M. Phil Thesis
on

Perception of Climate Change in Three Ecological Zones of Bangladesh

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Declaration

I undersigned hereby declare that this dissertation is my original work. The findings accumulated here are the results of inquiry that conducted in the areas under Charhajari of Noakhali, Pratapnagar of Satkhira, Nitpur of Naogaon, Bangladesh. The dissertation entitled "**Perception of Climate Change in Three Ecological Zones of Bangladesh**" for the requirements of the Master of Philosophy (MPhil) at the department of Anthropology, University of Dhaka. I also proclaim that this dissertation or any part of this has not been submitted elsewhere for the award of any academic degree.

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Certificate of Supervisor

This is to certify that the dissertation entitled, "**Perception of Climate Change in Three Ecological Zones of Bangladesh**" conducted by Md. Borhan Uddin, Reg. No. 243/2016-2017 has been completed under my direct supervision. It is an original work and it has not been submitted to any other University for a degree. I recommend this dissertation for final submission to the concerned authority.

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Abstract

Bangladesh is the seventh most vulnerable countries to climate change and also one of the most disaster prone countries in the world. Climate change has become the targeted hot topic for research in Bangladesh during the last decades; central focus has been given to the topic of impact, vulnerability, and adaptation. Notably, ethnographic study exploiting emic and cross-cultural approach to reach at the bottom line of the climate problem merely took place in Bangladesh. Therefore, anthropological insight is indispensable for understanding local beliefs, practices and attitude about climate change. In this regard, this study remains influential in the regime of climate science with its applicability. It mainly focused on peoples' beliefs and perception about (a) the changing trend of climate; (b) the impact of climate change on lives and livelihoods; and (c) the cultural dimension of adaptation strategies.

This work is divided into nine consecutive chapters. First chapter contains introductory information. It explain why conducting research on this issue was crucial considering present climate situation of Bangladesh. This chapter explores its importance in various policy formation both in local and national level. The second chapter deals with previous study reports, books, and articles and with other published materials on the topic. Literatures are categorized well into many subdivisions depending on the themes they covered. Chapter three includes methods and materials have been used throughout the research work. Along with a number of qualitative and quantitative methods including participant observation, KII, FGD, survey etc., it presents how collected data were analyzed for generating report. Theories and concepts are explained in connection with the relevance of the present study in the chapter four. The cultural theory of risk perception analyzes how climate risk is perceived, cultural and political ecology present distinct interplay among state, politics and local people.

Chapter five explores about the study people and sites. On ground of two selection criteria, namely a) ecosystem and ecology, b) climate change impacts and vulnerability, Charhajari union of Noakhai, Pratapnagar union of Satkhira and Porsha union of Naogaon had been selected. Discussion of the findings starts from chapter six. With a variety of qualitative tools, maps, and matrix, this chapter shows that study participants from all three fields view that climate situation is deteriorating gradually comparing to last decades. This chapter shed light into a lot of issues i.e. climate change indicators, perception and causes of climate change, impacts and vulnerability etc. Chapter seven endeavored to account climate change narratives from the members of various occupational groups. Chapter eight illustrates how local people adapt to challenges climate change poses to local community. Chapter nine draws conclusion with recommendation. The anthropological study concludes that climate change impacts are ecosystem based but perception is culture specific. In this regard, it emphasis on further place-based ecosystem wise perception research with a view to generate findings comparable to across sites.

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Chapter 1

Introduction

Introduction

Climate change is one of the critical problems present world has been encountering. According to Global Climate Risk Index, Bangladesh is the 7th most vulnerable countries to climate change and also one of the most disaster prone countries in the world (German Watch 2018). Bangladesh's flat topography, low-lying and climatic features, combined with its population density and socio-economic environment, make it highly susceptible to many climatic hazards, including floods, river erosion, cyclones, droughts, water logging, salinity intrusion, heat and cold wave, hailstorm, and thunderstorm that cause massive damage. Climate change adversely affects lives and livelihoods of people who directly depend upon natural resources for their daily subsistence (Uddin 2017). In this regard, people, especially poor, marginal and ethnic minority in Bangladesh, suffer most from these hazards due to high degree of base vulnerabilities and over exposure of climatic hazards. IPCC (2013) reported that no country of the world is aloof from the adverse impacts of climate change. Nevertheless, coastal and island communities of equatorial and tropical regions are said to be more vulnerable to climate change. MoEFCC, Bangladesh (2007) assumed that climate change will adversely affect the lives and livelihoods of approximately 70 million people of Bangladesh in the near future. But it should be mentioned that climate induced adverse impacts will not be same in every region of Bangladesh and that is to say coastal communities are more likely to be affected by rigid climate induced frequent hazards and disasters than rest of the country (MoEFCC, 2015). Therefore, this study considers two coastal districts and one drought prone district of Bangladesh to explore people's beliefs and perceptions toward climate change, and to account the possible and daily faced impacts of climate change by local community.

Furthermore, impacts of global climate change on local community of Bangladesh has been explored several times, but local people's perception regarding climatic change in Bangladesh has not comparatively explored with anthropological lens yet. Henceforth, climate change perception research in Bangladesh is rousingly an important task as 'knowledge of local perceptions is fundamental for gaining a better understanding of the

impact of climate change' (Byg and Salick 2009). But along with this, 'comparative studies across sites are important for building generalized theory around why and how (local Bangladeshi) people understand and interpret climate change and associated risks' (Crona, Wutich, Brewis, and Gartin 2013).

Moreover, Bangladeshi people, who mainly depend upon nature for daily subsistence, can read weather without any modern technology, because these 'people are good natural observers of the local environment has led to an appreciation for their knowledge which is situated in cultural and ecological contexts' (Salick et al 2009 and Turner 2009), and these ethno-climatologists possess in-depth climate and environment related knowledge that should be explored to account effects of global climate change on local scale in Bangladesh. This anthropological study is such a kind of effort that aims to elucidate local people's testimonies about climate change from the prism of different socio-cultural and ecological experience. Present study strives to collect climatic data using various angles, tools and strategies for the better reliability and credibility of the information gathered. It distributes its focus in three culturally diverse areas that are susceptible to climate change.

Climate change has become the targeted hot topic for research in Bangladesh during the last decades. Therefore, adaptation process is for local and locale people engagement in adaptation policy is vital. Local inhabitants of a community possess strong bond with nature; their in-depth understanding, views, beliefs and customs about the nature of change and changing behavior of local climate is very crucial to formulate well-articulated adaptation strategies for people in Bangladesh. Furthermore, anthropological literature to date on perception of climate change is in dire need of more in-depth and empirical research in Bangladesh. Moreover, each communities has specific concerns, thinking and practices, and developing resilience and adaptation strategies for these communities require comprehensive understanding and knowledge of their situation in regional and respective ecological context through carrying out anthropological in-depth studies. This study endeavors to account regionally-specific perceptions on impacts of, vulnerability and adaptation to climate change.

Statement of the Problem

Focal points of the present study correspond with the local Knowledge, Attitude and Practices (KAP) regarding climate change. It is recognized worldwide that local people are the worst sufferer of global climate change. People who directly depend upon nature for subsistence activities are severely impacted by climate change. In the context of Bangladesh, poor and marginal farmers still depend on nature mercy for production and livelihood. MoEFCC (2015) alarmed that climate change will adversely impact agricultural production in Bangladesh in the near future. In view of these devastating scenarios of climate change, this study will mainly focus on peoples' beliefs and perception about (a) the changing trend of climate; (b) the impact of climate change on lives and livelihoods; and (c) the cultural dimension of adaptation strategies.

Bangladesh attributable to factors like topographical situating, deltaic arrangement history and low-line beachfront morphology is maybe said to be the most catastrophe inclined region on the earth. The nation is presented to characteristic perils of every conceivable sort, for example, floods, riverbank erosion, storm, dry seasons, water logging, arsenic defilement, saltiness interruption, cold waves, and so forth. The (co)occurrence of these occasions are regularly coupled and duplicated with the high base vulnerabilities of the people, families and systems brings about fiascos that further drive the nation towards more prominent atmosphere debasement, hunger, neediness, social hardship and political clashes, and in this manner retaining the financial advancement of the nation. Both in Copenhagen and in Cancun, the world community consistently concurred that Bangladesh is the nation generally powerless against climate change impacts. In this manner, the circumstance calls for sure timely consideration from both national and worldwide networks to have been occupied with neutralizing the negative formative effects of debacles in Bangladesh.

In case of Bangladesh, this is all the more important, as recurring climate hazards undo the investments and development efforts particularly in southern and northern areas, where

livelihood stress is already higher than national average without climate change impacts. Second, we do not have sufficient knowledge regarding climate change-induced hazards. Climate events are not linear, and variability is often erratic and not often predictable. As climate system is the foundation of life in this planet, and therefore anything goes foul with it in terms of irreversibility, then human existence would be at real stake.

Efficacy of mitigation and adaptations to climate change depends on local people whose subsistence mainly depends upon weather, climate and nature thoroughly. If local perspectives, views, perception and practices are taken into consideration, climate policy and its management will be more communicable and effective. The present perception study helps provide the policy makers with reliable data to make informed decisions on people's perception and understanding of climate change in Bangladesh. So to address whether climate is changing, and to measure vulnerability, resiliency and adaptation to climate change, it is necessary to account local people's perception regarding climate change from anthropological ethnographic perspective.

Background and Rationale of the Study

The present study remains influential in the regime of climate science with its applicability. Notably, ethnographic exploration exploiting emic and cross-cultural approach to reach at the bottom line of the climate problem merely took place in Bangladesh. Therefore, ethnographic insight is necessary to internalize local beliefs, practices and attitude about climate change that is further useful for vulnerability and risk assessment, Disaster Risk Management (DRM), capacity building, and national adaptation policy formulation. This study with ethnographic approach of triangulated research intermingling qualitative and quantitative data into a common framework is expected to fill up gaps in the following state of climate knowledge:

Awareness: It is still predominant in Bangladesh that people who severely affected by climate change is nearly unaware about the critical impacts of climate change. This study

is participatory in nature and is expected to play roles in mitigating knowledge gaps regarding awareness level through sharing and disseminating scientific climate knowledge.

Ethnoclimatology: People having direct interaction with environment and nature strongly possess indigenous knowledge on climate change which is termed as 'ethno-climatology'. On the basis of the local peoples' testimonies and knowledge, a growing field of global climate study is ethno-climatology. Bangladesh government has undertaken Climate Change Strategy and Action Plan (BCCSAP), but locality based ethno-climatology has not been nourished yet. So, this study is expected to generate new knowledge and to fill up knowledge gap regarding ethno-climatology.

Rural Studies and Development: Climate change is an impediment to rural development. MoEFCC (2015) alarm that climate change is a catalyst which may increase expenditure of development project. Traditional rural studies have not accounted climate cost in socio-economic development process. Now-a-days, rude scenarios of adverse climate impacts have been observed and climatic issue should be undertaken into mainstream rural development studies. So, this study may play roles in filling epistemological gaps regarding rural development in Bangladesh.

Agricultural Production: Agriculture is the sector directly hampered by adverse impact of climate change. Peasants have to deal with weather and climate every day for survival purpose. This study accounts local peasants' views on changing climatic behavior, seasonality and seasonal calendar, production trend and productivity which produces new knowledge supplementary to existing knowledge to diminish gaps.

Objective of the Study

This study occupies two types of objective, one is general or ground objective and another is specific objective.

General Objective of the study

The general objective of conducting this study is to find out local people's perception of nature and trend of climatic change, deep understanding of erratic behavior of climate, and factors indicative to climate change.

Specific Objectives of the study

The specific objectives are to explore:

(a) Understandings of climatic change across study areas

(b) Cultural dimension of adaptation strategy

(c) Impacts and adversities posed by climate change

Importance of the Study

This study is crucial in order to produce climate knowledge in academic arena. Historically, Bangladesh has been facing various climate related disasters, whereas effective research to account these was insufficient. Disaster anthropology has been playing pivotal role since its emerging but notably, this kind of epistemology has not grown up in Bangladesh. Additionally, climate change is a diversified issue where specific and correlated methods need to be used. Anthropological contribution to study a complex issue like climate change underlies in its disciplinary invention of Climate Anthropology, which is distinct from mainstream in style and methodology. Climate anthropologists of American Anthropological Association (AAA) played important role in IPCC's fourth and fifth assessment report. Nevertheless, climate ethnography has not emerged in Bangladesh even after it is recognized as one of the most climate vulnerable country. The present study is expected to enshrine climate ethnography with field based participatory perception research may lead to make cross-cultural comparison of climate risk and adaptation strategies.

Interdisciplinary approach is required along with ethnographic approach to grapple with climate complexities in the present context of Bangladesh. Strong epistemological cooperation between social and natural sciences will generate comprehensive climate knowledge. In this regard, the present study may lead to a new gateway to this interdisciplinary approach.

This study is conducted in the three districts of Bangladesh. Coastal Protapnagar union of Sathkhira district is a climate vulnerable area where poverty prevails due to salinity intrusion, river-siltation and many other erratic climatic factors. Traditional agricultural production has replaced to shrimp cultivation due to salinity intrusion which massively affects lives and livelihood of poor people. Amount of income and income source of agricultural labor has dramatically decreased as shrimp cultivation predominates, whereas shrimp cultivation requires less labor than agriculture. Socio-economic development in Nitpur union of Naogaon district gravely hampered by drought, heat-wave and cold wave. Charhajari union of Noakhali districts have to struggle with several climate change induced hazards and disasters.

Considering the above issues, this study would serve rural development objective of country by identifying:

- adaptation options for alternative income source during and after climate stress,
- sustainable agricultural production, and
- factors of sustainable rural development

Moreover, the study is relevant to the following policy formulation for the country:

Climate Policy: Bangladesh government has formulated national climate policy titled *Bangladesh Climate Change Strategy and Action Plan (BCCSAP)* and *National Adaption Programme of Action (NAPA)* to tackle the climate stress. These were groundbreaking work for tackling climate challenge nationally. Notably, these policies were formulated from top-down approach (where policy or decision making process goes from upper

hierarchy/level to local people without active participation of local communities). However, the present study is designed to be operated from bottom-up approach (decision making process goes from local people's demand/voice/perception to upper level) with ethnographic accounting of peoples' perception and need. So the present study is expected to provide crucial input in further edition of the existing climate policies.

Disaster Policy: Frequency and intensity of disaster are said to be changed due climate change. Preliminary hazard trend analysis of the study area shows that subsequent changes have been happening in the time, duration, frequency and intensity of hazard during some decades. This study generates observation based local knowledge on hazard and disaster trend which may assist in upgrading DRR and DRM policy of the country.

Agricultural Policy: This study is designed to promote agricultural policies by providing crucial insights regarding area-specific agricultural and climate calendar namely rainfall patterns, temperature fluctuation, and crop variety etc.

Curriculum Policy: Although Bangladesh has been facing climate problems for decades, its academic discourse has not nourished in response to its devastation. While importance of local and indigenous knowledge and its patronage is recognized worldwide, it has not established in the higher education regime of Bangladesh yet. So this study is expected to play supplementary roles to the inclusion of the topic in mainstream education and higher education policy.

Scope of the Study

Research findings of the present study generate various aspects of usage within and across academic arena. In the academic arena, it profoundly create a gateway to anthropological ethnographic climate study in Bangladesh. Beside this, it indorse anthropological engagement in participatory climate research through 'being there'. Findings explore indigenous climate knowledge which may patronage preservation of this knowledge crucial for future research. Academically, it propose a critical collaborative framework for

epistemological cooperation and sharing across disciplines with a view to comprehensive climate science in Bangladesh.

This study is conducted from emic and cross cultural holistic perspective which is expected to generate comparative outcomes across study areas. Outside academic arena, these findings and outcomes provide insights in rural development studies, poverty alleviation and livelihood improvement through alternative income source promotion. In addition, findings may be used to include local people in various national policy formulation process including; climate and disaster policy, agricultural policy, development policy etc.

Conclusion

Present study is an extensive endeavor of long-term study on climate change perception research in the three study sites. It mainly entitles data and information that are derived from the beliefs, thoughts, and practices of local people. Prioritizing the importance of perception research through emic approach, this research identifies factors affecting human perception of climate change, and deep understanding of human-climate interplay from different environmental settings. Description of small and scattered stories in interpretive ethnographic way, and accounting of individual experience for mapping out collective social perception about changing trend and adaptation, justify its importance and relevance not only in Bangladesh and anthropology, but also throughout the world and other discipline.

Chapter 2

Literature Review

Introduction

Literature review is a vital part of any research that identifies strength and lacking of previous study on the topic. Literature review is regarded as pre-requisite in anthropological study as it provides relevant in-depth information, argument, and discourse contextual to the study. Present study follows systematic review and pointed out with study objects and its various parts.

Perceptions of Climate Change

Perception of climate change among the people at risk is a major issue as it has been identified that spontaneous and reactive adaptation depends on how the erratic climate features are conceived. Regarding perceptions of climate change, different survey results show that a large number of farmers and other nature depended livelihood groups have noticed some form of climate change. However, their perceptions are not always supported by meteorological records.

Feldman et al (2010) uncovers that Americans between the ages of 18 and 34 are, generally, part on the issue of a global warming and on certain pointers. By and large, the review information, gathered between December 24, 2009 and January 3, 2010, offer no anticipated picture of youngsters with regards to an unnatural weather change: while less worried about and distracted with a global warming, they are somewhat bound to accept that an Earth-wide warming is brought about by human elements and that there is logical agreement that it is happening. They are likewise to some degree more hopeful than their seniors about the viability of making a move to diminish a global warming. Furthermore, while they are less open to new data about global warming than elders, they are significantly more trusting of researchers.

Similarly, Thomas et al. (2007) examined South African farmers' perception of and response to one particular change of the climate: precipitation. They have found that a large portion of farmers has recognized changes in the precipitation pattern and, more

importantly, their perceptions correspond to the actual changes reflected by the rainfall records. Most notably, people see drought and dry conditions as natural events; the main change perceived is increase variability and uncertainty of specific climate parameters, such as late start of the rainy season and changing distribution of rainfall over various months. In this survey, over 70% of the respondents recognize increased climate variability. Besides, Mertz et al. (2009) examine farmers' perception of climate change in rural Sahel and also finds very strong recognition of the changing patterns and intensity of climate events.

Brammer (2014) sees that physical geology of Bangladesh's seaside territory is more differing and dynamic than is commonly perceived. Inability to perceive this has prompted genuine incorrect information on current rates of coastal erosion and land subsidence. This circumstance has been disturbed by accounts giving off base data on current paces of waterfront disintegration and land subsidence. This paper depicts physical conditions inside individual physiographic areas in Bangladesh's coastal area dependent on ground-studied data, and it surveys conceivable zone explicit relief measures to counter anticipated paces of sea level rise in the 21st century. Two significant ends are drawn: the selection of fitting estimates dependent on information on the physical topography of conceivably influenced regions could essentially diminish the anticipated relocation of a large number of individuals; and the effects of a gradually rising sea level are as of now substantially less than those created by quickly pressing Bangladesh's accessible land and water assets and by presentation to existing ecological risks, and the last issues need consideration.

Corner et al (2015) said that regardless of a very long engagement of research on more effectively communicating climate change to the overall population, there is just a restricted measure of information about how youngsters draw in with an issue that will shape and characterize their future. The paper through intensive review of global studies around there, drawing on review information and subjective research. Their survey is sorted out into two primary areas. The first quickly arranges youngsters' engagement with

climate change comparative with different concerns and inspects levels of mindfulness, concern and 'distrust' among this age group. The second spotlights on four key determinants of successful climate change communication and survey whether youngsters contrast in any considerable manner from research findings relating to the general population. The four components are the role of social values and perspectives in deciding climate change perception; the viability of 'data based' mediations; the 'mental separation' of climate change and message encircling; and the job of reliable community messenger.

Huq et al (2004) research the unpredictable connection between ecological hazard, destitution, and weakness for a context study did in one of the least fortunate and most flood-inclined nations on the earth, concentrating on family unit and network defenselessness and versatile ways of dealing with risk. In view of the consistently developing measure of writing in climate change, they create and test own diagnostic model. In a huge scale household overview did in southeast Bangladesh, they ask very nearly 700 floodplain inhabitants living with no flood security along the River Meghna about their flood chance, , flood risk, and methods for dealing with stress. Noteworthy investigation is their express testing of the adequacy of versatile adapting methodologies to diminish flood risk costs. They show that, families with lower income and less access to profitable common resources face higher exposure to danger of flooding. Dissimilarity in income and resource at community level besides will in general be higher at higher hazard risk levels, inferring that susceptible households are additionally all things considered progressively more vulnerable. As to distinguishing proof of methods for dealing with stress to manage flood occasions, they take a gander at both the ex bet family unit level readiness for flood occasions and the ex post accessibility of community level help and disaster relief. They find to some degree incomprehensibly that the individuals that face the most elevated danger of flooding are the least decidedly ready, both as far as household level ex bet readiness and community level ex post flood relief.

Delaporte and Maurel (2015) opine that climate change is going to affect agriculture tremendously, be that as it may, there is restricted data on smallholder ranchers vulnerability and adaptation needs. They evaluate the effect of climatic change on the household agrarian earning and along these lines, on peasants' adaptation procedures. Depending on information from an overview directed in a few networks in Bangladesh in 2011 and dependent on an IV probit approach, the outcomes show that a one percent point climate actuated decrease in farming earning pushes household to adapt by right around three percent points. In any case, certain techniques are excessively exorbitant and can't be managed in awful occasions. For those methodologies, we give proof of obstructions that compel the development and organization of adaptive measures, observably access to power and wealth.

Crate (2011) argues that early climate and culture studies were principally established in prehistoric studies and ecological anthropology, with the approach of climate change, anthropology's jobs have extended to draw in local to worldwide settings. The author expresses that considering both the phenomenal direness and the new degree of reflexivity that climate change introduces, anthropologists need to receive cross-scale, multi-stakeholder, and interdisciplinary methodologies in research and practice. Through such ethnography worldwide procedures can be followed locally and how worldwide procedures are being articulated by means of local information frameworks to elucidate the assemblies and clashes between the global to local discussions and understandings about climate change. She accepts fundamental to the development of climate ethnography is the refinement of techniques for how human discernments, understandings and reactions can be represented supporters for a political ecology of adaptation. Crate (2008) contends that in light of the fact that worldwide climate change is personally connected to culture, anthropologists are deliberately very much set to translate it, convey data about it, and act because of it both in the field and at home. She contends in the previous two decades, while anthropology has progressively received applied and open methodologies, there has additionally been an expansion in anthropologists' going about as backers as they witness

moral and human rights maltreatment in the field. Backing has a comparable spot in worldwide climate change examine as it has had in different instances of ecological equity. She accepts, backing is key not exclusively to our cooperative association with networks yet in addition to speaking to their eventual benefits in arrangement and other promotion settings. Anthropologist can fill in as communicators both to our indigenous research accomplices (understanding and conceivably giving data they need about worldwide climate change and in legitimate structures) and furthermore as facilitators of promotion by sharing the encounters of different indigenous gatherings and searching out the nearby, local, and national channels to express neighborhood concerns and illuminate arrangement. Considering the social ramifications of worldwide climate change, she proposes, one way to deal with an exploration plan consolidating applied and promotion approaches starts with seeing how our examination accomplices see the change that is happening, that creating social models. The initial phase in this procedure is to tune in, share, and oblige neighborhood people groups' methods for knowing and watching and build social models of how they see the nearby impacts of worldwide climate change on their reality and perspective.

Wisner (2010) argues that culture and climate are changing and these progressions cooperate with local information and practice. Research on these issues has concentrated on specialized inquiries, for example, how small farmers and domesticated animals attendants comprehend occasional conjectures, veterinary issues or economic situations. In any case, there is a progressively all encompassing method for drawing in neighborhood information. He contends, individuals use outer specialized thoughts and devices, even complex ones, that supplement their very own ideas and experience of progress. In any case, there are obstructions to defeat in creating such local information, including, long history of mastery of local individuals by urban elites, the regular utilization of science as support to constrain rural individuals to do what governments need, and abuse of one-size-fits-all strategies. It is additionally contended that no single, homogeneous information exists in a territory. Alternatively, maybe there are women types of information and the

information on men and seniors and the information on youngsters and kids, which are separated likewise by occupation and by ethnicity. Notwithstanding such social decent variety a bumbling utilization of institutionalized participatory techniques yields poor outcomes and may distance occupants, rather a participatory activity look into is required.

Roncoli et al (2008) view that anthropology's potential commitments to climate study are the depiction and examination of the intervening layers of social significance and social practice, which can't be effectively caught by techniques of other discipline, for example, organized reviews and quantitative parameters. They inspect various investigations that epitomize the manner in which anthropologists have drawn in with different parts of climate change. The authorss contend that 'being there' in the field give fundamental bits of knowledge that may enable social anthropologists to address present-day issues identified with worldwide climate change, gives that are going up against both neighborhood networks and worldwide logical and strategy networks. They recognize four covering aphorisms that explain the various ways societies connect with their reality through the crystal of climate change: how individuals see climate change through social focal points ("discernment"); how individuals appreciate what they see dependent on their psychological models and social areas ("information"); how they offer an incentive to what they know as far as shared implications ("valuation"); and how they react, separately and all things considered, based on these implications and qualities ("reaction"). Also, it is contended that, since climate change is about worldwide vacillations and interconnections, social anthropologists are tested to widen their field skylines and adventure out on unfamiliar epistemological landscapes. Simultaneously, given the ideological and politicized nature of climate science and its persuasive job in approach choices that influence the lives of indigenous networks, minimized gatherings, and poor people, anthropologists should stand firm in their custom of submitted localism and ethnographic reflexivity.

Rodenberg (2009) claims climate change isn't explicitly fair-minded by virtue of the tremendous extent of obligation that women bear for sustenance age from one perspective and their nonappearance of order over and access to land, development, and credit on the other confront women with colossal challenges when drought or conflicting precipitation plans alter improvement times, diminish crop yields, and undermine crop OK assortment. Further, one effect of a significantly settled divergence concerning benefits of heritage and titles to land and techniques for creation is that women are consistently declined access to new land with respect to cases of resettlement or cases for pay in the wake of flood events or other calamitous occasions. This circumstance is unfavorably sustained by non-attendance of instruction and nonappearance of access to information and getting ready. A situation of confined dynamic control in family and network every now and again speaks to a hindrance to women' ability to use their knowledge, e. g. by participating in crop upgrade to ensure stabile new accumulates. Additionally, the creator claims for men as well, in any case, the loss of pay security achieved by climate change includes a weight and serves to shake the foundations of the standard male supplier work. As a psychological and physical weight factor, this as frequently as potential prompts extended dissatisfaction and viciousness in the family. The high test connection between's calamitous occasion and prepared conflict over uncommon resources from one perspective and a rising in sexualised violence against women on various concentrates unquestionably to another circumstance of climate change, one that shows how sincere the need is for more thought in regards to be paid to sex express threats.

Peterson and Broad (2009) consider the move in theoretical and helpful interests for anthropologists stressed over climate. They suggest that force trades about air and climate differentiate in two unique manners from earlier interests in nearby climate, customary assortments, over the top events, and cosmologies. Thought is revolved around both the overall thought of anthropogenic climate change and the age and dissemination of sorts of legitimate data. In like way, this present place courses of action explicitly with pack perceptions and direct under conditions of helplessness. Furthermore, anthropologists may

more likely than not make themselves fight against the importance of a perilous climate devation as a noteworthy danger factor versus dynamically speedy (and longstanding) drivers of powerlessness including property rights, preparing, and access to water and social protection. Climate change talk can scatter conflicting force relations, letting governments free for poor biological and social courses of action and practices. It is fought that human sciences has been commonly reflexively stressed over ethnographic requesting impacts and adaptation to climate and customary climate impacts. In any case, the powerlessness in the data on how the open investigation of climate change will be seen and followed up on, and the normal and unintended aftereffects of action, is overpowering.

Moser and Ekstromc (2015) present an intentional structure to perceive impediments that may hinder the strategy of adaptation to climate change. Three key courses of action make the structure. Beginning, an orchestrated depiction of a romanticized, sound approach to manage adaptation dynamic makes up the strategy fragment. Second, a great deal of interconnected parts fuses the on-screen characters, the greater setting wherein they work, and the article on which they act (the course of action of stress that is exhibited to climate change). At all of these stages, authors ask (I) what could obstruct the adaptation technique and (ii) how do the on-screen characters, setting, and game plan of concern add to the hindrance. To energize the conspicuous evidence of impediments, they give a movement of systematic requests. Third, the structure is done by a clear system to help discover reasons for intervention to beat a given limit. It gives an exact starting stage to reacting to essential requests with respect to how to assist climate with changing adaptation at all degrees of dynamic.

Agrawala et al (2003) present relevant contextual investigation for Bangladesh finished under an OECD venture on Development and Climate Change. The report is sorted out around a three-layered structure. To begin with, progressing environment and climate change circumstances for Bangladesh are assessed and key sectoral impacts are perceived and situated along various pointers to set up requirements for adaptation. Second, Donor portfolios in Bangladesh are penniless down to take a gander at the degree of development

help exercises influenced by climate risks. A work area investigation of benefactor techniques and venture archives similarly as national plans is coordinated to assess the degree of for climate change stresses being created orchestrating and help. Third, an all around examination is coordinated for waterfront belt, particularly the sea shore front mangroves – the Sundarbans – which have been recognized as particularly powerless against climate change. The Bangladesh relevant examination moreover includes the hugeness of the trans-limit estimation in watching out for climate change adaptation. The effect of water distraction upstream on dry season streams and saltiness levels in the Sundarbans was in certainty equivalent to (if not higher than) the effect that may be encountered quite a few years after the fact because of climate change. Adaptation to climate change may require worldwide institutional plans, for instance, the Ganges Water sharing course of action to decide the force issues of water redirection. Finally, climate change dangers should in like manner not redirect from compellingly keeping an eye on other essential dangers, including shrimp developing, unlawful felling of trees, poaching of untamed life, and oil sullying from cargo transport traffic, that may starting at now fundamentally undermine the sensitive natural frameworks.

Adaptation and Government Initiatives

Ideally, self-ruling adaptation would be the most ideal approach to adjust to climate change and government inclusion would be pointless. Nonetheless, because of imperatives concerning data, assets, and so forth. Self-ruling adaptation alone may turn out not to be ideal, and governments have significant tasks to carry out. Fankhauser et al. (1999) contend that for self-governing adaptation to be successful, people must have the correct motivating force, information, assets and aptitudes to adjust productively. The administration's job is to give "a favorable domain" for adaptation, including the privilege lawful, administrative, socio-economic condition for self-governing adaptation. For instance, the administration needs to give the correct motivations to ranchers for taking versatile activities. On the off chance that the legislature finances certain yields vigorously and ranchers don't experience the ill effects of the evolving climate, they will have no motivating force to adjust without

anyone else. Government mediation is required, for instance, when ranchers adjust to dry seasons by utilizing water system all the more seriously and subsequently bringing about a consumption cost (a negative externality). Government inclusion may likewise be expected to urge individuals to make long-term venture on adaptation. The arrangement of products and enterprises of an open considerate mindset, for example, innovative work and meteorological administrations are without a doubt the administration's obligation and profoundly critical to the achievement of self-governing adaptation.

Islam and Shafie (2017) explored climate change from a diverse sense. Their study is a big climate venture in recent Bangladesh that covered four geographic areas; Assasuni of Satkhira, Porsha of Naogaon, Chakaria of Cox's Bazar, Tarash of Sirajganj. They have accounted local voices that were unheared for subsequent long times. The stories of marginal, poor and schedule caste people regarding climate change impacts were accounted with prior concern. It is a pioneering work on climate change from anthropological tradition. From impacts, vulnerability to local adaptation strategies, this study cross its own limit in many respects. It has inventory of NGOs and GOs in the selected study areas that produce a clear scenario of development interventions. Besides, institutional framework and government initiatives in framing climate change in Bangladesh are presented well.

Islam et. al (2017) said that climate change is a critical problem that require multidisciplinary approach and multinational cooperation. They endeavored to assimilate a wide variety of research papers in their edited book. It is an excellent book that bears climatic information about Bangladesh, Sri Lanka, India, Nepal, Maldives, and many more countries. This book created a multidisciplinary platform for both social and natural scientists across countries. Islam and Uddin (2017) comprehensively explain climatic terms in Bengali book. This book is one of the good climatic books in Bangladesh that has good appeal among researchers, development practitioners, students and teachers. Its strength lies in its simple explanations.

Mendelsohn (2000) contends that as long as the expense and advantage of adaptation are borne by a similar leader, private/independent adaptation will happen and will in general be productive. Nonetheless, he likewise contended that administration's inclusion in adaptation is fundamental on three grounds: externality, high data expenses, and value. The initial two reasons are like Fankhauser et. al., (1999) in any case, the third one, value, includes equity across various gatherings of individuals. The expense of individual adaptation is borne by the casualties of climate change, however value implies that polluters should pay for the harms of contamination. Therefore, government association may help move the expense of adaptation from the exploited people to the polluters. With regards to adjusting to climate change, this contention appears to fit better universally (modern nations versus creating nations) and across segments (industry/vitality areas versus farming) as opposed to locally.

Another kind of adaptation that legitimizes government mediation is the thing that Mendelsohn (2000) calls "joint adaptation", which takes after an "open decent." For joint adaption, he brings up, even with government intercession, it is hard to accomplish proficient adaptation since: 1) the aggregate addition may not be seen by each individual from the gathering; 2) the aggregate body may not concede to the degree of activity; and 3) recipients are more intrigued augmenting their own private increase than aggregate addition. Aaheim and Aason (2008) talk about the requirement for government inclusion in adaption on three ground: 1) adaptation is an open decent; 2) exchange costs are high; and 3) adaptation requires components of creation to be moved truly (fixed status). Accordingly, the administration is required either to encourage independent adaptation or to do the necessary adaptation straightforwardly (arranged adaptation).

Metroeconomica (2004) recognizes two adaptation forms: (a) "building adaptive capacity" includes making the data and conditions (administrative, institutional, administrative) that are required before adaptation moves can be made, and (b) "conveying adaptation moves" includes taking activities that will assist with lessening defenselessness to climate dangers,

or to abuse openings. Right now, adaptation could be thought of operators conveying adaptation activities, while governments assume a significant job in "building versatile limit."While perceiving government's job in advancing and encouraging self-ruling adaptation, it likewise should be remembered that the procedure of self-governing adaptation and that of government adaptation are totally different. As talked about in Brooks (2003), for the previous, adaptation will be dictated by the specialist's instruction, access to data, money related and normal assets, informal communities, and the nearness/nonappearance of contentions. For the last mentioned, the adaptation procedure will rely upon connections between the administration, the private part and common society, the administrative condition and the viability of state organizations, national riches, monetary independence, etc. Thinking about the interchanges between government activities and self-ruling adaptations at the nearby level, the examination assesses the current adaptation choices in the four research locales and distinguishes best practices to be reproduced in other climate helpless zones of Bangladesh.

Development and Adaptation

It is generally perceived that developing nations are progressively helpless against the effects of climate and hiveless ability to adapt. Consequently, adaptation to climate change has a developing profile in the universal improvement network. IPCC TAR (2001a) takes note of that “very little attention has been devoted to the interaction of adaptation to climate change with the ongoing development projects and programs” and that there is “surprisingly little recognition climate hazards and risks associated with climate change in established development projects and programs.” This has changed especially in the course of the most recent decade – in any event in talk: "mainstreaming" climate change adaptation has become a catchphrase being developed activities. The World Bank gives its 2010 World Development Report to the subject of improvement and climate change and calls for "joining of adaptation into climate-smart development" (World Bank, 2010).

Therefore, the connection among development and adaptation has become an appropriate issue. Schipper (2007) distinguishes two methodologies connecting development and

adaptation. In the primary methodology, adaptations did “with the specific goal of ensuring survival of livelihoods, lives and cultures during climate change, and can thereby be seen to aid progress in development by enhancing resilience to climate fluctuations.” The differentiating view is that development prompts better adaptation. This is the view communicated in IPCC TAR (2001b), which proposes that the versatile limit is more prominent when the country has "a steady and prosperous economy."

Schipper (2007) contends that the “vulnerability reduction approach” to development is more alluring than the “adaptation approach.” The "adaptation approach" converted into training is "mainstreaming" – mulling over climate change for improvement arranging. Be that as it may, this may not be powerful if the current improvement techniques neglect to address the basic reasons for powerlessness. In this manner, "it is weakness decrease that ought to be incorporated into improvement arrangement, as opposed to the production of explicit adaptation systems." Many individuals are powerless against the effects of climate change for non-climate reasons. While the adaptation approach just spotlights on climate impacts, the powerlessness decrease approach tends to the major purposes behind defenselessness, a considerable lot of which are about more extensive improvement.

McGray et al. (2007) likewise note these two perspectives on the connection among adaptation and development: seeing adaptation as a way to accomplish improvement and survey development as a way to accomplish adaptation. It proposes that an increasingly valuable approach to portray them is to consider subjects double targets instead of end and means. A development-adaptation continuum is proposed: from one perspective is customary improvement exercises, which diminishes generally weakness yet don't consider a particular climate issues; then again are adaptation activities profoundly focused towards explicit effects of climate change that are excluded from traditional development. Between these two limits are different types of exercises that place diverse accentuation on helplessness and climate change impacts. In particular, four classifications of adaptation exercises are recognized:

- Addressing the drivers of vulnerability: this is the development end of the range: exercises that diminish destitution and different components that lead to helplessness.
- Building response capacity: these exercises center around building capacities with respect to critical thinking. Models remember improvement for correspondence frameworks, mapping, enduring observing, and asset the executives.
- Managing climate risk: right now exercises, climate data is consolidated hesitation making. Exercises, for example, debacle reaction arranging and developing drought-resistant crops fall into this classification.
- Confronting climate change: these are activities that emphasis only on reacting to the effects of anthropogenic climate change and are not commonly remembered for traditional improvement, for example, migration of networks because of ocean level ascent. (Adapted from McGray et al., 2007).

Adaptation and versatile limit specifically can likewise be broke down with Amartya Sen's "capabilities approach." In this methodology, capacities reflect different "functioning's" an individual can possibly accomplish and require the entrance to "opportunities" – political opportunity, financial offices, social chances, straightforwardness ensures, and defensive security (Sen, 1999). Ospina and Heeks (2010) contend that the development of versatile limit itself is "formative," notwithstanding whether it is really used. Roy and Venema (2002) apply this way to deal with inspecting Indian women' powerlessness to climate change, and contends that development endeavors ought to be coordinated in the abilities structure so these women can improve their well-being, for example, access to social insurance, proficiency, and authority over their own lives, thus acting all the more promptly because of climate change pressures.

It ought to be noticed that for the conversation on development and adaptation, it gives the idea that all the time the creators have arranged adaptation at the top of the priority list, in light of the fact that the current inquiry is about the intentional arranging of an adaptation procedure – typically by national governments or on-screen characters in the universal

improvement network. Somewhat, notwithstanding, the contention in Lisa and Schipper (2007) can be viewed as a case made for independent adaptation: "improvement" is to give an empowering domain; when nature is there, individuals would have the option to adapt self-rulingly to whatever sway from climate change.

Hardi Shahadu (2012) proposes a planned model of Social Adaptation to Climate Change with a structure to envision air alteration direct through a chain of associations starting with media sway on climate information, information sway on human cognizance and human discernment on climate adaptation conduct. He inspects a diagram of taught youth in tertiary associations inside the Tamale Metropolitan Assembly of Ghana to react to key research questions, for instance, a) how does the youthful grasp and react to climate change? b) Is media consideration basically related to open data on climate change? c) Is climate information in a general sense related to human discernment on climate change? moreover, d) is human knowledge basically associated with climate adaptation conduct? The guideline finish of this examination is that understanding and envisioning an climate change adaptation can be redesigned through joining of this point separated domains of research to be explicit media consideration of climate change, open data on climate change and conduct change theories. This has the extra piece of room of thinking about attentiveness with respect to be given to the human parts of the climate adaptation activities.

Adaptation Strategies/Methods

Contingent upon the how dangers are decreased or kept away from, five classes of adaptation systems can be recognized (Agrawal and Perrin, 2009):

- Mobility – pools or keeps away from dangers across space
- Storage – It pools/decreases dangers experienced after some time
- Diversification – It decreases chances across resources claimed by families or assemblages.

- Communal pooling – It includes joint responsibility for and assets; sharing of riches, laboror wages from specific exercises across family units, or preparation and utilization of assets held on the whole during time of shortage. It decreases dangers experienced by singular family units.
- Exchange – It is generally seen as a way to advance specialization and increment income streams ,yet it can similarly fill in for the initial four classes of adaptation techniques.

The adaptation techniques examined in most exact writing can be categorized as one of these five classes. Most climate change related research centers at agriculture just, so the versatile methodologies are generally identified with specialized changes in cultivating work on, including, utilizing various assortments of a similar harvest is one of the most significant adaptation techniques. Further, changing planting dates, embracing shorter developing season, expanding the utilization of water system, water preservation procedure and soil protection strategies are drilled in a few nations. Barely any investigations concentrating on adaptation to climate change are talked about beneath.

Eriksen et al. (2005) watch various "indigenous" adaptation techniques to climate change impacts in Eastern and Southern Africa: (1) Diversification: For instance, fishers in Uganda additionally develop crops, raise domesticated animals, gather kindling, and take part in exchange and impermanent movement. (2) Livestock grouping is a significant adaptation to visit dry spells in Namibia and Botswana. (3) Ecological expansion: ranchers in Mozambique have plots in high ground when there is a great deal of downpour and in low ground when there is little downpour. Thus, Thomas et al. (2007) locate countless adaptation methodologies by ranchers in South Africa, for example, changing cultivating rehearses (plant drought-resistant assortments, have more domesticated animals and less harvests, construct dairy cattle cover), expanding vocation (get off-farm work, start a business)and framing systems (cooperatives, network plant ventures). Oxfam (2008) reports a few conventional and adaptation techniques by pastoralists in Easter Africa, for example, movement, broadening of group creature blend, adjusting crowd size, enhancing

touching with feed, and collecting precipitation water as an option in contrast to the undeniably questionable stock of groundwater.

Adger et al (2005) said that climate change impacts and responses are seen in physical and common systems. Adaptation with these impacts is continuously being seen in both physical and atmosphere structures similarly as in human changes as per resource availability and risk at different spatial and social scales. The creators audit the possibility of adaptation and the repercussions of different spatial scales for these methods. They design a great deal of regularizing evaluative criteria for settling on a choice about the accomplishment of adaptation at different scales. They fight that parts of sufficiency, capability, worth and legitimacy are noteworthy in settling on a choice about accomplishment in regards to the supportability of headway pathways into an uncertain future. They further battle that all of these segments of dynamic is sure inside arranged circumstances of monetary destinies of both emanation directions and adaptation, anyway with different weighting. The methodology by which adaptations are to be made at different scales will incorporate new and testing institutional strategies.

Eakin (2005) contemplated adaptation to atmosphere chances in three provincial networks in Central Mexico. The attention is on the impact of social, political and financial conditions on ranchers' versatile limits and their determination of adaptation procedures. Specifically, the investigation takes a gander at how various institutional changes collaborate with ranchers' capacity to adjust to atmosphere dangers and their adaptation decision set. Planting maize is the center employment procedure for all ranchers right now, maize is progressively helpless to harm brought about by changing atmosphere designs than elective harvests, for example, oat and grain. Ranchers stick to maize since it gives subsistence while wheat and grain rely upon the questionable business advertise. For little ranchers, meeting the subsistence need is the transcendent worry in their vocation technique, which genuinely restrains their adaptation decision set. Just huge ranchers can broaden their harvest blend. Another methods for adaptation is to expand business by off-farm work. Be that as it may, this decision is obliged by ranchers' own instruction level,

the separation to mechanical focuses where such work is accessible, and accessibility of open transportation.

Determinants of Adaptation, Barriers to Adaptation, and Adaptive Capacity

Dinar et al. (2008) discover incredible contrast among various nations regarding the reception of adaptation rehearses. In a few nations, more than 33% of respondents make no versatile move at all despite the fact that they have seen changes in the climate. He additionally proposes various components influencing the likelihood of a rancher adjusting to climate change. For instance: increasingly experienced and better taught ranchers are bound to take versatile measures, being head of family unit additionally prompts higher likelihood of adaptation, probably in light of the fact that he/she controls family unit assets, further, ranchers taking a shot at leased land are less inclined to adjust.

Alpiza et al. (2009) utilized a logit model to assess what qualities of espresso ranchers in Costa Rica are corresponded with selection of adaptation techniques. It is discovered that male ranchers are bound to adjust than female ones (however no clarification is offered for this distinction), and that the individuals who have recently put resources into soil preservation are likewise bound to adjust to dangers related with climate change. Then again, large espresso ranchers are more averse to adjust, likely in light of the fact that they have more assets to beat the antagonistic impacts from outrageous climate occasions. It is additionally discovered that age and instruction don't have any noteworthy impact on adaptation choices.

Brouwer et al. (2007) take a gander at vulnerability and adaptation to flooding in Bangladesh. By dissecting information from a household survey of inhabitants living in the floodplain along the River Maghna, they can show the connection between neediness, weakness and versatile limit. The more unfortunate live nearer to the waterway, along these lines confronting higher dangers of flooding; simultaneously, they have less ability to take ex risk preventive measures against floods and less access to ex post calamity alleviation.

The investigation additionally finds that more pay sources bring about lower harm costs from flooding; nonetheless, this technique is essentially utilized by the wealthier family units living further from the waterway. The most unfortunate family units, living wardrobe to the stream, have not many chances to broaden their pay sources. This finding is like the example saw by Eakin (2005): in the Mexican case, just bigger ranchers can expand crops from maize and have less atmosphere touchy harvests, for example, oat and grain, and just the better-to-do family units can put resources into human capital, which, thus, makes it conceivable to take part in other monetary exercises, for example, discovering work in the modern parks. The most unfortunate, with little landholding, is by all accounts caught in subsistence cultivating with high reliance on maize. One element of the Brouwer et al. (2007) study is that it takes a gander at adaptation at the individual family unit level, yet in addition at the network level. A significant finding at the network level is that more prominent salary imbalance is related with higher flood harm cost. Albeit no precise explanation can be recognized to clarify this relationship, one potential clarification is that networks with increasingly equivalent pay dispersion are bound to pool their assets and spend on flood security all things considered.

Cinner et al. (2009) researched the reaction of high quality fishers to a declining fishery. Despite the fact that the decrease in fish stocks might possibly be straightforwardly identified with climate change, the issue considered – exchanging occupation/business – is exceptionally significant. They look at the availability to stop of 141 Kenyan fishers from waterfront networks in Kenya under speculative situations of decreases in catch, and utilize a parallel rationale model to examine how their choices are impacted by their socio-economic conditions. The key finding is obvious: fishers from families with progressively material riches (estimated by family unit assets or structure) and more noteworthy number of occupations are bound to stop angling when angling stock decay. This again echoes the discoveries in Eakin (2005) and Brouwer et al. (2007): needy individuals can't activate the assets required to defeat either stuns or interminable low-income circumstance. This is additionally predictable with the "poverty trap" conversation in the improvement writing.

Plus, Alpizar et al. (2009) dissect ranchers' adaptation to climate change through a field explore different avenues regarding espresso ranchers in Costa Rica. It was discovered that individuals' own disposition towards hazard and vulnerability just as systems have consequences for adaptation decision-making.

Adaption and Institutions

Agrawal (2009) utilizes an examination between two neighboring locale in India to represent the significance of different establishments to diminishing vulnerabilities. He depicts that, groundnuts ranchers in both Anantapur District and Chitradurga District are presented to dangers because of monetary advancement just as dangers because of climate change (dry spell). In Anantapur, import rivalry and stale costs, in mix with dry spells, genuinely compromise ranchers' job. Changing to rain-fed natural product crops is troublesome in light of the fact that it includes high venture, and the organic products' shelf-life is too short to be in any way attractive. Paradoxically, ranchers in the neighboring Chitradurga District lessen their powerlessness by exploiting various open and market foundations, including sponsored dribble water system, crop protection, modest acknowledge, and agreement with exporters to supply for the European market. Subsequently, various foundations (or the nonattendance of specific establishments) lead to altogether different degrees of versatile limit and thusly levels of helplessness.

In addition, Adger (1999, 2000) gives a portrayal of institutional changes in Vietnam's progress towards a market economy and how they influence the nation's administration of atmosphere dangers. The examination was done in 1995-96 in the Xuan Thuy District in the Red River Region, which has a long coastline and tropical storms and waterfront storms are the significant atmosphere dangers. Building and strengthening ocean embankments is a significant measure to deal with the harms. During the collectivization time frame, individuals from cooperatives were required to contribute a specific measure of work to the errand of ocean barrier support. With Vietnam's market-oriented change, this training was supplanted with a duty, and work of waterfront security has gotten progressively professionalized (in light of the fact that the open door cost of ranchers' time gets higher)

and paid for with the barrier support charge. Nonetheless, the beach front cooperatives to which this expense income is allotted may utilize it for purposes other than ocean dam upkeep and support, for example, street development. Therefore, the aggregate wellbeing of the district is undermined. Right now, advertise situated change and decentralization bring about some debilitating of a significant adaptation measure. Be that as it may, as verified by Adger, this debilitating might be counterbalanced by the reappearance of common society and market establishments over the long haul.

One key limitation confronting the most powerless populaces despite climate change is the absence of assets – this is the reason the universal network just as governments dedicates a lot of exertion to helping them in adaptation. Therefore, an extremely specific foundation that might assume a significant job in self-sufficient adaptation in the creating scene is microfinance. Microfinance regularly focuses on poor people, and subsequently can conceivably be a viable component directing assets to the defenseless gatherings that are in extraordinary need to take versatile activities yet in any case do not have the asset to do as such.

Hammill et al. (2009) give a deliberate conversation about the linkage among microfinance and climate change adaptation. As they note, "the rationale here is basic – the more resources and abilities individuals have, the less helpless they are." Microfinance administrations furnish the poor with a methods for collecting and dealing with the benefits and capacities expected to turn out to be less vulnerable to stuns and focuses and additionally adapt to their effects. Agrawala and Carraro (2010) study the linkages among microfinance and adaptation in two nations exceptionally helpless against climate change: Bangladesh and Nepal. The specific idea of microfinance loaning – enormous volume, constrained worth credits, they watch, is "reliable with the essential idea of a dominant part of adaptation activities that will at last comprise of thousands of decentralized activities by people, families and networks, as they persistently try to disguise atmosphere chances in their exercises," i.e., participate in self-governing adaptation. All the more essentially,

microfinance can give the linkage between the macro-financing of adaptation in the worldwide climate change system and the adaptation exercises at the grassroots.

Their survey of microfinance loaning in Bangladesh and Nepal discover there is as of now critical cover among microfinance and climate change. They audit 226 microfinance loaning programs (each program can have a huge number of little credits) by 22 significant microfinance foundations (MFIs) in Bangladesh somewhere in the range of 2006 and 2008. These loaning programs are isolated into 10 classes: business and pay creating exercises; farming, animals, fisheries; ranger service; water and sanitation; wellbeing; lodging; training; sustainable power source; information-technology move; calamity alleviation and readiness. Projects for "agribusiness, animals and fisheries" represent 41% of the absolute number of projects, trailed by employment-generating exercises (19%), calamity alleviation and readiness (11%), water and sanitation (7%), and wellbeing (5%). Given that OECD has distinguished Bangladesh's need climate change chances as water assets (flooding), beach front assets, human wellbeing, and farming, the cover between the microfinance projects and climate change adaptation needs is clear.

Further, Agarwala and Carraro (2010) analyzed the advance projects' association with climate change adaptation and think of three classes: no connection, win-win, and climate-proofing. The "no-link" classification incorporates programs focused at absolutely income-generating exercises while these exercises would at last decrease powerlessness and fortifying adapting limit, there is no immediate connect to climate change. The "win-win"category alludes to "microfinance programs which, as at present organized, would consequently likewise add to adaptation to climate change." It remembers programs for farming and water assets that are sound practices from the adaptation point of view. Additionally included are programs on debacle help and readiness. The "climate sealing" class alludes to "exercises that may should be adjusted to assess the dangers presented by climate change and additionally to encourage adaptation. "Such exercises may inevitably prompt maladaptation to future climatic conditions or expect acclimations to be stronger to climate change. Right now, of the projects investigated fall under the "no-link" class,

43% are "win-win" and the staying 13% are "climate sealing." Although just characteristic, this finding is very noteworthy: with no unequivocal structure fixated on adaptation, 43% of the microfinance programs in Bangladesh are as of now supporting self-sufficient adaption to climate change. A comparable yet less solid linkage among microfinance and climate change adaptation is watched for Nepal. As per the creators' appraisal, of the 82 loaning programs offered by 22 MFIs from 2006to 2008, 41% don't have an immediate connect to adaptation, 37% are "win-win," and 22% are "climate sealing." They showed the particular courses through which microfinance encourages adaptation: credits are given to building more grounded houses that can withstand greater tempests, advances that advance the selection of new cross breed assortments that are tolerant to salt and water-related stresses, advances for improving water the board and water system, etc.

Chapter 3

Methods and Materials

Introduction

This anthropological study is designed under emic and cross cultural climate ethnography (emic and cross cultural model of climate ethnography encompass core ideas of emic perspective along with emphasis on cultural setting of social construction of meaning and functions) in order to listen, share, and accommodate people′s ways of knowing, observing, and perceiving and to compare how they perceive the local effects of global climate change in their daily lives. However, methodology of the present research will cover three parts: (a) data collection procedures—methods and techniques, (b) source of data—primary and secondary (c) data analysis.

Research Design

Present study is an outcome of intensive endeavors that follows proper academic design of empirical research. Research design is considered important in anthropological climate research because it provides methodological justification that is ground for data collection. Furthermore, perception study should follow a harmonized way to recapitulate people's testimonies of climate change. Perception analysis usually emphasis on structured format followed by Likert Scale. This study uses Likert tool as qualitative means of data collection, verification and analysis as well. As an anthropological study, it prioritize qualitative means of data collection and analysis with detail narrative of social events and phenomena. Quantitative data is collected to supplement qualitative information on how climate change is observed and what are the impacts of climate change experienced by local inhabitants.

However, the study is preceded through the following way:

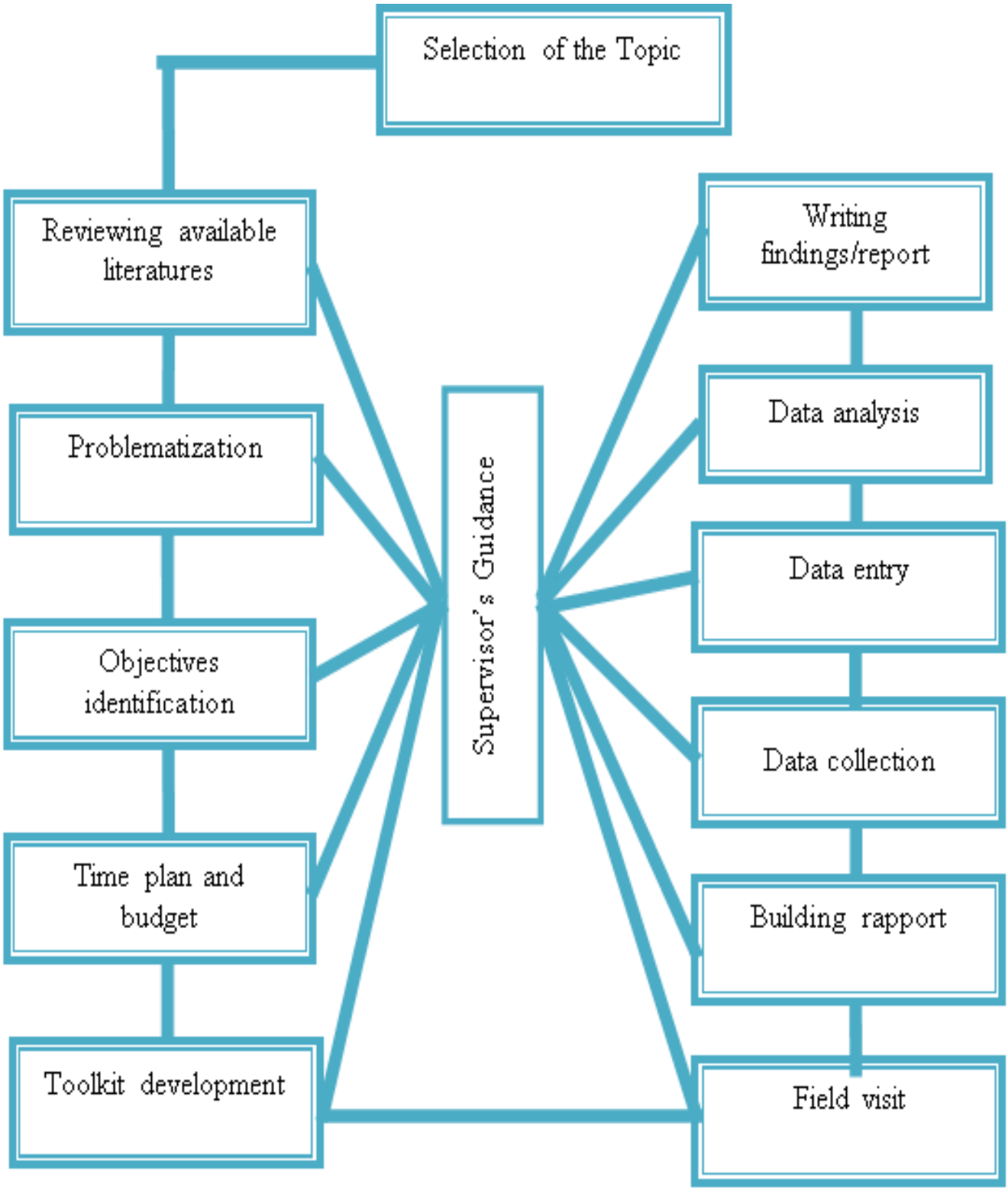


Figure 3.1: Process of the Study

This is an integrative or triangulated research where qualitative and quantitative data is collected and analyzed with a view to validate the findings cross-sectionally. Most profound form of triangulation approach to mix survey data with qualitative data has been used. In this regard, first approach is through observation and then to questionnaire. It enable the study to collect both numeric and qualitative data that validates the findings.

Data Collection Procedures: Methods

Present study occupies a number of methods and techniques for data collection considering context, quality and situation. With a view to reach at the heart of the problem, it exploits the following methods for internalizing people's understanding of climate change:

- Participant Observation: Covert and Overt Observation
- Key Informant Interview
- Focus Group Discussion (FGD)
- Case Study
- Structured Interview

Participant Observation: Covert and Overt

Present study follows participant observation in short term basis. It acknowledge that some essential requisite for being participant observer could not be followed due to some limitations; timeframe, budget and weather. This study strives adhering to anthropological customs of participant observation through participating local community's daily activities, cultural events, crop production and a list of communal activities. Participant observation takes place in two ways in terms of present study; overt and covert. Although, there are debates of ethical stance about covert observation in anthropological research because of thumping the objectives of research and observation as well.

Overt observation refers study people is well informed and concerned about the situation is being studied. Hence, researchers let people know about the things they are going to observe and research (Bandura 1961). It allows both researcher and study participant to be honest with each other. It is regarded as ethically more sound than covert observation.

Present study exploits overt observation process from the beginning of the fieldwork to the end. It helps understand the factual scenario of climate impact on crop production and livelihood options, and local adaptation measures. The study firstly let local people know about the issues it wanted to explore, and then continued observation. Overt observation took place in several formats and settings; during formal fieldwork, while walking around the field, during crisis moment such as storm etc.

Covert observation denotes the fact that researcher not informing the study participant about the intention of the study (ibid). Covert observation is undertaken when there is security issue of researcher and study people, when there is scope of getting fraud information if respondents know about the objective of research and observation. Moreover, if ethical obligations are compromised, covert observation helps to get authentic information on some sensible issue. For example, present study observe sensible political and religious discussion in covert manner of observation. A story should be shared: an embankment in Pratapnagar union of Assasuni upazila suddenly eroded during the first phase of fieldwork. Officials of Water Development Board is responsible for supervising the embankments. Local people were blaming the officials for not taking proper steps before the embankment eroded. They naturally vituperate the officials in front of the researcher because of not knowing about the intention of observation. They just took the researcher as one of the visitors walking alongside the river. It allows the study to observe the situation and interaction takes place in the community with covert manner.

Key Informant Interview

Key informant is a specialist source of data. The key informant procedure is an ethnographic research strategy which was initially utilized in the field of anthropology. The guideline focal points of the key informant system identify with the nature of information that can be acquired in a generally brief timeframe. To get the similar data from in-depth interviews with different individuals can be restrictively tedious and costly (Lincoln 1985). Tremblay identifies five features of an ideal key informant (Burgess 1989). *Role in*

community; key informant should have leadership role in the community. *Knowledge*; informant should have expertise knowledge on the topic and have explaining capacity. *Willingness*; informant should be willing to share his/ her knowing with the researcher as much as possible. *Communicability;* informant should have communication skills so that they can understand the interviewer and can make the researcher understood about their information. *Impartiality:* most important for the key informant is to be objective and unbiased.

Of these criteria, present study emphasized more on knowledgeability of the key informant about the critical issues of climate change. Additionally, community leadership and social acceptance were taken into consideration while selecting key informants. To observe erratic behavior of changing climate over a period of 20-30 years timespan age plays strategic role. Experience in crop production, knowledge about seasonality, respect to all communities living in study areas were also considered important for selecting key informants. Beside these, religious and political leadership, inheritance of traditional occupation and indigenous knowledge, focal role in social structure, impartiality to the statement provided were key criteria for selecting key informant. However, a total of nine key informant interviews were taken with three from each site.

Focus Group Discussion (FGD)

FGD was used to map out collective cultural perception of what is changing and why. A focus group discussion is a form of group interviewing in which a small group – usually 10 to 12 people – is led by a moderator (interviewer) in a loosely structured discussion of various topics of interest (Mishra 2016). FGD is one of the convenient way to collect wide range of information from group of similar backgrounds or experiences in a common platform. FGD generates information on collective views of participants' experiences, beliefs and thinking on a topic.

FGD allows present study to collect different kinds of data in shorter period of time. Group of similar people like same profession, socio-economic status and gender were gathered in

a group to discuss about uncertainty of climate change. FGD helps collect harmonious information because it allowed the study to justify and prove the response. Firstly, response on a topic listed in the checklist were asked, participants shared their experience and some exceptional cases were found, then moderator draw the finish line by summing up all participant's' view in brief and everyone agrees to the statement. Present study encourage everyone to share their experience on climate change, thus it found some participants as introvert who were not willing to talk and response. It especially gave provision to these participants and endeavored to pick up the community perception on climate change.

The setting of FGD was U shape. For privacy issue, this study did not use actual name of the participants during FGD, rather it numbered the respondents clockwise. For proper participation and interaction it requested the less interactive participants by calling through number given to talk and share their story. In case of FGD with women, children were whispering and they were managed professionally. Sometimes, discussion had to stop because of other people intrusion and heavy noise of surroundings. Therefore, a total of six FGDs were conducted in three sites where two in each study area.

Case Study

Case study is very popular method in qualitative research that indicates deep story of a social unit, family, person, and society as a whole. Case study method provides small range of data with big meaning. It helps collects individual's story and life experience in a unique format that ensures the depth of the information. Case study is sometimes not considered as separate method in anthropological research rather it is intermingled with other qualitative methods. The pleasure and pain, sorrow and happiness, petite untold sufferings of life is usually imprinted in case study. Present study utilized case study in recording certain events that demanded in-depth exploration. This study interpreted cases on impacts of climate change on seasonal variability, productivity and uncertainty.

Structured Interview

Primary estimation of sample size for quantitative information is 120 HH with equal 40 HH in each site. Sample selection criteria was purposive considering age, gender, profession, education and religion. Primary data is collected from fieldwork in two phases and secondary data is collected from available literatures, reports, articles etc. on climate change.

Data Collection Procedures: Tools and Techniques

A number of tools and techniques had to use for data collection, preservation and management in proper way. Unorganized data and random management of study inputs and outputs make research poor in quality. Moreover, it used the followings during the course of fieldwork;

- **Checklist and Questionnaire:** Present study adopted checklist for qualitative part and structured questionnaire for quantitative part (attached in the appendix). A formative checklist be fitting with all materials of qualitative part had been prepared from literature review and critical understandings of the problem stated in consistence with study objectives. A structured questionnaire had been structured focusing on both demographic background and key objectives of the study.
- **Notebook:** Personal notebook was used from the beginning of the fieldwork to final report writing. Of the tools used during fieldwork, notebook was essential part as it facilitated to scribble down key points, events, and other necessary things. Notebook was not keep available to study participants because of some sensible information written. During FGD and KII, notebook assisted to write down any important point or new angle of information that come up from respondent's view. These new ideas were explored latter on.
- **Camera:** Visual presentation takes very important part in anthropological research nowadays. Photo captures some undescriptive things in visual frame that portrait whole culture in many respects. Photo constructs imagery of culture that narrative

description can do seldom. Smart mobile phone has now high definition portable camera to frame in perfect scenario. This type of camera was used to capture field situations.

- **Audio recorder:** Qualitative data is enormous in size that may lost if not properly recorded. Moreover, it is not possible for any researcher to write up all the statements that respondents give during discussion. On the other hand, if researcher tries to write down respondent's speech as it is, it would prolong discussion time that respondent would not agree. Furthermore, this can cause missing of important information. To avoid these things and to save information, present study used audio recorder. Before starting audio recorder, this study took oral consent from the participants.

Sources of Data Collection

Data and information were collected from two sources: primary and secondary.

Data Collection from Primary Sources

In primary level, data were collected from field by the methods mentioned above.

Study of Secondary Sources

Secondary data was another crucial source of information for the present study. The secondary sources of information includes:

- Available literatures
- Website of ministry of environment, forest and climate change, GoB
- Ministry of Disaster Management and Relief
- Daily newspapers
- Monthly Magazines
- NGO reports
- Various websites and journals

Data Analysis

Collected data is analyzed through ethnographic tradition of triangulated research with special emphasis on qualitative outcomes and particular references to cases. Descriptive statistical tool is used to analyze quantitative data. Qualitative data is processed in NVivo software and then exported to Microsoft word after screening and final analysis. Data analysis process follows the below mentioned process:

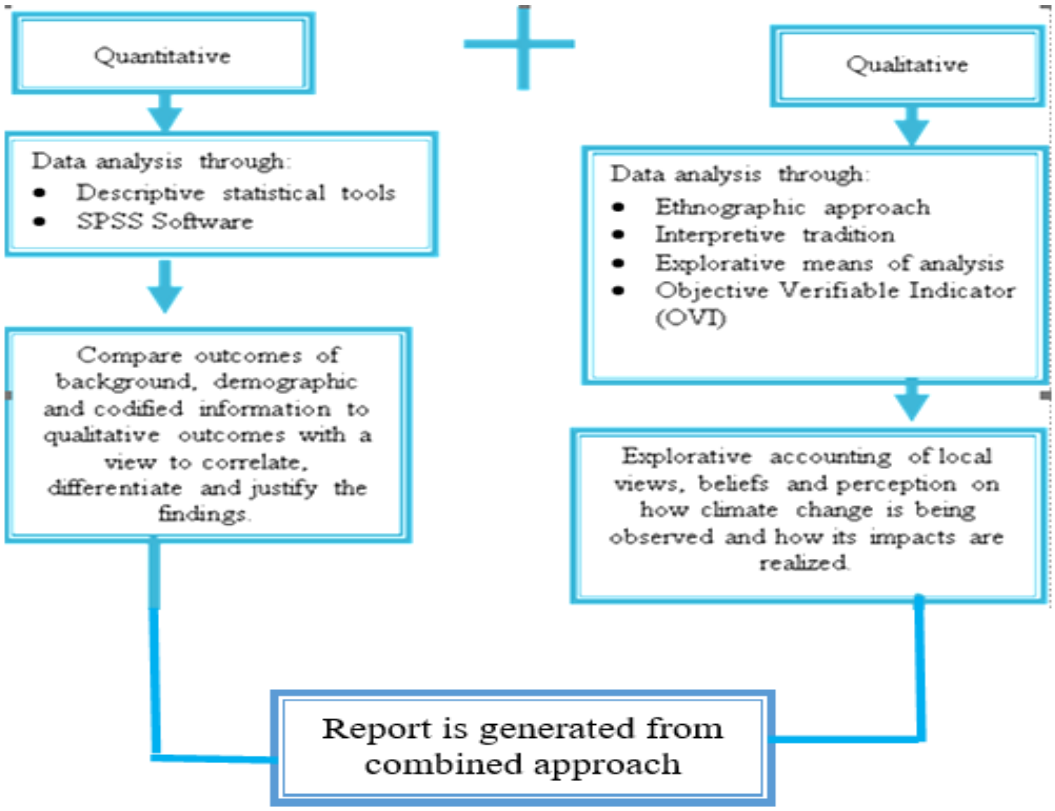


Figure 3.2: Data Analysis Process

Ethical Obligations

Ethics are a significant thought for anthropologists. The worry of anthropologists to conduct study that is morally solid has developed in the previous a very long while. Initially, when directing ethnographic field work, anthropologists weren't especially worried about ethical issues and the effect of their in-depth exploration on the individuals that they were researching. Today, anthropologists have a vastly improved comprehension

of the significance and conspicuousness of ethical problems. All exploration, especially field work, affects the individuals are being studied. As needs be, anthropologists must guarantee that their work doesn't contrarily affect their respondents, and the community they are studying (Explorable.com 2015).

Present study undertakes ethical issues with great concern. Although, research in climatic topic is not such sensible that could violate social norms and values of the community. Climate study is now very common as various NGOs and INGOs have been working in Bangladesh on the issue.

Some people talked about political system of the country is driving to climate change and brings about sufferings for local people. Some identified modernization and digitalization process in all aspects of life as a factor causing climate change in the country. Religious connection for climate change and social roles in mitigating change were accounted by some local inhabitants. These politically and religiously sensitive issues were dealt with professionalism. Women of Charhajari maintain *Purda* custom while they go to outside home. This study did not intervene in social and religious customs rather it collected data making women feel comfortable in their own way. Additionally, present study endeavors to use pseudo name for the respondents.

Conclusion

This chapter outlines the methods and techniques that had been used for overall research from selection of the topic to generation of the report. It presents how the present study is designed from ethnographic interpretive tradition of anthropology for the production of knowledge and discourse in epistemological regime. Climate research is relatively new in anthropology which does not have new methods for but somewhat different from mainstream methodologies. Climate research focuses on intensive interaction with locale through being there (Roncoli, Crane and Orlove 2008). However, the next chapter will explore about theoretical and conceptual background that present study grounded upon.

Chapter 4

Theoretical and Conceptual Framework

Introduction

Theories guide research throughout the course of the study. Theory is generated to analyze social facts with a structured format with a view to challenge existing knowledge and producing new one. Theoretical framework explains research problem from the prism of its argument and ensure open platform for further discussion (Gabriel 2013). A theoretical framework contains concept and their operational definition linked to the study. The identification of perfect theories and concepts requires clear understanding of research problem and study objectives. The selection of a theory depend on its relevancy appropriateness and analyzing rigors.

Theoretical Framework

The Cultural Theory of Risk Perception

The cultural theory of risk is derived from the writings of Mary Douglas and colleagues (Douglas 1966; Gross and Rayner 1985; Rayner 1992; Douglas and Wildavsky 1982). This theory firstly formed to analyze the roles of social agents in pollution and environment management and to explain societal conflict over risk. Nowadays, the cultural theory of risk is most influential in anthropological climate change perception research. Perception of climate change risk is understood by surrounding culture and is shaped by either individual or collective cultural consensus of risky or hazardous event (Mcneeley and Lazrus 2014). This theory denotes the idea that social organization and institutional culture frame risks very differently on ground of social construction of meaning of risk.

Cultural theory of risk asserts that climate risk is framed followed by various worldviews. These views are social values and beliefs around climate change. It states that there are four opposite worldviews namely egalitarian, hierarchist, individualist, and fatalist that perceive climate change differently from different social experience (ibid). People's perception of climate change vary from place to place, from time to time on ground of social context (Spickard 1989; Rayner 1992; Bellamy and Hulme 2011). This is relevant

with what Wolf (1982) said that culture is dynamic and emergent. Mcneeley and Lazrus (2014) added the conception of myths of nature to make the perception of climate change as multi-dimensional. Myths of nature describes about the interaction between society and nature. This term is best helpful for assessing belief, custom and ritual from superstition in terms of climate change perception (Thompson et al. (1990).

Climate change is a multi-scale problem which solution is rarely simple that requires a continuum of multiple voices and perspectives on environment possessed by local community people who are affected by it. But sometimes, group of people with different interest in perceiving risk especially in climate change may produce mismatch. For example, in a local community of Bangladesh, there are many people living with different interest who perceive climate change from their own socio-cultural background that can promote conflict of interest. Their views on climate change can different from each other. A farmer's perception of climate risk may differ from school teacher, because of livelihood dependency on nature, social status, range of social interaction and reference group in the community. The cultural theory of risk exactly identifies these conflicts derived from mismatched views on climate perception.

The process of risk assessment in cultural theory of risk is distinct from traditional quantitative views of risk that frame risk as possibilities of extreme events through quantification, and information is transferred from producers to receivers (Rayner 1992). Cultural theory of climate change perception encompasses three structures;

Individualist: These group of people are self-centered believe competition for key to success. Examples are businessmen and corporate personality strive for success through competing each other. Individualists perceive their own risk to climate change instead of collective or communal understanding of risk. Worldviews that this group possesses is low grid with relative weaker social relations with other. The connected myth of nature and their belief is that nature is benevolent having capacity to adjust to all kinds of human activities either detrimental or beneficiary for the nature. Their perception of climate

change is related with the arguments of Dunlop (1993) about the capability of natural environment to heal climate change by itself with the passage of time.

Hierarchical Bureaucracy: This process prepares framework for risk perception toward climate change. The Bangladesh Climate Change Trust, Department of Environment, are examples of hierarchical bureaucracy who formulate policy for the local people. The hierarchy bureaucratic worldview is high group with strong institutional bond but lack of harmony and consistency. This group believe that climate is governable through proper steps and is capable to tolerate human interventions in some degrees.

Egalitarian group: Egalitarian part are mainly local inhabitants who believe in mutual cooperation and collaboration instead of rigid competition. This group views climate change as a threat to all people living in the community and endeavors to adapt to adverse effect of climate change through a branch of collective measures. This group makes decision on collective communal consensus prioritizing social needs. In the context of Bangladesh, majority of the affected people form this group having poor impact on the policy made from top-down approach. People of this group have sympathy to nature and believe that nature has limited endurance capacity against human excessive interventions.

Table 4.1 Nature Myths about Climate

Group	Perception about Climate Change	Perception about Nature
Individualist	Climate system is favorable to humans; will always find its equilibrium on its own	Human being have supreme authority to exploit nature for their own wellbeing
Egalitarian	Climate system lies in a delicate balance; human insult can lead to collapse	Nature is mother and should be used with sustainability

Hierarchist	Climate system is controllable to a certain degree; climate risks not trivial, however, to manage for equilibrium we need better predictive capabilities	We should better utilize nature in formative way
Fatalist	The climate system is inherently	Nature is unpredictable

Originally Hulme (2010). Adopted from Mcneeley and Lazrus (2014) with slight modification as per understanding of the present study

Present study will take helps from this theory to identify key barriers to climate change adaptation, and to explore about the factors that influence the perception of climate change.

Cultural Ecology, Environmental Determinism and Possibilism

Ecology is a biological term that express the interaction of living organism to each other. Ecology indicates the relationship among species of natural environment. Cultural ecology is derived from the biological term by Julian Steward in 1930s and 1940s which talk about human interaction with natural environment. As a theoretical approach, cultural ecology focus on survival through explaining causal relationship among living organisms in the environment. Facets of cultural ecology are still relevant in ethnoecology and ethnoclimatogy (Tucker 2013). In biological term, ecology focus on physical environment to adapt to changes. But, cultural ecology denotes the idea that culture adapt to changes in the environment. Adaptation takes various form as environmental change is unpredictable and take new direction with the course of time.

Steward talks about culture core which focus on the ability of culture to adapt to change. The culture core is comprised of knowledge, technology, labor and family who collect resources from environment for the survival (Tucker 2013). Steward then talked about cultural behavior that regulate human activities to dominate nature. Main proposition of cultural ecology theory is that culture is changeable with the changing environment. It interprets practices that help human being to adapt to change. For example, traditional people of Chittagong Hill Tracts use their cultural knowledge for subsistence activities. It

views human culture having evolutionary power to change with the environment. It helps local people to identify beneficial tasks for environment, and to change survival techniques through better utilization of natural environment emerged from indigenous knowledge.

Cultural Determinism is the idea that behaviour, attitudes, and values are the product of cultural factors rather than biological factors (Oxford Reference 2020). It is a long debate in anthropology that which molds human behavior; nature or nurture. Cultural determinism support that nature is governed by human behavior, belief and practices. It also acknowledge cultural compromise to capricious behavior of nature in some respects. Cultural determinism argues that human culture and behavior control environment. On the other hand, environmental determinism asserts that environment molds human belief and culture, and culture need to adapt as environment changes.

Environmental determinism asserts that environment and physical geography shape human thought, belief, and practices. For example, beliefs, customs, rituals, and practices of people living in Chittagong Hill Tracts are different from plain people. Climatic determinism is derived from environmental determinism which think that not environment but climate shape human behavior and practices in the locality. Environmental possibilism or cultural determinism views that environment is changing by nature and it has components that make human able to adapt. For example, human ability to adapt to scorching heat through using umbrella or local *Mathal* and air conditioning technology. Environmental possibilism or cultural determinism tries to mitigate climate impacts and vulnerability by identifying proper adaptation measure through improving human capacity and resilience.

Political Ecology

Originating from the writing of Frank Thone in 1935, the political ecology theory flourished again through Wolf's writing in 1972. It is one of the influential theories that discuss about interplay of environment, socio-political and economic factors. Political ecology explores how political power, factionalism, crisis, rules, regulation and state policy

affect local environment and climate. Political ecology has taken core ideas from cultural ecology as Walker states, “whereas cultural ecology and systems theory emphasize adaptation and homeostasis, political ecology emphasize[s] the role of political economy as a force of maladaptation and instability” (2005, p. 74).

Political ecology has some dimensions (Bryant and Bailey 1997):

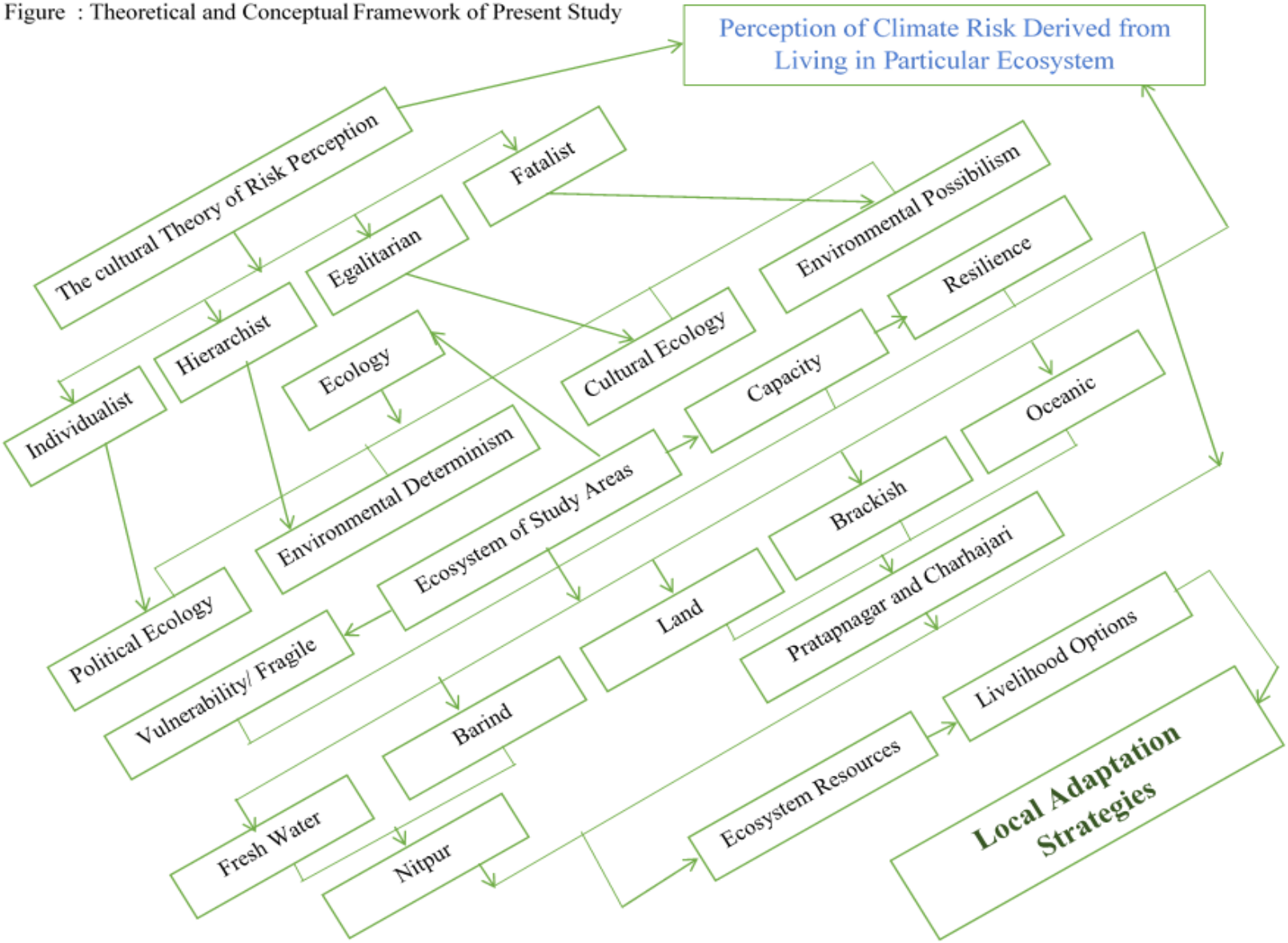
A) Environmental change has unequal impact on society. So, cost-benefit related with climate change is unequal as socio-economic and political system absorb the shocks differently from different experience.

B) Unequal division of impacts further minimize the gaps in economic and social spares. Political ecology influences political economy because any change in environment inevitable impact political and economic situation (Bryant and Bailey 1997).

Present study uses political ecology to inform policy makers about the impacts of climate change local environment has been encountering through the years with a view to better governance of the local ecosystem. This study aims to account decisions that local community takes for adaptation strategies under the regime of changing climate and political pressure.

With the course of time, two groups of anthropologist formed on the debate of political ecology; one group emphasis on political/ economic spheres and another on ecological aspects. First group (lead by Watts) seeks to explore about the impacts of politics on access to natural resources (Paulson, et al 2003). Instead of more focus on political impacts on ecology, Vayda and Watlers (1999) propose to focus on human response to ecological change with political reaction.

Figure : Theoretical and Conceptual Framework of Present Study



(Author Illustration)

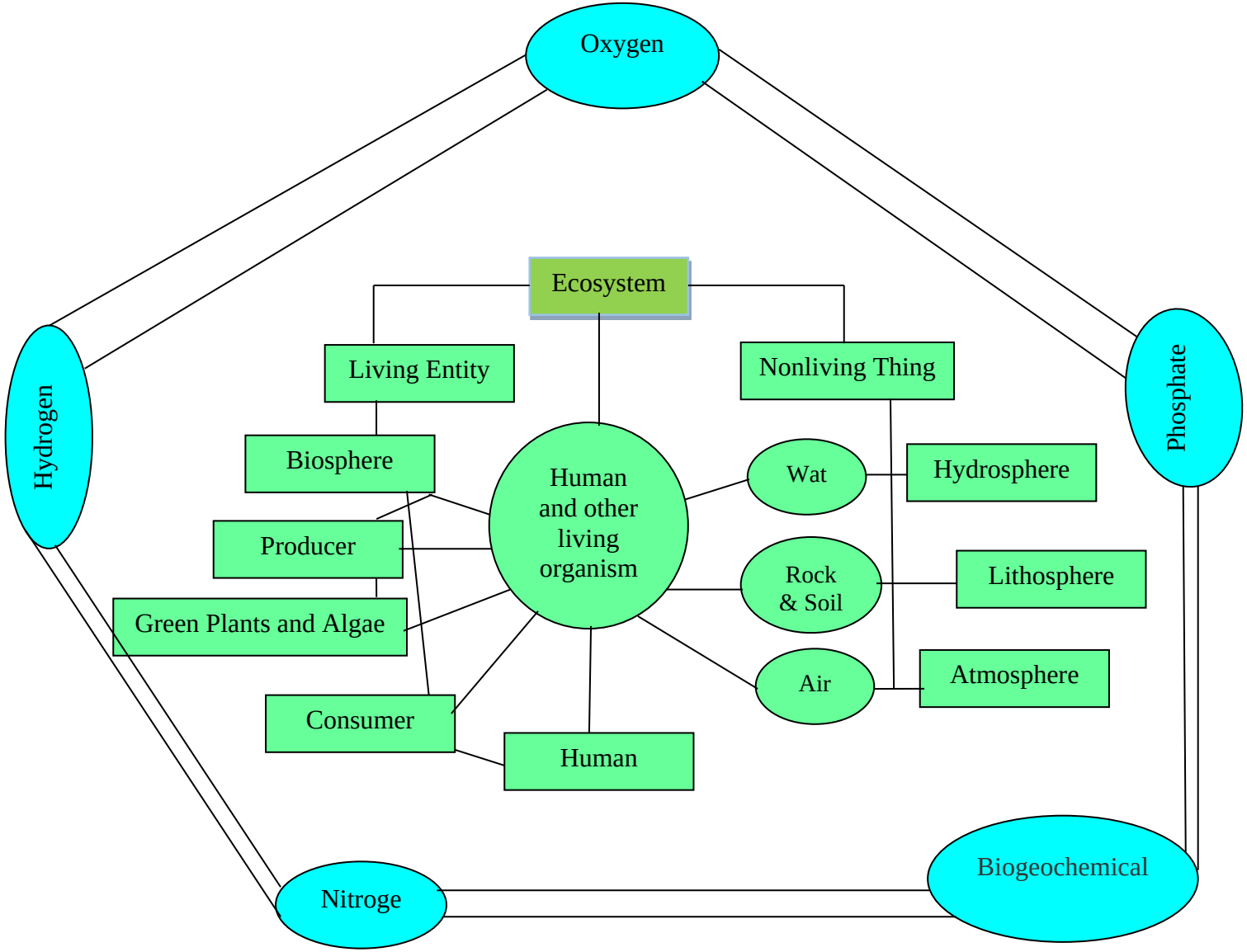
Conceptual Framework

Ecosystem

Ecosystem refers to the condition where living things, nonliving materials, other components of natural environment coexist. It encompasses all living things like human, plants, animal, bipedal living organism, and nonliving things like water, temperature, wind, moisture, precipitation, etc. From the perspective of present study, ecosystem indicates a state where all these things co-exist and interact with each other in systematic way. Ecosystem destruction happens when natural cycle is interrupted by external force like humankind and internal force like volcano (Alexander and Fairbridg, 1999). In narrow sense, ecosystem designates a complex system where more than two things interact with each other in harmonized way. It may be human stomach, a lakes or pond or small land. Large-scale ecosystem represent a great region where small-scale ecosystem shows a tiny region that also shelter many living and nonliving organisms (Schoener, 2009).

Bangladesh has an incredible biological system as its floodplains structure one of the world's most significant wetlands. These wetlands are home to several types of extraordinary plants, fish, winged creatures and other natural life. Individuals of Bangladesh are likewise reliant on these wetlands. These wetlands give basic natural surroundings to relocating winged creatures and in particular a wellspring of earning and nourishment for many individuals in Bangladesh (Redwan, 2009). The floodplain fishery assumes an imperative job in padding provincial neediness and providing creature protein to poor people and is an essential piece of the way of life and way of life of the many ethnic people. Considering the overall biological and topography of Bangladesh land, there are three broad kinds of ecosystem;

- Aquatic Ecosystem
- Soil Ecosystem
- Forest Ecosystem



(Source: Author illustrated)

Aquatic Ecosystem

Bangladesh is a country of river having 300 waterways. Adjacent to, bunches of rivers exist in land region. Again it's situated by the side of Bay of Bengal. That implies Bangladesh has a rich oceanic environment. We can separate sea-going atmosphere of Bangladesh into two:

- Marine Ecosystem
- Freshwater Ecosystem

Brackish and Oceanic Ecosystem

The area of the landward limit of the seaside zone is a component of three fundamental geophysical procedures: tidal variances; saltiness; and hazard for cyclone and tempest floods. The seaside zone of Bangladesh, influenced by these procedures, covers a territory of 47,201 km, or 32% of the nation, being the landmass of 19 areas. Around 35 million individuals, speaking to 29% of the populace, live in the seaside zone. A large number of the waterfront occupants are poor, and the population is presented to both cataclysmic events and man-made perils. Environmental change and sea level rise, incited by an global worming, likewise bargain the natural solidness of the waterfront zone (Ali et al 2002).

The coastline is 710 km since a long time ago, made out of the interface of different natural and financial frameworks, including mangroves, estuaries, islands, accumulated land, sea shores, a landmass, urban and modern territories, and ports. The mainland rack arrives at an expansiveness of 350 nautical miles. It is described by low saltiness; transcendently sloppy, sandy or sloppy sand base conditions and high freshwater and silt release. Up until this point, 475 fish types of 133 genera, 5 spp. of marine turtles, 24 shrimp spp. of 5 families, 50 spp. of crabs, 301 spp. of marine mollusks, and somewhere in the range of 20 spp. of ocean growth have been recorded here. In any case, the biology and conveyance of a large portion of these species are practically obscure (Ahsan 2013).

Image 4:1: Oceanic and Mangrove Ecosystem in Shymnagar Upazila

(Selim n. d.)

Lentic water biological systems (standing water) spread around 3% of the beach front zone territory. In mix with lotic water frameworks (running water), they bolster a very rich and assorted fish fauna: 260 species of indigenous freshwater, hard fish having a place with 145 genera and 55 families have been recorded up until now. Moreover, these biological systems bolster an extremely enormous population of economically significant freshwater shrimp.

Freshwater Ecosystem

Bangladesh is a place where there is rivers, lakes, and ponds. It was in excess of 300 waterways and bunches of lakes. So it has an enormous freshwater biological system. We can separate freshwater ecosystem of Bangladesh in three fundamental sorts:

- Lentic: sluggish or stable water, including ponds, lakes.
- Lotic: quickly moving water, for instance streams and rivers.
- Wetlands: territories where the dirt is immersed for some portion of the time.

Wetlands is the largest portion of Bangladesh ecosystem. The haors in the north-eastern part of Bangladesh are likely the most regularly immersed wetlands. They switch between an immense bowl of water during the rainstorm and a very much organized arrangement of littler wetlands incorporating beels and khals in the mid year. The haor bowl is known for its rich biodiversity. There is little uncertainty that the regularly immersed wetlands are among the most gainful ecosystem. Among the entire haors the Tanguar haor has been announced a Ramsar site and an Ecologically Critical Area. The biggest haor in the nation is Hakaluki Haor, which reaches out over 18,000ha during the blustery season, and comprises of more than 80 between associated beels. The rich fish assets of Hakaluki bolster one of the biggest inland fisheries in the nation. Tanguar is a significant "mother fisheries territory", where numerous species breed during the stormy season (Minar 2013).

Soil Ecosystem

Before thinking about the dirt biological system we should think about what is soil. Soil is the result of life form and atmosphere following up on rocks. It is a cozy blend of minerals, natural issue, and life forms. Numerous sort of living beings (for example plants, microorganisms, vertebrate and invertebrate creatures) are a piece of soil environment. Plants are a definitive wellspring of carbon, which is a basic auxiliary segment of soil and source vitality powering the procedures that happen with in the soils. Understanding the job of the soil in the ranch environment, realizing how to deal with the land, are basic and troublesome errands confronting the natural rancher (Khan 2015).

Soil ecosystem of Bangladesh alludes to the smaller scale creatures live in the soil and how they associate themselves. In undisturbed soil, leaves and other natural flotsam and jetsam amass on the where they separated by the decomposers. Oxygen consuming microbes and certain little creatures start the procedure. These living beings are joined by growths, bugs, springtails, little creepy crawlies, different arthropods and night crawlers help the procedure by devouring, blending and moving materials. Organic movement is most noteworthy when the dirt is worm. Rhizophere creatures like plants roots release or radiate countless natural substances and persistently bog off root tops into the dirt. The most gathering of bigger soil life forms are worms. Worm plays out the last assignment of preservation the transformation of disintegrated natural issue to stable human colloids. During the time spent acquiring, worms blend the subsoil in with the topsoil and store their supplement rich castings on or approach the dirt surface. The nearness of an enormous night crawler populace shows great soil fruitfulness. Bugs are the most plentiful of the dirt arthropods. Most parasites are valuable, benefiting from miniaturized scale living beings and other little creatures (ibid).

Forest Ecosystem

A forest ecosystem is a characteristic unit comprising of plants, creatures and smaller scale living beings in backwoods zone and capacities together with all of non-living physical

variables of nature. Intelligently, trees are a significant part of woodland look into yet the wide assortment of other living things and abiotic segments in many backwoods implies that different components, for example, natural life or soil supplements are regularly the point of convergence. Among various forest ecosystem of Bangladesh, Sundorban is major. The Sundarban, covering around one million ha in the delta of the waterways Ganga, Brahmaputra and Meghna at where it converges with the Bay of Bengal, is the single biggest square of tidal halophytic mangrove timberland on the planet shared between Bangladesh (62%) and India (38%), which bolsters a huge, biodiversity-rich interesting biological system. With its variety of trees and untamed life the timberland is a show-stopper of characteristic history. It is additionally a focal point of financial exercises, for example, extraction of timber, angling and assortment of nectar. The zone of Sundarban encounters a subtropical monsoonal atmosphere with a yearly precipitation of 1600-1800 mm and extreme cyclonic tempests. Colossal measure of dregs conveyed by the three waterways add to its development and elements. Saltiness inclinations change over a wide scope of spatial and transient scales. The Sundarban is crossed by an unpredictable system of tidal conduits, mudflats and little islands of salt-tolerant mangrove woods, and presents an amazing case of progressing natural procedures. The region is known for its wide scope of greenery. The most well known among these are the man-eating Royal Bengal Tigers, however various types of winged creatures, spotted deer, crocodiles and snakes additionally possess it. The mangroves have been broadly misused over hundreds of years for timber, fish and prawns, nectar, feed, or changed over for paddy and aquaculture and now it faces the genuine difficulties for its reality. Javan rhino, wild bison, hoard deer, and woofing deer are as of now wiped out from the region. While preservation endeavors have concentrated on untamed life, especially tiger, through making of a few havens and a biosphere hold, diminished freshwater inflows are a genuine risk as saltiness is rising. Heritiera fomes (from which Sundarban infers its name), Nypa fruticans and Phoenix paludosa are declining quickly.

Image 4:2: Lauchara Reserve Forest

Source: Unknown

However, present study is conducted in three sites with different ecological background. Charhajari union of Noakhali district is situated in coastal belt of southeastern Bangladesh. This place have fresh water, riverine, and brackish ecosystem with numerous hydro and land species. Nitpur of Naogaon district situated in Barind ecosystem with *Beel* biodiversity. On the other hand, Pratapnagar union of Satkhira district is located in a complex ecosystem featured by coastline, distant mangrove, fertile land ecosystem for mango production, and diversified riverine and brackish ecology.

Weather, Climate and Climate Change

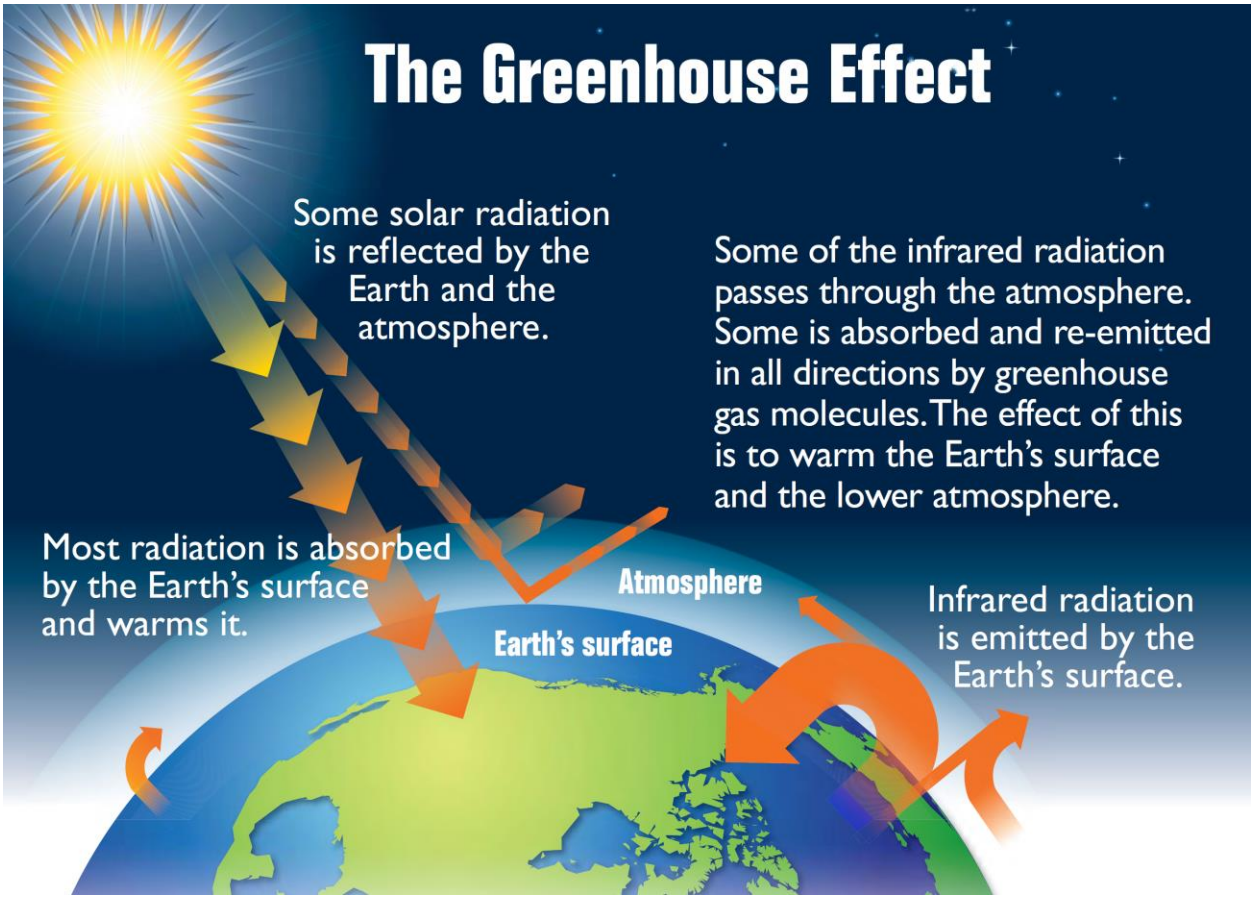
Present study views that, weather is the daily condition of precipitation, wind, temperature, sun-heat, humidity, and cloudiness, while climate is the mean state of this components of weather in particular place. Climate change is the change in the mean state of climate over years. Present study takes a timeframe of above 30 years to observe climate change.

Climate is frequently characterized as the normal condition of temperature, precipitation, wind, and water. A progressively explicit definition would express that climate is the mean state and changeability of these components over some all-inclusive timeframe. What's more, as weather changes from every day, so too does climate fluctuate, from day by day-and-night cycles up to times of geologic time a huge number of years long (Jackson, 2018). IPCC defines climate change as change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity (cited in UNFCC 2011).

Frequently environmental change alludes explicitly to the rise of global temperatures from the mid twentieth century to date (National Geographic Society 2019). Climate is here and there confused with weather. Be that as it may, climate is not quite the same as weather since it is estimated over an extensive stretch of time, while weather can change from every day, or from year to year. The climate of a territory incorporates average of temperature,

precipitation, wind and water. Different place have different climate followed by local weather. A desert, for instance, is alluded to as a parched atmosphere since little water falls, as downpour or day off, the year. Different sorts of climate incorporate tropical climate, which are sweltering and muggy, and mild atmospheres, which have warm summers and cooler winters.

Image 4:3: Climate Change Process



(Global Dimension 2018)

Vulnerability

Vulnerability refers to a situation which is susceptible to experience various types of environmental, climate and manmade hazard with limited capacity to cope with. This term has multidimensional aspects. Present study uses the term to indicates situation that is fragile to receive climate change induced hazard and disaster. This study exploits the term

from anthropological critical perspectives; each individual vulnerability story and sufferings around it is unique, community share a common vulnerability story in terms of massive impacts of climate change, social vulnerability has large scale impacts, factors associated with economic vulnerability, geophysical and ecological vulnerability produces basic susceptibility, religious affiliation generates different sort of experience in climate change regime, social construction of gender ascribed gender role, and age provides both opportunities for adaptation and threat for vulnerability on ground of range.

Adger (2006) defines vulnerability as a state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt. According to United Nations, 'vulnerability is a measure of the extent to which a community, structure, service or geographical area is likely to be damaged or disrupted, on account of its nature or location, by the impact of a particular disaster hazard' (United Nations 1997).

Vulnerability is the human component of catastrophes and is the consequence of the scope of monetary, social, cultural, institutional, political and mental elements that shape individual lives and the condition that they live in (Twigg, 2004). Vulnerability can be a moving idea to comprehend in light of the fact that it will in general mean various things to various individuals and in light of the fact that it is frequently depicted utilizing an assortment of terms. A few meanings of vulnerability have remembered presentation for exposure to shock. Regardless of some uniqueness over the significance of vulnerability, most specialists concur that understanding vulnerability requires more than examining the immediate effects of a disaster. Vulnerability likewise concerns the more extensive natural and social conditions that cutoff individuals networks to adapt to the effect of risk (Birkmann, 2006).

Vulnerability isn't just about destitution, yet broad research in the course of recent years has uncovered that it is commonly the poor who will in general experience the ill effects of debacles (Twigg, 2004; Wisner et al., 2004; UNISDR, 2009). Poverty is both a driver

and result of catastrophe hazard (especially in nations with frail hazard administration) in light of the fact that economic scarcity force individuals to live in dangerous areas (see introduction) and conditions (Wisner et al., 2004). Poverty and the other multi-dimensional components and drivers that make vulnerability imply that fragility to the effects of disaster is regularly, yet not generally, related with specific group, including women, kids, the older, the crippled, vagrants and migrated population, among others.

Furthermore, vulnerability is controlled by verifiable, political, social and institutional and common asset forms that shape the social and natural conditions individuals wind up existing inside (IPCC, 2012). These procedures produce a scope of quick risky conditions, for example, living in hazardous areas or in poor lodging, sick wellbeing, political strains or an absence of nearby establishments or preparing measures (DFID, 2004).

Climate Change Adaptation

Present study views that climate change adaptation is a set of strategies, actions, measures and policies that are taken to adjust to shocked produced by climate change impacts. Adaptation is the planned or unplanned response to impacts of global climate change on local communities. Climate change is a global phenomenon where developing, marginal, and underdeveloped country have less influence. Comparatively poor nations have to deal with climate change adaptation instead of mitigation because of their little engagement in causing climate change and high exposure of climate shocks. Industrialized and developed countries emit greenhouse gases responsible for global warming and climate change. Nevertheless, country like Bangladesh has to pay for climate change. So, for minimizing loss and damage, there are no alternatives for these countries except adaptation to climate challenge.

Bangladesh has already experienced devastating impacts of climate induced hazard and disasters in the last decades. Hence, adaptation strategies are multidimensional ranging from proactive to reactive, small scale to large scale, short term to long term. “Adaptation is adaptation in natural or human systems in response to actual or expected climatic stimuli

or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC TAR, 2001a)". UNDP defines it as a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented (UNDP, 2005).

Adaptive Capacity

In a broad categorical sense, adaptation has two types; successful and unsuccessful. There are some components that make adaptation successful, for example, financial capacity, resources adequacy, social network, and healthy ecosystem capable of supplying alternatives materials. These socio-economic and political components make adaptation successful and sometime futile. Present study internalizes adaptive capacity as the ability of a community to adapt to impacts with the combination of economic resources, social assets, ecological materials, and political support. IPCC defines adaptive capacity as the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC TAR, 2001a).

Conclusion

Theories and key concepts that are used in present study have been explored in this chapter. Current study endeavors to elaborate these concepts from the understanding of knowledge that is generated by local communities of study areas. It tries to use these terms and concepts for backing up findings with an extensive effort to produce new ideas about climate change in Bangladesh.

Chapter 5
Place and People

Introduction

This study emphasis on in-depth fieldwork to collect authentic data with a view to picking up local perception on climate change. Experience of climate change subsequently varies from place to place on ground of socio-economic status of the people. Present study targets to intermingle all voices of society regarding climate change impacts and adaptation. For this reason, it included people from various socio-economic background which is being explored in the current chapter.

Selection of the Study Area

Intensive fieldwork tradition characterizes anthropological research as distinct capable of generating findings that is more valid and justifiable. Present study extended its perseverance to conduct in-depth fieldwork through getting in touch with local community. Considering the tradition of research in anthropology, field selection is top most important in producing empirical outcome. Undertaking proper process of field selection in anthropology with prime concern, present study had selected three study areas; Charhajari union of Companiganj upazila in the district Noakhali, Pratapnagar union of Assasuni upazila in the district Satkhira, Nitpur union of Porsha upazila in the district Naogaon.

Before selecting study areas, current study center its focus on two things; a) ecosystem and ecology, b) climate change impacts and vulnerability. On ground of these two selection criteria, the above three unions were selected. Charhajari was selected for its geographic location in sea delta, complex riverine ecosystem, and history of climate impacts in the last decades. Assasuni was selected considering various issues; location in coastal belt, saline and brackish ecosystem, and experience of wining over climate induced disasters. Charhajari and Pratapnagar union belong to aquatic ecology while the other study area namely Nitpur lies in Barind ecosystem selected for drought, water scarcity, different land zone and ecosystem. These three study areas' story of climate change impact, vulnerability and adaptation are quite different basing on the interaction with surrounding environment

and particular ecosystem. Maiden reason for selecting three regions is to generate findings from the prism of critical sense.

The Study Area: Place and People

Charhajari Union of Companiganj Upazila

Companiganj, the third smallest upazila of Noakhali in regard of populace appeared in 1888 was moved up to upazila in 1984. It is said that during the British Period, this territory was formed into a commerce focus (which means Ganj). East India Company used to call seagoing vessel at the Companiganj port for sending out salt fabricated here at a huge amount. It is by and large accepted that the upazila may have been named Companiganj from the previously mentioned two words Company and Ganj. The upazila involves a territory of 380.95 sq. km. It is situated somewhere in the range of 22º37' and 22º54' north latitudes and somewhere in the range of 91º10' and 91º31' east longitudes. This upazila is surrounded by Dagan Bhuiyan upazila of Feni zila and Senbagh upazila in the northern part, Sonagazi upazila of Feni zila in the eastern part, Sandwip upazila of Chittagong zila in the southern part and Noakhali Sadar upazila in the west side (BBS 2013).

Charhajari is one of the unions of the Companiganj upazila which once was a char land evolved from Small Feni River. Charhajari union has a size of 3637 acres with a dividing canal in northern part and a river in eastern part. Charhajari union is bounded by Charparbati union in the north, Sonagazi upazila of Feni zila in the east, Bashurhat Pouroshova in the west, Musapur union in the south. Present study identified major social resources in the community;

According to the information obtained from the local people of Charhajari union the resources of this territory are as follows:

- Natural Resources: River, canal, land, trees.

- Social Resources: School, *madrasha*, *maktob* (religious school for Muslim children), fishery set, pond, *dighi*, tube well, market, mosque, temple, Pucka road, mud road etc.

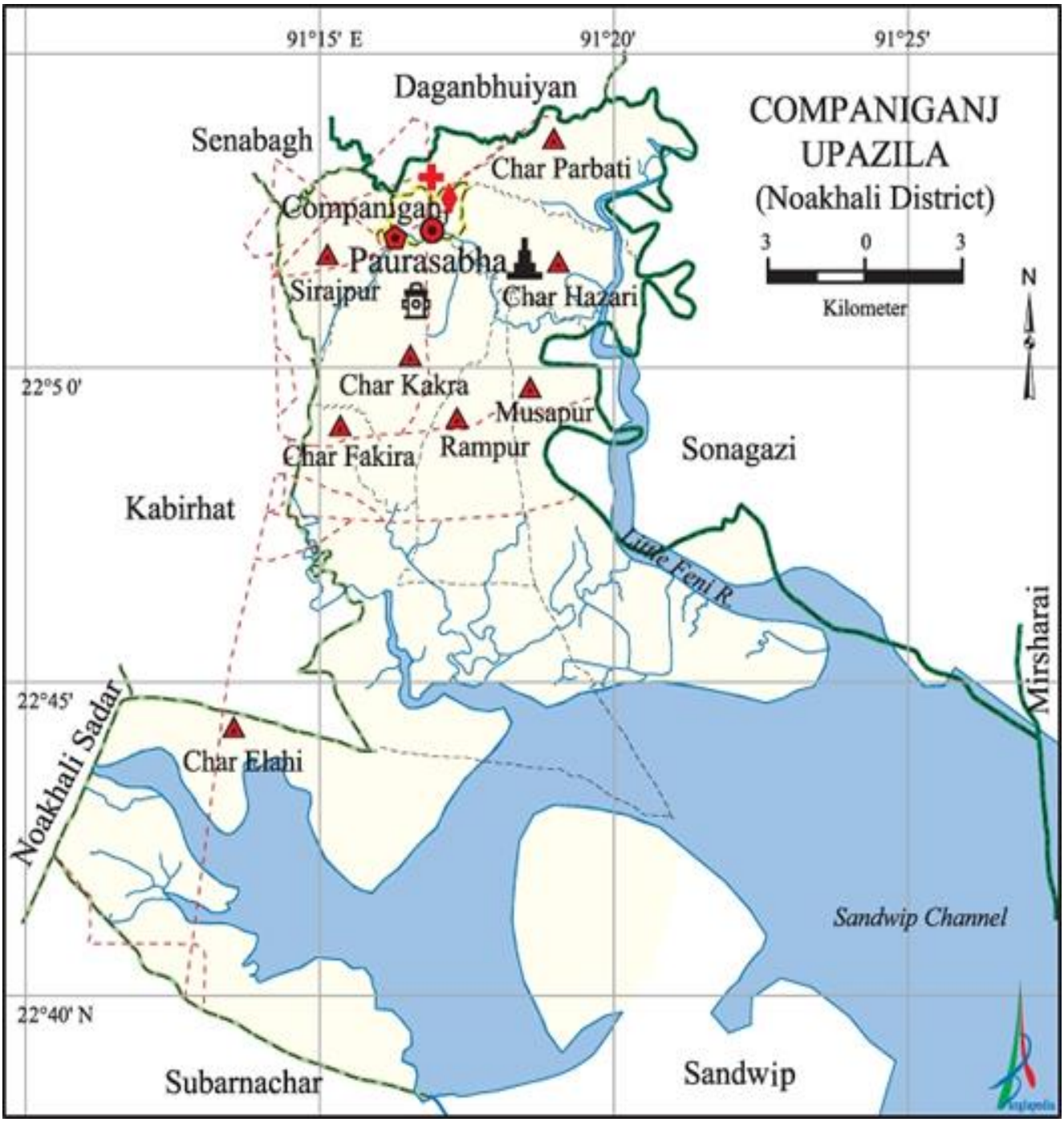
- Private Resources: Land, house and buildings, cattle, bicycles, motorcycles, gold, home furniture such as chairs, tables, cupboards, showcase, box, bed, brass; equipment used in the production, such as agricultural machinery, plow, yoke , tractors, power tillers, shallow machine, fishing net, current net, weeder, boat etc. Living materials, such as auto rickshaw, rickshaw, van, motor van, tractors, trolley etc.

- Government Resources: Roads, dams, poll –culverts, *upazila* health center, police station, *Upazila* Council, union council, cyclone centers, health centers, educational institutions and so on.

Map 5.1: Noakhali District

(Banglapedia 2014)

Map 5.2: Companiganj Upazila

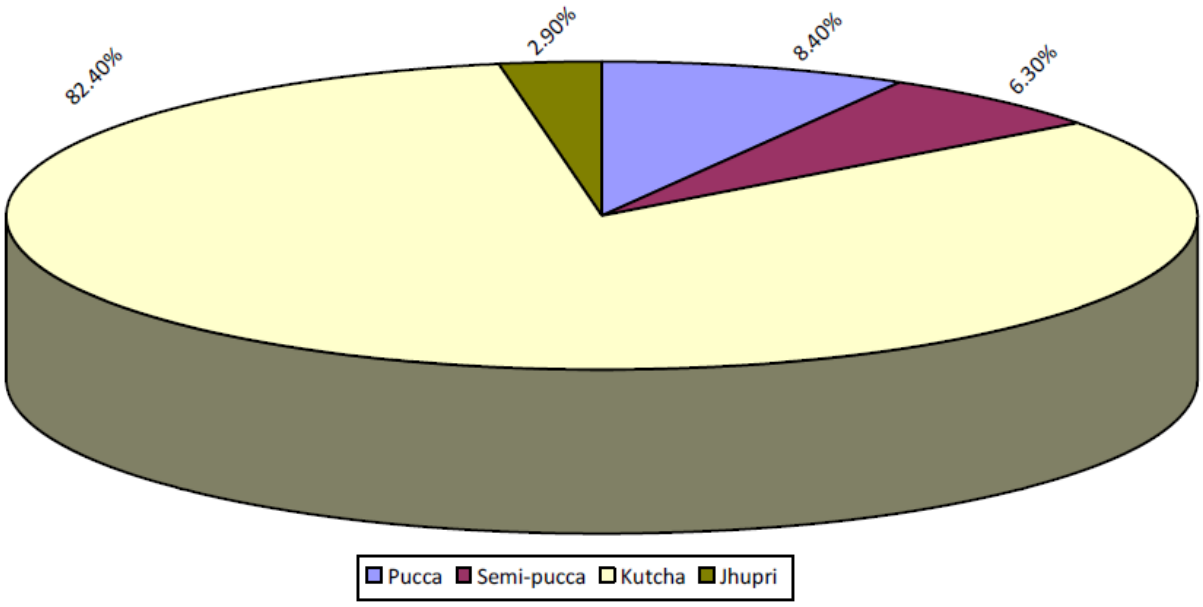


(Banglapedia 2014)

House and Household

There are 49015 households in the Companiganj upazila where 120000 male and 130000 female live together that comprises a total of 250000 population in the upazila. The average household size is 5.1 persons. Average household size for the study participants is 5.3. Among 49015 household in the upazila, 8.4% percent live in pucca house, 6.3% live in semi-puca house, 82.4% percent live in kutcha house and rest live in 2.9% in jhuri (BBS 2015).

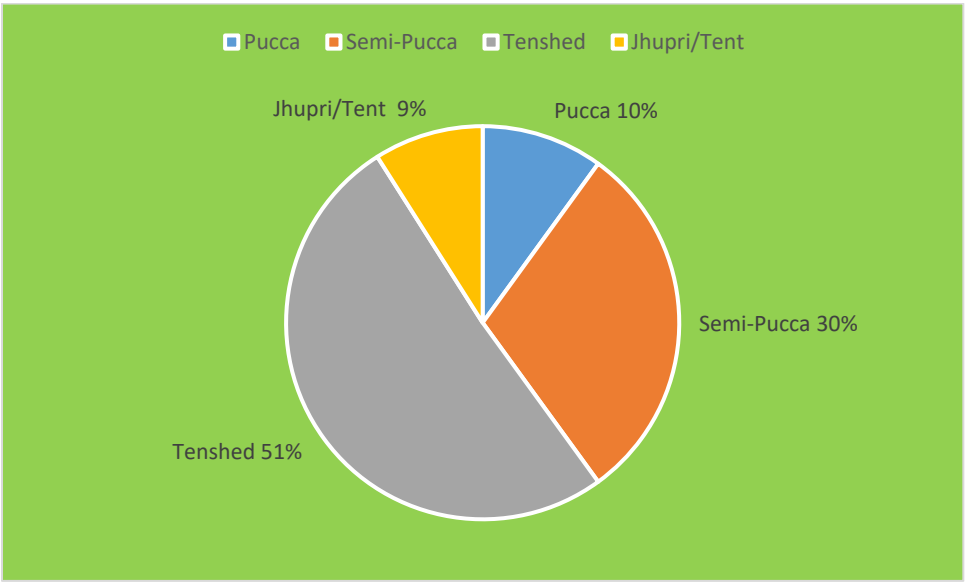
Chart 5.1: Housing Pattern in Companiganj



(BBS 2015)

House of the study participants living in Charhajari union are mainly ten-shed. Tin shed predominates housing pattern in riverside and char lands of the locality (chart 5.2). Wall and roof of the house in case of tin shed is made from tin with mud or cement floor. 30% of the respondents dwell in semi-pucca house where roof is made from tin but wall and floor is brick or cement made. Only 10% respondents live in pucca house with modern facility. These people are mainly rich farmer and service holder who have secured income and earning options.

Chart 5.2: Housing Pattern of the Study participants in Charhajari

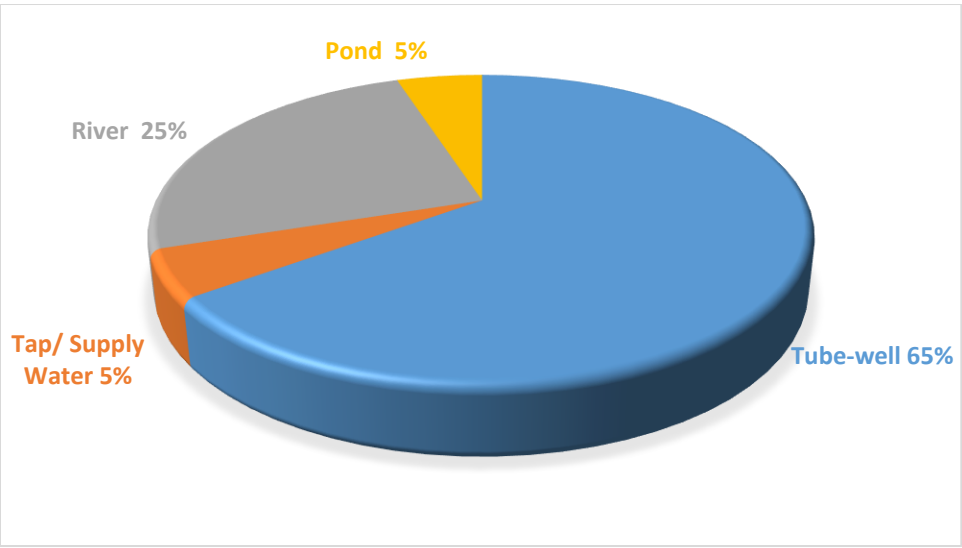


(Fieldwork 2018)

Water, Sanitation and Hygiene Practice

People of the Companiganj upazila mainly use (92.5%) tube-well water for drinking and other household purpose. Only 0.9% uses water from tap and the rest 6.6% households collect water from other sources (BBS 2015).

Chart 5.3: Drinking Water Source of Study participants in Charhajari

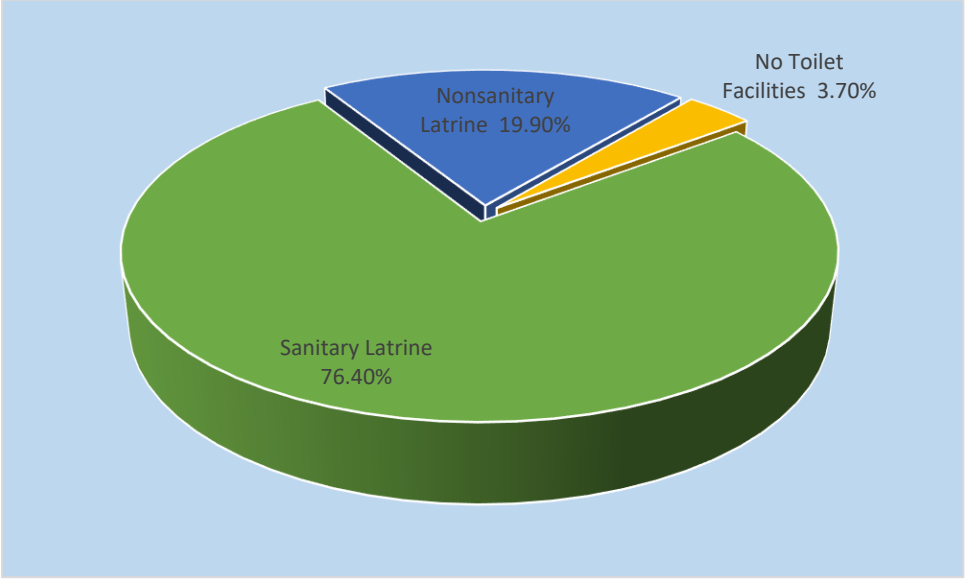


(Field Work 2019)

Chart 5.4 shows that majority of the respondents (65%) drink water from tube-well. It should be mentioned that most of the tube well in Charhajari union are normal in depth having less than 100 foot. Although, there are some deep tube-well installed by government initiative through the supervision of union council. People who live in riverside slum/ tent in Charhajari use tap water. A good number of respondents use river water for drinking purpose.

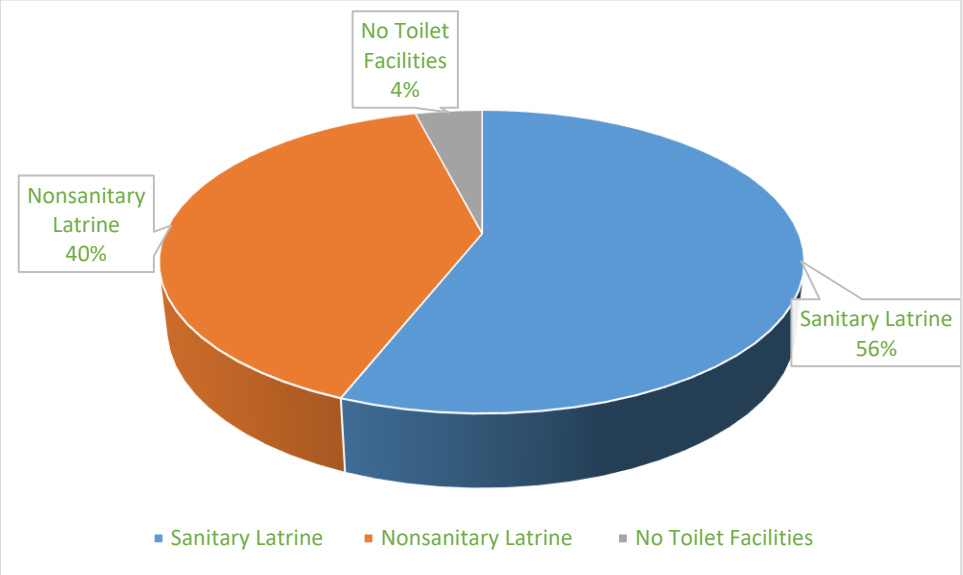
Chart 5.5 shows that people of Companiganj upazila are tent to be hygienic. 76.4% people dwelling in the upazila have practice of using sanitary latrine while 19.9% use non sanitary traditional toilet. 3.7% people of the upazila have no toilet facilities at all who defecate in the open environment.

Chart 5.4: Sanitation Practice in Companiganj



(BBS 2015)

Chart 5.5: Sanitation Practice among the Study participants in Charhajari



(Fieldwork 2019)

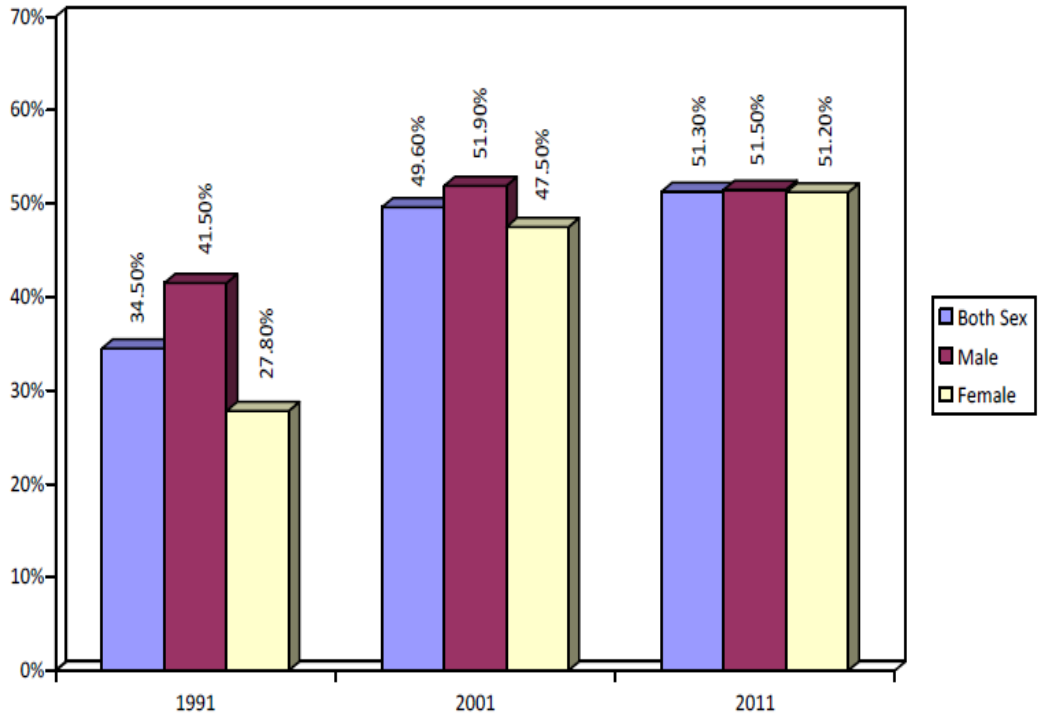
Fifty-six percent respondents report that they have practice to use sanitary toilet after defecation and they also report to wash their hands with soup. Forty percent respondents said that they do not have sanitary latrine facility and they defecate in traditional non sanitary toilet made from trees branch. They also said that they wash their hands after using toilet with mud of ashes. Four percent study participants report no facility of toilet facility.

Companiganj is a coastal upazila which have many remote char lands with limited electric facility. BSS (2015) reports that all the eight unions of the upazila have electric facility. People of Charhajari union consume electric facility although majority of the respondents report power failure or load shedding during summer seasons. People who living in river did not have electric facilities before two years. Now, these people are getting this facility despite living outside embankment and remained unprotected to various climate change induced hydraulic hazard.

Education and Literacy

In Companiganj upazila, 51.3% people who are 7 years and above are literate reported by BBS (2015). Chart 5.6 shows a comparative trend in literacy rate in Companiganj upazila. Literacy rate is increasing in the upazila as it was 34.50% in 1991 and swells up to 51.30% percent in 2011. While dramatic uplifting changes have been notice in terms of women literacy rate contrasting between 1991 and 2011, 27.80% to 51.20%. On the other hand, male literacy rate bumps up 2001 but dwindles in 2011. However, the overall literacy scenario in the upazila is increasing day by day and people are getting educated for various purpose.

Chart 5.6: Literacy Rate by Sex in Companiganj Upazila



(BBS 2015)

Women of Charhajari union are seems to be less active in attaining education and schooling as the chart 5.8 shows that 47.4 percent female of the union are literate while the rate is 51.20% for the whole upazila. The same scenario is noticed in terms of male literacy rate.

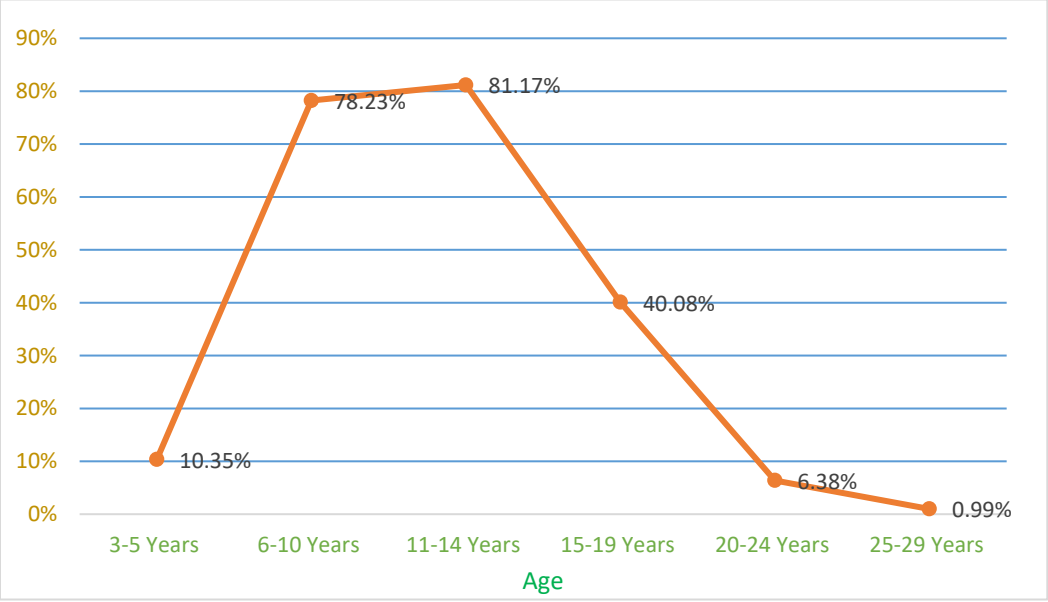
Table 5.1: School Attendance by Age Group in Companiganj

Sex	3-5 Years (%)	6-10 Years (%)	11-14 Years (%)	15-19 Years (%)	20-24 Years (%)	25-29 Years (%)
Both Sex	10.35	78.23	81.17	40.08	6.38	0.99
Male	10.24	77.52	78.94	42.73	11.34	1.89
Female	10.47	79.00	83.51	37.63	2.91	0.34

(BBS 2015)

Women have higher school attendance rate than their male counterpart in age group 6-10, 11-14 years, and this situation gets altered from the age groups 15 to 29 years where male school attendance rate is higher than women (table 5.1). Women have high rate both in school enrollment and dropout comparing to their male counterpart. Frustrating scenario of women school attendance comes at age 20 years that indicates women have low tendency and opportunity of higher education attainment.

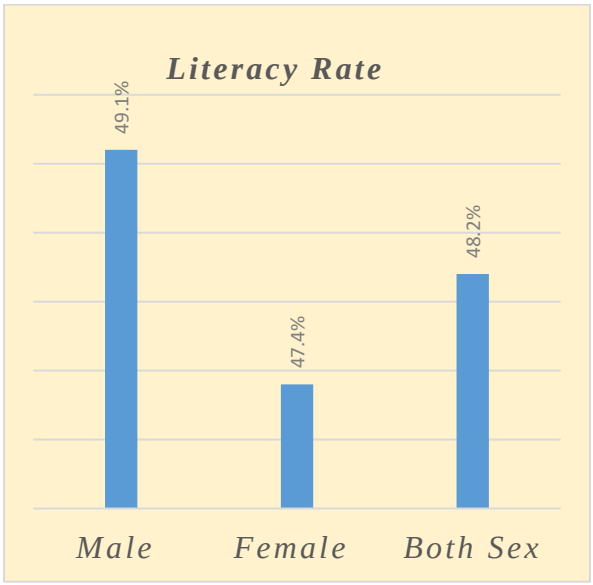
Chart 5.7: Trend in School Attendance in Companiganj



(BBS 2015)

Chart 5.7 shows that school attainment and formal schooling boosts up to the ages between 11 to 14 years, but starts to go down radically after fourteen years and reach at the bottom line when both male and female comes at ages 25-29 years old.

Chart 5.8: Literacy Rate in Charhajari Union



(BBS 2015)

Nature, Environment and Ecosystem

Charhajari is one of the coastal union at the edge of the Bay of Bengal with huge char land. The vegetation is restricted by and large to varieties having a place with the lower gangetic plane and of different areas in the southern part. But the Government supported afforestation program for the seaside belt, there is no sorted out ranger service in the union. Nonetheless, all residences are generally secured by thick and rich green foliage of wide assortment of trees. In the farmlands assortments of harvests to be specific neighborhood Hybrid and HYV rice, jute, vegetables, flavors, beats, oilseeds, and so on are produced. The vast majority of the trees developed in estate timberlands are organic products bearing. Mangoes, albeit poor in quality, develop in bounty. Almond or badam in curiously. Other normal trees are black berry, tamarind, *jalpai* (Elaeocarpus tectorius), *bel*, *chalta*, *boroi*, guava, and banana is seen all over the place however their quality is fairly poor. *Kamranga*, *ata*, *haritaki*, *amloki*, and so on develop liberally. Juice of *Gab* natural product blended in

with charcoal is utilized in shading vessels and hardening angling nets. Coconut is plentifully created in the union.

Indigenous timber trees incorporate *koroi, sheel koroi*, garjan, *jarul, shimul,* and so on notwithstanding, different colorful trees like teak, *mahagoni, sissu,* and so on have been in planted as wayside trees just as ranch ranger service. *Mandar*, a prickly tree for the most part utilized as fuel and fencing, is seen in pretty much every family unit backwoods. *Kadom* are exceptionally normal and are favored for assembling match stick. The product of *shimul or karpas* is utilized for stuffing sleeping cushions and pads and has a smooth appearance. Recently presented trees incorporate eucalyptus and pine are seen. Mango woods are bad as a timber, yet attributable to its being in bounty, it is quite utilized. The wood of tamarind and *kul* is hard grained and of good quality. The *amaltas* is utilized for house and harsh furnishings. *Jarul* is utilized for vessel building and mainstays of house. The rich development of palms is the most trademark highlight of the vegetation. *Supari* are increasingly more plentiful. Coconut are developed richly all through the region. Flavor palms or *tal* and date palms or *khejur* are additionally extremely normal. Date palm is a significant tree. The juice is extricated and made into *gur*, the leaves are made into tangle. *Tal* wood is utilized for posts of houses and other structure purposes, leaves are utilized for making enormous fans. *Supari* and *narikel* are the most important source of family income. Obscure trees incorporate banyan or *bat, pipal* and n*im.* There are a few assortments of stick, a great arrangement of bamboo of various assortments and covering grass or *chhan* despite the fact that their ranches are diminishing consistently. Utilization of bamboo is broad, for example, post and fencing of houses, creation of bins and plate of different sorts. In the swamps are found *sola* and *sitalpati* which is widely use making different sorts of mats and crates.

In any case, the accompanying warm blooded animals are still observed in the area in spite of the fact that their number is diminishing: jackel, fox, huge Indian civet or *bagdas*, *ottar or ud, lrrawaddy, kat biral,* Bengal mongoose or *beji,* diverse sort of rodents and a few types of bats. Practically all assortments of feathered creatures that are seen all over

Bangladesh are likewise generally observed in Charhajari. Raptorial winged animals incorporates lord shakun (Gyps bengalensis), lanner bird of prey or *baj*, swamp harrier or *gochila*, untouchable *cheel*, a few types of stork like lake heron or *kani boga*, steers egret or *boga* and black bittern or *kala boga* (Dupeter Plovicollis), crows and kingfisher and so on. Ducks are spoken to by various species including winter vagrants like green leg goose *rajhans, the pitail* and some other household species. Water birds are the little cormorant or *pankawri* water hen or *dauk*, and *kora*. Numerous sorts of colorful and singing birds are found in the area. These incorporate the national fledgling robin magpie, *kokil, halde pakhi, king crow or finga myna, shalik, bulbul, tuntuni, shama*, sparrow, flower-pecker, *babui*, popular for imaginative home structure on the few types of birds quails, and pigeons.

The reptiles incorporate various types of snakes and tortoises. The snakes incorporate various assortments of *cobra, urgabora, dughadabora, kuchiabora and jinlabora*, all toxic. The reptiles incorporate gecko, calotis, divider reptile and screen reptile. There are amphibnians like amphibian, frogs and tree frogs. There are numerous types of river and fresh water fish accessible in the area. Despite the fact that Charhajari is a coastal union, there are a few salt-water aquatic resources available now. Major fishes are *ruhi, katla, mrigel and kalabaush. airh, tengra* of a few kinds, *magur singi and koi) are viewed as flavorful, shoul, boal, gazar) and pabda* are accessible in plenitude. Prawn, cry fish (icha) and crabs are likewise found *muralla, punti, khoksha, bain* and *chela* are little fish and are discovered everywhere throughout the locale in bounty. Colorful fishes like grass carp, silver carp, *tilapia, nilotica,* and so on have likewise been presented for business pisci-culture in hatchery, ponds, fish farming project and river.

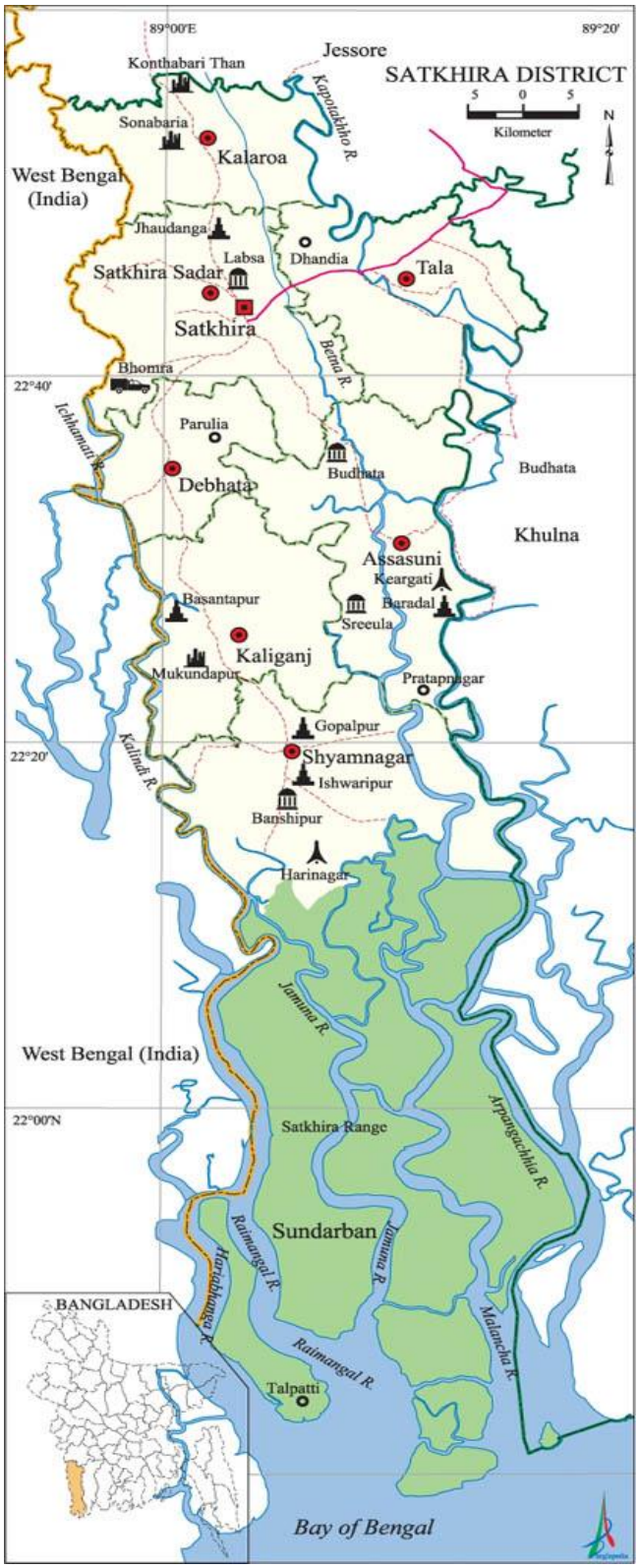
Pratapnagar Union of Assasuni Upazila

Assasuni appeared as a thana in 1896 and was moved up to upazila in 1983. It is said that in the long past, a holy person named Abdus Sobhan set up an isolation at where the upazila central station is found. There is prattle that individuals used to come to him to hear in (which means Suni in Bangla) about their destiny (which means Asha in Bangla). It is for

the most part accepted that the upazila Assasuni may have gotten its name from the over two words.

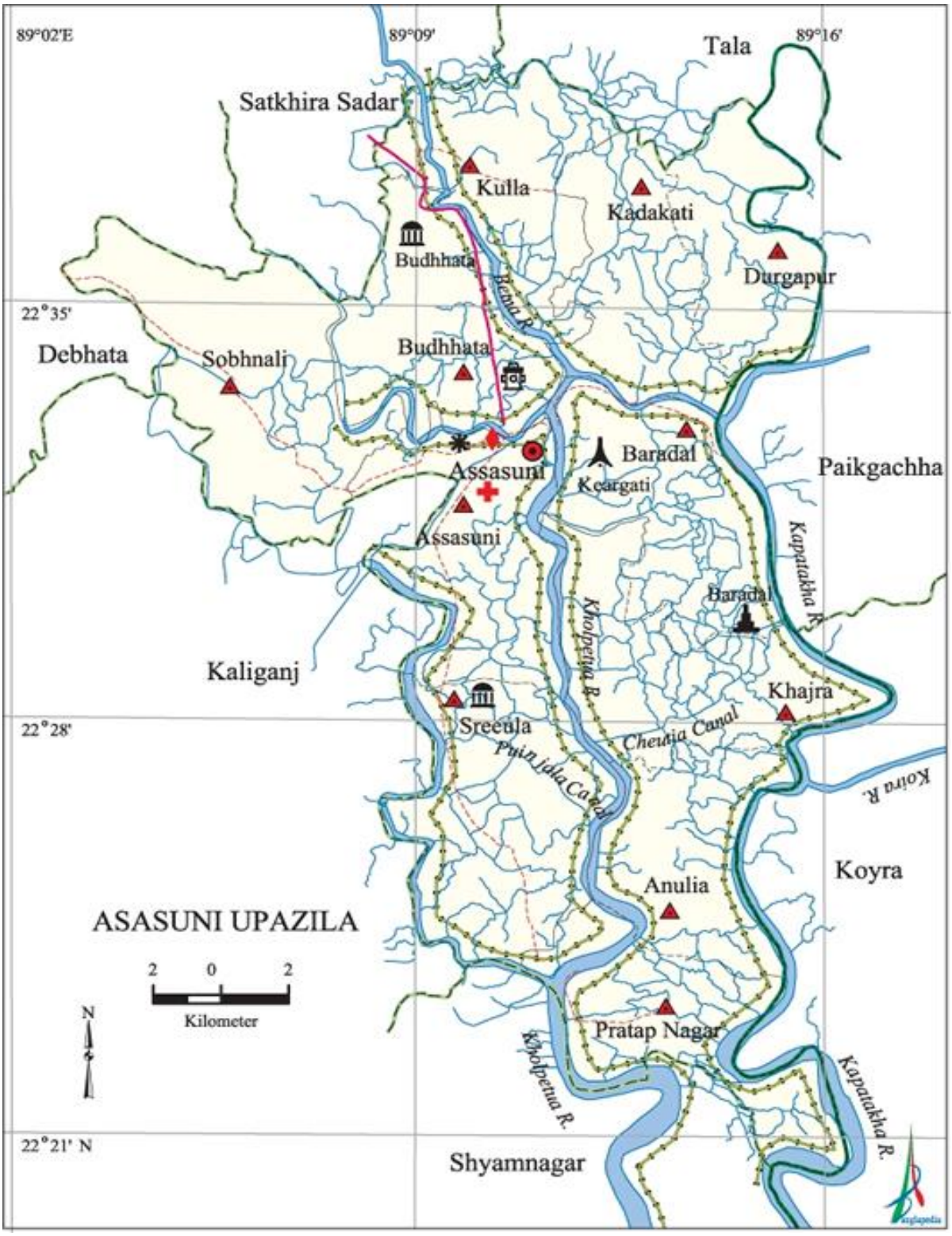
The upazila possesses a region of 374.81 sq. km. It is situated somewhere in the range of 22°21' and 22°40' north latitudes and somewhere in the range of 89°03' and 89°17' east longitudes. The upazila is bounded on the north by Satkhira Upazila and Tala Upazila, east by Paikgachha Upazila and Koyra Upazila of Khulna Zila, south by Shyamnagar Upazila and west by Debhata Upazila and Kaliganj Upazila. The upazila comprises of 11 associations, 143 populated mauzas and 241 towns. The normal size of populace of every association, mauza and town are 24432, 1879 and 1115 separately (BBS 2015).

Map 5.3: Satkhira Zila



(Banglapedia 2015)

Map 5.4: Assasuni Upazila



(Banglapedia 2015)

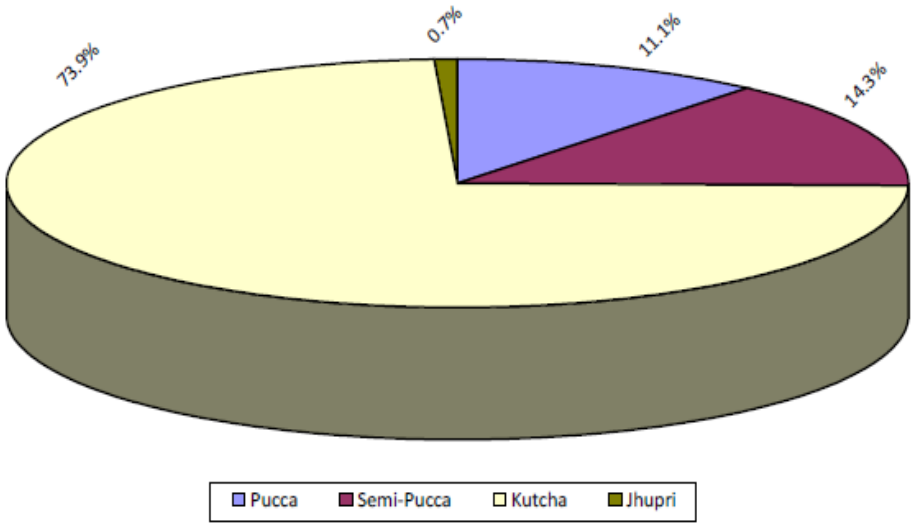
Local people of Pratapnagar union identified the following social resources considered important in social life:

- Natural assets: Trees, plants, forests, river, canal and land.
- Social assets: masjid and temple, school, college, market, and madrasa.
- Personal assets: house, jewelry, crop land, shrimp girdle, salt enclosure, shrimp enclosure, houses and trees, domestic animals, bicycle, motorcycle, auto-vehicle, rickshaw, van, etc.
- Government assets: embankment, road, dam, cyclone center, health care center, educational institutions, union council etc.

House and Household

According to Population and Housing Census 2011, a total of 268754 people live in the upazila where 133990 persons are males and 134764 are females. In the upazila, 11.1 percent people live in pucca house and 14.3 percent people live in semi-pucca house (chart 5.9). Majority of the respondents dwell in kutcha house made from mud, chan, thatched and straw. Less than one percent people live in jhupri or tent house in the upazila.

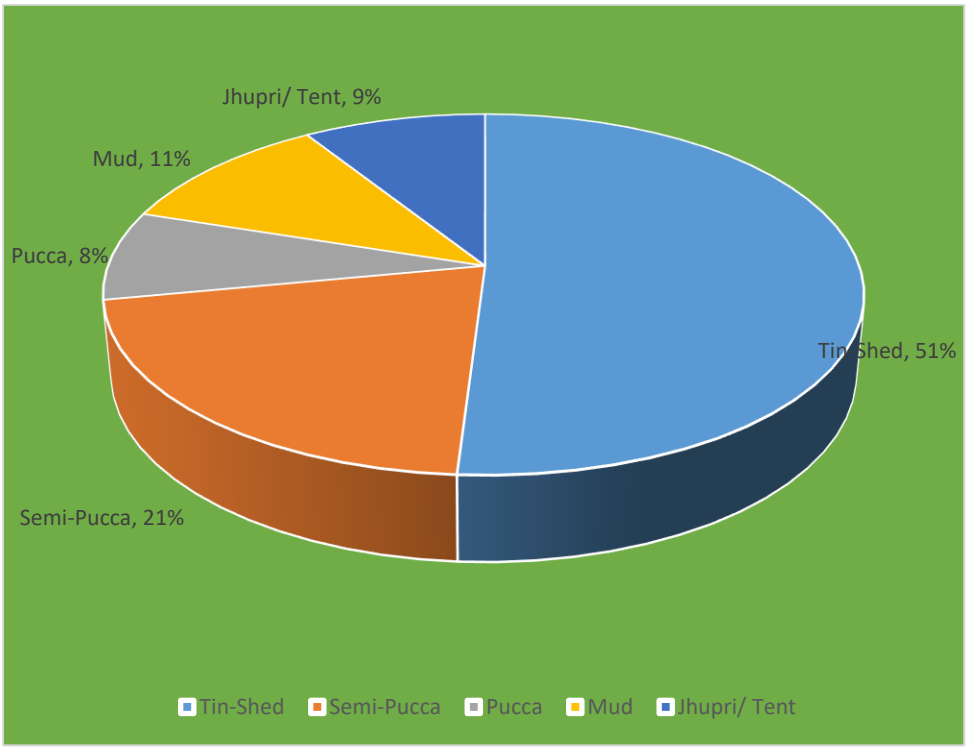
Chart 5.9: Housing Structure in Assasuni Upazila



(BBS 2015)

Respondents of Pratapnagar union mainly live in tin shed with tin wall, tin roof and mud floor (chart 5.10). Pratapnagar union is famous for making mud tiles, which is used in roof. This product is exported in many nearby countries including India. Mud tiles which is locally called as tally is different from other floor tiles in shape and color. Mud tiles have curving feature like roof-tin and stunning red color. So many houses in the union and upazila are made up off mud tiles with cheap cost. Twenty one percent respondents live in semi-pucca house which is mainly made from brick and cement with tin roof. Nine percent respondents inhabit in jhupri or tent house with minimal facilities. These people mainly live in outside embankment struggling with climate change driven hazard and disaster. There are some houses whose wall and floor is constructed from mud. According to BBS (2015) report the average household size in Assasuni upazila is 4.3 persons where present study found the average household size in Pratapnagar union as 4.4.

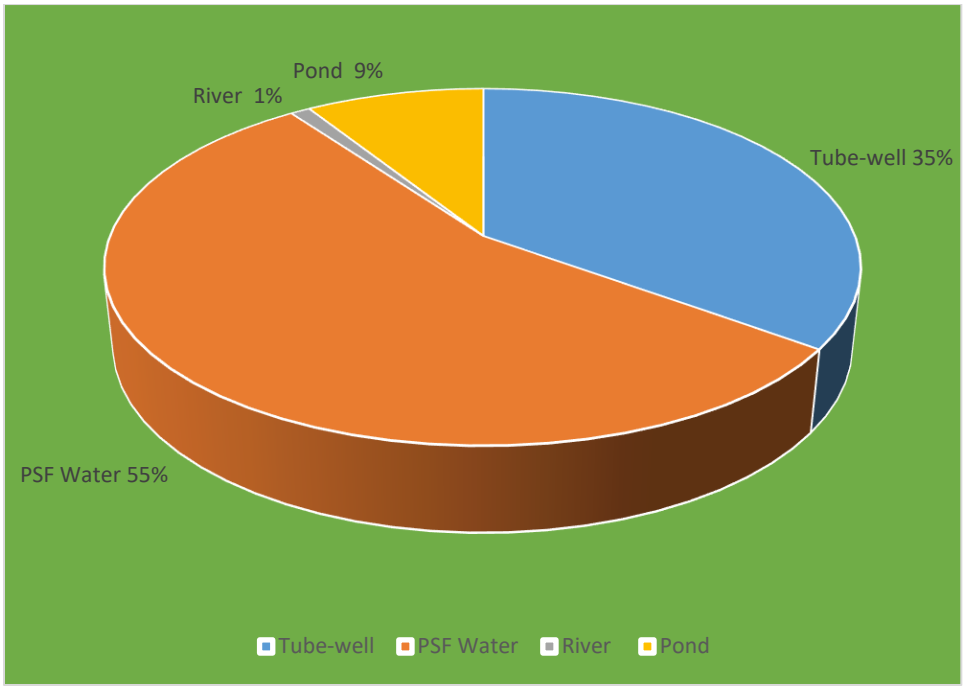
Chart 5.10: Housing Pattern of the Study Participants of Pratapnagar



Water, Sanitation and Hygiene Practice

Drinking water crisis is one of the central problems Assasuni upazila has been encountering for last decades. Salinity intrusion in ground water deteriorates fresh water in the upazila. Furthermore, pond and river water becomes salty due to come closer to the saline water. BBS explores that 71.5 percent household of the upazila drink tube-well water while 27.2 percent collect drinking water from other sources. Only 1.3 percent people drink tape water (BBS 2015). Present study reveals that fifty five percent people use Pond sand filter water (PSF) for drinking purpose (chart 5.11). Thirty five percent people drink tube-well water and nine percent people drink pond water without filtration.

Chart 5.11: Source of Drinking Water among the Study Participants of Pratapnagar



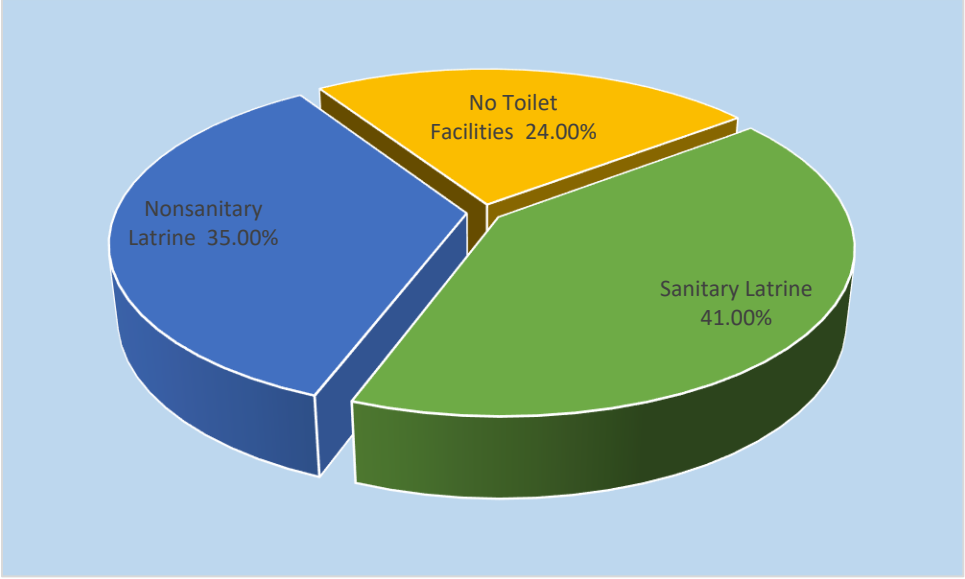
(Fieldwork 2019)

64.1 percent household in the upazila level use sanitary latrine while 32.4 percent have practice to use non-sanitary toilet and the remaining 3.5 percent household do not have any toilet facility at all (ibid). Twenty percent respondents of Pratapnagar union said that they have no toilet facilities and they defecate in open environment particularly in riverside or

jungle. Comparing to sixty percent household having practice of using sanitary latrine in the whole upazila, forty-one percent respondents of the present study report to have habit of using sanitary toilet (chart 5.12).

Assasuni is perhaps the most remote upazila of Satkhira zila which have vast area of char lands with minimal modern facilities like electricity, cable network, internet and so on. Many area of this upazila get submerged during rainy season and water logging is a big issue here. According to Population and Household Census 2011 Report of BBS (2015), more than thirty percent of households avail electricity facility in the upazila albeit respondents of Pratapnagar union reported revert fact during present study.

Chart 5.12: Sanitation Practice among the Study Participants of Pratapnagar



(Fieldwork 2019)

Education and Literacy

Assasuni is among the most marginalized and poverty intensive region in the Satkhira zila where uncertainty of subsistence earning predominates over other basic human rights, i.e. education.

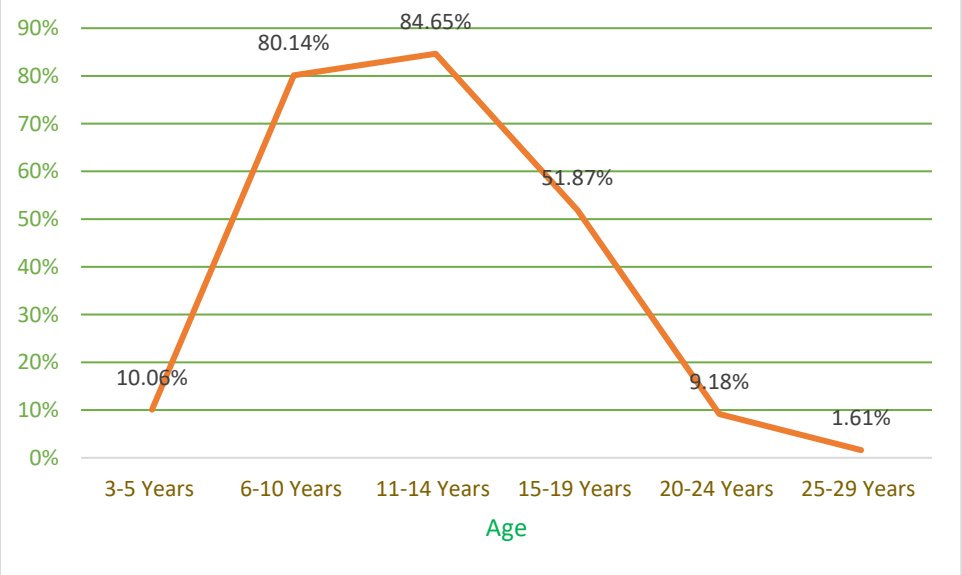
Table 5.2: School Attendance by Age Group in Assasuni Upazila

Item	3-5 Years	6-10 Years	11-14 Years	15-19 Years	20-24 Years	25-29 Years
Both Sex	10.06	80.14	84.65	51.87	9.18	1.61
Male	10.38	79.83	80.15	57.03	15.97	2.92
Female	9.72	80.47	89.15	46.51	4.43	0.58

(BBS 2014)

Women of the Assasuni upazila have low rate in pre-school attendance in comparison to their male counterpart. This picture changes in school enrollment during the age six to ten years where male attainment rate is 79.83 percent and female is 80.47 percent. Dropping out from school starts from 15 years old for both sex. This picture is presented in chart 5.13.

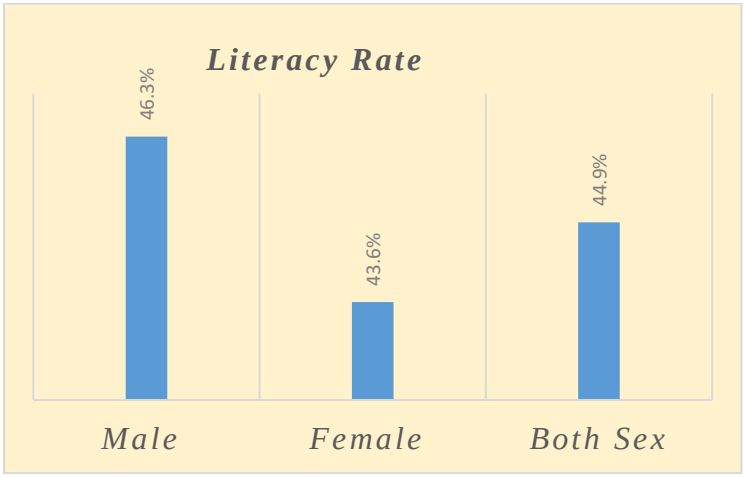
Chart 5.13: Trend of School Attainment in Assasuni



(Data Source BBS 2015, Author Illustration)

Chart 5.13 shows that enrollment rate increases up to 11-14 years old, but it starts to decrease or in another word, dropout starts after 14 years old. Thus, comparing to 1991 census, this upazila have increasing trend in literacy rate as literacy rate for both sex was 30.3 percent in 1991 that bumps up to 49.8 percent in the last census of 2011 (BBS 2015).

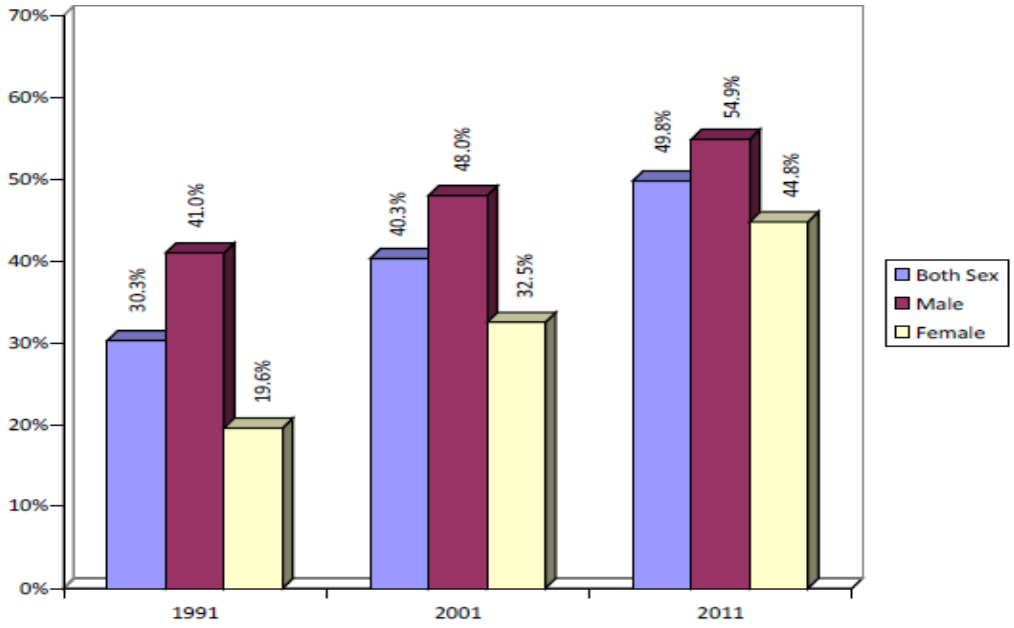
Chart 5.14: Literacy Rate in Pratapnagar Union



(BBS 2015)

Both male and female of this upazila have growing trend in pertaining education and strive to be literate (chart 5.15). Female literacy rate increased likely better than male from the timespan from 1991 to 2011. On the other hand, literacy rate among adult male of Pratapnagar union is 43.6 percent comparing to 46.3 percent female in the union (chart 5.14).

Chart 5.15: Literacy Rate by Sex in Assasuni



(BBS 2015)

Nature, Environment and Ecosystem

A minor part of Pratapnagar is secured by backwoods, sticks creepers and different trees blossoming with sloppy saline tidal banks. The *sundari* is the most significant of the backwoods trees. The shade of its wood is rosy which is exceptionally calming to the eye. On account of its strength it has an incredible interest. It can endure saline water yet achieves full stature on the bank of sweet water streams like *'Sela' and 'Passur'* and accessible in huge amount. Its timber is truly strong and has incredible interest for posts and boards. The *amur* and *dhundhul* have a closeness with *'Pasur'* however they are of substandard quality and as utilized now and then for making house posts. Little *Amoor* trees are utilized for making *'hookka'* (Local smoking channels) stems. One of the biggest of the area is *'bain'* (Avicennia officinalis) tree. For the most part it accomplishes 60 feet in stature with huge size. The wood is utilized for planking and as fuel. The blossoms of the tree are little yellow and sweet smelling and bear the cost of an unmistakable nature of nectar. Other significant trees are *garjan*, *goran* and *kankra*. There is an incredible chance of using them for tanning purposes. Of them just *kankra* achieves adequate size and has some an incentive as timber. The *gewa* tree flourishes in the most saline zones close to the ocean. Its wood is white hard and delivers great timber. It is especially reasonable for making match sticks and boxes and paper mash. The most striking tree is *keora*. Deer are particularly attached to its leaves and natural products. They rush under its branches to eat its leafy foods its leaves off as high as they can reach creating a uniform abrupt line along the forest where the foliage has been gnawed off. The *singra* tree supplies best kindling. The *karanj* tree is enormous in size and develops on high stream banks.

A few sorts of snake's including harmful cobra, karait, *rajshap* and non-venomenous, dhora, grass snake are seen wherever sneaking in the grass and from tree and here and there. Swarm in the stream beds, butterflies, moths, honey bees and wasps fly from blossoms extraordinarily in spring to accumulate nectar. Hundreds of assortments of fish different sizes are accessible in the streams and rivers. Most significant are the species are *vetki*, *bhangon*, *jaba*, prawn of various sorts are additionally accessible. Crane, twisted birds of different

kinds, paddy-winged animals, pigeons and other game feathered creatures are likewise abundant. The hental and the *golpata* are found in sloppy zones all over. The hental looks like a diminutive person date-palm and rafters are made it. The *goalpata* is viewed as one of the most significant items and its leaves are utilized for covering houses. A few kinds of palms and bamboo bunches develop practically areas. Mango (Mangifera indica) and jackfruits (Artocarpus heterophyllus) supply the commonest timber and are utilized for making entryways, windows, boxes and so on.

Creatures which are normal everywhere throughout the area are likewise available in Pratapnagar are jackal, wild hoard, wild feline, tree feline and so on. The waterways, *khals* (Channels) and *beels* (low lying damp spots) of the area abound with assortments of fish which are recorded underneath as per the wellspring of supply ocean fish prawns, shrimps and so on. *Pungas, hilsha, bagair, chital, boal* and so forth are angles accessible in nearby waterway. *Calibaus, ruhi, katla, mrigel or Carp, boal, shoil, koi, magur* and so on. In paddy fields *bhetki, bhangan, tangra, and parsia* locate a snappy development. They are gotten by the ranchers in the long stretches of October, November and December when paddy fields begin evaporating. At the coming of winter season kills, ducks and geese start to run on *beel* and burn zones. Others basic feathered creatures are crow, vulture, sparrow (Passer, cuckoo, kingfisher, bulbul, parrot, tailorbird and warbler.

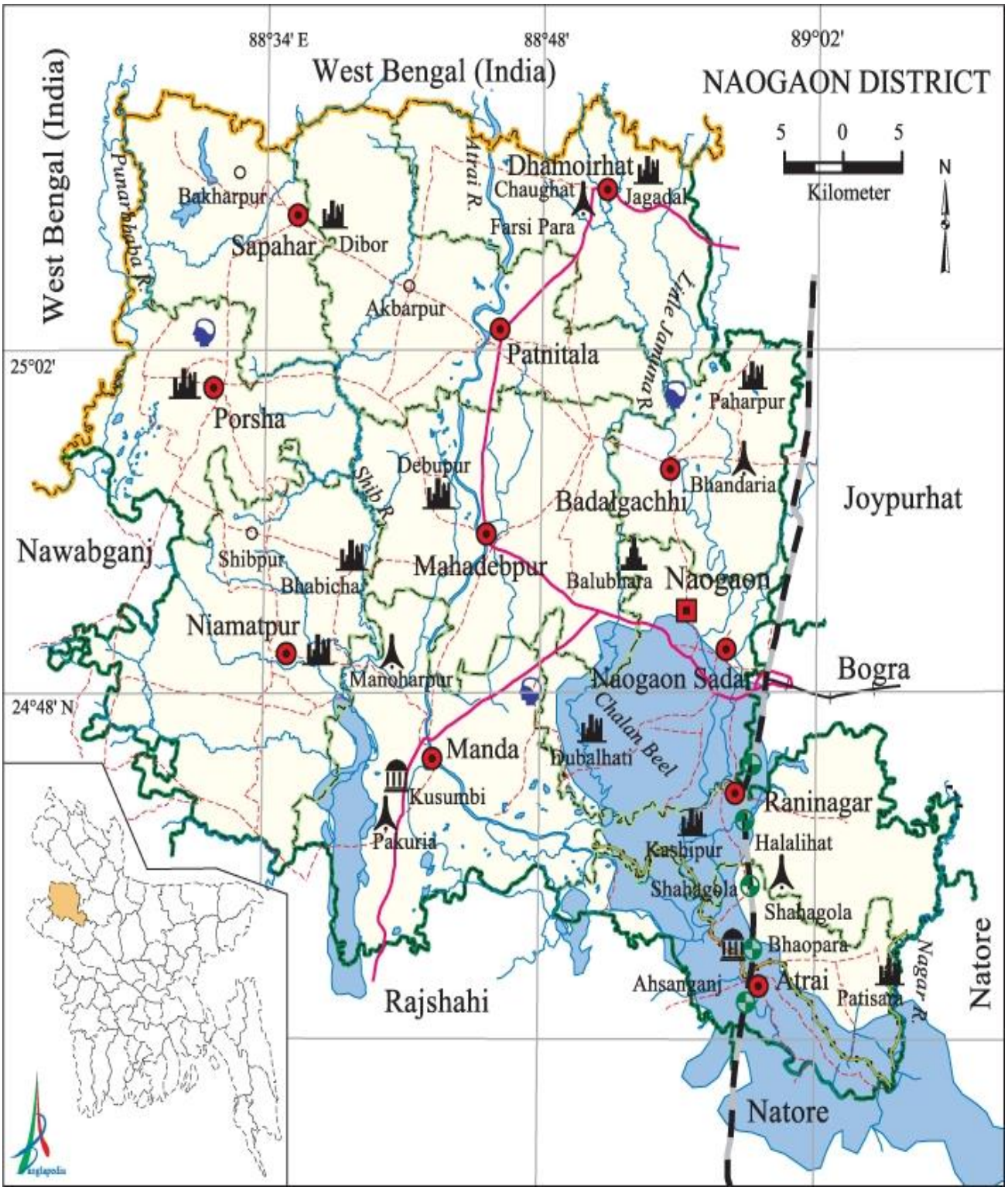
Nitpur Union of Porsha Upazila

Porsha Upazila appeared as a thana in 1933 and was moved up to upazila in 1984. It is the second smallest upazila of Naogaon Zila in regard of population. Nothing is certainly thought about the root of the upazila name. It is said that previously, a gathering of Persian individuals came here and settled at the current spot of the upazila base camp where a town experienced basement in the name Porsha. It is for the most part accepted that the upazila may have begun its name from the name of that town.

The upazila involves a zone of 252.83 sq. km. Counting 0.5 sq. km. stream zone. It is situated somewhere in the range of 24054' and 25005' north latitudes and somewhere in the range of 88024' and 880 39'east longitudes. The upazila is bounded by Sapahar Upazila in the north, east by Patnitala Upazila and Mahadebpur Upazila, south by Gomastapur Upazila of Chapai Nawabganj Zila and Nimatpur Upazila and west by West Bengal State of India. The upazila comprises of 6 associations, 155 populated mauzas and 246 towns. The normal size of populace of every association, mauza and town are 22016, 852 and 537 individually.According to the information collected from Nitpur union, the social resources of this union are as follows:

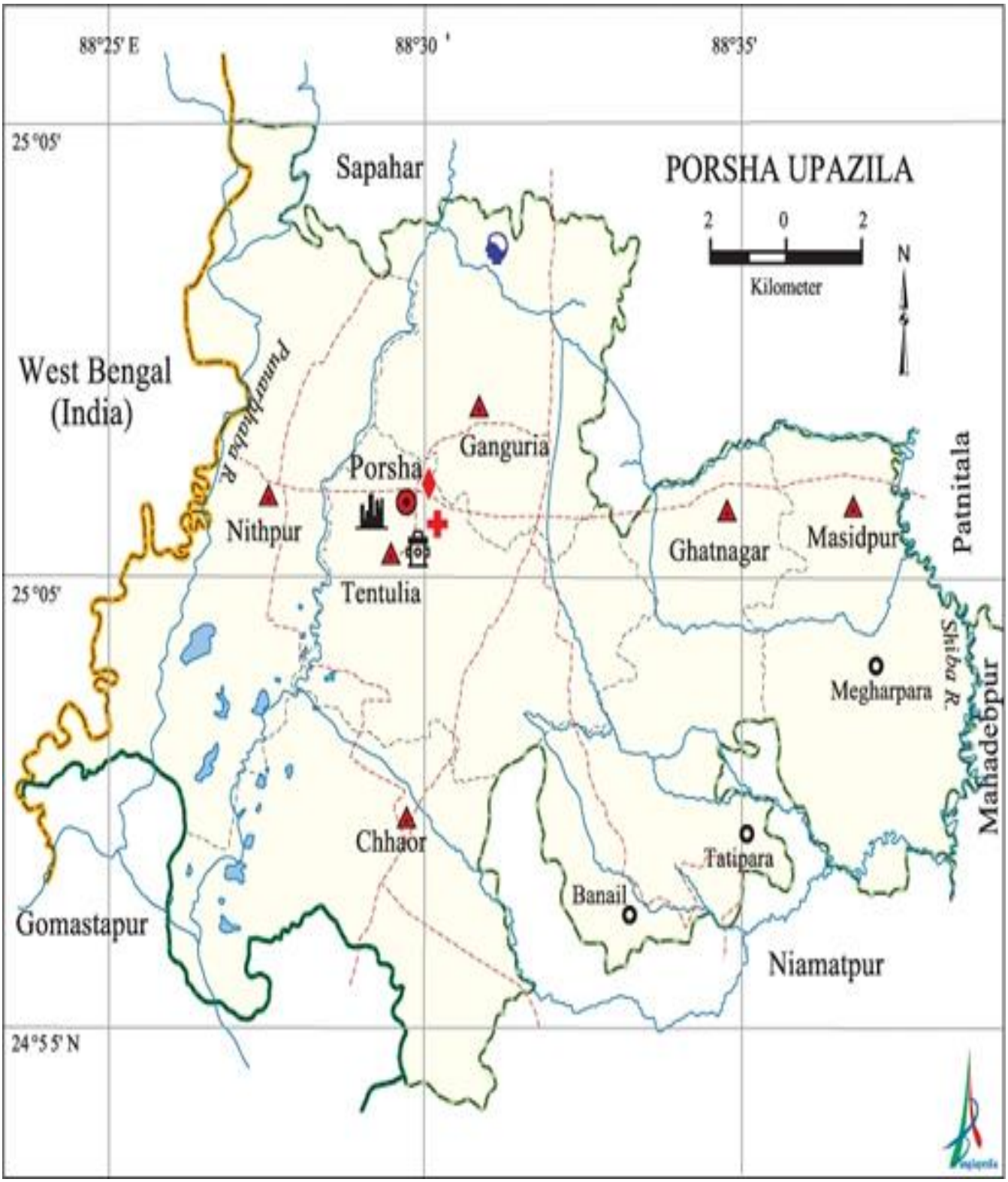
- Natural Resources: Farmlands, Seedbeds
- Social Resources: Bazaar, Mosque, Temple, School, College and Madrasa
- Personal Resources: Land, Households, Cattle, Bi-cycle, Motorcycle. Tools used in production e.g. Farming tools, yoke, hoes, tractors etc. Livelihood tools e.g. Auto rickshaw, rickshaw van etc.
- Government Resources: Road, Dam, Health Centers, Educational institutes etc.

Map 5.5: Naogaon District



(Banglapedia 2015)

Map 5.6: Porsha Upazila



(Banglapedia 2015)

House and Household

A total of 30773 households exist in the upazila and 7073 in Nitpur as per population and household census 2011 report. Average household size in Porsha upazila is 4.2 persons and 4.3 persons in study participants of Nitpur union. 2.5 percent and 5.4 percent people live in pucca and semi-pucca house accordingly. Maximum number of house (89.7%) comprises of kutcha materials while other 2.4 percent houses are made from tent/ jhupri (BBS 2015).

Water, Sanitation and Hygiene Practice

Porsha is a drought prone area where pure drinking water is a scarce resource in dry spell. Ponds, *beels* and canals start to dry up from the month of Poush. Water and sanitation is a big issue during this period. Fifty seven percent of the household use tube-well water for drinking purpose in the upazila (ibid). It is important to mention that underground water level significantly decreases in dry season that results many tube-well out of water. However, 5.9 percent household drink tap water where more than thirty-seven percent household get water from other sources (ibid). Less than twenty-five households have practice of and capacity to use sanitary toilet where more than twenty-seven households use non-sanitary unhygienic toilet. 48.4 percent household do not have any toilet facilities at all (ibid). BBS (2014) reports that despite covering all unions of this upazila, only 27.4 percent household have electric facility.

Education and Literacy

Forty-two percent population age at least seven years have literacy as reported by BBS (2014). However, table 5.1 shows a comparative scenario of school attendance by age. Age group between six to ten years have high yield to attain education and schooling in the upazila. Female schooling rate in age group 6-10 and 11-14 years are higher than male, but it loses its position as age grows like 15-19 and 20-24 age group.

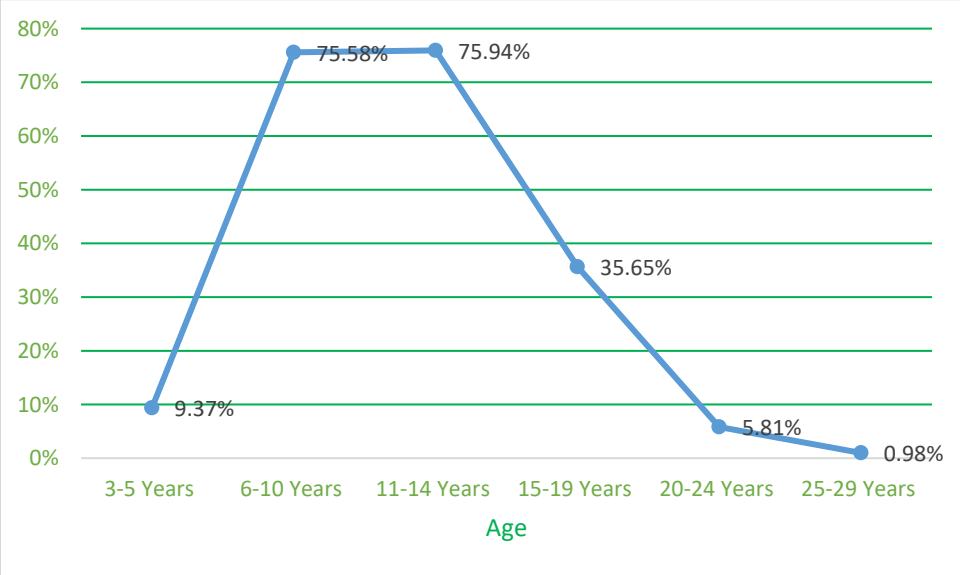
Table 5.3: School Attendance in Porsha Upazila 2011

Item	3-5 Years (%)	6-10 Years (%)	11-14 Years (%)	15-19 Years (%)	20-24 Years (%)	25-29 Years (%)
Both Sex	9.37	75.58	75.94	35.65	5.81	0.98
Male	8.48	74.19	69.48	37.15	10.14	1.74
Female	10.30	77.12	83.52	33.98	2.72	0.31

(BBS 2014)

This table brought about an interesting but shocking picture of highest rate of school attendance in lower secondary level and lower rate in 20-29 age groups that indicates low tendency to pertain higher education.

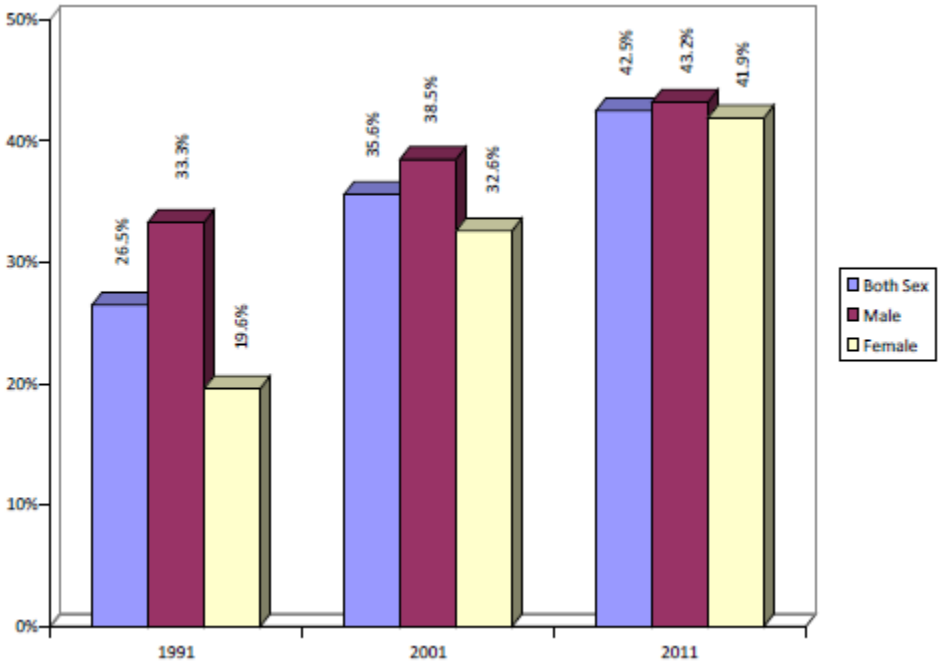
Chart 5.16: Trend of School Attainment in Porsha



(Data Source BBS 2015, Author Illustrated)

School enrollment rate for both sexes remain stable from the age range between six to fourteen years but it gradually downfalls after fourteen. People have high tendency to enroll in school and continue study until lower secondary or what is now called Junior School Certificate (JSC) level. At the age range between fifteen to nineteen years, school attainment decreases half-comparing to highest dwindle at the age range between twenty five to twenty nine years. Moreover, fluctuating scenario of school attendance by both sex is common in all three study areas.

Chart 5.17: Literacy Rate in Porsha Upazila

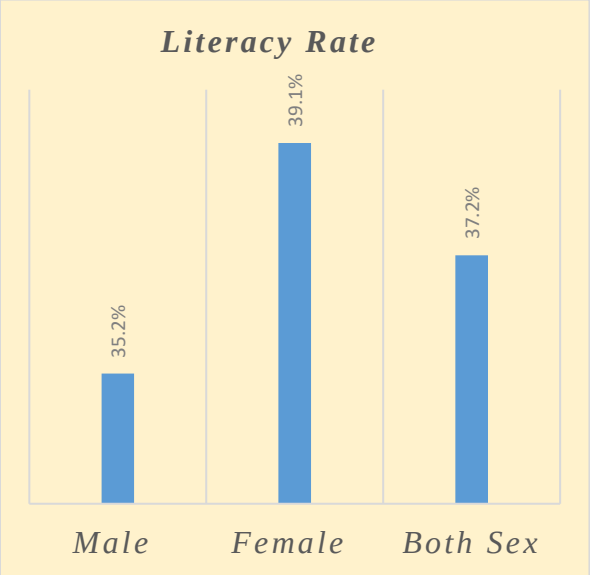


(BBS 2014)

A gradual trend in literacy rate is presented in the chart 5.17. It explores that male and female literacy rate from the timespan 1991 to 2011 is increasing simultaneously. Female literacy rate has grown more than twice in 2011 as it was 19.6 percent in 1991 and turned into 41.9 percent in 2011. Slight improve has been observed in 2011 contrasting to 2001 picture of literacy rate for both sex.

Nitpur union falls behind Porsha upazila in terms of literacy rate for both sex. Chart 5.18 shows that combined literacy rate in 2011 for both male and female in Nitpur union is 37.2 percent while it is 41.9 percent in the Upazila. Literacy rate among men of Nitpur is far away from Upazila picture.

Chart 5.18: Literacy Rate in Porsha Upazila



(BBS 2014)

Nature, Environment and Ecosystem

Nitpur union exists in Barind tract. A solid soil of ruddy clayey topsoil recognizes it from the rest of the parts of the region which exist in the flood fields of the Purnabhaba streams where soils are chiefly silty in redges and dirts in bowl focuses in certain regions and overwhelming muds in some different zones. The major farming items involve *aus, aman, boro*, jute and wheat. Among rice crops, aman covers by a long shot the biggest region followed by *boro and aus*. Rice covers 85.25% of the gross trimmed territory. Rabicrops incorporate mustard, *khesari, masur*, crush, potato, sesame, gram, flavors, barley, maize, tobacco, sugarcane and so on. *Tal* (palms) are bottomless in the Barind part of the region. Bambo and mango are abundant around home steads. The fields are frequently flanked with bananas. Moreover, the development of hemp plat is a strength of the region. The property vegetation of the Nitpur speaks to various types of normally planted trees. These are mango, jack-natural product, black berry, betel-nut, coconut tree, palm tree, guava, *sajna, lime* and so forth. Other normal trees incorporate *khair, babla, kaligarjan, mandar,*

kadbel, batul, siris, bhadi, cotton tree, *sonalu*, carambola, engine *koroi, pitraj, latkan, raktachandan, jalpai, nimpitali, barak bamboo, beora bamboo* and so on.

Road trees contain banyan tree, *ashatha tree, neem*, *Katbadam,* randi *koroi, debdaru*, *krishnachura*, *tamal, tamarind* and so forth. Moreover, the skimming macrophytes like *kachuri pana, topa pana, khudi pana* the inquisitive drifting greeneries, Some amphibian plants, for example, lily, lotus and oceanic bafy greens like *kalmi, helencha* and so on are additionally found in the shallower lakes, trench and beels of the ziia. Likewise, residence bushes, greenery and lawns with planted trees frequently offer help to numerous climbers and twiners. Bean is regularly developed, albeit winged bean is likewise once in a while planted, *Pui or basil* are planted for its verdant greens. In addition, a few plants are developed at the residences predominantly for stylish purposes. These are *Kamini, shefali sandhya malati,Jaba, gandhoraj patabahar, hasnahena*, *beli* and so forth.

The normal mammalian fauna that are commonly found in the area of the Nitpur are mouse, metho mouse, *nengti* mouse, basic house mouse, tortoise, *dora kathbirali, bhondar, kola badur, Indian pipistrelle* tickill's bat, jackal, *bon biral*, benji, and so forth. When a wide range of types of flying creatures used to be found in the area, yet now their numbers are being decreased fundamentally due to the decrease of bio-diversity through harm to the earth. In any case, the birds that are generally found right now jaybird, sparrow, *bhat martin, Jhuti* martin, swallow, *tuntuni*, *lal kite,* crow, jackdaw, kingfisher, wood-pecker, *tila* dove, *botkol, dhumkol, bulbul*, *choto fingey, holdey pakhi*, water-hen cuckoo, dark owl, *lakshmi* owl, *khuruley* owl, *kana korchey* heron, parrot etc.

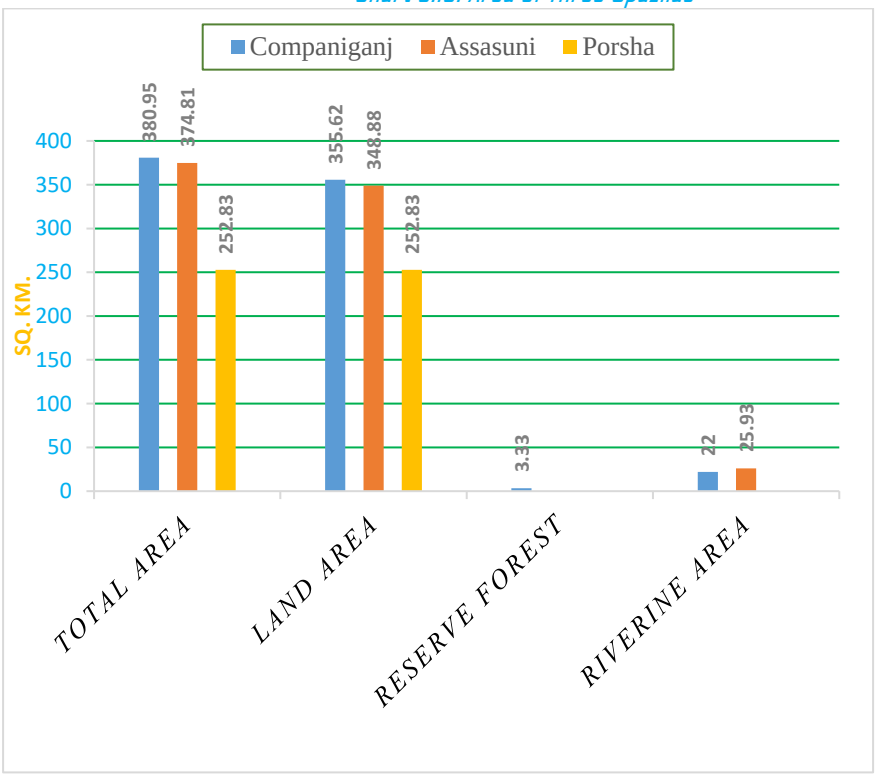
In addition, countless transitory birds visit Bangladesh during winter season. They are typically found in wet land regions. Anyway some of them are additionally found in the marshes and beels of this area. There are *chokha chokhi*, normal greenish blue, pintail, black leg goose, basic pochard, gadwall, plover, basic tern, bog harrier, tufted duck, pintailed kill, pied wagtail, darker shrike, regular sand flute player, minimal ringed plover herring gull, red-breasted flycatcher and so on.

Reptlies that are generally found right now *kali kaitta*, *kori kaitta*, *dhum* tortoise, reptile, *shanda*, *lguana*, *hunguishap*, *ghargini shap*, *dhora shap*, distribute shap, daraj shap, paina shap, *Jait shap*, *shankhini shap* and so forth. Among the creatures of land and water, the most widely recognized are *kotkoti* bang, *kuno* bang, *jhijhi* bang, *bhawa bang*, and so on. Lakes, streams, beels and waterways of the locale are the characteristic babitat for fish populace. The chief kinds of fishes are *ruhi*, *catla*, *Kalibaush*, *mrigel*, *koi*, *shing*, *magur*, *airh*, *boal*, *pangas*, *shoil*, *bele*, *chital*, *pabda*, *tengra*, *phali* and so on.

Three Study Areas at a Glance

Companiganj is the biggest upazila among all three upazilas in terms of area (chart 5.19). It has an area of 380.95 square kilometer that includes 355.62 square kilometer land area, 3.33 square kilometer reserved forest area, 22 square kilometer riverine area. Only this upazila has reserved forest territory which is situated in southern part. The second largest upazila Assasuni has an area of 374.81 square kilometer that comprises 348.88 square kilometer land area.

Chart 5.19: Area of Three Upazilas



(BBS 2014)

In addition, 25.93 square kilometer riverine area makes this upazila bigger than other two upazilas in terms of riverine region. Porsha is the smallest upazila in terms of total area and land diversity.

Chart 5.20: Demographic Information of Three Upazilas

Upazila	Number of Household	Population			Sex ratio (M/F)	Average size of household	Density per sq. km.	Literacy Rate
		Male	Female	Total				
Companiganj	49015	120000	130000	250000	92	5.10	658	51.3
Assasuni	62037	133990	134764	268754	99	4.33	717	49.8
Porsha	30773	66000	66000	132000	101	4.24	522	47.8

(BBS 2014)

Despite having larger than Assasuni and Porsha upazila, Companiganj is the second bigger upazila in respect of household number (chart 5.20). Assasuni is the largest upazila on ground of household number and total population, and this upazila is most densely populated upazila among three upazilas. Average household size is bigger in Companiganj than other two upazilas, and male/ female ration is higher in Porsha than Companiganj and Assasuni.

Table 5.4: Demographic Information of the Study Areas

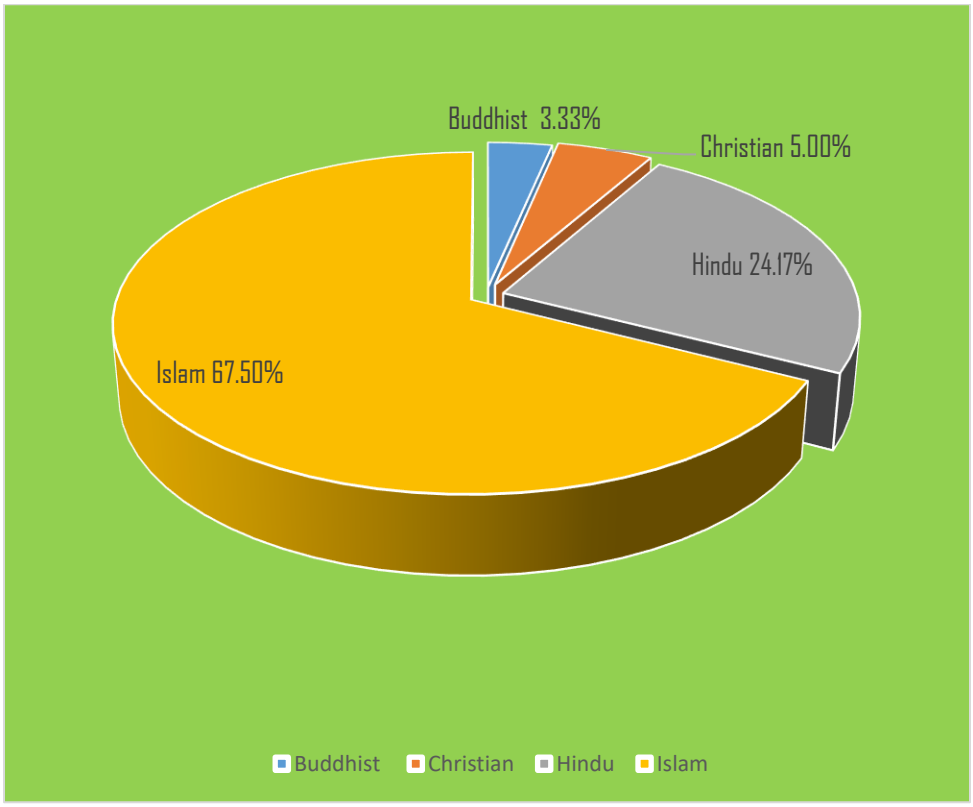
Study Area	Area in Acres	Number of Household	Population			Literacy Rate (%)		
			Both Sex	Male	Female	Both Sex	Male	Female
Charhajari Union	3637	5001	24911	11895	13016	48.2	49.1	47.4
Pratapnagar Union	8371	6562	29250	14280	14970	44.9	46.3	43.6
Nitpur Union	14433	7073	33733	16816	16917	37.2	35.2	39.1

(BBS 2014)

Religious Affiliation

Chart 5.21 shows that religion of the majority respondents is Islam. The second largest religious group among respondents across study areas is Hindu who comprises 24.17 percent of total study respondents. There are some Christian and Buddhist respondents who mainly inhabit in Nitpur.

Chart 5.21: Religion of the Respondents



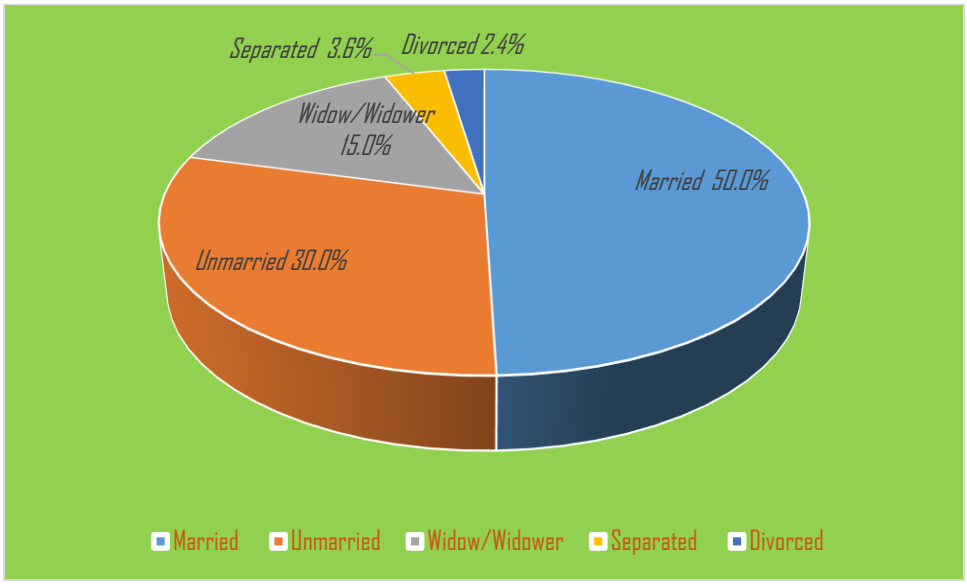
(Fieldwork 2019)

Marital Status of the Respondents

Perception of climate change requires many things; age, maturity, history of close connection with nature etc. Marital status may bring about different kind of worldviews regarding climate change. Married people's thinking and belief may vary from unmarried on ground various social experience. However, present study endeavors to account climate change perception from several prisms, marital experience is one of those things. Thus,

chart 5.22 shows that fifty percent respondents are married and thirty percent respondents are unmarried. Present study had kept provision for marginal and voiceless people as these people are considered the worst sufferer of global climate change. Present study counted upon the voices of fifty percent widow/ widower people, more than three percent separated person, and more than two percent divorced individuals.

Chart 5.22: Marital Status of the Respondents



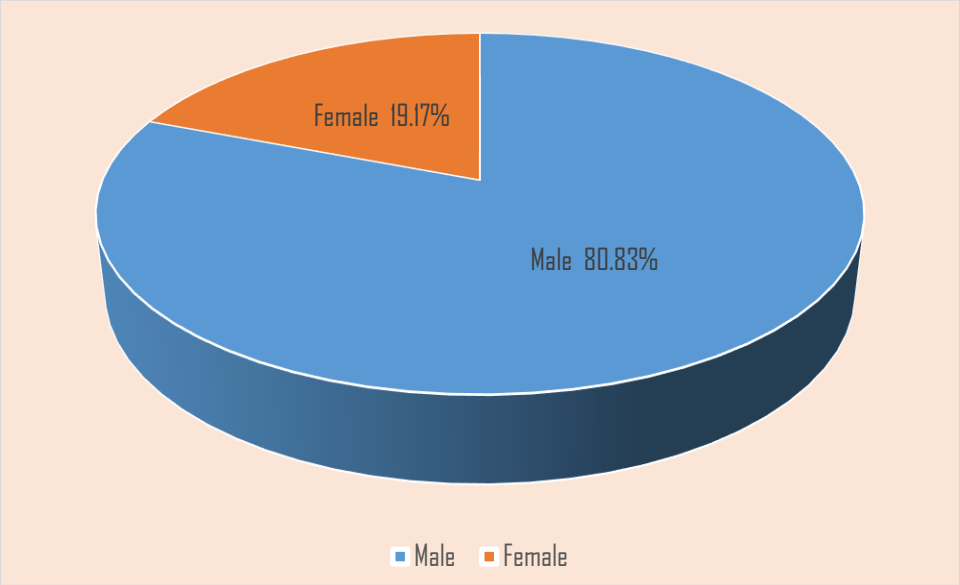
(Fieldwork 2019)

Gender of the Respondents

Gender is a social construction that molds social views in many respects. Gender and the roles around it are taught to human being through a process what sociology calls 'socialization' and anthropology terms 'acculturation'. Gender beliefs are heterogeneously distinct vary from place to place basing on certain gender experience. For instance, male role in traditional Bangladeshi society sticks them to public sphere that facilitates different insight than female who are bound to domestic sphere to observe climatic change. Moreover, Rosaldo and Lamphere (1974) claim that women have different worldviews having their own way of observing social world. Male and female interpretations of global climate change, individual stories of climate change cause and impacts, and male-female

different methods and strategies to deal with climate problem had sought particular epistemological focus in the present study.

Chart 5.23: Gender of the Respondents



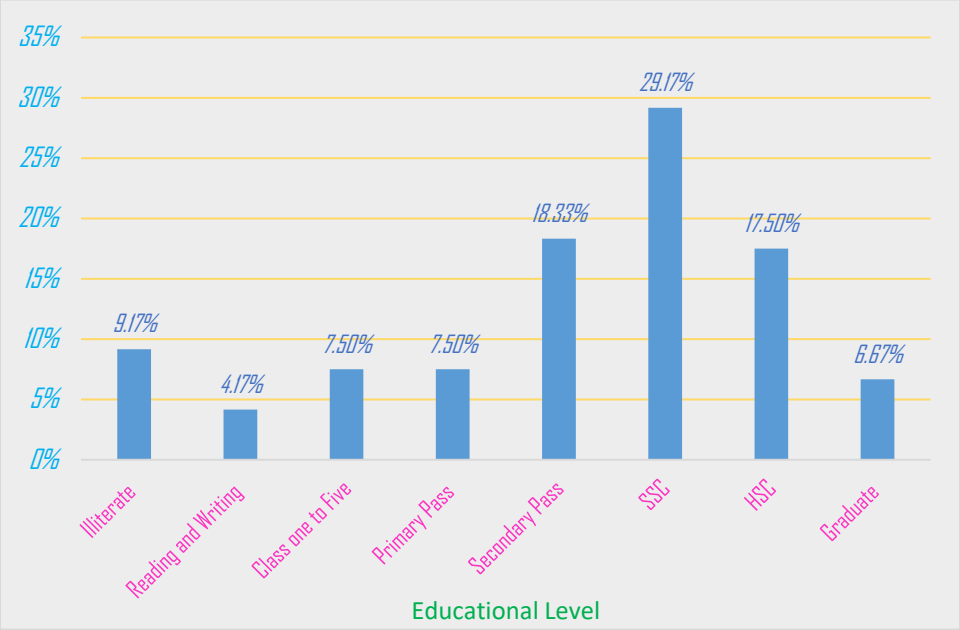
(Fieldwork 2019)

Chart 5.23 shows that 80.83 percent respondents are male while 19.17 percent are female. Male comprises large part of the respondents as they have closer connection to the factors that help to observe climate change i.e. crop production, day laboring etc. Women for the most part, stay home and do household chores with some exception in Pratapnagar and Nitpur union.

Educational Status of the Respondents

Chart 5.24 shows that lowest portion of the respondents (4.17%) can read and write only without formal schooling while the highest portion of the study participants (29.17%) are SSC passed. More than nine percent respondents are illiterate who mainly elderly people. Seven and half- percent people have passed class four and entered into class five but did not complete. Same number of respondents have passed class five (primary). It seems that there are less than seven percent people who are graduate and these people are mainly service holder, some are young.

Chart 5.24: Educational Status of the Respondents

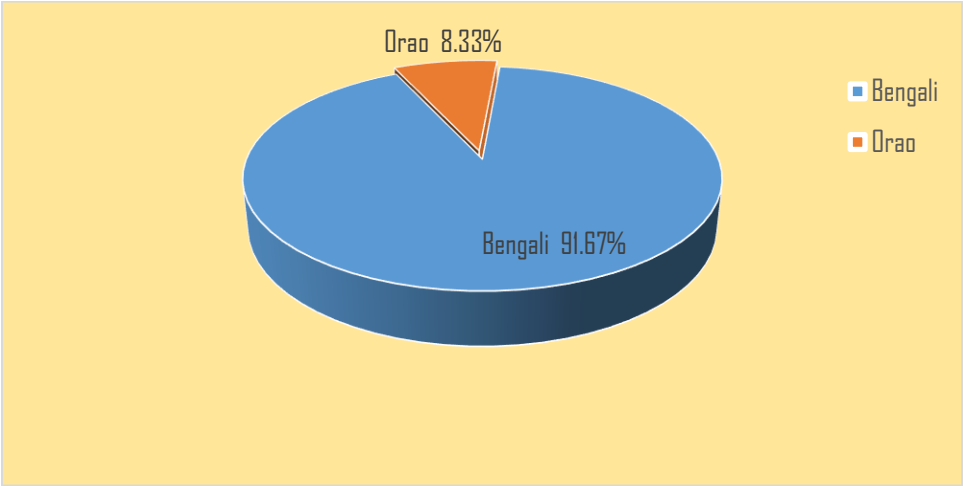


(Fieldwork 2019

Ethnic Identity of the Respondents

Ethnic identity is considered crucial in climate change perception research as ethnicity generates new kinds of vulnerability and adaptation strategies. Despite their ultimate dependency upon, and close connection to nature, ethnic minorities of the world are destitute group in climate policy of many countries. However, chart 5.25 shows that 91.67 percent study people are Bengali and 8.33 percent people are Orao who dwell in Nitpur. It should be clarified that there are no existence of indigenous or small ethnic communities in Charhajari or Pratapnagar union. Many other indigenous people like Munda and Santal live in Porsha upazila, but in Nitpur their presence is not so mentionable as they live in scatter. Orao is selected for their population density in Nitpur union.

Chart 5.25: Ethnic Identity of the Respondents



(Fieldwork 2019)

Settlement Duration in the Locality

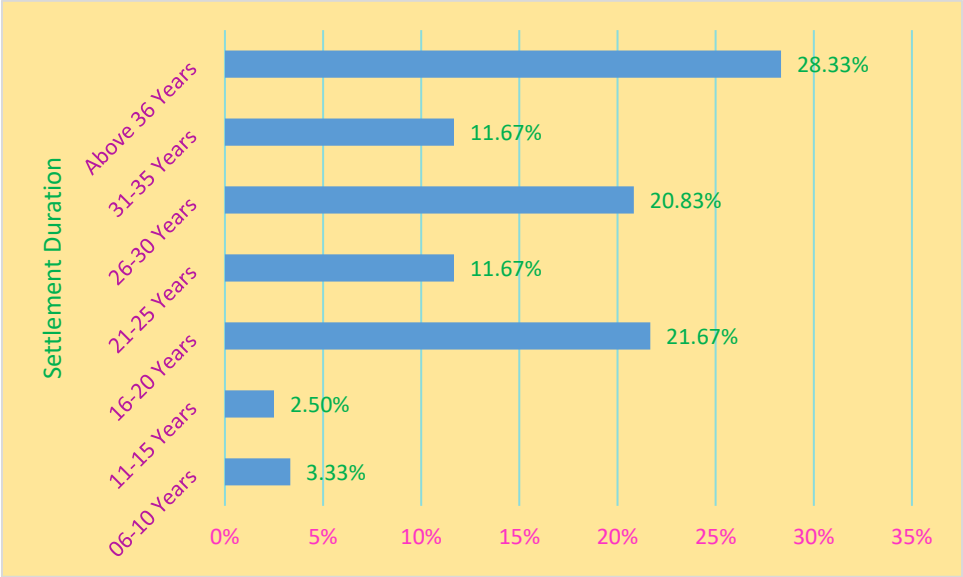
Present study categorizes respondents on ground of living duration in the study areas;

- *Key respondent*-who have been inhabiting in the community for more than twenty five years,
- *Young respondents*-who have been dwelling in the area for less than twenty five but more than fifteen years old, and
- *Potential respondents*-who have been living in the locality for less than fifteen years old.

Climate change observation requires living in a locality for decades. Present study tried to identify settlement duration of the respondents in the community. Long inhabitance in the community assist observing anomaly in weather for short time and climate change for long time through comparing temperature, precipitation, moisture, sweat, and wind quality to previous state. Likewise, deep bondage with the components of weather and climate developed from living together in local ecosystem leads to insightful interpretation of erratic behavior of climate. However, the chart 5.26 shows that 28.33%, 11.67%, 20.83%

respondents have been living in the community for more than thirty six years, thirty fiver years, and thirty years accordingly. These people are categorized as key respondents who are elderly people having in-depth knowledge on climate change comparing to other people. 11.67% and 21.67% people are grouped as young respondents who have been residing in the community for less than twenty-six years and twenty years accordingly. The remaining individuals are potential informants who have been living in the community for fifteen and ten years accordingly.

Chart 5.26: Settlement Duration in the Locality



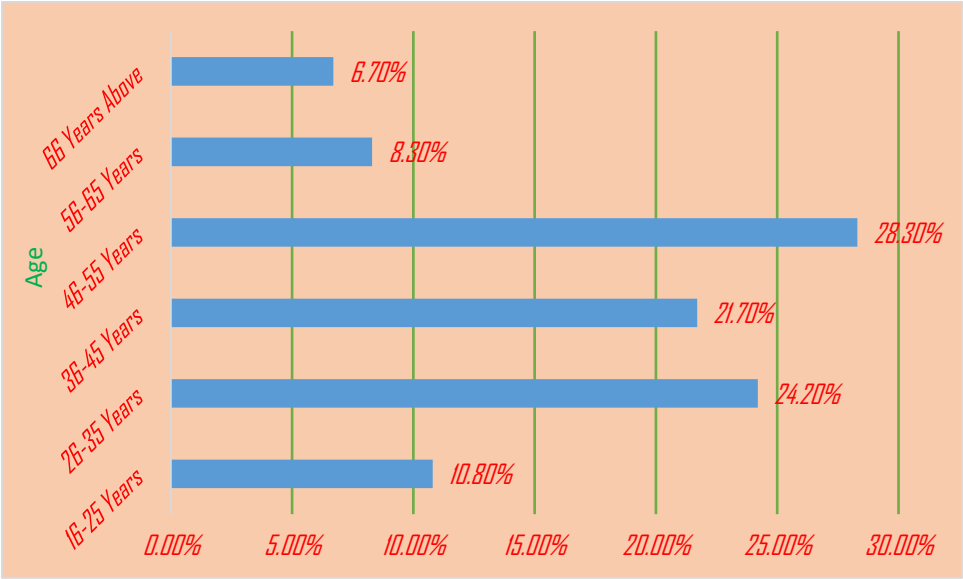
(Fieldwork 2019)

Age Wise Distribution

Chart 5.27 shows that majority percent (28.30) of the respondents aged between 46-55 years while lowest percent of respondents are sixty-six years and above. The lowest age group 16-25 years comprises 10.80 percent respondents who are younger than other groups. 24.20% and 21.70% respondents have age ranges from 26-35 years and 36-45 years accordingly. As it has stated earlier that to observe the indicators of climate change age matters. For this reason, lower limit of age bounded to sixteen years whereas it is close to

adult age i.e. eighteen years. Therefore, the mean age 43 years indicates the maturity of the respondents to provide corresponding climate change information.

Chart 5.27: Age of the Respondents



(Fieldwork 2019)

Conclusion

This chapter profiles out the study areas and respondents. In doing so, this chapter includes many secondary sourced data extremely relevant to present study. Focal background variables like age, educational qualification, marital status, settlement duration, gender, religion of the study participants etc. were graphically presented, and narratively explored out in order to generate critical research findings comparable on the basis of socio-cultural and demographic experience across regions.

Chapter 6

Climate Change Perception: Impacts and Vulnerability

Introduction

Climate change perception is a continuum of beliefs, practices, and activities derive from living in certain environment for longer period of time. It is testimony about why and how climate changes, practices of indigenous knowledge, and a set of activities to act on tackling this challenge in the name of adaptation and coping. Multi-dimensional climate change perception predominantly exists in the traditional or agrarian societies like Bangladesh where local people ascribe some reasons behind every environmental phenomena. Hence, lot of local stories, beliefs and so called superstition mix up with the factors like why climate is changing, who is changing climate, which human activities causing climate change, and what human should do to face climate change.

Perception of Climate Change

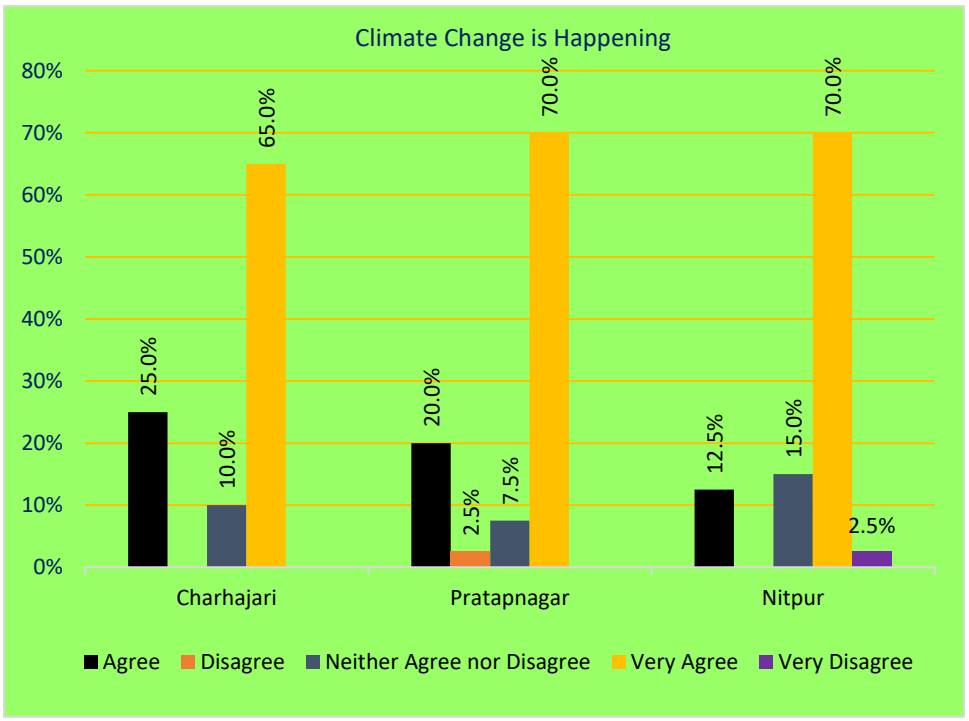
Despite the fact that Pratapnagar is the crude example of climate change impacts in all aspects of life, local inhabitants of Charhajari union possess comparatively deep understanding of climate change than other two sites. Therefore, climatic scenario is more visible in Pratapnagar; harsh saline landscape, scorching heat of sun and tree-less ecosystem miles after miles present reverse imagery of stereotypical greenish landscape of the country. Moreover, people would first shocked by the ecology of the region, and get sense back after coming closer to local people with warm interaction.

The Debate: Is Climate Changing?

This is a matter of big debate whether climate is changing or not. It is in fact a global debate that has local relevance too. There are lots of journal article on this discourse where famous sociologist Giddens leads on. This debate rises from epistemological regimes through the hands of few skeptics that finally turns into a political discourse in the United States and the world as well. Giddens (2008), in this regard, identified three categories of believers and skeptics of climate change; the first group thinks that global warming is happening for human greenhouse gas emission is not proven. Nevertheless, this group is skeptical about the severity of climate risk which they think is getting priority over many big problems the

world has been encountering for decades like poverty, HIV/ AIDS, nuclear weapons etc. Fluctuation in global climate is a natural phenomenon, which need not to be worried, and is a common feature of world climate. The second group is protagonists of the view that climate change is happening. IPCC, UNFCC in global scale and NGOs in local scale lead on this group. The last group is 'radical' who believe that we are already late to perceive the severity of climate change rate and the threats it poses. Perception of last group surpasses scientific projection and prediction about the impacts and changing rate.

Chart 6.1: Climate Change Is Happening

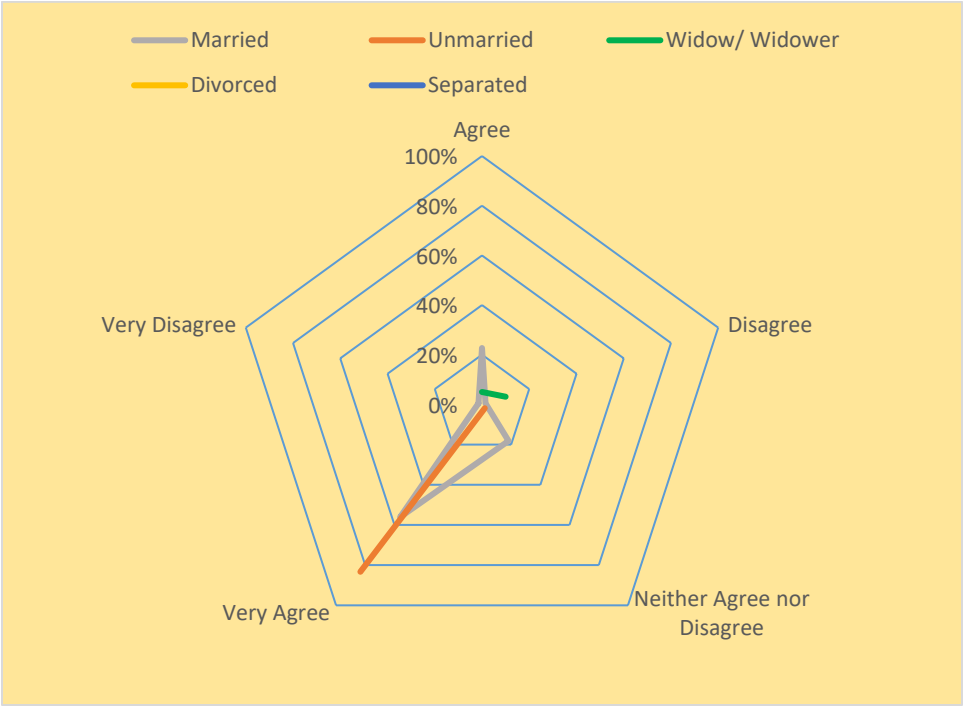


(Fieldwork 2019)

However, study participants from all three fields view that climate situation is deteriorating gradually comparing to last decades. Seventy percent respondents from both Pratapnagar and Nitpur are very agree to the statement that climate is changing (chart 6.1). A slightly lower percent of people from Charhajari are very agree to the statement. Twenty five percent respondents of Charhajari, twenty percent of Pratapnagar, and twelve-half percent

of Nitpur express their consent that climate is changing. Insignificant percent of people only from Pratapnagar behold skeptical belief about climate change.

Diagram 6.1: Climate Is Changing



(Fieldwork 2019)

On ground of marital experience, it has been shown in the diagram 6.1 that maximum opinions of both married, unmarried people goes to the strong consensus that climatic change is happening in the locality. It seems that some married people have neutral position regarding the perception of climate change. Table 6.1 explores about religious perception toward climate change in the communities. Seventeen percent of Hindu respondents comprises four percent of total respondents, and twenty-two percent of Muslim people, which is fifteen percent of total study people, agree that climate is gradually changing. All people from Buddhist community, eighty-three percent of Christian community, seventy six percent of Hindu community, sixty-three percent of Muslim community, all comprises sixty eight percent of total respondents are very agree to the statement.

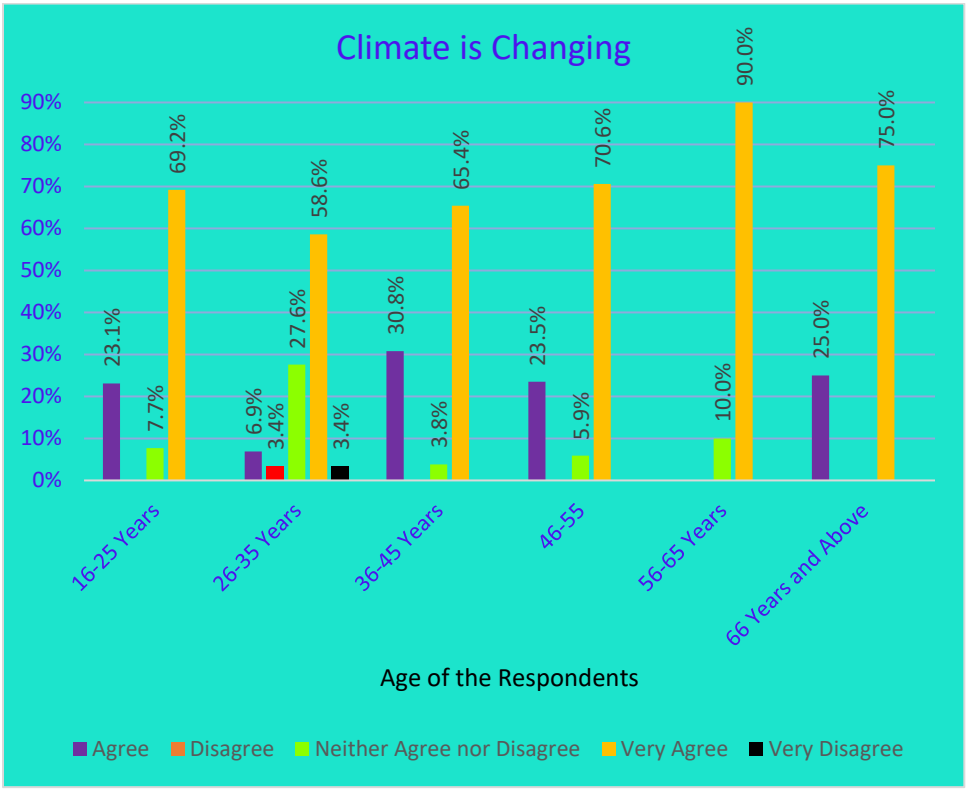
Table 6.1: Religious Affiliation Based Climate Change Perception

	Lickert Scale	Percent (%)	Religion				Percent of Total
			Buddhist	Christian	Hindu	Islam	
Climate is Changing	Agree	Within Religion of the Respondents	-	-	17%	22%	19%
		Percent of Total	-	-	4%	15%	
	Disagree	Within Religion of the Respondents	-	-	-	1%	1%
		Percent of Total	-	-	-	1%	
	Neither Agree nor Disagree	Within Religion of the Respondents	-	-	7%	14%	11%
		Percent of Total	-	-	2%	9%	
	Very Agree	Within Religion of the Respondents	100%	83%	76%	63%	68%
		Percent of Total	3%	4%	18%	43%	
	Very Disagree	Within Religion of the Respondents	-	17%	-	-	1%
		Percent of Total	-	1%	-	-	
Total		Within Religion of the Respondents	100%	100%	100%	100%	100%
		Percent of Total	3%	5%	24%	68%	

(Fieldwork 2019)

Climate change is a change in climate system over a period of twenty to thirty years. Local interpretation of weather and climate change requires indigenous knowledge on weather and climate of a particular region. This knowledge is communal, possessed by society members that is transferred from generation to generation for subsistence activities and survival strategies. Young members of the community acquire this knowledge by virtue of living in the community under close interaction with adults. Age and maturity are very important for climate change observation and procuring indigenous knowledge on it. In this regard, the chart 6.2 shows a contrasting scenario of age wise climate change perception in the study communities.

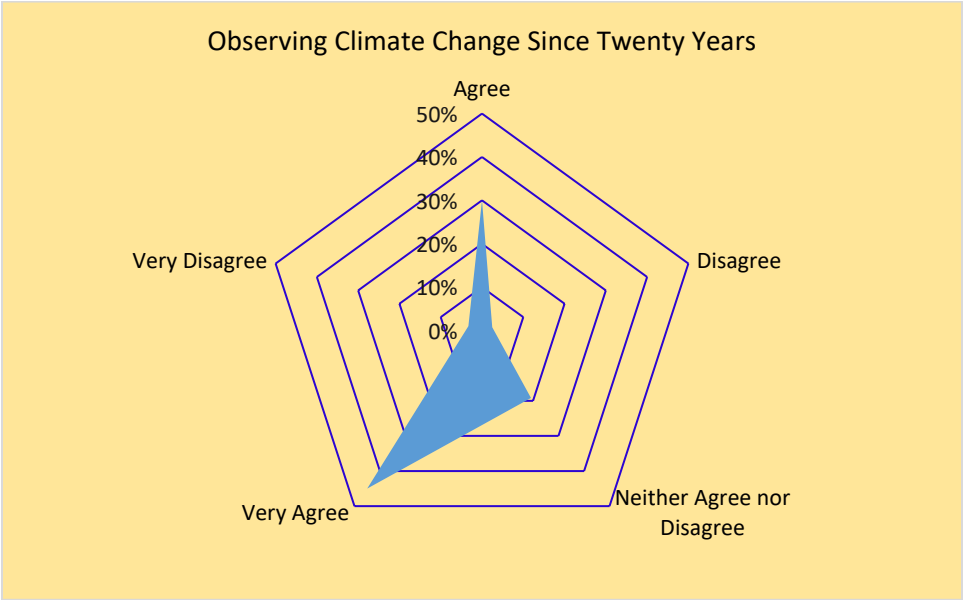
Chart 6.2: Age Wise Distribution of Climate Change Perception



(Fieldwork 2019)

The younger among the respondents have high agreement to the idea that climate is changing. Twenty three percent of the age group 16-25 years are moderately agree to the statement. It is seen in the graph that elderly people having age fifty six to sixty five years adamantly accept the issue that climate is changing. Most elderly people of the communities with age sixty-six and more years strongly accept the statement. People of this age group have neither hesitation nor doubt about the changing nature of climate. It seems that people who belong to the age group 26-35 years have less strong belief about climate change. More than three percent respondents under this age group only possess opposite opinion about climate change. Evaluation of majority respondents comes closer to the point of 'very agree' that further designates their observation of erratic behavior of local climate since twenty years (chart 6.3). A good number of study participants said that they are moderately agree to observe erratic behavior of climate in the locality.

Chart 6.3: Observing Erratic Behavior of Climate since Twenty Years



(Fieldwork 2019)

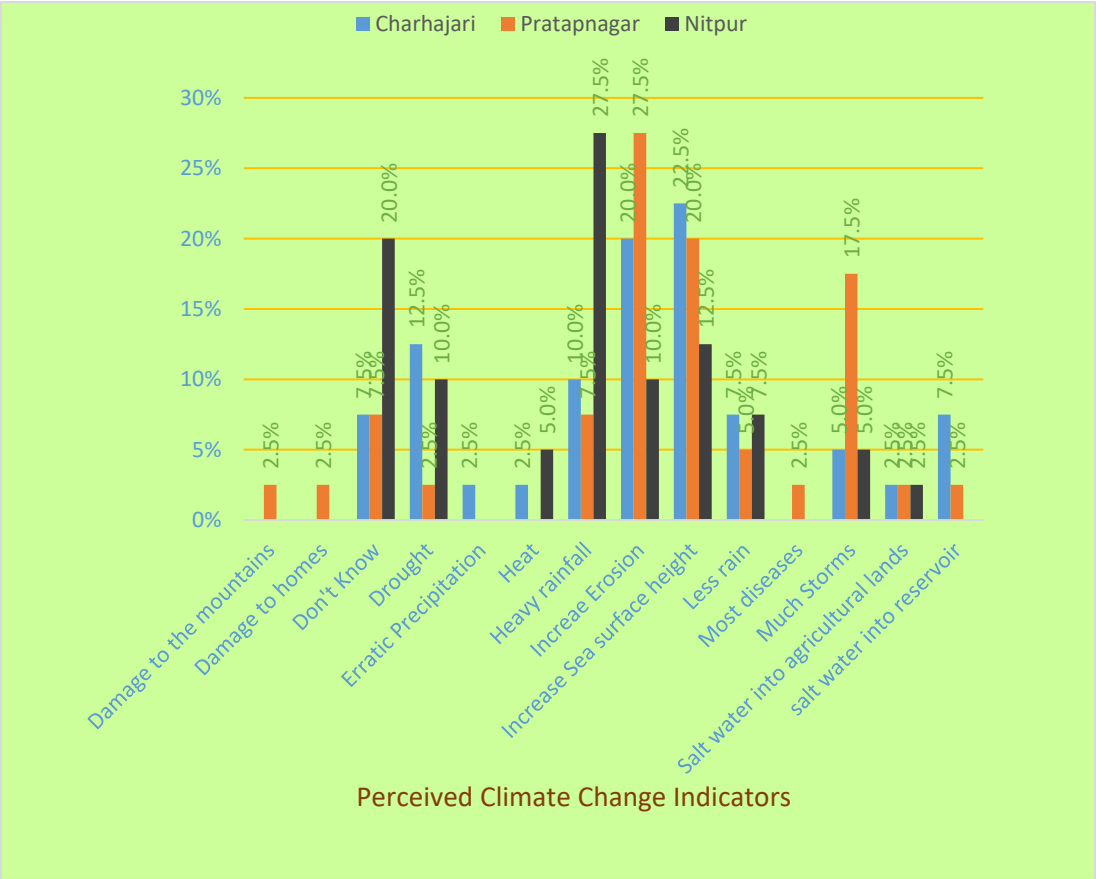
Climate Change Indicators

After the debate resolved, present study endeavored to explore about the factors that help local people to identify changing nature of climate. It extremely focused on the indicators by which local inhabitants demonstrate the climate is changing over times. Climate change indicators are the signs and signifiers that bears the testimonies of changing climate in the particular regions. There are two sorts of climate change indicators; scientific indicators of climate change are elaborated by world leading climate scientists and experts which are illustrated well in scientific way like global warming and temperature increase projection, ice melting in arctic, sea level rise, and social indicators are derived from the perception of local people on ground of living in a territory for longer period. However, the global indicators of climate change may coincide or collide with local context.

Chart 6.4 shows a comparative scenario of climate change indicators across study regions. It is shown in the chart that 12.5 percent respondents from Charhajari area, 2.5 percent from Pratapnagar and 10 percent from Nitpur identify drought as climate change indicators. Surprisingly, only Charhajari people recognize erratic precipitation as one of the indicators

that local climate is changing. 2.5 percent people of Charhajari and double of this number are from Pratapnagar detect heat for climate change. 27.5 percent, 7.5 percent, and 10 percent respondents respectively from Nitpur, Pratapnagar, and Charhajari identify climate change on ground of heavy rainfall within a shorter periods of time. River erosion is a local indicator of climate change in Bangladesh which is also identified by 27.5 percent people of Pratapnagar, and 20 percent people of Charhajari. Sea level rise is one of the mainstream indicators of global climate change as claimed by climate scientist is also recognized by local people of Charhajari, Pratapnagar and Nitpur. Among three sites, people of Pratapnagar highly ascertain more storms as one of the indicators of climate change while same percent of people from all sites pinpoint salinity intrusion into arable lands as indicator of climate change.

Chart 6.4: Climate Change Indicators

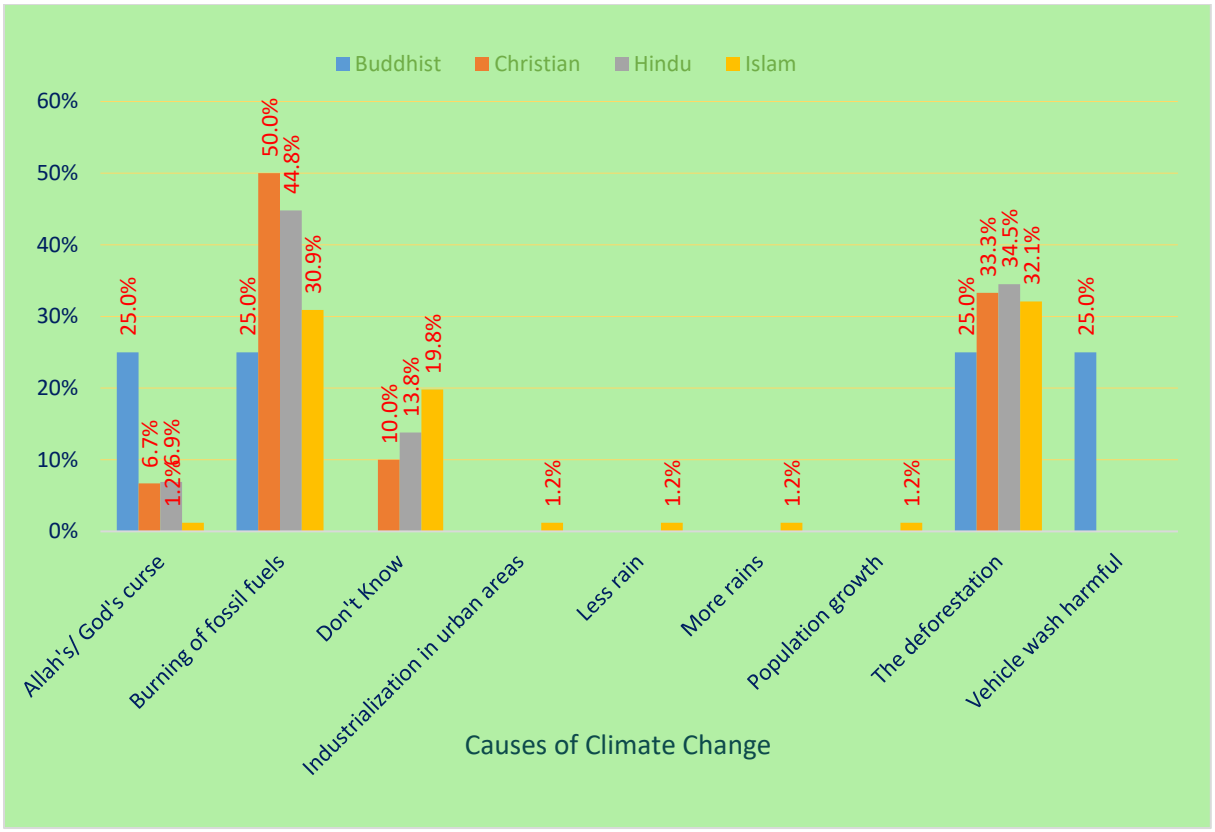


(Fieldwork 2019)

Causes of Climate Change

Natural scientists and geologists provide scientific definition of climate change prioritizing on scientific causes of climate change that is universal in nature. Mainstream climate literature talks about two types of climate change cause; natural reason and anthropogenic cause. Thus, local and indigenous people of many regions have their own understanding of climate change causes, though sometimes they accept scientifically valid causes. Nevertheless, local people tend to reject scientific causation behind climate change particularly when the question of their existence in the wilderness arises. In this regard, traditional inhabitants ascribe functional causes behind any anomaly occurred in nature like climate change. Their causation comprises of beliefs, thinking and practices that emerges from deep understanding with nature.

Chart 6.5: Causes of Climate Change



(Fieldwork 2019)

Bangladeshi people tend to regard climate change as Allah's curse or God's curse (chart 6.3). Local people have diverse perceptions and interpretations about climate change. Bangladesh is a Muslim dominant country where majority of Islamic follower adhere to Islamic customs. Hence, all religions get new form on ground of Bangladesh's national culture. Islamic practices in Bangladesh consist of both fundamental Islam, and local tradition, so the term 'Islam' denotes an amalgamation of basic Islamic rules, regulation in new and distinct form with local culture here. For wider sense, 'Hindu culture' in the context of Bangladesh refers to a new form of belief and practice that emerged from a continuum of cultural interaction of basic Hindu tradition to local Bangladeshi lifestyle, customs, beliefs, and practices. For example, the tradition of *Milad* ritual, *Kulkhani or Chollisha* ritual for Muslim are an addition to fundamental Islam. Here, religions shape up people perception toward climate change, particularly religions' explanation of causes of climate change is communicated to practitioners.

People of Noakhali and Satkhira regions have identified technological intervention in agriculture in terms of modern technology, human misdeeds and immoral tasks, violation of social norms and values as reasons for climate change (Mahmud and Uddin 2017). People of Noakhali tend to see normal condition of climate as the blessing of Allah and climate change as the punishment of Allah for human detachment from religious mandates and social deviance. Mahmud and Uddin (2017) mentioned an interesting case study'

> *"Allah is the creator of this universe. He sent us here for his worship. Allah promised to provide two things for human: Neayamot (gift and blessings) for good deeds and Gojob (curse) for immoral and sinful tasks. When humans indulge in committing sins such as violation of Purdah custom, telling lie, making premarital and extramarital sexual relations (termed as Zena), and denying of justice among others Allah sends down various types of punishment upon them. Thus, climate change is one of those curse and punishment (Mahmud and Uddin 2017:71)."*

Therefore, half- percent respondents of Christian community think that climate is changing due to burning of fossil fuels in local and global scale. 44.8 percent of Hindu religious group, 30.9 percent of Muslim group, and one-fourth percent of Buddhist people believe that burning of fossil fuels resulting climate change. Deforestation or cutting down the trees

and vanishing forest is classified by a good number of respondents for causation behind climate change.

Sources of Climate Change Information

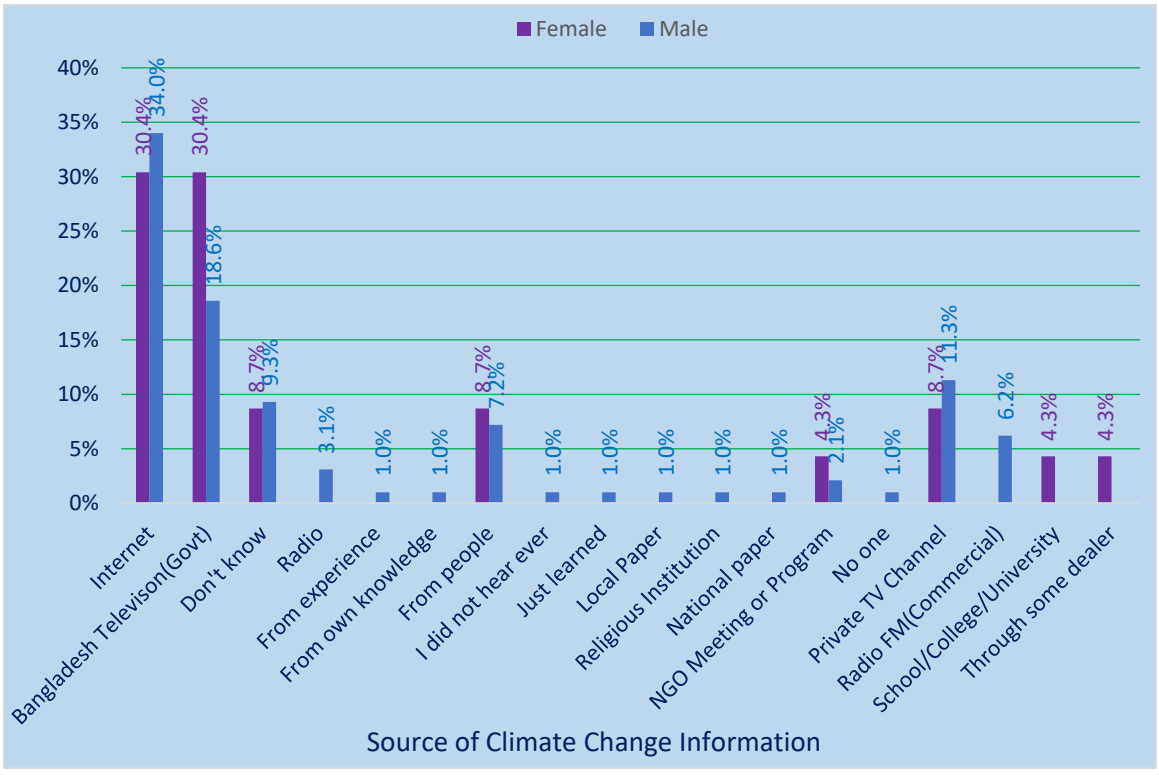
Access to information is very crucial matter, especially when it comes to the issue of crop production under climate change induced natural hazard and disaster. Climate information generation and dissemination helps local people particularly farmers and producers to make decision about harvesting timing, selection of the proper seeds as per temperature quality, sun-heat, wind direction and velocity, rainfall amount, moisture, cloud navigation, and haze amount. The forecast of danger and awareness signals also should reach at local level so that villagers can make decision about pre-collection of products in fear of damage and loss by climate change induced disasters. There are many sources of information available in local areas; some are reliable and much information are not trust-worthy likewise rumors. Local people get information about climate change from a wide range of sources; some are local and national, and a little information reach at the local inhabitants by crossing international border.

In Bangladesh rural society, men traditionally do agricultural activities while women do household chores. Nevertheless, many women of the study communities are engaged in production activities along with their male part. Few widow and separated women have to take whole decision about farming, i.e. which seed would be planted, when to plant, when to irrigate and how much hired labor necessary for plantation, weeds clearing, and collection of products. For these reasons, it is necessary for both male and female to receive climate and disaster information in times of emergency.

Chart 6.6 shows that most of the male and female study participants receive information about climate change through internet. Internet is now very cheap in Bangladesh albeit there are questions on speed and actual bandwidth. Agricultural data, weather forecast, climate seasonality and variability information are now available in Bangladesh Meteorological Department's website and their android apps. Moreover, the ministry of

agricultural extension also diffuse agriculture related climate information. Local people use Facebook where necessary information about weather and climate is available at rural level. This scenario was likely different two decades ago when people used to get information from radio. Information flow has changed dramatically with the advent of mobile device and internet; this is why now people have wide access to the information, as it was unthinkable in the near past. Therefore, 30.4 percent female respondents said that they get information on climate change from BTV while their male counterparts comprises 18.6 percent. By far and now, among various climatic information sources identified by the present study, internet and television are significant sources on which people rely upon. Nonetheless, some people pointed out the reliability and credibility of internet data mainly Facebook based information as there are much fraud information circulates. In this regard, local residents said that they share this climatic information with their friends, relatives and fellow farmers to come at the community consensus about the real fact.

Chart 6.6: Source of Climate Information

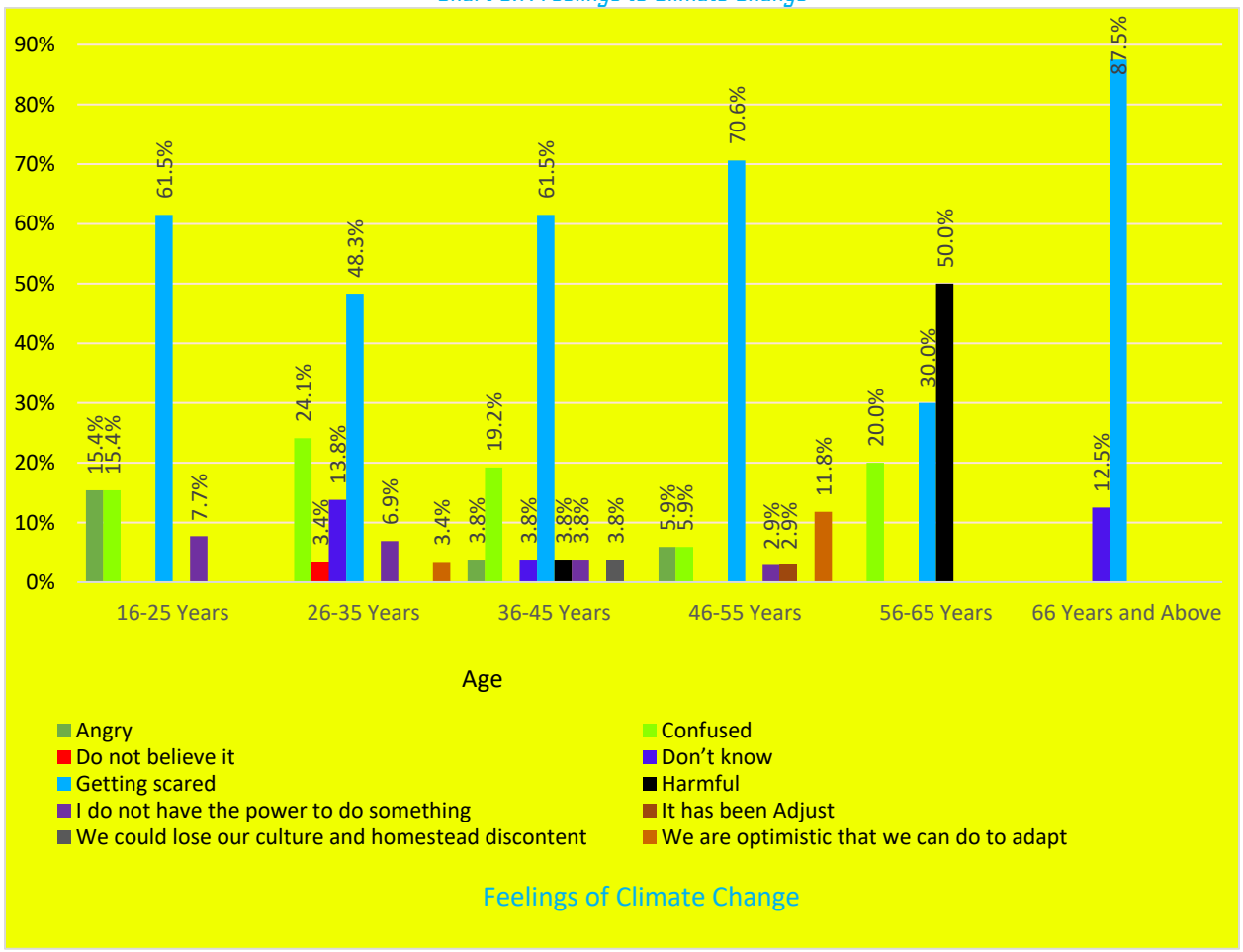


(Fieldwork 2019)

Feelings toward Climate Change

Climate change is the buzzword of present days that people used to hear about this frequently. It is now more real than abstract scientific explanation as people have been experiencing it in their daily life. Perception of climate change is relative depending on age, place, profession, education, religion etc. Mahmud and Uddin (2017) reports that climate change perception and feelings around it significantly depend on age as feelings and sensitivity of a young person meaningfully vary from elderly people. Climate change and its components have capacity to sensitize people in large public scale that may lead to social action across border i.e. Greta Thunberg

Chart 6.7: Feelings to Climate Change



(Fieldwork 2019)

Chart 6.7 shows age wise feelings of people to climate change. It is shocking that younger generation express their anxiety about climate change whereas 61.5 percent people of age group 16-25 years said to be scared due to climate change. Equal number of respondents of this age group feel angry and confusion to it. 7.7 percent young people belong to this age group do not know about feelings they have. Nearly half- percent respondents from the age group 26-35 years express their fear about climate change. A good number of people of this group are confused about climate change feelings while 13.8 percent said that they do not know about it. More than sixty one percent people of age group 36-34 years feel scary for climate change where 19.2 percent express their confusion about it. 70.6 percent people of age group 46-55 years think that they are getting scared because of climate change. Half percent respondents of age group 56-65 years feel harmful and 87.5 percent of age group sixty six years and more feel scary toward climate change. The chart gives a clear view of scary feelings of people from all age groups to changing climate.

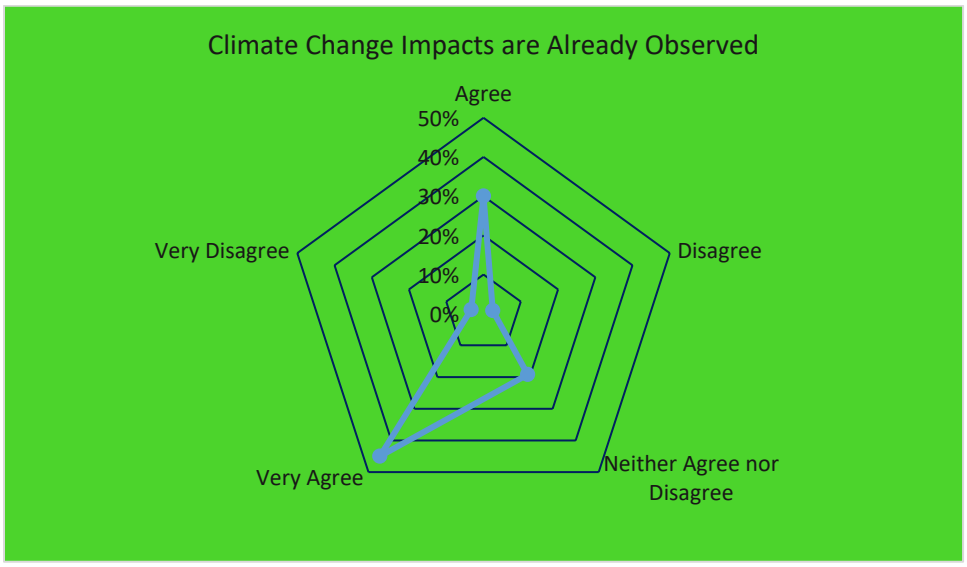
Local Interpretation of Climate Change Impacts and Vulnerability

Impacts of global climate change on local people of Bangladesh are well communicated in mainstream scientific literature. Hence, anthropological work on local people's testimonies of climate change impacts and vulnerabilities in Bangladesh is very inadequate to date. Local inhabitants have their own way of internalization, symbolism is attached to many climate induced debacles such as, thundering is considered as threat of or warning from Allah in Charhajari, their interpretations relating to socio-cultural and religious aspects of life sometimes collide with scientific argument. Nonetheless, profound understanding of local environment, close interaction with other components/ organ of ecosystem, and observatory power make local inhabitants' interpretation of climate change impacts unique, particularly in anthropology. Therefore, global projection of climate change trend and impacts may not fit in many remote parts of the world; here local peoples' interpretation and assumption are crucial information (re)sources. Climate change has many evidences in the locality which will be discussed later. First, people of the community strongly agree that climate change impacts are already observed and experienced (chart

6.8). Some respondents have neutral stance about the observation of climate change impacts in the locality. Their perception toward climate change is positive as they think climate is changing gradually but they are somewhat skeptical about the impacts of climate change in the locality. Taking account the existence of hazard and disaster before identification of climate change, this group of people argue that jeopardy is taking place but they are not sure whether this is happening due to climate change. A respondent said that –

> *Cyclone, thundering and norwester is now happening just happened before. We found norwester in our childhood more devastating than nowadays. It blew up tin and chan roof of the kutcha houses, spoiled the mango bud, fallen down roadside tree and electricity carrying pillars. Now, norwester is weaker than past. Recently, we see more frequent thundering than before. It is very unusual to observe much lighting with bursting sound. We are not sure whether it is happening because of climate change.*

Chart 6.8: Climate Change Impacts Observation

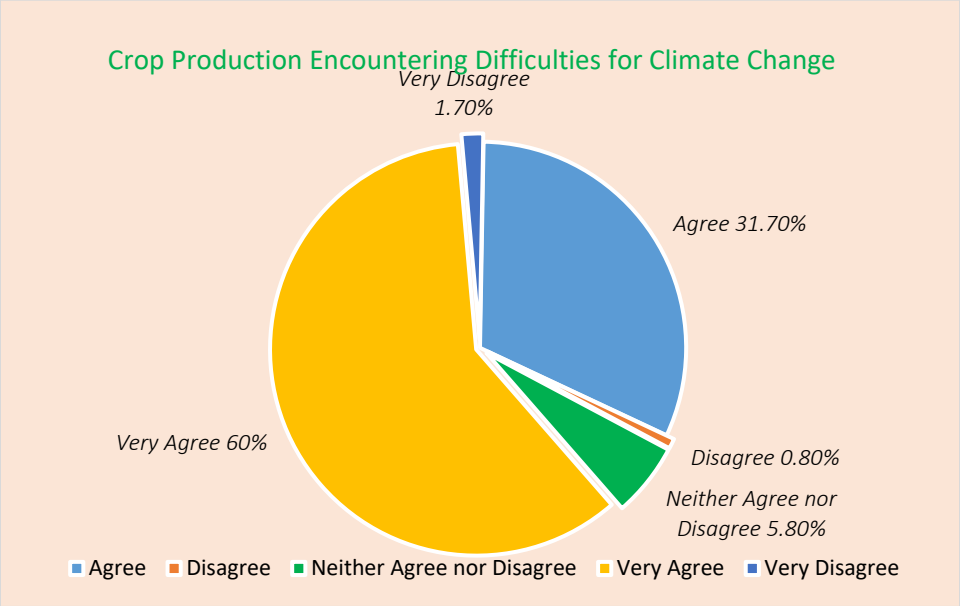


(Fieldwork 2019)

Therefore, chart 6.9 presents community agreement on the impacts of climate change on crop production in the locality. It is primarily found that majority's perception goes to very strong statement that climate change is having impact on crop production in the regions. Increased heat coupled with erratic precipitation have been stopping *Aoush* production in

Charhajari union. Moreover, irregular precipitation, unnecessary and harmful rain in dry season during *Robi crop*, scorching heat of sun during *Aman* and shrimp farming, downpour during crop collection time, all creates a very tough environment for crop production.

Chart 6.9: Crop Production Encountering Difficulties for Climate Change



(Fieldwork 2019)

Climatic Hazard: Seasonality and Trend

As it has been stated above that the occurrence of disaster was present in the past but climate change is said to increase their intensity and frequency with massive cost, or substantial damage and loss may be avoided through awareness buildup but climate change will aggregate natural perilous events in new dimension that the world might not experience before. That is loss and damage may be gradually less but frequency of climate induced catastrophic incidence will be escalated and tough to manage. However, people of all three study sites seem homogenous in counting upon disaster on ground of Bengali calendar. Local residents keep in mind of the calamities according to the Bengali months.

Table 6.2: Climatic Hazard Trend in Charhajari, Companiganj

Decades	Tidal Surge	Storm/ Cyclone	Norwester	Salinity	Thunderstorm	Heat Wave	Flood	Water Logging	Hailstorm	Erratic Rainfall	River Erosion
2017-2010	□ ○ Δ	□ ○ Δ	□□ ○○ Δ	□□□□ □□ ○○ Δ	□□ ○○ ΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□ ○○ ΔΔ	□□ ○○ ΔΔ	□□□□ ○○○○ ΔΔΔΔ
2010-2000	□ ○○ ΔΔ	□□ ○○ ΔΔ	□ ○ Δ	□ ○ Δ	□□ ○○ ΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○○ ΔΔ	□□ ○○ ΔΔ	□□□□□ ○○○○○ ΔΔΔΔΔ
2000-1990	□□ ○○ ΔΔ	□□□ ○○○ ΔΔΔ	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□□ ○○ Δ	□□□ ○○○ ΔΔΔ
1990-1980	□□ ○○ ΔΔ	□□ ○○○ ΔΔ	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□□ ○○ Δ	□ ○ Δ
1980-1970	□□ ○○ ΔΔ	□□ ○○ ΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○ Δ

Δ= Damage, ○= Range, □= Frequency of Occurrence (on five scale)

(Fieldwork 2019)

Present study had extensive effort to account the frequency of climatic hazard over a time period of fifty years. The time-interval for identifying climate change driven hazard was ten years. Respondents were asked to describe about the major hazard they have been observing over decades. After the key hazards had been identified by local people in participatory discussion, people were further asked to explore about the trend of loss/ damage against particular hazard that is whether damage of a hazard is increasing or decreasing over times, and the range of these hazards which is how much area and people are affected by certain hazard. The frequency, range and damage of tidal surge in 1970s was same that indicates its frequency of occurrence and intensity was likewise the loss and damage it resulted (table 6.3).

Two marks refer that tidal surge in this decade was moderately less common. Likewise 1970s, the frequency, intensity/ range, and damage of tidal surge remain same until 1990s, though its frequency reduced in 2000s but range and degree of damage remain same like previous decades. It indicates that the occurrence of tidal surge had decreased although damage rate and affected area did not lessened. Storm/ cyclone remain same likewise tidal surge in 70s but its range increased in 80s. People reported that the impacts of cyclone during this decade was enormous than previous decade as it costed many lives. Storm/ cyclone in 1991, 1998 and 1999 caused deaths of human being and livestock, damaged trees and infrastructure. This is why the frequency, intensity, and degree of damage is higher in 1990s. Tidal surge and cyclone are synonymous, tropical cyclone results tidal surge. These two hazards are decreasing day by day. People of Charhajari viewed that norwester was less common in 1970s that increased in 1980s and 1990s with same frequency, range and damage. According to local inhabitants, all three marks of frequency, range and damage during these decades were comparatively higher as it caused massive cost. During 2000s, the frequency, range and damage caused by norwester was less but it started to be higher since 2010s. Salinity intrusion in arable lands and thundering are increasing day by day. Heatwave remains same since five decades. Charhajari union is surrounded by a small Feni river that drains water when downpours. So flooding has a decreasing trend in the union. Water logging in small scale is presence here which also remain same over the decades. The incidence, range and rate of damage exposed by hailstorm is swelling from 1990s. Among all the hazards identified by local people of Charhajari, river erosion is mighty one in terms of frequency, range and damage. Before 1980s river erosion was less common in the locality which over decade appeared as a deadly hazard costing lives, assets, infrastructure, and even cultivable lands. The incidence of erratic rainfall in the form of pre-monsoon and post-monsoon heavy precipitation, downpour within a shorter period of time, irregular/less rainfall during monsoon has been increasing over decades in large part of the union that causes terrific damage and loss.

Table 6.3: Climatic Hazard Trend in Pratapnagar, Assasuni

Decades	Flood	Heat Wave	Hailstorm	Thunderstorm	Norwester	River Erosion	Water Logging	Salinity	Erratic Rainfall	Shrimp Virus	Tidal Surge	Storm/ Cyclone
2017-2010	□ ○ Δ	□ ○○ ΔΔ	□□ ○○ ΔΔ	□□□ ○○ ΔΔ	□□□ ○○○ ΔΔΔ	□□□□ ○○○○ ΔΔΔΔ	□□□□□ ○○○○ ΔΔΔ	□□□□ ○○○○ ΔΔΔΔ	□□ ○○ ΔΔ	□□□ ○○ ΔΔ	□ ○○ ΔΔ	□ ○ Δ
2010-2000	□ ○ Δ	□ ○○ ΔΔ	□ ○○ ΔΔ	□□ ○○ ΔΔ	□□□ ○○○ ΔΔΔ	□□□ ○○○ ΔΔΔ	□□□□ ○○○○ ΔΔ	□□□ ○○○ ΔΔΔ	□□ ○○ ΔΔ	□□ ○○ ΔΔ	□□ ○○ ΔΔ	□□ ○○ ΔΔ
2000-1990	□□□ ○○○ ΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□ ○○ Δ	□ ○○ Δ	□□ ○○○○ ΔΔ	□□□ ○○ ΔΔ	□□ ○○ ΔΔ	□ ○ Δ	□ ○ Δ	□□□ ○○○ ΔΔΔ
1990-1980	□□□□ ○○○○ ΔΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□□□ ○○○ ΔΔΔ	□□ ○○ ΔΔ	□ ○ Δ	□□ ○○ ΔΔ	□ ○ Δ	□□ ○○ ΔΔ	□□ ○○○ ΔΔ
1980-1970	□□□□□ ○○○○○ ΔΔΔΔΔ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○ Δ	□ ○○ Δ	□□ ○○ ΔΔ	□ ○ Δ	□□ ○○ ΔΔ	□ ○ Δ	□□ ○○ ΔΔ	□□ ○○ ΔΔ

Δ= Damage, ○= Range, □= Frequency of Occurrence (on five scale)

(Fieldwork 2019)

Flood was very frequent hazard in Pratapnagar union before two decades (table 6.3). During 1970s and 1980s, the occurrence of flood along with happening area and damage was too higher comparing now. Local residents report that there was gigantic flood in the union in 1970, 1971, 1977, 1978 that inundated all wards of the union and caused massive human and livestock deaths, wiping out of crops, washing out of fisheries. Therefore, flood incidence has been reducing gradually since 1990s. Heatwave occurrence rate remains same as of previous decades but its occurring area and surrounding damage has been increasing since 2000s. On the other hand, happening rate, intensity and substantial damages caused by hailstorm, thunderstorm and norwester are dwindling since 2000s. Frequency of occurrence, intensity of affect and damage exposed by

river erosion has dissimilar trend over decades. This union is surrounded by embankments that produce vulnerability of erosion risk. River erosion got new strength in 1980s when its frequency of occurrence, erosion area and amount of loss and damage preceded previous decade. Dramatically, river erosion was under controlled during 1990s that devastatingly appeared again 2000s. Now it is one of the growing impacts of climate change on local community of Assasuni with immense cost. Water logging happened in small scale during 1970s and 1980s though more area went under water during 1990s because of closing the canal through building dam for fish cultivation. From this time, the tradition of constructing dam in natural canal to create demarcation for fish cultivation has been going on that causes more area waterlogged and results sufferings of local dwellers. Salinity intrusion has been intensifying since 1990s which is now a major hazards in the locality with multidimensional impacts. Shrimp virus is growing faster over decades and bringing about massive loss. Storm/ cyclone and tidal surge caused by it have a decreasing trend after 2000s.

Table 6.4: Climatic Hazard Trend in Nitpur, Porsha

Decades	Drought	Heat Wave	Hailstorm	Thunderstorm	Norwester	Fire	Cold Wave
2017-2010	□□□□ ○○○○ ΔΔ	□□□□ ○○○ ΔΔΔΔ	□□□ ○○○○ ΔΔΔΔ	□□□ ○○○ ΔΔΔ	□□□ ○○○○ ΔΔΔ	□ ○ Δ	□□□□□ ○○○○ ΔΔΔ
2010-2000	□□□□ ○○○○ ΔΔ	□□□□ ○○○○ ΔΔΔΔ	□□□ ○○○ ΔΔΔΔ	□□□ ○○○ ΔΔΔ	□□□□ ○○○○ ΔΔΔΔ	□□□ ○○ ΔΔΔ	□□□□ ○○○○ ΔΔ
2000-1990	□□□□ ○○○○ ΔΔΔ	□□□□□ ○○○○ ΔΔΔΔ	□□□ ○○○ ΔΔΔΔ	□□ ○○ ΔΔ	□□□ ○○ Δ	□ ○○ Δ	□□ ○○○○ ΔΔ
1990-1980	□□□□ ○○○○ ΔΔΔΔ	□□□□□ ○○○○○ ΔΔΔΔΔ	□□ ○○ Δ	□ ○ Δ	□□ ○○ Δ	□□ ○○ Δ	□□□□ ○○○○ ΔΔ
1980-1970	□□□□ ○○○○ ΔΔΔΔ	□□□□□ ○○○○ ΔΔΔΔ	□□ ○○ ΔΔ	□ ○ Δ	□□□ ○○ Δ	□ ○○ Δ	□□ ○○ ΔΔ

Δ= Damage, ○= Range, □= Frequency of Occurrence (on five scale)

(Fieldwork 2019)

Nitpur is a drought prone area where precipitation scarcely happens. Table 6.4 shows that scenario of occurrence of drought in Nitpur remain same over five decades from 1970s to 2010s while its impacts significantly decreased from 1990s. Drought is a natural phenomenon where human has no control over its occurrence but there are some options open for humankind to escape the adversities exposed by drought partially. Irrigation engineering and local water management mechanism prompted by the advent of modern technology ensures installation of deep tube-well, and digging of water reservoir mitigated damage and loss over decades. Heatwave is another hazard in this area which frequency of happening, range or covering area, and damage was much higher during 1980s. Until 2010s, heatwave remains one of the impactful hazard in the locality. The rate of occurrence, range and impact of hailstorm increases likewise thunderstorm results hailstorm. In fact, most of the times, norwester results thundering and hailstorm simultaneously. So the incidence of norwester bumps up as of hailstorm and thundering. Local people report that the incidence, range/ intensity and damage generated by norwester and fire was bit higher during 2000s comparing to other four decades from 1970s to 2010s.

Fire is an exceptional hazard identified by local people of Nitpur in a participatory group interaction. Fire incidence takes place in this area during dry spell when dried materials like grass, jute stick, leaves and branches of tree, chan roof etc. come in contact with flammable substances such as match, lighter etc. Respondents report that the hazardous incidence brought about by fire during 2000s was tremendous whereas some intentional and retaliating fire incidence took place in this decade.

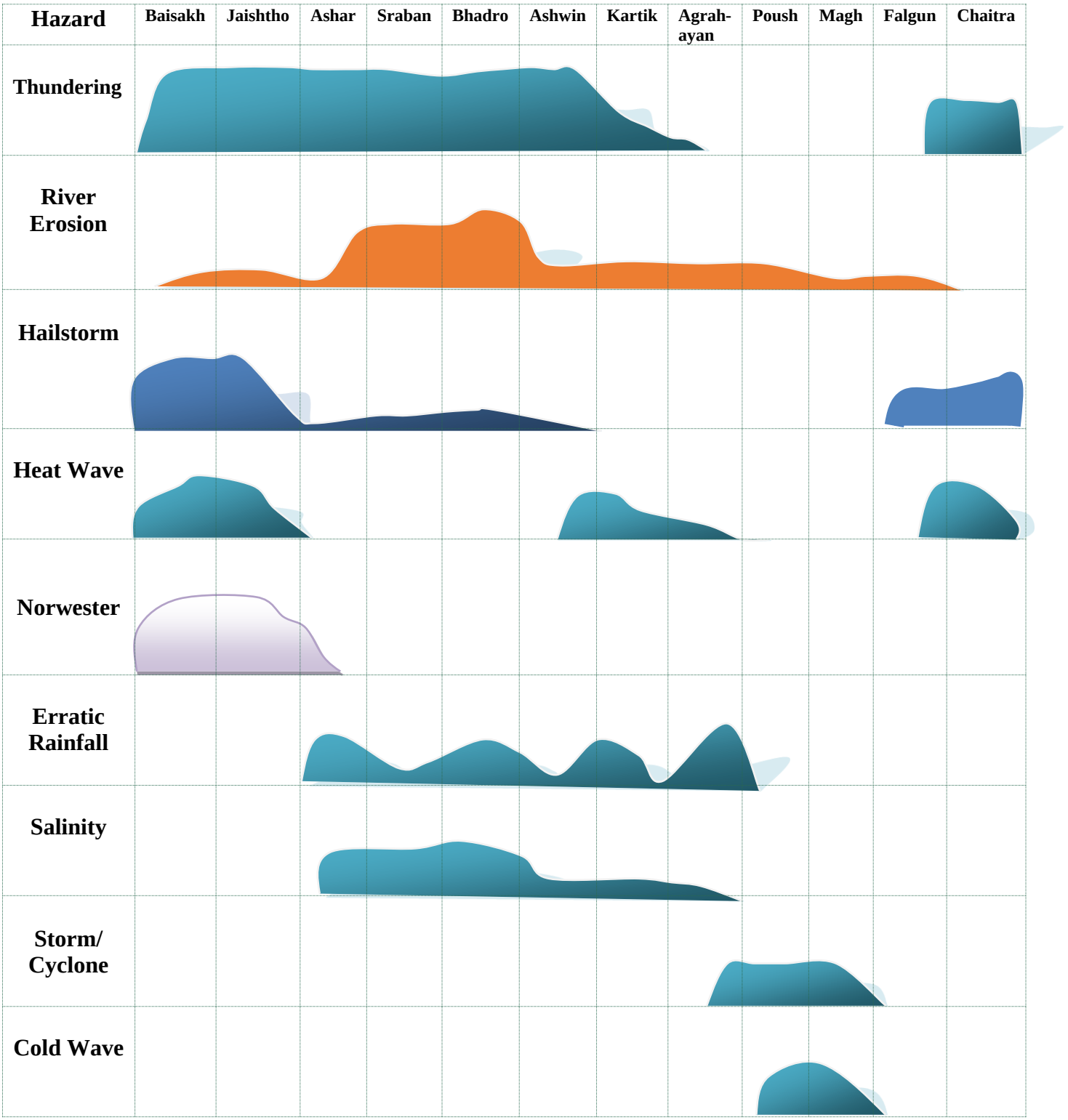
Nature of this region turns hotter in summer and colder in winter. Local inhabitants embrace two excessive temperature here; heat and cold. Hence, summer day starts with scorching sunlight and ends with sweating for high humidity, and winter day starts with bone shivering chill and low visibility for deep haze. Climate change induced increased trend of cold wave is true in Nitpur that cause massive damage of life, livestock and crop production.

Table 6.5: Bengali and English Calendar

Bengali Season	Start	End	Bengali Months	Corresponding English Names
Bosonto/ Spring	Mid-February	Mid-April	Falgun, Chaitra	Spring
Grishmo/ Summer	Mid-April	Mid-June	Baishakh, Jaishtho	Summer
Borsha/ Monsoon	Mid-June	Mid-August	Ashar, Sraban	Monsoon
Shorot/ Autumn	Mid-August	Mid-October	Bhadro, Ashwin	Autumn
Hemonto/ Late Autumn	Mid-October	Mid-December	Kartik, Agrahayan	Late Autumn
Sheet/ Winter	Mid-December	Mid-February	Poush, Magh	Winter

Local people from all three sites, account climate hazard on ground of the months of Bengali calendar. Some educated people have tendency to count upon hazards according to Gregorian calendar. This anthropological study tends to pick up local voices from the way it is (emic approach), so it strived to categorize hazard calendar and timing assimilating to Bengali calendar. Like Gregorian style Bengali calendar has twelve months, *Baishakh* comes first at 14 April. Serially the other months of Bengali calendar are *Jaishtho, Ashar, Sraban, Bhadro, Ashwin, Kartik, Agrahayan, Poush, Magh, Falgun,* and *Chaitra*. These twelve months are distributed in six seasons; *Baishakh* and *Jaishtha* months comprises summer, monsoon season consists of *Ashar* and *Sraban* months, autumn includes *Bhadro* and *Ashwin* months, *late-autumn* encompasses *Kartik* and *Agrahayan* months, winter is the total duration of *Poush,* and *Magh* months, and spring is the combination of *Falgun,* and *Chaitra* months.

Diagram 6.2: Climatic Hazard Calendar, Charhajari, Companiganj



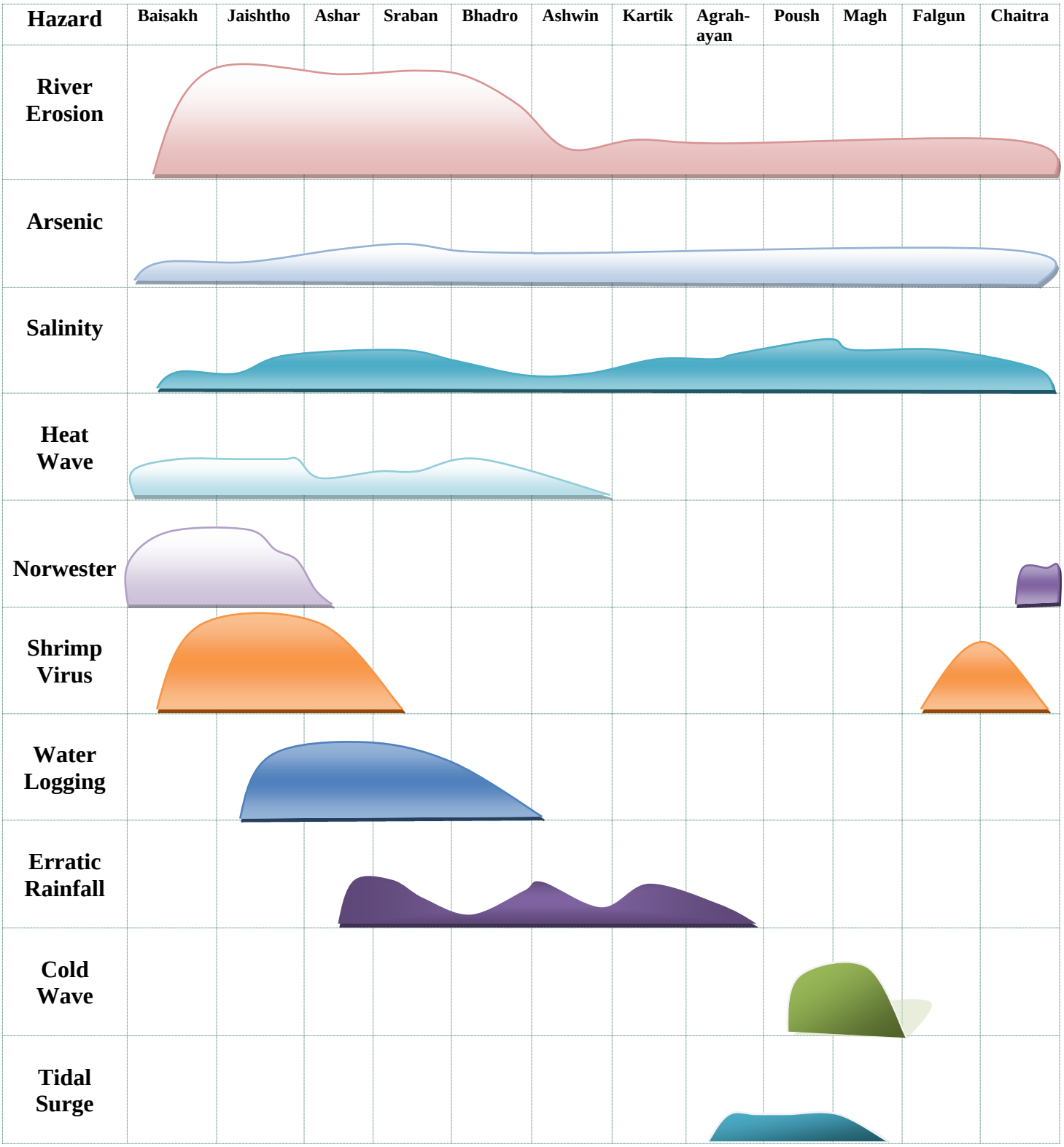
(Fieldwork 2019)

Diagram 6.2 shows that thundering/ thunderstorm/ thunder rain starts to take place in Charhajari union from the end of the Falgun that remain same until mid of the Ashwin. After mid Ashwin, less thundering happens that comes to the ends at the middle of Agrahayan. River erosion is a likely a yearlong hazard in Charhajari that starts from mid Baisakh to early Chaitra. River highly erodes embankments and edges from late Ashar to early Ashwin. Hailstorm starts to fall down on the locality mildly from first half of Falgun that boosts up during Baisakh to early Jaishtha.

Heatwave is a scattered perilous event in Charhajari that have existence during early Falgun to early Ashar and mid Kartik to late Agrahayan. Norwester or *Kalbaishakhi* hit the community from the beginning of Baishakh to mid Ashar. Erratic rainfall (including irregular precipitation, less precipitation, downpour, and continuous heavy rainfall for many days) predominates from mid Ashar to the start of Poush while salinity intrudes in the locality from mid of Ashar to the end of the Agrahayan. Tropical storm and cyclone affect the region from mid Agrahayan to early Falgun while cold weather waves from first half of Poush to early Falgun.

Among the menaces identified by local residents of Charhajari union, thunderstorm and river erosion are nearly yearlong hazard in which thundering happens throughout ten months out of twelve where river erosion occurs in eleven months. Heatwave blows on the locality for nearly seven months (national definition of heat wave is different from local perception; local people term it heat wave when scorching sun light and hot wind coupled with increased humidity blows on the locality. Contrariwise, Bangladesh Meteorological Department terms it as heatwave when the highest temperature touches or surpasses 36°C for 3 sequential days at three weather stations (Hossain 2019). Erratic rainfall goes on seven months of the year while salinity intrudes throughout six months. Both storm and cold wave take place for three months.

Diagram 6.3: Climatic Hazard Calendar, Pratapnagar, Assasuni



(Fieldwork 2019)

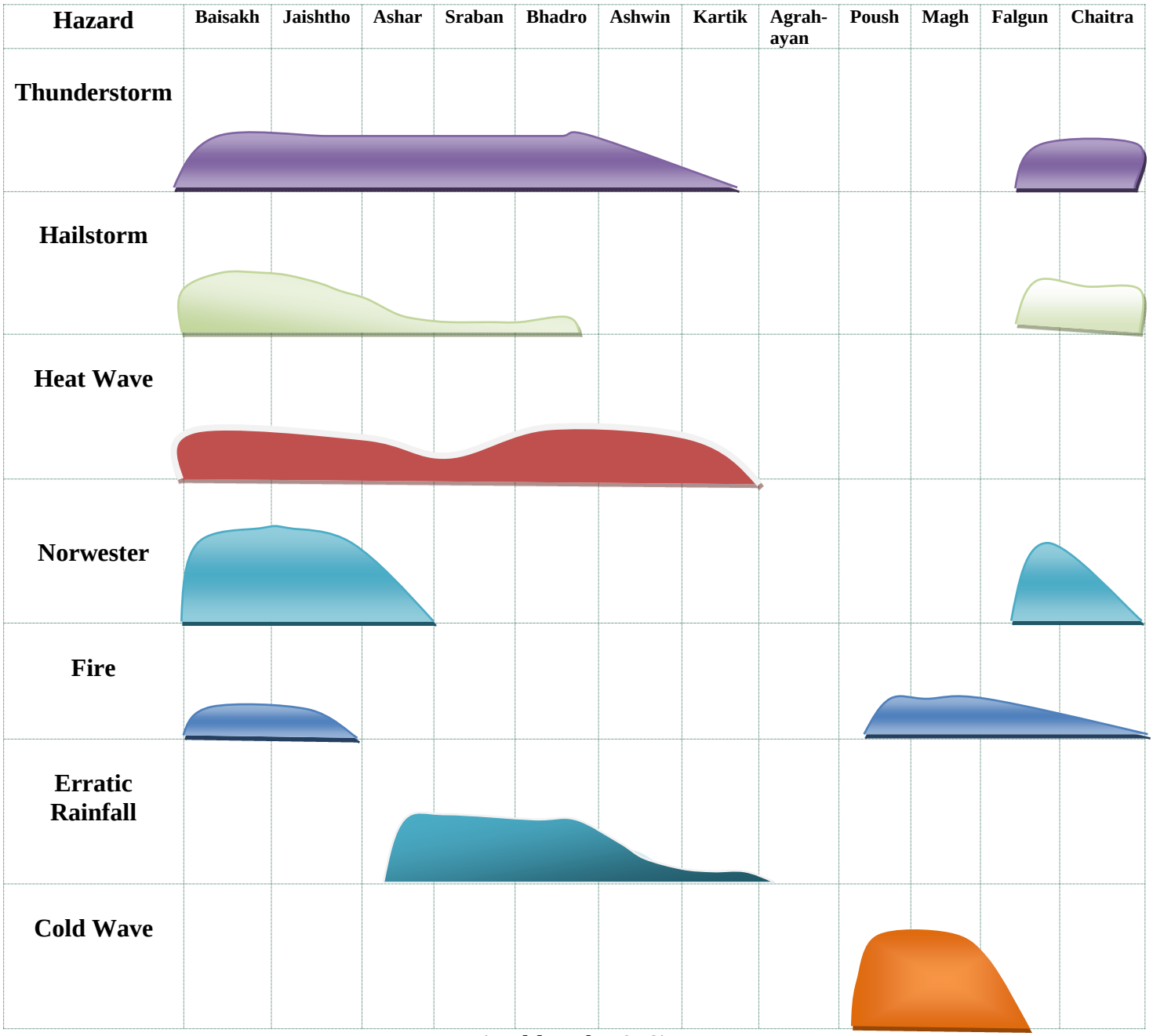
Diagram 6.3 shows that river erosion is a twelve months long hazard in Pratapnagar union that takes crude face from the mid of the Baisakh to late Bhadro. River erodes embankment and nearby edges when there are heavy flow in the *Kholpetua* and *Kapotakkhor* river. Scenario of arsenic contamination in underground drinking water remain same throughout the year. Unlike arsenic hazard, the amount of salinity intrusion in arable lands fluctuate pursuant to precipitation rate.

Pratapnagar is a saline prone area where shrimp girdle replaces agricultural crop production since 90s. Landscape of Pratapnagar is unlike other parts of the country where water desert represents a different Bangladesh with no trees miles after miles. As far as the eyes sight goes on, shrimp girdles are visible with no shelter plants that further makes the environment very harsh and sizzling in response. By reference to this exploration, it is shown in the diagram that heatwave prevails in the locality from Baishakh to Ashwin.

Norwester or *Kalbaishakhi* takes place from mid Chaitra to mid Ashar. It is mainly local types of cyclonic hazard that creates from increased temperature and humidity. Norwester is a regional climatic hazard while cyclone and storm is a tropical hazard that is forecastable but the first cannot. Norwester comes suddenly, affect quickly and vanishes promptly. It affect single part of a region while cyclone or storm covers vast area with devastating impacts. Shrimp virus usually go throughout the course of shrimp farming but raises during summer and dry season.

Water logged during rainy season when rainwater traps in the locality cannot find way out due to closure in the canal and drains. People of Pratapnagar union think that erratic rainfall takes place during mid Ashar to end of the Agrahayan. Its propensity increases in the beginning of Ashar, Ashwin, and in the mid of Kartik. Temperature of this union is likely warmer where cold wave is likely exceptional event. Nonetheless, according to the local inhabitants, cold wave blows upon this union from mid Poush to end of the Magh. Pratapnagar is situated in coastal belt where tidal surge sometimes engulfs the locality usually from mid Agrahayan to late Magh month.

Diagram 6.4: Climatic Hazard Calendar: Nitpur, Porsha



(Fieldwork 2019)

Nitpur is warmer region comparing to other study sites. Thundering is more frequent here. Thunderstorm occurs in same amount from mid Falgun to late Bhadro but starts to decrease from early Ashwin and finally ends up in late Kartik. Thundering rarely happens in winter season in the months of Poush and Magh. Nitpur area is famous for mango production

where hailstorm is one of the critical hazards that cost massive loss. Hailstorm drops down on the locality when winter season stops for spring and it continues falling in same amount until Jaishtha.

Like Charhajari and Assasuni, norwester takes place in the community from mid Falgun to late Ashar month of Bengali calendar. Due to situating in Barind tract, Nitpur has no record of major tropical cyclone/ storm. Owing to geographic location in land bounded drought zone, Nitpur has incidence of fire. On the word of local inhabitants, fire takes place during dry spell from mid Poush to the end of Jaishtha. This place is very famous for suffering from erratic rainfall throughout the years. For this union, erratic rainfall refers to the irregular or very inadequate rainfall during rainy season. Chilly weather waves on the locality from first half of Poush to mid of Falgun.

Narratives of Climatic Hazard

River Erosion

Fire leaves ashes but river erosion takes away everything, a local proverb used to indicate the cruelty of river erosion in the locality. River does not erode soil, in fact it washes away dreams. River erosion is the cruel hazard that makes people pauperized from all aspects. Countless mesmerizing houses, mosques, temples, centenarian banyan trees disappeared into river-heart and nothing left for destitute people except melancholic memories and wretched dreams. The Small Feni River and many canals demarcate Charhajari that welcome speedy current from the nearby Bay of Bengal to heat the shore community directly with enormous force. Of the reasons behind river erosion in the locality, overflow and speedy current from the Bay is central making the region more fragile to endure river erosion driven sufferings. Practically most of the respondents from this union remarked that the significant reasons for river erosion are – over siltation in the waterway, decline inside and out, feeble development of dam and current wave etc. In Charhajari union river erosion can likewise happen during anytime of the year because of the alters of the course of waterways.

Moreover, as indicated by the local individuals, river erosion is aggregating gradually because of chopping down the trees. For instance on account of chopping down of trees river erosion has expanded in the territory. They further explain that the rate, frequency and loss of river erosion have expanded after the year 2011. A portion of the harms done by river erosion incorporate – shrimp plots and ponds flood with water, shrimps and fishes wash away, water logging, harms of agrarian terrains and houses, interruption of saline water in the farming grounds obstacles crop production, income and earnings is hampered, destruction of mud road and houses in the territory. Nonetheless, another serious issue of river erosion is that saline water enters the field and expands the saltiness of the land. Thus amazing it gets difficult to plant new trees. River erosion additionally makes inconveniences for the cattle such as it inundates their habitats and decays away residence.

River erosion is one of the most intermittent condemnations to the individuals of Pratapnagar union. Senior citizens accounted that prior to thirty years river flow was much higher. In spite of the construction of riverside embankments for protecting the community, river erosion has become a typical issue to the villagers. As per the statement of local people, a portion of the significant reasons for river side erosion are over siltation of waterway bed, effectively dispersible soil, low quality embankments, declination of depth of river, absence of erosion management training and high current. Fishes are getting away from the flooded ponds/water repositories and enclosures as a result of river edge erosion. Prawns move to other enclosure as the logged water expels the fence. In addition, harms are done to arable terrains and houses. Salt water gets into the arable grounds and development of yields gets destroyed for embankment erosion. Mud houses and soil streets and even cobbled streets are harmed too. Arable terrains become salty in view of getting washed by stream water. Tree burns because of saline in soil and ranch gets incomprehensible. Abrupt river erosion wipes away everything heading to it; children, aged and PWD people, cattle, crops etc.

River erosion has another socio-economic impact that helps price hike of agricultural and habitable lands two times higher than normal state. Many rich people lost their homestead

for river erosion but this people have cash remittance deposited in the banks which facilitates them to buy new habitat. Thus, disappearing of certain parts of the locality and new demand of habitable lands from destitute people by river erosion aggravates price hike of both cultivable and livable lands that results in sufferings for other inhabitants too.

Erratic Precipitation and Inundation

Usual precipitation is essential for keeping the cycle of lives and livelihood dynamic, making ecology green, and for bestowing environment with resources. Community people report that rain timing and seasonality has changed over the decades. Showering in uncommon times like in winter and late autumn becomes very common recently. Contrariwise, there have heavy rains (more than normal) in some monsoons while other year experiences poor amount in the same season. Additionally, there were evidences of beneficial precipitation in dry spell in the near past that is likely idiotism now to expect. People of Pratapnagar reported abnormal type of heavy showers in winter season of 2016 that caused tremendous loss of *Robi* crops. Respondents from all three areas have strong settlement that precipitation pattern is now irregular; sometimes heavy rainfall in pre-monsoon and post-monsoon, sometimes less rainfall in normal schedule, heavy drizzling in a short time, absence of necessary rain in monsoon, etc.

Therefore, local people of Charhajari report that adequate rains lack during the months of Chaitra, Baishakh, Jaishtha and Ashar of Bangla year. It likewise happens during the months from June to September when it is monsoon season yet with less precipitation. It has been seen right now due to climatic change it rains less during monsoon season and significant harms done by this are development of paddy lessens, roots of paddy gets dry, increment of creepy crawlies, development of vegetables and betel leaf diminishes, and ailment of trained creatures increments. As per the statement of local individuals it was not the equivalent at any rate 30 years back and there was standard regular downpour and drought. However, in nowadays the force of poor rainfall has expanded. This is hurtful for setting up the seedbed of Aman crop and furthermore for developing summer vegetables.

This likewise influences the sweet water fish development because of less precipitation all the sweet water bodies evaporated and get toxic by trapped gas. Therefore, individuals are attempting to beat this circumstance through providing water utilizing deep shallow tube well.

Because of overwhelming precipitation during the initial weeks of *Ashar, Shrabon* and Bhadro creates problem for community people as whole. It causes damages to the people, livestock, infrastructure, natural resources and trees. Pond fish cultivators and anglers likewise face bunches of difficulties and harms during this time. For the pond fish cultivators their ponds become over overflowed, all the fishes skim away and over siltation keeps their lakes unfit for additional fish development. Large-scale sweet water fish development faces heaps of difficulties and harms for drencher, for example, fisheries immersion results washing out of fishes. What's more, the fishermen can't gather adequate fish which at last influences their livelihood. For the planters their seedbed and developed harvests stays submerged, and their yields and vegetables are harmed and spoiled due to over siltation.

Pratapnagar union is encompassed by water in a large portion. The exorbitant precipitation in Ashar, Sraban and Bhadro months causes water logging here. As the riverbed sediments up each year, the safety decays and tidal water gets higher. At last, the water logging issue has been heightening. Once more, the declining navigability of the *Kholletua* and *Kapotakkho* rivers exacerbates water logging of Pratapnagar region. Besides, unplanned drainage permits over heavy precipitation to make water logging at numerous territories. Principle explanations behind this are the over siltation and ascending of tidal water each year. Overwhelming precipitation is causing more water logging than before due to renting out channels, their miss-management and undertaking impromptu improvement programs and their implementation. This water logging makes incredible mischief the assets of nearby occupants. For example, pointless precipitation put the crops submerged that ruins both the reap and the land. Now and again, the niches are in a lower elevation than rivers and in this way it appears to be hard to deplete the additional water and eventually the

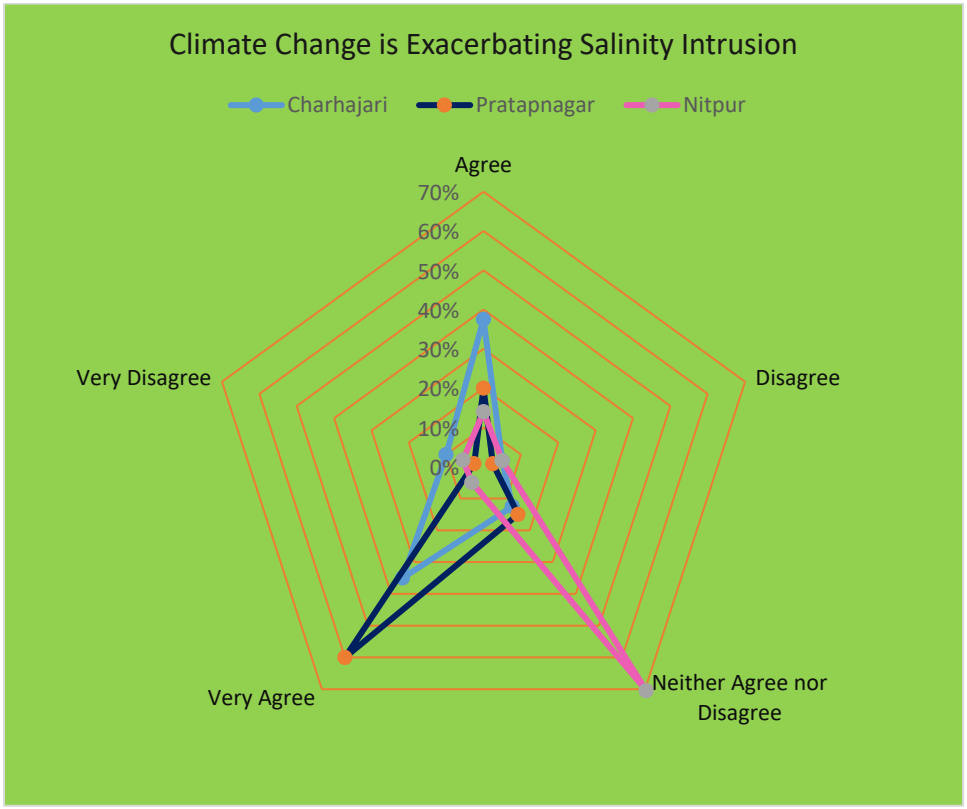
shrimp girdle goes submerged. Generally, the shrimp enclosure ought to be in such a height where, during the tide, water can be brought effectively through funnel/reservoir conduit. Because of the lower height of the shrimp enclosure extreme precipitation results water logging. Fishes escape out of the lakes/water stores during a substantial precipitation. Over the top precipitation prompted water logging makes harms mud houses and streets. At the point when the tube-wells get submerged for heavy shower, it causes shortage of drinking water.

Less rainfall is more common in Nitpur union. This region is situated in drought prone area of Bangladesh where rainfall is decreasing day by day. Elderly inhabitants account rainfall is becoming less frequent in monsoon comparing to near past, alternatively heavy shower takes place now in shorter period instead of regular precipitation in monsoon which cause water logging in one side and dehydration of crops in another end accordingly.

Salinity Instrusion

Salinity intrusion is another dominant hazard in Charhajari and Pratapnagar unions that causes multi-sectoral damage. Salinity intrude in arable lands for various reasons and means; cyclone driven tidal surge flow over the embankments and showers saltiness upon the community, excessive flow of salty river water floods over area, day of the new moon and full moon attract heavy current in the river that sometimes cause flooding. Besides, some political elites intentionally pave the way of salinity intrusion through corroding embankments for lucrative shrimp cultivation. Once an arable land is attacked by saline water then it takes years to come back at normal state. People do not have enough patience (in fact subsistence reality do not permit them to let the land uncultivated) to wait for years for washing away of salinity from lands through rainwater. Instead, they further welcome much saline water into land preparing for shrimp cultivation. Hence, salinity is a social hazard at one end with indescribable social impacts on ecosystem, human and other living organism’s health, infrastructure and trees, besides it is an economic resource that definitely generates more cash than any other livelihood options.

Chart 6.10: Salinity Intrusion Increased in the Locality



(Fieldwork 2019)

Chart 6.10 explores that majority people living in Pratapnagar are very agreed that salinity intrusion scenario is getting worse day by day because of climate change impacts. Comparatively, Pratapnagar has to endure more sufferings than Charhajari from salinity based socio-economic damages. Nitpur is a region where no existence of salinity intrusion is recorded yet. Therefore, tendency of Charhajari people are likely equally divided into very agreed perception and moderately agreed opinion.

Major portion of people living in Charhajari have contended that regular interruption of saline water has become destructive for their territory. However, when it is illegally done by the local powerful people (they slice the channels to enter the tidal water/saline water in the field) for shrimp developments it makes local residents vulnerable. Be that as it may, today a significant number of their properties are losing efficiency. Alongside, individuals of different occupations endure great pains and these cause extreme harms to their lives

and resources. For instance, farming lands are decreasing and crops are reducing because of saltiness and over salinity are making various viruses to shrimps among others. Saltiness has become a disease today and in course of time, this has become a significant issue right now.

Salinity is one of the serious issues Pratapnagar has been battling against. Saltiness causes harm to crop production, seedbeds and arable grounds, grass, and turns water salty. In this manner, livestock experiences ill effects of the shortage of grass and drinking water. Additionally, adaptation to saltiness forces to start more shrimp farm on arable grounds and fallow pastures. Along with these lines, less paddy cultivation and fallow pastures make the shortage of dry straw. Saltiness is responsible for the unevenness of nourishment fixings; that makes plants dried and trees get shriveled and is liable for the shortage of kindling/trees. The concrete mortar of various structures of houses, instructive foundations and government-private infrastructure get rotted and may fall because of saltiness. The existence of saltiness, arsenic and iron in the drinking water increase the scarcity of safe drinking water. As a result, individuals take shower either in saline water, or in the shrimp enclosure. Saline water causes kidney ailments, dormant contaminated water casus hypersensitivity in human body and other water borne infections. Because of saltiness in water, human skin get scratched and turned dark. Individuals experience ill effects of various interminable maladies for the shortage of drinkable water. As the quantity of trees decreases, the temperature likewise rises.

Increased Temperature and Heat

Increased temperature is a significant indicator of changing climate in a region. Temperature has various meaning derives from geophysical and social understanding. Primarily, temperature measurement by electrical resistance device at weather stations denotes the idea of hot, cold and temperate atmosphere. Hence, it is not important for the weather scientists to take account of local people’s feelings of temperature, which implies that temperature measurement does not count upon how much hot or cold people feel

instead it is an outcome of machine calculation. However, climate anthropology focus on social feelings of temperature as different people may experience different temperature despite staying in same location. Here is the question of how much actual temperature is felt by local communities against forecasted Celsius/ Fahrenheit. For instance, an elderly people from Pratapnagar exemplifies that –

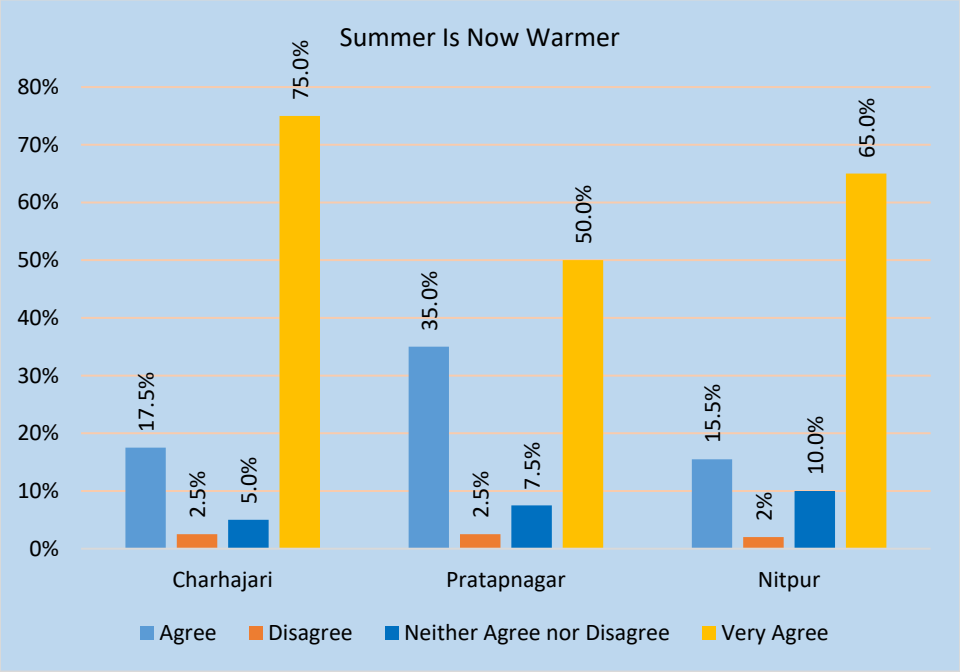
> *"we feel very hot even when weather station forecasts 30°C temperature in the district. It is due to the amount of actual heat and cold temperature predominate over the rural area is merely taken into account during measuring of temperature, instead district headquarter gets priority."*

Present study had keen eyes on people's testimonies of climate change induced increased temperature and heat in the community. People from Charhajari adamantly claim that they have been experiencing increased temperature in the form of heat since last decades (chart 6.11). An elderly farmer elaborates the issue –

> *"We saw hot weather existed from late Falgun to mid Ashar in our childhood. Warm temperature was also felt on those days, which was necessary for seasonal fruits like watermelon, jackfruit, mango etc. Sufficient amount of hot temperature made summer fruits juicy and mature, such as watermelon was red and sweet, mango was palatable and jackfruit spread out aroma. Now the environment seems warmer than previous, as heat has been felt in eight months of the year since two decades. Bangladesh is called country of six seasons, but we now see only three seasons prevail here summer, monsoon, and winter. There are rains in the monsoon but temperature merely comes down. Therefore, hot atmosphere along with augmented humidity make the environment suffocating as a result."*

Nitpur as a warmer region also reports prolonged hot temperature contrasting to previous decades. Half percent of total respondents of Pratapnagar strongly agree that summer is becoming warmer gradually. Nature of summer is distinct here whereas temperature forecasted by weather office is different from actual temperature felt in the locality. Nitpur experiences a critical summer heat coupled with increased humidity and hot wind brings about lot of sufferings for local people.

Chart 6.11: Summer is Now Warmer



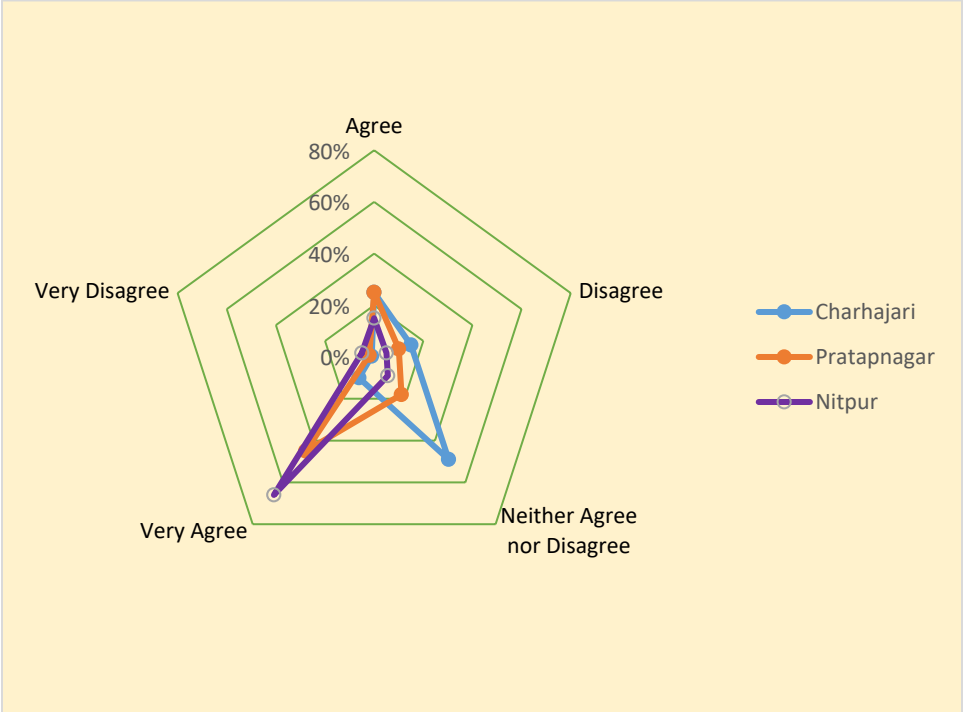
(Fieldwork 2019)

Blistering heat in dry season is a critical hazard of the study sites. Throughout the previous years the temperature has been exceptionally high despite the fact that there was a lot of precipitation. Nevertheless, prior lower temperature used to succeed more precipitation. That searing warmth and scarcity of water in summer and early monsoon, cause it incomprehensible for individuals to harvest crop in the due time. Regularly the seedbed/delicate plants need to confront harm, the yield of the field get wilted, the water level goes down; and irrigation system gets incomprehensible in the hot season. Furthermore, on account of all these the harvest can't get enough maturity. Ascend in temperature let shrimps fall prey to the epidemic and their ordinary development is intruded. This is same for the fishes of ponds/water repositories. Dry spell causes the shortage of water in the pond/tube-well. Inhabitants experience the ill effects of the shortage of water in doing domestic tasks, for example, washing dishes and dresses. Remaining outside the house is inconvenient to the skin during this time.

Drought

Bangladesh experience agricultural drought in terms of water scarcity for crop production (ICIMOD 2017). Drought picture is said to be horrific in near future due to climate change. More than thirty-four percent people of the country believe that lives and livelihood of local people is going to experience precarious impacts of global climate change (BBS 2015). In fact, drought situation and its management strategies have very long-term effect on intergenerational and social sustainability of underground water.

Chart 6.12: Climate Change Induced Drought Increased



(Fieldwork 2019)

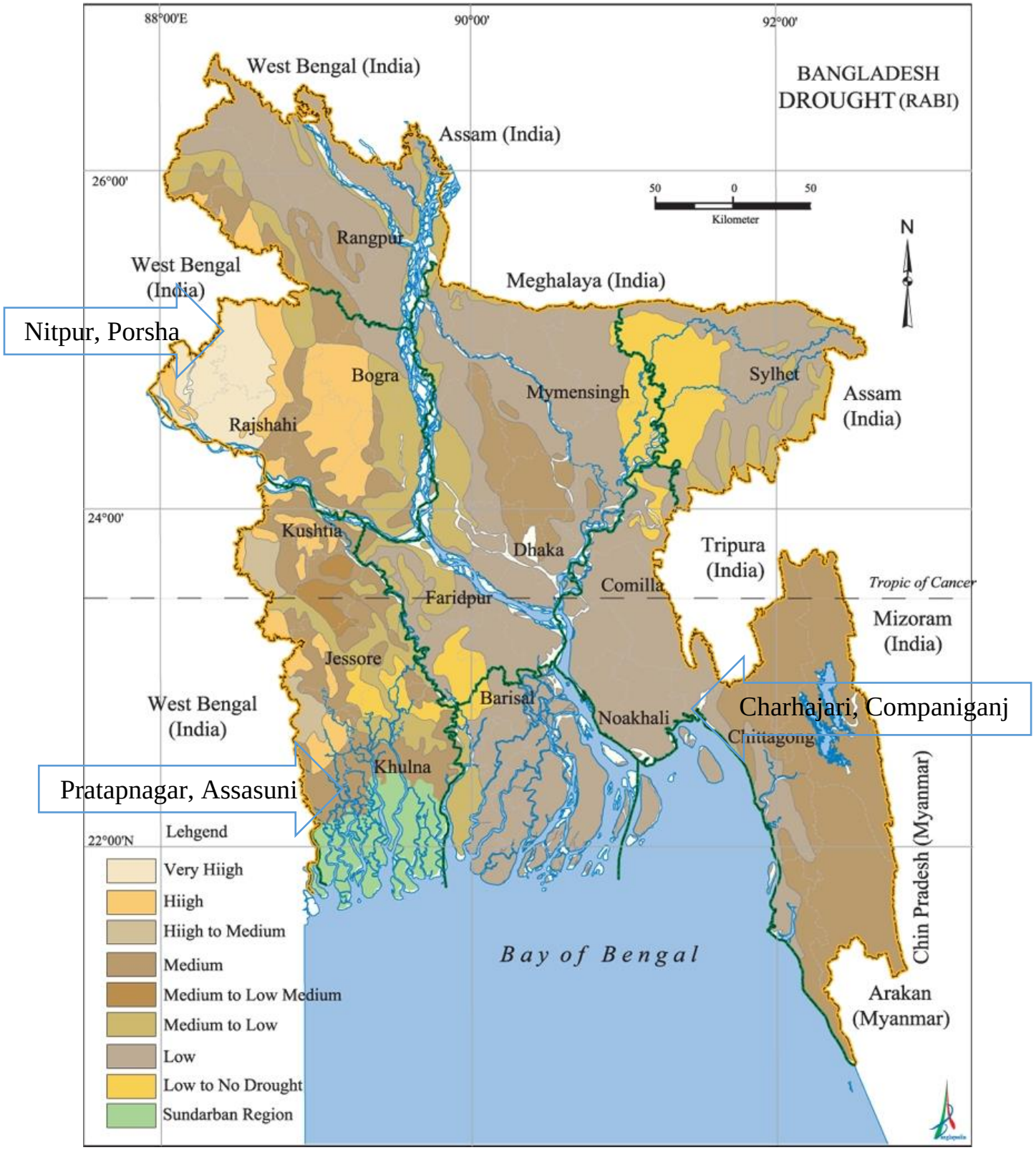
The northern parts of Bangladesh, the Barind Tract have a miserable history of fight against food and drinking water scarcity caused by drought. Less rainfall driven drought sucked soil moisture that eventually turned the territory barren with difficulties in crop production (BMDA N.D). Capricious behavior of nature had imprecated with malnutrition, poor foods, limited water that distinctly introduced the region as '*Manga Prone Area'* to the rest of the country and the world as well. Therefore, with a view to make the crop production of the

area less dependent on nature for water, modern irrigation technology had been introduced centrally by a set of management strategies and leading initiatives commenced by Agricultural Extension Department, Barind Multipurpose Development Authority and NGOs during late 80s and early 90s (ibid). People of Nitpur report that underground water was reachable at 50-60 feet depth when deep tube-wells were initially being installed during 1980s, which have gone down rapidly that now water can barely be withdrawn at hundred feet depth during dry spell. As drought situation worsens, underground water withdrawal increases to meet high agricultural demands that rises the fear of unsustainability.

Community perception about increasing drought tend to be highly positive in Nitpur and Pratapnagar while Charhajari people express moderate consensus to the statement that climate change is promoting drought in the locality (chart 6.12). Officially, Pratapnagar and Charhajari is not located in high drought affected area of Bangladesh, although local people perceive that drought or long term absence of rainfall creates drought like situation in the locality.

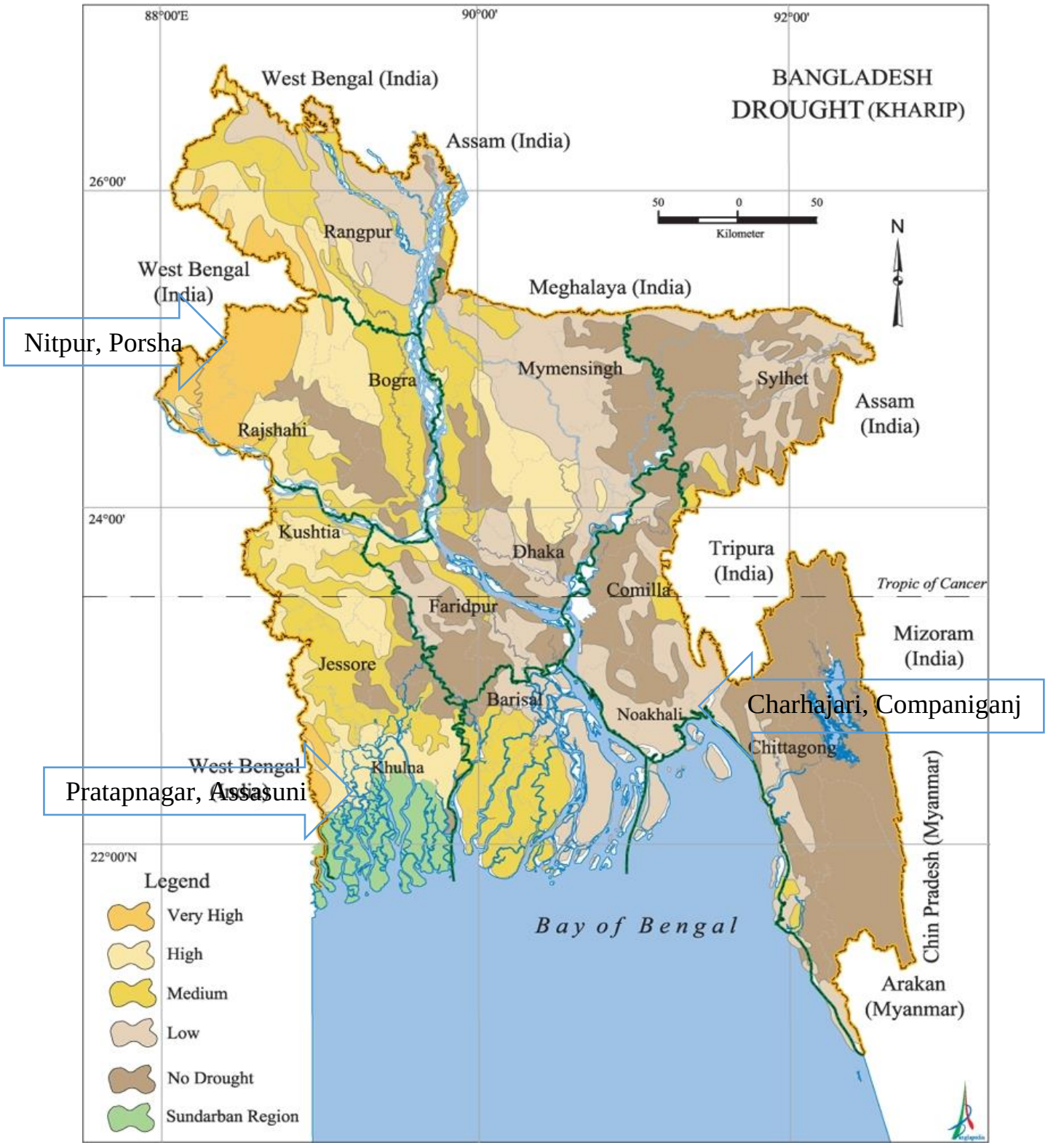
Droughts hit when there is a dry streak and lacking precipitation for a significant long time. During the dry spell, the territory tormented with dry spell gets more blazing, the water bodies, for example, rivers, wells and so forth get evaporated and usable water gets rare. River flow gets hampered, the corps begin scorching, the underground water level reduces. Drought is a major issue for the individuals who depends on crop production and cattle farming for their subsistence. Furthermore, the dust storms, pyromanias brought about by the dry seasons frequently achieve incredible devastations in the region. The greatest debacle of Nitpur is drought. Issues, for example, fire because of overheating, evaporating of water bodies, inadequacy of food, water shortage arrives at its pinnacle, not having the option to construct seedbeds and so on become pervasive during drought. It has been seen that the needy and marginalized individuals are the most influenced by drought.

Map 6.1: Bangladesh Drought Scenario in Rabi Season



(Banglapedia 2014)

Map 6.2: Bangladesh Drought Scenario in Kharip Season



(Banglapedia 2014)

Map 6.1 and 6.2 illustrate drought affected regions of Bangladesh. The first map explores about drought scenario in Rabi season and the latter elucidates drought prone area in *Kharip* season. It has been observed from two maps that Nitpur region lies in 'very high' affected area by drought in both seasons while Pratapnagar lies in medium drought affected area in Rabi season and high drought prone area in *Kharip* season. Charhajari have low risk of drought both in *Rabi* and *Kharip* season.

Hailstorm

Hailstorm is a dependent hazard that cannot occur lonely without happening of norwester and/ or rainfall. Local people interpret that heat wave creates favorable atmosphere for norwester and hailstorm. Warm weather collaborating with increased humidity proliferates the possibility of hailstorm to drop on the locality in dry season. Elderly people reported anomaly in the nature and intensity of hailstorm over the times. Hailstorm was likely to happen during summer in the past, which have changed its seasonality as it is now more noticeable in monsoon too. How much damage and loss hailstorm can produce depends on its size. Inhabitants report dramatic change of size of hailstorm since some years. A person said that-

> *"hailstorm is very fascinating to touch! It is now like an ice tennis ball. I had never seen such a big hailstorm in my young age. We used to play with the hailstorm ball in our childhood. It was marble size which was used to melted just after dropping at the ground. We also ate them to taste. Now the size of the hailstorm is bigger that holes the tin roof and injures human when fall directly on their body, particularly on head. We did not watch hailstorm happening every year in the juvenile age like nowadays. We merely had opportunity to watch it. In fact, we did not consider it as a hazard detrimental to our community, instead it was very fun to see and collect hailstorm. Thus, its changing motives, seasonality, and size have turned into a harmful hazard for the community people."*

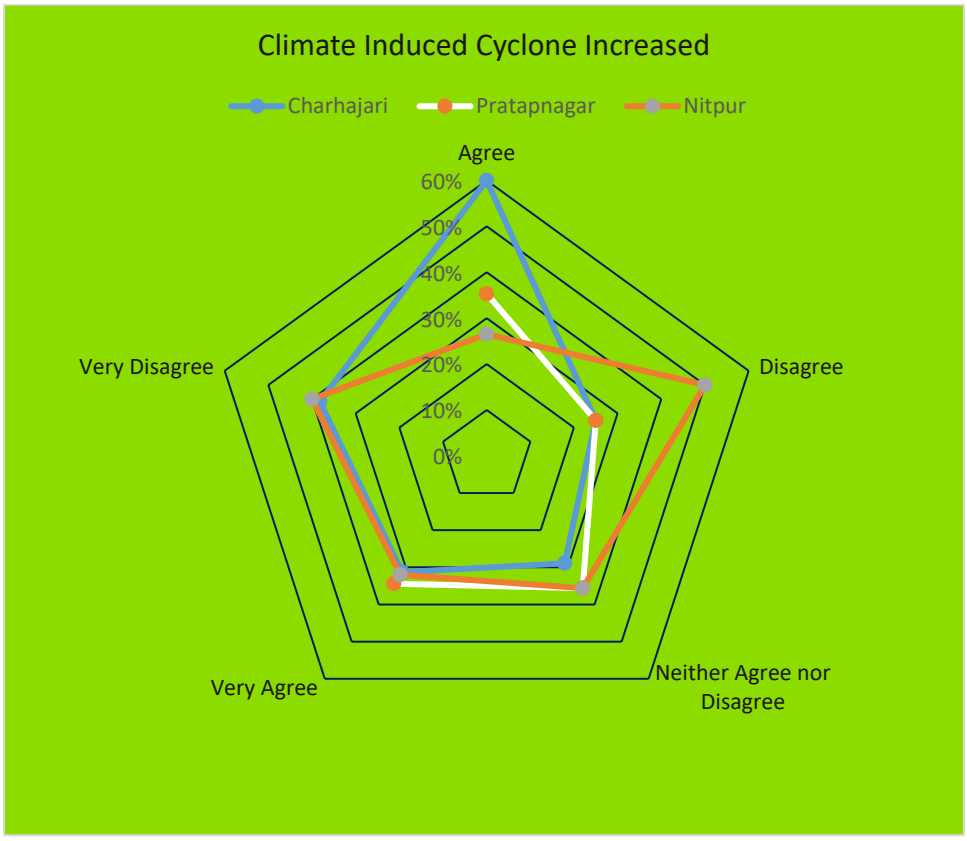
Hailstorms severely damage groundnuts, potato, paddy, seedbed, and watermelons, etc. It has most detrimental impacts on mango and surface crops. The hailstorms also damage the husk and tin roofs of houses. The poor people bear the brunt of the damage caused by

hailstorms. The hailstorms turn poor people into even poorer by causing devastation across the land. They are most harmed when their harvest is damaged by the hailstorms.

Cyclone

Cyclone is most harmful hazard caused by climate change. Many of the world's deadliest cyclones form in Indian Ocean and Bay of Bengal that heat both Bangladesh and India. Global warming driven increased temperature is said to escalate sea surface temperature that helps forming strong cyclone. Local people of Charhajari and Pratapnagar agree that climate change is increasing cyclonic events in the locality. Nitpur has no nearby sea and history of major cyclone recently.

Chart 6.13: Cyclone Has Increased



(Fieldwork 2019)

As indicated by the local individuals the quantity of cyclone has dwindled recently. Individuals of different occupations need to endure a great deal and these causes harms to

their life and resources. For example, shrimp cultivators face the issue of harms and over flood to their shrimp plot, anglers lose their lives while angling in the ocean and harms done to the harvests of the field. Nevertheless, a large portion of the harms are done to the crop production. According to local ranchers, it gets hard for them to beat the misfortunes brought about by violent wind. Local inhabitants envision cyclone observing thick dark mists in the sky. Radio and TV broadcast the gauge for the cyclone. People reported that deadliest cyclone such as *Sidr, Aila, Mohasen, Nargis, Titli* costed massive damage of lives and assets.

Climate change influences human understanding of environment. People had ability to anticipate extreme weather condition in the past, which is now at the edge of decay because of anomaly in local weather system brought about by climatic variability and change. This is why people now rarely can forestall coming hazards. A respondent elaborate this-

> *We used to read weather in our childhood without modern technology. In fact, there was radio that broadcasted weather information. We had neither trust nor time to pay heed to the weather news telecasted in the radio. We did not need to look at wrist watch to know about time, nonetheless we could tell exact time. There had some signs by which we could assume about coming cyclone; dog's crying at night, Jhom kuli (a bird) calling at night, increased temperature of pond and river water, abnormal jumping of fishes into water. Thus, we do not find these indicators to foretell about cyclone anymore. Now, dogs bark, birds sing, fishes jump but cyclone barely happens. Before the great cyclone of 1991, we observed in the daytime that fishes jumped out the water and water temperature was high. In the next morning, cyclone hit. However, we could not assume about its severity and high tidal surge that results enormous loss of lives and resources.*

Livestock Disease

Climate change helps spreading out livestock diseases in new and wide dimension that local people have limited knowledge to deal with. Moreover, the destruction of local ecosystem caused by environmental change, development intervention and modernization process has also lead to vanishing many local herbs that were used to heal livestock disease in rural area. For example, *Kabiraji* medicine was used to heal poultry and livestock in the past. The cost was very little; many times *Kabiraj* would have to pay 5 kg rice or 20 taka.

Currently bio-medical treatment is followed which is very expensive to afford. At present, *Kabiraji* medicine is rarely used as the amount of both *Kabiraj* and natural components for making medicine like trees, herbs, medicinal plants, creepers, have decreased dramatically. A local Kabiraj said that –

> *I have been practicing Kabiraji since my early young age. Basically, this is our hereditary profession. I saw my grandfather to heal livestock making paste from nearby herbs and plants. The outbreak of livestock diarrhea was frequent like human's on those days. My grandfather used to collect creeper from graveyard to feed the cow for curing of diarrhea and cholera. The herbs, medical plants and creepers were abundant on those golden days, and people had deep trust on our treatment system. My father also did Kabiraji. He used to travel around the village for collecting medicinal herbs which were starting to disappear gradually. The habitat of medicinal herbs and creepers such as abandoned jungle, forest, side of muddy road, antique graveyard etc. has been damaged by less rainfall, excessive heat, population increase, and a lots of development works. Sufficient rainfall and necessary heat patronized most of these herbs which are now at the brink of disappearance because of less rainfall and high temperature throughout the years except winter season. Surprisingly, winter season has also poor amount of cold recently.*

During the monsoon, cows have a higher incidence of disease due to excessive precipitation. At present, a disease called cow lamb occurs in the month of Agrahayan. The symptom is that legs and parts of the body swell. Poultry disease is more frequent in the month of Falgun. When people do not have money to buy daily commodities, they sell out poultry chickens in the nearby markets to meet other basic needs like food, clothing, tuition fees etc. Once disease like pneumonia affects a chicken it spreads out among the same species like epidemic.

Pig, locally know as black goat (castrated goat), is reared up by the some indigenous people of Nitpur. Pig usually habitats in very dirty and damp place that causes various disease. A well-known disease of pigs is *jagega* that swell up legs with black pimples. Monsoon weather coupled with cloudiness and humidity brings about the disease. Medical treatment is taken along with local herb based healing efforts. An effective herb treatment is undertaken where paste processed from leaf of a strong and tall tree called *Banlshil* is putted on the legs of pig for two to three consecutive days.

Cows and buffaloes suffer from mumps or throat disease due to excessive cold or overheating. This disease is common in all study sites. This disease increases body temperature and nose sneezing. If the sick cow is not treated immediately, it have high chance of death within two days. Cows, goats, sheep, buffaloes suffer from allergic diseases. This is mainly a tropical disease that attacks in monsoon and winter season. This disease causes the skin to swell up with pimples. Now biomedicine replaces traditional medicine that is made from a mixture of coconut oil and gist of *Kawa Rosun.* Local inhabitants report that unusual behavior of climate and weather cause unseasonal rainfall, hot, and chill that results livestock disease like cold, cough and fever. Worm disease is very common for the cattle nursing in the study communities. Domesticated pigeon also suffers from worm attack. In this regard, boiled water with neem leaf is fed to pigeon. On the day the neem leaf water is fed, the pigeon is not allowed to drink water from morning to afternoon. In the afternoon, the pigeon drinks neem leaf boiled water. Livestock also suffers from excessive hot weather induced heatstroke. Duck, hen and birds dies from this event in summer days and during incubating eggs. The intensity of the disease is higher now as accounted by local people.

Insect Attack

Insects are significant reasons for crop yield damages. As indicated by FAO (2016), 20 to 40 percent of worldwide harvest yields are decreased every year because of harm brought about by insects. Climate change is promoting food insufficiency, and its negative effects will exacerbate food security in near future. This is occurring by means of a few pathways, among which plant pests are a main source. Therefore, there are numerous potential pathways through which climate change may affect plant insects, including biology, spatial division, and food chain (Chaya and Xian 2019). Climate change could increment both the number and craving of insects, which could represent a potential danger to worldwide yield production. Global temperature rise of 2℃ above pre-industrialized levels could cause insect related crop loss from wheat, rice and maize to increment by 46%, 19% and 31%, accordingly. Furthermore, each extra degree of temperature rise could cause yield loss from

plant bugs to increment by a further 10-25%. To begin with, rising temperatures uplift pests' metabolism (Deutsch 2018) – making them damage crops at a quicker rate. The adequacy of conventional pest control methods will likewise be confronted. Insects will resist pesticides but crop plant's resistance will decrease. Improving traditional knowledge on insect pests control with modern pesticide spraying is taken by many peasants.

Local farmers identified that *Leda Pest* is one of the most damaging kind of insect that cuts the roots of paddy plant. Vegetable such as garlic, cauliflower, beans, pumpkin, sweet pumpkin, red leaf, data leaf, tomato also encounter its attack that eats vegetable leaves. Local farmers reported that the *Leda* insect was less invasive before, which is now higher. A traditional protection measure is taken where sublime birds are given shelter in the middle of the crop field by placing bamboo pillars. Those who cultivate small lands for their own consumption use ash on the vegetable leaves. Elder people in the area reported that no such insect was seen before using of insecticides and fertilizers. Since the use of fertilizers in crop fields began, pest attacks increased.

Lohar Jhuri insect damage crops by eating vealy and mature leaves of paddy plant. People in the area said that *Lohar Jhuri* was not an insect 20 years ago. They said that since the *buro* harvesting trend started, fertilizer was needed to use in the field. And with the onset of fertilization, the insect attacks begin. Previously, *buro* was harvested with the water from the *beel* which is now done with irrigation. Natural productivity of lands was bit higher, organic fertilizer was used instead of chemical manure. Scattered incidence of *Lohar Jhuri* observed in the past but its cumulative presence is more visible nowadays.

Urtunga insect invades the crop when soil water reduces. This insect cuts off the roots of the plants. This insect predominates in both Aman and Buro season causing harms to potatoes, tomatoes, red herbs, beans, pumpkins. The lower the amount of soil water, the high the attack and damage. Old farmers view that soil water amount and moisture subsequently reduces in early dry season (late autumn) since decades that patronize this pest. Watering is the traditional practice that works as pest repellent.

Sweating

People of Pratapnagar and Nitpur regard sweat as a recent hazard. Inhabitants argue that body sweats a lot while working in the field during the summer. Those who sit at home also sweats because of the intensity of heat and humidity. Moreover, the situation was prevalent normally in Chaitra, Baisakh and Jaishtha months which now extends to Bhadro, and Ashwin. Sweating caused by increased heat and humidity results physical weakness and fatigue that distracts concentration. It also produce bad odor and discomfort. After the winter, the sweating problem is seen from the beginning of the month of Chaitra to the beginning of the month of Agrahayan. Working class people testimony unusual sweating in monsoon that they consider very exceptional and of recent origin. Electricity service in rural area is beset with glitches like load shedding, power shortage and remoteness (explored in previous chapter) where a few schools can afford electric fan in classrooms. Elevated temperature and humidity, and human gathering in suffocating narrow rooms helps child's body to discharge much sweat responsible for blackout and less activeness, as claim by guardians.

Cold Wave and Fog

Winter and fog are a special feature of North Bengal. Cold wave and fog are common phenomena almost every year in Nitpur. This union has a lot of cold wave and mist in the winter. This event is less frequent in Charhajari and Pratapnagar that causes minor damage and loss. People have to face cold of winter sometimes less or more. According to local words, the number of cold wave and depth of winter fog is rising now more than ever. There is no winter that does not experience cold wave. Cold waves are reported in the area up to five times a year that is horrific. Thus, cold wave did not last for more than three to four days in the past, which now prevails for seven to eight consecutive days. The severity of cold is also higher than ever. It also rains many times due to cold wave. The duration and number of cold wave is increasing day by day in the locality. Although no one can answer the question of why the cold wave is higher than before, people's perception is that

the season is not same now. Some traditional occupation holders believe this is happening as a result of climate change. Contrarily, differences in local perception of cold wave have been noticed. Few people claim that cold wave is decreasing gradually and fog is not as cold as it used to be. According to them, cold levels have been declining especially for the past two years. However, locals sometimes see foggy weather before a cold wave blows upon the community that forecast of cold wave.

Cold wave has detrimental effect on human health. A variety of diseases, including colds and coughs, asthma, and fever outbreak during cold wave. Elderly people have high mortality rate during cold wave in Nitpur. Day laborers are the worst sufferer of cold wave; their subsistence insecurity enforce them to carry on working under freezing weather. Therefore, cold wave has the most negative impact on farming. Hybrid paddy seeds are tolerant to some fog, but BR 20 rice and other species of rice seeds cannot withstand fog. If the fog lasts for a long time without sunlight, the seeds decompose, turn white color and infected by virus. Potato farmers also suffer from cold influx. At this time, potatoes are rotten because of the high cold and absence of sun for somedays. Cauliflower and cabbage are dominant winter vegetable. People first harvest the seeds in the seedbed and then replant them on the main farmland in sunny weather. Sunlight is necessary for growing up of saplings as it provides nutrition, strength and congenial environment for growth. If the cold wave occurs after replanting on the main farmland then plants does not grow up and even dies. Besides, various types of pest attacks and no preventive measure can be undertaken due to the absence of sunlight (pesticides better work under sun heat). Simultaneously, cold flux also disrupts the production of chili. The chilly flowers fall to the ground when cold wave blows upon the community.

Livestock have to suffer from extreme cold wave during winter season. At this time, animals were kept inside the house to protect from cold hazard. Livestock suffers from cold and cough, eat less, and usual growth impedes. According to locals, when it comes to mango production, the influence of cold wave is high as mango bud often falls down results low mango yield.

Flood and Tidal Surge

Tidal surge and flood are infrequent hazard in study communities. Local individuals referenced that now they face less difficulty and misfortune because of tidal flood than that of 30 years ago. People talked about raised awareness about tidal surge. Still individuals of different occupations need to endure a great deal and these reason serious harms to their lives and resources. For example fisheries become over overflowed, fishes wash away, and genuine harms done to homes, educational and religious institution, mosque/ temple, hat bazaar, and streets. Because of tidal flood saline water enters the paddy field and accordingly it gets hard to produce crop in that field. This is one of the significant purposes behind numerous individuals to begin shrimp farming in their paddy fields. Nevertheless, this arrangement has negative side too. Haphazard installation of shrimp farm brings about cash, but subsequently makes community people reliant upon market for vegetables.

Thunderstorm and Lightning

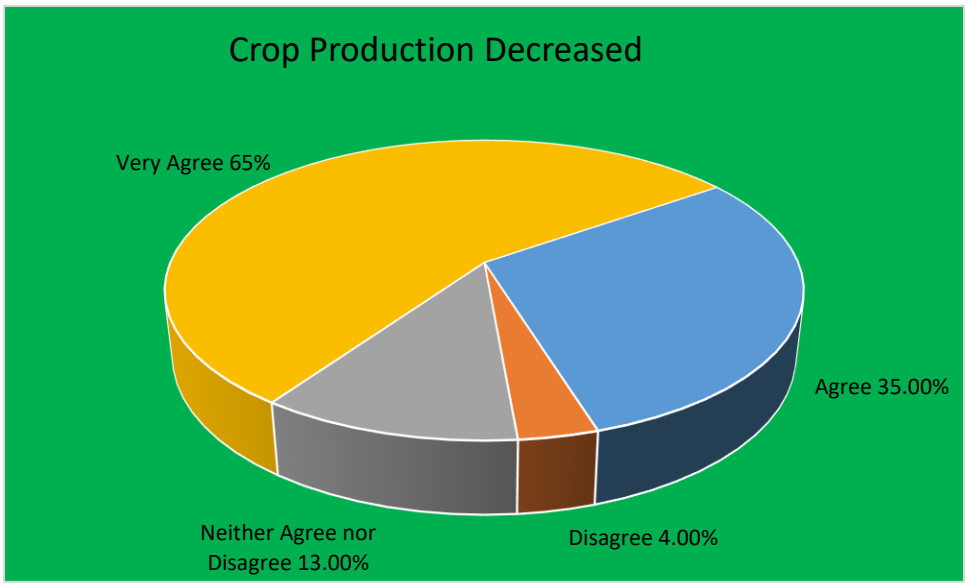
Thundering is reported to be high during the beginning of Baishakh to the end of Jaishtha months. According to local statement, now there is no rule, thunderstorm can fall down in Bhadro. Sometimes thunderstorms happens without rainfall. Lightning electrifies electricity conductive substances like human and animal body, metal, water, wet tree etc. that results major electric shock to fatal death when human comes in contact. It also raises the risk of burning homes, trees and other infrastructures. Lightning with thunderstorm produces double vulnerability of human and livestock death. The number of thunderstorm falls down a year is increasing day by day. People alarmingly report that thundering is becoming stronger than ever, having bursting sound with gigantic capacity to quake everything in range. Furthermore, its magnitude is extending gradually, now a single thundering can engulf huge area that was not observed in the past. People believe to have connection between long tree and less thundering; tall trees like *Gojari*, *Segun* endures thundering to keep surface people safe, that is the high rate of cutting down of trees, the high rise of thunderstorm. *Joto gorom toto gorjon* (blasting as much of hot), a local proverb

indicates that thundering takes place after much heat. It denotes a belief that deforestation induces warming temperature that results thundering in response. Therefore, a story of grounded land boundary pillars stealing is common to people, which explains these pillars used to worked as earthing that absorb the shock exposed by thundering and lightning to itself.

Crop Quality and Test Changed

For better production, quality and taste, crop needs a combination of necessary weather condition like proper rainfall, soil moisture, sunlight, wind, humidity, fog, and essential temperature. Any anomaly in the weather pattern results crop yield decrease and i.e. warm weather in winter season, chilly environment in summer, scarce rain in monsoon, fog in summer etc. all drive to crop yield decrease. Agriculture is prime occupation in all three study sites. Experienced farmers view that climate change causes reduction of traditional crop production.

Chart 6.14: Crop Production Decreased due to Climate Change



(Fieldwork 2019)

Majority respondents from all sites strongly agree that climate change is having impact on crop yield (chart 6.14). It influences seasonal variety of crop production. Now, crops need

to be harvested with the intervention of chemical fertilizer and pesticide, which have elevated crop yield but worsen quality and taste. Rice had been harvested without chemical fertilizer and pesticide thirty years ago, which is now impossible to think. Paddy production was dependent on natural weather condition, albeit crop yield was less abundant but was full of quality and taste. Erratic weather pattern promotes low crop yield, but rigid subsistence reality and latent pressure of market together provoke farmers to challenge the lower yield. Consequently, farmers seek help from chemical fertilizer and pesticides that finally results poor taste and quality.

The *Aush* rice had very different taste with enchanting aroma that is no longer available now due to uncontrolled exceeding use of fertilizer and pesticide. A farmer from Nitpur illustrates that-

> *Earlier, a bowl of rice could be eaten with salt only without any curry. It is now thought that the taste of the crop has lost. Today, it is seen that young generation does not want to take any more rice in the dish. Their taste and craving have changed. Nowadays, boys and girls cannot eat much rice as like as their ancestors. There are still more than fifty people in the locality who can eat half KG or more rice in one sitting. Rice was tasty and healthy. People in this young age are getting lazy, don't want to work hard. Hybrid foods are making them resemble to broiler chicken, fatty but low stamina.*

The difference between indigenous chicken and broiler chicken is similar to the dichotomy between present hybrid rice and traditional varieties of paddy species. Indigenous varieties of chickens grow up taking their own food from nature while broilers are born in incubator seeking aid of various vitamins and hormone medicines for growth. Rice cultivated in the same way with fertilizers, insecticide, and irrigation water does not taste like organically produced crop with cow dung, ash and compost fertilizer. This is very true in case of summer and winter vegetables too. The natural environment in which the vegetables used to grow is no longer available. For example, due to the extra fog in winter, sometimes heavy and sometimes less cold, erratic rainfall in winter all couples to deceasing quality and taste. Now, vegetables that are bought from market are a bit tasteless and cannot be boiled easily.

Local Interpretation of Six Seasons: Unpredictability and Uncertainty

Bangladesh is called country of six seasons. Seasonal variety makes Bangladesh abounding with many rivers, fruitful trees and cereals. All seasons vary from earlier to present. Its seasonal diversity are now at the edge of disappearance due to climate change. Climate experts assert how many seasons prevail in Bangladesh is now visible as many symptoms of seasonal variety lost its evidence (Dhaka Tribune 2017). Declining nature of seasonal variety has direct impacts on entire seasonal cycle like crop seasonality and sequence, hazard timing and preparedness, and human-environment interaction in the locality. For example, if summer ends late, summer crop gets late that push forward all other seasons and designated harvests. Its corresponding effects are not limited to production only; rather it has long-term impacts on human understanding of nature. Subsequently, people loose capacity of weather reading and cannot predict what is going to happen in the natural milieu, and merely can make harvesting decisions on ground of traditional environmental knowledge.

According to Bengali calendar, Baishakh and Jaishtha form summer season. The summer is different now from ever before. Earlier in the summer, there was breezing that would blow away the dust. Now the heat is higher than ever before. Summer seasonality has changed over times. Hot temperature usually started from the month of Baisakh in the past, which now happens from Chaitra, receding approximately one month. The receding of summer for a month produces multisectoral uncertainty and breaking down of traditional seasonal cycling. Daily commodity business of summer produces, eating habit and food chain, and overall socio-cultural life get impededLocal people perceive that there were many large trees and plants in the forest which, during Pakistan era, were cleared out and burned by some unscrupulous traders that generates much hot than ever as a result.

On the other hand, timings of monsoon has changed; sometimes it happens before schedule that collides with summer. Heavy rainfall prevails in one monsoon, drought like situation in another season. It is much unpredictable than ever. Moreover, prolonged monsoon in

autumn and late autumn has been prevalent since last decades. Usually, Ashar and Sraban are two months of monsoon. Local communities discuss about prolonged monsoon to Bhadro and Ashwin months. A member of the oldest group demonstrate that –

> *"Moreover, rainfall amounted excessive during the last monsoon, as two consecutive weeks had experienced endless raining without halt. The monsoon now lasts a long time. In addition to the Ashar, Sraban month, there is continuous rainfall in the Bhadro and Ashwin months. For the last two to three years, it has been raining even in Kartik month as well. We see rain even in winter nowadays."*

Autumn and late autumn are two seasons having less evidence of presence in the study communities. Bhadro and Ashwin consist of autumn, while late-autumn made up of Kartik and Agrahayan months. Beautiful scenery of autumn is engulfed by monsoon in some parts and summer in many respects. Only a distinct feature of autumn season, 'catkin flowers' flags its existence. Late autumn is characterized by temperate weather like not hot not cold which is also endangered by erratic drought and hot weather. Scorching sunlight in the daytime generates much heat unusual to its traditional traits. Traditional droplets and mild-cold like weather starting from middle of Agrahayan surrender dominance to exceeding heat in one season and cold in another year, no coincidence with conventional timings.

Winter, the season of vegetables, also comes late and end late. It is now very unpredictable, heavy cold bows on some years while other season experiences warmer winter. Poush and Magh are two months of winter according to Bengali calendar which is now slipping. Cold weather used to predominating over locality from the end of late autumn that rarely happen until mid of Poush month nowadays. Contrarily, cold remains present after Magh to first month of spring- Falgun. The late arrival of winter season significantly influences taste and quality of seasonal vegetables; early harvest of winter crop get hampered, insect attack for lacking of sufficient cold, prolonged maturity time and low quality of *Aman* paddy cause late harvesting of *Irri* paddy. Blanket thickness tells about cold amount that is 'if thick blanket requires in winter night it is heavy cold, conversely if thin blanket covers up cold then its warming cold'. Community perception asserts that thick blanket replaces thin over winter nights. A local hearsay- *Magher Shite bag kape* (tiger shivers in winter cold)

demonstrate heavy cold in the last month of winter season. Elder people believe this seldom happens now.

Spring is a transitional season between winter and summer. Its charming southern breezing, sweet sunlight, and temperate weather make it 'the king of all seasons'. Unfortunately, senior part of the communities express their frustration about its emerging time in one hand and existence on the other. Additionally, it is very difficult now for them to differentiate first half of spring from winter and second half from summer as these intervene in spring timing. Traditionally, by the end of winter, a fresh new spirit comes to nature to announce the arrival of spring. After pushing back winter dullness, nature refurbish with new green leaves. With the passage of time and changing global climate, spring has been losing its spontaneous exquisiteness, and becoming more uncertain and unpredictable. For example, instead of spring breezing, chilly wind predominates during Falgun month in the areas. It becomes very challenging for local inhabitants to anticipate when spring showers upon freshness on the society. Furthermore, spring is now characterized by increased hot weather. Still flower blooms, new leaves grow, birds sing in spring but there is a lacking of animation.

Conclusion

We have come to an understanding that climate change poses challenge to established long-term belief, practice and perception by bringing about erratic change in weather pattern and seasonality, hampering seasonal cycling, and questioning efficacy of traditional knowledge on weather reading. This chapter explores local beliefs, practices and deep understanding of climate change with evidential impacts observed that further claims perception of climate change in a traditional society like Bangladesh eventually varies on ground of various socio-economic and cultural experience. An intimate interaction between human and nature molds the way people perceive any change in the local climate and weather pattern. It has been argued that climate change is having severe impacts on crop quality and taste. Religion, like many other factors, shape people's understanding of climate change.

Chapter 7

Lives, Livelihood and Climate Change

Introduction

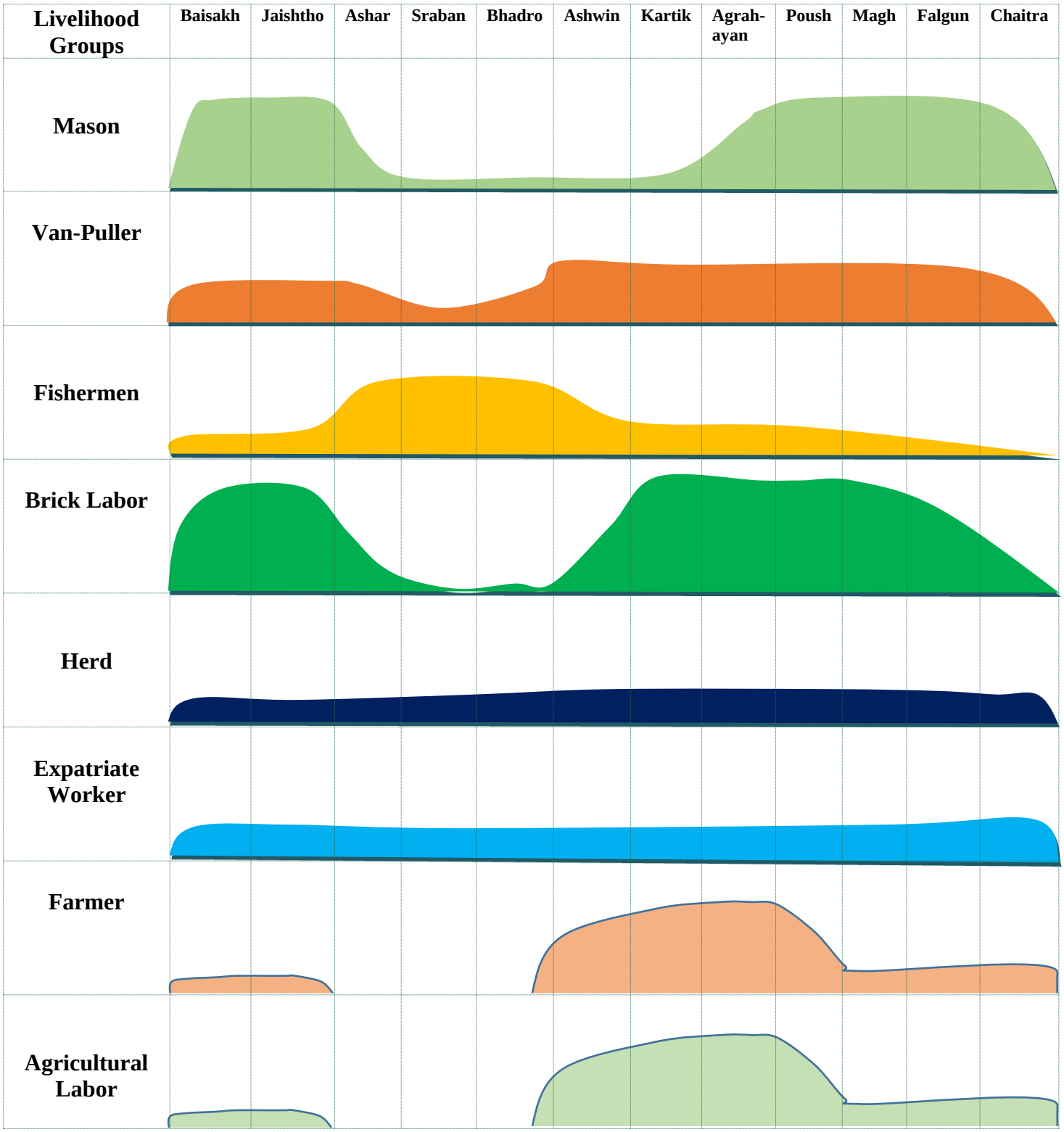
The threats climate change exposes are unevenly distributed among various occupational groups. Occupation has important indirect role in enduring climate change shocks. For example, a farmer has high degree of susceptibility to experience climate change impacts than a service holder. Angler and cobbler may have different levels of vulnerability and climate shock durability basing on their subsistence activities. Present study attempted to account occupation based experience of climate change impacts in order to explore how climate change generates diverse risk for certain subsistence group. Thus, it is seen that different livelihood based group have to suffer from perilous events produced by climate change.

Livelihood Seasonality

Bangladesh is characterized by land of occupational diversity, hence lots of occupational group keep the cycle of economy active with their very measures. Some occupations are conventional can be dated back to more than thousand years i.e. potter while many are of new origin originated to meet the demand of modern market i.e. software engineer. Not all professions have subsistence activity facility simultaneously around the year. Moreover, all occupations have peak and slack months. On the other hand, the degree of damage brought about by climate change significantly varies from season to season, and month to month. Therefore, livelihood and impact mappings are interrelated; livelihood seasonality should be explored first before talking about impact.

Extreme weather condition has more or less impacts on each livelihood option. Once a subsistence activity faces constraints due to climate change driven perilous factors, people migrate to other occupation either temporarily or permanently. Alternatively, climatic impact poses threat to one occupation in one hand, it creates option for other livelihood in another end, i.e. downpour stops activities in brickfield but it makes fishermen busy to catch indigenous fishes in lentic water bodies. Occupational migration is a well-practiced adaptation strategy among occupational groups of the study community. Marginal farmers, for example, may have opportunity to work as agricultural labor during slack season.

Diagram 7.1: Livelihood Calendar, Charhajari, Companiganj



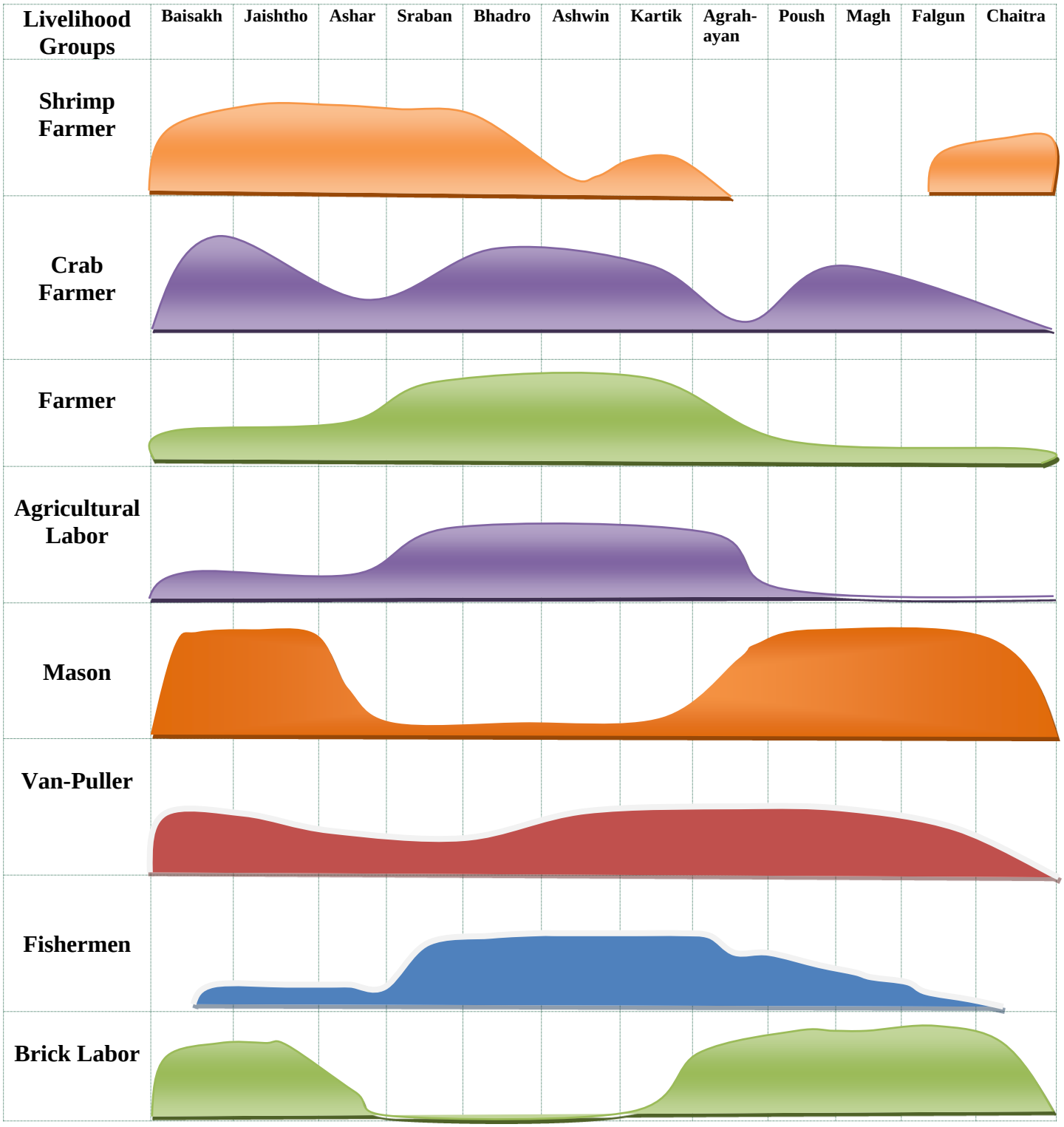
(Fieldwork 2019)

However, diagram 7.1 shows that masonry activities prevails in Charhajari throughout the year. Dry spell is good time for mason while monsoon is slack season for them. Although, Ashar and Sraban are two months of rainy season, masons argue that prolonged precipitation until the end of the Kartik month hinder masonry activities. Rickshaw and auto van puller are daily wagers whose livelihood remain likely same throughout the years except a non-major fall during monsoon. There are lots of fishermen in Charhajari who catch fish in nearby rivers, canals and ponds all through the years. This scheduled caste community has high subsistence income opportunities in lentic water bodies during monsoon.

Moreover, a portion of angler catch fish in the sea. Brick labor works in brickfield in roster system. It is a yearlong occupation option for the labor that have very low scope of activities during showers. A few people of the community take livestock raising as only means of subsistence. However, shepherding activities goes on simultaneously during the course of the year. Charhajari is an expatriate worker intensive area where at least a person nearly from all households send remittance from abroad all through the year. Charhajari area has two crop season- *Aman,* and poor amount of *Rabi*. *Aman* crop during late Bhadro to the beginning of Poush assigns more labors than *Rabi.*

Due to increased soil and surface water salinity, shrimp farming is very lucrative income earning source for the people of Pratapnagar. Shrimp farming has low activities during winter season (diagram 7.2). Crab farming is getting popular in the coast of Satkhira over past few years. Crab farmers need to carry on working during twelve months of year. It has slack time in monsoon and late autumn. Agricultural farmers and labors have to pass busy times during *Aman* season. Farmlands of Pratapnagar become suitable for agricultural crop production during monsoon as rainwater wipes away top soil salinity in some instances. Masonry is a yearlong subsistence activity which have dull time from mid Ashar to mid Kartik. Subsequent number of people in Pratapnagar are van puller who carry both people and goods. Van pullers have insignificant dull time during the months of monsoon.

Diagram 7.2: Livelihood Calendar, Pratapnagar, Assasuni



(Fieldwork 2019)

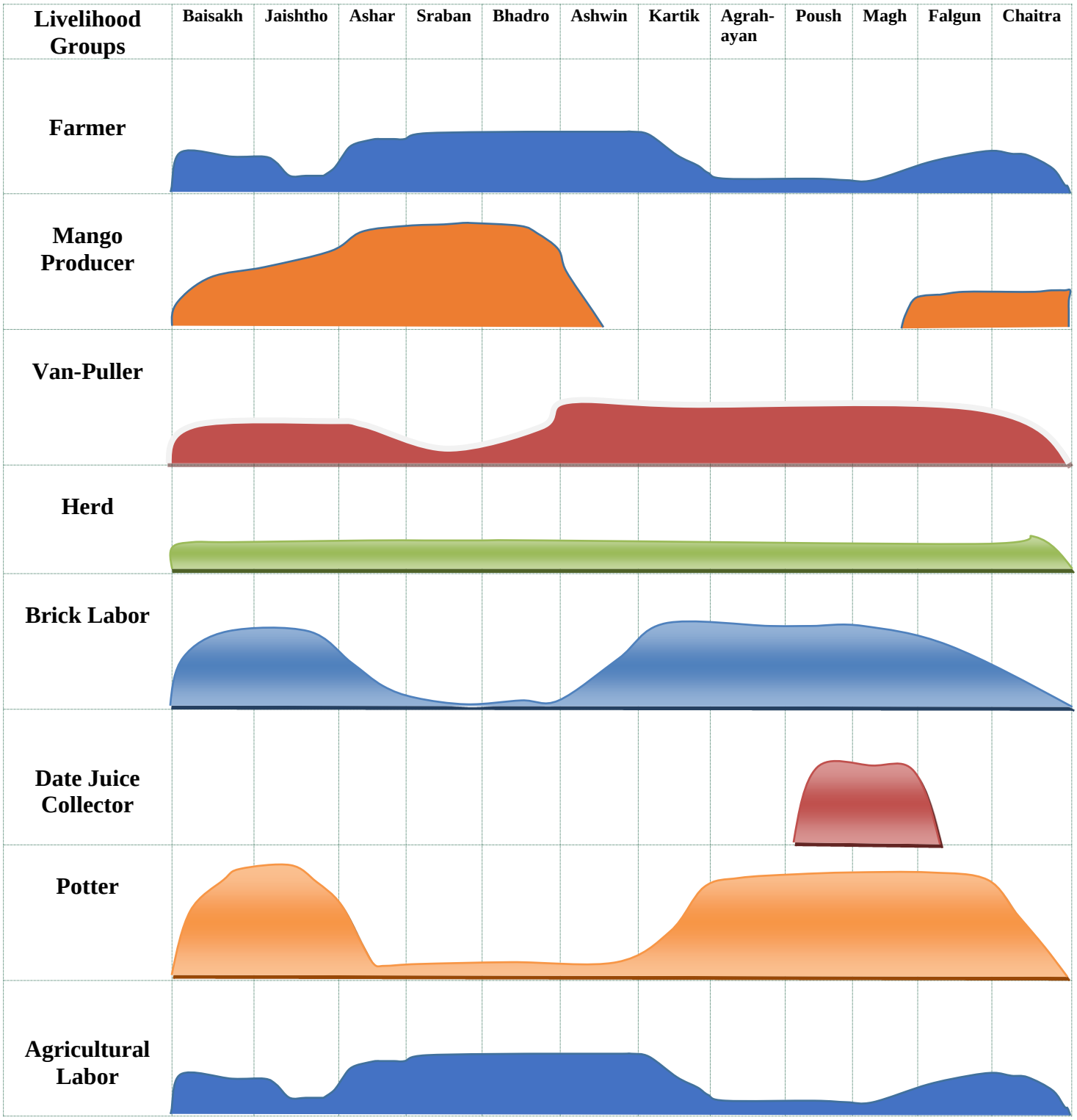
Traditional rickshaw van is replacing auto van with attached chargeable motor. Authority does not permit this kind of motor van and seizes when captures. This area poster a variety of fishing communities including traditional *Rajbangsi* community who anchors in the deep sea. Rainy season is peak period for this community. Monsoon is the proper time for traditional fishes to be abundant in paddy fields and canals, which are caught and collected by fishermen community. Brickfield labor have high opportunity of working in the field except Ashar, Sraban, Bhadro, Ashwin and Kartik months.

Nitpur is a paddy production based area where various species of rice are harvested throughout the years. This drought affected union utilizes its barren field with deep irrigation water under direct supervision of Barind Multipurpose Development Authority. Soil characteristics of the area is favorable for various fruits cultivation including mango, jackfruit, litchi and watermelon. Hence, combine harvesting has been practicing since last few decades.

Farmer occupational group passes much busy times at paddy harvesting, weeds cleaning, and crop collection from Ashar to first half of Kartik month (Diagram 7.3). They produce *Irri* crop during dry season with the aid of irrigation water. Overall, peasants of Nitpur spend times with farming activities throughout the year. Mango is produced once a year, blossom comes from late Magh (exact timing depends on mango species) and starts to mature from late Baishakh that finally finished at mid Ashwin. Wide varieties of mango is yielded in the locality which cash value depends on timings (early comer gets high price), taste and reputation. Van pulling task goes in parallel except rainy days of the year. Inhabitants of Nitpur raise cow, chicken, goat, sheep in general, while non-Muslims rear up pigs in particular. Livestock herding goes on simultaneously throughout the year.

Brick labor consists of majority working people in Nitpur. Likewise the activities in brickfield throughout Bangladesh, brick labors in Nitpur have poor facilities to work on during monsoon.

Diagram 7.3: Livelihood Calendar, Nitpur, Porsha



(Fieldwork 2019)

Date juice collectors are traditional occupation holder who engage themselves for juice collection during two months of winter season, as date tree does not discharge juice except winter season. It is a dominant means of temporal cash income for many local people. Selected head part of date tree is scratched in afternoon and a pottery pitcher is hang on until next morning. Amount of juice depends on amount of cold; heavy cold during night helps tree to generate much juice. Pottery is one of the traditional activities that represent Bangladeshi culture in many respects. The potters, locally known as *kumar*, need to concentrate entirely on their clay utensil making work from Baisakh to mid Ashar and mid Sraban to the end of the last month of Bengali calendar. Therefore, rainwater hampers their activities as they cannot dry up raw potteries.

Vulnerability and Capacity Assessment: Livelihood Options and Social Resources

As stated above climate change is said to have different impacts on different livelihood activities. This anthropological study aimed to account the degrees of vulnerability and capacity of each livelihood option under climate change regime. As discussed in conceptual framework analysis, vulnerability indicates to the factors that compel human, livestock, infrastructure, or even a system to endure potential shocks exposed by climate change. Capacity is the opposite idea to vulnerability. It is the abilities that make things capable to overcome any stress, challenges, obstructions and shocks generated by climate change. Capacity is a continuum of social, cultural, physical and financial capital that helps to win over vulnerability and risk. This antithesis denotes that vulnerability increases when poor capacity prevails, and capacity increment lessens vulnerability factors. Due to this reverse type of relationship, present study sets total six scales of assessment where three scales equally assigned to each criteria.

Table 7.1: Vulnerability and Capacity Assessment of Livelihood Options and Social Resources, Charhajari, Companiganj

Resources	Tidal Surge	Storm/ Cyclone	Norwester	Salinity	Thunders torm	Heat Wave	Flood	Hailstorm	Erratic Rainfall	River Erosion
Human Lives	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Crops	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X
Fisheries	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X
Cattles	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X	✓ ✓ ✓ X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X
Trees	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ X X X X
Roads	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Houses	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Infrastructures	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Tube-well	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ X X X	✓ ✓ X X X X
Horticulture	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ X X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X
✓ = Mark of Capacity (on three scale) X = Mark of Vulnerability (on three scale)					Total six scales (vulnerability 3+3 Capacity) If vulnerability increases capacity decreases and if capacity increases vulnerability decreases, here the relationship is reverse					

(Fieldwork 2019)

Table 7.1 shows that human lives have higher chance to be damaged by tidal surge because its poor capacity is not enough to win over vulnerability. The vulnerability symbols outweigh capacity signs that denotes that crops are vulnerable to tidal surge.

Agricultural crops have high vulnerability rate than capacity because tidal surge inundate, and damage crop items. Likewise crops, fisheries have high degree of susceptibility to tidal surge as it washes away fish resources. Cattles are also vulnerable to climate change driven tidal surge. Trees and roads have equal rate of capacity and vulnerability that indicates these two items have vulnerability to get damaged in one hand, capacity to challenge the vulnerability on the other hand. Vulnerability symbols outweighs capacity marks in case of houses that has high degree of chances to experience damage and loss generated by tidal surge in the form of structural destruction, inundation, and many more. Similar to houses, other infrastructure of the union encounter same rate of fragility toward tidal surge. Tube-well, ultimate source of drinking water in the locality, has two capacity marks that means it has low capacity to tackle tidal surge, and four vulnerability symbols interprets its high fragility that further refers that tidal surge has adverse impacts on tube-well. Horticulture has equal chance of being vulnerable and capable to endure and challenge tidal surge.

Likewise in respect of tidal surge, human lives have equal chance to be affected by tidal surge or to overcome it with capacity. Storm has lower capability to damage crops as it have high capacity to tackle cyclone. Fisheries is less affected by storm because it have high capacity marks to win over stress posed by cyclone. Livestock like cow, buffalo and goat have equal possibility to be affected by shocks produced by storm or to resist against harms. Storm hits trees directly which indicates trees have high chance of fragility and low opportunity of defense. Roads are rarely affected by storm except conveyance interruption due to barricade made by falling of large trees on the roads. Storm has direct impact on houses and infrastructures, brick made infrastructures have high capacity and low vulnerability while kutcha house has poor capacity but increased vulnerability.

Human lives, fisheries, livestock, and tube-well have highest capacity to triumph over norwester. All four items have lowest risk of vulnerability to the threats derived from norwester. Crops and roads have higher capacity level contrasting to fragility in terms of facing norwester. Houses and infrastructures are most vulnerable to norwester having poor capacity index. In fact, norwester brought about most damage to kutcha housing and

infrastructure. Norwester causes massive damages to horticulture products like mango. Horticultural items have lowest capacity to confront the vulnerability produced by norwester rather these crops and fruits have to suffer from crude impacts of this type of storm.

Salinity intrusion produces higher degree of vulnerability for agricultural and horticultural crops, and trees. Contrariwise, human lives, roads, houses, infrastructures, and tube-well are comparatively better capable to tackle the difficulties salinity generates. It has been reveal that agricultural and horticultural items, fisheries, road, houses, infrastructures, and tube-well do not have any vulnerability index in terms of thunderstorm. Capacity of these things does not allow thundering to cause any threats and damages.

Human lives have proliferated capacity to render the effects of heat wave. Fisheries, livestock, and trees own equal rate of vulnerability and capacity that indicates more or less probability to endure shocks emerged from heat wave. However, roads, infrastructure and houses have total six capacity index that express these items are not susceptible to heatwave. Therefore, heat wave is potential enough to cause damage for horticulture as it has poor capacity and elevated vulnerability.

Human lives of this union are not much susceptible to flooding like other assets. It seems that all the social resources except human lives have lower degree of capacity to confront bearings bring forth by flooding. Human has strong capacity to escape fatal death by flood in the community. Nevertheless, social assets like crops, fisheries, trees, cattle, roads, infrastructures, and tube-well get impacted by flood very easily. Hailstorm barely cost human lives as it has high capacity index for protection. Similar to human lives, fisheries, and livestock occasionally get hampered by hailstorm. On the other hand, both agricultural and horticultural crops have increased rate of fragility to absorb shocks produced by hailstorm. Thus, roads and tube-well do not have chance of susceptibility of damage.

Local people informed that erratic rainfall has no capability to make human lives, roads, house, and infrastructures fragile to its effects, as these resources possess increased

Table 7.2: Vulnerability and Capacity Assessment of Livelihood Options and Social Resources, Pratapnagar, Assasuni

Resources	Flood	Heat Wave	Hailstorm	Thunderstorm	Norwester	River Erosion	Water Logging	Salinity	Erratic Rainfall	Tidal Surge	Storm/ Cyclone
Human Lives	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ X X X X	✓ ✓ X X X X
Crops	✓ ✓ ✓ X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ X X X X	X X X X X X	✓ ✓ X X X X	✓ X X X	✓ ✓ ✓ ✓ ✓ X
Fisheries	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X
Cattles	✓ ✓ ✓ X X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X	✓ ✓ X X X X
Trees	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X
Roads	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓
Houses	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X
Infrastructure	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ X X X	✓ ✓ X X X X
Tube-well	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Horticulture	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X	X X X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ X X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ X X X X X

✓ = Mark of Capacity (on three scale)

X = Mark of Vulnerability (on three scale)

Total six scales (vulnerability 3+3 Capacity)

If vulnerability increases capacity decreases and if capacity increases vulnerability decreases, here the relationship is reverse

(Fieldwork 2019)

capacity. Horticultural and agricultural harvest are impacted by erratic rainfall. Tube-well, infrastructures, houses, roads, trees, cattle, and human lives have higher vulnerability rate than capacity indicators that refers these social resources are less capable to endure river erosion.

In Pratapnagar, human lives and fisheries have higher capacity to resist vulnerabilities derived from flooding (table 7.2). Crop, livestock, and horticulture have equal proportion of capacity and vulnerability index that indicates possibility of damage and adaptation capacity simultaneously. Trees, houses, infrastructures, and tube-well are vulnerable to flood having low capacity rate. Heat wave has potentiality to cause damage for tube well and horticulture. Roads, houses, and infrastructures have highest capacity level that demonstrate these social resources are capable of overcoming threats exposed by heatwave. On the other hand, human lives, crops, fisheries, livestock and trees have both possibility of vulnerability and capacity to tackle heat wave. Satkhira is famous for early season mango production which has to endure extreme vulnerability of damage by hailstorm. Hailstorm does not affect fish and livestock resources, roads, houses and other infrastructures since these things have entire capacity to resist hailstorm.

Crops have high yield to be damaged by hailstorm while trees encounter mild loss due to hailstorm. Inhabitants of Pratapnagar perceive that human lives, cattle, and trees bear jeopardy brought about by thundering in more or less amount. Norwester or dry spell storm has less impact on human lives, and tube well as these two things have higher capacity level to defy norwester. Contrarily, houses, trees, and various infrastructures have higher amount of exposure to norwester.

Human lives, agricultural crops, fish resources, trees, roads, houses and infrastructures, horticulture, tube-well have higher susceptibility and poor capacity to outweigh vulnerability to river erosion. Water logging is a prime hazard in Pratapnagar union which has tremendous impacts on crops, cattle, and tube-well. Agricultural crops have highest rate of vulnerability to face salinity. In fact, crops does not have any mentionable capacity

to win over salinity. Trees, houses, infrastructure, and tube well have four vulnerability marks that indicates higher degree of exposure to salinity with less capacity.

Erratic rainfall can affect crop production and fish resources as these have higher fragility condition and lower capacity index. Tidal surge seems to have severe impact on human lives, trees, houses and horticulture since their poor capacity supports proliferated vulnerability. Likewise tidal surge, cyclone causes damage to human lives in same amount. Additionally, cattle, trees, houses, and infrastructures, tube well and horticulture's poor capacity increase vulnerability to cyclone.

Table 7.3: Vulnerability and Capacity Assessment of Livelihood Options and Social Resources, Nitpur, Porsha

Resources	Norwester	Drought	Thunderstorm	Heat Wave	Hailstorm	Erratic Rainfall	Cold Wave	Fire
Human Lives	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X
Crops	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ X
Fisheries	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Cattles	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X
Trees	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ X X X
Roads	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Houses	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Infrastructures	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X
Tube-well	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓
Horticulture	✓ ✓ X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ X X X X	✓ X X X X X	✓ ✓ X X X X	✓ ✓ ✓ ✓ X X	✓ ✓ ✓ ✓ ✓ ✓
✓ = Mark of Capacity (on three scale) X = Mark of Vulnerability (on three scale)				Total six scales (vulnerability 3+3 Capacity) If vulnerability increases capacity decreases and if capacity increases vulnerability decreases, here the relationship is reverse				

(Fieldwork 2019)

Local people of Nitpur view that horticultural products like mango, litchi and pineapple have poor capacity to buildup defense against norwester, rather these fruits item are very vulnerable norwester. As of horticultural items, infrastructures, houses, and trees have very poor capacity and elevated vulnerability rate to norwester. As a drought prone area, majority social resources except roads, houses, and infrastructures entitles very high susceptibility and low capacity to face drought.

Most of the livelihood strategies in Nitpur acquire capacity to be less affected by thunderstorm. Thus, human lives, housing, and livestock mainly cow, buffalo and goat have to endure thundering as these have both capacity and fragility index. Crops like paddy, vegetables and fruits get damaged by heatwave in Nitpur whereas topographies of these items produce multiscale vulnerability under heat wave. Roads, infrastructures, and housing are better capable to meet stress generated by heatwave.

Hailstorm falls down from late spring to summer season when horticultural items like mango, jackfruit, litchi, banana and agricultural crops like watermelon, pumpkin, sweet pumpkin, cucumber etc. remain in the fields. These products get severely smashed by hailstorm as all these have very poor capacity rate to overcome shocks. Erratic rainfall throughout the years particularly affects crops. Human lives and cattle have very poor capacity to sustain cold wave rather their physical characteristics sensitize them to endure cold wave. Identification of local statement on vulnerability and capacity of fire was difficult; because all livelihood alternatives and social resources may highly be susceptible to fire as it has strong power to destroy anything in range. Although, inhabitants regard livestock, houses, and other flammable infrastructures are more vulnerable to fire incidence.

Occupational Experience of Climate Impacts

Horticulturalist

Mango, litchi and watermelon are summer fruits that require a substantial amount of hot weather throughout the summer season. Excessive heat causes premature yield that brings about low quality and price. Poor amount of sunlight results decreased sweet of these fruits. Due to hailstorms, the mangoes, litchi and particularly watermelons get damaged severely. Hailstorm tremendously affects mango bud, there is no way out for the gardeners to get rid of this damage. All kinds of horticultural items producer see capricious behavior of climate as prime cause for decrease in size and production. Pest attacks in mango and litchi has been increasing over some decades; some kinds of pests create habitat in these fruits that ultimate lower cash value. Horticulturalists report that these pests were merely seen in the past. Nowadays, late arrival, and prolonged winter extends to Falgun month hinders sufficient amount of temperate necessary weather for mango and litchi in spring season, which finally stretches cold insect attack until spring in response.

Date Sap Extractor

Nitpur is a cold prone region where many people extract date sap during winter season. These people also report erratic behavior of climate having impact on quality and quantity date juice. It should be mentioned that date juice is totally a natural sap that is collected in indigenous way. In fact, it is a typical practice among different gatherers. Nowadays, the date trees are ceasing to exist because of jolts. Collector group additionally say, if precipitation comes in the wake of freeing the leaves from the trees in the winter, the probability of the trees passing on increments. However, the actual reason for dying of the date trees as identified by them is inadequate rainfall in rainy season that impedes soil providing moisture, and nutrients.

Peasant and Farmer

Farmers of Charhajari harvest variety of crops in various seasons. For example, major crops are *Aman* paddy and *Rabi* vegetables. Minor number of people of this area produce various kinds of vegetables, such as bitter gourd, snake gourd, been, brinjal, potato, tomato, crunchy root. Now hybrid paddy species are being harvested instead of traditional varieties because of a significant number of reasons; changing weather pattern now brings about low outcome, hazardous events damage yield, traditional paddy needs much time and water than new species, some of traditional paddy plants were taller that made them susceptible to wind etc. Hybrid varieties augmented production but compromising quality and taste. Furthermore, this type of paddy is vulnerable to various insect pests that requires chemical fertilizer and pesticides. However, the impacts of climate change revolves around various agricultural divisions in Charhajari. Local statements on dangerous impacts of climate change on agriculture includes; high temperature supports the quantity of brown grass hoppers increments, because of less precipitation crop field evaporates, seedbed harms because of overwhelming haze during winter, increment of creepy crawlies during summer season, a wide range of yield fields harm during violent wind, substantial downpour suffocates the seedbed and harvest fields, betel leaf gets red on account of less downpour fall, livestock experience the ill effects of different ailments during winter and by and large there is less agrarian activities in the area.

Farmers view that because of saltiness, cultivating in the swamps of Pratapnagar is absurd. This has driven individuals to transform their cultivable land into shrimp girdle. Floodwater makes an obstacle to the opportune advertising of vegetables. Moreover, dry spell makes the dirt dry creation planting of seeds in time practically incomprehensible. As of recent changes have been seen for precipitation in time. Absence of satisfactory precipitation isn't great for the development of spinach. In the event that it rains too much, especially when the yield gets ready, it demolish the harvest. Unnecessary precipitation makes the ranchers fixed leaving them with no different options than to selling the juvenile vegetables. Reap are harmed if the trees breakdown by violent wind in the long periods of Chaitra, Baishakh, and Jyeshta. As the violent wind hits abruptly it is preposterous to take any defensive

measure. Water logging makes incredible arrangement of damage to the farming of this zone. Particularly, the cultivation of vegetables and paddy are difficult in such a brackish ecosystem. In any case, jute harvesting is a decent decision for a waterlogged region. One of the most destroying impacts is that it gets difficult to develop on this land for in any event five years.

Farmers of Nitpur report insufficient water to irrigate the farmlands during the dry spell. This causes less yield and less benefit. The catastrophic events achieve undeniably more pulverization than all else. During dry seasons, the cropland needs to be flooded with water from deep tube-wells, utilizing the pond water through motors. Local inhabitants said that many farmers are passing on because of thundering nowadays. Furthermore, during dry seasons, it is hard to cultivate crops, when there is little dampness in the grounds. Moreover, over the top precipitation harms the yields. These extraordinary circumstances cause damage for products, like mangoes and jackfruits alongside others. The hailstorms obliterate paddy, mango and watermelons. The norwester harms the paddy crops, mangoes get nipped. Throughout the winter, the peasants ensure the mango trees by covering the root with feed and leaves, utilize cow pee as bug spray, spread the plants with cinders in very virus climates and besprinkle in the rice fields. People view that cultivating procedures have changed throughout the years. Farmers used to use bovines to cultivate in the past, which now replaces motor tractors to burrow the terrains. Nowadays, various chemical fertilizers like TSP, urea, Potash and so on are used as manures. Farmers themselves believe that science has expanded the yield of produces but reduces quality.

Fishermen and Fish Farmer

Fishermen community traditionally catch fishes from generation to generation. This is mainly a hereditary profession, although some exceptions were noticed. Community perception assert that when atmosphere turns out to be hot all the fishes go under the deep water of the river, and because of this they need to gather fish from mid river. Angling in remote river is hazardous as a result of overwhelming breeze. Monsoon is the best time for

angling in the rivers as fish becomes abundant during this time. Fishermen don't go into the remote river to get fish particularly under horrible weather. Fishermen of Charhajari are mainly a Hindu scheduled caste community, nonetheless numerous Muslim and Hindu individuals of the area are entering into this profession nowadays. Consequently, the number of fishermen now outnumbers fish amount in the locality. Today they can't gather enough fish as a result of environmental change and cataclysmic events. Most of the people from fishermen community argues that subsistence earning by Fishing in the area becomes hard as fish amount in pond, canal and rivers has been decreasing due to erratic rainfall, unsustainable collection, and pollution. Natural water bodies like *Ga/ Hari* dry up in dry spell that results extinction of some species of indigenous fish.

Additionally, fish farmers have to suffer from various infection and disease of fish during winter and summer season. At these occasions, they put medications and increment the inventory of fish grain. Likewise during hot atmosphere, different sorts of trees are planted on the banks of the lakes so that shadow of these trees keep the water cool. Farmers attempt to confront the issues utilizing their various methods. Fisheries faces troubles too, downpour causes flooding drives to fish wash away. Again, because of flood, over siltation reduce depth of water of ponds that hampers fish development.

Fishermen of Pratapnagar catch fishes from ponds, canal, streams and sea. Dry season makes the water bodies dry and angling gets difficult. Along these lines on the off chance that they can't do angling a large portion of them go to nearby districts to function as workers in the fisheries or in the sweat water fish project. The fishers work just a half of a year and for the rest they need to remain inactive and at last quest for credit. They view that substantial precipitation is useful for them. Since with more downpour angles go to the upstream, canals and rivers get more fishes. Be that as it may, over the top precipitation isn't a gift for the poor cottages of the fishers. The most exceedingly awful catastrophe for the fishers is the storm. In the event that there is a notice of a violent wind they don't go angling into the Bay. On the off chance that they fall prey to cyclone during angling in the ocean, their lives and vessels may get pulverized.

Losing lives or net is a major damage to any fisher. To keep away from storm, at whatever point fishers notice a profound dark cloud in the sky or a breeze from the east, they go to the sheltered zone. When they get any admonition sign of storm on the radio, they take cover in the beach. Saltiness causes fishers to experience the ill effects of the shortage of drinking water. At the point when they sail in the bay, they need to hold up under a lack of drinking water. The salty condition of the ocean turns their skin seared. Diving just about 2 feet deep into the ground of catkin woods in the seaside territory the fishers get together their hunger for the sweet water and store it for later use. The fishermen believe that the quantity of fish has declined. Besides, presently it sets aside more effort to get fish than previously. This implies the quantity of fish is on a decay.

Fishermen of Nitpur view that over precipitation and absence of precipitation are both irksome for fishing. Downpours washes the fishes away and dry season causes the water bodies to evaporate. In the two cases, fishes must be sold in a lower cost as the assortment of fishes and cost goes down. There are different issues, for example, gases in the ponds during dry spell results fish death. In these cases, water is hit with bamboo or utensils to build the oxygen level in the water, disposing of the abundance water in the pond by cutting the edges during heavy rainfall, fencing the pond to protect from flooding, besprinkle calcium sulfate in the water, filling the pond with water from deep tube-well when the water level goes down and so on.

Nursery

A good portion of people in Charhajari and Pratapnagar subsist by planting seed, and taking care of saplings. These people also talk about their stories of climate impacts on nursery activities. A pest called *Agakata* attacks saplings with the increased temperature and *Leda* insect harms small plants by eating new leaves. Moreover, heavy rainfall inundates nursery that results decomposition of saplings. Excessive cold and fog are highly detrimental for germination and sapling sprouting. Norwester and Hailstorm also cause massive losses for nursery dependent people as these directly fall on saplings. Water logging creates problem

for nursery. Local nursery doers exploit indigenous knowledge to escape from climatic impacts. Nursery workers go under hardship in rainy season as heavy rain hinders sapling-creating procedures. Moreover, perfect seed has been scarce as weather condition varies, which influences seed quality.

Non-agricultural Laborer

Non-agricultural labors of the study area includes mason, weaver, potter, blacksmith, cobbler, tailor, assistant to mason/weaver, worker in rice mill, rickshaw/Van/ puller, pushing cart man/boatman, driver of motor vehicle etc. Majority part of non-agricultural labor reported physical weakness and low activity because of high temperature during summer, harms of kutcha houses due to heavy rain in monsoon, and street crash because of overwhelming mist in winter among others. According to the statement of non-agricultural labor, it gets hard to work out both during winter and summer. Both these circumstances cause them to experience the ill effects of different infections, for example, dehydration, cholera, diarrhea, in summer, and fever, cold-cough in chill so forth.

Brickfield laborers of Pratapnagar become jobless during monsoon and some of them join horticulture. Laborers from different segments come to work in the brickfield. The elective employments for the brickfield laborers are tea stall like petty business, vehicle driving, and so forth. Blistering climate and salty mud are useful for the block making. Dry season is advantageous for a brickfield and its laborers, since they land more positions during that time. Yet, thunderbolt, storm and river erosion harm the brickfield and turn its laborers jobless. Thunderstorm doesn't permit the laborers to work outside and river erosion welcomes water into the brickfield. The van-pullers speak to another catastrophic events that carry a revile to this gathering also. Flood makes their livelihood at stake as they do not drive van in inundated roads. Essentially, hot weather makes it hard to go outside to run the van and gain cash. Therefore, van-pullers illuminates that it sweats more and pulling a van appears to be increasingly laborious during summer time. At the point when the temperature gets high, travelers abstain from riding in the van. During this warm

climate van-pullers go out promptly toward the beginning of the day. They pull the van less around early afternoon however more toward the evening. In substantial precipitation travelers are not prone to ride in a van that has no sufficient facility to keep passengers dry from rainwater. In addition, when the violent wind hits, they don't go to pull the van. To maintain a strategic distance from any setback they stay careful about the chance of the twister. At whatever point dark mists show up in the sky or the breeze begins blowing then they take safe houses. In a waterlogged circumstance, the street gets submerged and they face inconvenience to pull the van.

Day laborers of Nitpur say that downpour, hot weather and chill are critical time for this community. Mason community of Nitpur said that during the dry spell there is an extraordinary absence of water. The exorbitant warmth and high sun can make working condition difficult. Rather, excessive heat and downpour both hampers masonry activities in many respects. on the other hand, rickshaw van Operator community claims that during overwhelming precipitation, riding on dangerous streets, the battery run after speeds up and costs various loss. They expresses that during the debacles, streets are obstructed due to evacuated shafts and fallen trees prevent them to drive rickshaw van.

Shrimp Producer

Shrimp farmers said that the amount of shrimp production is not equivalent to previous decades. A significant reason behind low yield of shrimp is unavailability of prawn minnow in natural water of river or sea ecosystem that is now harvested in artificial fish incubators. Presently, there is an appeal for shrimp minnows, and that is the reason the ranchers import minnows from different areas. Shrimp cultivating has become a significant occupation and business in Pratapnagar over last few decades. They included that previous shrimp cultivating was progressively gainful, yet now it is declining. The purpose behind this is the continuous assault of infection. The infection commences on starting of girdle. What's more, the infection exists till Kartik-Agrahayan when shrimp enclosures are ended. Shrimps get burdened with the infection as the temperature rises. The typical development

likewise gets hampered. At the point when the water temperature rises, shrimps take protects profound into the dirt and gets spots on their shells. These spots bring down the cost of shrimp. At high temperature, the pace of salt in the water decays and consequently outcome decreases too.

Conclusion

This chapter has explored about how climate change and its surrounding impacts influence lives and livelihood of occupational group in the localities. Of the various professional group, climate change is found to have adverse impacts on agricultural crop producers and laborers. Climate change driven debacles make daily life of occupational groups perilous through directly or indirectly affecting productivity and quality, and reducing cash value. Crisis moment arises for livelihood groups during excessive heat, cold and rain as social mobility goes down, transportability of the products get hindered, and poor yield all together drive to occupational migration.

Chapter 8

Local Adaptation Strategies

Introduction

While the developed world is working out the best mitigation strategies for reducing greenhouse gas emissions, the developing world needs help to adapt to the impacts of an already changing climate (OECD 2010). Climate change is a pressing issue of the present world that has created a dichotomy between industrial and traditional nations in terms of mitigation and adaptation practices. Therefore, local people of developing countries like Bangladesh has insignificant role in driving climate change. Nonetheless, these countries are the worst sufferer; their livelihood is facing continuous challenge, agrarian economy encounters superfluous obstacle due to yield loss, and social relations got new dimension in the era of climate induced cross border migrations. 'Adaptation', a buzzword concurrently repeated by world communities that emphasis on developing countries to accept global climate challenge as undeniable reality, and taking necessary actions to mitigate the press climate impacts put forward on a locality. Thus, traditional local communities have nothing to do with climate change except adaptation.

Major Adaptation Practices

Adaptation to Insect Attack

People of Nitpur inform that virus starts attacking when potato trees are grown up, which causes the potato tree to die. Despite besprinkling pesticide, virus rarely stops attacking that brings about low yield, and finally drives to the death of potato tree. The ashes are sprayed very often when the potato plant is grown up. This is widely practiced in case of homestead low scale potato production. Charhajari people report that pest attack starts when blossoms sprouts in bean plant which causes dull leaves. Then the ashes are sprayed on the tree. Additionally, pesticides are bought from the market and applied to the trees. If there is insect in the paddy, the rice is cut off, the leaves of the rice are wiped out and if the log insect attack in the bottom, the paddy plants get destroyed. This problem reduces the yield of rice. *Bashudin* fertilizers are provided when there is a *log* insect on the plant. This adaptation strategy has a high level of use. The paddy field is weeded through sprigged

branches of jujube tree so that dead leaves and infected paddy clean out. Insect attacks on vegetables cause the leaves to become pale in color. Again, if the insect fruits are infected with pests, the fruits decompose. As an adaptation technique, the best way is to prune the leaves of a tree that is decomposed. After the leaf is cut off, poison is given so that the insects can no longer attack on another tree or leaf. Inhabitants of Pratapnagar demonstrate that fish virus causes the fish to die. As an adaptation strategy, the fish with a large net are sprinkled with 5 grams of salt and then stirred into the net and released into the water. If the fish's wound still not heal, then consult with the fisheries officer to take further actions or to provide vitamin in the water, if necessary.

Adaptation to Livestock Disease

Cows, goats, ducks, chickens, pigs, pigeon etc. are raised in homesteads. These animals also suffer from various diseases. People from all three study sites report that the nature and frequency of disease attack has changed over times. Among chicken and duck diseases, anorexia, diarrhea, cholera, fatigue, dizziness are mentionable in the study sites. In the case of poultry chicken, the slim closet results nausea and anorexia. This problem is seen when the heat is high. The remedy is to bring medicines from the pharmacy and sell them cheaply if not recover.

Diseases of cattle includes rashes, fever, allergies, low intake of food, swelling of stomach etc. Particularly, cows and goats have blisters, sore throat, cholera, nausea, anorexia, fever, colds, coughs and wound behind the ears and under the tail. The causes of these diseases are overheating and chill, and if there is a slight cut or wound somewhere in the body, flea extends out the lesions by laying egg on the spot. These diseases cause cow-goat suffering and many times death. The remedy is to give powder or ointment on the wounded spot. Wherever there is a wound, amulet of certain tree's root and leaves is placed on the spot.

Indigenous people of Nitpur illustrate that pigs suffer from wounds on their feet, and stomach ulcers that sometimes leads to death. The reason for this is due to too much sun-heat and winter-cold. The extent of the damage is higher. As a remedy, pigs that are

infected with the disease are kept separate. If problems/ diseases exist after treating with drugs from the pharmacy and then they are sold at a low price or slaughtered to eat all together. In case of too many problems, the animal was taken to the hospital. These diseases occur at different seasons throughout the year. The disease is more prevalent due to the purchase of broiler feed from the market for cataracts, goats, ducks and chickens. The incidence of the disease has increased more than ever before. The vaccine is administered by a rural doctor to prevent the disease. In case of gas problems, practiced by people in all three areas.

Adaptation to Flood Induced Loss and Damage

Flooding is one of the hazards of the study communities that brings about enormous sufferings for local people. After the paddy seeds are planted, the paddy plants get damaged due to the floods. Red sand enters with flood water that further reduces fertility and productivity. In order to escape these losses, rice seeds are sown on high ground to protect from floods. Paddy seedlings are planted by observing the possibility of flood during the month of Ashar and Sraban. Embankment is constructed to prevent excessive river water from inundation of crop land and locality. Furthermore, during the monsoon season, when the water of the river rises, community people monitor water level at the nights in group. The isle (land boundary) is elevated around the land. Dung, ash and other organic fertilizer are added to the soil to bring back the fertility of the land. Due to floods, water enters the settlements and destroys clay walls. To protect settlements from floods, houses are built by raising the homesteads. Moreover, tin or brick walls are constructed instead of clay walls. Floods inhibit livestock to roam around in pasture and it results lacking of grass. To protect them from this, the cows are kept on the road during the day or on high ground, such as on the porch of the house and dried straw is given as food during night.

When the floods last for a long time, people have a crisis of drinking food, various water-borne diseases outbreak. To solve the problem of drinking water, taps are installed in high places so that the floodwater does not enter. Everyone becomes aware of the outbreak of

water-borne diseases, and if it is scabbed bitter herbs such as neem, basil juice, blending gist of Arjun tree's root are sprinkled. The day labor have to pass perilous time due to un-employability during flood. Before the monsoon floods, day laborers save money as much as possible. Moreover, many migrate to other areas. Sick patients cannot go to hospital due to road breaks or mud. Moreover, when the road is damaged people repair it by community participation. There is a lack of wood for cooking. Therefore, cow dung is coated in bamboo or jute stick in dry season to use as firewood during flood crisis moment. Floods sink the pond, and fishes go out. To protect the fish of the pond, net nets are bought from the market and fences are piled around the pond. When the pond is submerged by floodwater, commercial fish foods are placed in the middle of pond to restraint fishes' attention on foods and to prevent exit.

Adaptation to Heavy Rainfall

Uneven rainfall harms *Rabi* vegetables, such as radish, jute, spinach, cauliflower, cabbage, groundnuts, onion, sweet potatoo and potato. As a protection tactic, those who plant in small scale make roofs with polythene. Those who planted more land have nothing to do except replantation after the rain ends. Heavy rainfall inundates the *Aman / Boro* field that reduces the yield of paddy. When the rains are high during the ripening of rice, paddy plants fall to the ground. Adaptation techniques are practiced where isle is disconnected to let extra water go away from paddy field, and fallen paddy plants and harvests are collected as soon as possible to escape decomposition and minimize loss. Due to heavy rains, excess water cause harms for the roof, mud wall of kutcha house. As an adaptation measure, polyphone or tarpaulin are placed on the damaged wall instantly to gap the hole to prevent water dropping into house. Additionally, the distance of the roof from the wall is kept far away so that the rain cannot fall to the wall even in the rain. Due to the heavy rainfall, the water is struck in the vegetable garden, and the yield is low. Due to continuous rainfall, the water in the pond increases that results fishes wiping out from ponds. The damage is much greater. On one side of the pond, drainage canal is cut and the water is drained through the

net for impeding fishes fleeing. This strategy is widely used. Continuous rain can make the life of daily laborers very difficult.

Adaptive Practice to Heatwave

Farmers and day laborers have problems in collecting burro paddy due to excess heat and sunshine. Women usually have difficulty working in the sun when they work to dry rice after boiling for husking. Scorching sunlight burns skin, dehydration, fever, diarrhea, and typhoid occurs. Both men and women of Pratapnagar and Nitpur work for rice harvesting. To protect against intense sunlight and heat, they use a cap made of bamboo on the head, but to a lesser extent. Workers take frequent rest under tree shade or any nearby shady places while working in hot weather. Drink lots of saline water, and while drying up the paddy under direct sunlight, umbrella is used to keep them safe prom direct sun-heat. Due to working under the sunlight, the body discharges a lot of water out of the sweat. This leads to dehydration. Many times women place a wet chest veil (*urna*), and while both male-female put on wet rag on the heads to keep head cold. Due to the intense sunshine cattle cannot be kept in the open gazing field at noon. If the atmosphere is too hot at night also, cattle does not want to eat food because of the heat. To protect the cattle from these debacles, they were taken to the field at dawn for eating grass, and taken back at noon. Water is given thirty minutes later on. Due to the heat, brickwork workers also have difficulty working.

Adaptation to Inadequate Precipitation and Drought

Normal rainfall during the month of Ashar and Sraban is expected. But, sometimes low precipitation aggravate drought scenario even in monsoon. This causes a lot of problems in agriculture. This reduces the yield of rice. *Aman* paddy is entirely cultivated in the study areas with the direct aid of rainwater. The vegetables that are cultivated during the rainy season are also less productive nowadays. Because, there is little water available for farming. It has been reported by local farmers that during some monsoons, the land remains dry due to lack of sufficient rain water. It is also reported that in the absence of rainfall,

soil moisture decrease that further directs to burning of crops. As a result, farmers suffer from financial losses because of low yields. Vegetables that are cultivated during the monsoon face damage due to less-rainfall. No or insufficient precipitation for longer period of times couples with scorching sun-heat burns vegetables, paddy plants, and grasses of pasture. If there is a water crisis due to lack of rain, they irrigate farmlands with the assistance of electric motor. They use irrigation water as an alternative measure to tackle drought situation. But for that they have to spend extra money. Irrigation needs cost and energy, which a few farmers can afford. Less rainfall in monsoon also affects cattle. At this time, grasses do not remain available in the pastures to feed cattle. At this time, the dry straws that are stored in the rice are fed. Due to excess temperature during monsoon, people have to suffer from various malicious illness, such as itching, swelling, sore throat, etc.

Adaptation Strategies to Thundering

Even though the death toll due to thunderstorms was seldom heard 10-15 years ago, now every year people report fatal death due to lightning. The tree caught with fire when lightning falls on the tree. In this case, as the adaptation technique, the branches of the tree are cut down and wood is used for cooking. When lightning struck the house, there is nothing to do this time, the whole house is set with fire and get damaged. As part of its strategy, the house is renovated as soon as possible. When a thunderstorm falls on a human being, the person dies. To avoid this, people do not go out of the house during the stormy wind. This adaptation technique is more widely used. Cattle are killed when lightning strikes the cattle. To avoid thunderstorms, the cattle are kept in the pits rather than in the open.

Adaptation to Fog

Local inhabitants consider fog as a major disaster having negative impact on their lifestyle. Amon paddy seeds are sown in winter. During this time the seeds get wasted if there is excess of fog. Because the seeds need sunlight to germinate. The seeds get infected by virus because of lacking of enough sunlight due to fog. Sometimes the seeds are rotten.

Fog is removed from the paddy sapling with bamboo or sticks so that the dew point is not frozen there. Ashes are sprayed over the seeds. The fog also causes problems in livestock. At that time cattle cholera and skin disease appeared. In order to protect them from the cold, the goats are torn with jute bag. During this time, the poultry suffers from thin closet. Extreme fog causes colds in people, especially cold cough. Day laborers cannot work outside because of the cold and fog. During this time, fire is set to keep people and cattle warm, and to increase visibility.

Adaptation to Norwester

Norwester or *Kalboishakhi* is frequent every year. As a result, many types of losses occur. *Kalibashakhi*, there *Iri* paddy remains in the field when Norwester hits the localities. In this regard, paddy plants fall to the ground due to high wind speed. As a result, the yield get hampered and the desired outcome cannot be found. When the paddy falls, farmers tie a few bits together so that the plants are slightly upright. Because if they are on the ground for a long time, they are likely to be rotten due to logged water. Regardless, most damaged paddy plants are cut off and fed to the cows. The two varieties of rice *BR 28* and *Boro-Zira* used to fall down in norwester. Now, their cultivation is less practiced, instead people cultivate hybrid and *Choto Zira* rice. Tin shed and kutcha house are easily damaged if the wind speed is high. This is why poor people repair the houses every year in the month of Falgun-Chaitra, strengthening the pillars and roof of the houses. Those who cannot repair kutcha house's roof with new dried paddy stick or dried catkin plant (*chan*), use low quality second hand material instead. All most all households of the study community have mango tree. But, norwester damages mango blossom. As a result, mango yield is low. Many times tree breaks down and falls on people's homes. As a result, houses and people both are injured. For this reason, as a precaution strategies, people cut off the branches of trees before Baishakh and kept them short. Many times, people are at risk of danger when they are out of work during norwester. Extra dust blows in the air. Which is detrimental to human health. Communication is disrupted if the level of tree-uprooting is high. Many times the trees fall on the road and the road gets closed. In this case, local government

people came from the union councils to cut down trees and make the roads suitable for movement. At that time, livestock are at risk of falling trees on livestock. In this case, cattle are brought to safety when people pre-understand the possibility of tree falling by norwester. Working outside is only source of livelihood for day laborers. During this peril, the day laborers also face financial distress.

Adaptation to Salinity

Interruption of saline water in agrarian land makes hurt the land and production practices of local people. Local inhabitants utilize a few versatile techniques to counter the impact of saltiness. People use downpour water to limit the saltiness of the land and harvest crop during monsoon. Vegetables are harvested in moderately raised spots and its pace of utilization is high. In the majority of the cases shrimp cultivating replaces the act of agricultural crop due to saltiness. It takes some years to expel saltiness from the lake or water store. Therefore and at a medium rate sweet and salt water lenient are developed in the saline influenced water bodies. Alongside these at a medium rate goats and sheep are taken care of with the side of the road grasses than that of grasses from swamp land. It is a typical practice to plant organic product trees (like coconut, date and palm) and fuel herbs on the higher spots of residence territories. Utilization of tiles on the dividers of structures/mosques/sanctuaries/government and non-government foundations to shield them from saltiness is slight visible. Protection of downpour water in water repository, and drinking water from tube wells are exceptionally wide practiced in the communities.

Adaptation to Cold Wave

Cold stream causes *Aman* paddy plants to grow less. At that time, ash is sprayed on the seedling of the saplings and a little water is irrigated. This technique is widely used. When the paddy plant is grown up, it is said that cold wave can cause no damage at that time. When the sunlight is low in the cold stream, plants unevenly grow larger but the leaves of vegetables become smaller, the fruit size is not good and the taste is poor. Ashes are then sprayed on the vegetable garden in this respect too. As a remedy, fertilizer is used slowly.

If possible the sapling is covered with polythene. If the amount of cold is high, the pond water is cold too, fish reduces movement, so fish does not grow up, and hence the yield is low. The technique is to provide vitamin drugs in the pond water. For a few days, there is cold influx of human (e.g. cough, headache, sore throat, pneumonia, etc.). At that time, the house is kept warm by fire, and everybody takes warmth from fire at morning-night. In addition, people wear thick warm clothes for the winter. As a remedy for this, hot water and ginger tea are drunk more. Apart from this, if throat pain continues, *chan* leaves is chewed with a handful of rice, the pain vanishes. This technique is widely used.

Conclusion

This chapter has unveiled key actions and strategies local people undertake to cope with in short-term, and to adapt in long-term to climate change impacts. Climate change is a catalyst that causes change of other components of natural environment as well. Temperature increase and heatwave, for example, are two indicators of global climate change, but norwester and hailstorm are two side-by-side debacles of increased temperature and heat. Climate change impacts are not limited to some primary jeopardies projected by global climate science rather it has tributary impacts depending on geographic location and socio-cultural lifestyles. First, owing to climate change, temperature is raising and heat wave is happening, second, temperature raise and heatwave are causing norwester and hailstorm. These primary and secondary debacles emerging from ground reason 'climate change' affect people directly and indirectly. Local people whose subsistence relies on sensitive parts of natural milieu have to endure direct effects, while professional group of community like service holder, teacher, doctor, etc. have susceptibility to experience climate impacts more smoothly.

Chapter 9

Conclusion

Conclusion

Present study has demonstrated that climate change is not an abstract or illusory phenomenon anymore. Its substantial existence has already been observed in the last few decades. As a nation with predominance of agrarian economy, Bangladesh has to endure vicious impacts of global climate change in every aspects of her agricultural activities. Seed collection, processing, and harvesting in Bangladesh go under capricious behavior of weather. Climate change and variability have been making crop production very difficult over few years. Poor peasants who supply bread for 160 million people are ultimate sufferer of climate challenge.

Inhabitants have nothing to do with climate change mitigation and resistance, except undertaking proper coping and adaptation strategies. Here, adaptation strategy is nothing but local people's striving to survive under cruel reality of climate change. Successful adaptation requires an assortment of many techniques, strategies and maneuvers. Malfunction of any system in adaptation mechanism turns it futile and less sustainable. The underlying barriers to take adaptation actions like financial shortage, lacking of alternative means, absence of collective support and policy brings forth unsustainable adaptation. Apart from this, individual, communal, social, and state-institutional capacity strengthen climate change adaptation in most respects.

Local governments and political elite manage indigenous environmental resources in the study areas. Their authority could lead to beneficial outcome for both people and ecology. But driven by nepotism, factionalism, corruption, individualism, and self-hedonism some politicians hinder proper management of local environmental resources. As a result, it is seen that influential political person collaborating with local government's representatives barricade natural flow of canal for private shrimp production, extract sands from riverbed in illegal means, lift the soil on the banks of the river, cut down forest and roadside trees. The conflict of interest between common people and politicians in the locality influences local natural resource management and adaptation. State sponsored trees are planted on the two sides of embankments for protection from soil erosion during heavy rainfall, water

logging, drainage, and river erosion. Thus, some mischief politicians cut down big trees to make profit that increase vulnerability to embankment erosion. Here is the clash of political domain of ecology with cultural beliefs around local ecology.

Additionally, upazila leveled government officials try to influence over local environmental resources as entity of sovereign state power. The local users, on the other hand, utilize environmental resources for adapting to climate change induced hazards. Hence, the underlying interplay among politician, government officials, and local people resembles with the dichotomy between cultural and political ecology. According to cultural theory of risk perception, upazila government officials is hierarchist who endeavor to impose state environmental policies on local ecosystem that collide with traditional environmental ethics and practices of local people.

Hence, local people of three study areas embark on adaptation strategies to minimize the loss and damage exposed by climate change. These techniques include both small and large-scale measures, thus some adaptation practices are found common in all three regions. On ground of the fact, present study has come to an internalization that adaptation strategy can derive from two meaningful ways; adoption- when adaptation techniques is borrowed from other community or regions, and new creation- when adaptation strategies emerge from the knowledge of local people who are practicing.

In line with the statement of local people, present study argues that extinction of social values, mores, and ethics has associative roles in causing climate change. Deviance from environmental ethics of sustainable use of nature drives to emit much greenhouse gases responsible for global warming and climate change. Apart from this, human culture is also liable of changing climate in some part. In accordance with the perception of local people in three study regions, this anthropological study puts argument on certain fragment of cultural practice augments global climate change. The more hedonic activities, the higher increases of climate change.

‘Climate variability’ is a least focused issue in climate research of Bangladesh to date. Most climate literatures discuss about long-term climate change instead of short-term climate variability. Present study had potential maneuver to account climate variability from local perspectives. In doing so, it focused on seasonality and changes in short-term and long term. Inhabitants report that weather condition is very fluctuating nowadays that perceptible difference is easily observed over two to three years. Summer in one season, for instance, is different from other year. People can easily distinguish this difference, and because of this irregularity, they look for seasons with conventional natural features, which according to their testimony, is at the edge of decay because of climatic variability and change.

Of the indicators demonstrating the impacts of climate change on local communities, seasonal variety decline is central affecting every aspects of socio-economic life. The unfamiliar behavior of the local weather questions the ability of the local people to interpret weather. This is a very frustrating factor elderly people noted down. Moreover, harvesting variety is much influenced by the seasonal variety that further results extinction of various paddy species, indigenous fish, and herbs. Changes in the arrival and departure timing of each season influence the yield of assigned seasonal crops in one end, correlated social beliefs, festivals and rituals encounter extreme pressures of eradication on the other. Once upon a time, the *Nabanno* festival was widely celebrated by peasants after new paddy collection for first time in a season. Regrettably, the climate change, along with other socio-economic change exacerbates crop failure and production cost so that peasant can hardly make profit now, despite gaining more yields contrasting to last thirty to fifty years. In the past, farmers produced crops with the full blessings of nature that poorly required chemical fertilizer and pesticides. Nowadays, farmers are gaining more yields than previous era, but costing and yield both are high that merely permit farmers to make profit like past. That is why local ranchers gossip about ‘high yield and low satisfaction’. The disappearance of *Nabanno* festival is the example of this.

Additionally, taste and quality of crops, vegetables and fruits have been worsening day by day. Yet it is very difficult to prove whether local foods taste have changed or not except relying on inhabitants testimonies. Besides, pests attack has increased dramatically with the changing climate. Natural productivity of land has also reduced for many natural and anthropogenic reasons; lacking of necessary weather condition for soil moisture and nutrition, unsustainable intensive use, machinery cultivation equipment use, and destruction of farmland ecosystem etc. Farmers start to use chemical fertilizer when they gain low yield because of poor productivity of farmlands. The use of chemical fertilizer accelerate yield but compromise quality and taste with pest attack.

Among the negative impressions climate change imposes on communities, salinity is central in Pratapnagar, erratic rainfall in Charhajari, drought in Nitpur. Saline landscape of Pratapnagar differentiates it from other parts of the country. Present study stated Pratapnagar as a 'water desert' at first sight, owing to brackish topography and watery geophysical features. It is very fertile for shrimp production but very barren for crop production. Along with this lentic ecosystem, fragile lotic ecosystem in association with climate change brings about lot of sufferings for local people in terms of river erosion, flood and inundation, and tidal surge. The study argues that ecosystem supplies resources, absorbs and defies climatic shock in one hand, while generates vulnerability in other means. For example, a place with riverine ecosystem is abundant with natural fishes, sand, communication and water than a land locked place. Although, land locked place is however deprived of natural river resources, but has zero probability of susceptibility to climate change induced riverine hazards.

Charhajari people tend to understand climate change on ground of predominance of erratic rainfall. *Aoush* paddy production was once dominant in the region that is now practiced in less amount. People blame climate change for insufficient precipitation during early monsoon essential for *Aoush* seedling preparation. Majority farmers give up hope keeping the farmland fallow during *Kharif-1* that casually made them dependent upon market in

response. Nitpur feel climatic change through increased temperature and drought. Lacking of necessary precipitation makes life at stake in various respects.

It is very clear that all study participants perceive climate risk on ground of their collective worldviews. According to occupation-based analysis of research findings, it seems that farmers group perceive climate change in very distinctive way than other group do. Some portion of farmers are egalitarian believing that climate has limit to endure human intervention while others are fatalist with belief that climate is capricious. Teacher, service holder, village doctor possess beliefs like egalitarian group whereas petty businessmen (raw vegetable) tend to believe in exploitation of nature through technological intervention.

Bangladesh is a land of versatile ecological hotspot. Climate change unevenly affects people relying eloquently on ecological settings and topography. Climatic shocks in Bangladesh is colorful like its ecology. Every ecological spot has different variants of climate change impacts; coastal belt experiences climate change impacts in the form of cyclone, tidal surge, and salinity, riverine ecological zone has river erosion, flooding, and salinity, forest ecosystem has abnormal death and extinction of traditional trees and herbs, and land ecosystem incorporates all stated impacts with drought, thundering, temperature rise, heat and cold wave etc.

Under the broad ecological categorization of Bangladesh's topography, each single individual of traditional occupational group has distinct story of climate change influence. For instances, a peasant of Barind ecosystem internalize climate change in very different way from his fellow beings of littoral ecosystem. Alternatively, it has been observed that people own different worldviews on climate change despite inhabiting in same kind of ecosystem of two distant regions. Such as, people of riverine Charhajari have very divergent perception of climate change than riverine Pratapnagar. For this reason, present anthropological study argues that climate change impacts are ecosystem based but perception is culture specific. In this regard, it emphasis on further place-based ecosystem wise perception research with a view to generate findings comparable to across sites.

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Appendices-1: Questionnaire

Perception of Climate Change in Three Ecological Zones of Bangladesh

Household Survey Questionnaire

খানা জরিপ কাজে ব্যবহৃত প্রশ্নমালা

SECTION-A : BACKGROUND INFORMATION

A1. Household Identification and Location

Household ID Number	:						
Cluster Number	:						
VillageName	:						
Locality/Ward Name	:	**Upazilla** :		**Zilla** :			

A2. Respondent Identification

Name of the Respondent	:				
Ethnicity of the Respondent	:				

A3. Interview Information

		Day		Month		Year	
Date of Interview	:					**1**	**2**
Interview Duration	:						
Time of Interview	:						
Place of Interview	:						

Interviewer	:		
Supervisor	:		
Data Entry	:		
Interview Status	:		

Interview Status Code:1- Fully completed; 2- Cancelled; 3- Reluctance; 4- Partially completed; 77- Others (Specify)_____|

A3. Consent Seeking Statements

আমার নাম _Md. Borhan Uddin_, আমি ঢাকা বিশ্ববিদ্যালয় থেকে এসেছি। বর্তমানে আমি জলবায়ু পরিবর্তন সম্পর্কিত একটি জরিপ কাজ করছি। উক্ত জরিপ কাজে আপনার অংশগ্রহণ একান্তভাবে কামনা করছি। জরিপ কাজটি শেষ করতে 01 ঘন্টার মত সময় লাগবে।

জরিপের অংশ হিসেবে আপনার খানা সম্পর্কিত কিছু প্রশ্ন করব। আপনার এবং খানার অন্যান্যদের কাছ থেকে যে তথ্য নিব তা কঠোরভাবে গোপন রাখা হবে এবং শুধুমাত্র গবেষণার কাজে ব্যবহার করা হবে। এই জরিপ কাজে অংশগ্রহণ করার ফলে আপনাকে কিছু দেয়া হবেনা। আপনার ইচ্ছা হলে আপনি কোন প্রশ্নের উত্তর না দিতে পারেন বা পরিপূর্ণ সাক্ষাৎকার নাও দিতে পারেন। আমি কি আপনার সাক্ষাৎকার নিতে পারি?

SECTION B:HOUSEHOLD COMPOSITION

201. Details of the Household members.

Sl. No	Name	Relation with HH Head	Sex (Code:1=Male2=Female)	Age (Years)	Education	Marital Status	Primary Profession (See Code)	Secondary Profession (See Code)	Typeof impairement if there is any PWD in the household?
(01)	(02)	(03)	(04)	(05)	(06)	(07)	(8)	(09)	(10)
1.		1							
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									

Relation code	Column 03	1- Self; 2 Husband/Wife; 3. Son/Daughter; 4 Brother/ Sister; 5 Sister in law /Brother in law ; 8 Grandparent; 9 Grandchild; 10 Housekeeper; 11 Father/ Mother 77 Others (Specify)_____
Educational Qualification	Column 06	77. Children <5 yrs, 81- Illiterate, 82- Can read and write 83-Pre-primary/study period (last completed educational year/class/degree , for example primary -5, secondary -8, SSC 10, HSC 12, Graduation 14, Masters 16, MPhil 18, PhD 20)
Marital status	Column 07	77- Child <5 years; 1- Unmarried; 2 Married; 3- Widow; 4- Divorced/Separated/Deserted
Primary & Secondary Profession	Column 8 and 9	1-Agriculture (own land); 2-(only mortgaged/borrowed or rented / bargha land); 3-Agricultural labour (day labourer/agricultural labourer/assists in household agricultural activities); 4- Non agricultural labourer (mason/weaver/potter/blacksmith/cobbler/tailor/assistant to mason/weaver/ worker in a rice mill); 5- Rickshaw/Van/ puller Pushing cart man/boatman; 6- Driver of motor vehicle; 7-Government/ Nongovernment employee;8-Professional (Teacher/ Lawyer/Doctor/ Engineer); 9- Big/ Middle Businessman; 10 Petty business; 11 Housewife, 12- Housekeeping in others household; 13- Garments' worker, 14- Unemployed; 15-Student; 88- Not applicable (<6 years) 77- Others (Specify)_____
Type of Impairement	Column 10	01- Cognitive Impairement; 02-visionary Impairement; 03- Speach and hearing Impairement; 04-Physical impairment; 05- Multiple Impairement

SECTION C: LIVING CONDITION

Question No	Question	Answer and Code	
301	Type of house made up of? Please circle the specific code after observation	Building/ Cement Construction	01
		Tin Shed (Pucca or Semi Pucca Wall)	02
		Tin Shed (Tin Wall)	03
		Tin Shed (Tin/ Thatched/ Mud Wall)	04
		Thatched House (Cane/ Straw/ Leaf)	05
		Squatter House (Plastic/ Polythene)	06
		Others, please specify) _____	99
303	How long have you been staying here?	<1 year	01
		01-05 years	02
		06-10 years	03
		11-15 years	04
		16 years and above	05
304	What is the major source of drinking water?	Supply from WASA/ Taped Water in House Premise)	01
		Deep Tube Well)	02
		(Tube Well)	03
		Preserved/ Protected Well)	04
		Uncovered Well)	05
		(Harvested Rainwater)	06
		(Surface water- river, lake , pond etc.)	07
		Others, please specify) _____	99
307	Is the water source submerged during last stormsurge or affected during last drought)	Yes	01
		No	02
		Don't Know/Can't say	03
		Others, please specify _____	04

SECTION- F: CLIMATE CHANGE AWARENESS AND ADAPTATION

Question No	Question	Answer and Code	
601	Have you ever heard about or read anything about the issue of climate change?	Yes	01
		No	02
		Don't know	88
		Others (specify)	
602	Have you heard about the possible impact of climate change in your locality? If yes what are those?	Sea level rise	01
		Increase land erosion	02
		Increased salinity in drinking water sourcrces	03
		Increased salnity in cultivable lands	04
		Drought	05
		Heat wave	06
		Increased precipitation	07
		Decreased rainfall	08
		Increased decease	09
		Declined plant and trees	10
		Damaged private bussinees and infrastructure	11

Question No	Question	Answer and Code	
		Damaged Govt./ public utilities	12
		Don't know	88
		Others (specify)	
603	What the are the climate change impacts you are experiencing in your area?	Sea level rise	01
		Increase land erosion	02
		Increased salinity in drinking water sourcrces	03
		Increased salnity in cultivable lands	04
		Drought	05
		Heat wave	06
		Increased precipitation	07
		Decreased rainfall	08
		Increased decease	09
		Declined plant and trees	10
		Damaged private bussinees and infrastructure	11
		Damaged Govt./ public utilities	12
		Don't know	88
		Others (specify)	
604	How have you adapted with the climate change impacts? (read out the impacts respondents have mentioned? (specify the adaptation practices)	Sea level rise	
		Increase land erosion	
		Increased salinity in drinking water sourcrces	
		Increased salnity in cultivable lands	
		Drought	
		Heat wave	
		Increased precipitation	
		Decreased rainfall	
		Increased decease	
		Declined plant and trees	
		Damaged private bussinees and infrastructure	
		Damaged Govt./ public utilities	
		Don't know	
		Others (specify)	
605	Have you heard about the possible impact of climate change in Banglaesh at national level? If yes what are those?	Sea level rise	01
		Increase land erosion	02
		Increased salinity in drinking water sourcrces	03
		Increased salnity in cultivable lands	04
		Drought	05
		Heat wave	06
		Increased precipitation	07
		Decreased rainfall	08
		Increased decease	09
		Declined plant and trees	10
		Damaged private bussinees and infrastructure	11

Question No	Question	Answer and Code	
		Damaged Govt./ public utilities	12
		Don't know	88
		Others (specify)	
606	In your opinion what are the causes of climate change?	Excessive use of fossil fuel (coal, oil, gas, etc.)	01
		Deforestation	02
		Will of God	03
		Don't know	88
		Others (secify)	
607	From which sources did you know about climate change?	Radio (Bangladesh Betar)	01
		F.M radio	02
		Foreign radio stations (BBC, VOA)	03
		Bangladesh televaision (BTV)	04
		Private tv channel	05
		Indian tv channel	06
		Internet	07
		Local news paper	08
		National neswS paper	09
		Street drama	10
		Posters	11
		Religious institues (Mosque, Church)	12
		Known people (friends, relatives)	13
		School/ college/ university	14
		NGO meetings	15
		NGO meetings	16
		Others (specify)	
608	From which sources would you like to receive information about adaption options for climate change?	Radio (Bangladesh Betar)	01
		F.M radio	02
		Foreign radio stations (BBC, VOA)	03
		Bangladesh televaision (BTV)	04
		Private tv channel	05
		Indian tv channel	06
		Internet	07
		Local news paper	08
		National neswS paper	09
		Street drama	10
		Posters	11
		Religious institues (Mosque, Church)	12
		Known people (friends, relatives)	13
		School/ college/ university	14
		NGO meetings	15
		Local governments	16
		Others (specify)	
609	How do you feel about climate hcange	Scarded about possible consequences of climate change	01
		Don't believe climate change	02
		Doubtful	03
		Helpless (cant do anything)	04
		Hopefull (can adapt with changing climat)	05
		We can loose our home and culture	06
		Don't know	88
		Others (specify)	

SECTION- G: AWARENESS LEVEL ABOUT CLIMATE CHANGE

I will read out some statements about climate change please response how do you agree with those:
Fully disagree= 01
Somewhat disagree=02
Don't agree or disagree= 03
Somewhat agree=04
Fully agree=05

Question No	Question	Fully disagree	Somewhat disagree	Don't agree or disagree	Somewhat agree	Fully agree
		01	02	03	04	05
701	Climate change is happening					
702	I don't know that climate change is having impact on people of this locality					
703	I have been observing change climate of this area for last 20/30 years					
704	Agricultural cultivation in this area has become difficult due to climate change					
705	Average tempature during summer has increased in this are due to climate change					
706	Climate change is cuaseing increased or decreased rain in the locality					
707	Due to climate change salinity has increased in the coastal areas					
708	Due to climate change rate of cyclone has increased in the coastal areas					
709	We can face climate change through decreasing air pollution					
710	Climate change increases drought					
711	Agricultural production has decreased deu to climate change					
712	Climate change increases occurance of flood					
713	Detrimental pests for agriculture has increased due to climate change					
714	Climate change will have detrimental impact on future generations					
715	Everyone can do something to adapt with the climate change					
716	It better to live now rather thinking about what may happen after fifty years due to climate change					
717	Climate change is having adverse impact on the people of Bangladesh					
718	We can do nothing to face climate change					
719	We should try to adapt with climate change					
720	We have to act now to stop climate change					

SECTION- I: খানার মোট বার্ষিক আয়ও ব্যয়(Gross Annual Income and Expenditure of the Household)

প্রশ্ন নং	প্রশ্ন			
901	গত ১২মাসে খানার	আয়ের উৎস	Code/ Value	বার্ষিক আয় (টাকা)

প্রশ্ন নং	প্রশ্ন			
	আয় (আয়ের উৎস এবং পরিমাণ)	কৃষি (নিজ ও বর্গা জমি)	**1**	
		হাঁস-মুরগী/ গরু-ছাগল-ভেড়া পালন	**2**	
		মাছ চাষ	**3**	
		গাছ বিক্রি	**4**	
		চাকুরী (বোনাসসহ)	**5**	
		ব্যবসা	**6**	
		মজুরী	**7**	
		রিক্সা বা ভ্যান চালান	**8**	
		বাড়ি/ দোকান ভাড়া	**9**	
		বিদেশ থেকে প্রাপ্ত অর্থ	**10**	
		বৃত্তি/ উপবৃত্তি/ টিউশনী	**11**	
		সাহায্য/ সহযোগিতা/ ভাতা/ VGD/ VGF কার্ড	**12**	
		হস্তশিল্প	**13**	
		অন্যান্য (উল্লেখ করুন) _____	**73**	
		অন্যান্য (উল্লেখ করুন) _____	**74**	
		অন্যান্য (উল্লেখ করুন) _____	**75**	
		অন্যান্য (উল্লেখ করুন) _____	**76**	
		অন্যান্য (উল্লেখ করুন) _____	**77**	
		খানার মোট বার্ষিক আয়:		

	খানার মোট বার্ষিক ব্যয়			
902	গত বছরে আপনার খানায় কোন খাতে কত টাকা ব্যয় হয়?	ব্যয় খাত	Code/ Value	বার্ষিক ব্যয়
		কৃষি খাত (ফসল উৎপাদন, গরু,ছাগল,হাঁস-মুরগি পালন ইত্যাদি)	**1**	
		অকৃষি খাত (ব্যবসায় বিনিয়োগ ও অন্যান্য ব্যয)	**2**	
		খাদ্য	**3**	
		পোশাক:	**4**	
		বাসস্থান তৈরী/ঘর মেরামত	**5**	
		ঘর ভাড়া/মাটি ভাড়া	**6**	
		শিক্ষা	**7**	
		স্বাস্থ্য/চিকিৎসা	**8**	
		বিনোদন	**9**	
		যাতায়াত	**11**	
		বিদ্যুত/ পানি/ গ্যাস বিল	**12**	
		কেরোসিন	**13**	
		অন্যান্য জ্বালানী দ্রব্য	**14**	
		অন্যান্য নিয়মিত বিল	**15**	
		ঋণ পরিশোধ	**16**	
		অন্যান্য (উল্লেখ করুন) _____	**74**	
		অন্যান্য (উল্লেখ করুন) _____	**75**	
		অন্যান্য (উল্লেখ করুন) _____	**76**	
		অন্যান্য (উল্লেখ করুন) _____	**77**	
		খানার মোট বার্ষিক ব্যয়		

(ধন্যবাদ দিয়ে সাক্ষাৎকার শেষ করুন)

Appendices-2: Checklist

Perception of Climate Change in Three Ecological Zones of Bangladesh

1. Have you heard of "climate change"?
2. Do you believe in climate change? If no, why?
3. What do you know about it?
4. Where have you heard about climate change?
5. How important is the issue of climate change to you personally?
6. Why is it important to you?
7. What do you think causes climate change? (Belief)
8. What impacts, if any, do you think climate change may have/ you are already experiencing?
    9. Drought (ritual connected with it to mitigate)
    10. Heat and cold wave (ritual connected with it to mitigate)
    11. Salinity and river erosion (ritual connected with it to mitigate)
    12. Thunder storm (ritual connected with it to mitigate)
    13. Food and Downpour (ritual connected with it to mitigate)
    14. Cyclone and Nor'wester (ritual connected with it to mitigate)
15. Have you observed uncertain behavior of weather now a day? How you interpret it?
16. What are the indicators of climate change that help you identifying it?

17. Precipitation pattern (amount, duration and seasonality) is like before?
18. Summer is like before?
19. Winter (fog, duration, and seasonality) is like before?
20. Do you think climate change is something that is affecting or is going to affect you, personally?
21. If yes, in what way(s) is it affecting you, or is it going to affect you?
22. How your Health is being affected by climate change?
23. How your Lives, Livelihood, Income and Earnings are being affected by climate change?
24. How your Water, Sanitation and Hygiene practice are being affected by climate change?
25. How your Occupation is being affected by climate change?
26. How your Production and Food Security are being affected by climate change?
27. How climate change affects your traditional values and customs?
28. How climate change affects your Environment-Ecosystem of the locality?
29. What impacts do you think climate change have on Social Relations, Power Structure and Social Organization?
30. How do you feel about climate change? Shocking, scaring..,…

Field Images

Image 1: Riverside Locality

Image 2: Goat Grazing in the Field

Image 3: The Small Feni River

Image 4; Flower Blossoming

Image 5: Onion Cultivation

Image 6: Beautiful Flower

Image 7: Dry Straw

Image 8: Wild Flower

Image 9: Village Road

Image 10: Indigenous Beans

Image 11: The River