from hatishurh leaf
- **Fracture** – applying garlic and kumurjyo plant paste and wrapping with a piece of bamboo mattress

Managing emotional distress & releasing anxiety

- Use of salt water drink
- Mourning song, singing gazal (poetic verse), reciting verses from scripture and praying loudly
- Ensuring supply of herbs
- Growing medicinal plants in homestead

Meeting nutritional needs

- Setting fish traps in canals to catch fish during floods
- Giving pregnant mothers starch from boiled rice as extra caloric intake
- Adults consume less and give children more food
- Feeding children and income earning males first, then women
- Growing vegetables and keeping poultry on homestead

2.3.5 Interviews and Case Studies

Developing two questionnaires of 18 questions each for use in IGDs, individual interviews and case studies was one of the major tasks of the study. Designed to collect specific information, the process was based on trial and error and teamwork.

Each of the 46 potential case studies was explored through individual interviews with practitioners using a previously developed open-ended questionnaire. Interviews concentrated on details about the nature, purpose and procedure of each practice as well as its requirements in terms of skills and materials. Forty-six case studies have been outlined, based on the information collected during interviews.

2.4 Data Analysis

Data analysis was conducted progressively by the study team at the end of each stage of data collection: literature review, regional stakeholder consultation, upazila level workshop, IGDs and individual interviews, and finally through the validation workshop.

An analytical framework with two broad elements had been developed beforehand to support data analysis. First, there were three sets of criteria for inclusion and exclusion, determining a) the extent of indigenous knowledge base of the practice; b) the disaster risk reduction element of the practice; and c) whether and how the practices relates the four areas (early warning, water management, livelihood and health and nutrition.) Second, there were sets of criteria used to determine the value of each practice, both in terms of its benefits and replicability. The analytical framework is explained in further detail below.

2.4.1 Literature Review Findings

The study team sorted and prioritized indigenous knowledge documented in available literature. The main query focused on whether or to what extent:

- The specific piece of indigenous knowledge leads to practice.
- The practice contributes to reducing disaster risk.
- Replication of the practice adds value in the current context.

2.4.2 Findings from Regional Workshops

The study team analyzed the data generated through the consultation to determine:

- Relevance of each of the practices to disaster risk reduction and the four specific areas.
- Geographic location where each practice is applied.

2.4.3 Findings from Upazila Workshops

The study team split in three groups, and each analyzed data generated from the upazila level workshops. The goal was to identify communities that apply each of the already listed practices.

2.4.4 Findings from the IGDs

The study team split into three groups, and each group, in consultation with the other two via telephone, analyzed data generated from the IGDs in each of the upazilas. The analysis applied subjective scoring based on the criteria described in the "Criteria for Inclusion" section below, focusing on:

- Determining whether or to what extent each of the practices relates to indigenous knowledge.
- Establishing the relevance of each practice to disaster risk reduction.
- Ascertaining the relationship of each practice to the four categories.
- Analyzing the value addition potential through replication for each of the practices.
- Prioritizing the practices to be explored further through individual interviews and weeding out those that had already been examined in order to avoid redundancy.

2.4.5 Findings from Individual Interviews

The study team analyzed the findings, rigorously applying a scoring system based on the criteria described in the "Criteria for Inclusion" section below, in order to determine:

- The nature and purpose of the practice and how it relates to disaster risk reduction and the four specific areas.

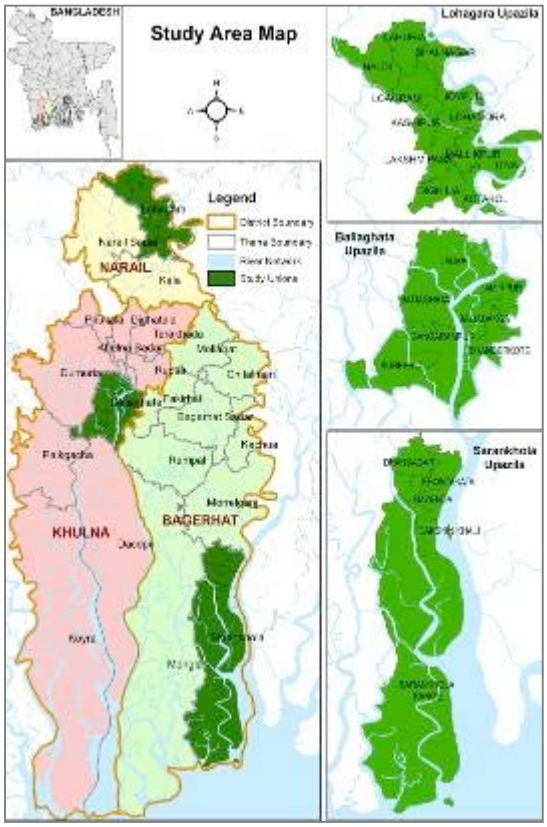
- The processes involved in the practice and how it relates to indigenous knowledge.
- The cost-benefit aspect (including economic, opportunity and social costs and benefits) and whether replication is desirable.
- Replicability potential of the practice as well as barriers to replication.
- The scope and opportunities for replicating practices.

2.4.6 Regional Validation Workshop

Validity analysis—necessary to any form of social research—was accomplished through a regional level workshop in Khulna. Participants came from wide range of backgrounds, including government and NGO officials, practitioners from relevant fields of work, local stakeholders and academics. The group reviewed the study team's findings and conclusions, providing valuable feedback that was then incorporated into the study.

Chapter 3: Study Area and Analytical Framework

3.1 Locality and Hazard Profile



The Program for Strengthening Household Access to Resources (PROSHAR) works in three upazilas or sub-districts of the Division of Khulna, Bangladesh: Lohagara in the Narail District, Batiaghata in the Khulna District and Sarankhola in the Bagerhat District. It targets the most vulnerable and marginalized households of rural coastal Bangladesh in the most impoverished and malnourished areas in order to reduce food insecurity among local populations.

3.1.1 Geographic and Demographic Features

- **Batiaghata Upazila** (Khulna District), with an area of 248.33 sq. km, bounded by the Dumuria and Rupsa upazilas and Kotwali and Sonadanga thanas (also sub-districts) to the north, the Dumuria Upazila and Paikgachha Upazila to the west, the Dacope, the Paikgachha and Rampal upazilas to the south and the Rampal, Fakirhat and Rupsa upazilas to the east. The upazila consists of 7 Union Parishads (smallest governmental administrative units), 158 mouzas (administrative districts corresponding to land areas) and 121 villages. The population is 114,976 (55,285 female and 59,691 male) and the literacy rate stands at 53% (47% for females and 59% for males). Agriculture and agricultural labor account for a large share of occupations in the area (42.94% and 19.67%, respectively). Other livelihoods consist of commerce (10.53%), wage labor (6.35%), service (4.85%), transportation (2.22%), fishing (1.64%) and construction (1.06%), while 10.74% work in some other form of employment. The main rivers are the Kazibachha, Shoilmari, Salta, Jhopjhopia, Pasur, Sibsa, Rupsa and Nalua.

- **Lohagara Upazila** (Narail District) has an area of 290.83 sq. km, and is bounded by Mohammadpur Upazila to the north, Kalia Upazila to the south, Alfadanga, Kashiani and Gopalganj Sadar upazilas to the east and Narail Sadar Upazila to the west. The upazila consists of 12 Union Parishads, 154 mouzas and 233 villages. Population of this area is 231,000 (120,191 female and 110,809 male). The literacy rate is approximately 48% (45% for females and 51% for males). The majority of the population is employed in agriculture (44.36%) or agricultural labor (16.48%), with commerce (10.84%) and service (10.60%) also accounting for a significant share. Other occupations consist of transportation (3.42%), wage labor (3.04%), fishing (1.74%) and other (8.33%). The main rivers are the Nabaganga and Madhumati.

- **Sarankhola Upazila** (Bagerhat district) has an area of 756.61 sq. km, and is bounded by Morrelganj Upazila to the north, the Bay of Bengal to the south, Mathbaria and Patharghata upazilas to the east and Mongla Upazila to the west. It consists of 5 Union Parishads, 12 mouzas and 45 villages. The population is 1,476,090 (735,952 female/740,138 male), and the literacy rate is approximately 59% (58% for females and 60% for males). Nearly half are employed in agriculture (32.94%) or agricultural labor (11.96%), with other occupations consisting of commerce (14.14%) forestry (8.65%), wage labor (7.32%), service (5.78%), fishing (4.27%) and other (14.94%). The main rivers are the Balleshwar, Haringhata and Chandpai; the Sundarban mangrove forest covers a major area of the upazila.

3.1.2. Natural Hazard Profile

Because of its geographic location, climate and river systems, the study area—consisting of the Batiaghata, Lohagara and Sarankhola upazilas—is exposed to various natural hazards. These include floods, cyclones, storm surges, nor'westers, riverbank erosion, salinity intrusion and erratic rainfall. Flooding destroys standing crops in the field, sweeps away domestic birds and animals, causing damage to embankments, roads and culverts as well houses and household assets. Cyclones are always associated with storm surges, which may cause large scale damage to life, property and the environment. Nor'westers typically affect only small areas, but can have devastating impacts, severely damaging houses, installations and infrastructure. Erosion occurs along river banks and its impacts are long lasting, washing away land, installations, roads and embankments. Salinity intrusion seriously disrupts agriculture and water management systems. Erratic rainfall may cause floods that lead to loss of crop and assets. There are concerns that the frequency, intensity and magnitude of these hazards are accelerating due to climate change and that levels of salinity in the area are rising steadily due to embankment construction and water withdrawal in the upper stream.

A description of hazards in each study area follows:

- **Batiaghata:** Exposed to cyclones to some extent, with the lower part susceptible to cyclone induced storm surges. Because of Cyclone Aila some parts have been permanently affected by salinity and water logging. During the Bengali months of Chaitra and Boishakh (spring and summer), some localities experience nor'westers.

- **Lohagara:** Risk of cyclones is relatively low here. During the rainy reason, erosion occurs along the banks of the Nabaganga and Madhumati rivers, low lying areas flood, some remaining water logged for months. During the Bengali months of Chaitra and Boishakh, some localities experience nor'westers.

- **Sarankhola:** Highly susceptible to cyclones and associated storm surges, the upazila was severely affected by Cyclone Sidr in 2007. Also, high levels of salinity in the ground water are a serious concern, causing river water to remain excessively saline for about seven months out of each year.

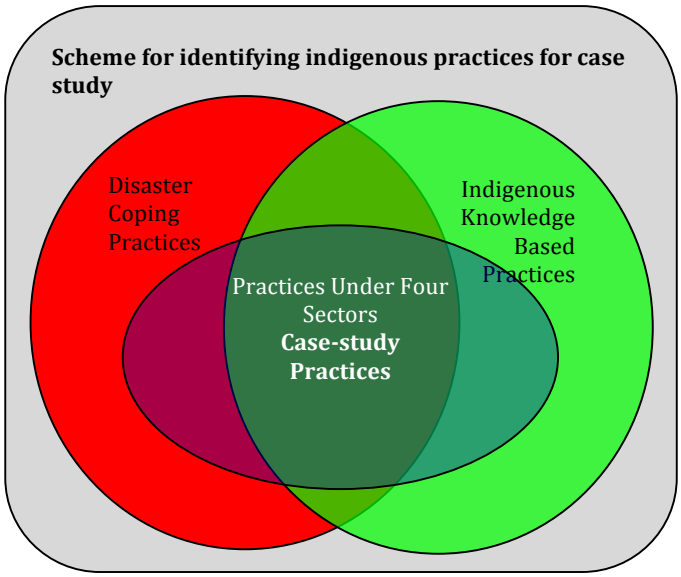
3.2. Indigenous Coping Practices Analytical Framework

As previously discussed, the analytical framework has two broad elements. First, three sets of criteria for inclusion and exclusion: a) criteria to determine the extent of the indigenous knowledge base of the practice; b) criteria to determine the disaster risk reduction element of

the practice, and c) criteria to determine whether and how the practice relates the four specific sectors (early warning, water management, livelihood and health and nutrition). Second, there are sets of criteria used to determine the value of the practice in terms of its benefits and replicability.

3.2.1 Criteria for Inclusion

a. Indigenous Knowledge Based Practices



Indigenous knowledge: Indigenous knowledge, accumulated though generations of living in a particular environment, belongs to and is sustained by communities. In seeking to define indigenous knowledge, the World Bank referred to Warren (1991), who described it as local knowledge, unique to a given culture or society and contrasting with international knowledge systems generated in universities, research institutions and private firms. Flavier et al (1995) suggested it as the information base for a society, facilitating communication and decision making, dynamic in nature, continually influenced by internal creativity and experimentation as well as contact with external systems (World Bank Group website). Kiplang'at and Rotich (2008) posited that it "encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood. Indigenous knowledge is developed and adapted continuously to gradually changing environments and passed down from generation to generation and closely interwoven with people's cultural values." According to Van der Bleik and van Veldhuizen (1993), indigenous knowledge consists of "ideas, experiences, practices and information that have been generated locally or generated elsewhere, but have been transformed by local people and incorporated into the local way of life."

The ICSU Study Group considered instead traditional knowledge, which "is a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment." However, Awori (1991) differentiated between indigenous and traditional knowledge, where the former is an original form of knowledge that cultures have developed organically out of need.

As noted, there are numerous definitions of indigenous knowledge, with some scholars emphasizing the "generation of the knowledge by original inhabitants of the place," while others consider it knowledge transformed and incorporated by locals into their way of life, irrespective of origin. What is common to all definitions is that this knowledge mostly remains undocumented, embedded among people in various forms—cultural practices, customs, traditions, religious and spiritual beliefs, rituals, ceremonies, folk stories, folk songs, legends and proverbs. Indigenous knowledge differs from modern scientific thought in several ways as briefly presented in the table that follows.

Aspects/ Factors		Modern Scientific Knowledge	Indigenous Knowledge
How approached	:	Compartmental	Holistic
How communicated	:	Written	Oral tradition
How taught	:	Lectures and theories	Observations and experience

How explained	:	Theory and "value free"	Spiritual and social values

Indigenous knowledge based practices: As this study is primarily concerned with disaster coping practices, a distinction was made between *knowledge* as "understanding of subject or situation," and *practice* as "application or performing an activity." The study looked exclusively at the application of local knowledge and did not explore "knowledge without any resulting action." For example, events like frogs croaking or ants shifting their eggs to a new place, perceived as forecasting heavy rains or flood, where there was no indication that these had triggered any action relating to saving life or asset, were not considered for replication.

Furthermore, in order to determine the indigenousness of a practice, four criteria or distinguishing features, developed through consultation with key stakeholders (e.g., community representatives and disaster management practitioners associated with the communities) were applied. These include the following.

- **Traditional practice –** It is an established or inherent way of acting in the community, widely accepted and integrates with broader cultural traditions. Additionally, the practice may have recently evolved, but has already been integrated into the local culture in ways that ensure its continuity and reproduction.
- **Experience based –** It is empirical rather than theoretical and has evolved as a consequence of practical engagement in everyday life, irrespective of the origin of the knowledge, local or otherwise. It has been developed by the community through experimentation and experiences and is transmitted through demonstration and replication.
- **Communally trusted –** It is a community developed practice informally applying intimate understanding of the environment. Its efficacy and dependability are not validated by scientific methods; nevertheless, the community continues to rely on these beliefs to get desired results from their application.
- **Reliant on locally available resources –** Materials and tools as well as skills required are readily available within the community. Often, necessary resources come from recycling and byproducts of household materials.

b. Disaster Risk Reduction Elements

Communities develop disaster risk reduction practices over time and adapt them to the local culture and environment. These are applied to minimize impacts of disaster, including averting loss of life and property, preventing disruption of services and social functioning as well as reducing physical and emotional distress. The strategies, as responses to risks, are diverse as well as context specific. Walker and Jodha (1986) state that traditional methods of handling risk can be divided into risk minimizing practices and loss management mechanisms. However, the practices fall into three general categories, a) risk avoidance, b) risk minimization and c) risk retention. These are defined below.

- **Risk avoidance –** Finding ways to bypass impacts of hazard. Does not seek to lessen the magnitude of the hazard, but rather involves abstaining from performing activities that could potentially carry risks. For example, not fishing in the sea during

cyclone season, using crop cycles to avoid floods, and refraining from cultivating rice in saline prone areas.

- **Risk minimizing –** Aims at lessening the impacts of the hazard, and mostly includes structural measures. For example, building embankments to prevent tidal surges or flood water from entering into the locality. May also involve non-structural measures, such as planting trees around the homestead or applying environmentally friendly technology for shrimp culture in the coastal region.
- **Risk retention –** Neither mitigation nor avoidance, but essential to preparedness and improving resilience, aims to sustain societal functions in the face of hazards. This includes early warning related and other preparedness activities at the household level, including but not limited to stocking dry food and making portable stoves.

c. Practice Relates to the Four Specific Sectors

In accordance with the purpose this study, only the practices related to four specific categories (early warning, water management, livelihood and health and nutrition) were explored. To distinguish those practices falling under these areas a set of criteria were applied, which include the following:

- **Early Warning –** Activity undertaken to anticipate hazardous event in order to:
    - Protect life – avoiding injury or death; and
    - Protect assets – preventing or minimizing loss of assets including housing, household assets, productive assets and crops.
- **Water management –** Activity undertaken to guarantee access to water for domestic use during disaster, ensuring:
    - Quantity – that adequate volume of water is available; and
    - Quality – that available water is safe for domestic use.
- **Livelihood –** Activities undertaken for income earning and meeting basic needs during and post disaster, including:
    - Productive assets – replacement and utilization of;
    - Household assets – replacement and use; and
    - Physical fitness – ensuring that income earners remain physically fit enough to work.
- **Health and nutrition –** Activities undertaken to maintain health and nutrition during disasters, focusing on:
    - Physical health – preventing and curing illnesses;
    - Emotional health – reducing emotional distress; and
    - Nutrition – maintaining adequate and balanced food intake.

3.2.2 Replication of the practices

A major concern of the study was replication of indigenous knowledge based practices to help the wider community improve disaster coping mechanisms. A set of criteria were applied to assess whether or to what extent replication is feasible.

Replication factors

- **Readiness –** To what extent the practice is ready for replication and not dependent on unique conditions.
- **Receptivity –** To what extent the practice is acceptable to others and unlikely to be rejected for social, cultural or economic reasons.
- **Resources –** Whether required resources—financial and material capacity as well as skills—are readily available to those in the wider community seeking to apply the practice, and to what extent others will face difficulties in reproducing it.
- **Risk –** To what extent the practice is likely to be correctly applied and that other communities will achieve expected results.
- **Returns –** Whether the practice is likely to be effective in other locations, and that its impact will not be of poor quality when applied in a different context or community.

Chapter 4: Local Practices for Protecting Life and Assets

4.1 Selecting Crops for Cultivation Considering Rainfall Patterns and Temperature

a. Objective:

To ensure reasonable harvests despite irregular weather patterns.

b. Material:

Knowledge and experience.

c. Process:

Observing weather to select crops for cultivation

Local farmers in the Tetulia village of Lohagara Upazila select crops for cultivation considering temperatures, types of clouds and speed and direction of winds. If they notice any significant changes in weather patterns, they select crops that they believe to be more suitable for the changing conditions rather than following the traditional crop cycle. For example, if local farmers notice a delayed winter or relatively warmer weather during early winter, they opt for crops that cope better with such conditions, choosing masur and kheshari pulses over wheat. Similarly, if there is no rain or fewer rains at the beginning of the traditional rainy season, farmers cultivate local varieties of aush and aman rice that have greater tolerance to drought conditions, instead of the usual high yielding varieties of rice

This practice is widely popular among the farmers in the Tetulia village of the Lohagara Sadar Union of Logara Upazila.

Md. Mohiuddin Molla (50) is a farmer living in the Tetulia village in Lohagara Union. He inherited the profession form his father. After years of observation he noticed that weather conditions in cropping seasons do not remain constant; instead, they vary from year to year. Sometimes winter is quite cold, other times less so; in some years it rains heavily during the monsoon months, and in others, it rains very little. He noted that crop selection based on the traditional crop cycle does not always produce a good harvest. Therefore, Mohiuddin Molla observes weather conditions (temperature, humidity, wind and clouds), tries to predict the conditions of the upcoming season and selects a crop accordingly. This year (2012) there was less rainfall, so he predicted it would be a warmer winter. Accordingly, he opted for masur (pulses) instead of rice. The majority of the times this method has been beneficial, to him as well as to the other farmers who apply this practice, in minimizing crop failure and losses.

Source: Md. Mohiuddin Molla, Age- 50, Vill: Tetulia, Lohagara Union, Lohagara, Narail.

d. Principle:

Selecting crops that suit anticipated weather conditions for cultivation.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ Moderate: Dependent upon individual's ability to assess weather conditions and forecast future scenarios, something that could be improved through access to more reliable and systematic weather information	▪ High: Acceptable to local farmers because it helps them select more suitable seasonal crops	▪ No Additional resources are required, and therefore, there are no financial implications	▪ High: Farmers may not be able to predict correctly because of weather related variables and complexities	▪ Uncertain: Returns are inconsistent

f. Inference:

- Weather risks facing crops could potentially be reduced using this practice. Therefore, it adds value to the current crop cultivation system.
- Replication is desirable, but practice should be improved through establishing access to formal information systems regarding weather and agriculture.

g. Scaling up Requirement:

- Information center at community level to be set up through consultation with local farmers where they can access weather and agriculture related information. Also, establishing linkages with weather forecast and agricultural extension services.
- Simple tools to be used by the community for analyzing weather, developed through consultation with farmers, weather experts and an agronomist.
- Public education to develop farmers' weather assessment skills through a training event.
- Information, Education and Communication (IEC) materials such as posters to support the training event.

4.2 Predicting Cyclones by Observing Wind Speed and Deep Sea Wave Size

a. Objective:

To ensure safe return from the sea before a storm strikes.

Predicting cyclones by observing wind speed and wave size in ……

b. Material:

Knowledge and experience.

c. Process:

During October - November and May - June the local fishermen of the Sarankhola area keep a close watch over wave size, wave direction and wind speed while out sea fishing. If they notice that winds are blowing from the north with increased speed and that waves coming from the south are growing larger, they know to expect a severe storm. They stop fishing and head back to shore. Fishermen from Sarankhola have been practicing this tactic inherited from their elders for years.

Nuru Akond (75) of the east Khontakata village is a fisherman. He used to go fishing with his father, and has a great deal of knowledge about the sea. In 2007, just four days before the Super Cyclone Sidr, Nuru Akond was out fishing in the deep sea. He noticed wind speeds from the north increasing and giant waves coming from the opposite direction. Understanding immediately the potential for a storm, he informed other fishermen and started back toward shore. When he returned he heard Signal # 9 had been broadcast.

Source: Nuru Akond, Age- 75, Vill: East Khontakata, Khontakata Union, Sarankhola, Bagerhat.

d. Principle:

Monitor the key signs to predict escalation of imminent cyclone.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ Low: Requires unique skill and applied in highly unique conditions	▪ Low: Applied in unique situations, i.e., fishing in deep sea during cyclone season	▪ No resources required except understanding of weather; therefore, no financial implications	▪ High: Difficult to apply correctly, as wind direction changes constantly during a cyclone, reducing chances of predicting correctly and in a timely manner	▪ Low: Uncertain whether it will produce expected results; fishermen may receive warning too late and may not have time for a safe return to shore

f. Inference:

- This measure should not be used as the sole method of early warnings for cyclones. However, in combination with information received through the formal cyclone warning system, it is likely to increase the ability to understand formal warning messages.

g. Scaling up Requirement:

- Simple tools for analyzing observable weather signs in order to gauge symptoms of an impending cyclone.
- Raising awareness to apply the measure to better understand formal weather forecasts and cyclone warnings, through interactive sessions.
- Educational poster to support the interactive sessions.

4.3 Keeping Additional Floats in Fishing Boats to Use as Lifesavers

a. Objective:

To save lives by using floats in the event that a boat capsizes.

b. Materials:

Floats and nylon rope.

c. Process:

Fishermen from Sarankhola Upazila use floats when they cast their nets. When they fish at sea, they carry additional floats, making wreaths by tying together five or six floats with nylon rope and wearing these. They do it as a precaution against drowning in case of accidental capsizing of their boats.

Fishermen from Sarankhola have been using this life saving technique for a long time.

Keeping Additional Floats in Fishing Boats to Use as Lifesavers

d. Principle:

Rahim Hawladar of Kadamtola village of Rayenda Union is a fisherman. When he goes fishing in the sea he always keeps additional floats on his trawler. He makes wreaths using five or six floats, tying them up with nylon rope. This way he prepares himself in case his trawler should capsize. He has been using this technique for a long time.

Source: Rahim Hawladar, Age- 50, Occupation- Fishing, Vill- Kadamtala, Union- Rayenda, Sarankhola, Bagerhat.

Use materials that float on water to increase buoyancy and prevent drowning.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Easily applicable by any boat crew	▪ High: Floats are essential materials for fishing	▪ No additional expenditure incurs; it is only an alternative use of existing materials	▪ Low: Fishermen are more familiar with floats as compared to lifejackets	▪ High: Float wreath increases buoyancy sufficiently to prevent drowning

f. Inference:

- This practice significantly reduces the risk of drowning and is similar in effectiveness to using a lifejacket. Its acceptance to boatmen and fishermen in Bangladesh is high when compared to lifejackets. The economic cost is negligible as it relies on materials that are already used for fishing. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Raising awareness through interactive sessions with boatmen and fishermen to promote this practice.
- Educational poster to support interactive sessions.

4.4 Submerging Household Implements when Cyclone is Imminent

a. Objective:

To save household assets during cyclones and storm surges.

b. Materials:

Household ponds.

c. Process:

When they receive cyclone warnings, before heading to shelters, people in Southkhali Union under Sarankhola Upazila immerse their household implements (kitchen utensils, knives, crowbars and spades) in their ponds or pools. They tie heavier items together and submerge them, while lighter items like pots and pans are filled with mud before immersion. When the cyclone is over, people return to salvage those items.

Immersing household appliances when cyclone is imminent

The people in Southkhali Union have been doing this for a long time.

Siddiqur Rahman of Chaltabunia village in Southkhali Union is owner of a trawler. When he got a warning for Super Cyclone Sidr, he moved to a cyclone shelter with his family. Before leaving, he immersed household implements (kitchen utensils, knives, crowbars and spades) in his pond. He tied up the knives, crowbars and spades together with rope and then filled the pots with mud and sank them in the pond. After the cyclone he returned and collected those materials.

Source: Siddiqur Rahman, Age- 50, Occupation- farming, Vill- Chaltabunia, Union- Southkhali, Sarankhola, Bagerhat.

d. Principle:

Avoid air and water currents by keeping items submerged under water.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Any household with a pond is able to implement	▪ High: Ponds are common household features for rural areas	▪ Ponds: No additional expenditure is incurred when applying.	▪ Moderate: Occasional asset loss may incur, particularly if pond is shallow or filled with high volume of debris	▪ High: Generally effective in protecting household implements

f. Inference:

- This practice significantly reduces the risks of household asset loss, and compared to other methods requires relatively less preparation and time. Its replication is highly desirable.

g. Scaling up Requirement:

- Raising awareness through courtyard sessions.
- IEC material such as flip chart to support courtyard sessions.

4.5 Hanging Weights from Four Corners of Roof during Cyclone Season

a. Objective:

To prevent roofs from being blown away by storm.

b. Materials:

Brick, iron wire and bamboo shoots.

c. Process:

A stack of four to six bricks is tied to one end of a piece of iron wire, and the other end of the wire is tied to one corner of the roof. The length of the wire is such that the brick stack hangs about a foot above the ground. In this way, each of the four corners of the roof is secured with stacks. Sometimes, instead of iron wire, bamboo shoots are used. The additional weight reduces the likelihood that the roof will be blown away by seasonal storms. Usually, this is done in the month of Chaitra under the Bengali calendar (corresponding with the beginning of spring). It is applied to corrugated iron sheet roof houses or thatches that cannot be anchored to the ground because they are near ponds or on soft ground.

Its application, learned from neighbors and elders, is very common in the Jalma Union under the Batiaghata Upazila.

Hanging weights from the four corners of the roof during cyclone season

ArunDhali of Dikbaran village of Jalma Union has two houses with corrugated iron sheet roofs. The houses stand by the edge of a pond. ArunDhali reinforces the joints of the houses each year by the end of the Bengali month Chaitra. To save the roofs from seasonal storms he hangs four to six bricks from each corner of the roofs. He learned it from his neighbors and has been doing it for a long time.

Source: ArunDhali, Age- 45, Occupation- Farming, Vill- Dikbaran, Union- Jalma, Batiaghata, Khulna.

d. Principle:

Add weight to the structure of roof to secure it more strongly.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Anyone can apply, whereas other methods, such as tying to trees, are not always applicable	▪ High: Most suitable where other options are not feasible	▪ All materials required are available locally and relatively cheaply, costing approximately one third of single day's wage for a local day laborer	▪ Low: Technology is simple, and anyone can implement	▪ High: For storms of moderate intensity, but effectiveness for more severe storms not proven

f. Inference:

- This practice can save help to save roofs from moderate seasonal storms. Its economic cost is insignificant. Replication of this practice is desirable in areas not prone to cyclone.

g. Scaling up Requirement:

- Raising awareness about various local technologies through courtyard sessions
- Flip chart to support courtyard sessions.

4.6 Tying Roof to Mud Walls of House

a. Objective:

To prevent roofs from being blown away by storms.

b. Materials:

Wooden pegs, iron wire and/or nylon rope.

c. Process:

The technique involves tying the four corners of a roof firmly with heavy duty wooden pegs inserted into the mud walls of a house. A wooden peg is fixed approximately 18 inches from the top of each wall—a total of eight pegs. The roof of the house is then firmly tied to the pegs using nylon rope or iron wire. Normally, this is checked and reinforced in the month of Chaitra (March – April) under the Bengali calendar.

This practice is observed in the villages of Gangarampur Union under Batiaghata Upazila, and locals learned it from neighbors and elders.

Tying roof of house with veranda and mud walls with wooden pegs affixed to the ground

NiharRanjanBiswash of Maitvanga village of Gangarampur Union has a house with mud walls. The roof of the house is made of corrugated iron sheet and timber. During construction, he fixed two heavy wooden pegs on each of the four walls of the house. He then tied the roof of his house to the pegs. He learned this technique from his neighbors.

Source: NiharRanjanBiswash, Age- 52, Occupation- Carpentr, Vill- Maitvangan, Union- Gangarampur, Batiaghata, Khulna

d. Principle:

Securing roof structure of dwelling by tying it to the walls.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Can be applied during construction as	▪ Moderate: Usually completed during	▪ Additional expenditure is negligible, i.e., eight wooden pegs and	▪ Low: Very simple technology	▪ High: Generally protects

well as retrofitted	construction. People may be reluctant to retrofit	pieces of nylon rope (equal to approximately the cost of 10kg of rice)	and easily applied	roof from being blown away

f. Inference:

- This practice can save the house roofs from moderate seasonal storms; its economic cost is insignificant; replication of this practice is desirable.

g. Scaling up Requirement:

- Raising awareness about various local technologies through courtyard sessions
- Flip chart to support courtyard sessions.

4.7 Tying Roof of House with Veranda and Mud Walls with Wooden Pegs Fixed to Ground

a. Objective:

To prevent roofs from being blown away by storms.

b. Materials:

Wooden pegs, iron wire/nylon rope.

c. Process:

For houses with mud walls and verandas on the front side, two wooden or bamboo pegs are fixed on the ground, near the plinth at the rear corners of the house. Then each peg in each corner of the roof and cross beam of the respective side is tied with iron wire or nylon rope. In the month of Chaitra under the Bengali calendar, this fixture is checked and reinforced.

This practice is observed in Maitvanga village of Gangarampur Union. People applying this technology learned it from their elders.

Tying roof of house with veranda and mud walls with wooden pegs fixed on the ground

ShomirBiswash of Maitvanga village of Gangarampur Union lives in an earthen house with a veranda in the front. The roof is made of corrugated iron sheets. To protect his house from seasonal storms (Kalboishakhi), Shomir trusses the rear side of the roof with two pegs wedged into the ground. To do this, he wedges two pegs into the ground close to the plinth at the back of the house, and ties two pieces of rope to each of the pegs. Then, he firmly ties up the rear corners with one rope and cross beam with other rope. He learned to do this from his father to protect the roof from seasonal storms.

Source: ShomirBiswash, Age- 48, Occupation- Farmer, Vill- Maitvangan, Union- Gangarampur, Batiaghata, Khulna.

d. Principle:

Anchor roof of the house by tying it to the ground.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology, simple to reproduce	▪ High: Locally available materials	▪ Very little additional expense – may cost approximately a single day's wage for a day laborer	▪ Low: Anyone can apply	▪ High: Generally successful in preventing roof from being blown away

f. Inference:

- This practice is effective in saving roofs from moderate seasonal storms. The economic cost is minimal, and replication of this practice is desirable.

g. Scaling up Requirement:

- Raising awareness about techniques through courtyard sessions.
- Flip chart to support courtyard sessions.

Chapter 5: Local Practices for Ensuring Quality and Volume of Water

5.1 Conserving Pond Banks to Keep Water Safe

a. Objective:

To keep pond water safe for household consumption.

b. Materials:

Money for pond excavation and renovation, necessary implements, labor, lime and alum for water cleansing as well as net and bamboo for fencing.

c. Process:

In many localities of Sarankhola Upazila people use pond water for drinking. Rainwater is captured in ponds during the monsoonal months and stored for the rest of the year. Typically, people elevate pond banks to prevent outside water intrusion, and install fences to keep animals away. The surroundings are kept free of trees that readily shed leaves. If a pond should become contaminated by outside water, the water is bailed out, lime is applied to the dry pond bed and the water is subsequently cleansed by applying alum. Generally, ponds are dried once in two to three year intervals in order to re-excavate and repair their banks.

The people Sarankhola Upazila have been practicing this measure to secure safe drinking water.

Jahirul Islam of Chaltabunia village of Southkhali Union maintains a pond as a source of potable water. This pond has no connection to outside water sources. The banks of the pond are relatively high, and it is fenced in with two to three feet of high netting. Only trees like coconut and battle nut, which do not shed leaves, were planted on the banks. Aside from Jahirul's family, about 50 other families collect potable water from this pond.

Source: Jahirul Islam, Age- 38, Occupation- Grocery, Vill- Chaltabunia, Union- Southkhali, Sarankhola,

Raising the pond bank to prevent intrusion of outside water and installing fences to keep animals away

d. Principle:

Placing barriers to prevent intrusion or contact that may cause contamination.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ Moderate: Ponds are viable sources of drinking water only in specific geographic locations, dependent upon structure of land	▪ High: Ponds are common household features	▪ Established ponds and resources for re-excavation and maintenance are required, the cost of which is significant compared to average household incomes	▪ Moderate: People may find regular maintenance of pond difficult	▪ High: A well-managed pond has potential to ensure adequate supply of potable water

f. Inference:

- This practice significantly reduces water scarcity in saline prone areas where pond excavation is feasible. Although economic costs are high, replication of this practice is desirable.

g. Scaling up Requirement:

- Raising awareness about ways of ensuring safe water in ponds though courtyard meetings.
- Flip chart to support courtyard sessions.

5.2 Collecting Rainwater Using Plastic Sheets

a. Objective:

To obtain potable water though harvesting rainwater.

b. Materials:

Plastic sheets, bamboo poles, rope or cloth, water containers, filters.

c. Process:

People of Sarankhola Upazila use rainwater for drinking. During the monsoonal months, they construct a structure made of bamboo poles and plastic sheets to catch rainwater. To do this, they secure together four bamboo poles, forming a rectangular shape, with one side about a foot higher than the other. A rectangular plastic sheet is then tied to the four corners of the poles. When it rains, containers are placed to collect water caught by the plastic sheet.

The people Sarankhola Upazila have been using this process as a means of harvesting rainwater for a long time.

Collecting rain water using plastic sheets

Abdul HaqGazi of East Khontakata village collects rainwater for drinking. At the onset of the monsoon season, he sets up a structure in his yard using four poles and a large plastic sheet. When the rain comes, he places a container below to collect water.

Source: Abdul Haq, Age- 52, Occupation- Farmer, Vill- East Khontakata, Union- Khontkata, Sarankhola, Bagerhat.

d. Principle:

Catch rainwater before it falls to the ground.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined and simple technology	▪ High: Use of rain water when available is common in these communities	▪ All materials required are locally available and few additional expenses are incurred (equaling approximately the cost of 40kg rice)	▪ Low: Simple technology easily applied	▪ High: A household can obtain safe water during monsoonal months as well as enough water for three months following

f. Inference:

- This practice has the potential to enhance the availability of potable water. Economic costs are negligible and replication of this practice is highly desirable.

g. Scaling up Requirement:

- Raising awareness about various ways of ensuring safe water though courtyard meetings.
- Flip chart to support courtyard sessions.

5.3 Keeping Kai Fish (Climbing Perch) in Water Containers to Preserve Rainwater

a. Objective:

To keep stored rainwater free of insects.

b. Materials:

Live Kai (climbing perch) fish.

c. Process:

Because of high salinity in ground and surface water, the people of Shurkhali Union under Batiaghata Upazila use rainwater for drinking, collecting it in the rainy season and storing it for use during the dry season. However, within a short period, insects begin to breed in the water. To prevent this from happening, some keep two or three Kai fish in the container to eat insects and keep the water clean.

This practice, learned from elders, is practiced in the villages of Shurkhali Union.

Keeping climbing fish (Kai and Shing fish) in water containers to preserve rainwater

AfrozaBegam of Sundarmahal village of Shurkhali Union uses rainwater for drinking. She collects rainwater during the rainy season and preserves it in large earthenware containers. She uses this water for three to four months. After about a month or so, she puts two or three live Kai fish in each container, thus ridding the reserved water of insects. However, she still filters the water with a clean piece of cloth before drinking. She learned this practice from neighbors and has been implementing it for a long time.

Source: AfrozaBegam, Age- 38, Occupation- House wife, Vill- Sundarmahal, Union- Shurkhali, Batiaghata, Khulna.

d. Principle:

Use biological methods of control to keep water free of insects.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology	▪ Moderate: Some may not consider such water potable	▪ No additional resources required, except Kai fish, which are locally available	▪ Low: Very simple technology, easily applied	▪ Low: Does not ensure that water is free of bacteria or other micro-organisms

f. Inference:

- This practice may successfully remove insects or worms from stored water, but does not ensure water quality. Although economic costs are negligible, replication of this practice is not desirable.

g. Scaling up Requirement:

- Investigation and experimentation to add element to ensure water quality. Only subsequently, consider replication that could be done through raising awareness and public education.

5.4 Applying Raw Turmeric to Water Containers to Preserve Rainwater

a. Objective:

To keep stored rainwater safe from insects and free of germs.

b. Materials:

Raw turmeric and cloth.

c. Process:

Due to the high salinity in ground and surface water, the people of Khontakat Union in Sarankhola Upazila use rainwater for drinking, collecting it during the rainy season and storing it for the dry season. Within a short period of time, insects begin to breed in the water. To prevent this, some place a paste made from two or three pieces of raw turmeric wrapped in a clean cloth into the water container.

Apply raw turmeric in the water container to preserve rain water

This practice has been observed in the villages of Khontakat Union under Sarankhola, as well as in in many other villages in other unions under the upazila. The local people have learned it from their elders.

Nasima Begum of East Khontakata village of Khontakata Union uses rainwater for drinking. She collects rainwater during the rainy season and preserves it in large earthenware containers. She uses this water for three to four months. After collecting water she wraps turmeric paste in a piece of clean cloth and keeps it in the container. She, however, still filters the water with a piece of clean cloth before drinking. She learned it from her neighbors and has been implementing this practice for a long time.

Source: Nasima Begum, Age- 42, Occupation- House wife, Vill- East Khontakata, Union- Khontakata, Sarankhola, Bagerhat.

d. Principle:

Apply herbal repellant in the form of turmeric in order to keep stored rainwater free of insects.

e. Replicability:

Replication factors

Readiness	Receptivity	Resources	Risk	Returns
▪ High: Well defined technology, easily implemented	▪ High: The use of turmeric as an herbal repellant is common in target communities	▪ No additional resources required except turmeric paste, which is readily available	▪ Low: Simple technology, easily applied	▪ Moderate: Uncertain regarding to what extent it removes insects from water and whether it removes bacteria

f. Inference:

- This practice may reduce insect or worm presence in stored water, but does not ensure water quality. Economic costs are negligible. Before this practice is promoted, further investigation to determine its effectiveness to ensure safe water is required.

g. Scaling up Requirement:

- Investigate to what extent it makes water bacteria-free and develop methods to improve this aspect based on the findings,
- Raising awareness about various ways of ensuring safe water though courtyard meetings.
- Flip chart to support courtyard sessions.

Chapter 6: Local Practices for Generating Income and Meeting Basic Needs

6.1 Storing Jute Stalks on Raised Platforms Covered with Plastic Sheets to Preserve as Cooking Fuel

a. Objective:

To prevent stored cooking fuel from getting wet.

b. Materials:

Bamboo, rope, plastic sheet, axe and shovel.

c. Process:

The people of Naldi Union under Lohagara Upazila keep jute stalks in heaps on raised platforms and wrap them with plastic sheets. Typically, people erect a platform approximately two feet high, made of bamboo. They store jute stalks on it in a way that the upper ends of the stalks are on one side and the lower ends on another. It creates a slope on the top of the heap. Then, they wrap the stack with a plastic sheet. Jute stalks stored in this manner do not get wet during rains or flooding.

This practice has been seen in the villages of Naldi Union. The local people learned it from their elders.

Storing jute stalks on raised platforms covered with plastic sheets to preserve jute stalks as fuel for cooking

Shankar Malo of Naldi Union builds bamboo platforms about two feet high in his yard and keeps jute stalks there. He wraps the jute stalk heap with plastic sheets to protect them from rain and flood water. He learned this from his father and has been practicing for a long time.

Source: Shankar Malo, Age- 45, Occupation- Fish trading, Vill- Naldi, Naldi Union, Lohagara, Narail.

d. Principle:

Avoid contact with soil and use water-proof sheet to prevent cooking fuel from getting wet.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology, easily applied	▪ High: This practice is a minor modification to a common practice of storing jute stalks and similar materials on raised platforms	▪ Requires a small investment in the form of a few pieces of bamboo and plastic sheets (expenses equaling roughly the cost of 40kg rice)	▪ Low: Technology is simple and easily reproduced to achieve desired results.	▪ High: Effective in keeping cooking fuel dry; also reduces risk of fire when compared to storing jute stalks in kitchen

f. Inference:

- This practice is extremely effective and economically viable. Thus, replication of this practice is highly desirable.

g. Scaling up Requirement:

- Raising awareness through interactive sessions to promote this practice.
- Educational poster to support interactive sessions.

6.2 Laying Bricks in a Row to Prevent Damage of Plinth Area by Rainwater Falling from Roof's Edge

a. Objective:

To prevent plinth area erosion caused by rainfall.

b. Materials:

Bricks.

c. Process:

The majority of families in Naldi Union under Lohagara Upazila typically place a row of bricks around the foundation of their homes in the area where rainwater falls from the roof. Water falls onto the bricks instead of the house's plinth area, preventing damage.

Laying bricks in a row to prevent damage to plinth area from rain water falling from roof

This practice is very common in the villages of Naldi Union. Local people have been applying it for a long time.

BinitaSharkar of Naldi Union is a housewife who lives in a mud house. To protect the plinth of her house she places a row of bricks beside the foundation where rainwater falls from the roof, preventing erosion. She learned this measure from her mother and has been using it for a long period of time.

Source: BinitaSharkar, Age- 72, Occupation- House wife, Vill- Naldi, Union- Naldi, Lohagara, Narail.

d. Principle:

Use hard cover to minimize land erosion caused by water flow.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Simple and well defined technology, can be easily applied elsewhere	▪ High: Flexible technology, and can be accomplished using alternative materials, such as battle nut plants or plastic sheets	▪ Requires bricks, which are locally available. The cost of 40 bricks is equivalent to a single day's wages for a day laborers	▪ Low: Easily applied by anyone	▪ High: Extremely effective in reducing erosion of the plinth area caused by rainwater

f. Inference:

- This practice is effective and economically viable. Thus, replication is desirable.

g. Scaling up Requirement:

- Raising awareness through interactive sessions to promote this practice.
- Educational poster to support interactive sessions.

6.3 Using Social Relationships to Acquire Food Aid in Times of Crisis

a. Objective:

To ensure food security in times of crisis through the use of social relationships.

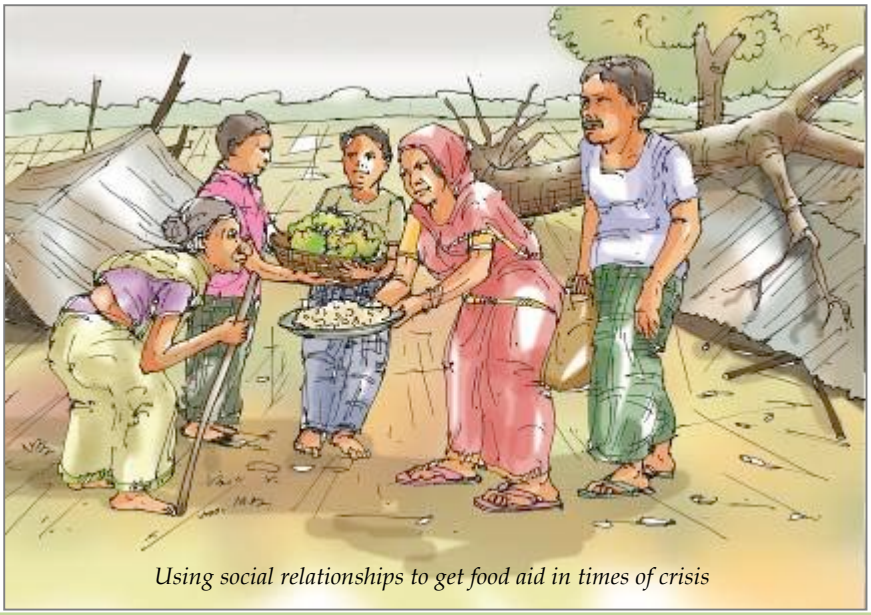
b. Materials:

Social relationships, relatives and neighbors.

c. Process:

Food scarcity is normally experienced during periods of hazard, with many families suffering from lack of food. Most households in the Amoda village of Laxmipasha Union attempt to overcome this by sharing and exchanging food with each other. Typically, affected families receive support from neighbors and relatives who are relatively well off. In order to preserve this tradition, villagers maintain amicable relationships with neighbors and relatives and try to build social bonds.

This practice is common in the villages of Laxmipasha Union as well as in Lohagara Upazila.



Using social relationships to get food aid in times of crisis

Lovely Begam of Amoda Village of Laxmipasha Union is a housewife. She is the head of household, since her husband is suffering from mental illness. Previously, her husband was a well-off farmer, but lost everything due to flood and illness. Lovely is presently living in a hut built on a piece of land owned by a local UP (Union Parishad or Council) member. During times of flood when Lovely's family suffers from lack of food, she receives sustenance as well as other assistance from her neighbors and relatives.

Source: Lovely Begam, Age- 38, Occupation- House wife, Vill- Amoda, Union- laxmipash, Lohagara, Narail.

d. Principle:

Apply social capital for maintaining household food security during disaster.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ Moderate: Process is not well defined. Although it is possible to apply in other communities, is to a large extent dependent on local cultural beliefs and value system	▪ Moderate: Everyone may not be willing to apply	▪ Social capital and reputation. No additional expenditure	▪ Moderate: May lead to client-patron relationships. Additionally, extensive use may cause market failure	▪ High: Reasonably addresses distress in disaster affected households, but cannot ensure standards of living

f. Inference:

- This practice reasonably addresses food scarcity experienced by households during times of distress due to disaster, and economic costs are negligible. Therefore, replication of this practice is highly desirable.

g. Scaling up Requirement:

- Raising awareness about ways of ensuring food security though courtyard meetings.
- Flip chart to support courtyard sessions.

6.4 Building Houses Using Jute Stalks to Reduce Damage Due to Hazards

a. Objective:

To minimize economic losses caused by hazards by applying a low cost and flexible housing technology.

b. Materials:

Jute stalks, jute rope, bamboo, wood, nails, labor, expertise.

c. Process:

Jute stalks, a byproduct of jute—one the main crops grown in Lohagara Upazila—are commonly used as cooking fuel. Some in Kashipur Union in this district also use the stalks in the construction of houses, making walls and roofs out of the material. Homes made of jute stalk are cheap, light-weight and easy to build. Though not particularly hardy and prone to collapse during a storm, causing them to have to be rebuilt every two to three years, materials can be recycled as cooking fuel, resulting in low economic costs. Additionally, since materials are light-weight, they rarely result in human casualties.

This practice has been observed in Gandab village under Kashipur Union and is common in other areas in Lohagara Upazila. Local people have passed down this practice for generations.

Building houses using jute stalks to reduce damage due to hazards

Md. Robiul Islam of Gandab village of Kashipur Union is a farmer who builds jute stalk houses, taking into consideration local hazards like flooding and seasonal storms as well as house building expenses. He uses jute stalks as the primary material for building the walls and roofs of his house. The jute stalk houses can stand for several years, but he rebuilds them every two to three years, using discarded materials as fuel for cooking.

Source: Md. Robiul Islam, Age- 69, Occupation- Farming, Vill- Gandab, Union- Kashipur, Lohagar, Narail.

d. Principle:

Apply disposable housing technology to minimize economic loss caused by hazards.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology and	▪ Moderate: Some people may consider it a sign	▪ Alternative use of available materials; does	▪ Low: Easy to apply	▪ High: Effective in reducing disaster losses

easily applied in other locales	of poverty	not incur additional expenses		

f. Inference:

- This practice significantly reduces risks of asset loss, and the comparative economic cost is negligible. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Exploration and innovation to improve the quality of houses.
- Public education through community meetings.
- Poster and video to support community meetings.

6.5 Dropping Fish Food in Specific Part of Pond When Flooded Due to Heavy Rains

a. Objective:

To retain fish stocks in flooded ponds.

b. Materials:

Fish food, tree branches and trunks.

c. Process:

Dropping fish food in specific area of flooded pond to maintain fish stocks

During floods, shrimp farmers fix net fences around ponds to prevent shrimp from escaping. But when rising water breaches the fence, they drop food, especially wheat chaff, coconut oilcake and cooked rice, in specific spots of each pond, thus attracting fish and keeping them in the pond.

This practice has been observed in Vandarkot Union of Batiaghata Upazila.

KhurshidaBegam of Amirpur village of Vandarkot Union is a shrimp farmer. She has a fishpond of one acre in size. During Cyclone Sidr her fishpond was inundated. She dropped food, such as wheat chaff, coconut oilcake and cooked rice, in a specific spot rather than spreading it all over the pond. In this way she was able to retain the shrimp.

Source: KhurshidaBegam, Age- 32, Occupation- House wife, Vill- Amirpur, Union- Vandarkot, Batiaghata, Khulna.

d. Principle:

Use bait to retain fish in pond.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Easy to reproduce in other places	▪ Moderate: There are uncertainties about the efficacy of this technology, and many farmers may be	▪ Requires few additional resources; the usual quantities of fish feed are used, but dropped in one	▪ Low: Simple process, easily applied	▪ Moderate: There is no guarantee that fish will remain in the

	reluctant to apply it	location instead of distributing all over the pond		pond

f. Inference:

- This practice has the potential to reduce risks of asset losses. Although its efficacy is uncertain, its comparative economic costs are negligible. Replication of this practice is desirable when other options have been exhausted.

g. Scaling up Requirement:

- Educational poster to disseminate information about this practice.

6.6 Planting Sunflower Seeds in the Field without Plowing

a. Objective:

To minimize expenses and delay in cultivating crops following a flood.

b. Materials:

Seed and fertilizer.

c. Process:

Generally, farmers plough and prepare lands in order to sow sunflower seeds in the Bengali month of Agrahayana (corresponding with late fall). However, if they have previously planted aman rice, they do not get adequate time to prepare the land for sunflower cultivation, since the aman harvesting period coincides almost exactly with the sunflower seeding period. To overcome this difficulty, some farmers in Gangarampur Union under Batiaghata Upazila grow sunflowers using a no-till farming technique, sowing sunflower seeds just after harvesting the rice. They still apply fertilizers and insecticides and irrigate the field as required.

This practice has been observed in the Katiarampur village of Gangarampu Union under Batiaghata Upazila.

This method of sunflower cultivation could potentially help to offset the delay in preparing land for cultivation caused by flood. Other crops, such as local varieties of rice and pulses, could also be grown using this method.

Cultivating sunflowers without tilling

IsaburRhmanGoldar of Katiarampur village of Gangarampur Union cultivated sunflowers on 25 decimal lands (one-quarter acre) after harvesting rice in the month of Agrahayon without first plowing the field. After sowing the seeds he applied 5kg TSP, 5kg MPO, 10kg Urea, 10kg Gypsum and 0.5kg copper fertilizer on the field. He also irrigated the field twice. He harvested the crop within 120 days' time.

Source: IchaburRhmanGoldar, Age- 48, Occupation- farming, Vill- Katiarampur, Union- Gangarampur, Batiaghata, Khulna.

d. Principle:

Use residual soil moisture to grow crops.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology, easily applied elsewhere	▪ High: Farmers are typically receptive to innovation	▪ Does not require additional resources; instead, saves expenses on tilling	▪ Low: Simple technology, easily adapted	▪ High: As effective as other methods of cultivating same crop

f. Inference:

- This practice reduces the cost of agricultural production; therefore its comparative economic cost is negligible. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Public education through community meetings.
- Educational poster and video to support community meetings.

Chapter 7: Local Practices for Maintaining Health and Nutrition

7.1 Growing Medicinal Plants on Homesteads

a. Objective:

To ensure availability of medicinal plants for treating illnesses caused by hazards.

b. Materials:

Seeds and saplings of various medicinal plants.

c. Process:

Many people in the Lohagara Upazila of Narail District use herbs and medicinal plants—such as such as tulsi, patharkuchi and neem—to treat illness caused by local hazards. To ensure their availability, they are grown on homesteads, alongside other vegetables in kitchen gardens or planted along homestead borders.

Mainly, household women carry out this practice, which is found in almost every area of Lohagara Uupazila.

Growing medicinal plants on homesteads

Parul Rani Sarkar is a housewife in the Naldi village of Naldi Union. To ensure timely availability of medicinal plants like tulsi and patharkuchi, effective in treating common illnesses such as cough and cold, she planted them in the back of her homestead. This was passed down to her by her mother.

Source: Parul Rani Sarkar, Age- 36, Occupation- house wife, VillNaldi, Union- Naldi, Lohagara, Narail

d. Principle:

Grow medicinal plants on homestead to make herbs available for treatment of diseases.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ Moderate: Reasonably defined, but	▪ High: People generally	▪ Does not incur additional	▪ Moderate: Some people may select	▪ Moderate: Effectively ensures availability of necessary plants, but may

plant species not clearly determined	grow herbs in household gardens	expenses	inappropriate herbs	discourage use of modern medicine when necessary

f. Inference:

- This practice successfully ensures availability of desired medicinal plants. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Further research and strengthening the practice by determining specific plant species and their use and contraindications.
- Raising awareness through courtyard sessions.
- Flip chart to support courtyard sessions.

7.2 Setting Fish Traps (Gorabushna) in Small Channels to Catch Fish during Floods

a. Objective:

To supplement the meeting of nutritional requirements by catching fish in channels during floods.

b. Materials:

Net and bamboo rings.

c. Process:

People in the Dhanshagar area catch fish in the Khajurbaria channel, which is linked to the Bhola River. During high tide, locals place small traps made of bamboo rings and net (called gorabushna) into the water stream. Although this method does not capture large quantities of fish, the small amount of fish caught helps people in the region to meet their daily needs for protein.

This practice has been observed in the Dhanshagar area of Sarankhola upazila.

Setting fish traps (gorabushna) to catch fish during floods

Hashi Akter is a poor housewife living in the Khajurbaria village in Dhanshagar Union in Sarankholaupazila. She lays small traps (gora bushna) in the Khajurbaria canal to catch fish. She catches only a small quantity of fish in this manner, but is able to add this to her family's daily diet, thus somewhat reducing nutritional deficiencies.

Source: Hashi Akter, Age- 40, Occupation- house wife, Vill- Khazurbaria, Union- Dhanshagar, Sarankhola, Bagerhat

d. Principle:

Collect food from common bodies of water.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology that can be used elsewhere	▪ High: Fishing using traps is a common practice in the communities	▪ Incurs very little additional expenses. The cost of the trap is less than a single day's wage of a day laborer	▪ Low: Simple technology, applicable by both men and women	▪ High: Effective in acquiring enough fish to meet daily nutritional needs

f. Inference:

- This practice reduces nutritional deficiency at the family level, and the comparative economic cost is negligible. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Public education through community meetings.
- Educational poster and video to support community meetings.

7.3 Growing Vegetable Seedlings in Suspended Pots (Aeroponic Gardening)

a. Objective:

To minimize the effects of seasonal inundation and salinity on homestead vegetable gardens.

b. Materials:

Coconut shell, plastic bottles, earthenware pots, rope or cloth, soil and vegetable seeds.

c. Process:

People in Chaltabunia of Sarankhola Upazila are not able to grow vegetables on their homesteads because the land remains extremely moist due to seasonal inundation at the beginning of the planting season. If they wait for the land to dry, the delayed crop is damaged by increased salinity that occurs during the later part of the year. To overcome these obstacles, village women grow vegetable seedlings in suspended pots. They use discarded items such as coconut shells, plastic bottles and earthenware pots, fill them with soil and manure and sow vegetable seeds, especially eggplant, chili and bitter gourd. Normally, they hang these pots on tree branches and take them inside when it rains. When seedlings are ready for transplantation and the land becomes dry enough, the seedlings are

planted in the backyard garden. In this way, villagers are able to save their crops from salinity intrusion.

This practice, applied primarily by women, is common in Sarankhola Upazila.

Growing vegetable seedlings in suspended pots

MinaraBegam is a house wife who lives in Southkhali Union with her family. During the rainy season Minara produces vegetable seedlings in hanging pots. She uses coconut shells, plastic bottles and earthenware pots to sow the seeds. First, she fills the pots with soil and plants the seeds in them, hanging them from tree branches. When it rains, she takes the pots into her house. After the rainy season when the moisture level in the soil is suitable, she transplants the seedlings into her garden.

Source: MinaraBegam, Age- 42, Occupation- house wife, Vill- Chaltabunia, Union- Southkhali, Sarankhola; Bagerhat.

d. Principle:

Adaptation in homestead gardening to mitigate adverse seasonal conditions.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined technology, easily reproduced elsewhere	▪ High: Growing vegetables in homestead gardens is common in the communities	▪ Does not incur additional expenses; requires only innovation and alternative use of discarded household items	▪ Low: Relatively easy process; anyone can learn it quickly	▪ High: Reasonably effective in producing seasonal vegetables for household consumption

f. Inference:

- This practice reduces risks to homestead gardening, effectively produces seasonal vegetables, and its comparative economic cost is negligible. Replication of this practice is highly desirable.

g. Scaling up Requirement:

- Skill development through courtyard learning sessions.
- Flip chart to support the courtyard sessions.

7.4 Giving Pregnant Mothers Starch of Boiled Rice Along with Regular Diet during Periods of Food Scarcity

a. Objective:

To meet nutritional needs of pregnant mothers during disaster.

b. Materials:

Starch of boiled rice and salt.

c. Process:

When people of the Chaltabunia village of Sarankhola face challenges in ensuring a balanced diet for pregnant mother during disaster periods, they compensate for that by offering starch of boiled rice to pregnant mothers in addition to their regular meals.

This practice is common in Sarankhola Upazila.

Giving pregnant mothers starch of boiled rice

d. Principle:

LackyBegam is a housewife who lives with her family in Chaltabunia village of Southkhali Union. In 2007 during Sidr, she was pregnant. At that time her family suffered from a food shortage, but her family gave her starch of boiled rice along with her regular meals. It reduced her nutritional deficiency to some extent.

Source: Lucky Begam, Age- 35, Occupation- house wife, Vill- Chaltabunia, Union- Southkhali, Sarankhola, Bagerhat.

Use available resources during crisis periods to meet nutritional needs of pregnant mothers.

e. Replicability:

Replication factors

Readiness	Receptivity	Resources	Risk	Returns
▪ High: Easily reproduced elsewhere.	▪ High: Rice is readily available	▪ Does not require additional resources	▪ Moderate: Lack of understanding about pregnant women's needs and compelled by severe food shortages, some may deprive pregnant women of a normal diet, replacing with starch of boiled rice	▪ Moderate: Compensates for lack in diet deficiency, but not fully

f. Inference:

- This practice reduces nutritional deficiency only to some extent. Although the comparative economic cost is negligible, replication of this practice should be conditional so that it does further marginalize pregnant women.

g. Scaling up Requirement:

- Build it into activities for raising awareness about pregnant women's needs.
- Flip chart to support awareness raising sessions.

7.5 Applying Turmeric and Neem Paste to Treat Scabies

a. Objective:

To treat scabies by applying herbal medicine.

b. Materials:

Neem leaf and raw turmeric paste.

c. Process:

Many people, especially the women, of Southkhali Union under Sarankhola Upazila apply neem leaf and raw turmeric paste to cure scabies, which they catch through constant contact of dirty water. They prepare neem leaf and raw turmeric pastes separately, mix them in equal proportions, and then apply to infected areas.

This practice is commonly observed in Sarankhola Upazila.

Apply turmeric and neem paste to treat scabies

Momotaz Begum lives in Chaltabuniya village of Southkhali Union with. Due to Super Cyclone Sidr all of Momotaz Begum's neighboring water sources were contaminated by animal corpses and extirpated trees. During that time, the prevalence of scabies increased and Mamtaz Begam was infected. To treat her scabies, she prepared raw turmeric and neem leaf paste, and applied it to the affected area. She was cured through this treatment.

Source: MomotazBegam, Age- 40, Occupation- house wife, Vill- Chaltabunia, Union- Southkhali, Sarankhola, Bagerhata.

d. Principle:

Use herbal ingredients to cure scabies.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High; anyone may apply	▪ High; use of herbal cure is common in the communities	▪ It does not require any additional expenses	▪ Low; the process is simple, could be reproduced easily	▪ Moderate; turmeric and neem have healing properties but its efficacy through this process is not certain

f. Inference:

- This practice may produce positive results, but its effectiveness is not scientifically proven. The comparative economic cost is negligible, and replication of this practice is desirable.

g. Scaling up Requirement:

- Investigation to determine its efficacy and limitations.
- Raising awareness through courtyard sessions.

- Flip chart to support courtyard sessions.

7.6 Mixing Turmeric with Breast Milk to Treat Common Colds in Infants

a. Objective:

To treat coughs and common colds in infants.

b. Materials:

Breast milk and raw turmeric.

c. Process:

The women of Pankharchar village in Itna Union under Lohagara Upazila feed infants a mixture of breast milk and raw turmeric to cure coughs and colds. Women prepare a paste from raw turmeric and mix with breast milk in a small bowl, and then feed it to babies.

This practice is observed in Pankharchar village of Itna Union under Lohagara Upazila. Usually, this practice is passed down from mothers and grandmothers.

Mixing turmeric with breast milk to treat colds in infants

ShanazParveenShumi of Pankharchar village in Itna Union under Lohagara Upazila is a housewife. During winter last year her 6-month-old baby contracted a bad cold. To cure her baby's cough she fed it a mixture of breast milk and raw turmeric paste for three or four days. In this manner, she was able to cure her baby.

Source: ShahnazParveenShumi, Age- 22, Occupation- house wife, Vill- Pankharchar, Union- Itna, Lohagara.

d. Principle:

Use herbal ingredients to cure common cold.

e. Replicability:

Replication factors				
Readiness	**Receptivity**	**Resources**	**Risk**	**Returns**
▪ High: Well defined	▪ High: Anxious mothers will readily agree to	▪ Does not require additional	▪ Moderate: Some mothers may not be able to identify the illness or	▪ Moderate: Efficacy of this treatment

process	apply	resources	may apply incorrectly	is uncertain

f. Inference:

- This practice may produce positive results, though its effectiveness is not scientifically proven. The comparative economic cost is negligible. Replication of this practice should be conditional, so that it does not put the baby at risk.

g. Scaling up Requirement:

- Further investigation and strengthening the practice so that its scope and limitations are clearly defined.
- Raising awareness through courtyard sessions.
- Flip chart to support courtyard sessions.

Chapter 8: Concluding Remarks

8.1 Pertinent practices for replication

a. Protecting life and assets

- Use floats to survive during boat capsize - fishermen use floats keep their nets floating in the water; instead of lifejacket fishermen may use wreath made of five or six floats tied together; it could easily keep a person floating and help the person survive during boat capsize.
- Keep household implement in a pond – when cyclone warning sounds, in some parts of Sarankhola upazila, people, before heading to the shelters, put their household implement in their ponds; the household items remain under water while cyclone or storm surge pass over the place.
- Tie weight to the roof frame or tie the roof to the wall or ground – people in Baiaghata upazila tie roof firmly with heavy duty wooden pegs inserted into the mud walls of a house; if they do not have mud wall, they tie with bamboo pegs fixed on the ground; and if the soil is soft, they tie weight to the roof frame. It prevents roofs from being blown away by storms.

b. Ensuring quality of and access to Water

- Use plastic sheet to collect rainwater – salinity levels of surface and ground water in Sarankhola are very high; the local people collect rain water for drinking. They use a very simple structure made four bamboo poles and a rectangular plastic sheet.

Generating income and meeting Basic Needs

- Keep jute stalk on raised platform – households in Lohagara upazila use jute stalks as fuel for cooking; they store it the back yard on a raised platform covering the stalk with plastic sheets. It prevents the fuel from getting wet and reduces risk of fire hazard.
- Build low cost house using locally available materials – in some parts of Lohagara upazila, people use jute stalk, which abundantly available in the area, to make walls and roofs of their houses. The material is low cost and light weight; so even their collapse due to cyclone or flood; they suffer very little loos of asset of human casualty.
- Use zero tillage farming technology - farmers in Batiaghat upazila plant sunflower seed in the wet ground without plowing the fields. It reduces plantation costs also to minimize expenses and helps timely plantation despite the fields being affected by flood. In addition to sunflower, many other crops could be cultivated using zero tillage technology.

c. Maintaining health and nutrition

- Grow medicinal herbs in homestead garden – rural women in Lohagara Uupazila mix medicinal plants with vegetable in their gardens. It ensures availability of the local remedies for some common illnesses such as cough, cold and skin diseases.
- Use locally made traps to catch fish – poor women in Sarankhola upazila use Gorabushna (locally made fish trap) to catch during monsoon. They get only small quantities of fish but it helps meet their daily needs for protein.

- Grow vegetable using suspended pots - growing vegetables in suspended pots is widely practiced in some parts of Sarankhola upazila. Women use discarded household items as pots. It incurs no costs and enables growing vegetables for household consumption when salinity level in the soil is too high or the ground is too wet.
- Use neem leaf and raw turmeric paste to cure scabies - women in some parts of Sarankhola upazila make neem leaf paste and raw turmeric pastes separately, mix them in equal proportions, and then apply to cure scabies. Both neem leaf and turmeric are available locally; and they have medicinal properties to cure skin diseases.

d. Strategy for replication

- Broadly, strategy for replication is to raise people's awareness and make information available to them. It includes:
- IEC materials – develop materials to raise awareness of the people about the practice and its value in reducing disaster risks also to help people get information about the process and technical details of the practices.
- Awareness raising session and disseminating information – organize courtyard sessions in the communities to help people better understand the issues and the potential solutions and provide them information that they require to replicate the practices.
- Support change agents – organize and support some change agents who would replicate the practice and demonstrate the process as well the value of the practices.

8.2 Summary and Conclusions

This study analyzed and documented indigenous practices used to predict the occurrence of natural hazards, as well as methods employed to avoid loss of life and assets, and ensure availability of potable water, the continuation of livelihood activities and access to medical care and nutrition during disaster.

Indigenous practices represent innovations with the potential to fill mainstream development gaps

In this study, researchers attempted to uncover the basic principles and logic underlying previously unexplored and seemingly arbitrary beliefs that have been adapted into indigenous practices by these communities. When dealing with isolated instances collected from the field, it could appear that these practices have no coherent interrelationship that could justify a community's investment into their utilization. However, once put together and analyzed as a whole, interesting findings emerged, revealing strong interrelationships that point toward a very serious issue—the mainstream development gap. When considering the area context, hazards, vulnerability, uncertainty, available services and local resources, it became evident that practices were thoughtfully developed responses to address specific gaps. For instance, the use of medicinal plants and herbs for treating diseases highlights a lack or unavailability of adequate health services. The study, however, did not involve a detailed investigation of those mainstream development gaps, which may require a separate comprehensive study.

Local practices are derived from experience

Communities developed these practices out of necessity—primarily, to meet the demands of daily existence—and they were developed through trial and error. These practices are not tested scientifically, but people believe in their efficacy. They continue to experiment, innovate and adapt until they find their practices that produce desired results, reinforcing confidence levels. Practices are integrated into local traditions and passed down from generation to generation.

Indigenous knowledge based practices are context specific and not always replicable

Throughout the study process a wide range of data relevant to mechanisms for coping with disaster were collected. The practices documented, often interwoven with cultural values, are designed or adapted to achieve specific objectives or serve precise purposes. Identical reproduction of these practices in another community or cultural setting may not be possible. However, the principles behind these practices may be replicable. For example, the specific use of jute stalk in the construction of housing to reduce asset loss from sudden storms seems to have very little wide applicability. However, the use of flexible, disposable, lightweight and cheaply available local materials that can be recycled has promising implications.

Indigenous knowledge based practices are not a panacea for communities' disaster vulnerability

There exist many practices, as documented through this study, that help communities cope with local hazards. Some of these practices have the potential to somewhat reduce a community's vulnerability to these elements. However, communities do not have the solutions to all their problems. Existing practices in some areas are weak and not as effective as they could be. For instance, in the southern part of the Khulna Division, current indigenous practices for managing potable water are inadequate and ineffective to cope with salinity intrusion, something that has emerged as a local hazard in recent times due to climate change. This suggests that the changing environment may be adversely affecting communities' ability to develop and promote indigenous practices for disaster risk reduction. Any effort aimed at replicating indigenous knowledge based practices should take this element into consideration.

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