Study of Generic Settlement Pattern in the Bengal Delta

by

M. Masud Ur Rashid

A thesis submitted

In partial fulfilment of the requirement for the Degree of

DOCTOR OF PHILOSOPHY

in Architecture

Faculty of Engineering & Technology

SELINUS UNIVERSITY OF SCIENCES AND LITERATURE

March 2022

Supervisor: Dr. Qazi Azizul Mowla

Professor, Department of Architecture, Bangladesh University of Engineering and Technology, Dhaka.

DECLARATION

It is hereby declared that this thesis contains original research works and has been submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Architecture at Selinus University of Sciences and Literature, Italy.

The research was conducted under the supervision of Dr. Qazi Azizul Mowla, Professor, Department of Architecture, Bangladesh University of Engineering and Technology where I was a part-time student of Doctor of Philosophy. The research was administrated through systematic academic procedures and proper approvals. After finishing the research work, the thesis has been transferred for its evaluation to the Faculty of Engineering and Technology of Selinus University of Sciences and Literatures with my proper consent.

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M. Masud Ur Rashid

ID No.: UNISE1748IT

DEDICATION

Hamida Begum

My mother.

My utmost respect to all the mothers

who are struggling to raise the generation defying all odds.

ACKNOWLEDGEMENT

All admirations go to Almighty Allah the most Merciful and most Benevolent for His kindness and blessings.

It is a great pleasure to acknowledge my indebtedness to my supervisor Professor Dr. Qazi Azizul Mowla, for his constructive advice, appropriate guidance and moral support which always helped me in every stage of this research. This thesis has been worked out under his careful supervision and indefatigable guidance.

I am grateful to Dr. Salvatore Fava, my general supervisor at Selinus University who allow me to transfer my thesis to Selinus University of Sciences and Literature from the Bangladesh University of Engineering and Technology when I was facing hurdles to wrap up the thesis works and receiving the degree. I am also thankful to the members of the Doctoral Committee who have guided me to accomplish the research.

I appreciate my friends and colleagues at the Southeast University and Institute of Architects Bangladesh for encouraging me and sharing their knowledge in this research area. I also acknowledge the assistance of Ar. Shadika Khanam Surovi, Ar. Rushda Zafar, Ar. Jayedi Aman, Ar. Kistaz Habib, Shahriar Mahmud, Arif Mahtab Kabir, Sumon Howlader and my childhood friend Md. Mahbubul Islam during the research works.

I am grateful to my mother for her love and affection, my two brothers, lovely nephews and in-laws for their appreciation, and especially my life partner Habiba Akhter and my two little angels Rashid Manha Hadiqa and Rashid Mariha Harisa for their endless support and patience that inspire me to complete the research.

I owe my thanks to all of them.

M. Masud Ur Rashid

Dhaka, March 2022.

ABSTRACT

Every nation has some identity attributes that make it distinct from other nations, of which settlement pattern is the most important one. There are studies on essential components of a viable settlement and also there are studies on the evolution pattern of settlements in this region. But, no studies were found that explains the "generic pattern" of any particular settlement typology. It is observed in the Bengal delta that every time a settlement begins to evolve, it follows the same common principles, giving rise to a certain pattern. To identify that pattern of Bengal settlements, the present coastline, which is the active delta and represents the thousands of years old geo-climatic context of this region, has been analysed. The objective of this study is to identify the generic settlement pattern in the Bengal Delta. The sub-objectives are to find out the phenomenon behind the evolution of a particular settlement pattern in the Bengal Delta in response to traditional ecological knowledge (TEK) and finally to validate the settlement pattern as the generic one which can be used as a basis for future planning and design at any scale and level.

The research has been conducted through a triangulation of literature review, phenomenological approach and qualitative data analysis. The analogical context is identified through the historic phenomenological interpretation of available literature. The historic settlement pattern is reconstructed for the phenomenological study in the present context to verify the prevalence frequency and intensity of the historic pattern. This research essentially attempted to connect methodically, the various threads and fill up the gaps to identify the order that prevails in the settlement pattern of the Bengal Delta, thereby testing the hypothesis, that "Bengal Delta has a generic settlement pattern". From the three stratified zones, 22 case study settlements were selected at random for the field survey, KII and FGD. On analysing all the data, historic interpretation of the settlement patterns and logically identifying the phenomenon behind the development, a 'generic settlement pattern' is revealed. Theoretically bracketed settlement components, their growth pattern and character is further scrutinized in the analogous historic Bengal delta context to 'confirm' that they are tied up in a single thread and further validated in both rural and urban context.

The generic settlement module is found to vary between (1 km to 1½ km) x (1 km to 1½ km) with a population ranging from 30-100 homesteads. Depending on the context, scale, and level of development, this module takes on various shapes through logical transformation, mutation, adaptations or resiliencies. The elements of a settlement are connected both physically and psychologically. The generic settlement pattern as identified comprises of four parts i.e. homogeneous part, central part, circulatory part and community interaction part. The communication route gives the settlement inter and intra-accessibility with the community facilities and organize the whole settlement spontaneously with TEK and gives shape to the settlement. Settlements in Bengal Delta employ the wisdom, knowledge, and practices handed down from generation to generation. There is an order both in the internal system and external outline of the settlements. The pattern that is identified is generic in nature because it is found to be the basis of all the organic settlements at various scales and levels in Bangladesh (which is a part of the Bengal Delta) unless it is modified by some external forces.

The studies in the Bengal Delta context found some common denominator that provides the basis of a 'generic pattern' persisting and prevailing in all levels and scales when evolved by TEK organically. Transplanted ideas not rooted in the context, particularly during the colonial era, has brought about some changes in the settlement pattern that cause chaos. For sustainability purposes 'transformation' instead of 'transplantation' is identified to be the right approach for settlement planning. The generic settlement pattern that is identified for Bengal Delta can be used as a basic framework for any future settlement planning and design in this region for its sustainability.

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INTRODUCTION

"Imagine yourself high in the air over the Himalayas. Look down and you see a forbidding landscape of snow-capped mountains and harsh vegetation. But now look to the south-east and discover an immense floodplain stretching between the mountains and the sea. That shimmering green expanse is Bangladesh."

- Schendel, 2009

1.1. Background

Man has three basic needs that are Food, Cloth and Shelter. These needs are fulfilled by nature or the environment (Marx 1975). In the early stages, Man used branches of trees, caves or rock-cut for shelter. Man, being a rational social animal, began to replicate natural shelters transforming them into houses and settlements of various scales, levels and hierarchies like homesteads, hamlets, villages, towns and cities evolved. Bengal Delta, being very fertile was considered a suitable geo-climatic context for human habitat. Settlements started evolving in the delta gradually with the formation of habitable land. Apparently, there is no specific pattern or order in the settlements of Bengal, yet settlements in the Bengal Delta are recognizable or identifiable from other settlements in the world. That means, there is an innate character and 'identity' and this identity must have certain attributes. So, what are the attributes that provide this identity? If any settlement is needed to be studied, is to be studied in its context. The evolution process often gives a clue to the hidden order that prevails in the settlements, if it is not completely destroyed by any external intervention. Original order and pattern is to be traced back by having a clear understanding of the circumstances it has passed through (Mowla, 1990a & 1997a). The context affects the type of distribution, spacing and morphology of settlements (Hudson, 1976). Human settlement is an organized colony of human beings consisting of shelters in which they live, work or enjoy and the circulation system that facilitates their movement.

South and Southeast Asia is traditionally and culturally the home of rice cultivation. Rice has been documented in the delta as a source of food in history since 2500 B.C. From the early records and phenomenological assumptions, it can be said that rice cultivation has shaped the original settlement pattern and morphology of the Bengal Delta (Rasid and Paul, 1993). A crucial shift in the settlements occurred when agriculture evolved from shifting cultivation to rice cultivation on permanent fields (Schendel, 2009). Settled life encouraged settlements based on geo-climate and availability of local materials, and with this, various relevant crafts also flourished. Barter trade between different surplus

products gave rise to certain places *(hat)* for the exchange of essential goods. As a result, the earliest settlements and community life began in this region (Kavas, 2009).

1.1.1. Germination of a Concept

In the case of vernacular settlements, housing has always been a direct expression of the responses to the geo-climatic context, state of know-how of construction techniques, and available local construction materials (Turner, 1976). With the change in the global context, in terms of technological, climatic, socio-cultural and economic factors, traditional architecture and settlement patterns in Bengal Delta are also transforming. Textual evidence suggests that radical changes started taking place in the settlement patterns only during the last one hundred years or so and this is more evident at urban settings (Dey and Bhaduri, 2016, Schendel, 2009). Historical accounts indicate the persistence of a historic pattern prevailing in this region till date (Khan, 1996). What makes any settlement pattern to bounce back to a historic pattern in various levels and scales? is a natural inquiry that germinates the concept of this research. In this context, it is necessary to conduct some studies on the traditional settlement patterns of this region to create some baseline textual evidence and to identify the 'generic' settlement patterns that gave rise to all other prevailing patterns in a different hierarchy in this region.

1.1.2. Research Problem

Every nation has its identity based on certain attributes, of which house type and settlement pattern is one and the most important. To clarify the identity of Bangladesh, it is important to identify the settlement pattern of Bangladesh. The major portion of Bangladesh is a part of the Bengal Delta (Schendel, 2009). Several researchers on different levels and scales have also studied the settlement of Bengal Delta's rain-fed rice culture (Sultana, 1993; Baqee, 2011), but none of these could provide a holistic chronological account and logical argument leading to their thesis of settlement transformation in time and space. Universally, two types of basic settlements were identified i.e. hunters and gatherers and agricultural. There are studies on essential components of a viable settlement (Doxiadis, 1968) and also there are studies on the evolution of settlements in this region (Sultana, 1993; Mithun, 2008; Mowla, 2019b). No studies were however found that discusses or explains the "generic pattern" of a particular settlement anywhere in the world, except the hunters/gatherers and agricultural settlement concepts of their origin. Therefore, the studies on settlement pattern and formation were taken as the basis for the identification of a generic settlement pattern and the Bengal Delta was taken as the case context.

1.2. Generic Pattern of Settlement

Emrys Jones (1965) described settlement patterns as the relationship between houses and other components of work and travel. He points to a broad scale map in order to identify this relationship. However, Finch and Trewartha (1946) attribute the contrasts in the arrangement of streets and houses, i.e., patterns to the site as well as the historical causes. The identifying factors are thus clear: 1) the pattern refers to the geometric shape of the settlement, which can be of various types, and 2) the relationship between the number of dwellings and the number of public spaces/places. The analysis of patterns brings forth diverse shapes and forms for the various types of settlements depending on the context. In a particular context, the common denominator provides the basis of a ‘generic pattern’ that are applicable in all levels and scales.

The generic pattern is the relationship pattern of the core components generated by the interaction of several socio-economic, geo-climate, anthropological, technological, and ecological factors (Hasan, et. al. 2017). The pattern of a settlement and movement system is described as being greatly influenced by the physical environment. Hoover (1935) cited water as the key environmental element in the determination of settlements and economy. Generic patterns represent the core patterns that develop, multiply or transform spontaneously, to take many forms, patterns and shapes (Alexander, et al. 1977).

1.2.1. Definition, Scope and Approaches

The term ‘settlement’ is derived from the word ‘settle’. In a more or less permanent abode, the term 'settle' means 'to establish' or 'become established'. This also implies temporary residency at a place. 'Settlement' means the settlement units, along with the houses they dwell in or otherwise use, and the ways they travel, representing an organized colony of human beings. (Finch, 1977). The Greek word 'Ekistics', which means the science of settlement, was first used by Doxiadis (1968). As a scientific mode of study, it relies on analytic descriptions, organized in five elements i.e. nature, anthropology, society, shelters, and networks. According to Doxiadis (1968), it is generally a more scientific field than planning and has considerable overlap with some of the less restrained fields of architecture. However, on the basis of socio-economic characteristics, occupational structure, way of living, and population volume, human settlements are classified as urban and rural. Some scholars' definitions shed light on the meaning of settlements. All urban settlement patterns have their origins in indigenous settlements (Brunhes, 1952).

Settlement is the topographic expression of the grouping and arrangement of two fundamental elements i.e. houses and pathways (Brunhes, 1952). Three items appear to be dominant in the above concepts of a basic settlement or topographic expression; implying the settlements as physical distribution of houses, human living (work), and the

system of pathways for people's movement. Daniel and Hopkinson (1989) and Haggett (1965) characterize a settlement as a place where people inhabit and carry on a variety of activities: commerce, development, defence, etc. meaning that each settlement has a certain affinity or bonding. Dicken and Pitts (1963) consider it at a different scale and level by explaining "settlement (attributed) to the grouping of people and houses into hamlets, villages, towns, and cities".

Indigenous settlements are spontaneous and the environment is based on primary occupations that strive on local resources, such as agriculture, forestry, mining, fishing, and hunting. Settlement arrangement, location, spacing, roles and internal structure differ regionally with the diversity of physical circumstances and the type of human societies they represent. Therefore, the basic attributes of this study are these important elements such as the relationship of distribution, scale, the morphology of settlement functions as created by man across time and space. This study focuses on identifying the basic components of a settlement and their spatial relationships in the Bengal Delta.

1.2.2. The Origin and Growth of Settlements

Historically the first settlement began to form in the Neolithic period. Earlier the population depended largely on land and natural resources. Agricultural activities also began then. Gradually, new and improved capabilities brought with them a surplus production of food. A part of the population was, therefore, able to pursue other activities. Trade and craft subsequently changed the social structure, settlement morphology and their linkages. Every breakthrough in technology brought change with it but the core pattern remained essentially the same (Mowla, 2012a; 2019b) for each region.

During his period of adaptation to the environment man came in close contact with various environmental features and his response brought forth changes in his physical landscape. It is a way of understanding man in a matrix of human and physical relationships and interrelationships. These interrelationships are best expressed through the settlements which are concrete expressions of human colonization of the earth’s surface.

According to Finch and Trewartha (1946), isolated or dispersed and the nucleated are two primate types of settlements influenced by the local resources and topography. Chandel (2013) says that nucleated and dispersed are two major patterns in rural areas. From the early ages, settlements were defined as the description and analysis of the distribution of shelters by which people attached themselves to the land for primary production. Three aspects of the cultural landscape were highlighted by Jordan (1966): i) the pattern of settlement or distribution of farmstead, ii) the field pattern of farms arising from the division of land for agricultural use, and iii) types of house and farmstead, including building materials and folk architecture.

1.3. The Bengal Delta – the Context

Two Himalayan rivers, the Ganges and the Brahmaputra, which drain into the Bay of Bengal as a combined river, carry with it the largest amount of sediments. Together, these two rivers have contributed to the world's biggest delta, known as the Ganges-Brahmaputra Delta or the Bengal Delta (Schendel, 2009). However, although these two rivers had previously debouched separately to the Bay of Bengal, they are now combining into the bay before eventually emptying. These river delta construction operations lead to the creation of Bangladesh or the land of Bengal (Rasid and Paul, 1993).

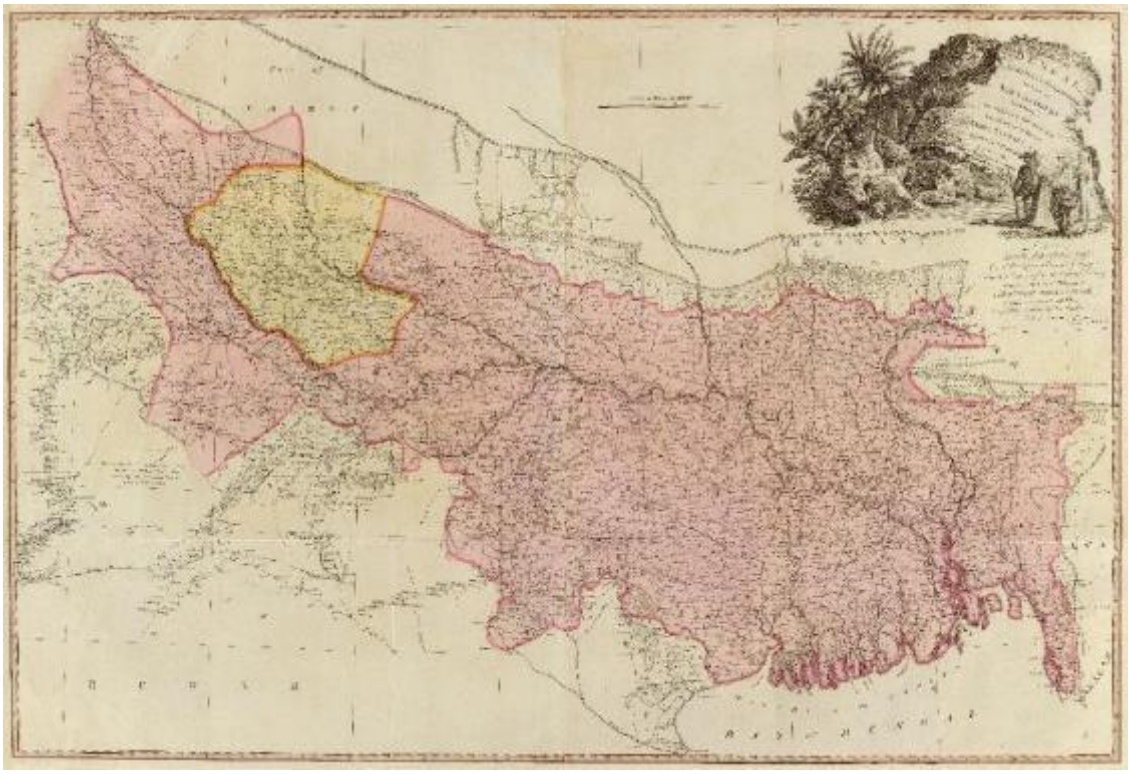


Figure 1.1: Map following the Ganges River by James Rennell in 1786.

The overall deltaic coastline can be generalized as the western inactive or old delta and the eastern active Meghna deltaic plain (Figure 1.1), in conjunction with the occupation of several river courses and shifting depocentres. Although the inactive old delta is relatively ancient, the plain of the Meghna delta is geologically very new. Bengal Delta is bordered to the west by the Indian Shield, to the north by the southern margins of the Barind Tract and to the east by the Tippera Surface. The delta's main progradation is continuing to the South-South-East into the Bay of Bengal.

1.3.1. Bengal Basin and Bangladesh

One of Bangladesh's physiographic units is the Ganges-Brahmaputra delta. The region is almost plain ground, with elevations ranging from 15 meters in the north to almost one

meter in the south. The gradient on the surface of the delta is around 0.016m / km. In Khulna, Barisal, the southern part of Faridpur and the eastern part of the Noakhali district, the average elevation of the delta is less than two meters. Bangladesh's Bengal delta region is densely populated, with agricultural activities prevalent due to the high fertility of the land. In terms of land cultivation, fishing, navigation, common property resources (e.g. from the Sundarbans mangrove forest), and other economic activities, the livelihood of most people depends on the environmental conditions of the delta. In this wide and constantly evolving delta, continual land accretion and erosion affect the lives and life of people, the pattern of settlement and the socio-cultural structure of Bengal Delta (Schendel, 2009). Historically, this region now called Bangladesh is emerging from continuous land accretion towards south and south-east (Rasid and Paul, 1993). Interpreting the geo-climatic conditions and the historic records, it may be safely assumed that the present active delta presents a similar context available thousands of years ago in its northern plains.

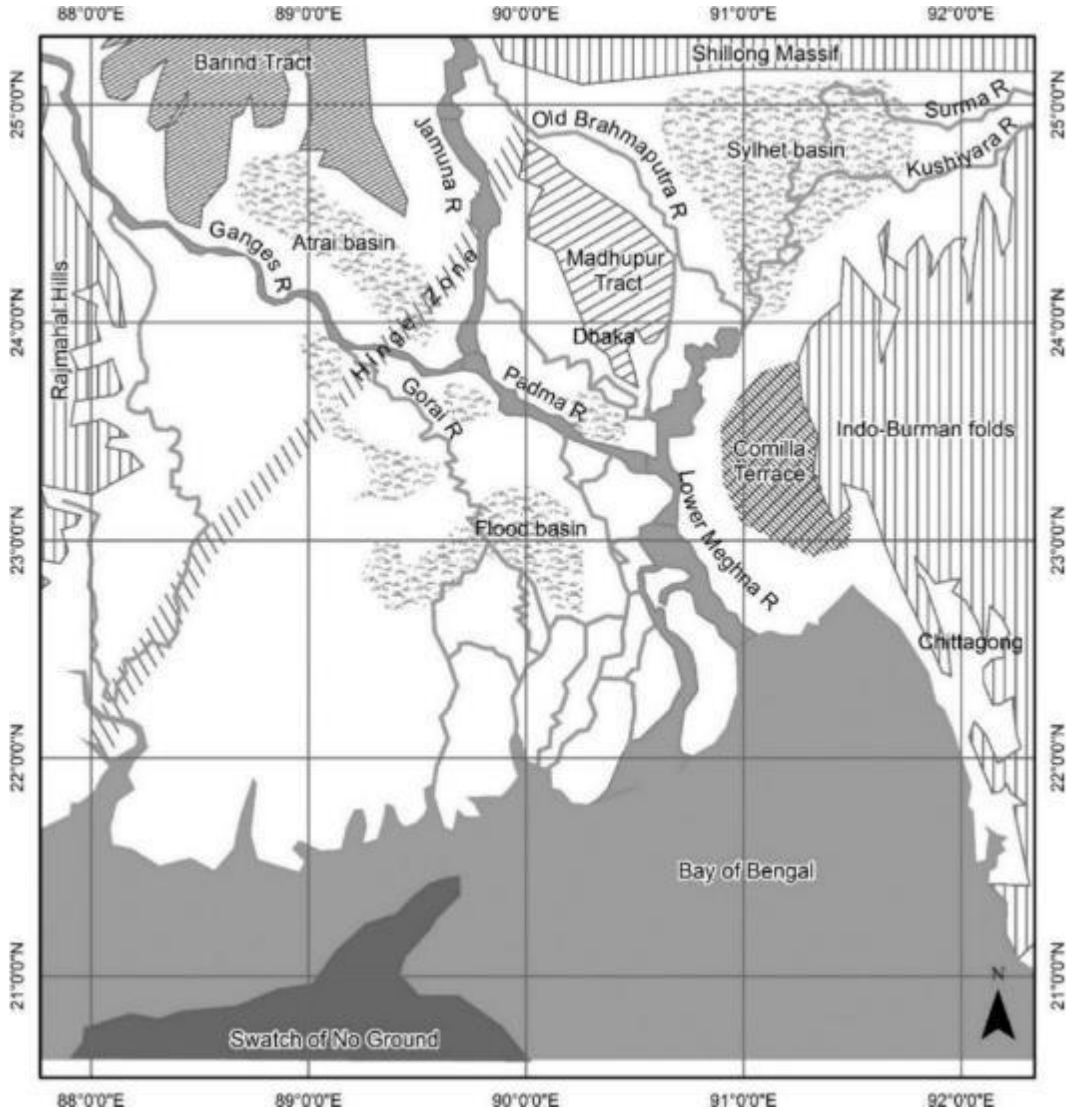


Figure 1.2: Geological setting of the Bengal Delta. (Source: Akter et al, 2016)

1.3.2. Bengal Basin, Bangladesh and Bengal Delta

The Bengal basin is one of the most important alluvial basins of the world because of its size and location distributed within the political boundaries of Bangladesh and a part of India (Banglapedia, 2017). A large area of the Bengal Basin, which comprises the total territory of present-day Bangladesh, encompasses the Bengal Delta (Lindsay et al, 1991; Goodbred, 1999). The Ganges–Brahmaputra–Meghna River Delta is located in the Bengal basin (Morgen and Mclntire 1959; Goodbred and Nicholls 2004). The Ganges–Brahmaputra–Meghna (GBM) River Delta is also called the Ganges delta or Ganges–Brahmaputra (GB) river delta, Green delta or Bengal delta (Bagchi 1944; Goodbred and Nicholls 2004; Islam 2006) (Figure 1.3). Three powerful rivers-The Ganges, the Brahmaputra and the Meghna in Bangladesh portion formed and created the new active delta by the sediment deposition. (Goodbred and Kuehl 1999). The delta in Bangladesh and West Bengal of India occupies an area of about 115,000 km^2 (Woodroffe et al. 2006). The natural flow and annual flooding of the rivers bring the silts and sediments and as a result, the delta begins to expand into the coastal zone and offshore areas (Bagchi 1944; Goodbred and Keuhl 1999). The livelihood of the Bangladesh portion of the Bengal delta depends on the supply of fresh water in the downstream Ganges (Padma-in Bangladesh portion) (Rahman 1988; Khan et al. 2004).

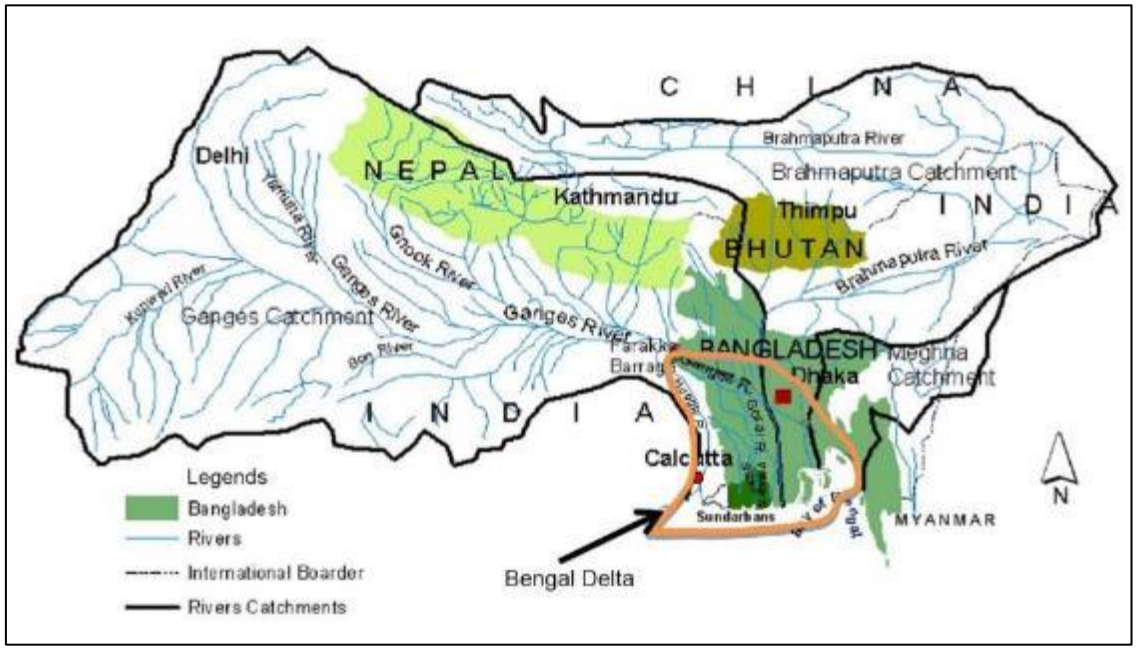


Figure 1.3: Geographical location of the Bengal Delta, Bangladesh and the GBM catchments (Source: Islam and Gnauck 2008)

1.4. Focusing on the Study Area

The Bengal Delta is located within the political boundary of both Bangladesh and India, but the present active delta is fully within Bangladesh. The whole of Bangladesh has emerged from the siltation process of the delta and gradually moved towards the south

(Islam 2001; Schendel, 2009). For the present research, it has been inferred from background studies that the coastal region provides the analogical context for the study of the ancient evolving settlement pattern in the Bengal when the whole Bengal was an active delta (Schendel, 2009). The mouth of the active delta, therefore, provides the near-perfect context to study the human habitation process in this whole delta (Rasid and Paul, 1993). The historic persistence of the pattern provides credence to the hypothesis that there is a "Generic Settlement Pattern in the Bengal Delta" and the coastal areas are assumed to represent the scenario of the Bengal Delta of thousands of years back.

Figure 1.4: Focusing on the study area.

1.4.1. Coastal Region in Bengal Delta

Figure 1.5: Coastal region of Bangladesh. (Source: Maps&maps, 2014)

The vast low-lying areas in Bengal Delta are exposed to the risk of seaborne natural hazards like cyclones, tidal surges, soil and water salinity and shoreline erosion along with terrestrial hazards like waterlogging (Islam, 2004). A similar context prevailed in the former coastal areas of this delta which gradually has receded to the present coastline. "Coastal areas of Bangladesh contain some of the world's most diverse natural and socio-economic resources" (Rasheed, 2008) such as agricultural land, marine fisheries, forestry, waterways, salt production, sea trade and tourism. Despite the geo-climatically hostile context, human settlements have long been drawn to the coastal areas, historically captivated by the resources and trading opportunities. Settlements, adapting to the context have evolved here with some unique attributes. Though a similar vulnerable context prevails in the coastal areas (Figure 1.5), the settlements are resilient and still the most densely populated region of Bangladesh, accounting for 28 percent of the total population (PDO-ICZMP, 2003b).

1.4.2. Why Coastal Region?

The whole of Bangladesh has evolved gradually on deltaic flood plains formed by the silt brought down from the Himalayas. The coast gradually receded and the present coastline is in the formative stage as earlier coastlines were thousands of years back (Elahi et al. 1998). The coastal area is assumed as an analogical context of Bengal Delta's historic past when the settlement first started. It provides the analogical context for the study of the remote evolving settlement pattern in the Bengal when the whole Bengal was an active delta.

1.5. Hypothesis

The settlement pattern of the Bengal Delta evolved from the geo-climatic context of a warm-humid active delta and the activity pattern rising from rice-cultivation needs. Settlements in the Bengal Delta are recognizable from other settlements in the world. That means, settlements in the Bengal Delta have an identity and there must be certain characteristics or attributes that provide that identity. New settlements spontaneously take the shape of older settlements signifying the prevalence of some ordering principles. The evolution process of the settlements can give a clue to the hidden order that prevails in the settlements. By analyzing this process (from a historic context) it is assumed to be possible to identify a settlement pattern evolving from the context. The spontaneously developed core pattern seems always similar but transforms responding to the prevailing context. This persistence of the basic components in all stages but adapting to newer conditions indicate the prevalence of a generic pattern. This context helps formulation of the hypothesis that "**There is a Generic Settlement Pattern in the Bengal Delta**", which is unique to Bangladesh and which may describe settlements at different levels and scales.

1.6. Research Question

Every nation has its identity based on certain attributes, of which house type and settlement pattern is one and the most important. To clarify the identity of Bangladesh, it is important to identify the settlement pattern of Bangladesh as set in the hypothesis. According to Christopher Alexander (1977) "identification of a pattern is a discovery", therefore, this research poses the question "***What is the generic settlement pattern in the Bengal Delta?"*** which can be called Bangladesh's own. In line with this question, the objective of the research is formulated.

1.7. Objectives with Specific Aims and Possible Outcome

Objective: **To identify the generic settlement pattern in the Bengal Delta**.

Specific Objectives:

- To find out the phenomenon behind the evolution of a settlement pattern in the Bengal Delta.
- To validate a settlement pattern as the generic one i.e. basis of all other settlement patterns in Bangladesh and which can be used as a basis for future planning and design.

Possible Outcomes:

Identifying a generic settlement pattern module evolving from the context, i.e. basis of all subsequent patterns; which can be used as a basic framework for future settlement planning and design in the Bengal delta for sustainability.

1.8. Significance of the Research

The identification of a pattern is like finding the generic code (Genome) of a 'species', in this case 'settlement'. This study is considered a contribution to the "Ekistics" research identifying the generic code of settlement formation in the Bengal Delta that is, factors affecting spatial qualities; and the way people negotiate their living with environmental and socio-cultural behaviour. In Alexander's (1977) words, identification of "A pattern is a discovery in the sense that it is a discovery of a relationship between context, forces and relationships in space, which holds absolutely". The studies on settlement pattern and formation were taken as the basis for the identification of a 'generic settlement pattern in the Bengal Delta' context. This study identifies settlement types in the research area, which is also a contribution to the knowledge of human settlement. The study attempts to find the patterns of settlement which is generic in nature and can be used as a basic framework for future settlement planning and design in this region for their sustainability. This study establishes one of the several cornerstones of Bangladeshi national identity.

Libang et al (2017) and Ren et al (2019) rightfully believed that a sustainable development guideline for the future can be achieved by understanding the settlement distribution pattern which is generated through the evolution process in rural contexts of a specific region. Wang et al (2017) used the term 'original settlement pattern' to express these types of development of the settlement.

The case study area is the Coastal region of Bangladesh, where some climatic vulnerability issues and their adaptation with settlement were addressed as a historic phenomenon. Historic resilience and adaptation to the context is assumed to have manifested spatially to generate a settlement pattern (Mowla, 1999, 2019b). The formation of human settlement and their settings are a continuous process of the part of a long historical journey of human civilization. Through this process, settlement receives many qualities to be a sustainable one. Thus the generic pattern can provide guidelines for future planning for human settlement as sustainable.

1.9. Limitations in the Research

There are some limitations and challenges that the researcher faced during different phases of the research. They are as follows:

Firstly, thousands of years old context cannot be recreated, as such some qualified assumptions are made from the documentary evidence of the past.

Secondly, the research is conducted to study some specific settlements in the indigenous context with special emphasis on physical, functional and social aspects of settlement development. As this research has given more priority to the patterns of settlement; it is not providing detailed information regarding dimensions or construction techniques of house-form or homestead.

Thirdly, settlement pattern is related to several disciplines, most importantly social, anthropological and geographic issues and theories as background studies. The researcher had to rely on secondary sources to receive required in-depth information to address such issues.

Fourthly, there is hardly any research done on this issue in this region; so, the entire study had to be started from scratches.

Finally, the field study areas were not easily accessible in Bangladesh. All specifically required information regarding the settlements of this region is not formally documented either, however, qualified sample information and data are triangulated.

1.10. Organization of the Dissertation

Three main sections constitute the total structure of the thesis. They are:

i. The Introduction and Method sections where the background and the present state of the problem are discussed and the foundation of the research is laid i.e.

understanding of the problem and formulation of hypothesis. Research design is also clarified in these sections.

ii. The literature review section investigates the related existing studies, they are evaluated and the framework of research is narrowed down i.e. Research Design is focused.

iii. The analytical sections where the study cases are analyzed within the framework developed above to draw a conclusion on the research question from various perspectives i.e. the logical answer to the problem.

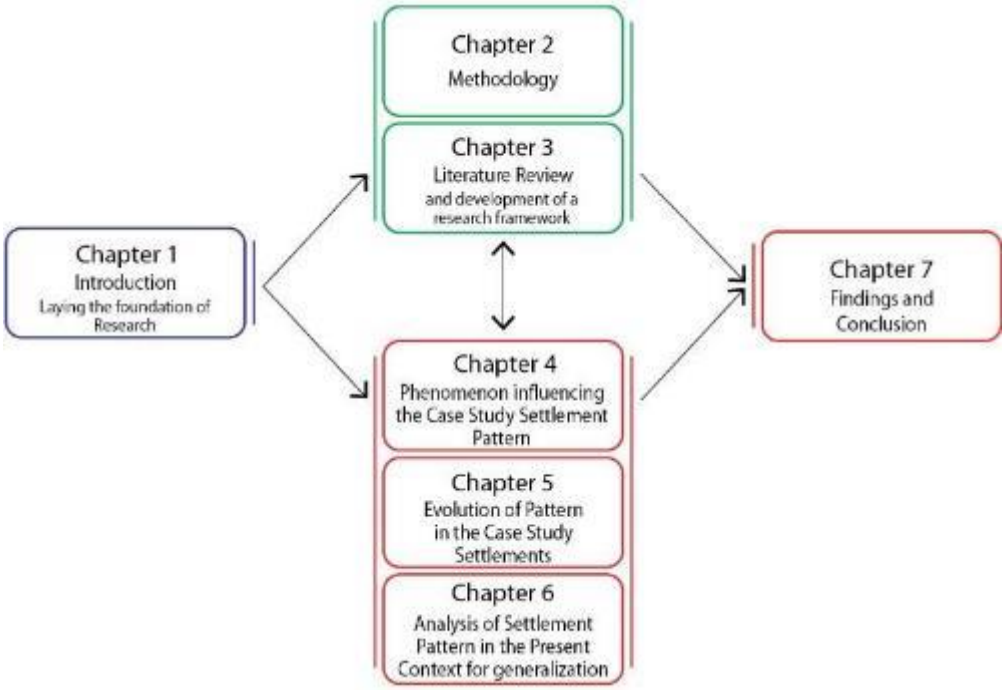


Figure 1.6: Organization of the dissertation.

This research has been organized into seven different chapters. The first three are the development of an idea, procedure of research and development of research context. It defines concepts and discusses theoretical arguments which would support the formulation of a research methodology through which the present research and empirical investigation have been carried out. The latter three chapters are discrete but interrelated, each contributing to the forward movement of each of the objectives of the present research. The last chapter concludes this research by summing up the findings. A brief description of these seven chapters is given below.

Chapter 1 describes the field of the research, postulating its significance and presenting the background of the problem, the aims, objectives, research questions, and finally the rationale of the research. It includes identification of the problem, the definition of key concepts, the justification for the study, and the limitations of the study.

Chapter 2 clarifies the research methods used in order to investigate the research question and rationally meet the objectives of the research. The chapter also gives a brief description of the sample study area, the rationale of selecting the study areas, methods

of investigation to be used, determination of the sample size, sampling procedure, observation of the field, the appraisal procedure, data processing and analysis.

Chapter 3 presents the theoretical framework employed for this study and a review of the relevant literature. This chapter focuses on the review of the literature used in the text for a clear understanding of the concepts about the human settlement, tropical delta, rice culture and the Bengal Delta as the key context of the research. Some global settlement patterns including rice-based societies are also discussed. The rain-fed rice cultivation and its effect on the human settlements of the Bengal Delta are explained. This study gives a conceptual basis and pictorial background of the specific context of the research subject clarifies the research gap and draws a bracket on literature for the hypothesis.

Chapter 4 discussed the patterns of settlement which have developed through some inter-related phenomenological processes. It starts from the establishment of a single homestead and continues till many forms of transformation based on the context. The selection of the location is the starting point of a pattern. From an individual homestead to a large settlement, the process works to generate the pattern. There are several variances of the patterns that the settlement generates through many stages and influence of the context. These are classified as geo-climatic and anthropological impacts. This chapter discussed the phenomena behind the evaluation process of the patterns in the case study settlements and the patterns that are visible and serve as a foundation.

Chapter 5 is another analytical chapter that discussed and evaluated the patterns of case study settlements of three different zones of the coastal areas of the Bengal delta. Settlements developed through different interactive key attributes are assessed. The boundaries and organization of the settlements are also described in this chapter. The case study settlements help to understand the context and spatial settings of settlements of three different representative zones for this research.

Chapter 6 discussed a further analysis of the pattern identified in the case study settlements in Chapters 4 and 5 and draw a synthesis of the pattern. The generic pattern is discussed with reference to the early literature. The spatial pattern varies in different case study zones. Adaptation to natural disasters has contributed towards the generation of a unique settlement pattern, identified as ‘generic’. The generic settlement pattern, as evolved and transformed into the urban settlement patterns shows the relevance and similarities of hidden order in both, indicating a common root.

In Chapter 7, an evidence-based conclusion is drawn from the analysis in Chapters 4 to 6 with recommendations by pulling together the findings. By reflecting on the theoretical understandings and empirical findings of generic settlement pattern this concluding chapter highlights the bases of identification of generic settlement pattern and their realistic evolution and evaluation, with the scope of formulating a planning and design framework for sustainable human settlements for the Bengal Delta.

Chapter 2

METHODOLOGY

2.1. Introduction

Methodology enumerates the nature and types of processes that are followed in a standard format to attain an objective. The overall strategy that is followed in this study has been discussed here. The research "Study of Generic Settlement Pattern in the Bengal Delta" is intended to find out the root pattern of settlement in the Bengal Delta that has evolved through thousands of years. The evolving context is therefore assumed by analogy because, observing the persistence of the historic pattern prevailing till date, and an elementary literature review of settlements in a similar context allows it to be assumed as such. The topic is broadly related to the multidisciplinary domain of architecture, sociology and geography. Different relevant approaches for this type of social research are weighted/evaluated to determine the basic method of study and to fix the strategy of present research (Holloway, 1997):

Correlational research: the systematic investigation of relationships among two or more variables, without necessarily determining cause and effect (Goodman and Kruskal, 1979) is discarded as cause and effect relationship is needed in the present research.

Exploratory research: studies that are merely formative, for the purpose of gaining new insights, discovering new ideas, and increasing knowledge of phenomena (Singh, 2007). As the phenomenon and product are assumed to be historic, this approach is discouraged.

Descriptive research: research that provides an accurate portrayal of characteristics of a particular context (Koh and Owen 2000). These studies are a means of discovering new meaning, describing what exists, determining the frequency with which something occurs, and categorizing information.

Ethnographic research: the investigation of a culture through an in-depth study of the members of the culture staying in the context; it involves the systematic collection, description, and analysis of data for the development of theories of cultural behaviour in the present context (Geertz, 1973). The method is partially used embedded in another strategy to evaluate the present status, that is, with historic phenomenological accounts.

Historical research: research involving analysis of events (recorded, inferences, evidenced or circumstantial evidences) that occurred in the remote past (Skocpol and Somers, 1980) is partially useful for present research to determine the context for evaluation.

Qualitative research: research dealing with phenomena that are difficult or impossible to quantify such as beliefs, meanings, attributes, remote context and symbols; it may involve a systematic procedure for the quantification and objective examination of

qualitative data/info, such as written accounts or oral messages/maxims, public perceptions, theme or ideas; for example measurement of frequency, order, the intensity of occurrence of the situation in order to determine their meaning or effect called content analysis. Cause and effect relationships can be quantified to some extent by developing a matrix (Merriam, 2009), therefore, partially useful for the present research.

Phenomenological research: an inductive, descriptive research approach developed from phenomenological philosophy; its aim is to describe an experience assumed to be actually lived by the person in a certain context. Certain descriptions of data may follow the historical and ethnological approach (Moustakas, 1994). This method is the most suitable approach to evaluate historic context and its persistence in the present context.

2.2. Phenomenological Approach of Qualitative Research

A phenomenological study of a product emphasises the qualitative investigation on cause and effect focusing on the commonality of a lived experience within a particular group or community (Creswell, 2013). The fundamental objective of this approach is to arrive at a definition of the nature of the distinctive phenomenon (Eagleton, 1983; Kruger, 1988; Moustakas, 1994; Creswell, 2013). Phenomenological methods are epistemologically based on a paradigm of subjective knowledge and subjectivity and emphasize on the value of personal perspective and logical reinterpretation challenging the existing. As such, they are powerful in interpreting subjective experience, gaining insights into the motives and actions of people, and cutting through the clutter of stereotypes and traditional wisdom taken for granted (Husserl 1970). To achieve a deeper understanding of people's views of a certain phenomenon, qualitative approaches are used (Merriam, 2009). Qualitative research was defined by Yin (2014) as gathering data from a variety of resources, evaluating data, analysing evaluations to generate results.

The Phenomenological research has overlapped with other essentially qualitative approaches including ethnography, hermeneutics and symbolic interactionism (Kruger, 1988; Kvale, 1996; Holloway, 1997; Greene, 1997; Robinson and Reed, 1998; Maypole and Davies, 2001), which is considered as a valid methodological approach. The overall research is more aligned to the Phenomenological approach of qualitative research, as such, identified this approach as the best means for this study (Davidson, 2000). The present hypothesis has been evaluated through a triangulation of the Phenomenological approach, Quantitative data analysis and Literature review. The basis of historical reconstruction was phenomenological (local geo-climatic context and human response) from secondary source analysis. The Case study settlements are being evaluated on the basis of the context along with the key informants' interviews (KII) who are the representatives of each settlement. Through the interview and observations, the phenomenon behind the evolution of a settlement pattern in the Bengal Delta is further clarified with onsight evidence. The focused group discussion (FGD) has been made to

receive more in-situ knowledge/information about the evolution of the pattern of the case study settlements. At the outset (preliminary focus), the purpose of this study is to gather data on the development of the 'settlement pattern' and the 'phenomenon' influencing settlement formation, lastly its prevalence in different scales and levels is tested to qualify the pattern to be 'generic'.

2.2.1. Bracketing for Research

According to Miller and Crabtree (1992), the researcher must 'bracket' the hypothesis/suggestion/preconceptions and "enter into the individual's lifeworld and use the self as an experiencing interpreter". In this approach, the present study was carried out using an approach developed by Husserl (1931). The researcher begins with a specific example of the phenomenon he wants to understand in this approach, known as free imaginative variation, and then varies every possible way to differentiate its essential features from those that may be incidental or accidental to it.

The literature review provides a background knowledge base for inquiring and interpreting the human settlements globally and in the study context. In the present research, the informed assumption is made from background studies, by assuming that the present coastal area provides the analogous context of ancient Bengal Delta to study basic settlement pattern in the Bengal Delta. Accordingly, objectives were set to find the phenomenological causes and validate the "settlement" as being generic. Observing the persistence of a particular settlement pattern in the Bengal Delta, the hypothesis or assumption was set at the very beginning, the research question and objectives were derived from that (Ref. Sec. 1.5). The literature review helps narrow down the process and to focus on relevant prevailing information (called bracketing), find the gaps which were not addressed and set a yardstick for further research to get an answer to the hypothesis. The researcher took the bracketed information and ideas for further scrutiny in the study area's (Bangal Delta) analogical context as well as to investigate the gap that was not covered by that bracketed information or ideas.

2.2.2. Literature Review

Literature review brings out the gist of previous works on settlement formation and their evolution, identifies the gaps of research and critically reviews those studies with reference to the research issue being investigated. Reviews of the literature are intended to provide a summary of sources that have been explored when studying a particular topic and to show readers how the research fits into a broader field of study (Fink 2014) and find the gaps which were not explored. Through literature review, relevant authentic concepts are bracketed not for repetition but for verification in a particular context besides filling the gaps to validate the hypothesis. Literature review for the present research is to achieve the followings:

a) To identify an analogical scenario and develop a framework for research.

b) Bracketing the information/data for verification in the analogical context.
c) To learn lessons from similar studies, identify the research gaps with respect to specific hypotheses and validate some previously reviewed concepts and ideas (Wood, 1991).
d) Determine an appropriate analytical process to fill up the research gap.

For this study, authentic secondary sources of data included books, journal articles, documented conference proceedings, degree awarded dissertations, government publications, publications by Non-Government Organizations and valid internet sources.

2.2.3. Research Design

The aim of the research design is to provide an appropriate framework for the study and find an answer to the hypothesis. It determines how the relevant information for the research can be obtained authentically; moreover, the research design process requires multiple interrelated decisions (Aaker, Kumar and George, 2000). The phenomenological approach of qualitative research is found suitable over the pure ethnographic approach as it deals with the explanation of some phenomenon of some remote past by confirmation of the traces in the present analogical context and therefore is applied through various deductive methods of systematic triangulation and bracketing.

To meet the objectives the research problem is broken down into subquestions and in the present case into two i.e. To explore the phenomenon causing certain settlement pattern to evolve in the Bengal Delta and validate the prevalence of that settlement pattern in the present context and justify it being ‘generic’ in nature as assumed i.e. basis of all other settlement patterns in the Bengal Delta and therefore can be used as a guideline for future planning and design of settlements in this region for their sustainability.

Understanding of this process was possible only through historical reconstruction of the scenario and assess the phenomenological conditions causing the certain pattern to emerge. In the present research, it has been inferred from background studies that the coastal region provides the analogical context for the study of the remote evolving settlement pattern in the Bengal when the whole Bengal was an active delta. The objectives were then set to define the phenomenons that may have caused a certain type of evolution of settlements and that still persists to justify the “settlement” as being “generic”.

2.3. Outline of Methodology

The research has been conducted through a triangulation of literature review, phenomenological approach and qualitative data analysis. After analyzing the various related literature, some fundamental principles for phenomenological research were listed and collated. The analogical context is identified through historic phenomenological interpretation of available literature and a historic settlement pattern

is reconstructed for the phenomenological study in the present context to verify the prevalence frequency and intensity of the historic pattern. From the analogous context, various geographical locations of the Bengal Delta were stratified on the basis of their evolving stage, from the three stratified contexts 22 case study settlements were selected at random for the survey and KII and FGD. Case study settlements are being evaluated on the basis of the context. For spatial order and uses of space, observation and expert opinions and key informants perceptions and evidential information were gathered. Some qualitative information and quantitative data are triangulated to logically support the argument (Moustakas, C. 1994). As mentioned before, basically the historic interpretation and Phenomenological Approach of the Qualitative research process are applied to support the hypothesis, that Bengal Delta has a generic settlement pattern. The research process has been used in the following sequence:

A. Literature Review

- Identifying the characteristics of settlement pattern in similar Rice-cultivation based societies in the tropical belt.
- Understanding the global vis-a-vis indigenous settlement patterns in Bangladesh.
- Identify common attributes, factors and features of settlements in the above categories of studies and bracketing the relevant attributes for further study.

B. Field Survey and Case Studies

The study is conducted in some areas from the coastal region of Bangladesh which is assumed to represent different zone, stages and where the character of historic Bengal Delta is evident, which is still active and in a formative stage as it was thousands of year back.

Table 2.1: Zoning and Sampling in the study area.

	Districts	Sample Size	Basin	Delta
Zone A	• Borguna • Patuakhali • Bhola	10	[Western Zone] at Ganga-Padma Basin	Old Delta (representing consolidated geo-morphological evolution stage)
Zone B	• Lakshmipur • Noakhali • Feni	6	[Central Zone] at Surma-Kushiyara Basin	New Delta (Direct analogical context)
Zone C	• Chattogram • Cox's Bazar	6	[Eastern Zone] Basin of Chittagong Region	Foot Hills (representing Delta Periphery)

The field survey is conducted on spontaneous settlements (10 from Zone A and 6 from the other two zones) recording the physical observation and mapping, photographs, reconstructed drawings with the help of key informants and other sources, drawings/sketches of evolving pattern from physical evidence, public discussions/ interviews/ questionnaire survey to confirm or verify or cross-check the

data/information. More data were collected from Zone A as it provides the largest variation in scale and level (Figure 2.1 and Table 2.1).

Homesteads of relevant settlements are also studied as the physical and social unit from where the settlements evolve. Data collection methods such as observations, semi-structured questionnaire survey and Key Informants Interviews (KII), Focused Group Discussions (FGD) and Case studies were adopted for evaluation and cross-checking.

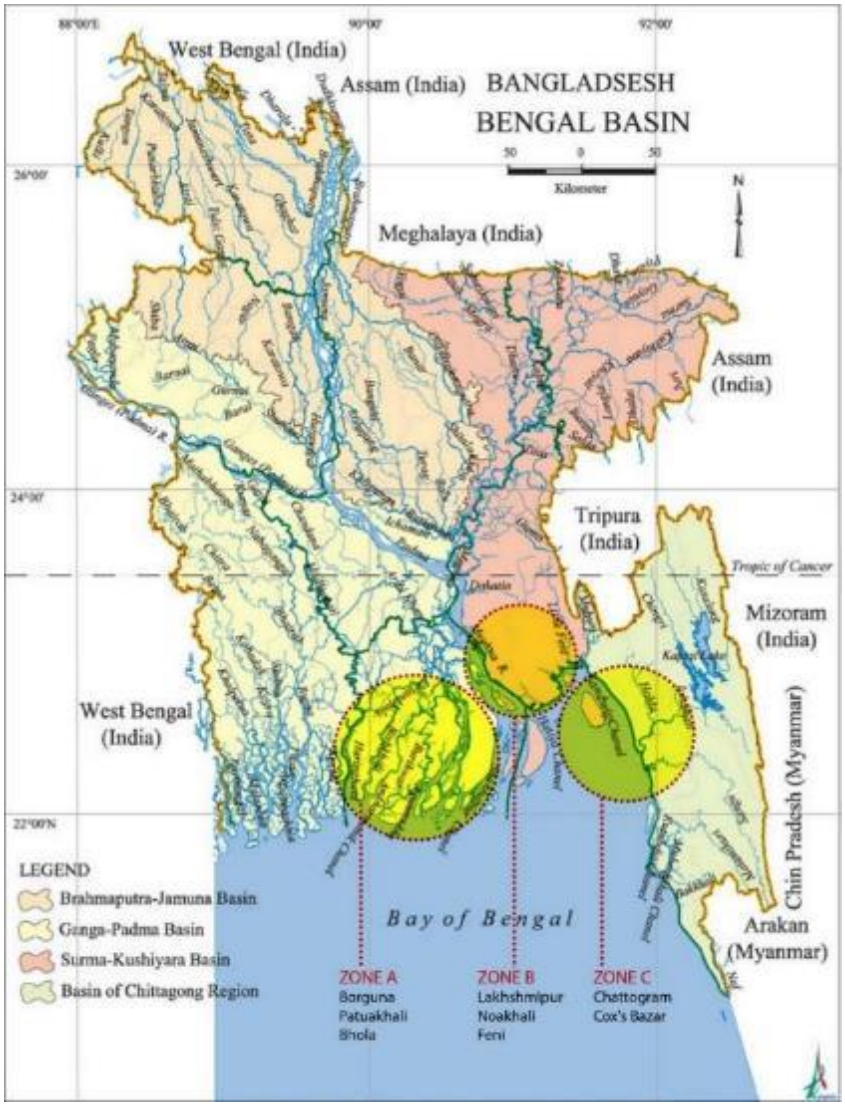


Figure 2.1: Zoning for the study area.

C. Following literature review and field study, the Empirical Data Analysis is done.

D. Commonalities or common denominators as analysed in literature review and case (field) studies, to identify the core pattern of the settlements, were reevaluated by another method to confirm the persistence of a suggested pattern i.e. the hypothesis.

E. The identified pattern is checked at random at various scales and levels for final validation of the hypothesis i.e. the settlement pattern is generic in nature.

2.3.1. Research Matrix

The research matrix shown below indicates the acquired information, their sources and the tools needed to undertake the respective research objective and specific objectives. This matrix provides a framework for Research design. The flow chart (Figure 2.2) and the research matrix (Table 2.2) explains the research method followed in this research.

Table 2.2: Research design matrix.

Research Objective	**Research Objective** To identify the **generic settlement pattern** in the Bengal Delta	**Specific Objective -1** To find out the **phenomenon** behind the evolving settlement pattern of the Bengal Delta.	**Specific Objective -2** To **validate** a settlement pattern as the generic one i.e. **basis of all other patterns** and which can be used as a guideline for future planning and design.
Required information	• **Physical factors** • **Socio-cultural factors** • **Economic factors** ° Geo-climatic impacts ° Anthropological impacts	• **Spatial settings of settlements** • Physical and social layouts of Settlements • Universal pattern ° Organization of settlement ° Boundary and Administration of Settlement	• **Morphological analysis** • **Generic structure of the settlement** ° Physical attributes of settlement ° Cross tabulation(s) with the variables of – context. ° Settlement Genome
Ways of collection of data	• Secondary source of Data • Literature • Physical observation • Key Informant Interviews (KII) • Focused Group Discussions (FGD) Contextual study Settlement history Sketches Photographs Parametric visualization	• Literature • Published maps • Existing studies • Physical observation • Satellite image • Key Informant Interviews (KII) Sattelite images Drawings Sketches Parametric analysis	• Physical observation • Semi-structured Questionnaire (SSQ) Survey Household history Photographs Drawings Sketches *Apply the findings in a new context to see its validity*
Outcomes	**Evolution of settlement pattern in the study areas** • Origin and evolution of settlement in Bengal Delta. • Evolution of settlement in the study areas. • Selection of the analogical context for the settlements. • Evolving Pattern in the study areas vis-a- vis historic scenario.	**Different types of Organization of settlement** • Basic pattern of different settlements vis-à-vis the context. • Spatial settings of each settlement and influencing phenomenon. • Organization of each settlement and present context. • Boundary and Administration of Settlement • Basic components of settlement, evolution pattern and influencing phenomenon.	**Generic settlement pattern and its validation** • Morphological Analysis to validate the Generic Elements. • Develop schematic Generic Structure of Case Study Settlements and historic pattern. • Physical Attributes of settlement pattern in different Zones and their relationship • External forces that affect the basic settlement pattern. • Adaptation with Environment and Behaviour • Test the identified generic Pattern at various scales and levels.

2.3.2. Research Flow chart

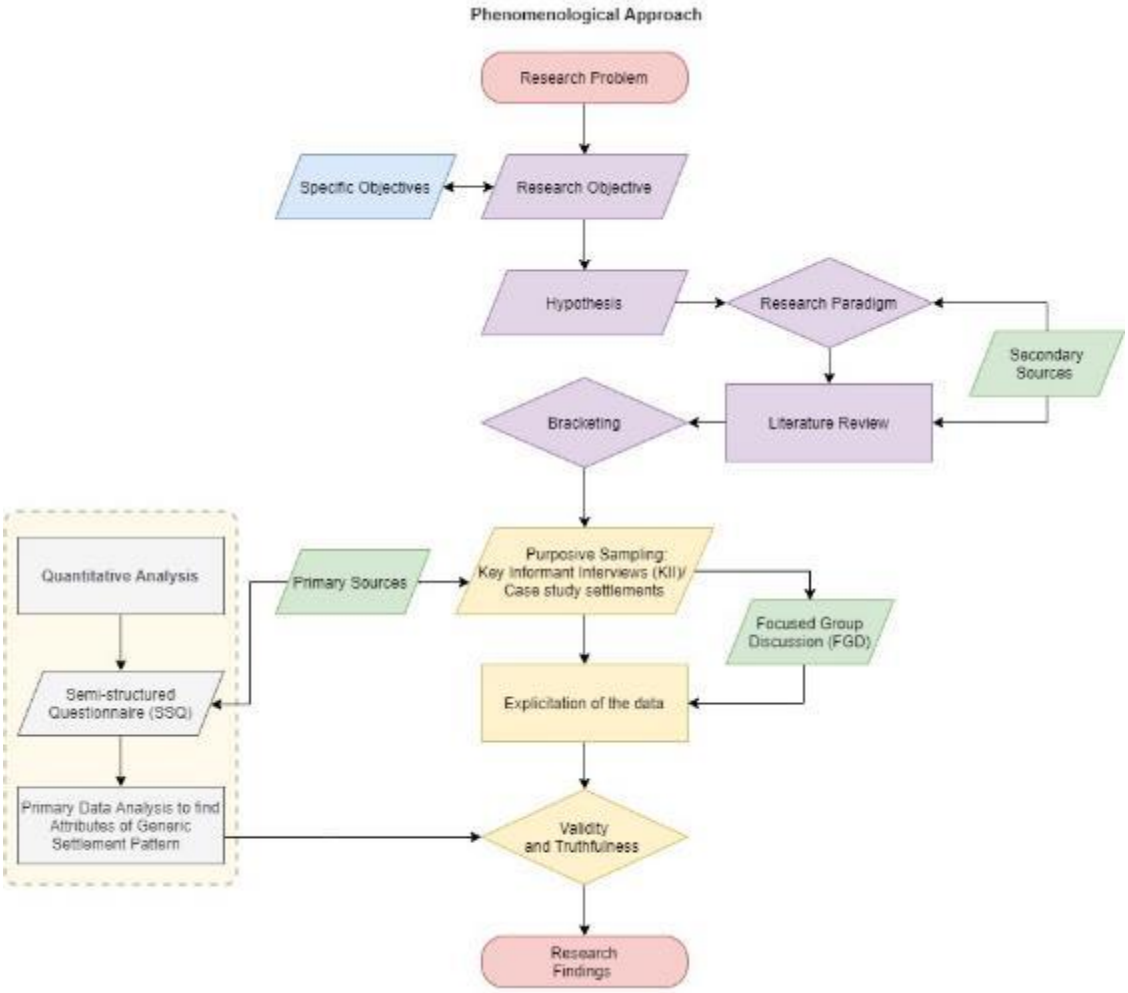


Figure 2.2: Research flow chart.

2.4. Methodological Procedure

Holloway (1997) notes that phenomenology-using researchers are reluctant to recommend techniques. Hycner (1999) confirms by suggesting that "there is a fair reluctance on the part of phenomenologists to concentrate too much on particular measures." He continues to suggest that a method should not be imposed on a phenomenon (Hycner, 1999). Phenomenological research begins with a synopsis of the research paradigm, followed by a description of the position of the participants in the research, accompanied by methods of data collection, where data storage methods are illustrated. According to Adrian Van Kaam (1955) and P. F. Colaizzi (1978), to convey the overall meaning, the researcher developed a combination of textural and structural descriptions. The purpose of collecting data from three different zones is a form of 'data triangulation' to contrast the data and 'validate' the data if it produces similar findings (Holloway, 1997).

2.4.1. Research Participants/Informants

Generally, non-random purposive sampling is used in qualitative research sampling since the researcher wants to choose particular individuals for the sample that meet the study requirements (Polkinghorne, 2005). For phenomenological studies, Polkinghorne (2005) suggested interviewing 4 to 25 people. Key informants are usually selected from those that would be considered to have the best-specialized information on specific topics. In the present case, KII were senior knowledgeable persons or local community heads (Ref. Sec.2.3).

Figure 2.3: KII in progress for the present research.

Following Welman and Kruger (1999), to classify the primary participants (case study settlements, KII and FGD), purposive sampling was chosen by the researcher. The researcher selected the sample based on his informed judgement and the purpose of the research (Greig and Taylor, 1999), looking for those who "have had experiences relating to the phenomenon to be researched" (Kruger, 1988). For the present research, the primary participants are the Key informants of the selected case study settlements. The purposive case study settlements are selected to study the phenomenon of the generation of the generic pattern. The researcher used snowball sampling to trace key informants. Snowballing is a way to extend the sample by asking one informant or participant to suggest others for interviewing (Crabtree and Miller, 1992; Babbie, 1995).

2.4.2. Key Informant Interviews (KII)

KIIs include interviews with individuals who have especially knowledgeable viewpoints on an aspect of the event being evaluated. They are loosely structured, depending on a set of issues to be addressed. Interviewers spontaneously frame questions, scan for information and take notes that are further expanded (USAID 1996). KIIs are qualitative and in-depth. In the present study, key informants are chosen from those who are expected to have specialized information on particular topics. (Ref. Table 2.1 and Appendix: List of KIIs)

2.4.3. Focused Group Discussions (FGD)

The FGD has been made to receive more in-situ knowledge/information about the evolution of the pattern of the case study settlements. Nine (9) FGD sessions were conducted in the field to substantiate the findings of the qualitative analysis and to get greater insight into the phenomenon working behind the settlement pattern. Nine FGDs have been carried out by including three participants in each zone. The FGD respondents included government officials, NGO workers, formal and informal leaders to convey the voice of each group. The checklists of the FGD included various issues about which the group has a clear understanding i.e. about the local settlement establishment and evolution.

2.4.4. Data-gathering Methods

The specific 'phenomena' that the researcher focused on, is the generation of a settlement pattern and more particularly the evolution and development of a generic pattern. The main research question of this study is: what do you think is the core settlement pattern in the Bengal Delta? However, Bentz and Shapiro (1998) advise that the researcher must allow the information to appear: 'Doing phenomenology' means 'collecting rich phenomenon descriptions and their circumstances'. For this reason, along with some other informative questions, the main interview questions that were put to KIIs were:

- When, why and how the case study settlement was originated?
- What are the major components that the informant experiences during evolution?
- How do different phenomena play roles over the process of evaluation of the settlement? (providing informant some hints)

Jon Kabat-Zinn (cited in Bentz and Shapiro, 1998) states that "inquiry does not mean looking for answers". For this study, in-depth phenomenological interviews with key informants from 22 case study settlements were conducted aiming at finding the clues. Through the interview and observations, the phenomenon behind the evolution of a settlement pattern in the Bengal Delta is searched. Memoing' (Miles and Huberman, 1984) is another major source of evidence used in this study. It is the field notes of the researcher that document what the researcher observes, sees, encounters and feels in the process of documenting and focusing on the course. Thus a story of the settlement evolution process is drawn. Field notes are a secondary data storage tool in qualitative research. (Lofland and Lofland, 1999).

2.4.5. Data-storing Methods

Field notes and memoing are "a step towards data analysis" (Lofland and Lofland, 1999). Morgan (1997) notes that since field notes require interpretation, they are "part of the analysis rather than the compilation of data". During the analysis process, the writing of

field notes compels the researcher to further explain each interview context (Miles and Huberman, 1984; Caelli, 2001).

For this research, all interviews are written and audio-recorded. Each interview was assigned a code, for example, “KII-A1.” Where ‘KII’ represents ‘Key informant Interview’ and ‘A1’ represents the code for the case study settlement (Table 2.4). Right after the field survey of each case study settlement the recorded interview, survey memo and notes (scanned by the cell phone camera with Camscanner application), GPS location and all the photographs are uploaded in online drive. A licensed Google storage drive was used for this data storing purpose.

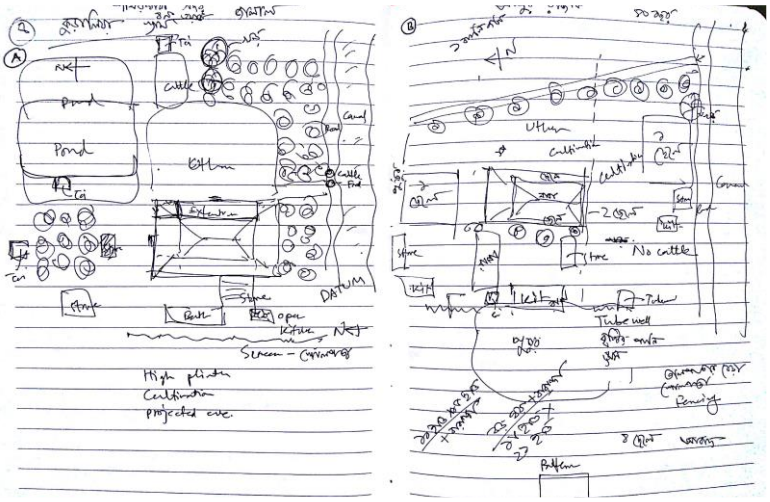


Figure 2.4: Sample of memoing during the survey.

2.4.6. Explicitation of the Data

The “term ‘analysis’ usually means a ‘breaking into parts’ and therefore often means a loss of the whole phenomenon, whereas ‘explicitation’ implies an investigation of the constituents of a phenomenon while keeping the context of the whole” (Hycner, 1999) . Analysis is regarded by Coffey and Atkinson (1996) as “systematic procedures to identify essential features and relationships”. It is a way to transform the data by interpretation. For the present study, the Hycner (1999) method has been used for explicitation. This explicitation method has five phases, which are:

1. Bracketing and phenomenological reduction: It applies here to the bracketing of the particular opinions aligned with the assumption of the study (Miller and Crabtree, 1992). Each interview record is carefully analysed for familiarization with the interviewee/informant's words and to develop a holistic sense/picture together with the interviewer’s observations (Holloway, 1997; Hycner, 1999).
2. Delineating units of meaning: This is a step in describing the evidence needed for the study to make a considerable amount of judgmental decisions while intentionally bracketing their own conclusions to prevent inappropriate subjective judgments (Holloway, 1997; Creswell, 1998; Hycner, 1999).

3. Clustering the units of meaning to shape themes: The researcher again constrained his presuppositions to stay true to the phenomena. These clusters usually consist of clustering units of meaning together (Moustakas, 1994; Creswell, 1998) and the researcher identified important themes, often referred to as units of significance (Sadala and Adorno, 2001).
4. Summarising each interview and case study: At this point, the study conducts a 'validity check' by returning to the informant and case study settlement to determine if the essence of the survey has been correctly 'captured' (Hycner, 1999).
5. General and particular themes and a composite summary: The researcher concluded the interpretation by writing a summary, which represented the context from which the hypothesis originated (Moustakas, 1994; Hycner, 1999).

2.4.7. Validity and Quantification

In this study, the phenomenological research design contributed toward truth. The researcher bracketed himself consciously to understand (Mouton and Marais, 1990), in terms of the perspectives of the participants interviewed and the case study settlements the phenomenon that was causing "the pattern of the settlement". The survey of the case study settlements made bracketing the researcher during the transcription of the interview further contributed to the truth. Besides the explicitation of survey and interview findings, the FGD among each category of case study settlements has been made to receive more in-situ knowledge about the evolution of the pattern of the case study settlements.

2.5. Field Survey

The term *field* is used in research to refer to the setting from where first-hand data collection takes place. Typically, this refers to observation, physical surveys, in-person interviewing and field study. In the present research, the Field Survey is carried out in an assumed analogical context to identify the evolving settlement pattern of the regions through some systematic investigation and mapping including direct (physical and ethnographic) observations (Ref. Sec.2.3, Table 2.1 and Appendix: List of KIIs).

2.5.1. Sampling Method

According to Webster (1985), Sampling is a method or procedure for choosing a suitable sample or representing a population to determine the characteristics of the entire population (Webster, 1985). The purposive sampling technique is also known as judgment sampling. The researcher determines what should be known and sets out to identify individuals who are willing and able to provide the data by their knowledge or experience regarding the process of developing a settlement. In each study area, some purposive sampling has also been done (Table 2.3 and section 2.5.2).

2.5.1.1. Stratified sample

Table 2.3: Sample size for case study settlements

	Sample Size
Zone-A	10 nos.
Zone-B	6 nos.
Zone-C	6 nos.
Total	22 nos.

Note: More samples were taken in Zone-A because of the diversity available there.

For homestead the following formula applied:

$$n_h = 10n_s$$

Where, n_s = desired sample size of the settlement

n_h = desired sample size of the homestead

So, $n_h = 10 \times 22 = 220$ (10 homesteads in each settlement)

2.5.1.2. Selection technique

The samples are selected by the following methods:

Stage-1: Collecting information about the chars/ unions near the Bay of Bengal in the selected zones through published maps and statistics. A list of settlements was prepared for each zone.

Stage-2: Selecting a char/ union by simple random sampling method. Then physically approach that char for a reconnaissance survey.

Stage-3: Selecting settlements based on some category identified with the help of local informants.

Stage-4: After approaching a settlement, randomly selecting any one homestead for a questionnaire survey (for quantitative data). Then select the other 9 homesteads sequentially by using the following formula.

$n^{th} = n/10$ [where n = total number homestead in the settlement]

2.5.2. Case Studies

This research utilized a case study approach to determine the evolution pattern of case study settlements. Different settlements from different zones of the coastal region of the Bengal Delta were selected as case studies. The case study refers to both the procedure and the effects of the investigation (Stake, 2005). According to Yin (2012), the uniqueness of a case study, which is referred to as an "empirical analysis of the contemporary phenomenon," is set within its real-world setting specifically where the boundaries between context and phenomenon are not evident (Ref. Sec.2.3, Table 2.1, Table 2.4, Figure 2.5 and Appendix: Datasheet of KIIs).

2.5.2.1. Study area

The study is conducted in some areas from the coastal region of Bangladesh from eight (08) coastal districts (adjacent to the Bay of Bengal, Fig. 2.5) which represent different zones, stages and characteristics of the Bengal Delta, and which are still active and in a formative stage. From the literature review, these areas are assumed to represent the scenario of the Bengal Delta of thousands of years back.

Table 2.4: List of case study settlements

Case Code	Settlement name	Zone	Administrative location
A1	Jinntola	A	Patharghata Upazila of Barguna District
A2	Padma Char	A	Patharghata Upazila of Barguna District
A3	Koralia	A	Patharghata Upazila of Barguna District
A4	Char Duani	A	Patharghata Upazila of Barguna District
A5	Jaliaghata	A	Patharghata Upazila of Barguna District
A6	Char Kajal – Balar Char	A	Golachipa Upazila of Patuakhali District
A7	Char Montaj	A	Golachipa Upazila of Patuakhali District
A8	Char Kukrimukri - Babuganj	A	Char Fasson Upazila of Bhola District
A9	Char Kukrimukri - Shababpur	A	Char Fasson Upazila of Bhola District
A10	Char Kukrimukri - Boyatibari	A	Char Fasson Upazila of Bhola District
B1	Char Folkan	B	Kamalnagar Upazila of Lakhsmipur District
B2	Char Jogbondhu	B	Kamalnagar Upazila of Lakhsmipur District
B3	Char Alexander	B	Ramgati Upazila of Lakhsmipur District
B4	Char Mehar	B	Ramgati Upazila of Lakhsmipur District
B5	Char Elahi (para-1)	B	Companiganj Upazila of Noakhali District
B6	Char Elahi (para-2)	B	Companiganj Upazila of Noakhali District
C1	Dakkhin Moghadia	C	Mirsharai Upazila of Chattogram District
C2	Saidpur	C	Sitakunda Upazila of Chattogram District
C3	Muradpur	C	Sitakunda Upazila of Chattogram District
C4	Nadalia, Bashbaria	C	Sitakunda Upazila of Chattogram District
C5	Boalia, Bashbaria	C	Sitakunda Upazila of Chattogram District
C6	Kumira Jele Para	C	Sitakunda Upazila of Chattogram District

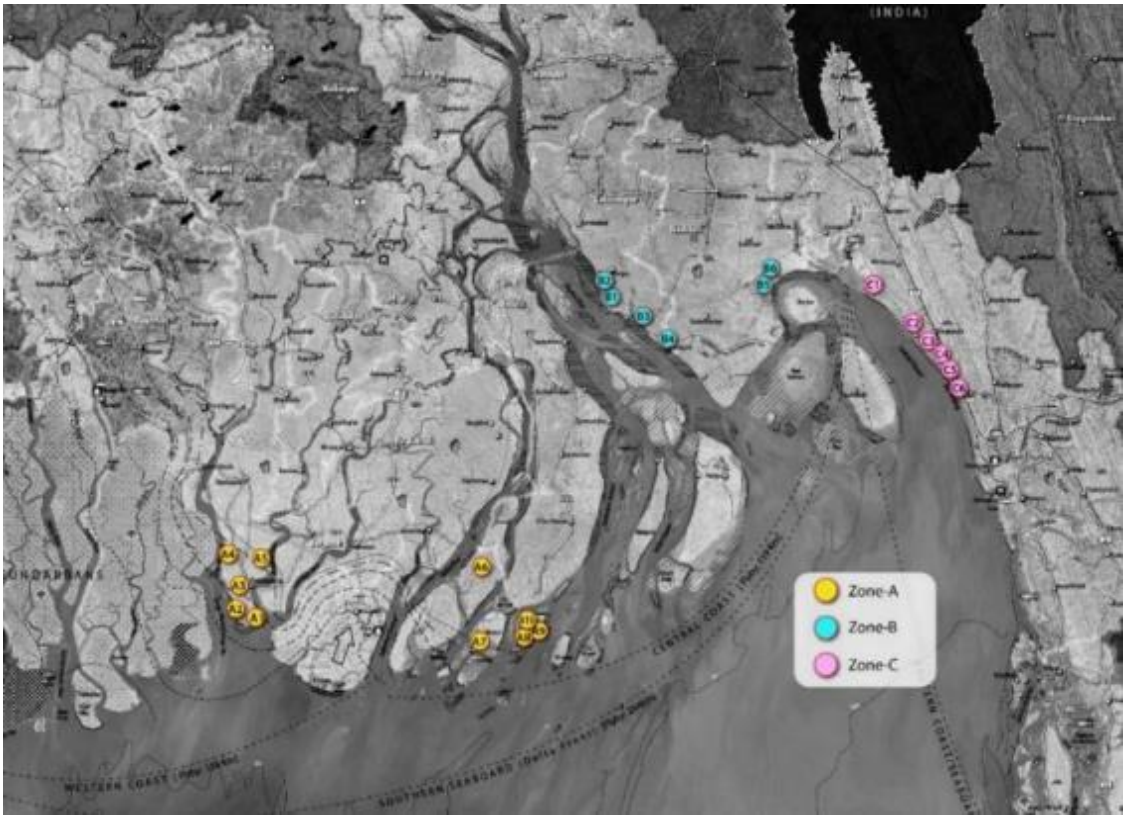


Figure 2.5: Location of case study settlements

2.5.2.2. Study population

Homesteads of the settlements are also studied as an initial physical and social unit of the settlements. The settlements are divided into three categories as follows:

i) Settlements in the newly rising (still formative stage) *chars* (land)
ii) Settlements in the settled *Chars* (landmass, more or less established) and regular rice cultivation has started.
iii) Settlements that were established for more than fifty years.

2.5.3. Observation

The qualitative researcher aims to be as unobtrusive as possible to investigate the natural context so that neither the intervention of the researcher nor the methodology conflict with the situation. This is why one of the preferred methods is participant observation (Woods, 2006). The selected settlement cases of this research are directly observed to get an understanding of the social and spatial qualities of the settlements. Some relevant ethnographic information were also received through observation of the case study settlements. The attributes of the settlement pattern by physical and social layout are identified by direct and ethnographic observation and enumerations.

2.5.4. Sketches, Photographs and Google Earth Images

The task is to capture as much detail and interaction as possible, through making notes, tape-recording, sketch maps, photography. The benefits are that they are the recording elements that can be studied later in detail. Sketches sometimes help to capture the spirit of data obtained by the interviews. In this research, the sketches and satellite images from *Google Earth, ArcGIS* and *Satellite.pro* are used to analyse and for documenting the pattern of the case study settlements. The history of the development of the study site during the last decade was also taken from the Earth Engine software. The changes and the physical relationships of different parts of a settlement are analysed through this. The photographs are used for documenting the patterns of the spaces, the sequences of social and functional activities, and different influences that exist in the present condition of the settlement.

2.6. Quantitative Analysis

Quantitative Analysis is required to find out the occurrence and frequency of attributes of the settlement pattern and cross-checking the data received by the phenomenological tools. For quantitative analysis, a Semi-Structured Questionnaire (SSQ) survey has been conducted among 220 participating homesteads on the same case study settlements that were selected for KII. Primary data regarding demographic, socio-economic, infrastructure, and disaster-response collected from the survey were also documented (Ref. Sec.2.3, Table 2.1, Table 2.4, Figure 2.5 and Appendix: Datasheet).

2.6.1. Primary Sources of Data

According to Yale (2017), primary data sources are sources that provide first-hand information concerning the specific issue under investigation (2017). To validate the hypothesis four data collection methods such as semi-structured questionnaire survey and Key Informant Interviews (KII), Focused Group Discussions (FGD) and Case studies were adopted.

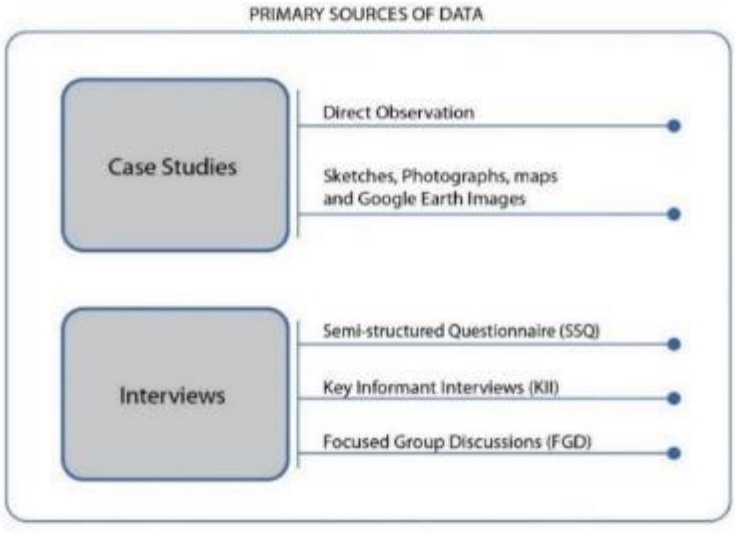


Figure 2.6: Primary sources of data by field survey

2.6.2. Semi-structured Questionnaire (SSQ)

The semi-structured questionnaire is a method of a guided interview where some of the questions are fixed (Oppenheim,1992). During the interview, the interviewees share their viewpoints and ask the interviewers questions, which allows them to provide quantitative and qualitative data with more valuable knowledge, such as their thoughts on sensitive issues (Keller and Conradin 2020). After selecting the sample settlements, a few set of questionnaires was prepared (Appendix: Questionnaires). An important use of semi-structured interview schedules in fieldwork is for cross-checking KII and FGD data. (Section 2.5.1.1 and Appendix: Datasheet).

2.6.3. Empirical Data Analysis

After the literature review and field survey Empirical Data Analysis is carried out:

a) To identify the boundaries and features of each legible settlement through interpretative Phenomenological approach and quantitative data analysis.
b) To identify the pattern of each case study group and make a comparison with others to find out the root characteristics of settlement pattern vis-a-vis the local context.
c) To draw a comparison between the study areas.
d) Identify the common basic pattern.

Finally, analysis of commonalities in the literature review and case (field) studies are grouped to generalize the findings.

2.7. Analysis

According to Judd et al. (1989), data analysis is a process of analysing, editing, modifying, and modelling information to determine the appropriate information to support decision-making and propose conclusions. Creswell (2009) identifies the first stage of data processing as organizing and preparing; this includes collecting and organising field notes. Srivastava and Thomson (2009) refer to the first step as familiarization, which suggests that, by reading and analyzing the transcribed interviews, the researcher gets "immerses" in the results.

Data analysis is used within the data collected to define, interpret and evaluate patterns. The researcher allows the data to dictate the emerging topics, challenges, and principles to create a thematic structure (Braun and Clarke, 2006). The researcher then develops a framework comprising the key problems, ideas, and patterns expressed by the participants, using the notes taken during the familiarization stage.

By the analysis of collected data from the field survey and literature review, the hypothesis is evaluated. By this analysis, the truthfulness of phenomenological bracketing are validated and the hypothesis of the research is judged with respect to its

compatibility with the hypothesis. To validated the findings, some randomly selected settlements at various scales and levels are considered.

2.7.1. Qualitative Analysis

The different type of settlements (by their age of establishment and the age of the landmass) representing different stages of the evolution process is analysed. These are also aligned with the bracketed idea of settlement evolution and its components. Thus the research methods help to validate the hypothesis.

2.7.2. Quantification of Data

Some quantitative data collected in the process was used to get information about the attributes of different settlement components. These help to find out different elements of settlement pattern and the inter-relationship among them. The collected quantitative data about the physical attributes of settlements are analysed to find their inter-relationship. Besides the data analysis colour pattern analysis has been used to find the relationship between the components of a settlement. A comparative analysis among the attributes that play a role in the development of settlement pattern in different case study zones is found by the quantitative study. The validity of findings from the phenomenological analysis are cross-checked by the analysis of quantitative data.

Colour Pattern Analysis: By the technique of colour pattern analysis, the comprising physical elements of a settlement are converted into prominent colour and the image is being analysed with a parametric tool (Cool PHP Tool software). This software reports the amount of colour shade used in an image. Areas occupied by different types of physical components are represented by different specific colours. After giving this coloured image as input for the software, the amount of footprint of the overall settlement with its different elements come out (Fig. 2.7).

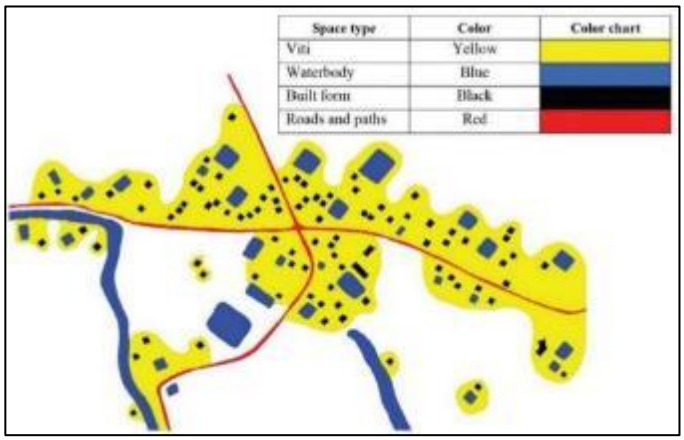


Figure 2.7: Sample plan and colour coding for ‘Colour Pattern Analysis’.

2.7.3. Validation in Urban Neighbourhood

To validate the finding in the study area, it is compared with some settlements at various levels and scales. To compare the generic pattern identified in this research, three organically developed settlements at various levels and scales of different sections of Dhaka city that grows without any planning intervention are taken as the test case. They have been selected randomly. The selected settlements are- Kaundia, Paikpara and Goidertek. Dhaka being an extreme case of settlement growth is taken to test the pattern. The physical observation, satellite images and detail maps are used as a tool to make a comparison with the identified pattern of settlement from case study sites.

2.8. Summary

The study intends to identify a ‘generic’ pattern of settlement in the Bengal Delta. The investigation is carried out by triangulating the phenomenological method, quantitative data analysis and relevant literature review. The settlement patterns in similar (analogous) contexts were studied from the secondary and primary sources to determine a research framework and to identify the research gap. Phenomenology (local geo-climatic context and human response) was the basis for the historical reconstruction of settlement pattern. Based on the context, the case study settlements are analysed along with the KIIs. Contemporary and traditional tools were used for data collection, storage and analysis. Through the interview and observations, the phenomenon behind the evolution of a settlement pattern in the Bengal Delta is clarified. This research essentially attempts to connect methodically, the various threads and fill up the gaps to identify the order that prevails in the settlement pattern of the Bengal Delta, thereby testing the hypothesis.

Chapter 3

SETTLEMENTS IN TROPICAL DELTAS

3.0. The Context

The greater part of the present-day Bengal Delta is formed by the alluvial soil brought down by the mighty rivers. The most significant feature of its landscape is provided by hundreds of rivers and rivulets, which have moulded not only its physiography but also the way of life and living of the people and their settlements (Mowla, 1997). Into the delta flow a number of major rivers, the Ganges/the Padma, Jamuna, Teesta, Brahmaputra, Surma, Meghna etc. The Bengal Delta is also called Ganga-Brahmaputra Delta. Their different branches, channels and distributaries provide some 230 significant waterways with a combined total length of about 250,000 km (WDB 1990) flow down to the Bay of Bengal in the South. This geo-morphological phenomenon is going on for thousands of years and together with the climate and rice-culture needs, the resultant basic settlement pattern also did not evolve much (Mowla 2012; Paul 1939). Several hypotheses about the un-changeability of socio-cultural characteristics and their physical manifestation in the Bengal Delta is discussed variously, however, one aspect is common i.e. The roots of indigenous architecture and settlement of the Bengal Delta are embedded deep into the psyche of rice-culture based common people (Wittfogel 1962).

The indigenous tradition is the direct translation into the physical form of a culture, its needs and values. As Marx observed in the case of India focusing on Bengal: ... *The simplicity of the organization of production in these self-sufficing communities that constantly reproduce themselves in the same form, and when accidentally destroyed spring up again on the spot and with the same name - this simplicity supplies the key to the secret of the un-changeableness of Asiatic Societies, an un-changeableness in such striking contrast with the constant dissolution and re-founding of the Asiatic States and the never-ceasing changes of dynasty. The structure of the economic elements of society remains untouched by the storm clouds of the political sky* (Emile Burns 1935; Kosambi 1956). Though Marx's observations are based on modes of production and its physical manifestations, the following sections would examine the phenomenon responsible for this un-changeableness of the basic simple settlement form or pattern in the rice-culture context of the Bengal Delta as discussed by Paul (1939), Wittfogal (1962) or Emile Burns (1935).

3.1. Development of Rice Culture

As a single and overriding cause, agriculture inspired numerous nomadic groups to permanently settle around the globe. As water is a fundamental need for agriculture, areas around water bodies such as rivers, lakes, ponds etc. have emerged as a potential geographical area of settlement. Small patches of human habitat have started to develop

in terms of the size of population and the number of communities, with growing progress and meeting needs through agriculture (Dey and Bhaduri 2016). Rice cultivation started when men (or, more likely, women) dropped seeds on the soil in the low-lying wetlands surrounding their homesteads, kept the weeds and animals out, and probably manipulated the supply of water. The homesteads were located near the cultivation fields as individuals discovered that rice plants reacted to the enriched soil near their temporary settlements in yield (Hawkes 1969).

Rice was believed to have been first domesticated in the region of the Yangtze River valley in China (Grist 1965) based on archaeological evidence. Morphological analyses of rice phytoliths from the archaeological site of Diaotonghuan clearly illustrate the transition from wild rice collection to domesticated rice cultivation. At the Diaotonghuan stage, the vast number of wild rice phytoliths dating from 12,000-11,000 BP shows that the collection of wild rice was part of the local means of subsistence. Changes in the morphology of the Diaotonghuan phytolith from 10,000-8,000 BP suggest that rice was domesticated by this time (Ricepedia 2019). Soon afterwards, in Central China, the two major varieties of Indica and Japonica rice were cultivated. There was a major expansion of rice cultivation in the late 3rd millennium BC into mainland Southeast Asia and westwards through India and Nepal (Watabe & Toshimitsu 1974).

Ancient India is undoubtedly one of the oldest regions where the domestication of Asian Rice began. The oldest carbonized grains in the Indian subcontinent date back to around 2300 B.C. (Allchin 1969; Mehta & Oza 1973; Buth & Saraswat 1972). The oldest excavation from Mohenjodaro in the Indus Valley of Pakistan dates from around 2500 BC (Grist 1965). Around the middle of the second millennium BC at after, or shortly before, the Aryan intrusion, rice cultivation probably started in North-west India (Grigg 1974). In the mid and upper Ganges, wet rice cultivation began in the late 3rd millennium BC (Grigg 1974; Watabe & Toshimitsu 1974), like in northern China. Carbonized rice glumes are found by recent excavation of Non-Nok Tha in Thailand which is dated back to 3500 BC or earlier (Chang 1976). China, North-east India and South-east Asia seem to be tied up with the same thread in terms of domesticated rice cultivation.

The Asian rice (*Oryza Sativa* or *O. Sativa*) grew from an annual progenitor over a wide belt that spread to North Vietnam and South China from the Ganges plains below the foothills of the Himalayas, through Upper Burma, northern Thailand, and Laos (Chang 1964, 1976). Rice was most likely introduced from the Nepal-Assam-Burma-Yunnan region into the Yellow River Valley from this aggregate of centres and non-centres, and from Vietnam from a coastal route into the lower Yangtze River basin where the cool-tolerant race (*Keng* or *Japonica*) was formed (Chou 1948; Ting 1949a; Ando 1959; Chang, K. 1968; cited by Chang, T.T. 1976). In the third century BC, rice was imported into Korea and Japan from China. (Ando 1951; Anon. 1954; Hamada 1967 cited by

Chang, T.T. 1976). Southward into the Malay Archipelago and northward into central China, the tropical rice (*Indica* or *Hsien*) spread. Indica rice was possibly grown in the middle basin of the Yangtze River before A.D. 200 and started to spread (Fuller 2011) in the sixth century. About 1084 BC, rice was cultivated in Indonesia. (Roschevicz 1931). The Javanica race spread from there to the Philippines, Taiwan, Ryukyu and Japan. At several places within or bordering the belt, domestication may have occurred separately and concurrently. The dissemination trend of the three geographic races in Asia (Chang 1976) is schematically shown in Figure 3.1.

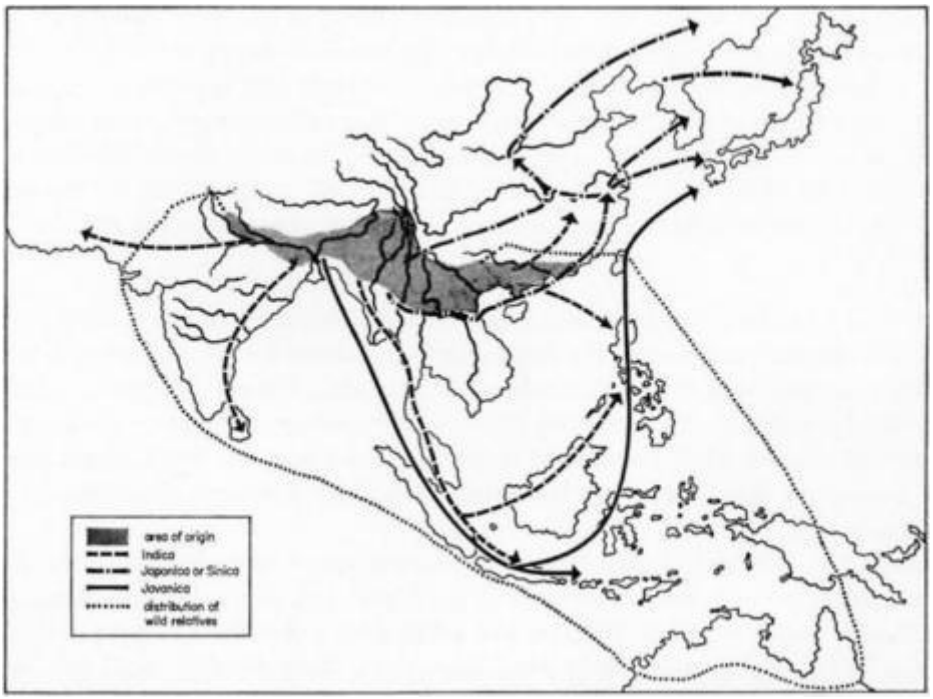


Figure 3.1: Distribution of O. Sativa and its wild relatives in Asia and Oceania. (Source: Chang 1976)

Ganges-Brahmaputra basin (Bengal Delta) seems to be the location of origin from where Indica/Japonica/Javanica verities of rice domestication and cultivation spread or converged, which also indicate that the Ganges-Brahmaputra basin (Bengal Delta) had more geophysical interaction and affinity with East-Asia in terms of rice-cultivation induced settlements typology. Today, most rice is produced in Bangladesh, India, Myanmar, China, Japan, Indonesia, Philippines, Vietnam, Thailand and Pakistan, which is 92 per cent of the world's total rice produced is by Asian farmers (Ricepedia 2019) and Ganges-Brahmaputra basin (Bengal Delta) or Bangladesh seems to be knotting the geophysical ties.

('Rice culture in the Bengal Delta' has been discussed in section 3.4.1.)

3.2. Rice Culture-based Civilization in South Asia

The identity of many Asian cultures is fundamental to rice as food and crop. Indeed, in East, Southeast and South Asia, the majority of mainstream state cultures, from Japanese to Sichuanese, to Thai or Sri Lankan Sinhala, see rice as a central part of their cultural tradition. Rice is important for Asia's monsoon civilizations (Fuller 2011).

The related tradition of cooking (steaming and boiling), food texture preference (as for glutinous rice, sticky), and ritual focused on the close possession of ancestors are illustrated by Fuller and Rowlands (2009, 2011). The history of the human population and Asian cultures and the evolution of rice are inseparable, regardless of which concept of civilization is preferred. Many archaeologists have stressed the significance of rice farming as a catalyst for demographic development, population spreading out and the roots of active village life and are a key component of the agriculture/language spreading assumption (Higham 2003; Blust 1996; Sagart 2003; Fuller 2011). The culture of rice and its processing gave rise to a certain (south-east Asian) civilization manifested in the settlement pattern.

3.3. Global Patterns in the Similar Context

The preceding section shows that Bangladesh, China, India, Thailand, Korea, Vietnam, Indonesia, the Philippines and Japan are the prominent rice culture-based nations (Fuller 2011) and had more affinity among them in terms of rice-cultivation induced settlements typology. This section discusses the typology of settlements in three major rice culture-based countries (Japan, Vietnam and Thailand).

3.3.1. Some Rural Settlement Forms in Japan

Japan is a fertile area for rice-based settlement study. Though not in the tropical region, over the ages, sectional and general separation has accentuated the broad regional variations brought about by nature. Then, too, Japan was drawn towards Bengal Delta from many sources by its civilization. It is here to discuss certain forms of settlement that are characteristic of significant sections of Japan, although of course, they do not exhaust all the types found in the country (Bray 1994). The Yamato Basin, Satsuma, the Echigo Plain, and the Tokachi Plain are the areas that are considered. To indicate the different types of settlement forms presented, these geographical place names are used. Consideration is given to the general distribution pattern; the agglomeration morphology, or local dissemination pattern; and the occupancy unit morphology.

3.3.1.1. System of land division based on rice production

A method of the land division known as the Han den, or Chinese land method (Hall 1931), was among the material cultural types that entered Yamato from the Celestial

Empire. This included the division of the land into squares and the distribution of it. The division's smallest and most common unit was a plot measuring approximately six by six feet. This module was expected to produce enough rice for one day to feed one adult male, and the plan was called the *Ku bun den*, '*mouth sharing land*' method. The next largest square was created by three hundred and sixty such plots, enough on the basis of the lunar calendar to sustain one man for one year. All of the dividing lines were north-south and east-west oriented (Hall 1931) based on Chinese Geomantic feng-shui traditions.

A *mura*, which is divided into economic entities called *azas*, is the smallest political division. For instance, an *aza* of dry crop upland may contain *muras* that lie on the border of the plain (Moon 1989). Since the Yamato Basin lands are fairly uniform throughout, it often happens that all of the *mura* lands are suitable for rice cultivation. In such instances, *Aza* is responsible for the comprehensive operation and maintenance of irrigation and flood control facilities. One collection of houses includes the usual *aza*. In size and distribution, these clusters tend to be uniform, because the size and productive quality of the *aza* domain are almost the same everywhere on the basin surface (Figure 3.3). They also appear to adhere to the ancient system of Han den (Figure 3.2) pattern. There are around two hundred and fifty village clusters on the Yamato Basin floor, ranging in scale from a minimum of twenty houses to a maximum of eighty, with about sixty for the rest. These lie within an average distance of one kilometre from each other (Hall 1931,1932).

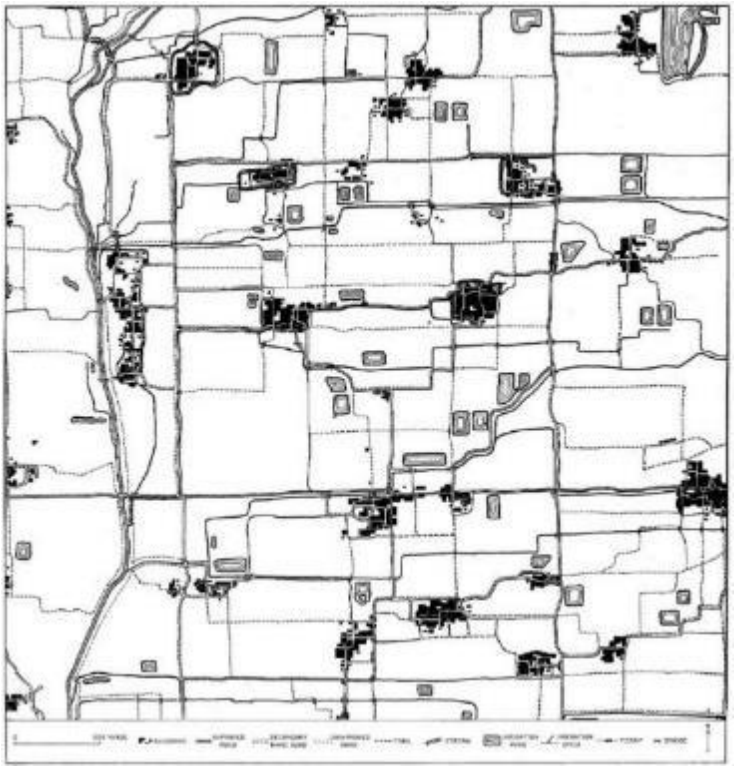


Figure 3.2: A Map of the Yamato Basin. Note the rectangularity of all the landscape forms, showing affinity to the ancient Han den traditions on the floor of the basin. (Source: Hall, 1931)

Figure 3.3: Rural settlement of the Yamato Basin. (Source: Hall, 1931)

The traditional village's shape was introduced from China with the rice culture. It is an extraordinarily compact rectangular agglomeration surrounded by a hedge and a moat. These agglomerations can be described as a checker-board pattern and are locally called *Kaitos*. The word *Kaito* has been translated as "within the wall." The four passages from the villages corresponding to the compass's cardinal points are another element corresponding to the Chinese village (Hall 1932). These are also known as the gates to the north, south, east, and west, even though there were no gates in any living person's mind (Moon 1989). The arbitrary establishment of political units has triggered to break down the village personality, frequently enclosing multiple *Kaitos* under one mura office (Hall 1931) (similar to the older spontaneous *para/mahalla/grama* pattern forcefully merging within the current politico-administrative unions/wards in Bangladesh).

The moat restricts the sum of houses that can be built within it. The eldest son in Japan inherits the family's dwelling, and the younger sons who wish to create their own home are soon forced to settle outside. This has been done in two ways: first, by the construction of new adjoining *Kaitos*; second, by the setting up of a new *Kaito* just beyond the moat and along any road leading from the village (outside of ‘inside the wall’) (Moon 1989).

Another aspect of the *Kaito* is that it virtually forms a single-family unit that retains a traditional shrine and burial ground. There are generally one or two family names within the moat, and there are seldom more than four or five. These families are traditionally bound by marriage to each other. To the home-loving Japanese, this role is most desirable. Before the implementation of the Han den, there is some historical evidence and plenty of tradition pointing to the existence of compacted settlements. This is not unexpected, as rice cultivation possibly existed for at least a century in the Yamato Basin (Hall 1932). As the topography is similar to the Bengal delta, it has similar features in traditional homestead formation, however, demarcations are mostly by numerous natural water channels, for being in the delta.

3.3.1.2. The Echigo type

The Echigo type includes a drypoint settlement that is serpentine in shape for the location on ancient dunes and active and abandoned levees, a specific land ownership distribution, and a house shape well adapted to local conditions. It is a characteristic of the complex plains of the delta bordering the Sea of Japan. The Echigo delta plain is Japan's largest delta plain (Hall 1931). The deposits are formed by the longest of the Japanese rivers (Figures 3.4 and 3.6). The chief utilization and settlement attraction here is the superabundance of water, like the Bengal delta through other context is different.

Figure 3.4: A distinctive farmstead on the Tokachi Plain, Japan. (Source: Hall, 1931)

Figure 3.5: Map of an area in Echigo delta Plain, Japan. (Source: Hall, 1931)

From study and general observation in widely separated portions of Japan, a few generalizations concerning forms of indigenous settlement in Japan is possible. Regarding the regional pattern of distribution, rice lands with few exceptions are occupied by small and compact village agglomerations rather evenly distributed. The form of the agglomeration is largely an adjustment to natural topographic conditions; social and economic conditions are likely to decide the structure. In most cases, small and independent irrigation systems are used. Both are subject to violent floods, and unit dry point sites have been occupied. As a result, a disseminated pattern of rural distribution is found (Figure 3.7), these generalizations are comparable with the apparent Bengal delta settlement pattern.

In areas of dry crop cultivation, a disseminated pattern with a tendency toward agglomeration seems to be universal. As shown in the rectangular land division of Tokachi, the local pattern structure has a close connection to artificial forces (Hall 1931).

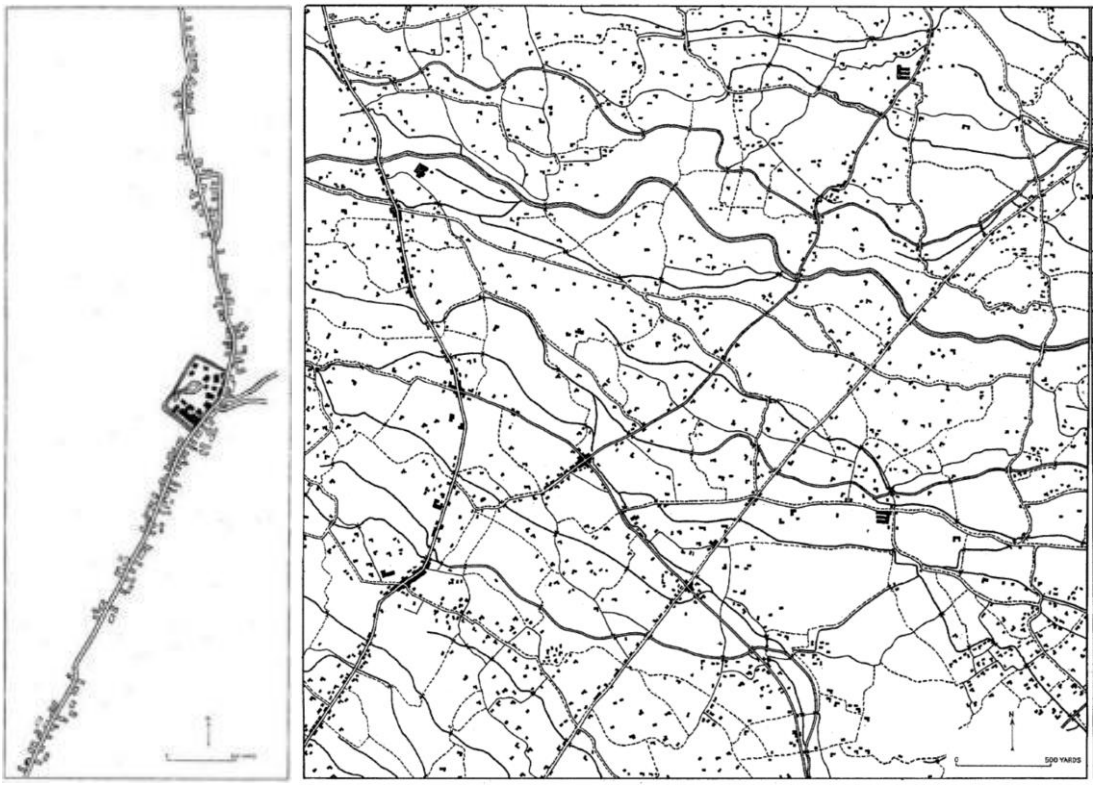


Figure 3.6: (Left) A segment of Echigo delta Plain, Japan

Figure 3.7: (right) Map of a portion of the Oi Gawa delta showing the settlement's scattered pattern in rice fields of the steeply inclined plain but densifying along the route i.e. guided by the contour lines. (Source: Hall, 1931)

Figure 3.8: Ta Phin village in Vietnam. (Source: Internet)

3.3.2. Settlement Patterns in Vietnam

In Vietnam, there are several distinct patterns in traditional settlements. Geomantic feng-shui principles influence the orientation of houses and community buildings, particularly in northern and central Vietnam. Many of these structures face the sea in central Vietnam.

Traditional buildings are often clustered closely together in the densely populated Red River delta in the north and are surrounded by a bamboo hedge or an earthen wall. On the central coastal plain, with small clusters of farmsteads along watercourses, lowland Vietnamese villages are characteristically close-knit, and fishing villages are often situated in sheltered inlets. In the Mekong delta in the south, several villages are strung out along rivers and roads; others are loose-knit clusters of farmsteads, some scattered across the rice fields (Figure 3.8) (Hayami 2001). Rice is the most significant grain. It is grown predominantly in the Red and Mekong river deltas. The villages of minority Cham and Khmer closely look like those of the Vietnamese.

3.3.3. Settlement Patterns in Thailand

The dominant settlement pattern in Thailand remains the rural village, where the primary occupation is wet-rice cultivation (Britannica 2019). There are numerous types of settlements that vary according to location. On higher ground, surrounded by rice fields, villagers in the northeast live in houses clustered together. By contrast, in the north, where most villages are located in the alluvial basins of major rivers, population growth and transportation improvements have tended to disperse the villages far from the rivers and towards the main railroads and highways, decreasing the amount of rice-growing land available (De Young 1970). The north also includes much of the country's hill settlements, which are similar but smaller than those of the nucleated villages of north-eastern Thailand. (Figure 3.9) (Hirsch 1994).

Figure 3.9. Aerial view of rice field pattern with scattered cluster settlement in a rural area of Thailand. (Source: Internet)

The Chao Phraya delta is heavily populated along with regions of high land that are free from floods. A wide network of irrigation canals has changed the pattern of settlement and transportation. The mobility provided by small motorboats using the canals has made it possible to create villages to the east and west away from the rivers (Hirsch 1994). Previously scattered cluster settlements amidst paddy fields have transformed due to contemporary transportation systems. Settlement trends have experience changes by new highways, particularly at river crossings and canals where new towns have emerged (Tannenbaum 1994).

3.4. Bengal Delta and the Settlement History

As noticed in the major rice culture-based countries, the deltas are the unique outcome of the interaction of rivers and tidal processes resulting in the huge sedimentary deposits in the continental shelf of the world. Although comprising only 5% of the world land area, deltas have up to 10 times more than the normal population and agricultural production due to land fertility (Ericson, 2005). The Ganges-Brahmaputra-Meghna Delta (GBM Delta), which is called the Bengal Delta in this research, forms the main part of Bangladesh. It is the world's largest and the most populated delta (Ericson, 2005) and encompasses approximately 100,000 km2 of Bangladesh and West Bengal of India. Most people of the delta depend on water-based livelihood for their existence. 156 million people live in Bengal Delta, despite frequent tropical cyclones, tidal surges, and heavy monsoon induced floods.

With its rich collection of flora and fauna induced cultural resources, the coastal areas of the tropical deltas present the most challenging settings given their diverse character and location at the land–water interface and give rise to a certain pattern of transient settlements throughout its long history.

3.4.1. Rice Culture in the Bengal Delta

In Bengal Delta, there is the setting of the floodplains with their frequent inundations and a humid tropical climate, both particularly unkind to material remains of human settlement in the remote past, not made of the sturdiest materials. Since stone does not occur naturally in the Bengal delta, early humans are likely to have relied on materials such as wood, bamboo and mud that did not survive the ravages of nature.

The prehistoric discoveries that have been made so far are almost exclusively from higher terrain surrounding the floodplains. Today the eastern hills of Bangladesh and the western plateaux (now in West Bengal, India) give the best clues to the early inhabitants of the region (Bertocci 1996). Here stone, pebbles and petrified wood (fossil wood) were available. Fossil wood industries producing hand axes, blades and scrapers have been found in Lalmai, a small range of hills in Comilla district, Sitakund (Chittagong district) and Chaklapunji (Sylhet district). Archaeologists have linked these with similar tools from West Bengal, Orissa and Bihar (India) and the Irrawaddy delta (Burma). Evidence shows that the makers of these early tools were hunters and gatherers and survived by hunting animals/fish and gathering plants (Chakrabarti 1992, Schendel 2009).

Cultivation of plants and domestication of animals occurred well before 1,500 BC. The earliest indication of settled agricultural communities comes from the old delta in West Bengal (Schendel, 2009). Here sites have yielded stone and bone tools, pottery with geometric designs, iron agricultural implements, domesticated rice and the bones of domesticated animals such as goats, cattle and buffaloes. Based on these findings, it seems likely that the subsistence base for people living on the poorer plateau soils was an amalgamation of rice cultivation, animal husbandry, fishing and hunting, but that those living on the more fertile alluvial soils of the delta depended heavily on rice cultivation (Schendel, 2009). In this zone, a crucial shift occurred when agriculture evolved from shifting cultivation to irrigated cultivation on permanent fields. This type of agriculture became so productive and rewarding that settled populations expanded rapidly. Settlements grew and various supporting crafts also flourished (Schendel, 2009).

Originally a swamp plant, rice is extremely well suited to the ecology of the Bengal Delta, where it is known as *dhan* (paddy) when unhusked, *chaul* (*caul* or *cal*) when husked and *bhat* when boiled. Generations of cultivators selected and adapted rice to suit their needs, especially in terms of disease resistance, growing season and taste. In this way, they developed thousands of varieties to suit a multitude of local agro-ecological conditions (Allison 2003; Khan 1991). In the deltaic environment, special rice species were evolved for different levels of flooding. Possibly the most unusual is ‘floating rice’ (*jalidhan*), grown on low-lying land. This allows them to survive by floating in even 5-6m deep water. Historically, a pattern of land use developed in which the highest delta lands were

reserved for homesteads and orchards (mango, jackfruit, coconut and betel nut). Slightly lower grounds were used to grow rice seedlings and vegetables, and middling and low lands for rice cultivation (Schendel, 2009). On middling lands, there were usually two rice crops: spring rice (*aus*, March to August), followed by autumn rice (*aman*, June to December). On low lands, with annual flooding, the main crop was autumn rice followed by winter rice (*boro*, February to April). Indica/Japonica/Javanica rice verities also thought to have evolved here and disseminated by the migrating people from this land to Far East (Blust 1996; Sagart 2003). The rice culture is associated with its processing activities and festivities requiring certain types of space (Mowla, 1997a & 1999). The countryside, besides a natural water channel, became dotted with such specialized clusters of homesteads built around man-made ponds (*pukur*) that were used for drinking water, washing and fish-breeding (Schendel, 2009), a unique character indeed. The success of rice-based deltaic agriculture provided the foundation for sedentary lifestyles, which, by about the fifth century BC, led to urban centres, long-distance maritime trade and Bengal's first sizeable states (Maloney 1984; Paul 1939).

Figure 3.10. Wetland rice filed in a rural settlement in Bengal Delta. (Source: Field survey 2018)

Figure 3.11: Rice Harvesting Now and First Century BC. Fragment of a terracotta plaque, Chandraketugarh. (Bertocci, 1996 extracted by Schendel, 2009)

Though in the same broader geo-political context, some distinct dissimilarities are being identified between the Northwest Indian subcontinent, Bengal and Southeast Asia. No doubt, these are primarily conditioned by geo-climate; in the Bengal Delta, it is the 'wet culture' while in Northwest India it is the 'dry culture' (Blust 1996; Fuller 2011), former is the cradle of 'rice civilization' while the latter embodies "wheat and barley" civilization' (Paul 1939). Due to being in the transitional zone between Southwest and Southeast Asia, the Bengal delta has a lot of commonalities of settlement and other traits of Southeast Asia (Figures 3.10 & 3.11). A significant character of 'wet culture' being on scattered artificially raised settlements amidst vast wet green paddy fields (Bertocci, 1996).

3.4.2. Settlement in the Bengal Delta

Geological evidence indicates that most of the areas of the Bengal Delta remained underwater during the Palaeolithic period and perhaps because of that human settlements evolved in the adjacent hilly regions and valleys. Evidence of man's antiquity has been sought in this region, therefore, not on the deltaic plains, but in the older geological formations (Bakr 1971). As the Delta extended by sedimentation process, the human settlement also gradually extended to plain land (Hunter 1885) gradually receding from hilly areas. It may be presumed that by the late Neolithic Age, a substantial landmass must have been formed in the plains which made it possible for settled life between 1000 BC and 300 BC when the ancient *janapadas* flourished with mature cultural and political organizations in place (Paul 1939; Wittfogal 1962). This period roughly corresponds with the settled rice culture in this region (Grigg 1974; Watabe & Toshimitsu 1974). In this situation of the ecologically induced process of land formation between the hills and the sea, it is not unexpected that ethnically the majority of the people of Bengal Delta have more cultural affinity with the aboriginal peoples of the surrounding hills in the east than with the people of other regions in the west (Maloney 1984). From pre-historic intra-Asian cultural exchanges, Bengal not only came under the sway of an agrarian culture of Southeast Asia, but it was also is a 'shattered zone' that became a contact point between Southeast Asia and the Middle-Ganga region of India. The process of assimilation of Southeast Asian Neolithic agro-cultural elements, such as wet-rice cultivation and Munda languages, to the Middle-Ganga region via the Bengal Delta, seems to have taken place well before the West Asiatic Neolithic cultural elements reached there via north-western India (Fuller 2011; Bertocci, 1996).

The people of the Bengal Delta (basically Bangladesh) have never been able to lull themselves into a false belief that they controlled nature. They live in an environment where land and water meet and where the boundaries between these elements are in constant flux (Maloney 1984; Low 2017). As a result, settlement patterns have always been flexible and often transient in nature. From travellers' accounts, Chronicles and

historical interpretation, the arrangement or composition of homesteads and settlements are thought to be guided by the topographical context (Figure 3.12). It is known from an early age, the copper-plate grants of the Palas, Chandras, Senas and other contemporary dynasties that the villages and towns varied considerably in size in this region. They appear to have been of one uniform scattered clustered pattern (Majumdar 1929 & 1943). Evidence found that they were usually of the 'nucleated', and not of the 'single farm' type as in the dry-culture of the Northwest Indian subcontinent. Thus, it appears that the rural population lived in lineage-based communities but widely scattered habitation due to topography (Low 2017; Emile Burns 1935). Generally, the *grammas* (villages) consisted of settlements or habitats (*Vāstu*), arable land (*Kshetra*), and natural meadow-land (*go-chara*) providing meadow for the live-stock usually located around homesteads or along the village boundaries. In most of the villages, there were pits, ponds and canals (*garta* and *nālā*), barren tracts (*ushara*), tanks, cattle tracks (*go-patha* or *go-mārga*) or *halots* and paths. Some villages had periodic markets (*hatta*). The villages which were along the trade routes had *bazars*. A few villages are also stated to have been in the possession of woodlands or jungles (*sa-vana, sa-jhātavitapa*). As agriculture requires much water, most of the villages stood on the banks of rivers tributaries, canals etc (Ray 1993). Surplus of the villages needed *hatta* and *bazars* giving rise to *janapadas* (Hunter 1885).

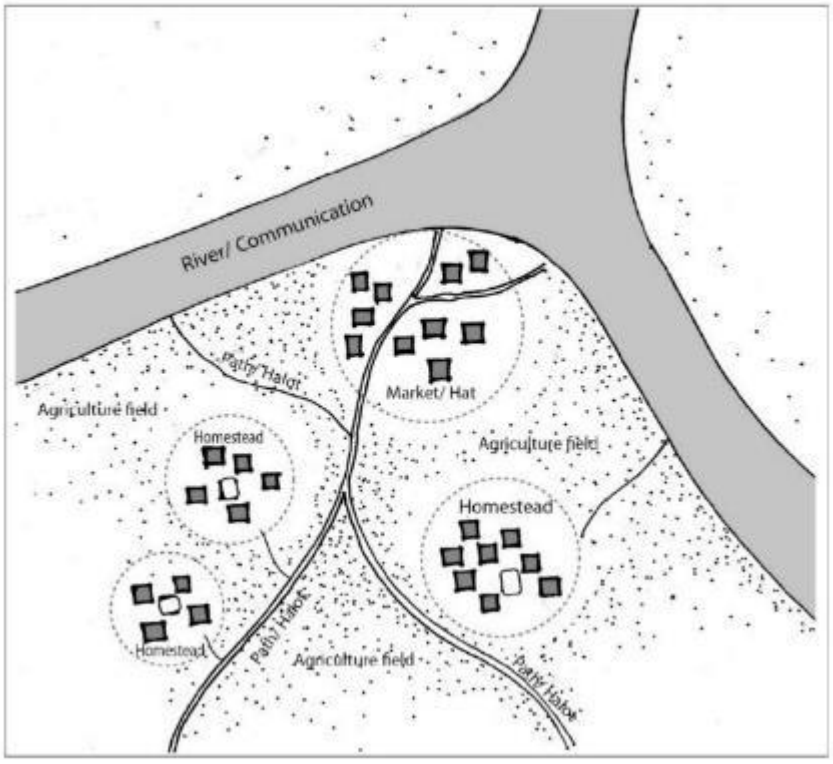


Figure 3.12: Schematic layout of settlement in the Bengal Delta reconstructed from the descriptions based on Ray 1993; Mowla 1997a; Dey & Bhadduri 2016 and Low 2017.

3.4.3. Settlement in the New Delta

Chinese Traveller *Fa-Hien* in the fourth century; *Hiuen Tsang* in the seventh century and the Moorish traveller *Ibn Batuta*, in the fourteenth century, gave almost similar accounts of their travel through this deltaic land (Geetha, 2017), signifying un-changeability of settlement pattern for at least fifteen hundred years as observed by Marx in the nineteenth century (Emile Burns 1935). "We moved down the river between villages and orchards for fifteen days as if we were going through a bazaar" (Ibn Batuta 1969, p. 271). Referring to the geo-climatically hostile conditions for living, Abul Fazal (1579) called this land a 'Hell, but full of bounties' which attracted people to settle here. "There is nothing in Bengal's history to match the ancient glory of Patna or Ujjain or Benares… yet it is possible that being somewhat left behind over a long stretch of history has made it that much easier for Bengal to develop its peculiar combination of open-minded receptivity and cultural pride" (Sen, 2007), taking a queue from Marx's observations regarding un-changeableness of the basic simple settlement form or pattern in this region (Emile Burns 1935) present hypothesis challenges Sen's notions and exerts that there is a unique settlement pattern in Bengal though transient in nature which proudly withstood the onslaught of the hostile environment through thousands of years (Paul 1939; Wittfogal 1962).

The most significant features of the New Delta or east Bengal floodplain settlements brought down by historic chronicles and present-day observations was that the settlement in the Bengal Delta did not evolve as a corporate social organization which gives a particular inhabited place continuity through the ages marked by intense interaction among its population and permanency (Hunter 1885; Wittfogal 1962). An important aspect of settlement here is spatial mobility and freedom due to the frequently changing course of rivers. In east Bengal, there was no fixed boundary of the neighbourhoods within the village and between two villages. The dwelling places or homesteads (*Bari)* were temporary huts (*Ghar)* made of mud, bamboo and thatch which could be dismantled and shifted away any time when needed. The temporary and perishable nature of the huts reflected the transitory nature of the villages which was without deep roots and the psychological attachment of its population with the place (Maloney 1984; Low 2017). This stood in sharp contrast from the most common features of west, north and south Indian settlements. In east Bengal abundance and easy availability of water, the most essential element needed for settlement's survival did not require cooperative and collective efforts to obtain it. Moreover, convenience of migration and building a new homestead within the region again and again due to innumerable and extensive waterways, loose communal and social organization, independence of the farmers in paying rents to the authorities and the frontier character of the settlements of East Bengal were largely accountable for giving birth to such transitory villages and loose social organization. This made the east Bengal settlements elusive or unique (Figure 3.13) but still having a strong personality (Paul 1939; Wittfogal 1962).

Figure 3.13: Settled and mobile people side by side. Water Gypsy in a Bengal village in the year 1860 (Source: British Library)

The east Bengal Delta floodplain settlements did not lose their transient character even in the middle of the 20th century. The term 'elusive villages' was coined by the American anthropologist Peter J Bertocci in his study on the rural social organization of two Comilla villages in the 1960s of last century (Bertocci 1969), and about a century before (mid-19th Century) by German philosopher Marx (Emile Burns 1935). The absence of strong communal living and tradition-bound rural organization made the people of East Bengal atomistic, factionalist, averse to discipline and order, hedonistic and heterodox. Cooperation and collective action for attaining common goals or social capital was very weak (Khan 1987; Khan 1996). They were least obedient to political authority, prone to anarchic behaviour and by nature rebellious. Mughal imperial chronicler of Delhi Abul Fazl described Bengal as 'a house of turbulence'. Interestingly he rightly ascribed the reasons for such behaviour of the Bengalis to the geo-climate of Bengal. The heat and humidity of Bengal were so tormenting to the central Asian Mughals that they called it 'a hell well-stocked with bread' (Fazl 1579), that is there was no question about the fertility of this deltaic land. Land measurements were also based on agricultural production. Traditionally the quantity of land is measured according to *katha, gonda, pakhi, kak* etc. or *ana, gonda, kora, kranti, and Til* etc. or other variances in Bangladesh based on old agricultural basis as in Japanese ku *bun den* measure (section 3.3.1.1). There are two types of land measurement even currently in use in writing land related document in Bangladesh. One is *Sotangso* and other is *gonada, Katha, pakhi/bigha etc*. One is official and the other is popular derived from history. However, a relationship is established between these two. The contemporary official measurement is one-hundredth of one-acre is called "decimal" or 100th part of acre or "one *shotangso*" of an acre of land. 20 *Katha* of land equal to one *Bigha* land and three Bighas equal to one Acre of land. This land measurement system refers to historic agriculture-based settlement 'Measurement'.

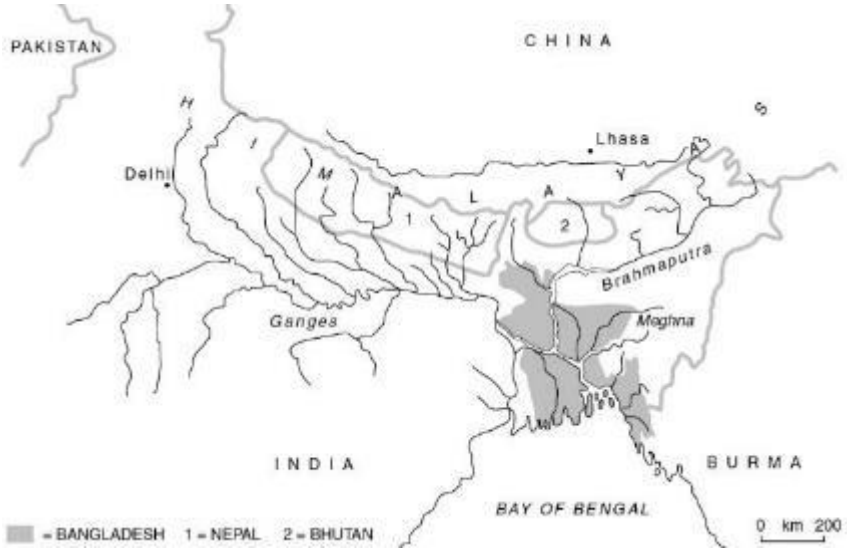


Figure 3.14: Map showing the catchment area of the Bengal delta. (Source: Schendel, 2009)

3.5. Geo-climatic Characteristics of the Bengal Delta

As mentioned before, Bengal Delta (the Ganges-Brahmaputra delta) is one of the most fertile regions in the world, thus earning the nickname 'The Green Delta'. The Gorai-Madhumati River roughly divides the present Bengal delta into two parts: the young, vibrant, eastern delta and the older, less vibrant, western delta (Chowdhury, 2012).

3.5.1. The Bengal Delta as a Land of Water and Silt

The delta is huge because almost all water running off the Himalayas, the highest mountain range on earth, has to pass through it (Figure 3.14) (Steven 1978) bringing huge siltation by which the delta is formed and stretches south. The Brahmaputra joins the Ganges in central Bengal and together they empty into the sea through Megna (Schendel, 2009).

3.5.2. Livelihood with Climatic Vulnerability on Coastal Area

Newly formed land in the Bengal delta is less conducive to settlement and cultivation than old, degraded lands, due to the poor condition and salinity of new alluvia and continuous vulnerability to tidal surges and floods, along with the scarcity of domestic freshwater. Meeting on the banks of the seas is more important with time, as the people have to settle down in the lowlands, coastal zones, and islands vulnerable to tidal surges and floods to the edges of their climate as never before. In this way, some people are forced continually to put themselves dangerously in the water's way. This is what is happening for centuries (Rashid, 2018). Historically, this context gave rise to a unique settlement landscape to this area described in section 3.3, contextualized with the rice cultivation culture of South East Asia. To respond to this context, the unique feature of Bengal delta settlements is the digging of ponds for sweet water and to raise the land for

homesteading in the flood plains. The homesteads are surrounded by orchards to protect them from the high tropical winds (Figure 3.15) (Mowla 2019; Paul 1939).

3.5.3. Origin and Evolution of Settlement in the Region

To recapitulate, according to Chowdhury (1988), based on history, "the settlement in Bengal started almost 20 thousand years ago on the hilly forests of South–East region". The explanation of Chowdhury (1988) is also supported in the writings of Mohammad Habibur Rahman (1989). According to him, the elevated regions of North, West and East of Bengal were primarily the home of the present civilization (Rahman, 1989). According to Kosambi (1956), contradicting Chowdhury (1988) and Rahman (1989), in the Bengal Delta, the commencement of agriculture and settlement on the river valleys and plane lands occurred around 800 BC. The expansion of farming resulting in surplus leads to the formation of a market-oriented economy (Baqee, 2011). Due to this huge success in agriculture, the Ganga river basin flourished with settlement and prosperity. Meanwhile, the tendency of private ownership of lands began to appear (Kosambi, 1956 & 1965, 23-57) giving some permanency to settlements. Due to the flourishing farming, surplus goods were produced arousing the necessity of trade. To supply and exchange these surplus goods with distant settlements, ports were developed. The settlements or villages of Bengal were almost self-contained though not completely self-dependent, this is because some necessary items like salt, iron, etc were not produced locally. They used to receive necessary items in exchange for surplus goods that they produced (Kosambi, 1956 & 1965, 11). These observations coincide with Ray 1993; Maloney 1984; Low 2017 or even Sen (2007) i.e. from the early history, Banaras or Kashi, Patna or Pataliputra or Ujjain emerged as trade centres for agricultural resources from the Delta and the religious or administrative reasons were secondary (Chowdhury, 1992, 8).

In the era Before Christ, the exchange centres were known as "Shongbaho" in Sanskrit. Generally, Shongbaho means "market town", where people from remote areas used to come to trade goods. According to Sen (1974,30), from 5th to 6th Century "Shongbaho" was known as "Bithi". In general, Bithi means a road lined or covered with large trees, actually most of the time, these exchange centres used to develop on a path like this as such they were named after it. The settlement that evolved almost twenty thousand years back extended to the newly formed lands and got gradually transformed due to the many subsequent socio-cultural interventions, for instance, clustered, compact, linear etc. but in the core, they remained similar in the character being from the same origin (Kosambi, 1965; Paul 1939; Wittfogal 1962).

According to Sultana (1993), to comprehend the pattern of a settlement, the study of its development is considered significant. The growth of the settlement is largely controlled by nature. It has been revealed that a high density of settlement has been generated by

favourable physical conditions. In the region, the evolution of settlement is closely linked to the geological time frame of landmass formation. For its manifold appeal, the distribution of settlements largely followed the navigable river course as a means of transport and a source of water for agriculture.

Sultana (1993) continues, the settlements in Bangladesh were locally clustered on the highlands in the initial stage by avoiding low lands covered with dense forest but regionally yielding a localised pattern. The second phase is one of infilling stages when settlements were scattered to give a more dispersed regional pattern of settlements on the low lands of agricultural potential and finally the third or present phase of the competition which is brought for the excessive population growth during the last one century. In some areas with a normal pattern of settlement growth, land occupation in the limited land space results in high density. In Bangladesh, housing processes are a manifestation of the country's agricultural economy and have evolved in terms of physical and cultural structure. However, Sultana (1993) argues that this is the same pattern passing through three different phases.

3.5.4. Factors for the Generation of a Settlement Pattern in the Region

Hameed (2000) identifies various factors affecting the spreading of settlements. A few factors are more accountable for the distribution of settlements from the various physical, economic, social and political variables. Hameed (2000) argues that the distribution of settlements is not only dictated by natural factors but also affected by socio-economic variables. Settlements formation are related to traditions, and the essence of the built-up region is spontaneous. Through invisible threads of the social fabric, they are closely knit together and inter-dependent on each other to carry out their socio-economic business. Hameed's (2000) is the intangible part of what Sultana (1993) describes in terms of physical growth.

Chandel (2013), found that the characteristics of settlement pattern in different contexts of rural and urban context are diversified according to the closeness to natural resources, economic tendencies of settlement and density of settlement areas. Kumbhar (1996) examined settlement distribution, centrality, spacing, and functional variations as a geographical study of rural settlements. He identified various factors that have affected the distribution, forms, pattern, location, and spacing of rural settlements. He has also clarified the morphogenesis of settlements as well as nucleation and dispersion. Aragones, Francescato and Garling (2002) or Lee (2004) stated that the dwelling form and organization are influenced by the culture in which it develops and may be viewed to reflect the connection between culture and environment.

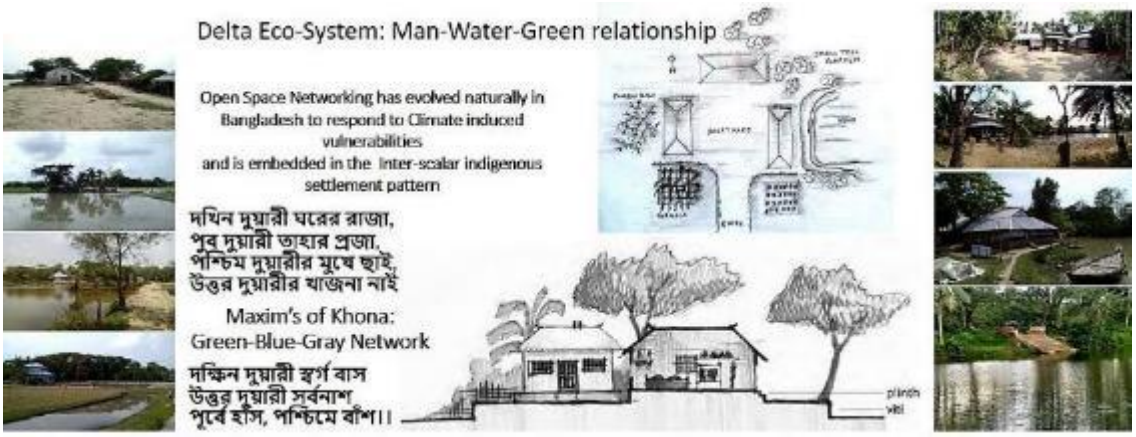


Figure 3.15: Hydro-Morphology has influenced the social norms which in turn has been manifested physically in the Bengal settlement pattern. (Source: Mowla, 2019b)

Elaborating on Chandel (2013); Sabiha (1993); Aragones, Francescato and Garling (2002) or Lee (2004), Mowla (1999 & 2019b) opined in the case of Bengal Delta, that hydro-morphology has a profound influence on the social norms which in turn has been manifested physically in the settlement pattern of this region (Figure 3.15). The evolution of the settlement pattern is a process where old factors disintegrate, and new factors come into existence and sometimes become more dominant, which finally leads to the coordinated development between the built forms and their surroundings. The pattern of settlement is the relationship between houses and buildings to one another in certain geo-climatic contexts, that is, they are moulded by Geo-climatic and Anthropological factors.

3.6. Formation of Settlements

Libang et al (2017) referred settlement as a place where people focus and settle down for the purpose of living and production. According to the characteristics and sizes, settlements can be classified into two categories: urban settlements and rural settlements. In the 19th century, the study on settlement geography started around the world, the relationship between settlements and the environment has since begun to be explored by several researchers (Kosambi, 1956 & 1965). They have identified the association of settlement distribution with two basic resources water and land (Libang et al 2017). Paul (1939) and Tan & Li (2013) found that the pattern of settlement has a close connection between the landform, the historical tradition, the agricultural system and the villages.

3.6.1. United Nation's Concept of Settlement

As recently as in 1976 the United Nation in Vancouver conference established the principles of human settlements, which included assessing a variety of previous elements – housing, architecture, planning and their relationships, as well as other, practises such as environmental improvements and national as well as international growth etc. The Vancouver declaration lays down the following criteria for settlements:

"...Human settlements means the totality of the human community - whether city, town or village - with all the social, material, organizational, spiritual and cultural elements that sustain it. The fabric of human settlements consists of physical elements and services to which these elements provide the material support..."

According to Sarkar (2010) the main physical components of a settlement are:

i. **Shelter/ Dwellings,** i.e. the structures created by man for his safety and security with various shapes, sizes, styles and materials, from the elements and their uniqueness within a society.
ii. **Infrastructure**, i.e. the composite networks to deliver or remove people, energy or information, goods from the shelter;
iii. **Services**, i.e. those which are required to accomplish the functions of a community, such as health, education, nutrition, welfare, culture, and recreation.

3.6.2. Doxiadis' Theoretical Framework of Settlement

Doxiadis (1968) in his seminal study outlined that human settlement consists of two major parts. One is the content (i.e. Man, alone and in societies) and the second one is the container (i.e. the physical settlement, comprising all-natural and man-made or artificial components). He declared that settlements work organically and subdivided them into five basic elements (Figure 3.16). They are:

i) Nature, providing the foundation upon which the settlement is created and the frame within which it can function.
ii) Man, (also referred to as 'Anthropos' or human) in an attempt to satisfy his biological and mental needs and his senses, it affects the environment.
iii) Society, indicators such as social stratification, cultural trends, education, health and security, economic growth, law and administration are included.
iv) Shells, or the structures within which Man lives and carries out his different functions.
v) Networks, or the natural and man-made systems which facilitate the functioning of the settlement, for example, roads, water supply, electricity, etc.

According to Doxiadis (1968), as interpreted by Pertsemlidis 2007 and Hameed 2020, the relationship among man, society, shells (house), human contacts (paths) and nature promotes a basic settlement pattern. This concept is based on five principles: maximizing human potential; minimizing efforts (in terms of time, energy, money, routes); optimizing the protective space of human; optimizing the interaction between human and their environment and optimizing the convergence of previous principles.

Doxiadis (1968) study of the organisation of settlements has guided us to conclude that throughout their total structure, they always consist of four parts: homogeneous, central, circulatory and special. These parts are derived from the five basic elements of the settlements. According to him, hypothetically any settlement consists of these four parts (with the elements of the house, agro-fields, barter trade, community and connecting path) i.e. Homogeneous part: fields, houses etc; Central part: built-up area; shops etc; Circulatory part: roads/ streets etc; and Special part: temple, school etc. These descriptive illustrations of the components and relationships remarkably fit well with the settlements in the Bengal Delta, reconstructed from historic interpretations (Figure 3.12).

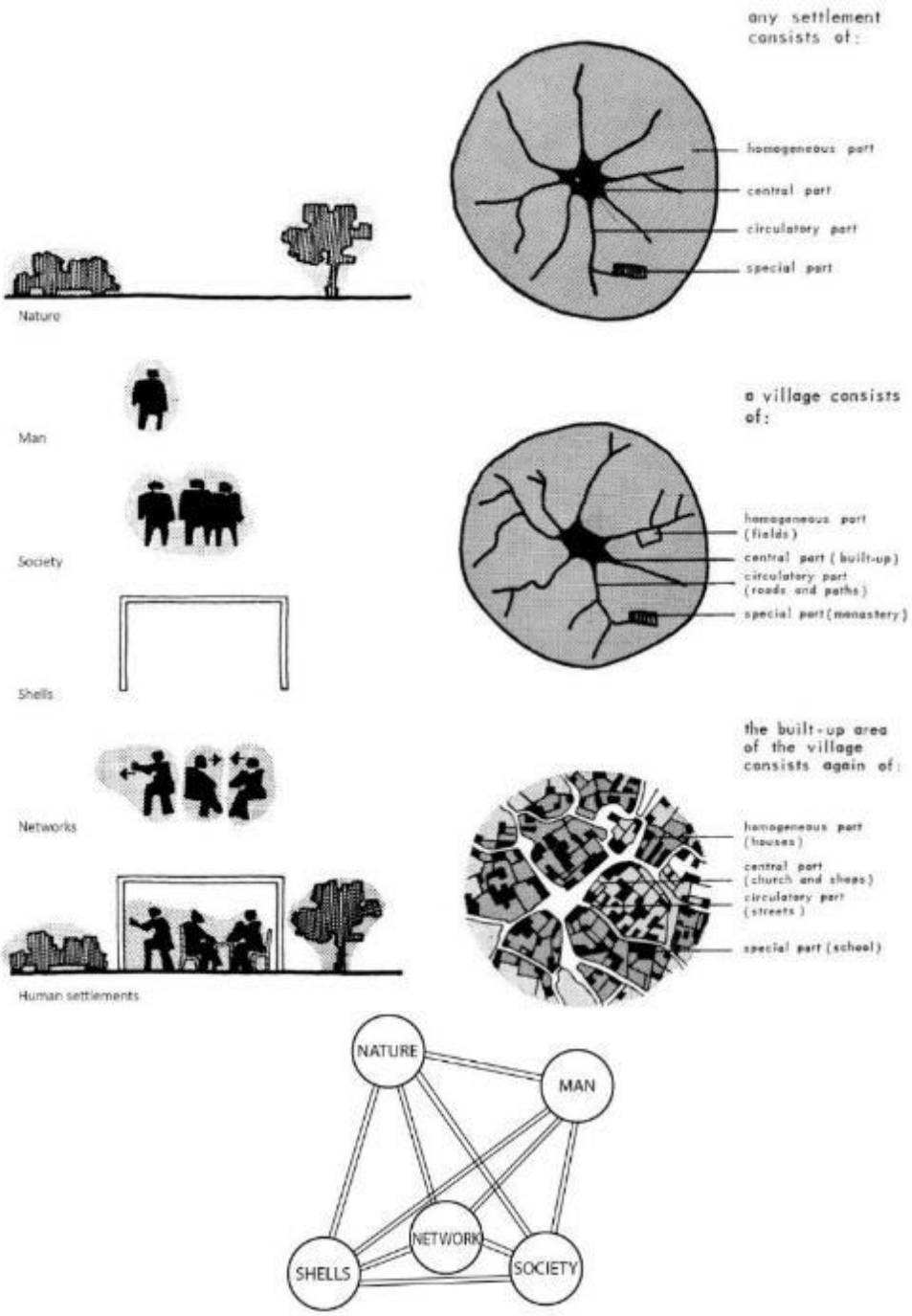


Figure 3.16: Schematic presentation of Five elements of settlement in four levels by Doxiadis (1968, p. 22 & 28).

The descriptive analysis of human settlements often investigates the settlement's anatomy. It is possible to distinguish settlements according to their degree of functional homogeneity, the form and number of functions of the central area, the circulatory patterns contained within the settlement, or some special function or purpose observed in the settlement. On a certain geographic scale, most human settlements contain a certain type of all these kinds.

3.6.3. The Anatomy of Settlements in Bengal

Khan (1996) examines the particularity of the settlement organization in the Bengal Delta, which currently constitutes the territory of Bangladesh. This is done by drawing comparisons with the settlement organisations that are prevalent in other parts of India. According to him, the Deltaic Bengal settlements were mostly "linear settlements" (with little demarcation where one village ends or where another begins), while in most of South Asia they were mostly "nucleated settlements" (with tight clusters of houses surrounded by rural fields). He cites Beverley, the first Superintendent of the Bengal Census in 1871, and W.W. Hunter, in support of the dispersed nature, in terms of physical location and landscape, of the Bengal settlements. It essentially described the development of settlements along communication routes, water or otherwise.

There is much documentary evidence regarding the antiquity of the term ‘Bengal’ or ‘Bangla’ to define the Bengal delta. Among some linguists, it is claimed that the ‘Bangla’ is originated from the term ‘Vanga’ and ‘*al*’ which is derived from the Tibetan term ‘*Bans*’ which connotes low lying ‘wet’ and ‘moist’ land protected by dam called ‘*al*’ (Das 1969; Paul 1939). According to this understanding, Bangladesh literally refers to a protected wetland. This seems more plausible since the Bengal delta is one of the largest wetlands in the world and initial settlers had to protect their flood plains by dykes or ‘*al*’. Separated by mountains, hills and forests, Bengal was a land of its own. Her regional isolation was further reinforced by the countless rivers that crisscrossed the deltaic regions. Water was acting as a critical resource for the evaluation of settlement. The relationship between the structure of human settlement and the source of the supply of water is complex. The Bengal Delta had plenty of virgin and marshland, perfect for rice farming and with adequate water to cultivate rice. The households were also self-sufficient concerning the supply of water (Khan 1996; Kosmbi 1956).

Akbar Ali Khan (1996) discussed the concept of ‘local village’, which developed spontaneously without always having a distinguishable territory and demarcations ‘in accordance with locally recognized boundaries’ (The Bengal Survey and Settlement Manual 1936, p. 307). They cannot be conveniently found on a map. The settlements are elusive and a mental entity. It is very complicated for an outsider to define a village. Only

the inhabitants have a strong understanding of what settlement is their own, it was mental mapping (Government of Bengal, 1936).

All settlements in a particular region may not be homogenous. Even within the same region, the structure of a few villages may apparently deviate from the common pattern (Wittfogel 1962). According to Martin (1921) the structure of rural settlement in Bengal, the houses are scattered and there is no regular and well-defined site but mentally related. Both historical and anthropological studies suggest that the village is more or less nucleated in the western region of Bengal (old Delta), while the settlement pattern in the eastern Bengal (new Delta) or Bangladesh is linear and dispersed (Mandlebaum 1990, p. 337). The perception that the term conjures up in the imagination is that of a close collection of houses belonging to cultivators and agricultural workers working on the field for two or three miles around. There was no central place for socialising in most of the settlements (Paul 1939). The centres of social life are temples or mosques (Thompson 1923). Hunter (1985) noted that the villages of Bengal vary greatly in various sections and houses and are found in straggling rows lining high river banks or in small clusters on mounds laboriously thrown up during the dry months when the water briefly disappears from 12 to 20 feet in height. According to Srinivas (1987) and Gait (1902), most of the settlements in the new delta were scattered and small initially and gradually consolidating to take nucleated pattern as seen in the old delta. The observations fit well with Tan and Li (2013) suggestions as well as Mowla's (2019b) concept of settlement evolution in the Bengal Delta.

3.6.4. Parametric Representation of Settlement in Bengal

Mowla's (2019b) parametric concept of settlement evolution (Figure 3.17) in this region ties together various concepts of settlement components and growth presented in the preceding sections and support the basic reconstructed settlement form (Figure 3.12), hence illustrates the understanding of the evolution of a settlement pattern along three major axes to enable explanation at various scales. This illustrative explanation of the growing relationship fits well with the descriptions of settlement growth in the Bengal Delta (Paul 1939; Wittfogal 1962; Emile Burns 1935), also as reconstructed from historic interpretations (Figure 3.12).

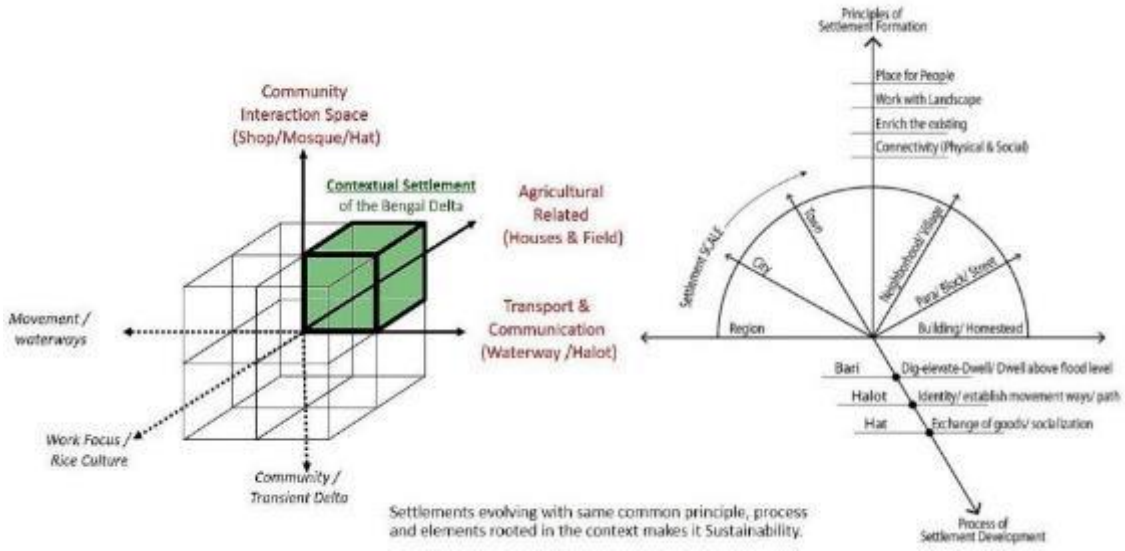


Figure 3.17: Parametric Representation of the growth pattern of a settlement ie. Community, Work and Movement at various levels and scales. (Source: Mowla, 1990 and 2019b)

Human settlement is an organized colony of human beings consisting of shelters in which they live, work or enjoy and the circulation system that facilitates their movement. (Trewartha et al. 1967). The settlement process thus inherently involves the aggregation of people and the distribution of land as their resource base. One settlement is distinguishable from that of the other by their constituent attributes and growth pattern (Sultana 1993). From the preceding review, the schematic layout of the historic settlement in the Bengal Delta (Figure 3.12) is found to be structurally explained well with the Doxiadis's principles (Figure 3.16) and Mowla's parametric evolution/growth concept (Figure 3.18), in terms of its constituent elements and its evolving process. This may therefore be taken jointly as the basis to facilitate understanding and explanation of the settlements in the Bengal Delta for further investigation, analysis and conclusion (Figure 3.18) in the current scenario of the historic delta context.

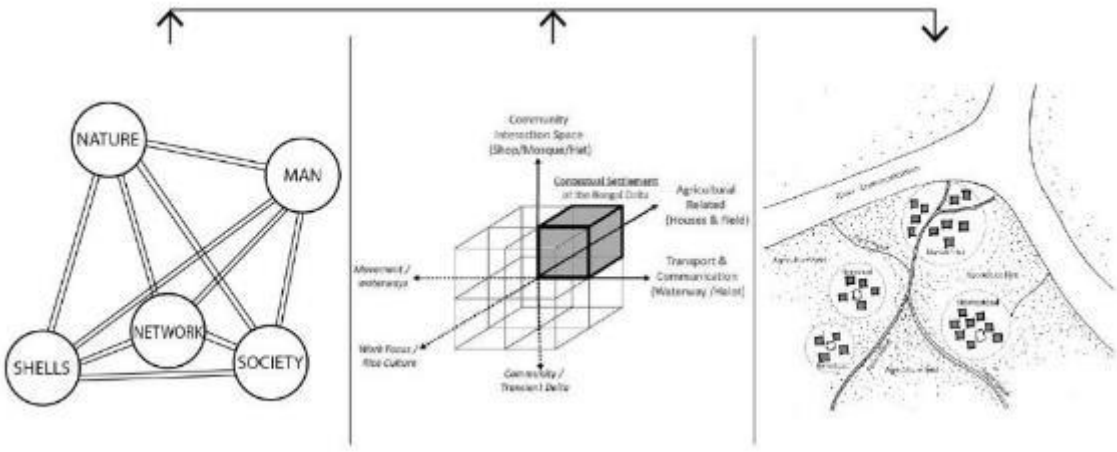


Figure 3.18: Explanation of the Bengal Delta Settlement pattern.

3.7. The Bengal Delta Settlement

Agricultural activities in low lying areas are dominated by rice farming during the wet season because of the persistent flooding or waterlogged conditions caused by monsoon rains that make it difficult to grow upland crops. The prevailing conditions in the Bengal Delta for thousands of years, trigger the settlement formation from the same common principles, processes and elements (Figure 3.17 and 3.18), which is also identified by Marx (Emile Burns, 1935).

Kamal (2006) has pointed out that from time immemorial, the Bengal basin region had a complex indigenous tradition of water management in their settlements for household use, flood protection and agricultural practices that worked with a natural surface and rain water and ecosystems to what the local people called living with water (জলের সাথে বসবাস) approach, this was more or less in place until the British colonial rule in Bengal (1757–1947). With the British colonial rule came their standard urbanisation of the landscape and water management, called the "road-rail and urban-industrial model" (Chapman and Rudra, 2007), from the mid-nineteenth century, this engineered urbanism began to show that it was a miss-match with local geo-climatic context. Failure to understand Bengal topography a greater emphasis on engineered construction works for controlling the nature in the Bengal settlements, over time, diminished the traditional Bengali knowledge/skill/strategies of living with the natural cycles of water in the flood plain. This necessitated to explore for the roots to identify the generic settlement pattern in the Bengal Delta. Even today Western-based/biased education/practice of experts/planners/designers is responsible for creating a knowledge gap between professionals and locals and could not overcome external colonial mindset.

3.7.1. Settlement Formation in Bengal

The settlement system includes two different, but connected components: the way land is broken into owners and how owners manage to arrange buildings on their land (Paul 1939, Wittfogal 1962). The size of the built-up area and the inter-house area thus decide the forms of settlement, but from the same common principles (Figure 3.17). Of course, agricultural land patterns are a core feature of landscapes and also significantly add to the character of a region (Kabir & Mowla, 2012; Mowla & Kabir, 2012). Various factors and circumstances are responsible for the different trends in the patterns of settlement (Mandal, 2001, p.187). These are:

a) Physical factors: the shape of landscape, altitude, environment and water availability.
b) Security and safety factors: defence against the wild animal, natural hazards (storm, flood) and manmade offence (thefts and robberies).
c) Cultural and traditional factors: societal structure, religion and caste etc.

However, ‘b’ and ‘c’ may be considered a by-product of ‘a’ i.e. the pattern evolves from physical geo-climatic factors.

There is an overall hierarchical pattern within rural settlements in Bangladesh. It begins with a *gram* (village), composed of several *Paras* (neighbourhoods). Social and ethnic influences often motivate this segmentation of a large settlement. Each Para again comprises of some *Bari* (homesteads) usually established on raised land, which in turn are comprised of several *Ghar* (dwelling units of individual households within an extended family) and ancillary buildings typically arranged around a courtyard (Figure 3.19) (Hasan, D.M., 1985, Rashid, 2013). Ponds are a ubiquitous feature of these settlement-providing water for domestic uses (Baqee 2011). Until recently, ponds were the main source of drinking water in rural Bangladesh before the beginning of large scale sinking of tube wells (Rasheed, 2008, p.204). The gradual elimination of ponds is transforming the earlier loose pattern into a more compact one. However, when the settlements are destroyed due to some geo-climatic (River erosion or Cyclonic surge) it bounces back to its original pattern, confirming Marx’s observations (Emile Burns 1935; Kosambi 1956) that there are some innate characters in the settlement that surfaces persistently and which the present study attempts to call ‘Generic’.

Figure 3.19: A typical courtyard in a Bangladeshi rural homestead (Source: Hasan, 1985).

3.7.2. Settlement Types in the Bengal Delta

The pattern of settlements in any area refers to the spatial relations between one dwelling to another, i.e. whether they are located close to each other or they are further apart and if the spacing of dwellings exhibits any geometric form (Hudson, 1969 quoted in Rasheed 2008, p.203). Rahman (1974) and Rashid (1991) identified three distinct variations of rural settlement in Bangladesh: Linear, Scattered or dispersed hamlet and Nucleated depending on topography and communication channel. On the other hand, Rasheed (2008) categorized rural settlements into two broad groups: clustered and dispersed where the linear pattern is a subtype of clustered settlement. Khan (1996) identified the linear and dispersed pattern of settlement that separated Bengal Delta from the other parts

of the South Asian sub-continent. Mowla (1990b, 1997b) however, identifies only one pattern i.e. scattered clusters, which takes different shapes depending on geo-climatic circumstances. A serially cohesive unit is a gram/para with basic components of shelter/homestead (Ghar/bari), work area/ agricultural field/ water bodies; trade and commerce (*hat/bazar*); and circulation path/*halot*) as described by Doxiadis (1968) (Figure 3.16 & 3.20).

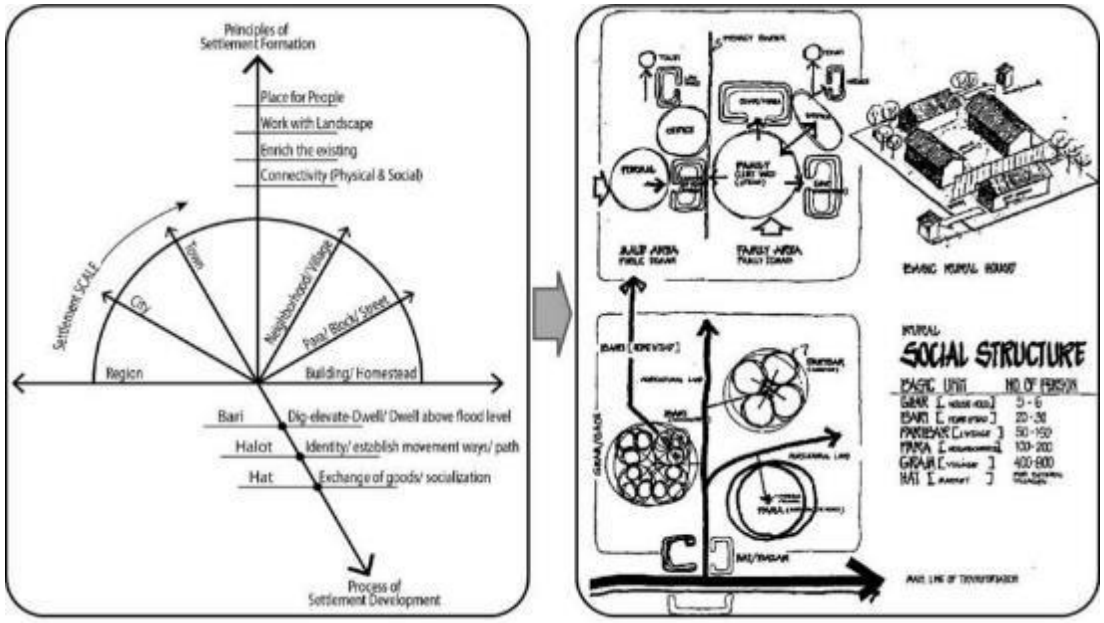


Figure 3.20: Transformation of social structure into physical form in the rural settlement context. (Source: Based on Mowla 1997b, 2019b)

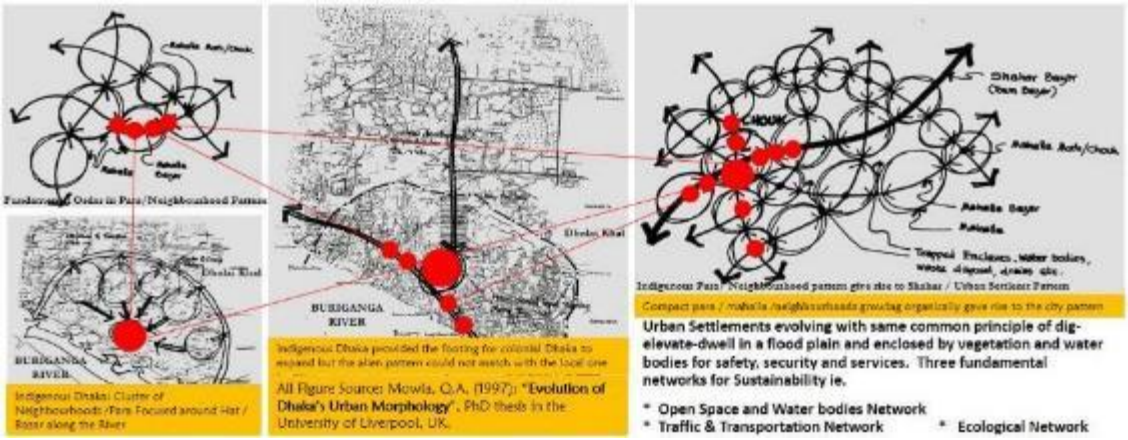


Figure 3.21: Basic Urban Pattern in this region has grown from the Context as can be evidenced in Bangladesh's primate city Dhaka (Source: Mowla, 2019b).

3.7.3. Scattered Cluster

Settlements take linear shape while evolving along rivers, roads or embankments (Khan 1996). It is clustered shape when evolving on a natural higher ground. Mowla's (1997b) concept, therefore, fits better with the settlement pattern of deltaic rice-culture settlement. Which also showed that settlement pattern is generated from the social structure of

livelihood (Paul 1939, Wittfogal 1962; Emile Burns 1935). The basic components are homesteads (Ghar, Bari, Paribar), Neighbourhoods/Para (*Morh*, Path) and community area (Hat/Bazar) (Figure 3.20) that consolidates in a tight urban context (Figure 3.22) and confirm with the principles of Doxiadis (1968).

3.7.4. Anthropogenic Aspects in the Bengal Delta

Bangladeshi settlements have been described as elusive (Bertocci 1996). They are not clustered around a central square, protected by defensive walls or united in the maintenance of joint irrigation works (Khan 1996). Instead, they consist of spread out homesteads and small hamlets (*para*) perched on slightly elevated plots that become islands when moderate floods occur. Like the lie of the land changes in the active delta, villagers are often forced to relocate and rebuild their houses but exactly in the same manner they were doing it for thousands of years, thus provoking to consider the settlements in Bengal Delta to attributed '**generic**'. Thus, nature's changing topography acts as a social and economic resource, and the mobile and fragmented nature of settlement has shaped politics (Paul 1939; Kosambi 1939; Emile Burns 1935). Bangladeshi settlements were not tightly organized communities under a single village head. Instead, they were governed by family and hamlet leaders' continuously changing relationships (Khan 1996; Wittfogal 1962). States seeking to control the population have always had to find ways of dealing with this flexible pattern of power-sharing adapted to life on the frontier of land and water (Schendel 2009; Emile Burns 1935).

3.7.5. Spatial Aspects

In the Bengal Delta, the rural cultures are tiny republics, Charles Metcalfe (1966) said. The towns are autonomous. By the self-contained villages, they will create everything important to lead their daily life by themselves. There is an organisation setting down the periphery of a village. The borderline of a village is generally imaginary or marked either by river, hill and ridge or by trees, which means the natural features mark the boundaries. Apart from agricultural fields, sometimes roads, fields allocate the borderline. According to Apastamba scripture, a village consists of houses starting from 2/3 to any number (Kher, 1973). Mowla (1990), however, identifies a village of about 80 to 150 households in a dense situation like Bangladesh although in the newly rising chars or coastal new settlements it may be much less (Figure 3.20). The smallest settlement in Bangladesh should have few homesteads (bari), their working grounds (agriculture fields or fishing grounds), a hat, and a circulation system between the components as described by Doxiadis (1968).

In general, there is no fixed population of a village. In Bangladesh, the names of the villages like TeGharia, PachGharia, Shatgharia, etc. show the layout of the household/population (Chowdhury, 1992). Small villages were known as "Gramak" and

"Para" was called "Patak" or Hamlet in English. The basic group of indigenous homesteads connected both physically and socially is the core settlement pattern which may be designated as '**generic**'. The boundaries of a generic settlement are not always administrative. Rather imaginary and social. Perhaps they may not be in the same as state-set administrative unit 'union'. There are some attributes for the generic indigenous settlements i.e. Sharing the same community space; Sharing the same source of water or resources; Sharing the same space for the exchange of goods and evolving and consolidating in a similar manner. These attributes and settings point to the earlier descriptions (Figure 3.18). Principles of Doxiadis (1968) and the concept of Mowla (1990) seems to hold good but would require further studies for their validation in the Bengal Delta context. The literature review also gives clue to the concept that the principles that prompt generation of indigenous (rural) settlements also holds true for the consolidated (urban) settlements of the particular region (Figure 3.17; 3.20 & 3.22), showing its nature to be '**Generic**'.

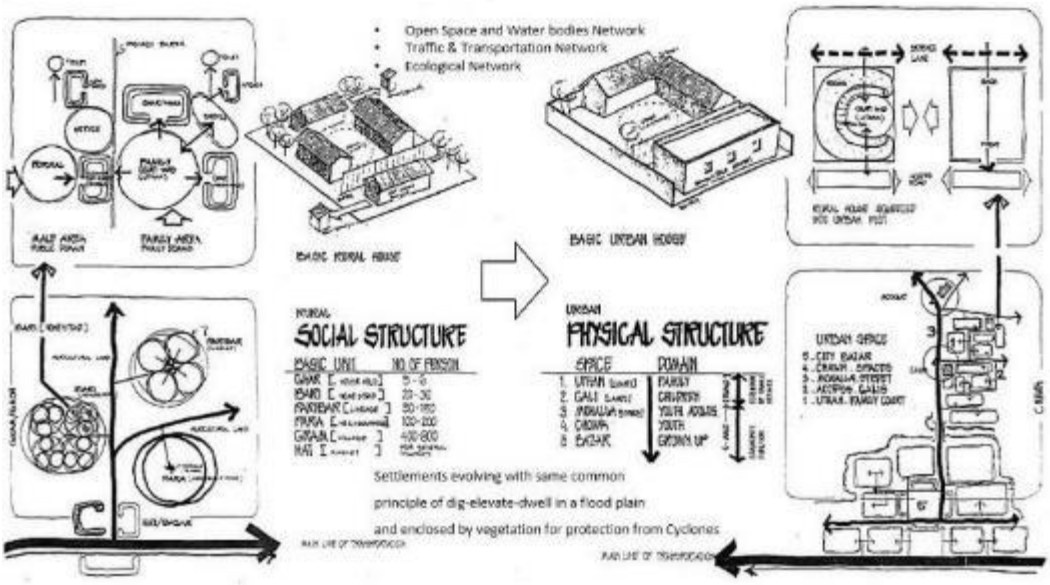


Figure 3.22: Settlements at various scale and levels, developing from the same common principles rooted in the context are sustainable (Source: Mowla, 1990b & 1997b)

3.8. Summary

The desktop study and literature review reveal that many studies were carried out on the evolution of settlements and that globally the settlements can be categorised into two broad groups, that is, hunters and gatherers settlements and settled agricultural settlements. Among the settled agricultural pattern, there is a sub-group of wet-rice culture and Bengal Delta settlement typology fits into that but with some unique attributes of 'rain-fed rice cultivation culture' in a 'warm-humid' tropical region. From the historic interpretations and phenomenological assumptions, it is observed that the production and processing of rice together with geo-climate has shaped the pattern and

morphology of settlement of this great tropical delta. Surplus product of the fertile delta gave rise to places (*haat*) for the exchange of goods in and around, thus earliest settlements and community life started in this region. The resultant settlement pattern may be specifically attributed to Bengal Delta. In rural areas, the same pattern is loose and in urban areas, it is compact that is it follows a single pattern of composition and growth. When it consolidates further in compact situations, it is manifested in ribbon-like shopping streets with residential quarters behind.

The literature review shows that there are studies on essential components of a viable settlement and also there are studies on the evolution of settlements in various phenomenological contexts. No studies were however found that discusses or explains the "generic pattern" of a settlement that has evolved in the Bengal delta context. The studies on settlement's core component and their evolution pattern were therefore taken as the basis for the identification of a generic settlement pattern and the Bengal Delta is taken as the case context.

The literature review and theoretical analysis show that independently developed Doxiadis global principles of settlement components and Mowla's concepts of settlement growth in the Bengal delta are relevant to explain the research and the reconstructed pattern from historic interpretations, is thereby bracketed to form the basis for further investigation and to fill up the gaps.

In a nut-shell, theoretically bracketed settlement components, growth Pattern and their character is further scrutinized in the subsequent chapters the analogous historic delta context to show that they are tied up in a single thread and to validate that the settlement pattern in the Bengal Delta is generic in nature.

Chapter 4

PHENOMENON INFLUENCING THE CASE STUDY SETTLEMENT PATTERN

4.1. Evolution of Settlement in the Study Areas

From history and literature review, it is assumed that the active delta coastline provides the perfect historical context for the evolution of settlements (Section 1.4.2). The evolution process that is identified from the literature and the field studies would be compared to filter out the root pattern. (adjacent to the Bay of Bengal, Fig. 2.5) which represent different zones, stages and characteristics of the Bengal Delta, and which are still active and in a formative stage. It was identified that the settlements in the Bengal Delta were shaped by the geo-climatic conditions and rice-culture needs.

A total of 22 settlements have been studied and evaluated with respect to many attributes identified in the previous sections (Figure 2.1 & 2.5).

To find the basic pattern, the evaluation process of the case study settlements in three different contexts are categorized as follows:

a) Establishment of new settlement from scratch
b) Migration due to river erosion
c) New settlement in an old village
d) Addition or Expansion within existing settlement
e) Cluster Extension of an existing settlement

4.1.1. Establishment of New Settlement from Scratch

Generally, a new settlement starts with a new homestead on the agricultural land. When the families grow big and difficult for them to accommodate themselves, some members start a new home. For this, they have a choice to select agricultural land which is mostly low lying. It is found during the field survey that new homesteads are laid beside the existing road or communication route preferably near the old homestead.

As the families grow, an extended family is split into nuclear families. In due course, the nuclear family again grows big. The beginning of a settlement starts with the digging of a pond to get the necessary earth to raise the *viti* above flood level and suitable for building a house. The location of the pond thus created is generally located at the front side of the plot. This gives a distance from the approach road to the built-forms and ensures the necessary privacy of the house. If the land is tight, they build their house just

after the pond. But if the land is plenty, the house is built on an external *uthan*. Thus, a pond, a *uthan* and a single room built-form are the core elements of a homestead or the nucleus of the settlement. The pond and *uthan* (courtyard) have multiple uses in a homestead. The homestead is surrounded by thick vegetation to protect it from storms and also to meet the household needs (Fig. 4.3).

Historically, leaves and reeds were widely used materials in this delta. Though not comfortable, now people consider CI sheet as a durable and low maintenance material for their built-forms besides being a status symbol in the rural areas of Bangladesh. People always tend to construct their first house with CI sheet. It is widely found during the field survey that people build the main house with CI sheet and for supporting functions by locally found organic materials. The most neglected house section is the toilet. At first, they are made by some very temporary materials like PVC sheet or bamboo surface and later gradually they are improved. This shows the priority and resilience of the people of Bengal. The living shelter is the priority, functions of households are performed outdoors and built gradually as the affordability increases.

Figure 4.1: A newly settled homesteads in Char Montaj.

Figure 4.2: Settlement in a primary stage in Char Elahi of Zone-B. (Reconstructed 3D)

Figure 4.3: Homesteads are being developed transforming the paddy fields in Char Elahi of Zone-B.

When one family is settled in a new piece of land. Other families are attracted to lands beside this newly settled house. This ensures security and community living. In such a way a cluster of homesteads gradually comes up and a new settlement emerges. Two (9%) cases of this stage of the settlement formation are found among the 22 case study settlements. The cases are seen in Char Montaz of Zone-A, where a large extended family has decided to develop a new nuclear family and build their own house in a separate piece of land that was used for agriculture before.

In Char Elahi of Zone-B, it is found that homesteads are built from scratches on agricultural land. The settlement is at a primary stage of its development. New homesteads are being developed transforming the paddy fields into *viti*. As observed before, this might connect the total village physically, at some point in time.

4.1.2. Migration Due to River Erosion

Deltas are dynamic landforms that have been the foci of agriculture and aqua-culture evolved by humans for millennia (Ericson et al, 2005). Riverbank Erosion is an endemic and recurrent natural hazard in Bangladesh. The erosion that destroys standing crops, farmland and homestead land affects millions of people every year. About 5% of Bangladesh's entire floodplain is estimated to be directly affected by erosion every year (Rahman and Gain, 2020).

The immediate effect of riverbank erosion is human displacement. The displaced people generally move to the neighbouring areas, but it is not uncommon to migrate to distant places. In erosion-prone regions, most families have experienced a lifetime of displacement. In this repetitive cycle, it may go up to 10 times or even more. Erosion-induced displacement involves the displacement of entire families. This results in temporary-type settlements. This phenomenon is going on for ages (Rahman, 2010).

Displaced people find new lands to settle their homestead. It is found by the field survey that, they might take the lease of a piece of land to resettle and 36% (4 out of the 11) cases found where the leased land is situated within one-kilometre distance from the bank. The possible reasons found by the key informants' interviews (KII) include:

- The rent of the land near the river is relatively low and affordable.
- It is easy to move with an old house to a short distance. Long-distance migration needs huge expense and hassle.
- Many people have land to cultivate beside the river or in their old erosion effected settlement or in the char. They have to maintain proximity with them to monitor and harvest crops. Lives and living are tied together with their agricultural land.

It is found from field survey that people move their house to a safer location that is reasonably far from the river but within their financial and physical reach. These kinds of people maintain their distinct society. They set up the mosque, *eid-gah*, madrasa and club of their own. They also have community leaders for their own (*matobbor*) and community guardians. Thus, migrant people started their settlement on new land with their old houses. They settle and resettle generally with the age-old system of dig-elevate-dwells to start with, as described in section 4.1.1.

Figure 4.4: Settlement of river eroded victims at Char Jogbondhu of Zone-B. (Reconstructed 3D)

Figure 4.5: Settlement of river erosion victims at Char Jinntola of Zone-A

In three different survey zones, 11 villages are resettled by the refugees of river erosion. Char Jogbondhu of Zone-B is an example of settlement by such migrant people where river erosion refugees of the mighty Meghna resettled their houses in a new land seven years ago and replicated their own generic settlement. The village is only 500 metres away from the river edge. At that time the river was 4 kilometres away from the location.

The settlement of Jinntola of Zone-A is only fourteen years old. People from different river eroded area shifted to this newly raised landmass beside the Bishkhali river was still not suitable for agriculture. Thus gradually over time, people from the different area formed a new community and settlement for themselves. Similar situations are found in Padma Char, Char Kajal, Char Montaj and Char Kukrimukri of Zone-A and Char Jogbondhu, Char Mehar and Char Elahi of Zone-B. In the year 1985, 38 river erosion families migrated from different locations and started living on the newly raised landmass called Padma Char at the western point of Patharghata Upazila of Barguna district. After 34 years of its beginning, it is now a settlement of more than 300 homesteads.

In the Char Kajal of Zone-A, the settlement on Balar char started around 50 years back. River eroded people from different villages of the mainland of Bhola district started living here and started cultivating. There were only fifteen homesteads resettled and are growing. They are clustered in the middle of largely agricultural land. The pattern of growth is similar to other case studies.

Figure 4.6: Padma Char.

Figure 4.7: Settlement in a growing stage on Balar Char at Char Kajal of Zone-A.

Figure 4.8: Settlement on the generic village of Balar Char at Char Kajal of Zone-A. (Reconstructed 3D)

Figure 4.9: Settlement in the beginning stage on Char Montaj of Zone-A.

The settlement on Char Kajal started around 35 years ago. Like Char Kajal, the river eroded people from different villages of the mainland of Bhola district started living here and started agriculture. Settlements in Char Kukrimukri of Zone-A also began more than 60 years ago by erosion refugees of the Bhola district. In all the cases, they resettled and started agriculture simultaneously. People moved here with their extended family and at once multiple homesteads started coming up. Different families started to build homesteads in different locations of the island. Each of them follows the same pattern of development and are growing as in the previous settlement described in section 4.1.1.

The settlements of Char Mehar of Zone-B was settled more than 20 years ago by the river erosion victim of Alexander union of the same district. They were originally farmers but due to losing agriculture fields by the river erosion many of them had to adapt to new livelihood means of service or business. A narrow pathway divided the settlement into two villages. One side is occupied by the old inhabitants and another side is developed by the re-settlers, the victim of river erosion. The land was an agricultural field before and now these are being transferred into homesteads. They are maintaining a separate society and build their own mosque in the village. In Figure-4.13, the western part of the pathway is the core village developed by the river eroded refugees.

Figure 4.10: Settlement in Char Kukrimukri of Zone-A.

Figure 4.11: Settlement in Char Kukrimukri of Zone-A. (Reconstructed 3D)

Figure 4.12: Settlement in Char Kukrimukri of Zone-A sharing *uthan* with multiple families.

Figure 4.13: Settlement in Char Mehar of Zone-B. (Reconstructed 3D)

In Char Elahi of Zone-B, the settlement cluster is a compact one consisting of 12 homesteads. It has been settled 15 years ago by some river eroded people from distant locations. The cluster has developed on a raised mound created by earth taken from few ponds. The settlement is still at a growing stage and being developed on a raised land surrounded by large paddy fields. Often the vegetation growing around indicates the age of the settlement.

Figure 4.14: Settlement in Char Elahi of Zone-B.

Figure 4.15: A newly built house in the settlement of Char Elahi of Zone-B.

4.1.3. New Settlement in an Old Village

In the coastal areas of Bengal Delta natural disaster is very common. People need to adapt their living to such calamities. Bengal Delta has a long tradition of resilience and natural disaster adaptation. Adaptation helps improve the capacity of civilization to deal with climate change across time scales, from short-term (e.g. seasonal to annual) to long-term (e.g. decades to centuries). The people of Bengal Delta are doing it quite well (Rashid, 2018).

It happens that, the total village is washed out by the cyclonic surge, and they need to build their homesteads from scratches. One such devastating cyclone was Sidr in 2007, which struck the Bangladesh coast on 15 November 2007 and moved inland, damaging infrastructure, causing multiple casualties, disrupting economic activity and impacting social conditions, especially in the poorer areas of the region (Rashid, 2018).

Figure 4.16: A reconstructed image of a homestead in the settlement of Char Duani of Zone-A.

Figure 4.17: Settlement of Char Duani along with the embankment.

After the complete washout of settlement, only the land of the settlements remains in its place, a few trees and some part of built form made with permanent materials remained as an identity of the old homesteads. People started building their new houses on their old land. Char Duani of Zone-A is an example of such a case found during the field

survey. This village is in Patharghata Upazila. Patharghata was most affected by cyclone Sidr. Char Duani is a village exposed to the Haringhata river. During Sidr, the total village was washed away. When people start rebuilding settlements, they started building with variations of materials but in the same old spatial pattern.

It is obvious that when people face some natural disaster they developed their own way of response for the adaptation of such incidence. And this way, a whole settlement is rebuilt as their old settlement and the new one takes a new shape with the old pattern.

4.1.4. Addition or Expansion within Existing Settlement

It is a normal phenomenon of housing that, it has some generic growth and development pattern (Turner, 1976). New homesteads are developed adjacent to the existing homestead. It is found in 4 cases from the field survey that, people lease out their land adjacent to homestead and sometimes they just permit migrant people to build houses not for money but also for some other social obligations and benefits. This type of process is called '*uthuli'* or '*utkara'*.

Figure 4.18: A homestead of *Utkara* living in Char Kajal – An age-old transient pattern.

'Uthuli' and '*Utkara'* are two Bangla words that mean landless and partially dependent people who had been allowed to erect their houses rent-free on the land of others (KII, 2018). Landlords, in exchange for a plot, claim agricultural labour, household service, and political support (Rashid, 2013). *'Uthuli'*/'*Utkara'* is a word mainly used in the coastal area of Bangladesh is a matter of disgrace. '*Utkara'* means people who live on other's land. They have to build their houses on their own. They use the owner's land for living based on verbal commitment and understanding. People who built their houses on the basis of '*utkara'* gives agricultural labour to the tenants. They have to look after the agriculture fields and live stocks and process the outcomes for the tenants. For example, they have to look after the live stocks and supply the milk to the landowner. It is their duty for the tenants to take care of all trees and their fruits also. (Observed in Char Folkan, Char Alexander and Char Kajal of the survey areas).

Migrant people build their houses in such a way to get benefits of facilities of social spaces like mosques, ponds etc. there are 4 cases of such examples found during the field survey. In Char Folkan of Zone-B, people started moving their house to space between old buildings and on the agricultural field adjacent to the existing homestead. The studied settlement is more than 60 years old but recently people from the river edge are relocating their settlement inside the village. The village is being congested with its newly migrating inhabitants. There are two different communities in a single village. The old community is stronger and dominant over the new one. Even they have a sort of social segregation like separate mosques for their societies. Though the settlement of Char Alexander of Zone-B is more than 30 years old, there are river erosion refugees, settling here during the last few years.

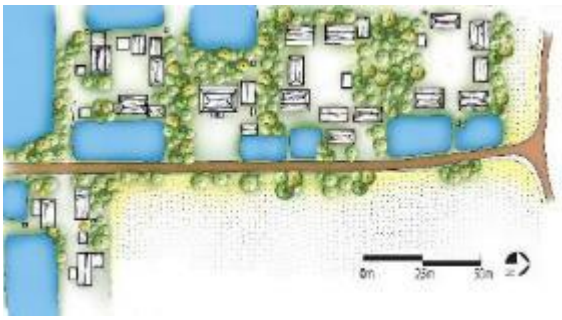


Figure 4.19: Settlement of Char Folkan.

Figure 4.20: Migrant people built their houses in the old village of Char Folkan.

Figure 4.21: Migrant people built their houses on the extension of an existing homestead.

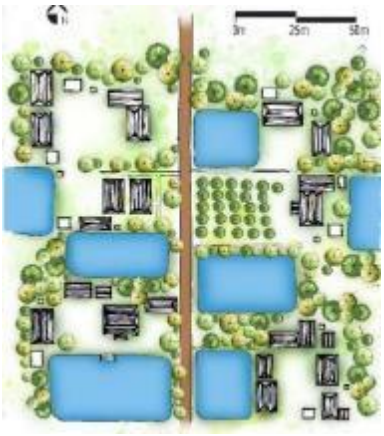


Figure 4.22: Partial settlement of Char Alexander.

Due to the land scarcity, the vacant spaces in between houses and *uthans* are filled up to erect new houses. In such a situation, the settlement is gradually densified. The hundred years old settlement of Kumira Jele Para of Zone-C is very compact in nature and it is receiving more compactness day by day due to a shortage of land. There are narrow pathways and houses are settled on both sides. Each house is an individual homestead and the narrow pathway act as a breathing and socializing space for the inhabitants.

Figure 4.23: Dense settlement of Kumira Jele Para.

4.1.5. Cluster Extension of an Existing Settlement

Settlements are being surrounded by agricultural fields. When the settlement portions are saturated with homesteads, people start developing their new homesteads on an adjacent agricultural field. In this process, another group of homesteads grow with a separate cluster as an extended part of the older village. This spontaneous cluster is known by the same name as the old village.

This type of extension is found in the four settlements of Zone-C. This coastal area is situated alongside a band of agricultural land. A one kilometre wide land alongside the bay is used for agriculture. Being exposed to the coast, this area was not considered suitable for settlement. The government established an embankment along the coastal edge a few years back, protecting the agricultural land from the tide and people started expanding their settlement on the agricultural land in a similar pattern as before. Some scattered clusters make a pattern that looks like moving out from the old village towards the coast.

The surveyed village of Saidpur of Zone-C is an expansion of a more than hundred years old settlement. The extension started taking place around 50 years ago along an organically developed pathway towards the sea. Scattered clusters were developed with individual homesteads and over time the clusters are growing big with new homesteads due to household expansion. The inhabitants are farmer and their house forms and their organization have the reflection of rice culture-based development identified in earlier sections. Muradpur and Nadalia of Zone-C are other examples of the extended village.

Figure 4.24: Cluster extension of Dakkhin Moghadia which is an expansion of the old village.

Figure 4.25: Clusters of Saidpur which is an expansion of the old village.

Figure 4.26: Clusters of Muradpur which is an expansion of the old village.

4.2. Selection of Location for the Settlements

Location, site and context are three important aspects in the study of human settlement. Location of a settlement indicates the place where an object or settlement is situated viz. concerning latitude, longitude, distance, direction and ecological conditions. A site, on the other hand, indicates the land on which the houses and other structures of the settlement are built with relation to surroundings. In other words, a site associated with precise features of terrain on which the settlement began and over which it spread. There is a close relationship between the site and the physical environment of the area. Selection of settlement site is always governed by attractive and restrictive forces of physical setting i. e. geology, relief, drainage, soil, climate and available materials. The situation is related to physical and cultural conditions over a much wider area (Mandal 1989). Chisholm (1962) indicates the importance of arable land, grazing land, water, building material and fuel as site determining factors. Preston E. James (1969) expresses it “as we identify things geographically because they deal with location”. For Paul Vidal de-la Blache (1926) the whole of geography lay in the idea of ‘Place’ and geographically, the

first question of all is ‘where’? Dickinson (1949), Brunhes (1952) and Peter Haggett (1965) also discussed the location and siting of settlements, confirming the field observations.

Chisholm (1962), suggested the classification of settlements and the description of the relationship between man and his physical environment. The settlement systems can be seen as adjustments to a combination of physical, biological and cultural parameters so that it can be anticipated that a shift in one or more inputs can lead to a system re-adjustment (Barker,1969).

The combined effect of physical, economic and cultural factors or sometimes one or two factors assist in determining a settlement’s location. The classification of settlements according to the suitability of site/location assists in highlighting the various kinds of geographical advantages which lead to the origin and growth of settlements (Cain, 1963). Physical features and landscape play an important role. Arable land, grazing land, a perennial source of water, adequate transportation and communication link, building material and fuel are site determining factors. Hydrographic features are the most important factor in determining the site. Riverbank, river confluence, stream, river island, coastal and wells are significant pull factors in the sites selection.

4.2.1. Factors Affecting Location and Siting of Settlements in the Study Areas

The site and built-form of settlements are interwoven in a very complex phenomenon and sometimes the site is taken as an important criterion for the classification of settlements. There are three sets of factors that affect the sites and location of the settlements (Rashid, 2020). These factors are:

1) Physical factors
2) Socio-cultural factors
3) Economic factors

The relative importance of one or the combined effect decides the location of a settlement. Several physical, socio-cultural and economic factors are important in the settling process and have been identified from the field survey. All factors contributing together makes a settlement vibrant.

4.2.2. Physical Factors for Selection of Settlement Location

It is observed that the physical setting plays an important role in the location and site of settlements. Physical factors that attract human to select a site for settlement include water body (for transportation routes, water for drinking and farming), flat land (for easy to build houses), fertile soil (for crops), forests (for timber and housing) etc settlements (Rashid, 2020). Broadly, the physical factors can be distributed into two categories:

a) Sites related to Hydrographic features
b) Sites related to Physiographic features

19 settlements of the three case study zones are found sited based on the physical factors among them 8 (42%) are related to hydrographic and 11 (58%) are related to physiographic features.

4.2.2.1. Sites related to hydrographic features

Hydrographic features are the most important determinants for the selection of the location of a settlement in Bangladesh (Khan, 1996; Rashid, 2020). Water is a very important resource that attracts settlement. Water is mostly used for irrigation and transportation purpose or used for domestic purposes, pastoral operations etc. Considering different types of hydrographic features, the surveyed settlements may be categorized into the following three different types.

i. River side settlement
ii. Confluence side settlement
iii. Canal side settlement

In flood-affected areas and marshy lands, settlements are not found near the river side or in the marshy areas. In such situations, the settlements are situated at a drier point. In river valleys, high terrace plains are selected for the location of settlements, while in marshy areas the parts which are raised over the sea level and remain dry for most periods of the year are favoured for the location of settlements. In the relatively higher terrain, the traditional dig-elevate-dwell process of settlement starts.

River side settlement

River side attracts human agglomeration, likewise, several settlements in the study region are located on the river bank. Kumira Jele Para of Zone-C was developed adjacent to the Coast and river towards the coast. As the village is for fishermen this location is suitable for this settlement. Char Duani of Zone-A is situated alongside the Haringhata river of Patharghata Upazila of Barguna district. Clusters dot along the river.

Char Duani of Zone-A

Kumira Jele Para of Zone-C

Figure 4.27: River side settlement.

Confluence side settlement

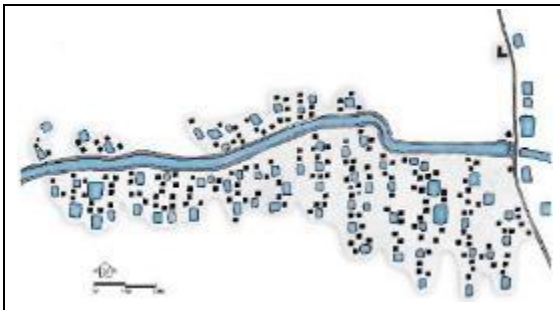
The river confluence sides have been attracting people since historical times as good navigation junctions. Jinntola and Padma Char of Zone is an example of such settlements.

Jinntola of Zone-A

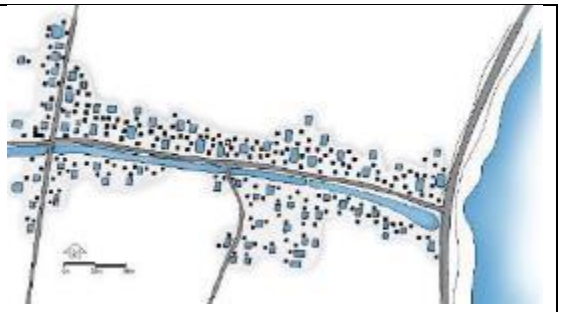
Padma Char of Zone-A

Figure 4.28: Confluence side settlement.

Canal side settlement

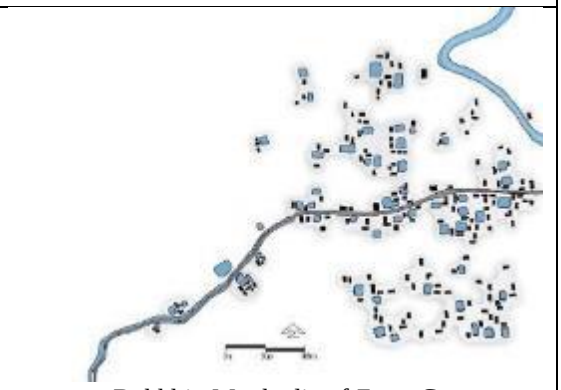


Koralia of Zone-A

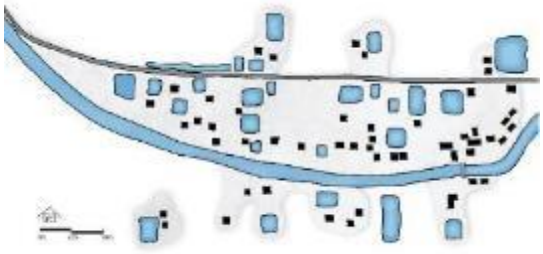


Jaliaghata of Zone-A

Muradpur of Zone-C



Dakkhin Moghadia of Zone-C



Char Kukrimukri- Babuganj of Zone-A

Figure 4.29: Canal side settlement.

A canal provides a permanent source of water for agriculture and domestic use. Naturally, the people who have their lands near the canal side prefer to stay on the canal side. Five settlements have come up in three zones of the study area along the canal. Canal side settlements are the modem time development and attract people due to water and transportation facilities. Canals are developed for irrigation purposes and to develop a road/embankment, which is a relatively recent phenomenon ie. About 100 years. Since the canals are not much developed in the study region, the canal side settlements are fewer in the study region.

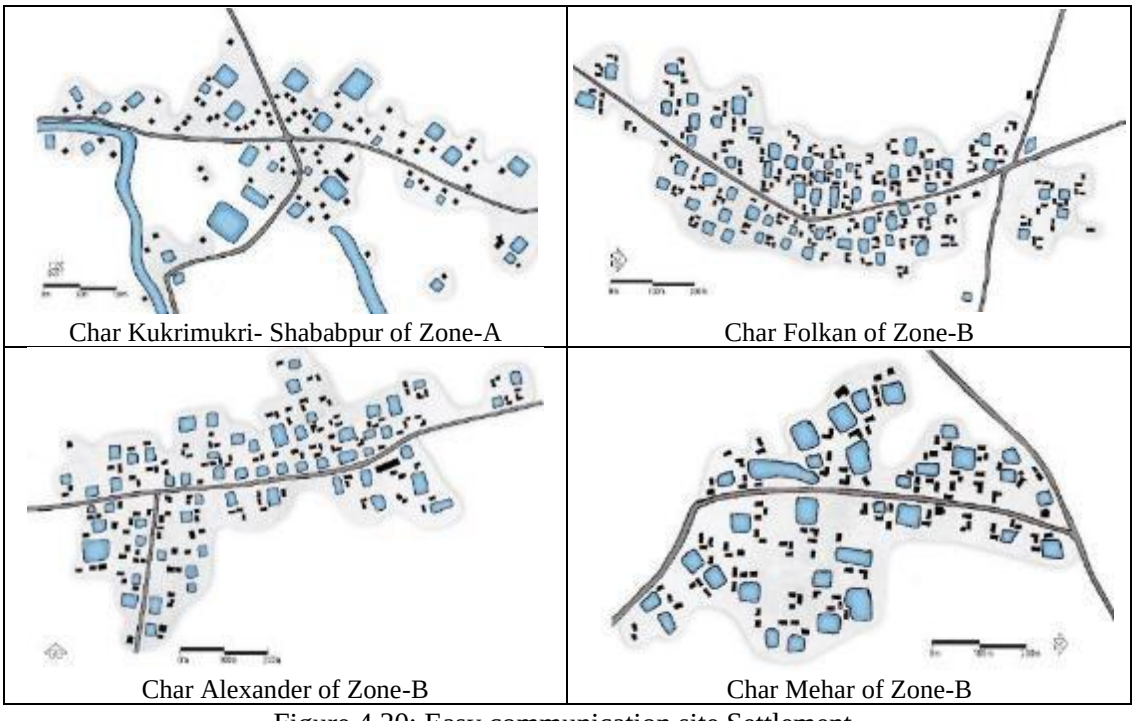
4.2.2.2. Sites related to physiographic features

After discussing the various rural settlements sites related to water bodies, it is appropriate to understand the definitive role of the physical features in siting the settlements. Among the physical factors determining or controlling the sites of settlements, the suitability of available land for occupancy and cultivation besides easy accessibility is important.

In deciding the site and location of rural settlements, the physiography of the region plays a significant role. In the spatial distribution of rural settlements, some settlements are found to be centrally located and often visited by the people of surrounding villages triggering the growth of markets and other central places at such points. The centrality helps them grow into hat/bazar/ganj and a township. Followings are the consideration of physiographic features that determine the location of settlements.

i. Easy communication site
ii. Fertile land site
iii. Flood protected site

Easy communication site



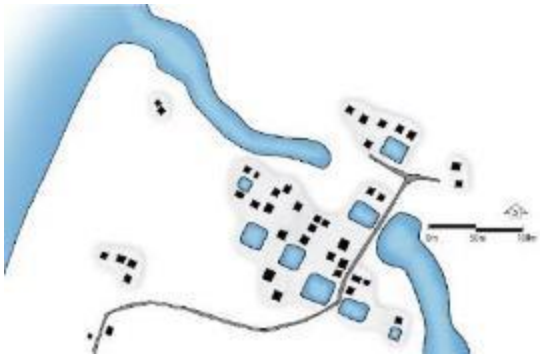
Char Kukrimukri- Shababpur of Zone-A | Char Folkan of Zone-B

Char Alexander of Zone-B | Char Mehar of Zone-B

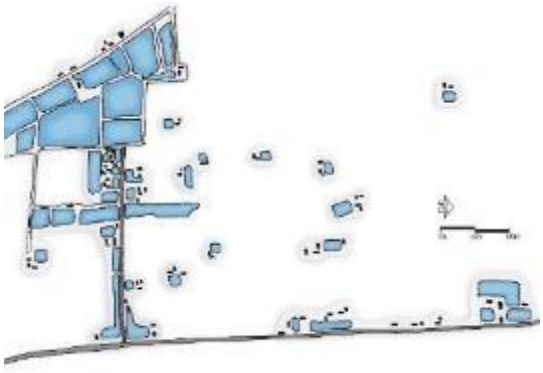
Figure 4.30: Easy communication site Settlement.

The proximity of the transportation route (road/canal/river) is an important element that attracts the location of the settlement. A significant aspect that affects settlement patterns is the need to connect with other places for trade and commerce purposes. Four settlements in the study area can be classified as 'Road side' settlements. Roads are the contemporary form of historic deltaic water channels, but unlike natural channels, man-made roads are developed with a shorter distance and economic criterions.

Fertile land site



Char Kajal -Balar Char of Zone-A



Char Elahi (para-2) of Zone-B

Saidpur of Zone-C

Nadalia- Bashbaria of Zone-C

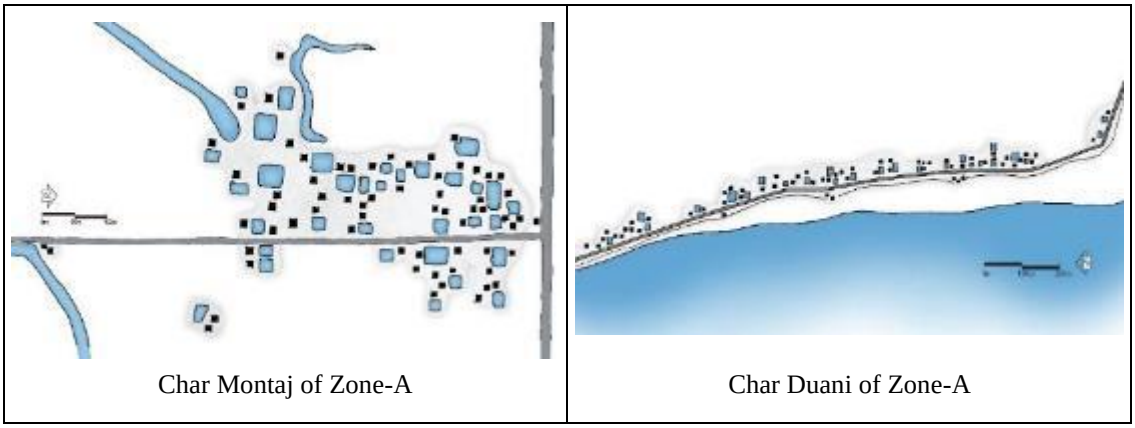
Boalia-Bashbaria of Zone-C

Figure 4.31: Fertile land site Settlement.

Agriculture is identified as a predominant factor influencing various nomadic groups to settle permanently in a place across the world (Abrams, 1964). Where the soil is fertile, land available for cultivation is sufficient, water is enough for irrigation, all these factors have encouraged the growth of settlements in a location. As agriculture is the major mean of living, people always give preference to locate their settlement where fertile land is available, obviously along with some water source.

Flood protected site

In Bengal Delta, people try to select a site that is protected from the flood. In the field survey, it is found that the government makes embankments to protect the land from floods and tidal surges. People then are attracted to such protected land for their settlement. Char Montaj and Char Duani of Zone-A are examples of such locations. Settlements of Zone-B have also come up inside the embankment alongside the coast.



Char Montaj of Zone-A | Char Duani of Zone-A

Figure 4.32: Flood protected site settlement.

4.2.3. Socio-cultural Factors for Selection of Settlement Location

Cultural and social factors have always played an important role in giving locational importance to certain points. Sometimes a site of an ancient temple or a tomb of a historical man or historical monument act as a reference point to attract people to settle. When some river eroded people relocate their homestead to a new location, other people from the same community try to help build their houses in the same location. People feel comfortable among their kins and previous community though the location is completely new. Balar Char of Char Kajal and Char Jogobondhu are examples of these types of settlements.

4.2.4. Economic Factors for Selection of Settlement Location

Economically valuable sites are preferable by people. When the question of purchase comes, cost becomes an important consideration. Land adjacent to homestead or *viti* land has a higher price than agricultural land. Roadside land is expansive than the land which has no connection with the communication route. The price of the old landmass is higher than the newly raised char. This is why people relocate their houses and start building their new settlements in a newly raised char. Padma Char is an example of this kind of settlement. In the year 1985, 38 families start living on this newly raised landmass in the western point of Patharghata Upazila of Barguna district. As the soil was not suitable for cultivation, people got the chance to buy the land at a cheap price. That cheap price attracted people to select the location for their settlement. Char Elahi (para-1) of Zone-B is another example of having a similar factor.

Again, land near the eroding riverbank has a relatively low price as they are in vulnerable condition though affordable. Many people have land to cultivate besides the river or in their old village which is erosion affected or in the char. They have to keep those under surveillance to harvest a maximum crop. So, they prefer those lands for their settlement (section 4.1.2). Char Jogbondhu is an example of a location with these factors. It is situated beside the river Meghna at Ramgati Upazila of Lakshmipur district. This is an old landmass but eroding at a higher rate. The village is only 500 metres far from the river edge at present.

Affordability plays a significant role to select the location for settlement. The Kumira Jele Para settlement, which is hundreds of years old, is very compact in nature and receives more compactness day by day due to land scarcity.

4.2.5. Summary

It is observed during the field survey that the settlers are attracted by the sites which provide them sufficient safety, connectivity, affordability and cultivable land. Location and sites of settlements are also influenced by environmental factors, water supply, drainage, soil availability of agricultural land.

Since the region is dominated by agricultural landscape more than one-third (42%) of the settlements of the study region are attracted by hydrographic features such as river banks and canals. 50% of settlements are sited based on different physiographic features. Besides this, some important nodal points/roadside settlements and miscellaneous religious sites are also observed in the study region. In whatever manner the site is selected for settlement or wherever the settlement starts, it begins with the dig-elevate-dwell process with basic shelter, courtyard and pond which gradually expands and densifies (Table: 4.1).

Table 4.1: Factors for selection of settlement with examples from the field survey.

<table>
<tr><td rowspan="6">Physical factors for selection of settlement location</td><td rowspan="3">Sites related to Hydrographic features</td><td>River Side Settlement</td><td>Char Duani,
Kumira Jele Para</td><td rowspan="9">Begins with Dig-elevate-dwell process with basic Shelter-courtyard-pond which consolidates in a generic settlement.</td></tr>
<tr><td>Confluence Side Settlement</td><td>Jinntola</td></tr>
<tr><td>Canal Side Settlement</td><td>Koralia,
Jaliaghata,
Char Kukrimukri -Babuganj,
Dakkhin Moghadia,
Muradpur</td></tr>
<tr><td rowspan="3">Sites related to Physiographic features</td><td>Easy communication site</td><td>Char Kukrimukri – Shababpur,
Char Folkan,
Char Alexander,
Char Mehar</td></tr>
<tr><td>Fertile land site</td><td>Char Kajal -Balar Char
Char Elahi (para-2),
Saidpur,
Nadalia- Bashbaria,
Boalia-Bashbaria,</td></tr>
<tr><td>Flood protected site</td><td>Char Montaj,
Char Duani</td></tr>
<tr><td colspan="2" rowspan="2">Socio-cultural factors for selection of settlement location</td><td>Land ownership factors</td><td>Char Kukrimukri - Boyatibari</td></tr>
<tr><td>Community factors</td><td>Kumira Jele Para
Char Jogbondhu
Char Kajal -Balar Char</td></tr>
<tr><td colspan="3">Economic factors for selection of settlement location</td><td>Char Jogbondhu
Padma Char
Char Elahi (para-1)
Kumira Jele para</td></tr>
</table>

4.3. Pattern Generation in the Case Study Settlements

Settlement layout also changes according to their culture, inhabitants, population density and so on (Section 3.5.4). This section mainly focuses on the dominant factors behind the evolution of settlement.

4.3.1. Shape by Geo-Climatic Impacts

Some geo-climatic factors have impacts on the evolution of settlement. Some of those factors are listed below:

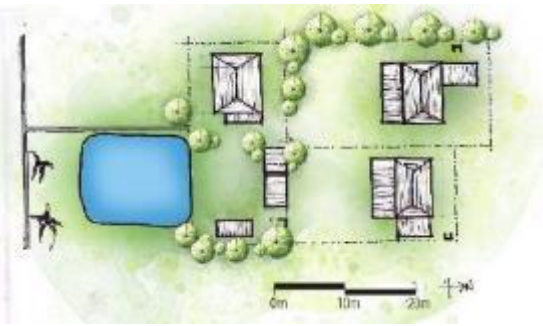
a) Shape of land
b) External geographic forces
c) Vernacularism/ Traditional Ecological Knowledge (TEK)

4.3.1.1. Shape of land

The shape of settlements is usually influenced by the surrounding landscape. The shape of land mainly depends on the shape of arable land. The pieces of agricultural land are

orthogonal in shape in this delta because of the plain land. A big chunk of land is divided throughout generations. This division of land in orthogonal geometry is easier to measure plough and irrigate widely practised in this region. In the plain land, whole villages have evolved over time by raising land and such settlements are still being established.

As agricultural lands transformed into land for building homesteads, the shape of homesteads become orthogonal in shape. Settlements are the combination of multiple homesteads. The settlements thus become orthogonal in shape.



Homesteads at Char Kajal

Homesteads at Char Montaj

Homesteads at Char Kukrimukri

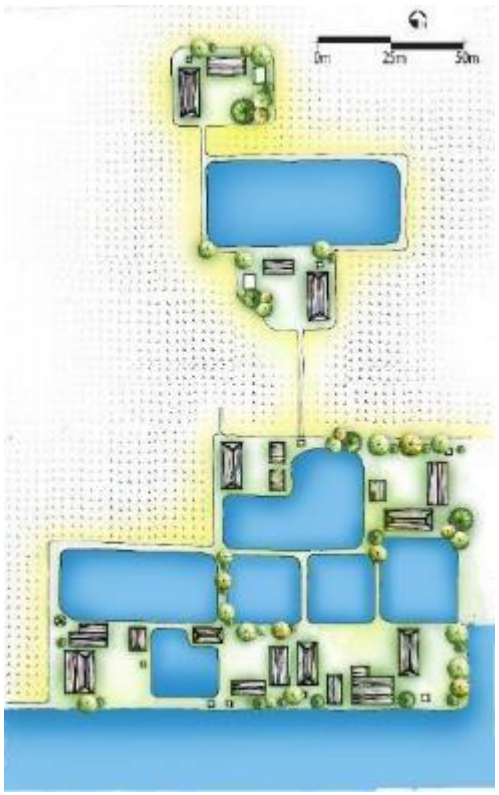
Homesteads at Koralia

Figure 4.33: Some homesteads with the orthogonal distribution of land in Zone-A.

When one homestead is placed after another homestead they form a cluster (Figure 4.33). In most of the cases of the field survey, this property line is demarcated by a little level difference at the ground or some trees. Ponds or other water bodies sometimes act as the edge of two homesteads. These ponds are also rectangular in shape.

The plots are rectangular, the ponds are rectangular and above all the built forms are also rectangular in shape. These orthogonal objects unitedly make the shape of the settlement a geometric one in the plain land of this delta.

Settlement at Char Kajal of Zone-A



Settlement at Char Elahi of Zone-B

Figure 4.34: Geometric shape of settlement.

4.3.1.2. External geographic forces

There are some micro and macro level geographic forces that play significant roles to generate the shape of a settlement, such as water bodies, rivers or canals, roads etc. They can be natural or manmade. Rivers and canals are natural forces. Roads are not natural, but it has the similar geometric character of river or canal. They are also linear in nature and gives the settlement a liner shape. They act as a driving force to determine the direction of growth of the settlement. Homesteads develop perpendicular to the canal or road. And as settlements are a combination of multiple homesteads the shape of the settlements generically receives a linear shape along with the direction of a canal or a road.

The road or canal acts as a communication route. Often, it is only a single street with homesteads on either side of the road.

Settlement at Char Kukrimukri of Zone-A

Settlement at Char Mehar of Zone-B

Figure 4.35: Settlements pattern generated by the Canal and road.

4.3.1.3. Vernacularism/ Traditional Ecological Knowledge (TEK)

Vernacularism is the Traditional Ecological Knowledge (TEK) which is characterised by the use of local materials and knowledge, without the supervision of professional architects. Vernacular designs, whether residential houses or designed for other purposes are usually basic and functional. Vernacular architecture is characterized by a built environment dependent on local needs; described by the availability of appropriate indigenous materials to its specific region, and represents traditional practices. Vernacularism is distinguished by its dependency on needs, building materials and customs that are unique to its specific area. It is a type of architecture indigenous to a particular time and place and not replicated from elsewhere (Oliver, 1997).

Vernacular impact help shape the settlements by using the experience, expertise and traditions passed down from generation to generation living and working in them. They are also well suited to the geological landscape, the land-inhabiting culture, and the sense of their climate (Islam, 2003). This may be termed as the generic pattern.

Thermal comfort is of principal importance and is expressed in the preference within the homestead compound of light, lightweight building materials, natural colours and substantial shaded areas. As the seasons and nature, trees, water, and topographical characteristics are of special significance. In building shape, alignment and arrangement by symmetry, concepts of nature and divinity are reflected (Baqee, 2011). The desire to synthesize the constructed world with that of the natural in Khona maxims manifests intrinsic respect for existence. (Figure 3.14).

The role of light and airflow is always given importance while building houses and this can be realised by a maxim given below:

দক্ষিণদ্বারী ঘরের রাজা, পূর্বদ্বারী তার প্রজা; পশ্চিমদ্বারীর মুখে ছাই, উত্তরদ্বারীর খাজনা নাই। (সুবলচন্দ্র মিত্র, বাংলা প্রবাদ ও প্রবচন, পৃ: ৮১)	*South-faced house is the King* *Eastern face is his Subject;* *Ashes on the Western face,* *Northern-facing house needs no Tax.*

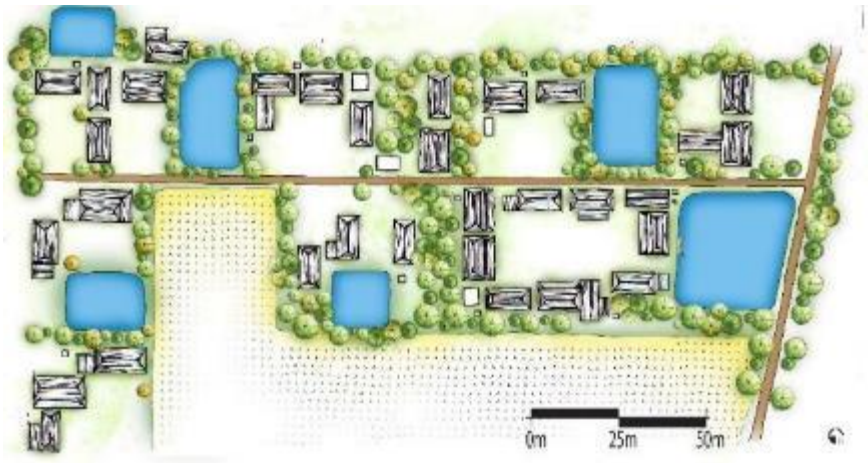
Traditionally, the orientation of houses followed the vernacular practice which in turn plays a role in the overall pattern of the settlement. Inside the homestead, each building is normally rectangular in form and usually single-storeyed, but often double-storeyed buildings are also. In agricultural communities, the additional purpose of grain storage is also combined with accommodation. To take advantage of the prevailing wind direction to get relief from humidity, the main dwelling unit, typically the first to be built is usually angled to face south. However, the pattern of arrangement around the rectangular courtyard involves compromise in the direction of the other buildings eventually implemented, but following a sequence, i.e. North-South and East-West respectively. Utilities and services into West or North.

House forms are of different sizes and shapes, though rectangular is the common shape in Zone-B and C and square is common in Zone-A. Rooms are constructed around a rectangular or square courtyard. A primary dwelling unit and ancillary facilities, such as kitchens, granaries and cowsheds, begin with each homestead. The sleeping unit is the main dwelling with primary importance. At the beginning stage, the ancillary structures are constructed of semi-permanent materials. This is relocated to peripheral locations as the family expands, and more housing units are built around the courtyard. Therefore, a homestead consists of multiple small structures built consecutively.

Settlement of Boalia of Zone-C

Figure 4.36: Orientation of houses is the determinant of the settlement pattern.

There is a tradition of having inner and outer courtyards, depending on the economic status and circumstances. In some cases during the field survey, the courtyard was observed to be shared by multiple homesteads. The built forms around a courtyard (*uthan*) and a pond is the common unit feature of a homestead. Two homesteads are separated by the pond or rows of trees. Trees are planted to provide shade and to serve as a source of vegetables, fruit and timber along the property edge of the homestead, besides protecting the homestead from strong wind.



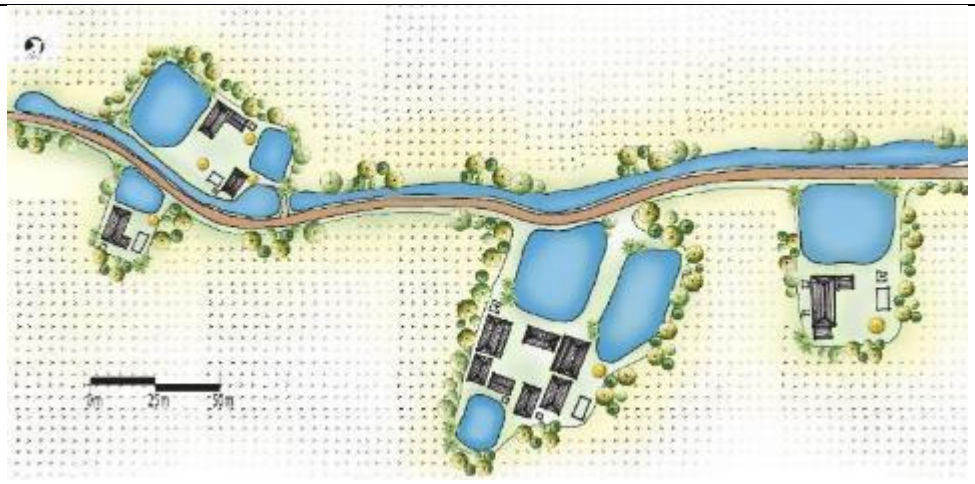
Settlement at Char Jogbondhu of Zone-B.

Figure 4.37: Rooms are constructed around a courtyard.

Houses are mainly made of locally available materials, such as bamboo, straw, grass, jute stick, *Golpata*, Palm leaves, mud and CI sheets (introduced during the colonial period). Houses have fencing to ensure the privacy of the household. The shapes are mainly oblong. A small veranda with bamboo or wood support is very common.

Like any other settlement in this delta, a pond and *uthan* is an important generic part of the villages of the surveyed regions. Earth is piled into a mound on which a homestead

is established by the excavation of ponds. More earth will be added over time to extend the mound. The settlement gradually expands in this manner. Homesteads clustered are usually nucleated around ponds. Sometimes ponds are positioned in front of the built forms. Commonly, the pond is located at the entrance of the homesteads. After the pond, there is a courtyard *(uthan)* around which the built-forms are placed. A pond in the backyard is a feature of many large homesteads. So, a homestead consisting of ponds, a *uthan*, built forms and trees collectively act as the unit or module of the whole settlement. Multiplication of this generic unit gives rise to the pattern of a settlement.



Settlement at Dakkhin Moghadia of Zone-C

Figure 4.38: Settlement Pattern begins with pond.

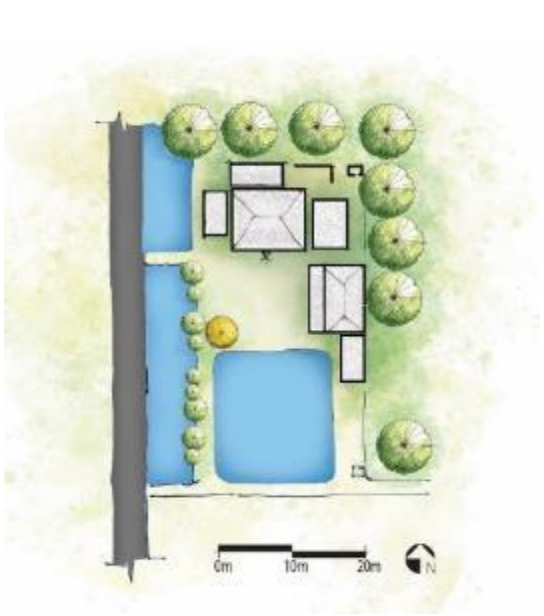
4.3.2. Pattern by Anthropological Impacts

There are sub-sets of anthropological factors that affect the evolution of settlement type.

a) Population
b) Livelihood
c) Religion and taboo

4.3.2.1. Population

The settlement form has a significant relationship with the size of the population of the settlements. Typical areas have a low population density and small settlements which gradually increase. A house often commences with an individual household and gradually develops into a settlement of several intergenerational households belonging to an extended family. The settlement gradually expands in a dispersed pattern over time. At first, they built additional houses in the same homesteads when the family expanded. To make the plinth earth is collected from the existing pond. The second and third houses may not maintain the climatically needed orientation. When the homestead has no space left to build more houses the *viti* area is expanded if the land is available. If there is not plenty of land people has to build their new house in a separate land. This land is also a part of the settlement. Thus settlement consolidates with the population growth.



Homestead at Char Duani

Settlement at Char Kukrimukri

Figure 4.39: Multiple houses for extended families in the same homestead.

4.3.2.2. Livelihood

Settlement refers to a place where people concentrate and settle down for living and production purposes. Inhabitants profession and income are the important factors that determine the shape of their settlement. The rural population has no choice but to continue adhering to indigenous materials, methods and designs not only because of their low prices but also because of their relevance, familiarity and acceptability, due to the very low incomes, employment and poverty that prevail in Bangladesh. People's dwellings embody and express cultural and lifestyle preferences. House or dwelling is a concept of both activities like living and residing and a place or structure to contain such activities. Domestic activities depend on social and cultural denominations and produce a spatial pattern at the household level (Gomes, 2014). However, this study focuses on the settlement level. It is found during the field survey that, settlements are generated according to human activities such as agricultural production and processing. On a broad scale, some livelihoods play roles in the shaping of the settlement. Such as- i) Agricultural labours, ii) Farmers, iii) Farmers with other sources of income, iv) Rich Farmers and Landowners v) Fishermen

The interview on the household level during the field survey, indicate the occupations of the participants in five basic types. And it is found that 64% of them are engaged in agriculture, 8% of them are in fishing, 5% of them are involved in private or government services and 11% do business (Figure 4.40).

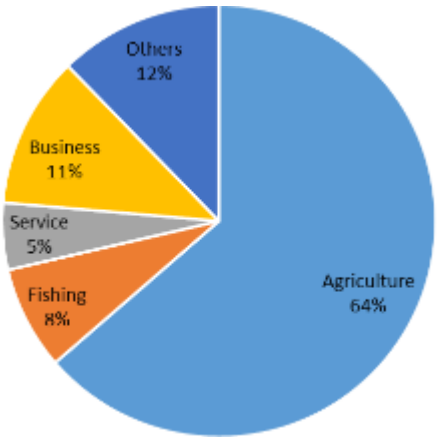


Figure 4.40: Percentage of the means of livelihood of the people in the survey area.

Figure 4.41: Permanent structure that reflects the richness of inhabitants.

In the case study settlements, apart from labours, farmers and landlords, some people provide basic services. Professionals who are found in case study villages are barbers, village teachers, etc. Some of them are self-employed and some of them are employed in public schools or institutions. There are also some households where the household head stays abroad and sends foreign remittance to his family. In the cases, people reach a level of richness that is reflected in their houses. For example, in Boalia of Zone-C, two-storeyed buildings are also found in the village. There is a saying in Bangla:

বাণিজ্যে বসতি লক্ষ্মী। "*Settlement is being blessed with business.*"

4.3.2.3. Religion and taboo

As discussed in Section 4.3.1 i.e. Khona's maxims besides social maxims, some certain religious rituals and taboos are manifested spatially (Mowla, 1999a). Almost anywhere in the world, it is found that there are certain settlement-related taboos and traditions. There are taboos and traditions in rural areas regarding homesteads (Baqee, 2011). 'Taboo' represents activities surrounding houses that the owner may not believe but accepts as social norms (e.g. not planting palm trees or tamarind trees near the house) (Mowla, 1999a). 'Beliefs', on the other hand, means a representation of such homestead practices that the owner not only believes but also ensures in practice (e.g. the toilets are not rendered facing east-west in Muslim owned homesteads; similarly, Tulsi and China Roses' trees are planted in the courtyard in Hindu owned homesteads in rural areas)

(Baqee, 2011; Rashid, 2013). In the field survey area, 95% population found Muslim and 5% found Hindu. In the layout and arrangement of the constructed forms, the impact of Muslim and Hindu beliefs and lifestyles is evident.

4.4. Summary

Most settlements in Bangladesh are considered as growing organically responding to the context. In contrast, 'planned' settlements are transplantations. That is the settlements that have evolved here in most cases, are a result of reacting to the possibilities provided and constraints imposed by local topography, climate, natural characteristics and local resource availability. Over time, this deltaic land has evolved in type and character. Settlement patterns are also subject to change because of increased human influence and interference with the environment. However, in reaction to the local natural context and features, there is consistency and certain traditional characteristics have evolved.

By the phenomenological investigation, there are two major phenomena found regarding the establishment of settlements. Due to the geo-hydrological condition of the delta, people need to raise their land from the flood level. For this, they dig ponds and collect earth to prepare the viti. This can be named as the geo-hydrological phenomena of settlement. The raised lands are seen like islands in the vast agricultural fields during the monsoon. To protect the homesteads from the wind, heavy rainfall and other deltaic climatic devastation, people introduced vegetation around their homestead. Orientation and shape of the built forms and materials also determined considering these. This is the geo-climatic phenomenon of settlements.

The amorphous shape uniformly distributed across the landscape, consisting of clustered or scattered settlements on raised land. On the high ground along natural levees of rivers or water channels, the elongated form is built. Nevertheless, there is dispersion both inside and in proximity to elongated settlements, which is influenced by the surrounding level and land configuration. Where high land is not available, the earth is dug up from the excavation of channels or wetlands to construct a mound on which to build a homestead. More earth can be added over time to expand the mound. The settlement steadily grows in this manner. Settlements thus built on raised mounds are scattered across the low-lying landscape in many places, and practically become islands during the rainy season. The dispersion allows individual homesteads to have privacy and protection, as households connected by kin usually settle on each mound and form homesteads. Homesteads and the settlement are surrounded by paddy fields.

Settlement pattern and organization is influenced by the culture in which it develops, however, its basic principles confirms the bracket for this study which is the logic of Doxiadis in terms of settlement components and Mowla's suggestions of a unique settlement pattern for Bangladesh. Societal norms and the geo-climatic context are manifested spatially in the settlement pattern.

Chapter 5

PATTERN IN THE CASE STUDY SETTLEMENTS

5.1. Pattern of Different Settlements

The literature review in Chapter-3 identified and bracketed a basic pattern and spatial distribution of basic components of settlements in the Bengal Delta. From the literature review, the portion of Bangladesh coastline that provides the geo-climatic context of thousands of years back has been selected to (refer to Table 2.1, Figure 2.1 and 2.5) verify the evolving settlement pattern in the Delta vis-à-vis nature of the bracketed universal pattern. As mentioned earlier, a total of 22 settlements have been studied and compared with many attributes. Observations from studied settlements are described in this chapter.

5.1.1. Case Study Settlements in Zone-A

Zone-A comprises three administrative districts- Borguna, Patuakhali and Bhola. This is the western Zone starting from the East of the largest mangrove forest and ends at the grand estuarine of the river Meghna. This part of the landmass is formed by the Ganga-Padma basin of the Bengal delta. Ten settlements are taken for the case study and Key Informants Interview (KII) from this Zone (Refer Table 2.4 and Figure 2.5).

A1- Jinntola

Jinntola is situated in the eastern portion of Patharghata Upazila in the Barguna district. The settlement is only fourteen years old. River erosion refugees moved to this new landmass beside the Bishkhali river. As this newly raised char river is not yet suitable for habitation or agriculture, the survey shows that about 70% of the inhabitants have switched to fishing in the river for their livelihood.

The river and the southern canal create the boundaries of the settlement of 60 homesteads. 70% of the homestead has its own pond and the settlement has a community pond as well. Both the homestead pond and community pond are used as the source of household water. Being saline, other natural sources (e.g. the river, canal and underground water) are not suitable for drinking and domestic use. 90% of the household are dependent on harvested rainwater for drinking. According to the kye informant Jobeda Begum, the underground water was drinkable when people have inhabited this land 14 years ago. But after the cyclone Sidr in 2007 the underground water has become saline.

60% of people have arable land at a long distance that is not suitable for cultivation. The settlement has a mosque and a couple of shops as the community interaction space.

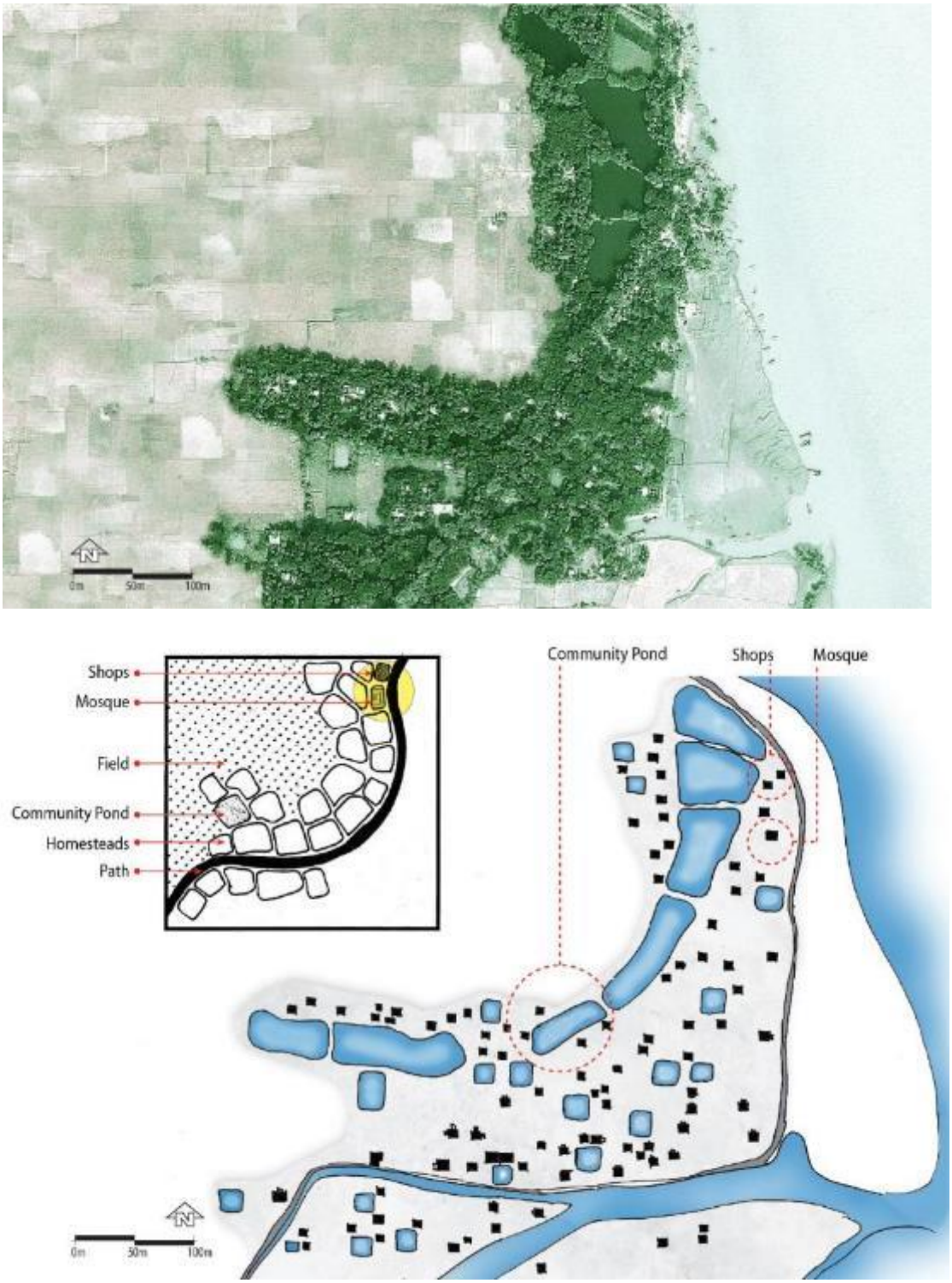


Figure 5.1: Settlement of Jinntola at Zone-A

A2- Padma Char

According to the key informant Asaduzzaman, in the year 1985, 38 families started living in this char at the western point of Patharghata Upazila of Barguna district. After 34 years, now this is a settlement of more than 300 homesteads. The landmass contains a wide band of mangrove forests and swamps in between the settlement and the coast,

which work as a shield during the tropical cyclone and also make the land fertile for agriculture. The total settlement has grown along a curvilinear path that starts and ends on a bigger road. There is a bazar and a school at the intersection of the road and canal near the river. The settlement has a school, a mosque, the bazar and a club for community socialization.

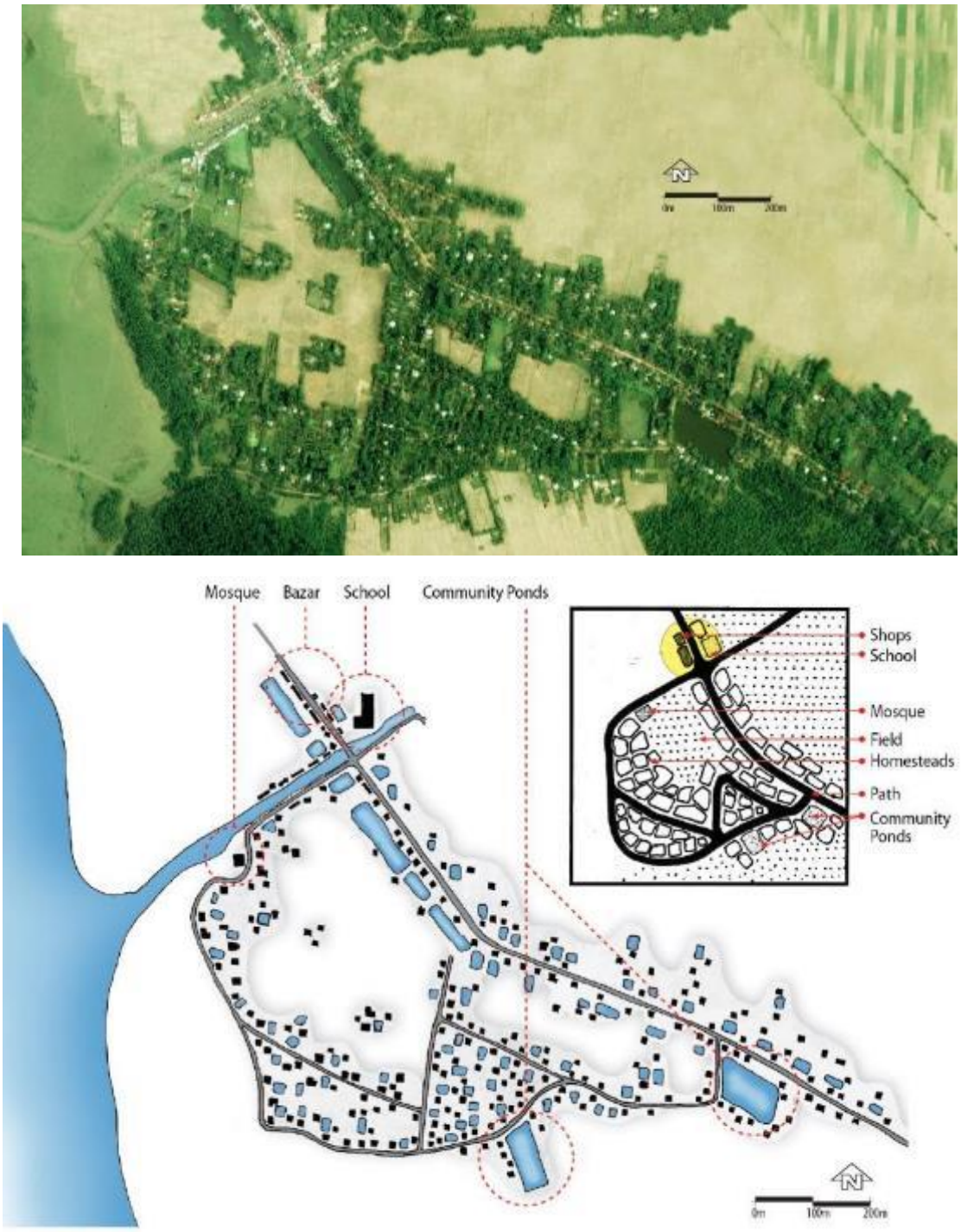


Figure 5.2: Settlement of Padma Char at Zone-A

More than 50% of the settled inhabitants are agricultural, 30% have moved to fishing due to inadequate agricultural land. Over time, adjacent land of mangrove forest became

ready for agriculture, in the process, this char has now become cultivable and people are cultivating paddy. 60% of the homestead has its own pond and the settlement has two community ponds as well. Both the homestead pond and community ponds are used as the source of household water. All the people are dependent on potable harvested rainwater as the main source of drinking water. 70% of people of this settlement have their own cultivable land.

A3- Koralia

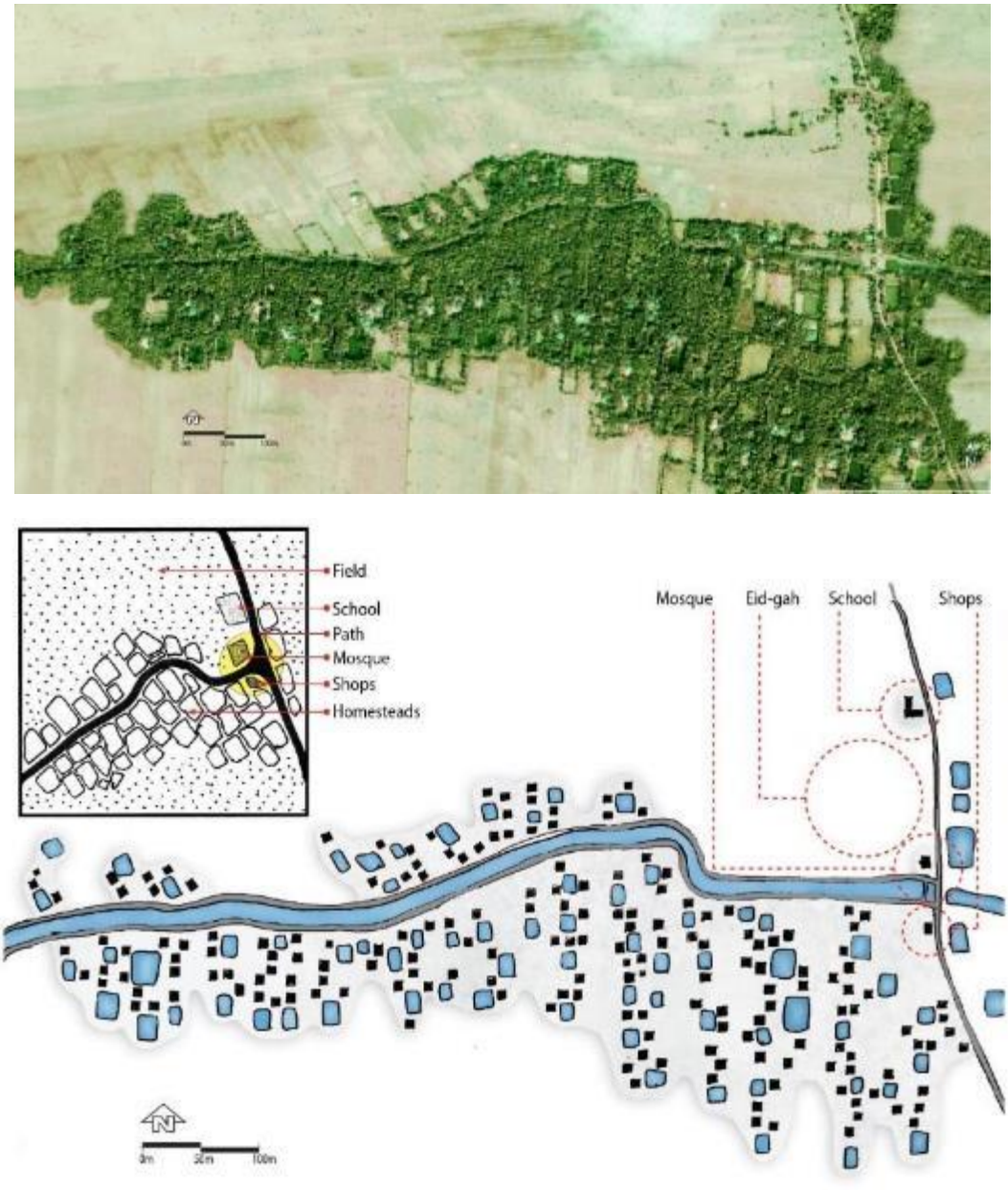


Figure 5.3: Settlement of Koralia at Zone-A.

Koralia is an old settlement of Patharghata Upazila of Barguna district. This settlement is not directly exposed to the coast. A central canal demarcates the settlement. According

to the key informant Abdur Razzak, this settlement was originated 60 years back inside the agriculture field alongside the canal. At present, there are 34 homesteads in the north portion. As the canal and road work as a reference line, the settlement expands in a linear direction terminating at a bigger road where some social common functions such as a school, a mosque and eid gah and few shops are concentrated.

90% of homesteads have their own pond, among them, 30% have two ponds within their homestead. The source of household water is the pond for 70% household but 100% household is dependent on tubewell for drinking water among them 80% is dependent on shared tubewell rest 20% have their own tubewell. This is basically a rice cultivating settlement where 70% of the total population has arable land. Recently a shift to the commercial sunflower and some other food grain cultivation is observed.

A4- Char Duani

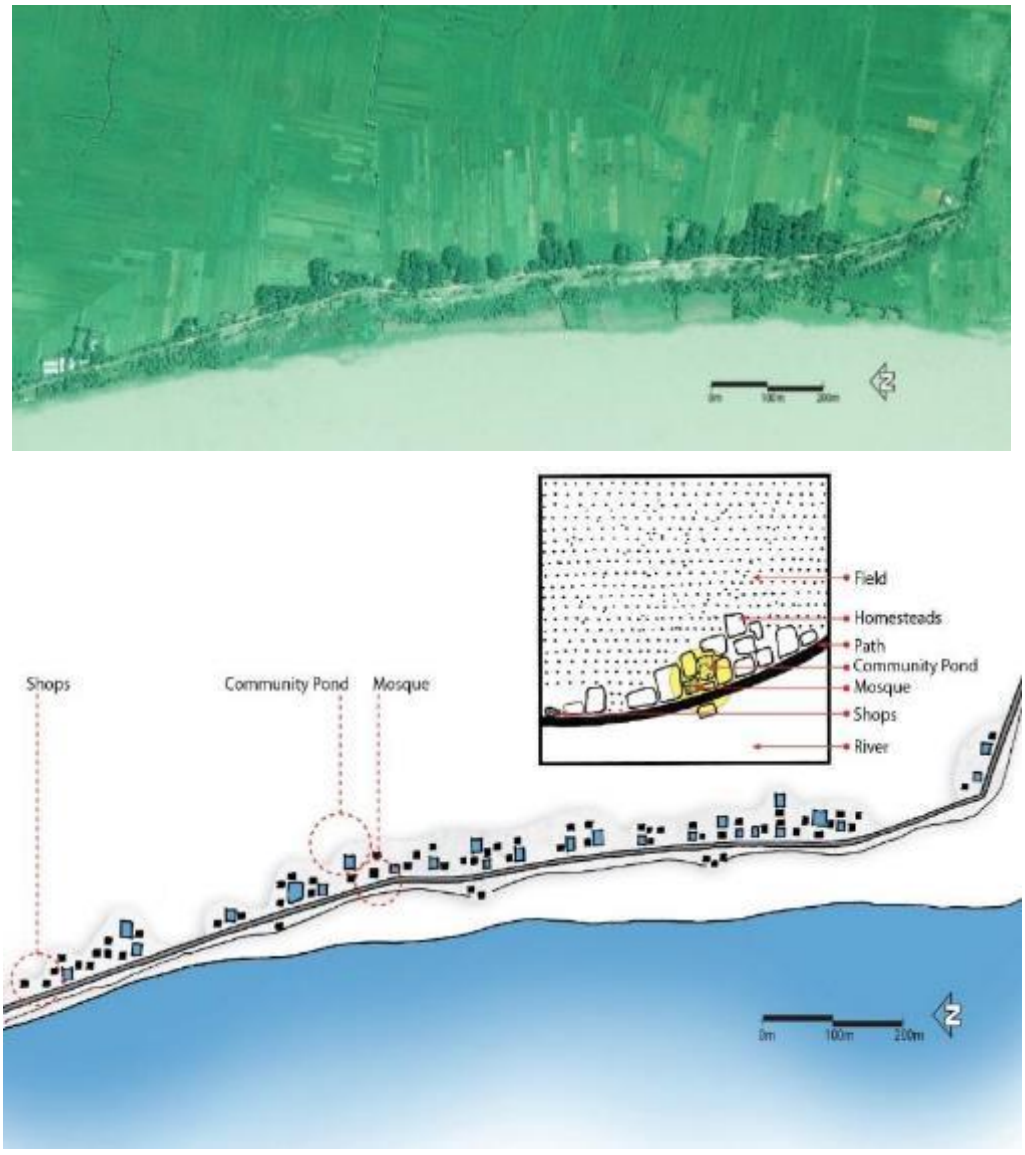


Figure 5.4: Settlement of Char Duani at Zone-A

Char Duani is situated alongside the Haringhata river of Patharghata Upazila of Barguna district. This landmass is an old one but the cyclone Sidr has changed the nature of the landmass. According to the key informant Abdul Hye, people have resettled alongside an embankment after the Sidr in the year 2007. Around 50 homesteads are in this settlement and it is growing with time. This is a newly built settlement by age and nature.

The long embankment gives the settlement a linear shape as it is yet in a growing stage, the homesteads are in a scattered position along the embankment. Apparently, the linear settlement is culminated by few shops which act as the community interaction space. A community pond and a mosque are located in the middle of the settlement acting as the central socialization space.

Salinity is a problem, though 80% of homesteads have their own pond for household use, for drinking only 20% of homesteads can use their homestead pond other people (80%) is dependent on the central community pond. For drinking water, the inhabitants also have community tubewell. The settlement is based on rice cultivation and 70% of the total population has arable land.

A5- Jaliaghata

Jaliaghata is an old settlement beside the Bishkhali river at the eastern edge of Patharghata Upazila of Barguna district. The settlement has grown beside a canal and canal-side road. According to the key informant Noya Mia Hawladar, the canal lost its connection with the river 30 years back due to a riverside embankment. After that, the canal is acting as a lake. The settlement was originated more than 60 years ago because of the natural canal and the wide agricultural fields. The canal and its adjacent road act as the reference datum for the settlement.

At present, the settlement is enclosed by a bigger road at one end and the embankment on the other side. At each end couple of shops have come up and they are being used as a social gathering space. A mosque and a school is situated at the edge and act as the community interaction space. At present, this lake is the source of household water for 70% of the homesteads; though 80% of homesteads have their own pond. For drinking water, every homestead has a tube well.

Agriculture is the means of livelihood of this settlement. During the questionnaire survey, it was found that 70% of the respondents are directly involved in agriculture and all the households has arable land surrounding the settlement.

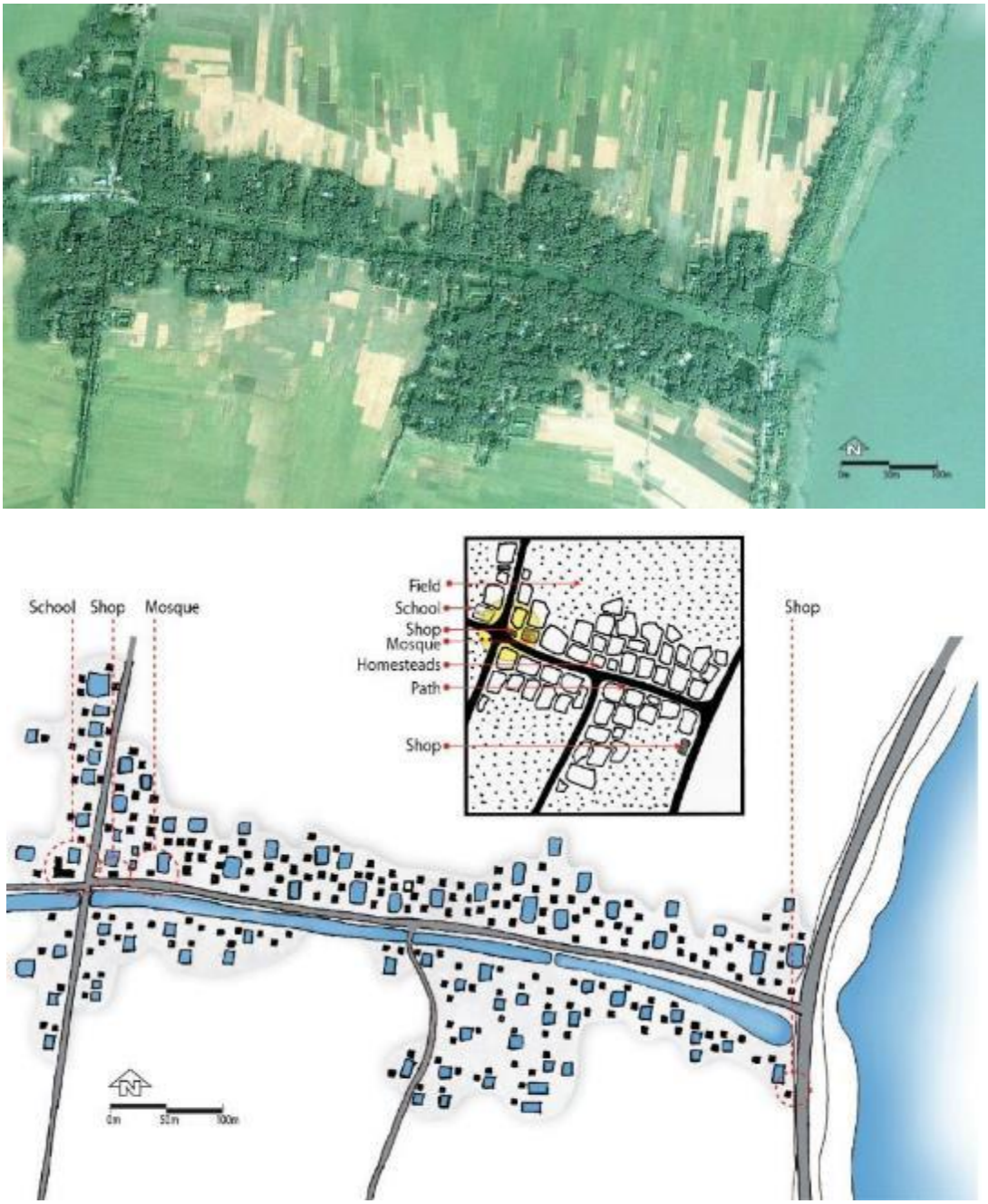


Figure 5.5: Settlement of Jaliaghata at Zone-A

A6- Char Kajal -Balar Char

Balar char is situated inside the Char Kajal of Patuakhali district. Char Kajal is surrounded by rivers and sea. Though the landmass is more than 300 years old; according to the senior inhabitant Matlob Munshi, the settlement on Balar char has started around 50 years ago. River eroded refugees from the mainland of Bhola district started living here. Fertile agricultural land and waterway communication attracted people to this area for settlement and could immediately start agriculture. Rice culture attributes are reflected in the settlement pattern. 90% of the inhabitants are farmers and 90% of the households have their own agricultural land.

There are only fifteen homesteads and the number is growing. They are clustered in the middle of the agriculture field and connected by aisle and informal pathways. 90% of homesteads have their own ponds which are used as the source of household water but there is only one tube well for drinking water for the whole settlement.

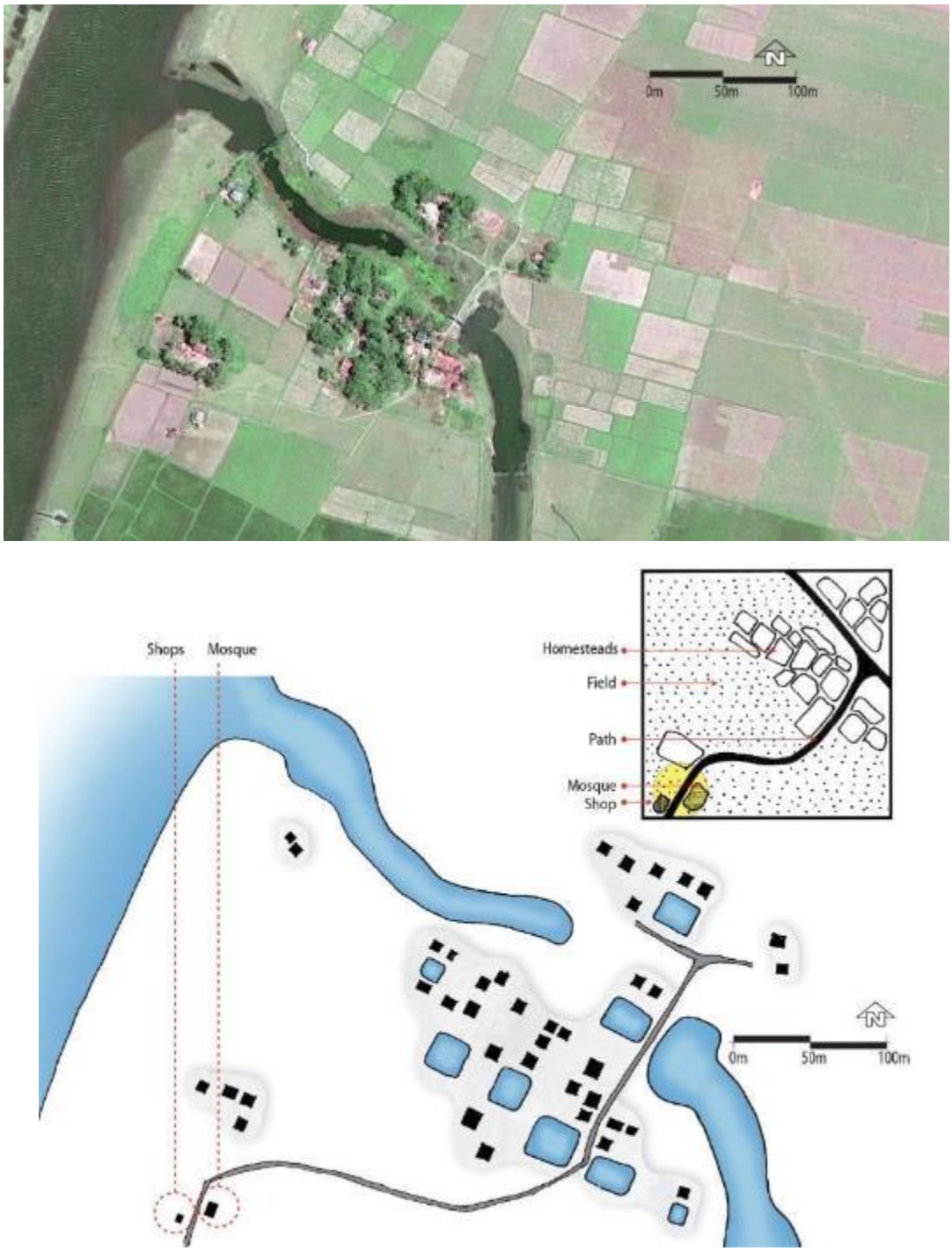


Figure 5.6: Settlement of Balar Char of Char Kajal at Zone-A

A7- Char Montaj

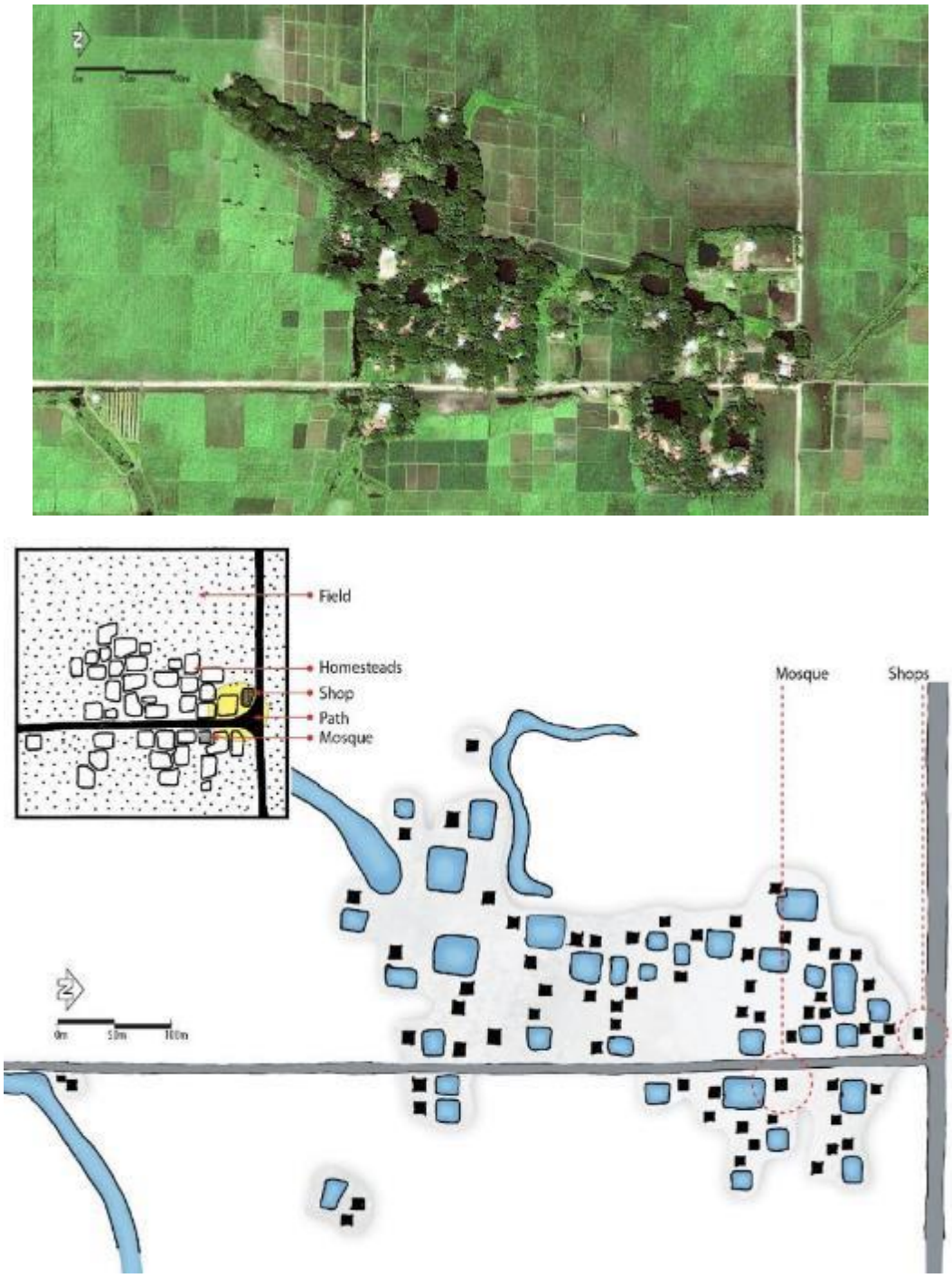


Figure 5.7: Settlement of Char Montaj at Zone-A.

Char Montaj is one of the most isolated islands on the southern edge of the Bengal Delta. It is under the Patuakhali district. Char Montaj is exposed to the Bay of Bengal on its three sides. The landmass is formed in the 1960s' and still developing. As per the key informant Hanif Molla, the settlement started here around 35 years back. River eroded people from the mainland of Bhola district started living here and started agriculture. One typical village is taken as a case for study among many scattered clusters.

There is a flood protection embankment around the char and well-established government-sponsored road networks inside the char. This road network guides the settlement growth and thus roads become the prominent reference datum. Agriculture is the occupation of 80% of respondents with Rice cultivation the prominent one in this settlement. All the households have agricultural land for their own.

A mosque and a couple of shops are the community interaction place for this settlement. 80% of homesteads have their own ponds which they use as the source of household water. For drinking water, 90% of homesteads have their own tube well. It is also found during the survey that people use water from the canal for drinking after filtration.

A8- Char Kukrimukri – Babuganj

Char Kukrimukri is an island situated in the southernmost portion of the Bhola district. This is one of the most isolated landmasses on the southern edge of the Bengal Delta. Char Kukrimukri is exposed to the Bay of Bengal and is surrounded by mangrove and swamp forests. Near about 300/400 years ago, this land has emerged in the Bay of Bengal. The island is situated at the Tetulia-Meghna estuary. Clusters of settlements have developed in a scattered manner over this island and they are still in a growing stage. River eroded people from mainland Bhola district started moving here and started cultivation. Rice culture is dominant in this settlement. For this study, three organic villages are surveyed. Agriculture is the occupation of 80% of respondents but all the households have arable land for their own.

Babuganj is situated in the centre of the island. The settlement is inside a natural boundary created by a road and a natural canal. According to the key informant Shajeda Bibi (a senior inhabitant of this village), the settlement began 30 years back. At that time the canal was the main communication route and source of water. The river eroded refugees selected the site for homesteading due to this canal. Both the road and canal made a two-way datum and an enclosure for the settlement holding ten homesteads.

The settlement has a bazar in the east and a mosque on the other side of the road. 90% of homesteads have their own ponds which they use as the source of household water. 10% of homesteads collect water from the canal for their household use. For drinking water, 70% of homesteads have their own tubewell and 30% collect water from shared tube wells.

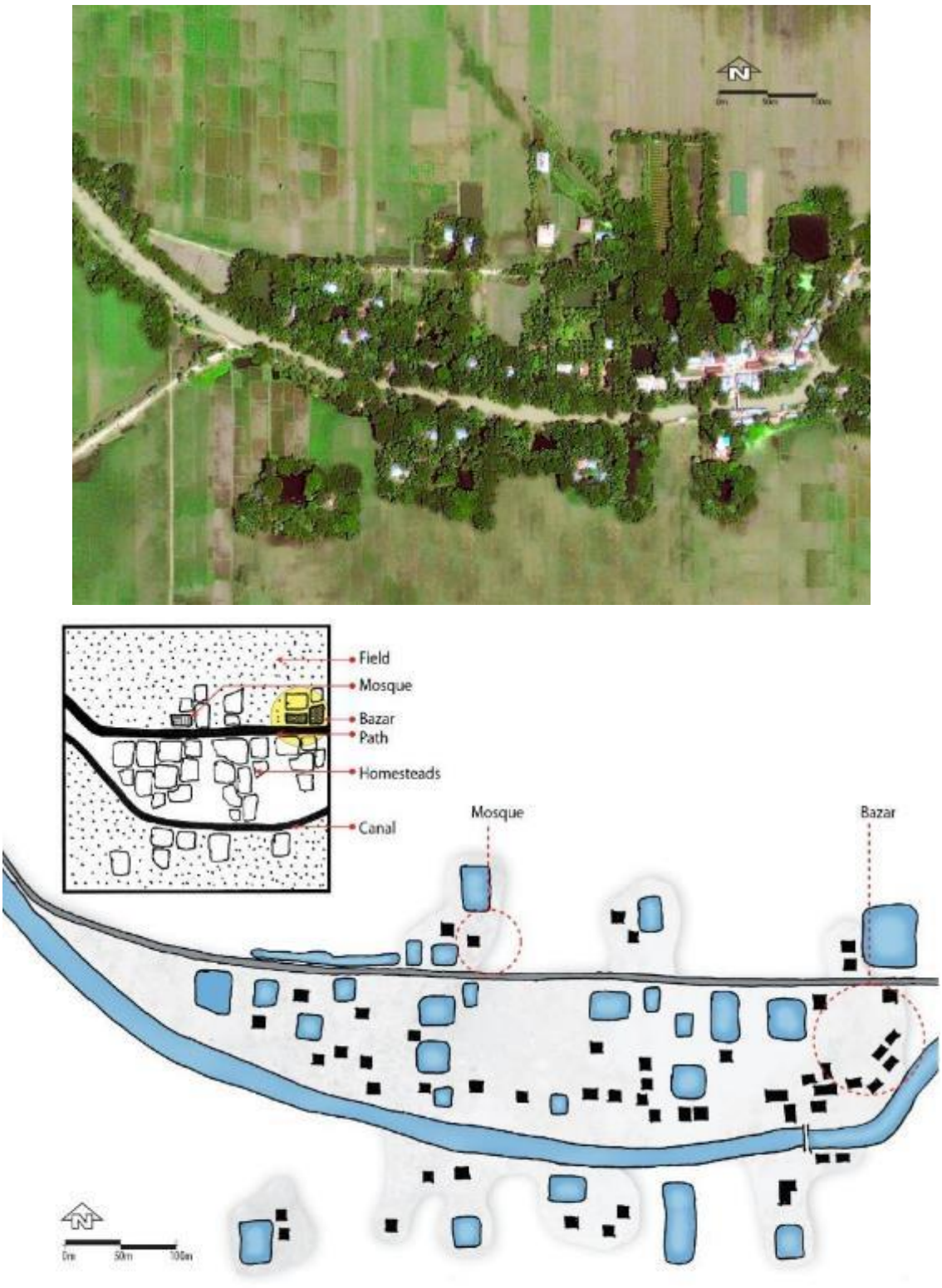


Figure 5.8: Settlement of Babuganj of Char Kukrimukri at Zone-A.

A9- Char Kukrimukri – Shababpur

Shababpur is situated on the western side of the Char Kukrimukri island. The settlement is clustered along the intersection of paths. The intersection shaped the village as

nucleated in a way but also expanding alongside the paths. The natural canal is an important feature of the settlement. According to the key informant Jahangir Sowdagar (community leader), the settlement started its beginning more than 60 years ago by some river eroded people from the mainland of Bhola district. Now around 30 homesteads have been established and the number is still growing.

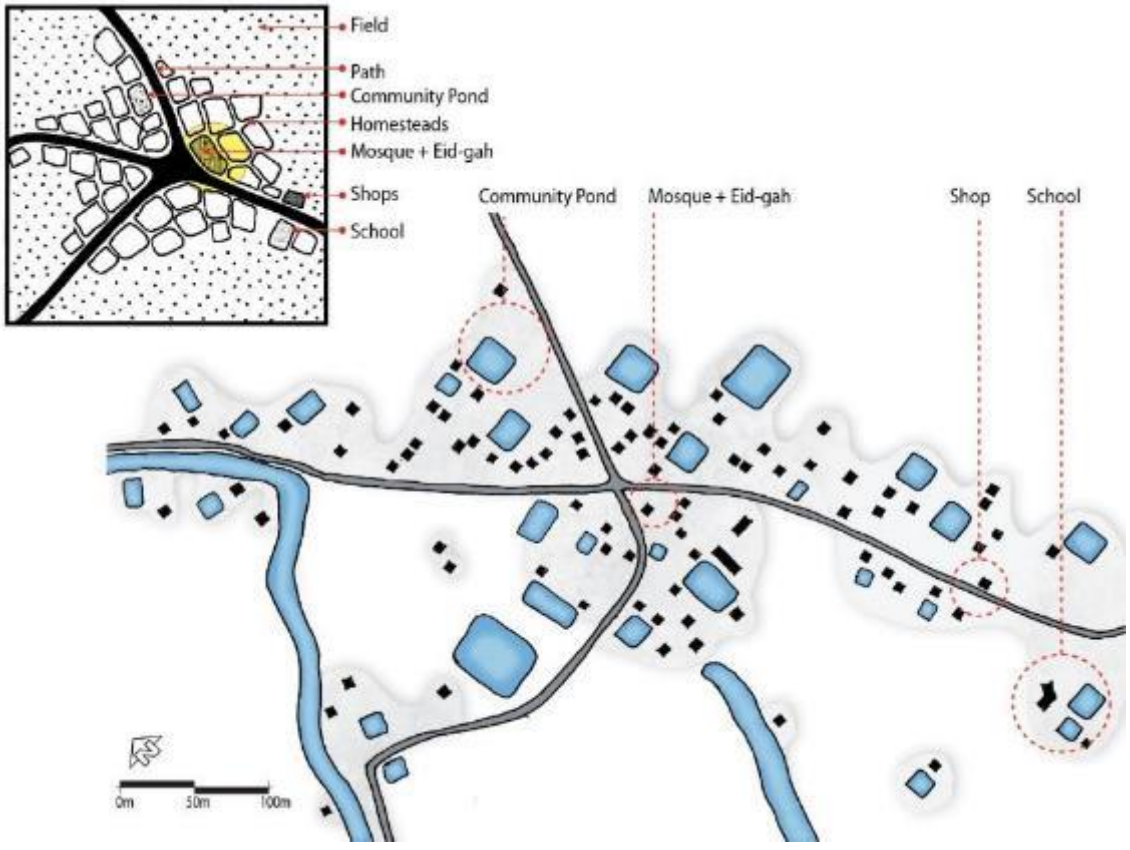


Figure 5.9: Settlement of Shababpur of Char Kukrimukri at Zone-A.

90% population of this settlement are farmers and all the respondents have their own agricultural land. The mosque and the eid-gah were established near the central node of the pathways. The primary school of the Char Kukrimukri is situated beside a road which is the end of this village. The school field and nearby shops are used as a community interaction space of this settlement. There is a community pond in the northern part of the settlement. This pond is the source of household water for 40% of the homesteads of the settlement. The rest of the 60% of homesteads collect household water from their own ponds and 80% of homesteads have ponds for their own. For drinking water, 70% of homesteads have their own tubewell and 30% collect water from other's tubewell. Water from the canal is not useable due to the salinity.

A10- Char Kukrimukri – Boyatibari

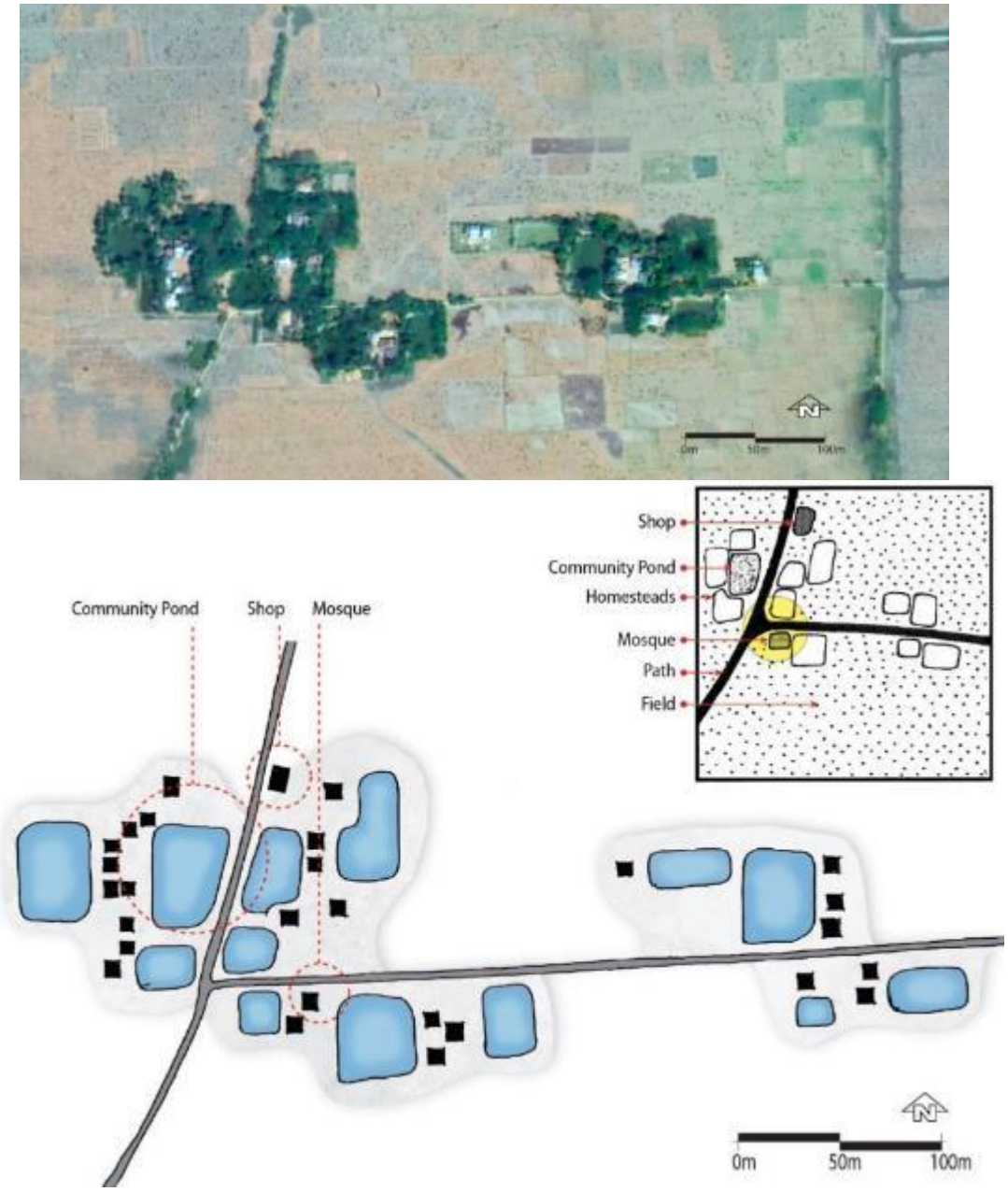


Figure 5.10: Settlement of Boyatibari of Char Kukrimukri at Zone-A.

Boyatibari settlement began at the eastern side of Char Kukrimukri about 70 years ago. According to the key informant Mohajon Munshi, the settlement began inside the agricultural field. An organic path was developed to connect the settlement with the nearby water route and bazar. In course of time, this organic path is transformed into a road and taken over by the local government. This is now the major communication route for this settlement. At present, there are twelve homesteads in this village. The village is still developing along this road and the road is acting as a datum for the settlement.

All the inhabitants of this settlement are farmers, they have their own arable land. A shop, a mosque and a community pond is the community converging space. The community pond is the source of household water for the whole settlement, though 80% of the homestead have their own homestead ponds, their water is not good for most household needs particularly drinking. For drinking water, 9 out of 10 homesteads have their own tubewell and the rest of them collect water from other's tubewell. Interestingly, this settlement reflects the age-old rice cultivation settlement pattern of the delta as interpreted from the literature review, though road, tubewell, building materials are contemporary.

5.1.2. Case Study Settlements in Zone-B

Zone-B comprises three administrative districts of coastal Bangladesh Lakshmipur, Noakhali and Feni (refer to Table 2.4 and Figure 2.5). This is the central Zone located between the coastal estuarine of the river Meghna and the Chattogram region. This landmass is formed by the Surma-Kushiyara Basin of the Bengal delta. Six settlements are taken for the case study and Key Informants Interview (KII) from this Zone.

B1- Char Folkan

Char Folkan is situated beside the river Meghna at Ramgati Upazila of Lakshmipur district. This is an old landmass but is affected by high river erosion. According to the key informant Monir Hossain, the studied settlement is more than 60 years old but recently people from the river edge settlements moved inside the village due to river erosion. They have selected this area because of the easy communication route and falling land prices due to the advancing river erosion threat. The settlement developed along a road, or in other words, the road was developed on a previous organic aisle connecting the homesteads at an early stage. Over time width of the settlement is growing and densifying as it cannot be expanded along the roadsides more. The village becomes congested with its newly migrated inhabitants. There are two different communities in a single village. The old inhabitants and the newly migrated peoples. The old community is stronger and dominating.

A mosque and an eid-gah are situated at an end of the settlement along with some shops which act as the community space for this settlement. There is a community pond in the middle of the settlement as well, but not properly maintained because most (80%) homesteads have their own pond. The community pond is an adolescent's recreation place. As the homestead ponds are not suitable for most domestic use, particularly for drinking, they have their own tube wells. 70% of the respondent are farmers and the majority (70%) of them have their own agricultural land.

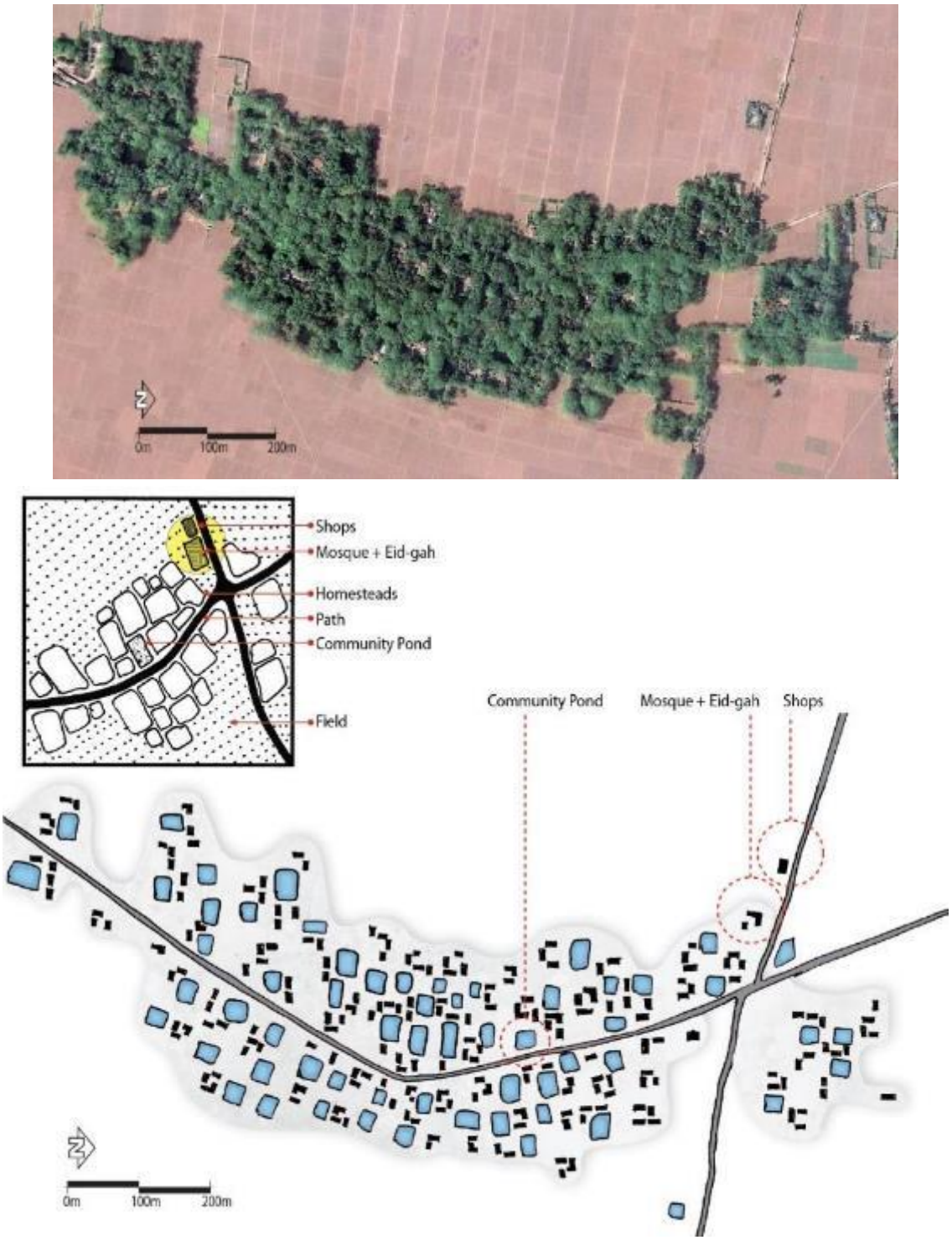


Figure 5.11: Settlement of Char Folkan at Zone-B.

B2- Char Jogbondhu

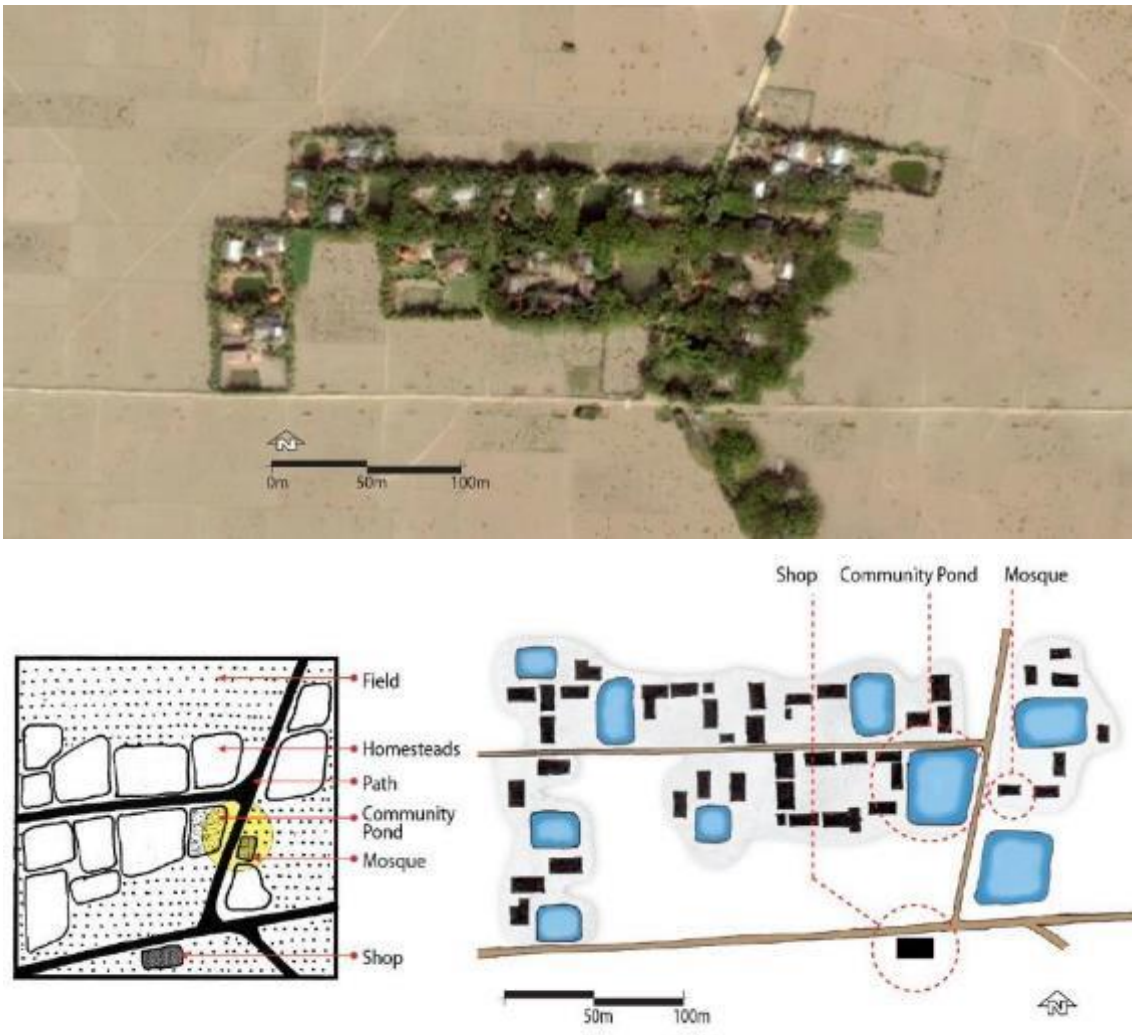


Figure 5.12: Settlement of Char Jogbondhu at Zone-B.

Char Jogbondhu is situated beside the river Meghna at Ramgati Upazila of Lakshmipur district. This is an old landmass but eroding fast. The village is only 500 metre far from the river edge. According to union council member Abul Khayer (key informant), the settlement was initiated by some river eroded people seven years back. At that time the river was 4 kilometres away from the location. The villagers depend on agriculture and have their cultivable lands in the area, that is why they don't want to re-settle far away. The settlement is connected by local road networks and surrounded by paddy fields. The inhabitants cultivate rice and their house forms and organization have a clear traditional reflection. At present 90% of the population have their own cultivable land.

This new village has 7 homesteads that consist of 15 families connected by a pathway. Each homestead has its own pond, which is the borrow-pit for raising the land above flood level. Water from these ponds is not usable for household or drinking purpose right now. As such most of the homestead in this settlement have installed tube wells. There

is a community pond for this settlement but only one family found who collects household water from this but used as the adolescents recreation place. A mosque and a shop adjacent to the settlement act as the space for social gatherings.

B3- Char Alexander

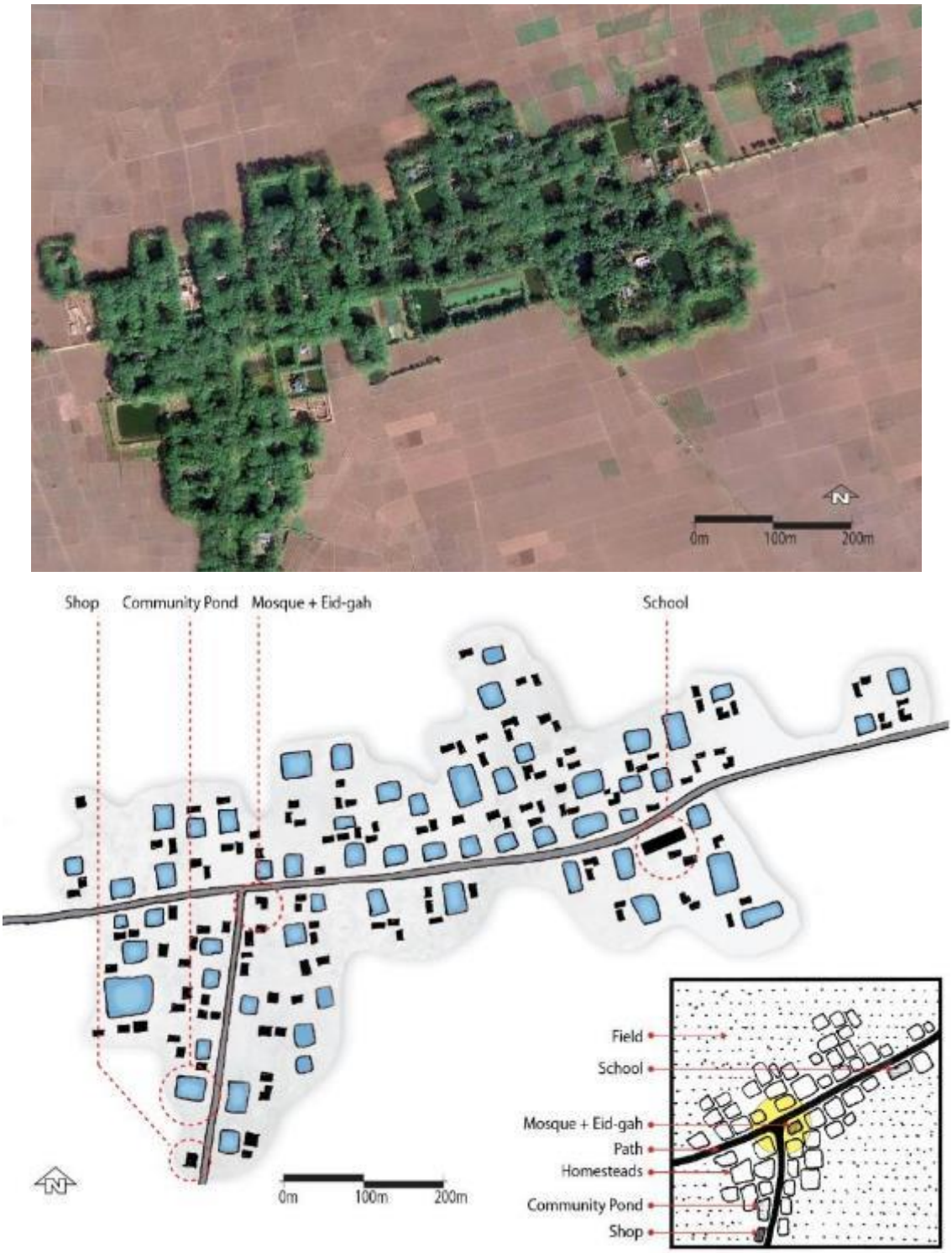


Figure 5.13: Settlement of Char Alexander at Zone-B.

Char Alexander is situated along with the river Meghna in Ramgati Upazila of Lakshmipur district. This is an old landmass but was eroding fast before the erection of erosion protecting embankment in 2015.

This organic village is less than 500 metres away from the coastal edge. According to the key informant Abdul Malek, the settlement is more than 30 years old but the river erosion refugees are settling here for the last few years. They have selected this area because of the easy communication route, near their agricultural land and being within the embankment. The settlement has more than 50 homesteads consisting of 100 families connected by a pathway. A node has evolved at the meeting point of two paths. The mosque and the eid-gah are placed near the node. The connecting road gives the settlement a linear shape and a direction of expansion along both sides of the road. There is a school, a shop and a community pond which are the social interaction space.

Ponds are used as a major source of household water. The community pond is the source of household water for 30% of the inhabitants. 60% of the households collect household water from their own homestead ponds. 80% of homesteads have ponds within their homestead. For drinking water, all the inhabitants are dependent on tube-well, among them, 70% have their own tube-well and the rest 30% collects water from other's tube-well.

70% of the respondents are directly involved with agriculture and 70% of inhabitants have their own agricultural land. The inhabitants cultivate rice and their house forms and organization have the clear traditional reflection of a rice-cultivation society as can be evidenced in the google image.

B4- Char Mehar

The studied settlement in Char Mehar has come up at the south-western landmass of the Lakshmipur district. This is an old landmass but was in a fast eroding stage before the erection of an erosion protecting embankment in 2015.

According to the key informant Md. Shah Alam, the settlement was established more than 20 years ago by the river erosion victim of Alexander union of the same district. They are originally farmers but by losing agricultural fields due to river erosion many of them have turned to other means of livelihood. During the field survey, it s found that 60% of the respondents are farmers with their own agricultural land, 40% of the respondents are doing business or services other than agriculture.

According to Md. Shah Alam, this land was once agricultural fields but now converted into homesteads. The river eroded people are coming here to settle because of the ease of communication and near their eroded settlement. Because of high demand, the land price has raised comparatively higher. Some pucca or semi-pucca buildings were also

found reflecting the economic strength of the communities. There is a narrow path that goes down from a bigger road. The pathway divides the settlement into two organic villages. One side is occupied by the old inhabitants and another side is inhabited by the erosion induced re-settler. They are separate communities and have built their own mosque at the end of the village. The settlement has more than 50 homesteads consisting of 100 families connected by the pathway. A mosque and a couple of shops are at the end of the settlement which acts as the social interaction space for the settlement.

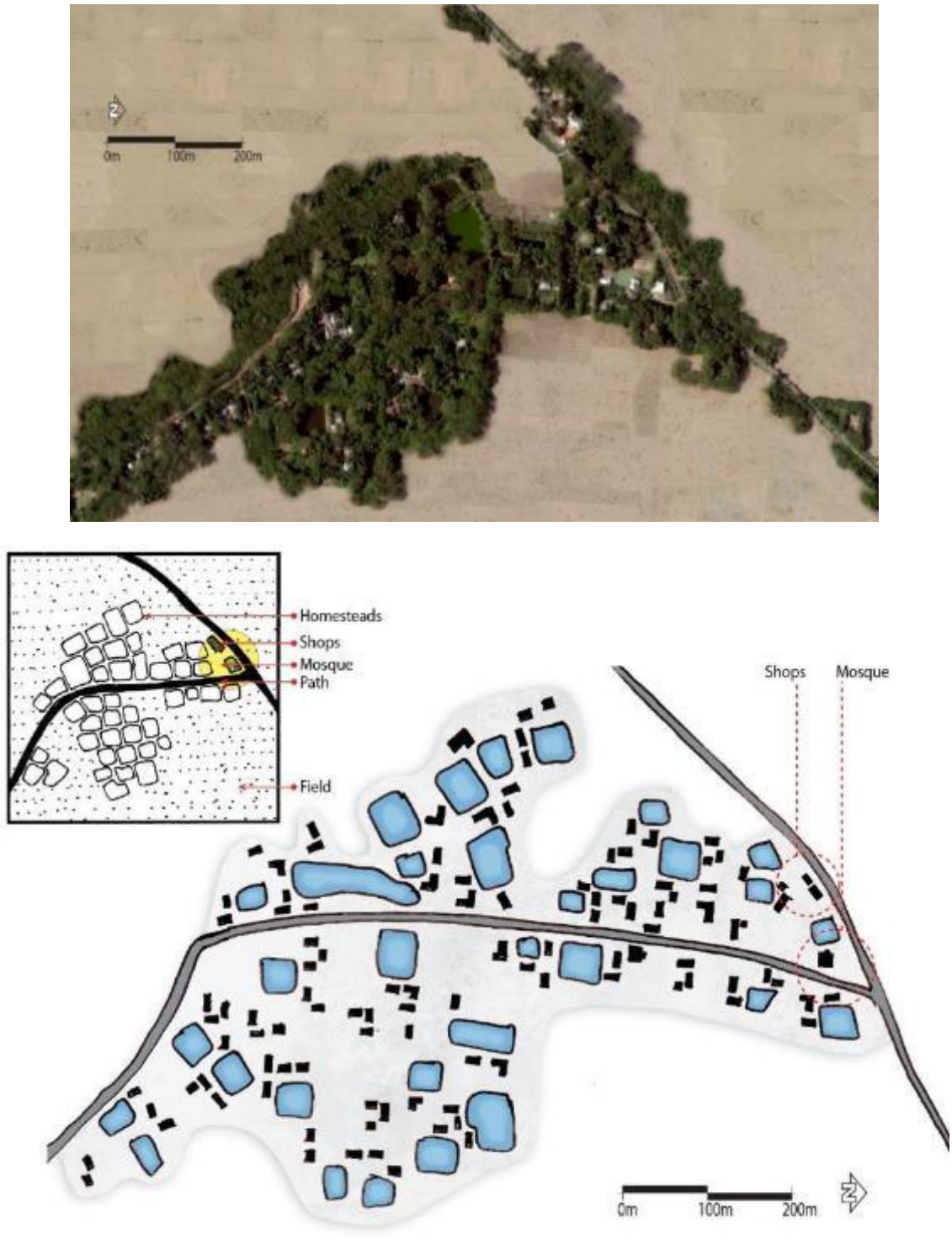


Figure 5.14: Settlement of Char Mehar at Zone-B.

A pond is a very common homestead feature and source of household water for this settlement. 80% of the homestead has ponds with them and 20% have two ponds within their homestead. 20% of homestead who do not have own pond is depended on other's ponds. For drinking water, they are dependent on tube-well. The inhabitants cultivate rice and their house forms and organization have a clear traditional reflection of a rice-cultivation society as can be evidenced in the google image.

B5- Char Elahi (Para-1)

Char Elahi is situated in the southern tip of the Noakhali district under Companiganj Upazila but in terms of communication facilities, it is more connected to Kabirhat Upazila than Companiganj. The landmass of this char is very low populated due to its exposure to the coastal belt and associated threat of natural vulnerability. There are embankments and road networks constructed by the government. This road network gives rise to a grid-iron pattern on the overall Char. As the landmass is old, this remote char is suitable for agriculture. Vast agricultural fields are the main feature of this landmass.

Survey founds that, the settlements are very dispersed in nature as found in the historic descriptions. There are scattered small clusters all over the char surrounded by paddy fields. For this research, two spontaneous villages are being studied. They are identified as Para-1 and Para-2.

Para-1 is connected with the Noakhali Beri Badh (embankment) with a pathway on it. The cluster is a compact one consisting of 12 homesteads. According to the key informant Md. Hanif, it is established 15 years ago by some river eroded people from distant locations. The clusters were developed on a raised mound created by earth taken from few ponds. The settlement is still at a growing stage and new ponds are being excavated to extend the mound. Thus the cluster is being developed on a raised land surrounded by wast paddy fields, a true historic scenario.

As most river erosion refugees have no landed property, they leave the agricultural job. Only 40% of the inhabitants have their own agricultural land and 50% of respondents are directly doing agriculture. The 12 homesteads have only one tube well that is used as a source of drinking water. For household water, they are dependent on the homestead ponds which is found in 80% of the homesteads. Reset of the 20% homestead collects water from other's pond.

A mosque was built with the help of a foreign organization for this settlement and its surroundings. Also, there are some shops near the settlements which play the role of the social interaction space for the inhabitants.

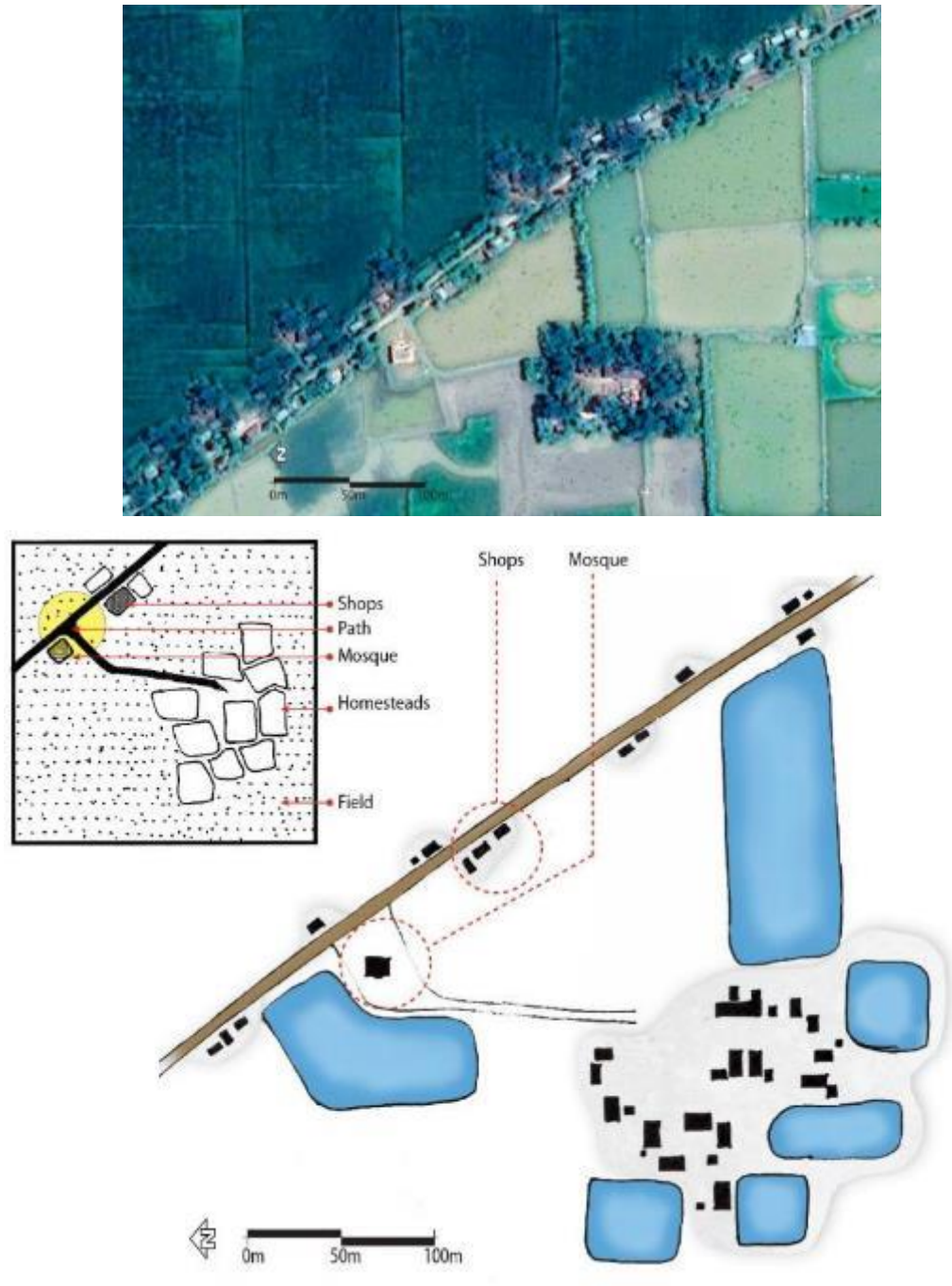


Figure 5.15: Settlement of Char Elahi (Para-1) at Zone-B.

B6- Char Elahi (Para-2)

Para-2 is a combination of some scattered homesteads. No formal connection among them is established yet. Small ponds are created to raise the *viti* for the homesteads. The overall settlement is at the primary stage of its development. According to the key informant Zahir Uddin, new homesteads are being developed converting the paddy fields. This might connect the total village physically in future. During the monsoon, the

paddy fields are flooded by water and homesteads look like islands. A true traditional scene.

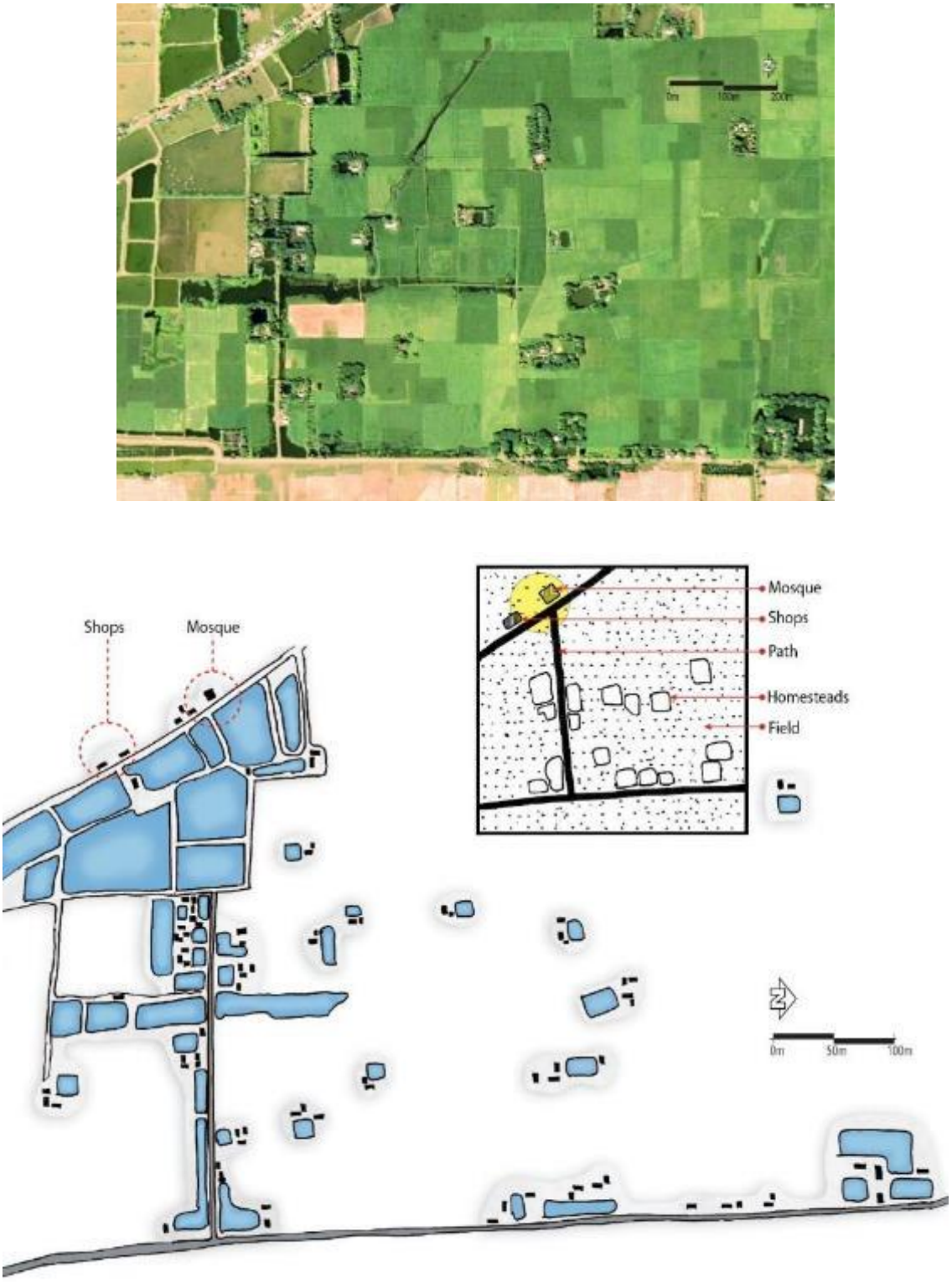


Figure 5.16: Settlement of Char Elahi (Para-2) at Zone-B.

A couple of nearby shops and a mosque is the social interaction places of this settlement. 90% of the homesteads have their own pond within the homestead and these are the

source of household water for them. For drinking water, all are dependent on tube-well. 20% of the homesteads have their own tube-well and the rest of the 80% collect drinking water from others' tube-well. 60% of inhabitants are agricultural who have their own arable lands around, but 30% of respondents are found doing animal husbandry. Horticulture and livestock are part of their livelihood besides the cultivation of rice. This seems to be a typically historic pattern of settlement in the Bengal delta.

5.1.3. Case Study Settlements in Zone-C

Zone-C comprises two administrative districts of coastal Bangladesh, Chattogram and Cox's Bazar (Refer Table 2.4 and Figure 2.5). This is the Eastern Zone between the Surma-Kushiyara Basin and the edge of the landmass of the Bengal delta. This part of the landmass is very old and is in the foothills of the Chattogram hill tracts Six settlements are taken from here for the case study and Key Informants Interview (KII) for the zone.

Zone-C is the oldest and most consolidated landmass of this Delta. The landmass is adjacent to the Bay of Bengal. There is no erosion record and is exposed to coastal edge in recent times. Six spontaneous villages are studied in this region.

C1- Dakkhin Moghadia

Dakkhin Moghadia is situated in Mirsharai Upazila of Chattogram district. There is a two-kilometre wide band of swamp forest between the landmass and the Bay of Bengal. After the swamp forest, one-kilometre wide land is agricultural land. Due to sea tide and being exposed to the coast this area is not thought suitable for settlement. The government created an embankment along the coastline edge leaving the forest outside and making the agricultural land safe from the sea tides.

There are roads from the villages to the coast. According to the key informant Kamrul Haidar Chowdhury, the settlement was originated 60 years ago but after the embankment is erected, the settlement is consolidating and is expanding along the road towards the coast. This settlement is originally established in a scattered manner. At present, there are 110 homesteads within this settlement. 90% of the homesteads have their own ponds and 30% have more than one pond within their homestead. These are used as the source of household water. For drinking water, tube wells are there. There are some scattered clustered that make a pattern like moving from the ancient village towards the coast. This road is also developed in a similar way along a natural canal.

The settlement has community facilities like a mosque, eid-gah, community pond, shops and a place for slaughter/sacrifice during Eid-ul-Azha adjacent to the mosque. All the

respondents of this settlement are found having own agricultural land, though at present 40% of them are doing occupations other than direct agriculture. The inhabitants cultivate rice and their house forms and settlement organization have its reflection.

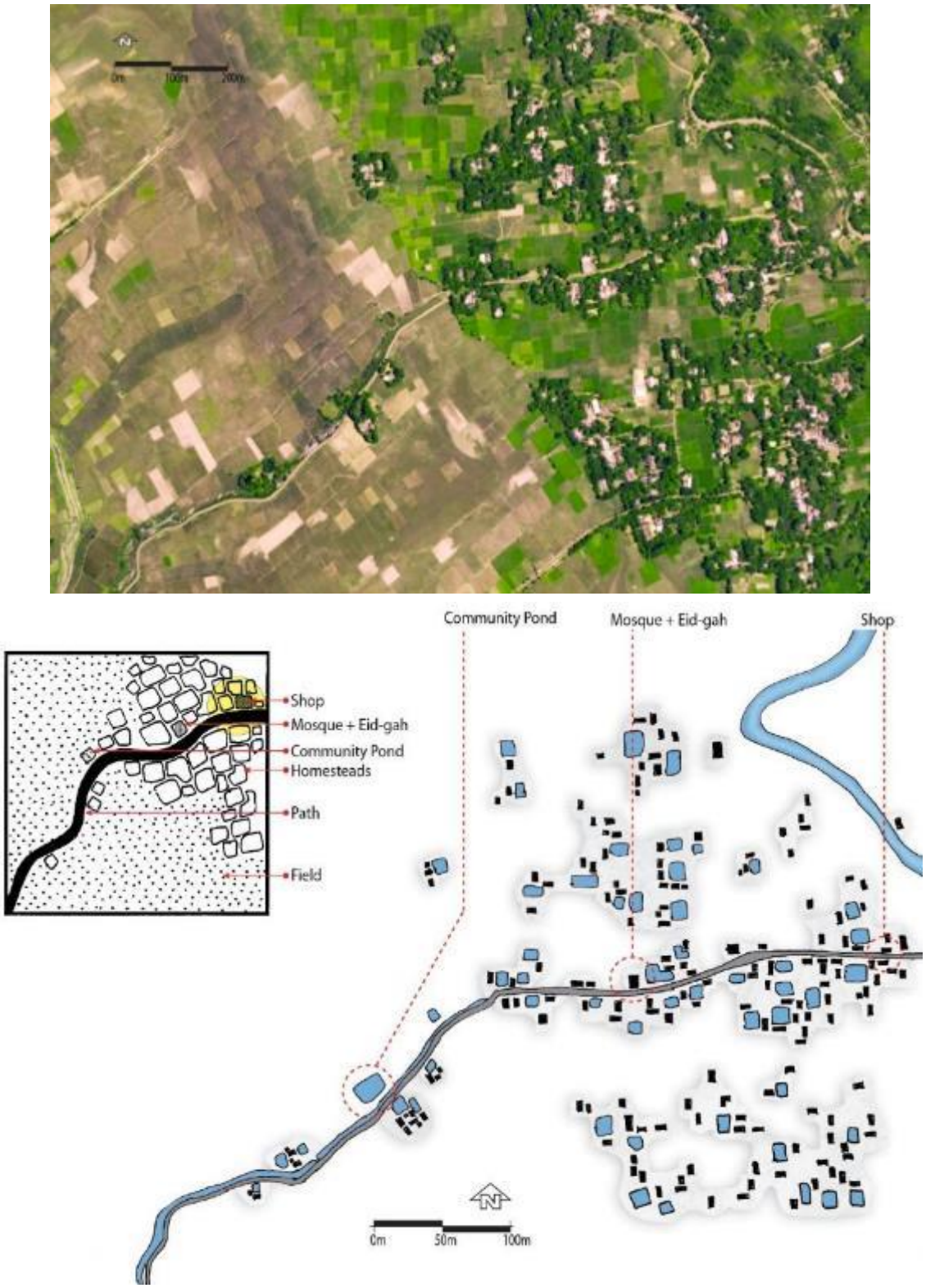


Figure 5.17: Settlement of Dakkhin Moghadia at Zone-C.

C2- Saidpur

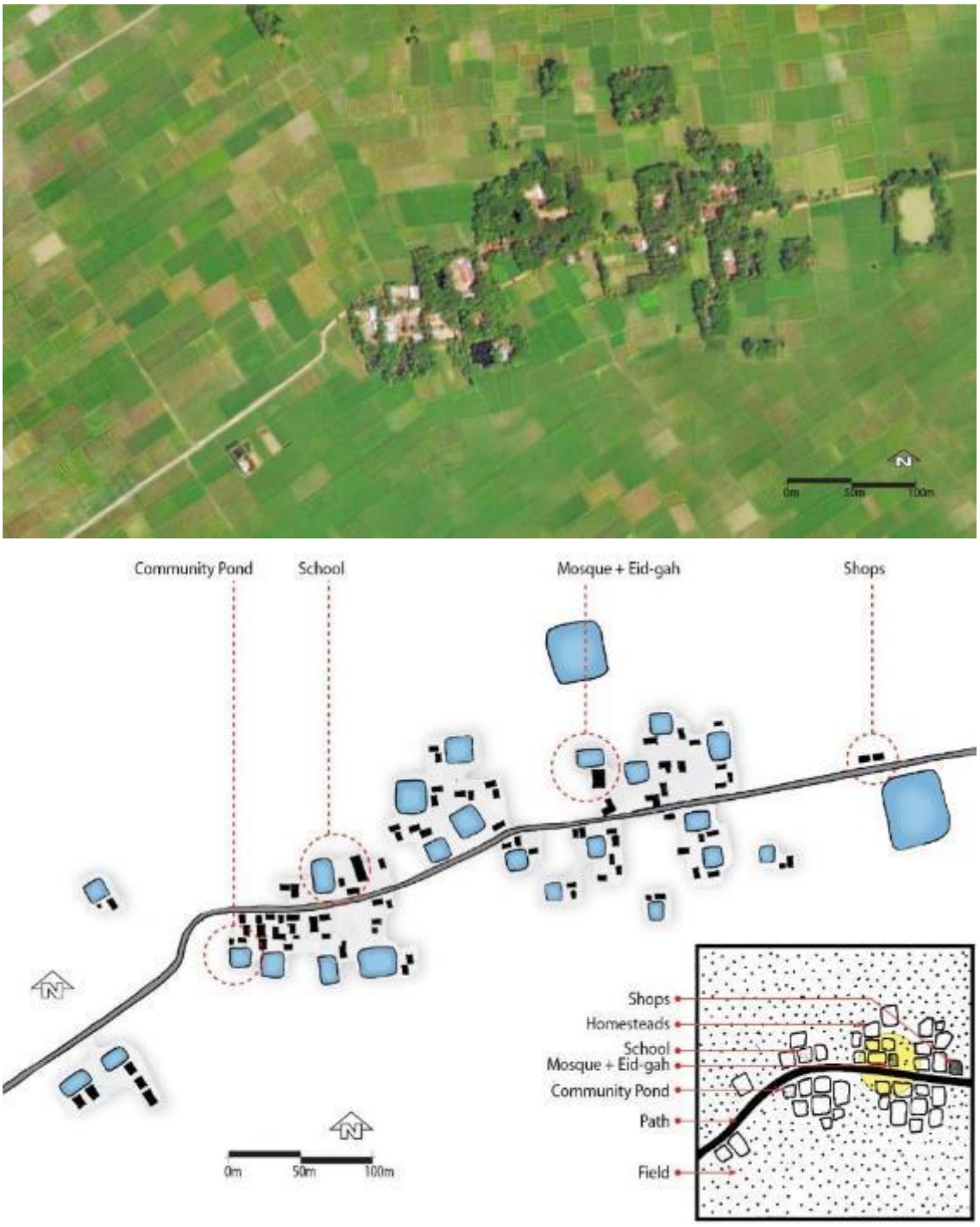


Figure 5.18: Settlement of Saidpur at Zone-C.

The studied settlement of Saidpur is in the Sitakunda Upazila of Chattogram district. It is inhabited by humans since the Neolithic era. Sitakunda is 70 km long and 10 km wide.

The studied village is an extension of a more than a hundred years old settlement. According to the key informant Khalek Bepari, the extension of the settlement started taking place around 50 years ago along an organically developed pathway towards the

sea and at present, there are 42 homesteads in this settlement. The path is east-west elongated and wide agriculture fields on both sides. The path to sea pulls settlement on either side in the agricultural land which is more than a one-kilometre wide natural buffer from the exposed coast. Scattered clusters were noted with individual homesteads and over time the clusters grew big with new homesteads due to household expansion. The path is also taking shape of a formal road and gives the homesteads physical connection. Thus a linear settlement is taking shape.

There is a primary school with a field, a mosque with eid-gah and a community pond for this settlement. At the eastern end, there is a couple of shops that also acts as the gathering space for the inhabitants. All the homesteads have their own homestead ponds but 30% of the homestead is dependent on the community pond for household water. For drinking water, tube well is the source. All the respondents of this settlement are found having own agricultural land, though at present 40% of them are engaged in an occupation other than direct agriculture.

C3- Muradpur

The studied settlement of Muradpur is located in the Sitakunda Upazila of Chattogram district. The settlement took a shape of a compact cluster. The cluster is connected by a pathway. According to the key informant Shaher Ali, the settlement originated 70 years ago and presently there are 40 homesteads in this settlement. They are physically connected by the outer courtyard. The settlement is only 500 metres away from the coastline of the Bay of Bengal.

Similar types of clusters have come up in a scattered manner in this area. A natural canal acts as a strong site force to attract such clusters At one end of the cluster, there is a mosque and at both ends, there are community ponds. These are the social interaction space of the settlement. There are some shops adjacent to the settlement.

90% of the homesteads have their own ponds and 40% have two ponds within their homestead. These ponds along with the community ponds are used as the source of household water. For drinking water, all the homesteads have their own tube-wells. All the inhabitants have their agricultural land and the reflection of rice culture is found in the organization of the house and settlement.

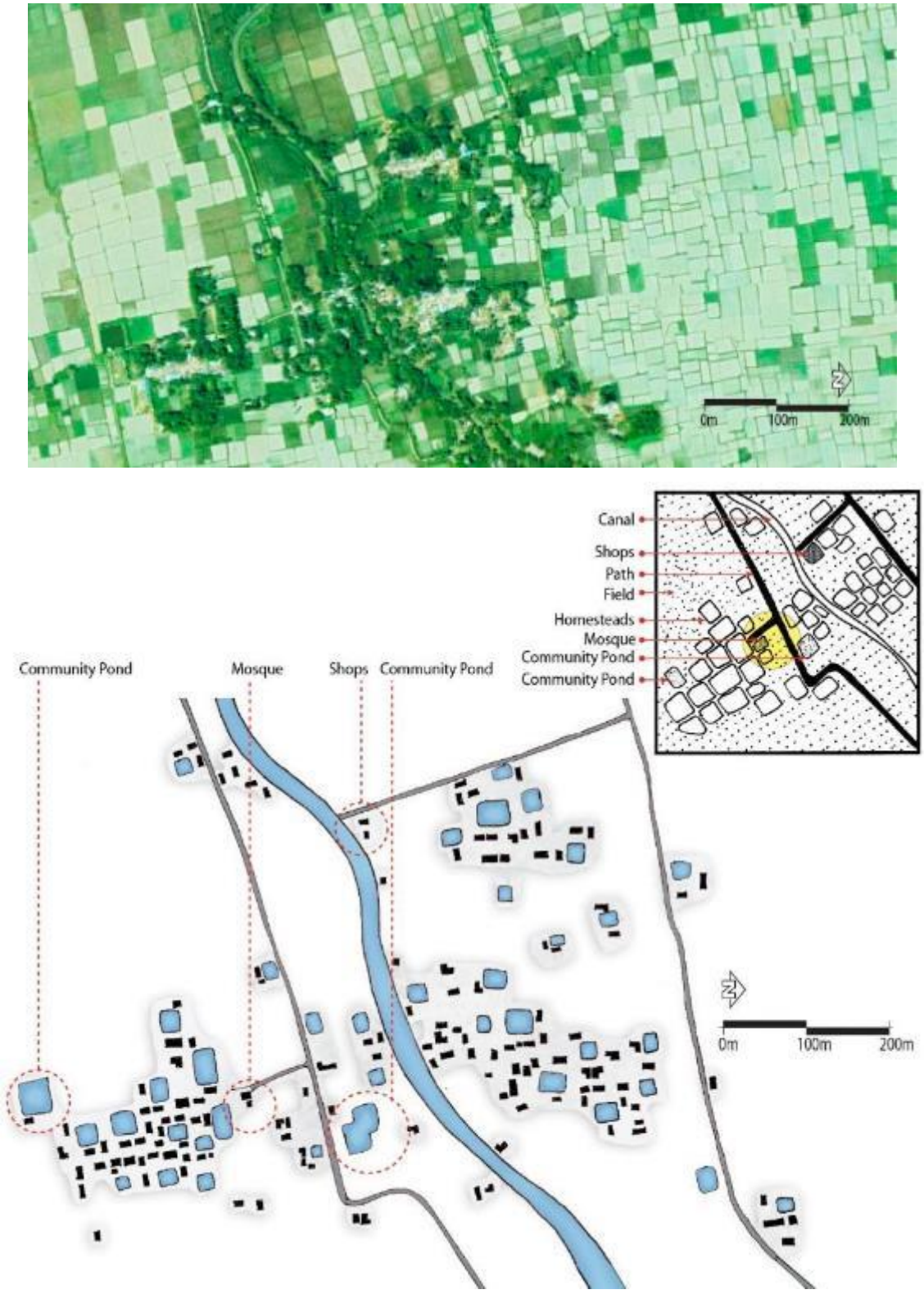


Figure 5.19: Settlement of Muradpur at Zone-C.

C4- Nadalia, Bashbaria

Nadalia is situated in the Bashbaria area of Sitakunda Upazila of Chattogram district. According to the key informant Alamgir Hossain, the studied village is more than a

hundred years old and presently settled by 70 homesteads. The settlement started taking shape along an organically developed pathway towards the sea. The path is east-west elongated with wide agricultural fields on either side. Scattered clusters came up with individual homesteads and over time grew bigger with household expansion. The path is also gradually taking shape of a formal road connecting the homesteads physically. Thus a linear settlement with clusters is taking shape. At the eastern end, the settlement terminates with few shops which is also a gathering space for the people. The mosque also acts as the social interaction space for this settlement.

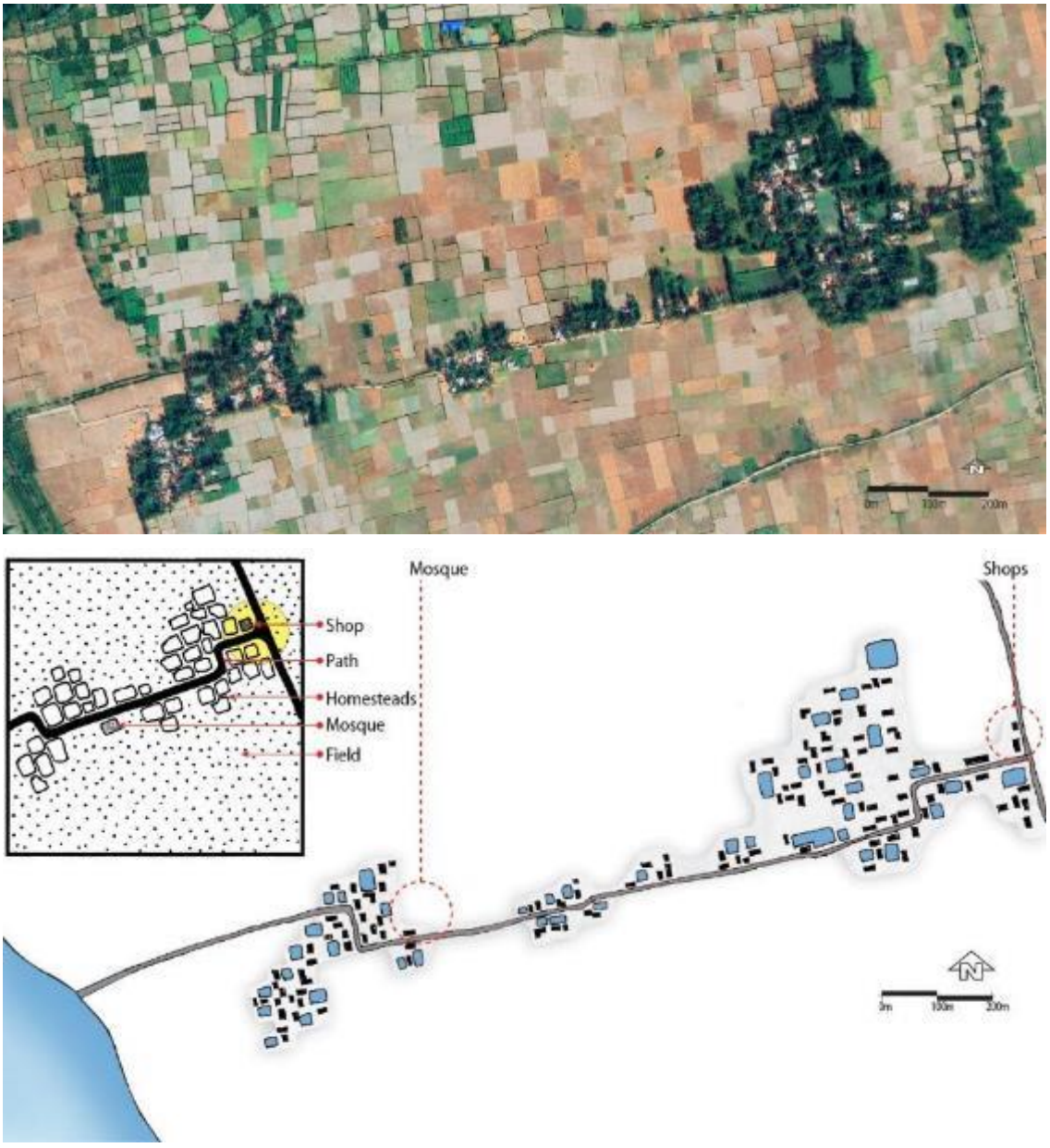


Figure 5.20: Settlement of Nadalia, Bashbaria at Zone-C.

There is no community pond in this settlement. 90% of the homesteads have their own ponds which is the source of household water and for drinking water they have tube-well. 80% of inhabitants have their own agricultural land. The means of living for 60% of

people of these settlements are direct agriculture and it is reflected in the organization of clusters like many other rural settlements in the Bengal delta.

C5- Boalia, Bashbaria

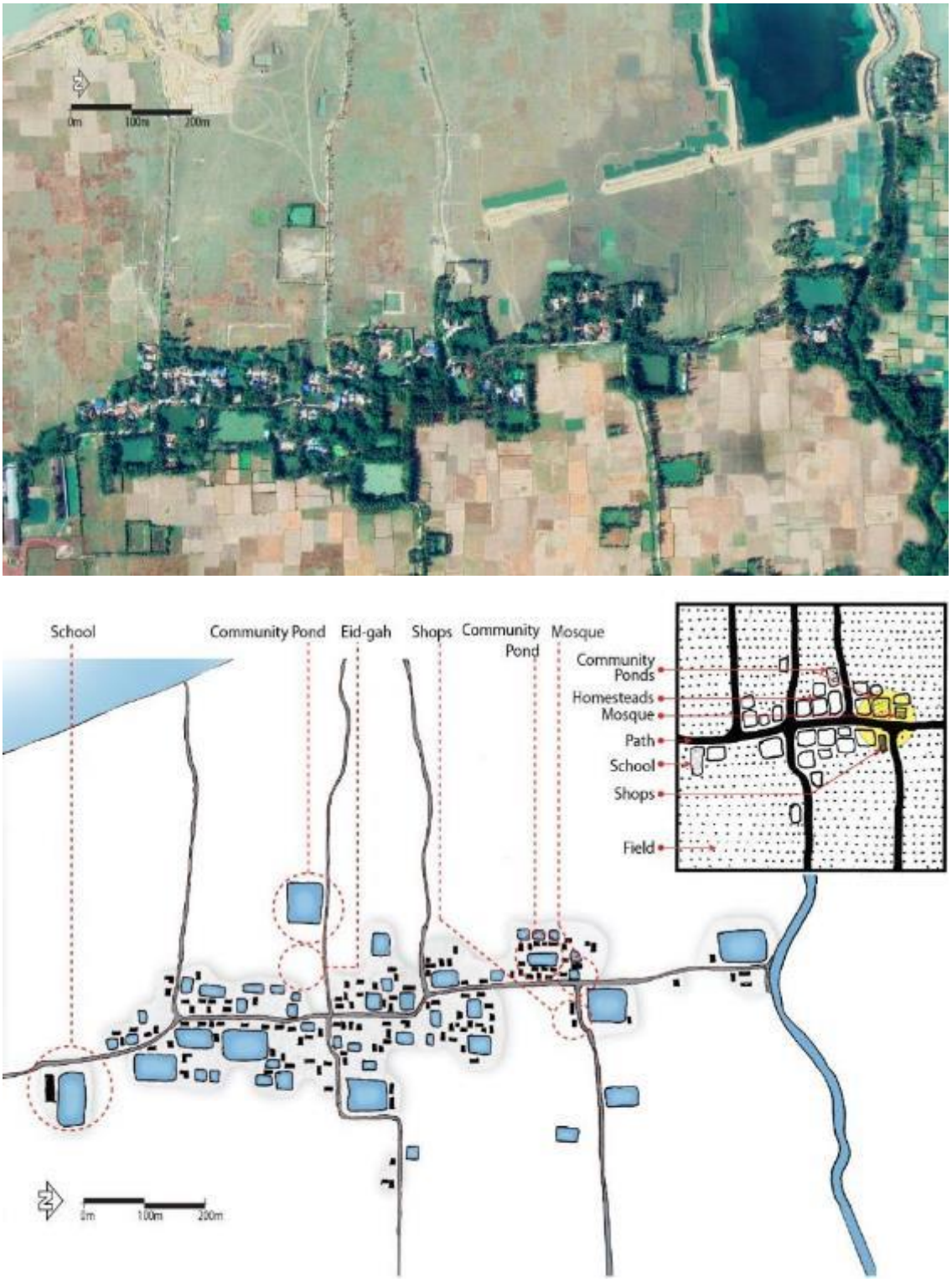


Figure 5.21: Settlement of Boalia, Bashbaria at Zone-C.

Boalia is situated in the Bashbaria region of Sitakunda Upazila of Chattogram district. According to the key informant Haji Nurul Islam, the studied village is a settlement of more than a hundred years old. Initially, a few clusters evolved in a scattered manner. Later they were connected with a north-south elongated pathway. The pathway is then converted into a formal roadway connection. There are vast paddy fields on both sides of the settlements that are cultivated by the inhabitants of these settlements. 90% of the inhabitants of this settlement have their own agricultural land, though at present 40% of them are involved with direct agriculture.

The studied village is a cluster of 30 homesteads named Chowdhury Para. the homesteads are internally connected by an informal path and courtyard. Houses are grouped around large ponds. At the end of the village, there is a pucca mosque dedicated to these 30 homesteads. The village is only 500 metres away from the coast of the Bay of Bengal. There is an embankment alongside the coast. In between the village and the coast, there is vast agricultural land.

All the homesteads have their own pond within their homesteads but few are not suitable for household water use. Community ponds are the source of household water for 50% of homesteads and the rest of 20% collect household water from tube-well. Tube-well is the source of drinking water for this settlement.

C6- Kumira Jele Para

Kumira Jele Para is a one-kilometre-long settlement situated at Kumira ghat of Sitakunda Upazila of Chattogram district. The total settlement is developed along a busy road leading to the coast. The road is named ‘Ghatghor Road’ is east-west elongated and started from the Kumira bazar and ended at the fishing port. The fishing port is located at the estuarine of a natural canal with the sea. The canal creates a boundary at one side of the settlement.

According to the key informant Shairu Bala, this is a settlement of more than a hundred years of age. It is very compact in nature and gradually getting more compact. Narrow pathways are coming up from the ‘Ghatghor Road’ like branches of a tree and house forms are settled on both sides of this narrow pathway. Each house form is an individual compact homestead. The narrow pathway act as a breathing space and socialization space for the inhabitants. Homesteads connected to a narrow pathway gives a small community feeling. For a few homesteads, there is a tube well which is the source of household and drinking water for the small community.

Kumira Jele Para is a settlement of fishermen. They are neither directly involved with agriculture nor have any land to do so. According to Shairu Bala, the settlement has more than 500 households divided into three different societies. All the people belong to the

Hindu religion and some of them have small deity/temple within their houses. Some NGOs are working to improve the living condition of these poor people. These have some impact on the traditional pattern of the settlement. For the sake of livelihood, the inhabitants do not move their house from the location. But the location is very vulnerable to nature as it is exposed to the sea.

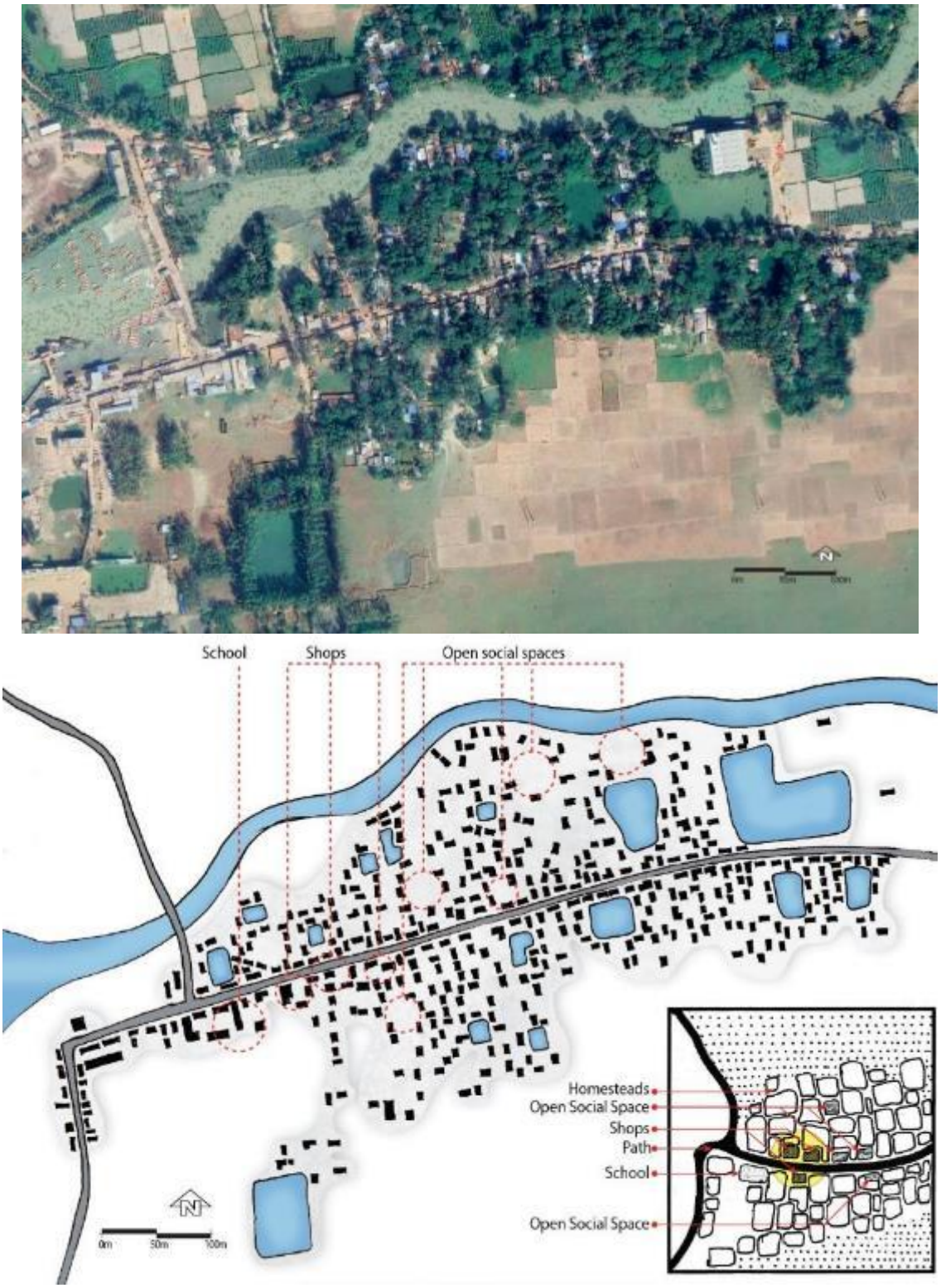


Figure 5.22: Settlement of Kumira Jele Para at Zone-C.

5.2. Spatial Settings of Settlements

Shelter acts as the initial unit of the module for any settlement. **The homesteads are comprised of different elements. They are the built-form, courtyard and waterbody.** There is not a single regular household found without a built-form shade, courtyard and a pond of some size and definition, similarly, none of the settlements was found in the study areas without a close relationship with the surface water body. When people started living in flatlands leaving the hills behind, they resided on a natural levee that was free from getting inundated during the floods and even if it becomes flooded, they used to move to another level. Meanwhile, by experience, men started raising the lowlands artificially and began to settle down in the massive flood plains of the delta. For this purpose, they were required to excavate earth resulting in ponds that became a part and parcel of the habitation/homesteads.

Bengal homesteads evolved on the raised platform called '*viti'* made by excavating earth from the ponds. The homesteads may or may not be physically connected with other nearby homesteads by *viti* but were in close proximity with adjacent homesteads forming the whole settlement. However, after consolidation or densification, individual homesteads become connected by raised viti and/or path. With the field survey data, the case study settlements and their surroundings are analysed. A study of the ratio of space allocation for different elements was done. Three major elements of a homestead were identified with their footprint ratio in different zones. They are i) the built forms, ii) the courtyard and iii) the water body (e.g. homestead ponds). This unit was enclosed by thick vegetation due to climatic reasons.

5.2.1. Built-form and Waterbody Ratio Analysis

Built-forms includes the house forms, cattle sheds, sheds for service functions (e.g. kitchen, toilets etc.) and waterbody includes the homestead ponds. Homestead ponds are almost always dug to borrow the earth needed to raise the homestead platform (*viti*) above the flood. Pond thus created is the major source of household water as revealed by the survey among the 220 homesteads, ponds are the source of household water for 75% of homesteads. Depending on economic status, 49.1% of households have homestead ponds while 25.9% is dependent on the shared/community ponds. 100% settled homesteads are surrounded by thick vegetation. According to the questionnaire survey data, 86% of the homestead ponds are the source of fish protein for the inhabitants.

From the field survey, in Zone-A, a minimum homestead area of 6 decimal (243 square metres) is found in the settlement of Jinntola, Koralia and Char Duani and the maximum homestead area found in Jaliaghata are with a land area of 60 decimal (2431 square metres). According to the field survey, the average homestead area of Zone-A is 22.11 decimal (896 square metres). The minimum footprint for the built area found is 21 square

metres in the settlement of Jinntola and the maximum footprint for the built area found is 277 square metres in Jaliaghata. The average footprint for the built form of Zone-A is 86.9 square metres which is 10% of the homestead area (Table 5.1).

Table 5.1: Area for homestead, built form and pond in Zone-A

	Zone-A	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	
Homestead Area	Minimum (SQM)	243	284	243	243	446	324	365	405	324	324	**243**
	Maximum (SQM)	1297	1418	2229	891	2431	1783	2148	2107	1783	1783	**2431**
	Average (SQM)	648	713	887	543	1366	871	1122	1062	871	871	**896**
Built form Footprint	Minimum (SQM)	21	30	24	24	57	40	28	39	32	40	**21**
	Maximum (SQM)	121	109	210	127	277	207	192	198	186	183	**277**
	Average (SQM)	58.8	53.3	91	56.2	116.6	98.3	92.3	98.2	102.1	101.4	**86.9**
	% of Homestead	**9%**	**7%**	**10%**	**10%**	**9%**	**11%**	**8%**	**9%**	**12%**	**12%**	**10%**
Pond Area	Minimum (SQM)	0	0	0	0	0	0	0	0	0	0	**0**
	Maximum (SQM)	360	425	750	440	1020	620	660	736	560	550	**1020**
	Average (SQM)	168.5	186	309.4	171.2	356.7	302.4	285.1	339.6	200	209.4	**252.8**
	% of Homestead	**26%**	**26%**	**35%**	**32%**	**26%**	**35%**	**25%**	**32%**	**23%**	**24%**	**28%**

Note: Homestead area include uthan/courtyard and surrounding vegetation on viti.

82% of the homesteads on Zone-A have ponds within their homestead. The maximum size of the pond is found in Jaliaghata with an area of 1020 square metres. Average of the minimum area for the pond is found in Jinntola with an area of 168.5 square meters and the average maximum area for the pond is found in Char Kukrimukri – Babuganj with an area of 339.6 square meters. The average footprint for the pond of Zone-A is 252.8 square metres which are 28% of the homestead area. In Zone-A, 38% area of the homestead is consisting of built forms and ponds and the rest of the 62% area is the courtyard, homestead garden, circulation and setback.

From the field survey, in Zone-B, a minimum homestead area of 6 decimal (243 square metres) was found in the settlement of Char Folkan and the maximum homestead area was found in Char Mehar with a land area of 60 decimal (2674 square metres). The average homestead area of Zone-B is 17.6 decimal (712 square metres). The minimum footprint for the built area found is 24 square metres in the settlement of Char Elahi (Para-1) and the maximum footprint for the built area found is 143 square metres in Char Mehar. The average footprint for the built form of Zone-B is 73.9 square metres which is 10% of the homestead area (Table 5.2).

Table 5.2: Area for homestead, built form and pond in Zone-B

Zone-B		B1	B2	B3	B4	B5	B6	
Homestead Area	Minimum (SQM)	243	324	324	405	243	324	**243**
	Maximum (SQM)	1337	972	2229	2674	648	1783	**2674**
	Average (SQM)	608	519	794	1106	405	843	**712**
Built form Footprint	Minimum (SQM)	36	28	29	34	24	36	**24**
	Maximum (SQM)	130	141	130	143	106	134	**143**
	Average (SQM)	72.7	72.9	73.3	83	63	78.7	**73.9**
	% of Homestead	**12%**	**14%**	**9%**	**8%**	**16%**	**9%**	**10%**
Pond Area	Minimum (SQM)	0	96	0	0	0	0	**0**
	Maximum (SQM)	390	420	420	460	220	660	**660**
	Average (SQM)	184.3	173.6	171.3	245	92.6	259.4	**187.7**
	% of Homestead	**30%**	**33%**	**22%**	**22%**	**23%**	**31%**	**26%**

Note: Homestead area include uthan/courtyard and surrounding vegetation on *viti*.

85% of the homesteads on Zone-B have ponds within their homestead. The maximum size of the pond is found in Char Elahi (Para-2) with an area of 660 square metres. The average minimum area for the pond is found in Char Elahi (Para-1) with an area of 92.6 square meters and the average of the maximum area for the pond is found in Char Elahi (Para-2) with an area of 259.4 square meters. The average footprint for the pond of Zone-B is 187.7 square metres which is 26% of the homestead area. In Zone-B, 36% area of the homestead is consisting of built forms and ponds and the rest of the 64% area is the courtyard, homestead vegetation, circulation and setback.

From the field survey, in Zone-C, a minimum homestead area of only one decimal (41 square metres) was found in the settlement of Kumira Jele Para and the maximum homestead area found in Boalia, Bashbaria with a land area of 88 decimal (3566 square metres). The average homestead area of Zone-C is 33 decimal (1340 square metres). The minimum footprint for the built area found is only 8 square metres in the settlement of Kumira Jele Para and the maximum footprint for the built area found is 164 square metres in Muradpur. The average footprint for the built form of Zone-C is 78.5 square metres which is 6% of the homestead area (Table 5.3).

Table 5.3: Area for homestead, built form and pond in Zone-C

Zone-C		C1	C2	C3	C4	C5	C6	
Homestead Area	Minimum (SQM)	405	729	1337	1337	1054	41	**41**
	Maximum (SQM)	1783	2269	2674	2836	3566	162	**3566**
	Average (SQM)	904	1236	1799	1892	2119	91	**1340**
Built form Footprint	Minimum (SQM)	36	61	63	48	77	8	**8**
	Maximum (SQM)	142	139	164	130	148	26	**164**
	Average (SQM)	76.2	88.8	97.2	89	105.1	14.4	**78.5**
	% of Homestead	**8%**	**7%**	**5%**	**5%**	**5%**	**16%**	**6%**
Pond Area	Minimum (SQM)	0	185	0	0	355	0	**0**
	Maximum (SQM)	525	1090	1190	1080	1330	0	**1330**
	Average (SQM)	228	378.7	673	468.5	596.7	0	**390.8**
	% of Homestead	**25%**	**31%**	**37%**	**25%**	**28%**	**0%**	**29%**

Note: Homestead area include uthan/courtyard and surrounding vegetation on *viti*.

78.3% of the homesteads on Zone-C have ponds within their homestead. The maximum size of the pond is found in Boalia, Bashbaria with an area of 1330 square metres. The average minimum area for the pond is found in Dakkhin Moghadia with an area of 228 square meters and the average maximum area for the pond is found in Muradpur with an area of 673 square meters. The average footprint for the pond of Zone-C is 390.8 square metres which is 29% of the homestead area. In Zone-C, 35% area of the homestead is consisting of built forms and ponds and the rest of the 65% area is the courtyard, homestead vegetation, circulation and setback.

Table 5.4: Comparative ratio of area for homestead, built form and pond

		Zone-A	Zone-B	Zone-C	
Homestead Area	Minimum (SQM)	243	243	41	**41**
	Maximum (SQM)	2431	2674	3566	**3566**
	Average (SQM)	896	712	1340	**967**
Built form Footprint	Minimum (SQM)	21	24	8	**8**
	Maximum (SQM)	277	143	164	**277**
	Average (SQM)	86.9	73.9	78.5	**81.0**
	% of Homestead	**10%**	**10%**	**6%**	**8%**
Pond Area	Minimum (SQM)	0	0	0	**0**
	Maximum (SQM)	1020	660	1330	**1330**
	Average (SQM)	252.8	187.7	390.8	**272.7**
	% of Homestead	**28%**	**26%**	**29%**	**28%**

Note: Homestead area include uthan/courtyard and surrounding vegetation on *viti*.

Comparative analysis shows that a minimum homestead area is found in the settlement of Kumira Jele Para of Zone-C (Table 5.4). It is a different type of settlement in comparison to other settlements that have been surveyed. The maximum homestead area is also found in Boalia, Bashbaria of the same zone. It is found from the field survey that, the average area of a homestead is 967 square metres. The average footprint for the built form is 81 square metres which is 8% of the homestead area and the pond is 272.7 square meters which occupy 28% of the total homestead area. Artificial waterbody (i.e. pond) is the integrated part of a homestead which occupies 3.5 times the footprint area than the house forms do.

Agricultural fields and roads and paths also occupy the land area and they are important parts of the settlement. Agricultural fields create an elusive boundary for the settlements and road/path generates the morphology of a settlement (further discussed in Chapter 6). They may be organically created by people in the process of homesteading or created by the state as infrastructure.

5.2.2. Colour Pattern Analysis

By the colour pattern analysis, the constituent physical elements of a settlement are represented by prominent colour and the image is being analysed with the help of a software named PHP Tool. The software gives an output about the amount of colour shade used in the image and thus the amount of footprint of overall settlement with its different elements become visible. The areas of footprint covered are:

i) Area covered by the *Viti* (the raised land from the surrounding agriculture field). People build their homestead on *viti* to keep their homestead flood-free. Gradually the *viti* of adjacent homesteads are connected forming the whole settlement and looks like an island in the surrounded agricultural lands. In the colour pattern analysis footprint of *viti* or higher grounds is represented by yellow.
ii) Area covered by waterbody. A water body is the lifeline of a settlement in the Bengal delta. A natural canal or river is the primary water body that most of the settlements have. To create the *viti* land suitable for building houses, ponds are dug to collect earth. Ponds are thus the integrated part of a settlement. In the colour pattern analysis, ponds and natural canals within the settlement are represented by blue.
iii) Area covered by shelter or built form. The built form includes all shelters inside the settlement. They may have a different use. In the colour pattern analysis footprint by the built forms is represented by Black.
iv) Area covered by roads and paths. Roads and paths also occupy a land area and they are part of the settlement. They may be organically created by people in the process of homesteading or created by the state as infrastructure. In the colour pattern analysis footprint by the built forms is represented by Red.

This area is calculated with an approximate dimension which extracted the agricultural fields surrounded by the settlements.

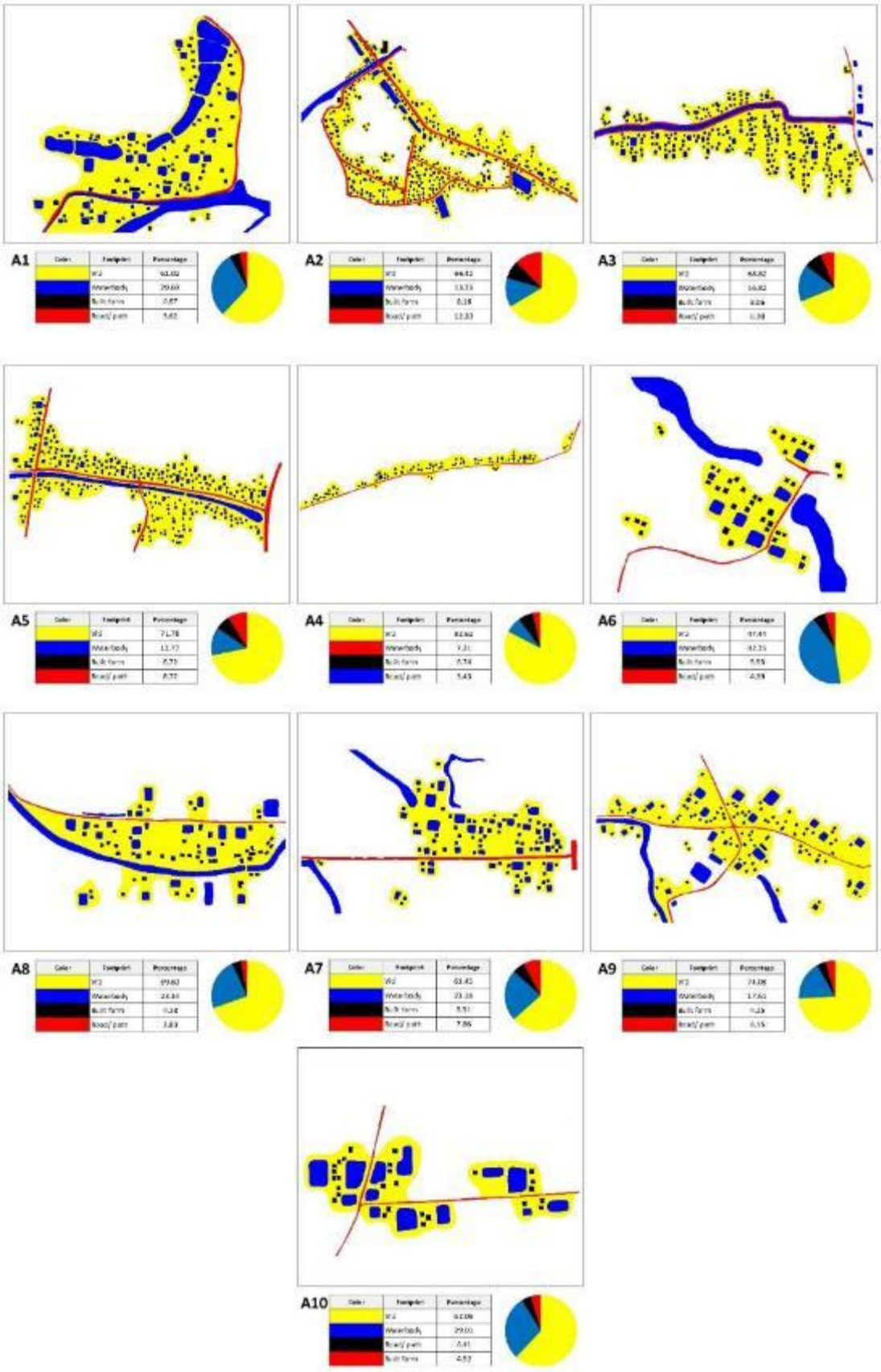


Figure 5.23: Colour pattern analysis of Settlements of Zone-A.

In Zone-A, it is found by analysing the 10 case study settlements that, waterbodies have a total of 22.85% footprint whereas the built forms have 7.08%. Circulation pathways have a footprint of 6.61% of the total area of the settlements.

In Zone-B, it is found by analysing the six case study settlements that, waterbodies have a total of 23.29% footprint whereas the built forms have 7.44%. Circulation pathways have a footprint of 4.86% of the total area of the settlements.

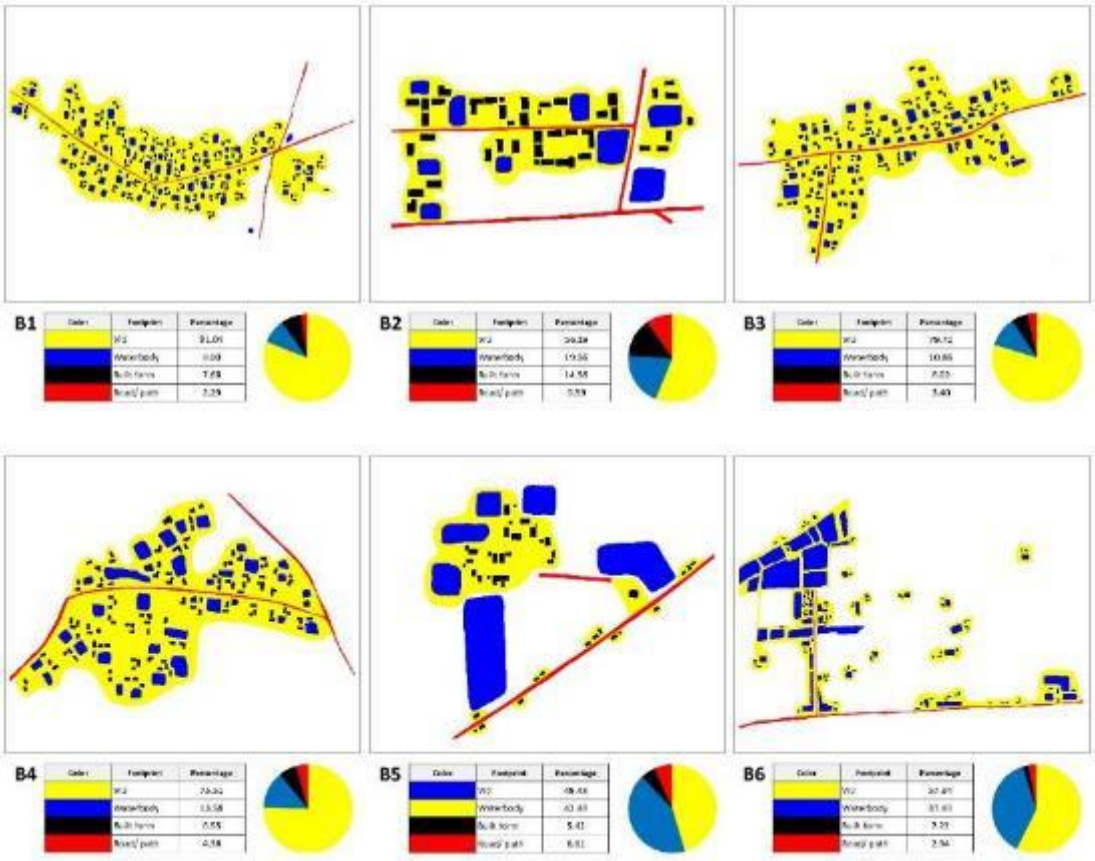


Figure 5.24: Colour pattern analysis of Settlements of Zone-B.

In Zone-C, waterbodies have a total of 20.44% footprint whereas the built forms have 9.35%. Circulation pathways have a footprint of 4.23% of the total area of the settlements.

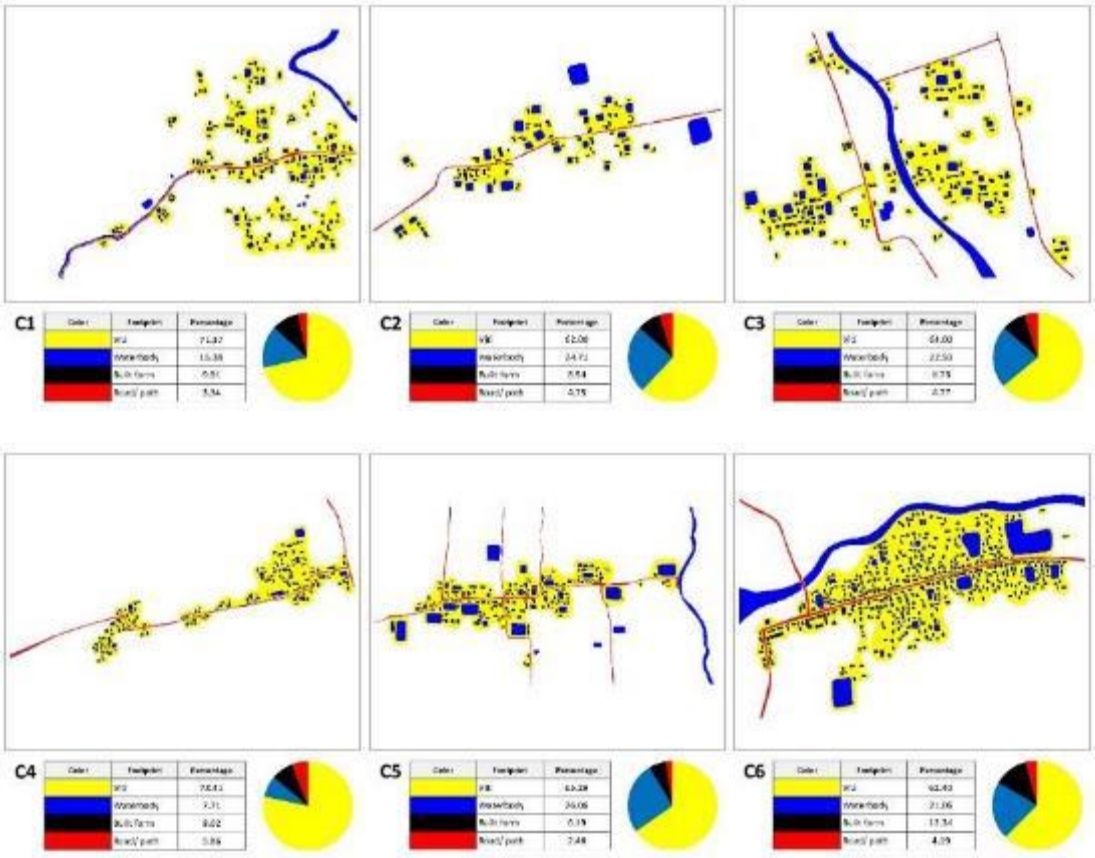


Figure 5.25: Colour pattern analysis of Settlements of Zone-C.

Viti and path generate the morphology of the settlement. The result of colour pattern analysis shows that the footprint for waterbody occupies on an average 21% of the land area of a settlement while the built forms occupy 7.30% (Figure 5.45). The waterbody of a settlement has three times the footprint of the land occupied by built forms. That also justify the findings from the quantitive analysis of Section 5.2.1 where the built form and waterbody was analysed on the basis of the received date of homestead level.

Color	Footprint	Percentage
	Viti (All elevated space including the green and open space)	66.66
	Waterbody (Canal, pond etc.)	21.08
	Built form (House, school, mosque, bazar etc.)	7.30
	Road/ path	4.96

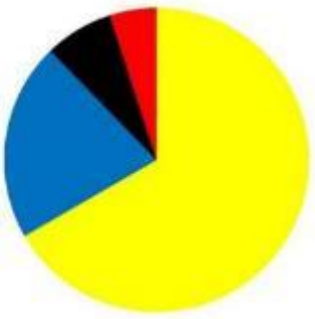


Figure 5.26: Summary of colour pattern analysis of all case study settlements.

5.3. Ethnographic Observation on the Settlements

From earlier discussion (Chapter 3) it is found that settlements of Bengal Delta are settled by the agrarian society. Besides a farmer in a village, some other relevant professionals live in the villages e.g. Kamar (ironsmith), Kumar (potter), Majhi (boatmen), Methar (cleaner), Jele (fishermen) etc for self-reliance. The phenomenological study on the 22 study settlements (and 220 respondents for quantifying the information) shows that 63.6% of the respondents are directly involved in agriculture, 7.7% are fishermen, 11.4% are in trade and commerce, 5% are service holders and 12.3% is doing other than the above five (Table 5.5).

Table 5.5: Comparative ratio of different occupations of the respondents.

Profession	Zone-A	Zone-B	Zone-C	Average
Agriculture	71.0%	66.7%	48.3%	**63.6%**
Fishing	10.0%	0.0%	11.7%	**7.7%**
Service	3.0%	6.7%	6.7%	**5.0%**
Business	9.0%	11.7%	15.0%	**11.4%**
Others	7.0%	15.0%	18.3%	**12.3%**
Total	*100%*	*100%*	*100%*	*100%*

The field survey shows that 78.2% of the inhabitants have their own agricultural land within the settlement (Table 5.6). On the other hand, it can be argued that agricultural land is one of the major forces founding a settlement and that ties down the people with their home settlement.

Table 5.6: Comparative ratio of availability of arable land.

Arable Land	Zone-A	Zone-B	Zone-C	Average
Yes	86.0%	65.0%	78.3%	**78.2%**
No	14.0%	35.0%	21.7%	**21.8%**
Total	*100%*	*100%*	*100%*	*100%*

There is a relation between the education level and the occupation of the inhabitants. As the landed property is becoming scarce, educated people tend to do services and business other than agriculture. Tables 5.7 and 5.5 shows that 26% of respondents of Zone-A have no formal education but 81% of respondents are engaged in agriculture and fishing. On the other hand, only 11.7% of respondents of Zone-C have no formal education but 60% of respondents in agriculture and fishing.

Table 5.7: Comparative ratio of the different education levels of the respondents.

Profession	Zone-A	Zone-B	Zone-C	Average
No	26.0%	13.3%	11.7%	**18.6%**
Primary	33.0%	36.7%	41.7%	**36.4%**
High School	26.0%	25.0%	20.0%	**24.1%**
Secondery	12.0%	16.7%	13.3%	**13.6%**
Tertiary	3.0%	8.3%	13.3%	**7.3%**
Total	*100%*	*100%*	*100%*	*100%*

The level of education also developed along with the age of settlement. People of Zone-C are more educated and the settlements of this zone are older than the other zones. Of the 22 case study settlements, 6 originated within the last 25 years, that is one full generation is still there, which means they are still in the formative stage. Four settlements are originating between 25-50 years ago; 9 settlements were with an age of 50-100 years and only 3 settlements were found to be 100 years old, showing the transient nature of settlements in the Bengal Delta. Such settlements are found in Zone-C because the landmass is more or less geo-climatically stable as this zone is in the foothill.

Table 5.8: Different age range of the case study settlements.

Age of the settlement	Zone-A (nos.)	Zone-B (nos.)	Zone-C (nos.)	Total (nos.)
Less than 25 years	2	4	0	**6**
25 to 50 years	3	1	0	**4**
50 to 100 years	5	1	3	**9**
More than 100 years	0	0	3	**3**
Total	*10*	*6*	*6*	**22**

The type of family is reflected in the growth pattern of the settlement. The type of family is also related to the establishment of the settlement. Survey founds that Zone-C has more joint family (combined family) than other zones. On average, 70.5% of families are joint and 29.5% are single in the survey areas. The average family size is 7.7 persons.

Table 5.9: Type of family in the case study settlements.

Profession	Zone-A	Zone-B	Zone-C	Average
Single	28.0%	36.7%	25.0%	**29.5%**
Joint	72.0%	63.3%	75.0%	**70.5%**
Total	*100%*	*100%*	*100%*	*100%*

It is found by the field survey that, 78.3% land of Zone-C belongs to the ancestor and 16.7% are purchased by the present inhabitants. On the other hand, in Zone-B, 15% land of Zone-C belongs came from the ancestor and 73.3% are purchased by the present inhabitants (Table 5.10). These data reflect the age and establishment of the settlement. As the people of Zone-B are more river eroded victims they need to settle their houses in a purchased land. Even 11.7% of people are using rental land to settle their homestead in this zone.

Table 5.10: Comparative ratio of the type of land ownership.

Land ownership	Zone-A	Zone-B	Zone-C	Average
Ancestral	43.0%	15.0%	78.3%	**45.0%**
Purchased	53.0%	73.3%	16.7%	**48.6%**
Sheltered	4.0%	0.0%	0.0%	**1.8%**
Rental	0.0%	11.7%	5.0%	**4.5%**
Total	*100%*	*100%*	*100%*	*100%*

Regarding the establishment of the house, it is found that 76% and 80% are self-built by the present inhabitants in Zone-A and Zone-B respectively. On the other hand, it is only 43.3% in Zone-C. 53.3% of the inhabitants of Zone-C received their houses from their ancestors (Table 5.11). It is happened due to the long age of the settlement.

Table 5.11: Comparative ratio of the origin of house establishment.

Establishment of House	Zone-A	Zone-B	Zone-C	Average
Ancestral	21.0%	16.7%	53.3%	**28.6%**
Self built	76.0%	80.0%	43.3%	**68.2%**
Purchased	2.0%	3.3%	3.3%	**2.7%**
Sheltered	1.0%	0.0%	0.0%	**0.5%**
Total	*100%*	*100%*	*100%*	*100%*

Inhabitants average stay in the settlement is 32.2 years in Zone-A, 15.1 years in Zone-B and 47.1 years in zone C respectively (Table 5.12).

Table 5.12: Duration of stay of the inhabitants in the settlement.

Duration of stay	Zone-A	Zone-B	Zone-C	All zones
Minimum (years)	4	4	26	**4**
Maximum (years)	70	58	70	**70**
Average (years)	**32.2**	**15.1**	**47.1**	**32**

Inhabitants average stay in the house is 26.3 years in Zone-A, 14.7 years in Zone-B and 39.7 years in zone C respectively (Table 5.13). People build new houses in the old

homestead or establish a new homestead in the same settlement when they leave their extended family. The average lifetime of a house is found 29 years from all three zones, that is about a generation.

Table 5.13: Duration of stay of the inhabitants in the settlement.

Duration of stay	Zone-A	Zone-B	Zone-C	All zones
Minimum (years)	1.0	4.0	13.2	**1**
Maximum (years)	65.0	58.0	70.0	**70**
Average (years)	26.3	14.7	39.7	**29**

Other than the Kumira Jele Para of Zone-C all the 21 settlements consist of the Muslim population.

5.4. Basic Character of Settlement

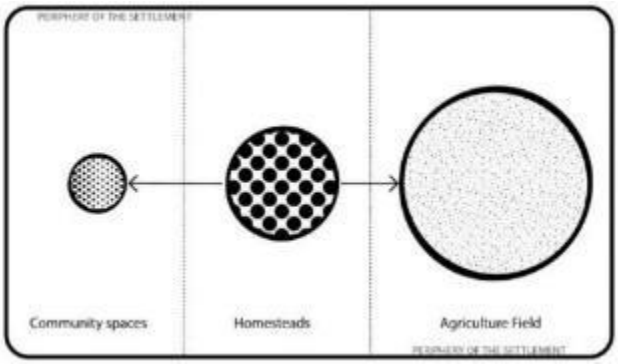
After a homestead, a *Para* is the smallest settlement unit of the socio-spatial structure. A village may be composed of one or several *paras*. The union is the lowest unit in the state's administrative structure but may not correspond with social *para*. The village is mainly a small settlement of human communities in the agrarian region where people's life and living depends on some form of local cultivation activity. Historically, a village was an autonomous area but in the modern system, a union is the lowest tier of administrative structure which may or may not follow the village boundary. The core socio-spatial character persists in the Bengal Delta in spite of gradual social transformation.

From time immemorial, most people lived in villages and most villages were similar socially and spatially. The social scientists and historians do not disagree on the autonomous and self-sustaining nature of Bengal villages, though they do differ on the methods of internal management and other institutional aspects of villages.

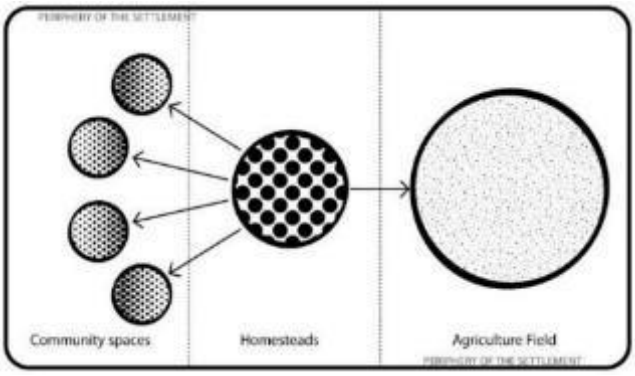
5.4.1. Connectivity Pattern of Settlement

The elements of a settlement are physically and psychologically connected sharing common memory. Homesteads act as the initial unit/module for any settlement. Generally, the settlements are surrounded by agricultural fields without any tangible physical boundaries. They only have an incognito understanding of the periphery of a settlement, which is psychological. The homesteads are linked with the community socialization spaces. Generally, two such social space is identified, one associated with the market and another with community pond/ school/mosque. However, there may be multiple numbers of such spaces depending on the population density and travel distance. The mosque is the most common space for community interaction which is found in almost every settlement. In 7 out of 22 cases, there are Eid-gah adjacent to the mosque. The Eid-gah has multiple uses throughout the year. 54.4% of the case study settlements

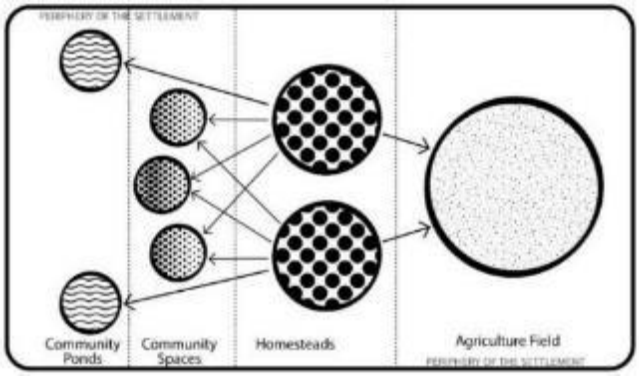
have community ponds, 40% of settlements have schools adjacent to the settlement and all the settlements have shops or bazar. In nutshell, Community ponds, Shops, Bazar, schools etc. are the other community interaction spaces.



a) Connectivity pattern of settlement having a single Community space.



(b) Connectivity pattern of settlement having multiple hierarchy Community spaces.



(c) Connectivity pattern of larger settlement having multiple Community ponds.

Figure 5.27: Different types of connectivity patterns in a viable settlement.

A community pond plays a vital role in the connectivity pattern of a settlement. There may be more than one community pond in a settlement. 3 out of 22 settlements has multiple community ponds. When a settlement has multiple community ponds the total homesteads are segregated into different groups or para and depend on different community ponds. Thus multiple groups of homesteads are created.

5.5. Summary

In the selection of sites, settlement is predominantly guided by geo-climatic factors and may be influenced by some other functional forces of nature or the occupation or circulation system and among the prevailing physical elements. The role of rivers, water channels, rice cultivation and paths/roads in creating a settlement pattern seems vital in the Bengal Delta. Economic factors, though secondary like markets, pathways, roads and canals have influenced the self-sufficiency of the village communities.

Case studies help identify some elements and stages of settlement formation i.e. Datum, Scattered and Clustered, Scattered and dispersed, Connection of multiple clusters, Compact cluster and Nucleated. It is found that the communication route plays an important role to determine the location as well as the shape of a settlement. The path gives the settlement inter and intra-accessibility with the community and community facilities. These organize the whole settlement in a generic manner taking various shapes.

Homesteads act as the initial unit of the module for any settlement. The built forms, courtyard and the water body are the three major components of this module in the middle of the agricultural field. Surveys show that artificial waterbody (i.e. pond) is the integrated part of a homestead which occupies 3.5 times the footprint area than the house forms do. Built-form and courtyard (uthan) are functionally complementary and forms the core or served area while pond and surrounding vegetation is the service of a homestead.

The survey found some settlements evolving in a scattered manner but the houses are clustered. Thus it looks like a few clustered are placed scattered over a wide landmass. Settlements are scattered and dispersed at the primary stage of their emergence. Multiple homesteads make the clusters, often they share the source of water, social spaces and even homestead premises with each other. Such clusters connected with strong physical community elements makes a '*para*'. The compact clustered settlement is a closely built-up area of houses. In this type of village, the general living area is distinct from the surrounding agricultural land. The closely built-up area and its intervening streets present some recognizable pattern or geometric shape, such as rectangular, radial, linear, etc. In such settlements, all the dwellings are concentrated in one central site. The inhabitants of the village live together and enjoy the benefits of community life. There is a well ordered blue, green and grey network. It reinforces the bracketed concept of this research for the spatial distribution and constituent components of a settlement, identified in the literature review. That is a scattered cluster taking different forms in response to the prevailing context of datum. Each cluster being consisting of a homogenous part, circulatory part and special part. One or more clusters may form a village. The group of homesteads that are connected both physically and socially is the generic settlement. They may not be under the same official administrative unit constituted by the state but definitely will have socio-psychological cohesiveness.

Chapter 6

ANALYSIS FOR GENERIC SETTLEMENT PATTERN IN THE PRESENT CONTEXT

"The space, natural or man-made, used by man, is a part of the settlement... (and) the space of a settlement accommodates all function of man, and can be recognized by his imprints on nature."

– C.A. Doxiadis

6.1. Morphological Analysis Substantiating for the Generic Pattern

Morphological study of settlements involves the study of the evolving patterns on the one hand and settlement layout plan and built-form on the other. The settlement pattern is the outer form of settlements resulting from the natural response and growth in its physical and cultural setting i.e. the physical relationship of settlement elements as a product of several geo-climatic and socio-economic forces. Thus, such studies analyse specific aspects through rationalization, identification, classification, regionalization as well as the description of the structure of settlements and their associated components. Therefore, it presents the process, function and mechanism in corroboration with different geo-climatic and socio-economic interactions.

In the present study, the morphological analysis of study settlements has been visualized with the physical pattern and structure of the settlements. It may be observed that the settlements are spontaneous and represent a kind of natural response and growth within the existing setting of the landscape. Although apparently study settlements do not express well-defined shapes and a distinct internal plan, but deep inside a considerable order and relationship, both in the internal system and external outline is observed and documented. Settlement pattern may be recognized by mere assessing the contiguity of one house with the other house. But the importance of the combined effect of different variables cannot be over ruled as being developing simply as an outcome of house clustering pattern. It is the relationship between basic components of settlement.

Mowla (2019b) in chapter 3 describes that there is an overall hierarchical pattern within organic settlements in Bangladesh. It begins with a *gram* (village) or *pada* (neighbourhood) usually established on prominent or raised land, composed of a number of *badi* (homesteads) *padas* (neighbourhoods) and spontaneous public gathering places like *morh/hat* (node/periodic market) with shops/mosque/school/ponds etc. Each *pada* consists of a number of *badis* (homesteads), which in turn are comprised of several *ghars*

(dwelling units of individual households within an extended family) and ancillary buildings (Figs: 3.20 & 3.21). Section 5.2.1 discusses the generic module revealed from the indigenous settlement case studies, the waterbody (i.e. pond) forms the integrated part of a homestead which occupies about 3.5 times the footprint area than the house forms itself.

According to Doxiadis (1968), as discussed in chapter 3, settlements are one of the basic parts of the system between man and society, which in his words "the space, natural or man-made, used by man, is a part of the settlement... (and) the space of a settlement accommodates all function of man and can be recognized by his imprints on nature." With regards to a settlement, the built-up area is the most intensively used part where dense expression of various functions of physical and cultural attributes can be seen. Thus, the built-up area becomes the core for a functioning community that covers/influences the surrounding space (Figure: 3.16). Based on Doxiadis (1968), in the present study, the morphology of Bengal settlement can be divided into four basic components:

1. The Homogeneous part
2. The Central part
3. The Circulatory part
4. The Community interaction part

These parts are closely associated with four dimensions viz. process, scale, time and spatial distribution discussed in Fig. 3.20, in which Mowla (1997 and 2019b) argued that, in the indigenous way of life, work, recreation/leisure and living comprise an interwoven system where, sometimes, it is difficult to segregate different components. This also reflects on their spatial development eg. mixed-use developments and multi-functional use of spaces from rooms in a house to public spaces. Even a path is a social space. This is a part of indigenous culture in the Bengal Delta. If the basic principles are understood and underlining order is identified, it is easy to translate settlement forms at any level and scale.

6.1.1. The Homogeneous Part

The Homogenous part is the work area or agricultural fields with which the indigenous settlements are surrounded and have a great role over the morphology of the settlement. One of the earliest and most dominant living traditions emanates from the rice cultivation -eating habit of the people of the Bengal delta. It is no wonder that rice fields dominate the landscape of indigenous Bangladesh. It is a very common nature of Bengal settlement that small villages are established like some islands in the middle of vast rice fields (Section 3.7). The whole Bengal delta is an immense floodplain, covering about 80% of Bangladesh and dominate life and living in Bangladesh.

These fields have multiple uses round the year with changing seasons and context for cultivation and other social uses in addition to being the land bank. This homogenous part of the settlement provides the scope for the expansion of the homesteads. The Homogeneous part of a settlement is the main source of food for the whole settlement and provides identity to the settlement.

Char Montaj (Zone-A)

Char Folkan (Zone-B)

Figure 6.1: Homogeneous part occupies most of the land.

Dakkhin Moghadia (Zone-C)

Char Jogbondhu (Zone-B)

Figure 6.2: Fields have different uses round the year.

6.1.2. The Central Part

The Central part consists of built forms particularly the homesteads of a settlement. An attempt has been made to study the homesteads and their types in the context of the physical as well as cultural environments of the study area. The house, a predominant element in the cultural landscape, provides evidence of the complex relations between man and his environment in this delta.

The typical core unit within a settlement in the Bengal delta is a homestead, consisting of a group of structures belonging to a single or an extended family. A typical feature is that of the arrangement of structures around a rectangular open courtyard (*Uthan*). Circulation between structures is through the courtyard and they face it and open into it while presenting a closed surface to the outside. Ponds are also an integral part of a typical homestead. Larger homesteads have a separate structure at the front of the homestead, which is built as a men's social space (*baithak ghar, Banglaghar* or *Kachari ghar*). *Uthan, ghat* and *Kacharighar* are the primary level social spaces in the settlement.

The indigenous *uthan* has multiple-use and functions on different occasions or festivals, ceremonials and even in day-to-day life. It is the privileged space of family and social cohesion, unique to the Bengal Delta. Being in a warm-humid area, outdoor living is important and the courtyard acts as the work and recreational area for the homestead. Household courtyards are basically the female and children domain. Non-residential parts of the settlement also developed around the different hierarchy of open space like *morh/hat/bazar*, mosque, school, pond etc.

6.1.2.1. Homestead Pattern

Depending on the social status and economic level of the inhabitants, the homesteads may have different numbers of houses clustered around a courtyard and this cluster creates a variant of the basic shape. The overall homestead pattern constitutes pond as part of the basic unit of the settlement morphology.

Each homestead begins with a main sleeping dwelling unit and ancillary structures, such as kitchens, stores and cowsheds. As the family grows, service units move farther to peripheral and more dwelling units are added around the courtyard. Thus, a homestead usually consists of several small buildings constructed consecutively. There are other features as well. A backyard pond is a characteristic of many large homesteads. Trees are planted along the outer boundary of the homestead to protect the homestead from strong wind, provide shade and serve as a source of horticulture, fruit and timber.

Figure 6.3: Homestead parts in Char Duani of Zone-A.

6.1.2.2. Homestead ponds

81.8% of homesteads in the survey area have their own pond, 14.5% of homesteads have additional backyard ponds, signifying the water body to be the integral and important part of the indigenous settlement. Not a single study settlement was found without a close relationship with the surface water body. The pond is dug to create the settlement. Ponds are used as a source of household needs. Ponds *ghat* (landing stairs) are the socialization space for the womenfolk, sometimes, they create a screen around the *ghat* to ensure privacy.

Char Kukrimukri (Zone-A)

Char Folkan (Zone-B)

Char Duani (Zone-A)

Char Alexander (Zone-B)

Figure 6.4: Ponds with different types of *Ghat* as a part of the homestead.

6.1.2.3. Building materials and Form

The environmental conditions like climate and financial status of the people are reflected in the construction features and materials used in the houses. Walls in indigenous houses are generally of two types: the more common screen type is constructed of various types of organic material, often thin and porous, to allow ventilation. The roof is the most difficult part to construct and the most expensive part of a house. Pitched roofs are usual, and of the gable (*do-chala*) or hipped (*chau-chala*) varieties are common for the main unit; the mono-pitched (*ek-chala*) roof is often used only in ancillary building. Roof types vary, but one most historic and common characteristic of the southern floodplains is the thatched roof with a ridge of curved bamboo poles. In the study area, the building materials used for house construction may be grouped into the following three categories (Brick and CI sheets are introduced during the colonial period):

a) Enclosing materials: bamboo, leaves, CI sheets, timber, burnt bricks, etc.
b) Roof materials: leaves, CI sheets, timber, burnt bricks, tiles, cement, etc.
c) Floor materials: mud, cement, concrete etc.

One of the generic features of the homestead is the use of locally available natural resources as building materials. However, the recent expansion of the cash economy has entailed the availability of imported and industrially produced building materials (though not environment friendly), such as corrugated iron (CI) sheet and brick, which although not affecting homestead pattern or house form very much, has altered the outer appearance of indigenous landscape substantially.

When the house is made of durable materials like brick or concrete the houses become compact in nature and ‘rooms’ are transformed into ‘houses’ within one roof (Fig. 6.11). The chronology of the use of the material is expressed in the following diagram:

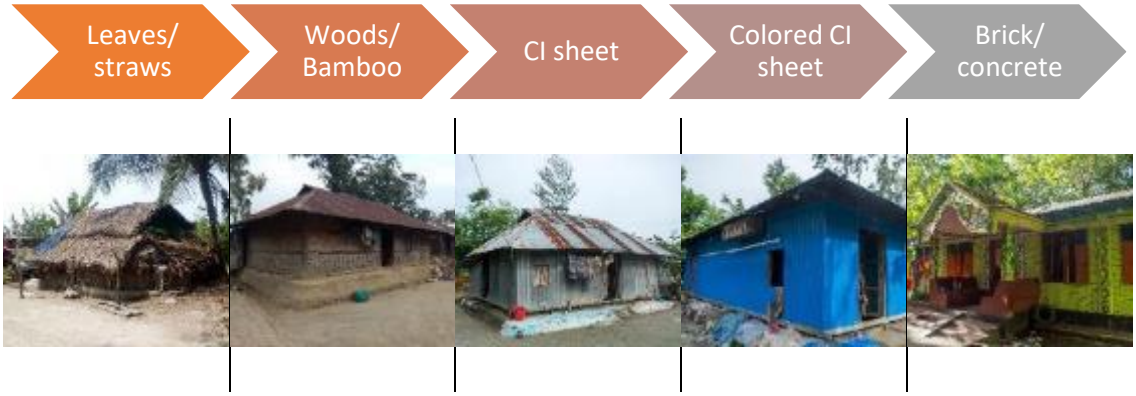


Figure 6.5: Chronology of the use of different building materials.

6.1.3. The Circulatory Part

Kutcha road at Jinntola (Zone-A)

Kutcha road at Padma Char (Zone-A)

Semi-pucca road at Jaliaghata (Zone-A)

Semi-pucca road at Char Mehar (Zone-B)

Pucca road at Char Kukrimukri (Zone-A)

Pucca road at Boalia (Zone-C)

Figure 6.6: Different types of roads as the circulatory part of a settlement.

Roads, paths and canals act as the major component of the Circulatory part in an indigenous settlement. This part of a generic settlement is the binding element of the total settlement. These may vary from the informal level *halot* to very formal level road. Their patterns are also commonly generated by geo-morphology but sometimes, they are imposed in a planned manner. Roads act as a connector and medium of communication with the other villages, bazars and other necessary services that are not within the premises of the settlements. In earlier days canals played a stronger role to shape the settlement, but now a day canals are gradually losing their function as a circulatory component for a settlement. Primary roads/paths have mostly evolved from *'halots'* developed in the paddy field at the earlier stage of settlement formation (Section 3.4.2).

6.1.4. The Community Interaction Part

There are some common spaces for the community in every settlement. *Hat*, Mosques, *Eid-gah*, Community ponds, schools etc. are the most common social spaces of a settlement.

a) Mosque: Mosque is a very common built form for every settlement. The land for such built forms is generally donated by the inhabitants. It is observed in the case study settlements that every Muslim village has a mosque. As the settlement expands and the population increases new mosques may come up.

Char Duani (Zone-A)

Char Jogbondhu (Zone-B)

Boalia (Zone-C)

Padma Char (Zone-A)

Figure 6.7: Mosques with different building materials.

b) Eid-gah: Eid-gah yet another prevalent open space used only twice a year for eid congregation and round the year used as a children's play area or other social gatherings space. 34% of the case study settlements has dedicated eid-gahs.

Figure 6.8: Eid-gah in the settlement of Koralia (Zone-A)

c) Community Pond: In the case study settlements 54% settlement has pond dedicated to the community and 25% of them has multiple ponds for the community. Such ponds are for the use of the community. People get drinking and household water from these ponds.

Koralia (Zone-A)

Padma Char (Zone-A)

Figure 6.9: Community Ponds

d) School: Though, not every settlement has a school, but primary schools when available are mostly government property, but acts as a social space for the community. 35.7% of the case study settlements have a school within the settlement. The school and its adjacent field are treated as a community space and school buildings are used as a shelter during natural calamities.

Padma Char (Zone-A)

Koralia (Zone-A)

Char Folkan (Zone-B)

Char Kukrimukri (Zone-A)

Figure 6.10: Primary schools in different settlements.

e) Shops or *hat/Bazar*: It is found that every settlement has at least one shop. In some cases, a *hat/bazar* is found adjacent to the settlement. Bazar and the local shops work as the centre for social interaction for the community people along with the usual business and trading. The shops and tea stalls are also seen in nodes/*morh* are gathering/gossiping places for the youths.

A *morh* shop in Char Folkan (Zone-B)

Bazar in Char Montaj (Zone-A)

Figure 6.11: A rural shop and a bazar in two different settlements.

There may be some other spaces for community use, such as the dedicated place for animal sacrifice, cyclone shelter, social club etc. These elements together form the community interaction part of the settlement pattern evolving in a generic manner.

Figure 6.12: School, Mosque and Eid-gah in the settlement of Jaliaghata (Zone-A).

The following table shows the amount of important social spaces in different study zones.

Table 6.1: Amount of important social spaces in different survey zones.

Social spaces of case study settlements				
	Zone-A	Zone-B	Zone-C	Average
Mosque	100%	100%	83%*	94%
Eid-gah	20%	33%	50%	34%
School	40%	17%	50%	35.7%
Community pond	50%	50%	67%	55.7%

* other worship space together makes 100%

All the case study settlements of Zone-A and B has Mosques. 83% of settlements of Zone-C have mosques; the rest are not settlements with Muslim populations but have their worship place. It is found that all settlements have at least one religious space for their inhabitants. On average 34% of settlements have Eid-gah. This Eid-gah has multiple uses throughout the year. 35.7% of settlements have a school for the kids. The rest of the settlements have to use schools from other nearby settlements. 55.7% of settlements have a community pond from here the inhabitants collect drinking or household water. Overall it seems, Bazar, Mosque and community water bodies are the most dominant community interaction part of the settlement pattern evolving in a generic manner, and frequently they are located adjacent to each other.

6.2. Settlement Organization of Case Study Settlements

As per Doxiadis (1968), components forming a settlement i.e. The Homogeneous part; The Central part; The Circulatory part, and the Community interaction part has been identified in the organically or spontaneously growing settlements in the study areas of Bengal Delta, that is, Bengal Delta has a pattern of settlements different from any other settlement in the world. What makes it unique is the manner the settlement components

are composed or organized. Pattern refers to the internal relationships of different components and when similar relationships between the components and growth are seen, it is termed as generic. The analysis of settlements reveals the arrangement of the Homogeneous part as a base palate, where the Central part, the Circulatory part, and the Community interaction part occur in a definite relationship. The Homogenous part of the settlement is generic in nature where the pattern occurs with its characteristic features as a unit as well as a distinctive entity of a larger system in territorial form. Nucleus form is most common but due to other contextual forces several varients are observed, these may take different shapes. Analysing the spatial structure of the case study settlements, four variants of organization of the central part, community interaction part and the circulatory part within the homogenous part are observed:

a) Core community interaction part at an end of the settlement
b) Detached core Community interaction part
c) Central community interaction part forming a nucleus
d) Holistic integration

6.2.1. Core Community Interaction Part at an End of the Settlement

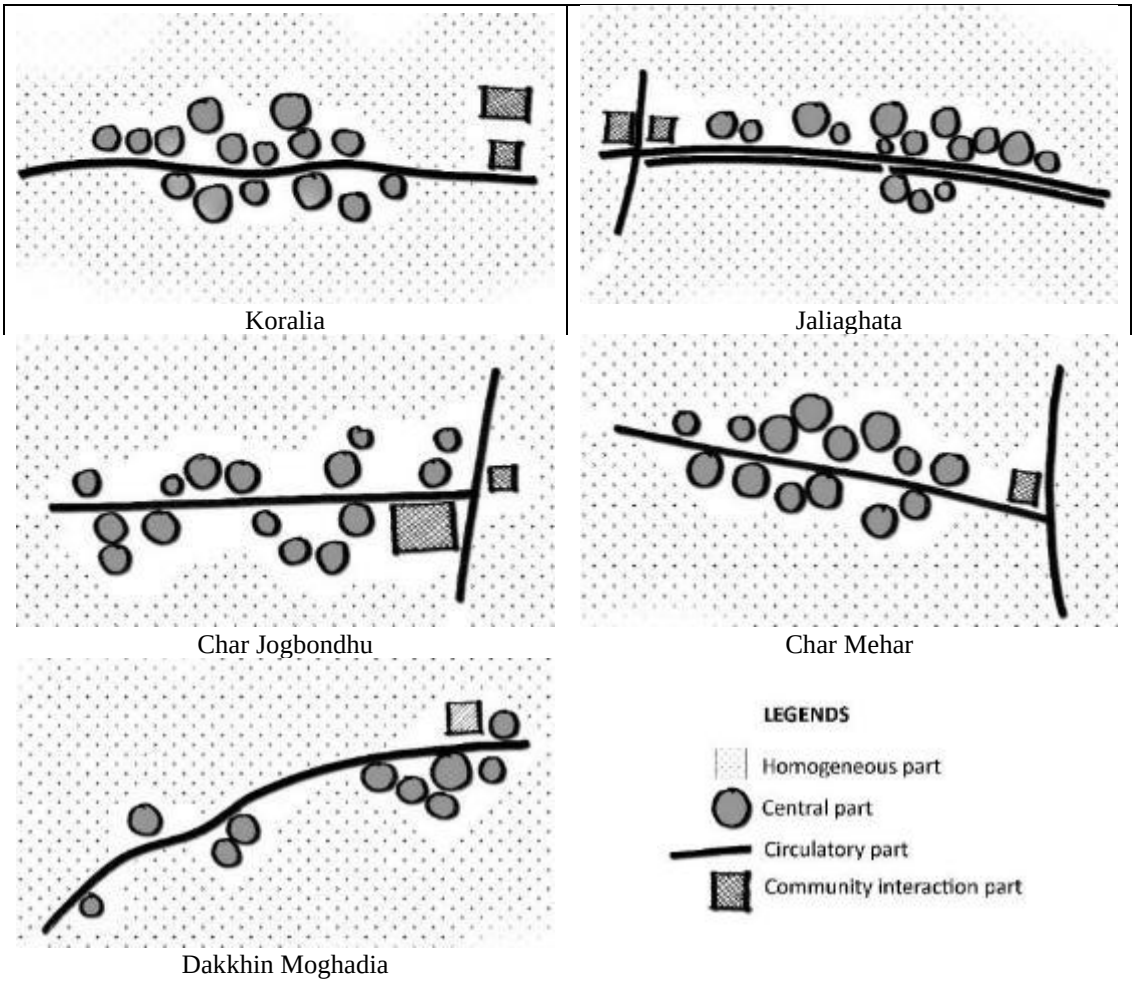


Figure 6.13: Morphological structure of case study settlements where Community interaction part is at an end of the settlement.

In some cases, it is found that the Central parts are organized side by side along the regional Circulatory part. The Community interaction part is positioned at an end of the settlement. In all cases, they are positioned at the entrance end of the settlement. If there are multiple elements of the Community interaction part they may comprise all together and create a community zone. Koralia and Jaliaghata of Zone-A, Char Jogbondhu and Char Mehar of Zone-B and Dakkhin Moghadia of Zone-C are examples of such pattern.

6.2.2. Detached Core Community Interaction Part

It is observed that in some cases, the Central parts are organized away from the regional circulatory part and where the Circulatory part does not directly play a role over the organization due to topographical reasons. The Community interaction part is positioned at a detached location from the group of the Central part because of the availability of land. Char Kajal of Zone-A, Char Elahi (para-1) and Char Elahi (para-2) from Zone-B are examples of such pattern.

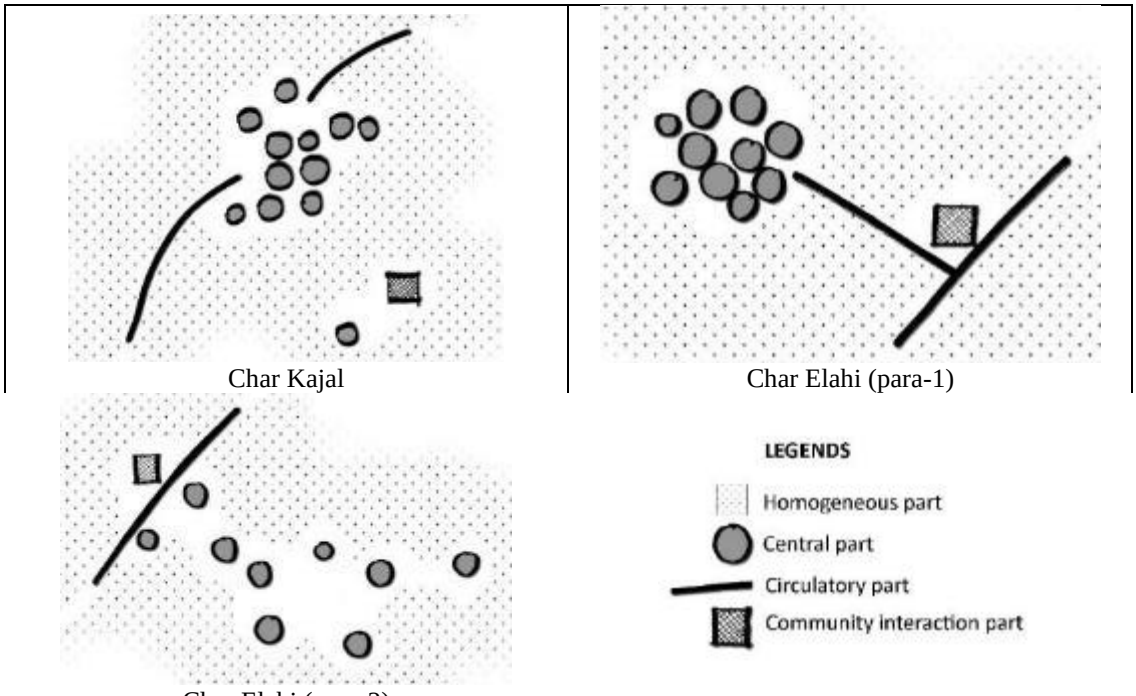


Figure 6.14: Morphological structure of case study settlements where Community interaction parts are detached.

6.2.3. Central Community Interaction Part forming a Nucleus

This is the most common type in the study areas. In such cases, the Community interaction part acts as the nucleus of the settlement. The components of Central parts are grouped around the social spaces. In this variant of pattern, the Community interaction parts are in the shorter reach of the inhabitants. There may be multiple social cores with a dominant one as a nucleus for the settlement. Though there is not more than one mosque in a settlement there may be multiple ponds or social gathering spaces that act as Community interaction part of the pattern. Char Duani, Char Montaj, Char

Kukrimukri (Shababpur) and Char Kukrimukri (Boyatibari) of Zone-A; Char Alexander of Zone-B; Saidpur, Nadalia, Boalia and Kumira Jele Para of Zone-C are the examples of such variant of pattern. In Kumira Jele Para of Zone-C, the open spaces in between the dwellings act as the Community interaction part.

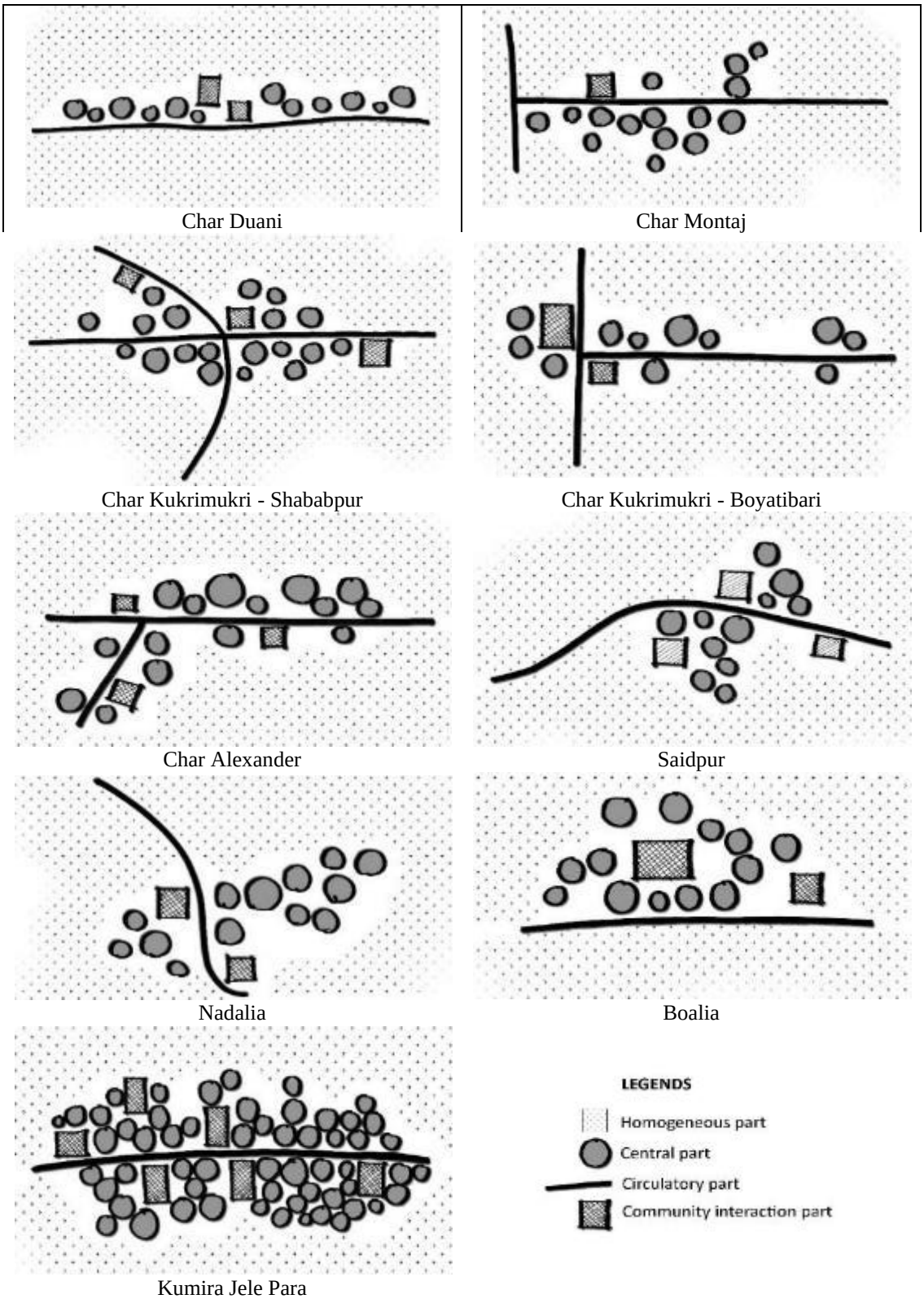


Figure 6.15: Morphological structure of case study settlements where Community interaction parts act as a nucleus.

6.2.4. Holistic Integration

It is found in some cases that the Community interaction parts are positioned in an integrated manner with the Central parts but they do not act as a nucleus. Because of the various physio-geographic reason the homesteads are not suitable to develop around the social spaces. Jinntola, Padma Char and Char Kukrimukri (Babuganj) of Zone-A; Char Folkan of Zone-B and Muradpur of Zone-C are examples of such pattern.

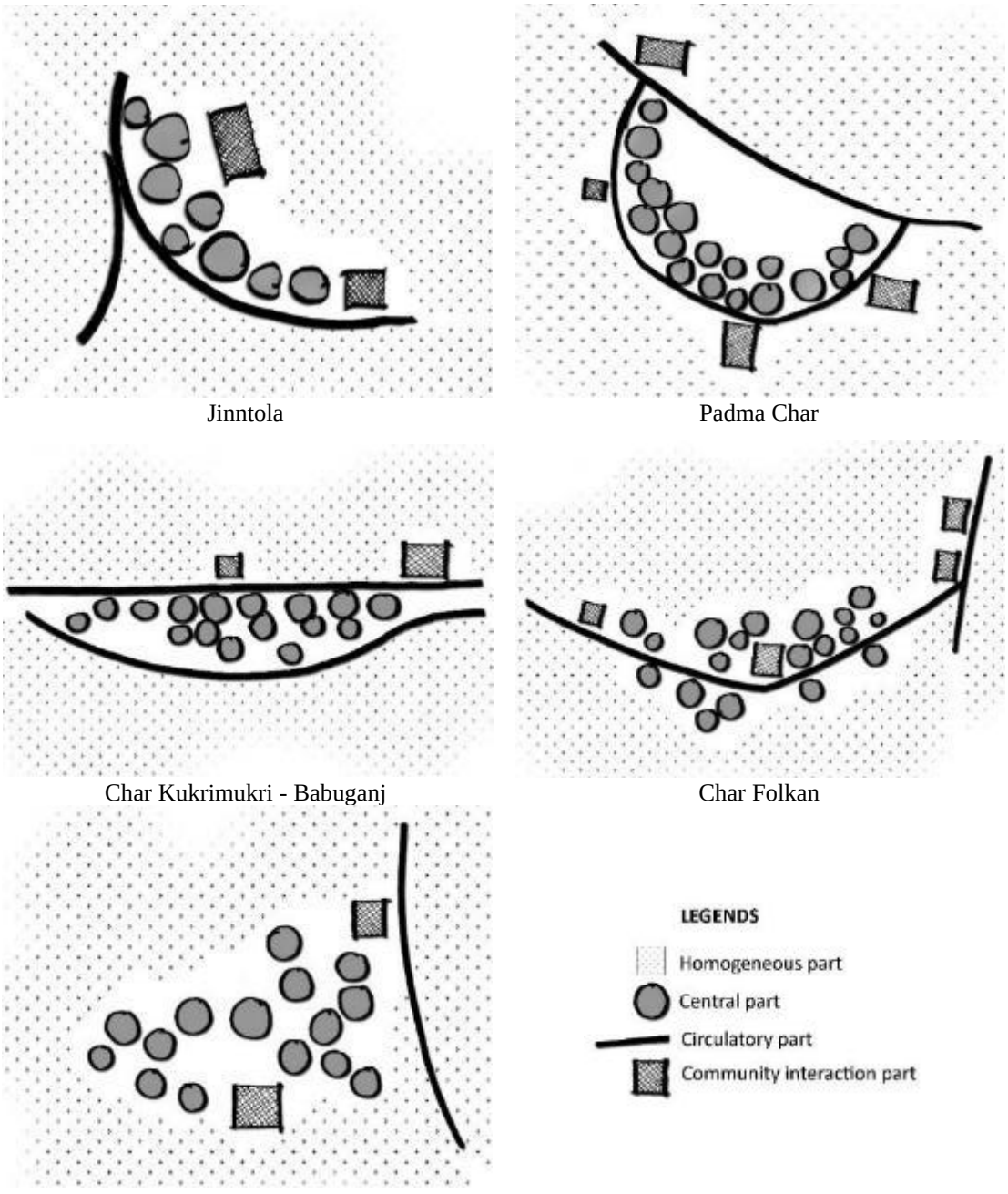


Figure 6.16: Morphological structure of case study settlements where Community interaction parts are integrated.

6.3. Physical Attributes of Settlement Pattern in Different Zones

The settlement pattern is similar but the shapes vary in different zones of the study area. The varients are due to the difference in attributes and these attributes determine the shape. The major physical attributes causing the variant is listed as follows:

a) Number of the house in a homestead
b) Shape of the homestead
c) Number of ponds in homestead

A comparative analysis of the field survey of different zones with respect to physical attributes of the central part of the settlement pattern is discussed here.

6.3.1. Number of House in a Homestead

The number of rooms is varied in different zones. This is because of the socio-cultural livelihood of inhabitants. In Zone-A, one big room is generally used for dwelling. The service parts like kitchen and storage are also solved within this single built form. Few homesteads have a different form for kitchen and cattle. On the other hand, in Zone B and C, single house form is not practised widely. Cluster with rectangular built forms is the traditional dwelling in these zones. Based on the number of rooms in a house, the houses have been grouped into four categories as shown in the following table.

Table 6.2: Number of houses in a homestead in different survey zones.

House numbers in a homestead (%)				
	Zone-A	Zone-B	Zone-C	Average
One	62%	18.3%	15%	31.8%
Two	26%	40%	38.3%	34.8%
Three	12%	30%	33.3%	25.1%
More than 3	0%	11.7%	13.3%	8.3%

Above table shows that the number of house form vary in different locations. In Zone-A there are 62% homesteads with single house forms, 26% of homesteads have two house forms and 12% of homesteads have three house forms. In Zone-B and C single room dwelling is only 18.3% and 15% respectively where the two-room dwelling is 40% and 38.3% respectively. There are 11.7% and 13.3% dwellings that have more than three rooms respectively in Zone B and C. There is no more than three-room dwelling found in Zone-A. On average, 31.8% of homesteads of the case study settlements have a single house dwelling, 34.8% of homesteads have a dwelling unit with two house forms, 25.1% of homesteads have dwelling unit with three house forms and there are 8.3% homesteads

found with more than three house forms. The more dense or more rooms, the older is the homestead or the settlement.

One room homestead at Char Montaj (Zone-A)

Multiple room homestead at Dakkhin Moghadia (Zone-C)

Figure 6.17: Homesteads with a different number of rooms.

6.3.2. Shape of the Homestead

Rooms (living, kitchen, cattle etc.) of a homestead are clustered in different shapes. They are categorized into five shapes. They are square shape, I-shape, L-shape, U-shape and O-shape.

Table 6.3: Shape of homestead cluster in different survey zones.

Shape of homestead (%)				
	Zone-A	Zone-B	Zone-C	Average
Square shape	48%	10%	6%	21.3%
I-shape	18%	22%	18%	19.3%
L-shape	22%	40%	46%	36%
U-shape	12%	22%	24%	19.3%
O-shape	0%	6%	6%	4%

The above table shows that; 48% of homesteads of Zone-A are in a square shape. On the other hand, Zone-B and C have only 10% and 6% of such organizations respectively. This is because of the single room dwellings at Zone-A. The single room is normally in a square shape. When the kitchen, stores and other functions are adjusted within adjacent rooms the form looks like ‘I’ in shape. ‘L’ is the most common shape in Zone B and C. Multiple rectangular rooms are organized in L shape. Sometimes they create a ‘U’ shape. ‘O’ shape also found in a very little number when the house forms enclosed an internal courtyard in Zone-B and C. No such situation is found in Zone-A.

On average, 21.3% of homesteads of the case study settlements have a square-shaped house form, 19.3% of homesteads have dwelling unit with a linear-shaped house, 36% of homesteads have house form that creates ‘L’ shape, 19.3% homesteads have a

comparatively large house that creates ‘U’ shape and there are only 4% homesteads found with an ‘O’ shaped house forms.

‘L’ shape organization of homestead at Char Kukrimukri (Zone-A)

‘U’ shape organization of homestead at Char Elahi (Zone-B)

‘I’ shape organization of homestead at Boalia (Zone-C)

Square shape organization of homestead at Char Kajal (Zone-A)

Figure 6.18: Homesteads with different shapes of the organization.

6.3.3. Number of Ponds in a Homestead

It is discussed earlier that the pond is an important segment of the homesteads as well as the whole settlement. A settlement in this delta cannot be imaginable without the existence of a pond. Homesteads may have a single pond or two ponds within the premise

of the homestead. Though there are some homesteads without any ponds. The following table shows the number of ponds in the homesteads of different zones of the study areas.

Table 6.4: Proportion of the homestead cluster with different number of Ponds.

Pond numbers in homestead (%)				
	Zone-A	Zone-B	Zone-C	Average
Single Pond	69%	75%	56.7%	66.9%
Double Ponds	13%	10%	21.7%	14.9%
No Pond	18%	15%	21.7%	18.2%

There is a single pond in 69% of homesteads in Zone-A, 75% homesteads in Zone-B and 56.7% homesteads in Zone-C respectively. There are double ponds in 13% of homesteads in Zone-A, 10% homesteads in Zone-B and 21.7% homesteads in Zone-C respectively. 18% of homesteads in Zone-A, 15% homesteads in Zone-B and 21.7% of homesteads in Zone-C has no pond within their homestead premise. They need to use the community ponds; the natural canal or lakes are the supplements of the ponds. On average, 66.9% of homesteads of the case study settlements have a single pond at their homestead, 14.9% of homesteads have two ponds within their homestead and there are 18.2% of homesteads found without any pond.

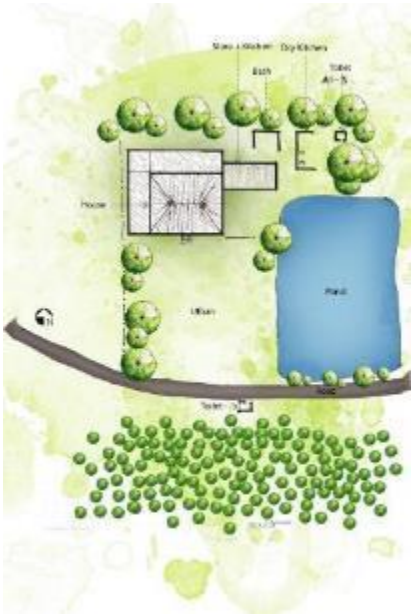


Figure 6.19: Homestead with a single pond at Padma Char of Zone-A.

6.3.4. Interrelationship of Different Attributes

The pattern of settlement is the relationship between one form to another. The attributes that are discussed in previous sub-sections are interrelated and play a role in the pattern of the overall settlement. Settlement condition depends on the economic and social state

of the household. The categories of the settlement are affected by the local environment and construction materials that are available locally in the context of the area. With the increase of family members, households are expanding their homesteads in a horizontal way that gradually decreasing agricultural lands. The nature of built-form and pond types and their distribution has an impact on settlement pattern.

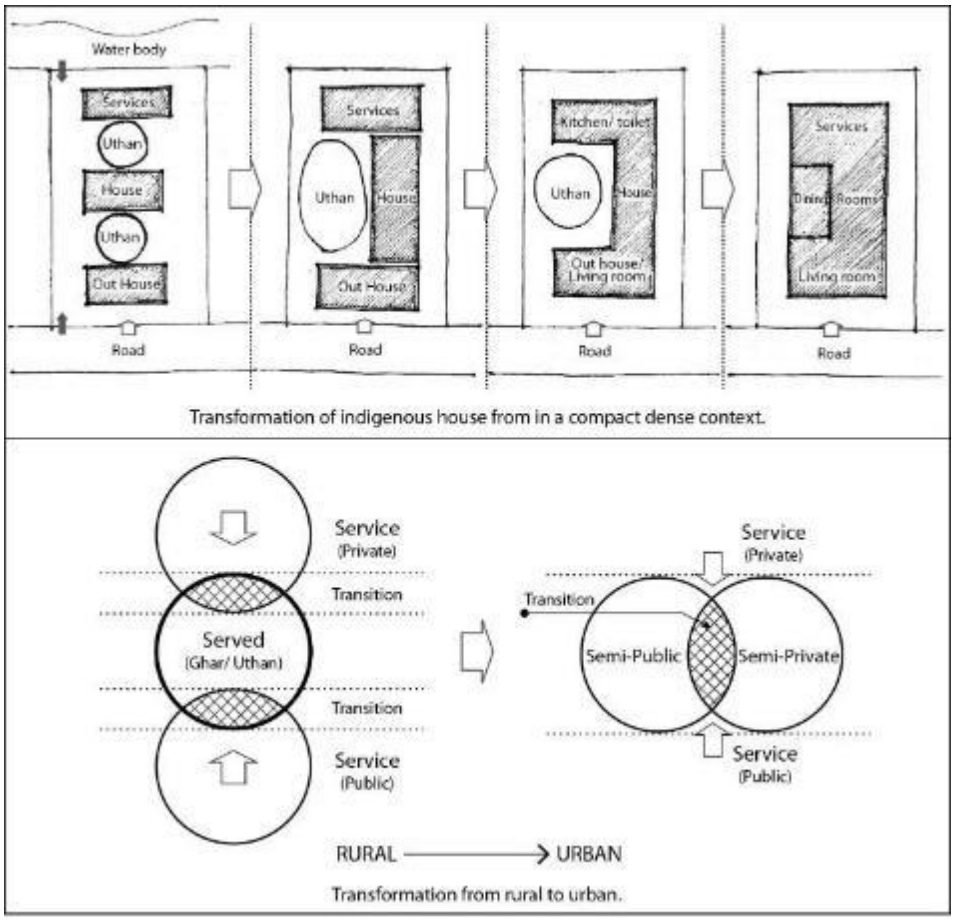


Figure 6.20: Mutation of Generic house Pattern under changing context.

6.4. External Forces that Affect Settlement Pattern

Generic settlements in the study areas have grown more or less spontaneously. They are the outcome of a long process of evolution. Generic settlement generates pattern responding to geo-climate and shaped by the prevailing socio-economic environment. The generic pattern is permanent which may have temporary varients responding to immediate external force or circumstances. The settlement consists of a social order which is interposed between human participants, providing potential forces that produce a coherent system. Some factors (imported planning ideas, materials etc) act as forces to influence the settlement. Their influence upon settlement is not always direct, but depends upon and is influenced by the society's perception of the physical environment and its physical attributes. The external forces that played a role in shaping some of the current case study settlements are being discussed in this section. However, though there

seems an apparent short-lived dent in the indigenous pattern, deep beneath, the indigenous pattern looks quite resilient and retains its core character.

6.4.1. Role of Government and NGOs

It is found during the field survey that, the Government and different Non-Government Organizations (NGO) plays some role in shaping of the settlement pattern.

Flood protecting embankment at Patharghata (Zone-A)

Erosion protecting embankment at Ramgati (Zone-B)

Figure 6.21: Flood and erosion protecting embankment.

- At the newly developed *char*s, the government establishes roads for the ease of physical communication for the settlements. These roads act as an attractive force factors to establish new homesteads as well as settlements, along them.
- The Government plays a role to establish cyclone shelter centres, schools even community ponds for drinking water in different locations within or adjacent to the existing settlement. These are the social spaces part of any settlement. Settlements expanded considering these social spaces.
- The Government provides deep tube-well for irrigation in many rural settlements which reduce dependency on natural sources of water like canals, rivers or lakes. There are many water filters for drinking water found during the field survey which is established by the government and other organizations like Red Crescent Society.

Char Montaj (Zone-A)

Char Kajal (Zone-A)

Figure 6.22: Roads built by the government for physical communication.

- After devastating natural disasters, different departments of government provide aid to re-built or repair houses. Such materials or infrastructure give sometimes shape to the housing. In Zone-A many settlements received such aids from the government.
- It is found that 95% of dwellings of the settlements of Zone A and 60% of Zone-B depend on solar power. There are some Non-Government Organizations NGOs, provide loans to install solar power for homesteads. 53% of the homesteads of Zone-A took a loan from a few NGO's to install a solar panel. Thus NGOs plays a role to ensure electricity over the settlement, which affects the orientation of buildings.

Figure 6.23: Cyclone Shelter Centre at Patharghata (Zone-A)

Water filter at Char Duani (Zone-A)

Water filter at Char Folkan (Zone-B)

Figure 6.24: Water filter established by different organizations.

- NGOs have several programs to provide loans to improve houses. People take a loan from different NGOs to improve their houses. Such programs are further increased after any natural disaster. Some NGOs have their own module for houses and toilets. 11% of the homesteads of the study area took a loan to build their toilets. By this process, they influence the way of development of the settlement.
- It is found that mosques, tube-wells and other social facilities are established by foreign organizations as a donation. Such an example of establishing a mosque is found in Char Elahi of Zone-B and a tube-well in Char Mehar of Zone-B.

Mosque at Zone-B by foreign donation Tube Well at Zone-B

Figure 6.25: Charity works by foreign donors.

6.4.2. Rural-Urban Continuum

The term rural-urban continuum came into existence because a marked difference between the urban and rural character is not seen in the settlements adjoining the city limits. On one hand, they have characteristics of the city because of their closeness to it and on the other hand, they cannot deny their indigenous origin. The interrelations between villages and towns are numerous through migrations, economic transactions, provision of services, cultural impacts. The organic development of settlements inside the city boundary also follows the same general pattern though often influenced by the specific context or some external interventions. Development in irrigation, satellite TV, telecommunication, Internet and other communication media make the urban-rural integration easier for rural inhabitants. Through the use of material and layout, people try to equip their houses with urban facilities though they are in the rural system. With compaction and densification what shape the urban settlement takes a point to be investigated.

6.5. Adaptation with Environment Responsive Behaviour

Adaptation is the process of improving society's ability to cope with changing conditions across time scales, from short term (e.g. seasonal to annual) to long term (e.g. decades to centuries). The Bengal Delta has a long history of adaptation through response towards the environment, adapting to and recovering from natural disasters. Bengal delta people have adapted to the geo-climatic and socio-economic challenges well and have produced a settlement pattern that bounces back, after every disaster and retains its core characteristics. It is observed that case study people are very resilient and have the capacity to build and rebuild their homesteads of transient nature, without any external help.

Figure 6.26: Settlements were washed away by Sidr in 2007 in many areas of Zone-A.

6.5.1. Adaptation by Local People

After any disaster, recovery is done mostly in an indigenous manner by the victims. The coastal embankment plays an important role in the settlement pattern of cyclone-affected households. During Sidr in 2007, in many areas of Zone-A, the embankment was eroded by tidal surges along with many homesteads. Some people who lost their lands rehabilitated themselves on the embankment or the slope of an embankment.

According to the inhabitants of Patharghata, after Sidr, the groundwater is contaminated by high salinity and that is not suitable for drinking (Figure 6.29). In such a situation, they had to harvest rain water and reserve it for use – it is an age-old technique. The government also took initiatives to filter the pond waters for drinking. (Figure 6.30).

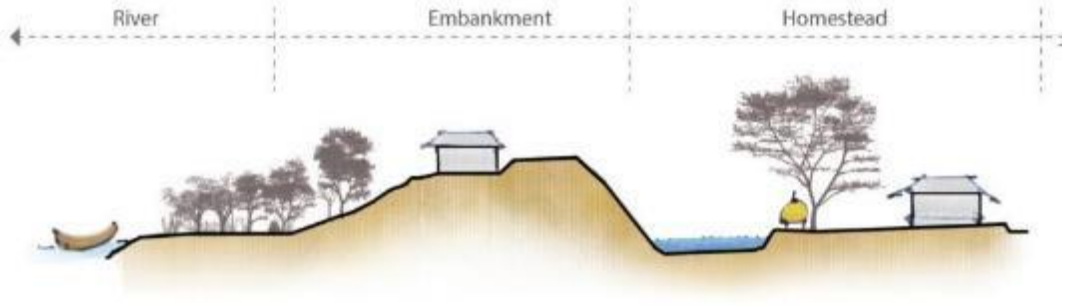


Figure 6.27: People established houses on the embankment right after Sidr.

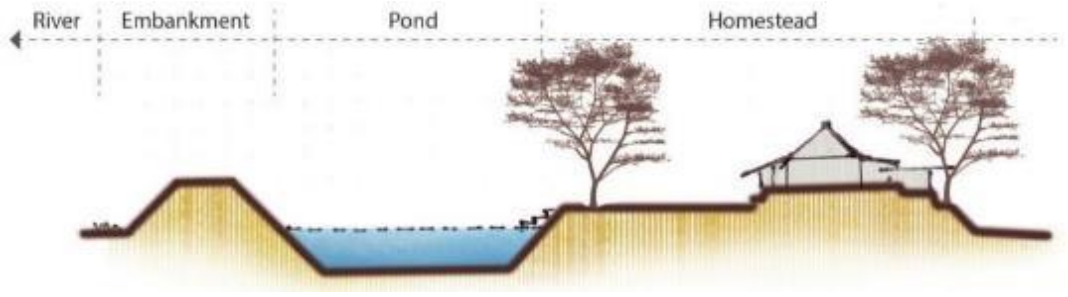


Figure 6.28: Typical position of homestead inside the embankment of the coastal edge.

Figure 6.29: Rain water harvesting at the homestead level at Zone-A.

Figure 6.30: Filter to make the pond water drinkable

Figure 6.31: People are making small buildings with permanent building materials in Padma Char of Zone-A.

6.5.2. Effects on Settlement Pattern

Through the experiences of natural phenomena, the local people have developed a resilience to survive, protect the houses and other valuable belongings. Indigenous communities living in the delta for centuries with unique identities have close contact with nature. They have developed an indigenous response to cyclones for survival. They have inherited the time-tested experiences of generations. The local builders show a unique talent of setting their houses with natural surroundings and house building techniques from plan to every detailing of construction which is resilient and responsive to hostile geo-climate.

6.5.2.1. Safety of houses by physical planning with the surroundings

The traditional builders show surprising talent in positioning their built-form with nature to withstand the harsh effects of geo-climate. They plant huge plantations around their built-forms as a protection from the wind where the peripheral trees face the force of the strong wind. As the cyclones mostly affect from the south and south-west corner, so the selection of trees for those edges are made according to their wind resistance capability. The betel nut, palm, coconut trees are used mostly for this purpose.

Figure 6.32: Trees act as wind breakers during the cyclone hit.

The distance of trees is determined from the average height of the trees. From the survey, it has been observed that they prefer positioning their houses by 20 to 30 feet away from trees. As the main hard brunches of trees are between these distances, so if the trees turn over by storm winds it will not severely damage the house. This distance may vary with the type of planted trees.

6.5.2.2. Orientation of houses

The local people are also concern about the house shape and their orientation. Rectangular rather than square is preferred for the house plan and the short-arm-side is usually placed towards cyclonic wind wards to get lesser wind pressure at the same time getting normal southern breeze from south, southeast. This traditional knowledge is very cleverly used in cyclone-affected coastal areas.

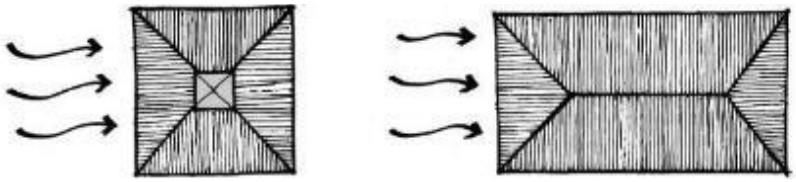


Figure 6.33: House orientation following wind direction.

6.5.2.3. Roof shape for more wind resistant

The roof shape of houses is also liable for catching the high wind and damage to the houses. The people confidently agreed to the idea of using the traditional hip roof than using that of a high gobble roof. From their long experiences, it is evident that houses with the hip roof are less affected by the cyclone. From their experience, a roof slope of about 30 degrees is maintained, which is found to be very wind resistant.

Figure 6.34: A preferred hip roof over '*ghar'*.

6.5.2.4. Architectural and structural details

Char Kukrimukri (Zone-A)

Padma Char (Zone-A)

Figure 6.35: Structural frame prepared by wood

Figure 6.36: Single story indigenous house with surrounded '*pashchati'*

Figure 6.37: Two-story traditional houses as protection against the tidal surges.

6.6. Transformation of Generic Pattern in the Urban Context

Currently, urban settlements in Bangladesh are of two types one is organic development and the other is planned. Planning norms did not grow from the context therefore Organic development that follows the intuition and traditional knowledge is more akin to the generic pattern (Figure 3.21). Planned areas are mostly 'transplanted' ideas from developed countries, on the other hand, organic developments are genetically driven spontaneous growth. The identified generic pattern derives from organic development. Here three settlements of different sections of Dhaka city are taken as a case to demonstrate, that given the opportunity people try to go back to their intuition-driven settlement pattern i.e. 'Generic Pattern of Bengal Delta'.

These are urban areas of high-density man-built structures. In an urban context, the pattern is influenced by a lot of external forces. Many interventions are in a planned (pre-determined) manner even in an organic urban settlement, still deep beneath the original order can be discovered on careful observation. To compare the generic pattern identified in this research with some organic urban settlements, three neighbourhoods have been selected randomly. The selected settlements are: Kaundia, Paikpara and Goidertek.

It is found that only the homogenous part is deeply modified in the urban setting and are incorporated with the Central part due to the dense context. Similar to the fields in rural areas as a reference of livelihood, so is the home-based work areas incorporated into the Central part of the settlement. The circulatory part is the guiding factor for the Central part which is the built forms and holds together other parts of the settlement. In the organic settlements in an urban area, the Community interaction parts also evolve spontaneously like in indigenous settlements to respond to the demand and context. In most cases, Community interaction parts are positioned in some central places, most common in the indigenous pattern. The selected neighbourhood pattern is shown below:

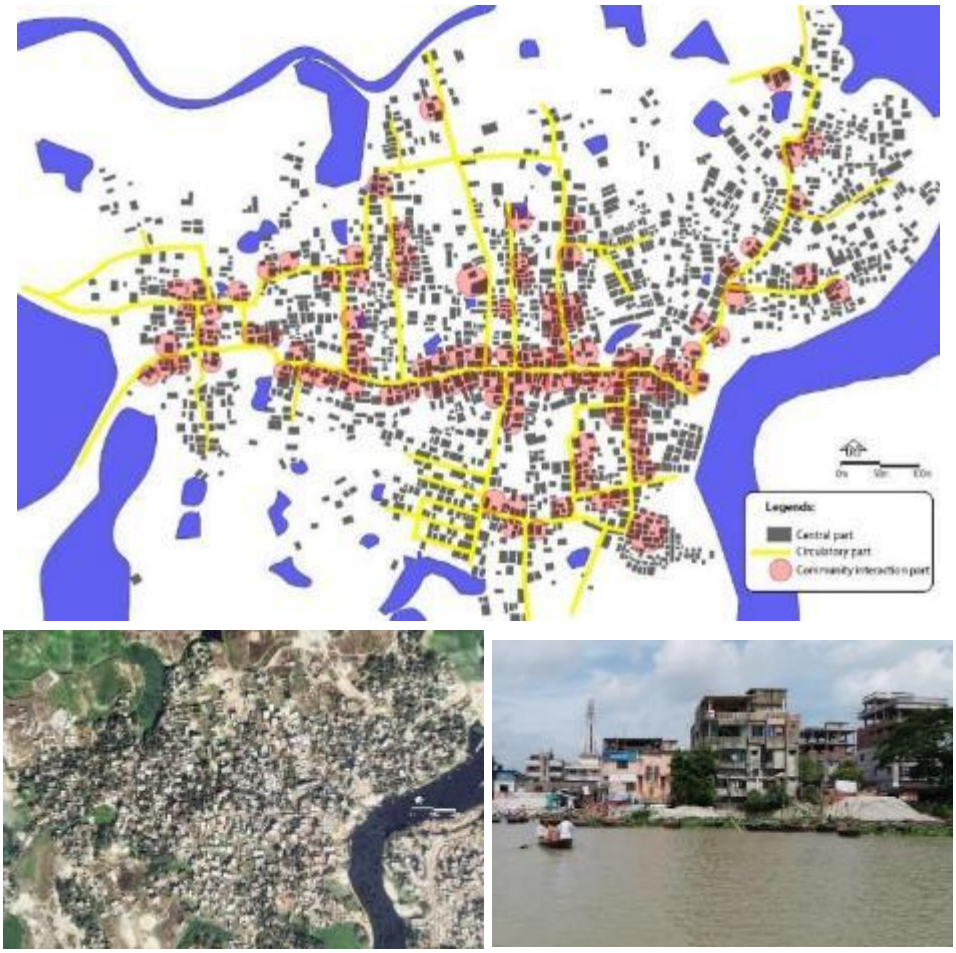


Figure 6.38: Settlement of the neighbourhood of Kaundia of Dhaka.

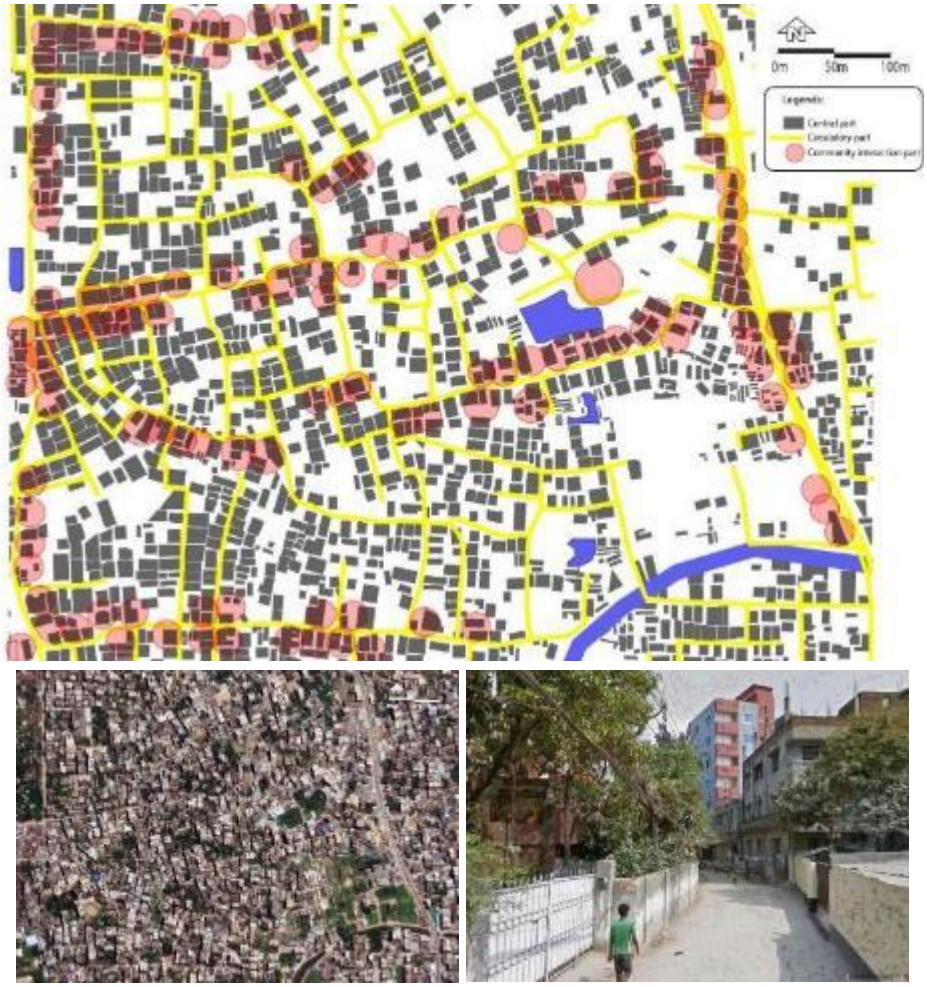


Figure 6.39: Settlement of the neighbourhood of Paikpara of Dhaka.

Figure 6.40: Settlement of the neighbourhood of Goidartek of Dhaka.

Schools, play fields, mosques, madrasas, eid-gah, post offices and bazars are the social places that act as the Community interaction part of the pattern in the neighbourhoods of three selected settlements in the urban contexts. The Shop is widely found to be the community interaction part, which is the place for social gatherings and daily shopping activities. In course of the mutation of a settlement in an organic process, due to the evolving/changing context, many inhabitants start their business by establishing a shop within the neighbourhood. The number of shops gradually increases with the growth of the settlement and as demand increases. These shops are developed alongside the road which is the circulatory part of the settlements.

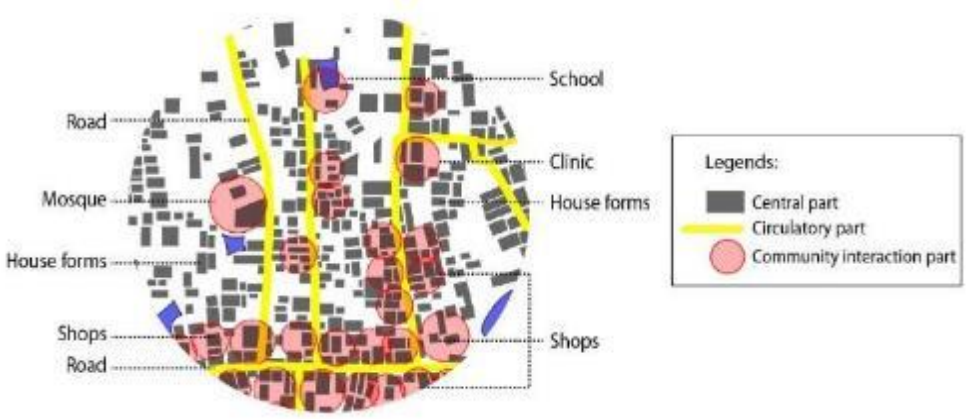


Figure 6.41: Elements of an urban neighbourhood (blow-up of the settlement of Kaundia).

The circulatory part caters for infrastructural facilities/amenities as well as the communication network throughout the settlement. Homesteads have their faces towards the road. The circulatory parts act as the artery of a settlement and are connected with livelihood in many ways. While it is found that unplanned cities have a semi-lattice structure where every node has relation with other nodes and are more vibrant, which Christopher Alexander (1965) called ‘semi-lattice’. Similarly, the elements of the semi-lattice pattern of the settlement reflect the generic settlement pattern of the Bengal Delta. Surprisingly, Marx’s observation focusing on Bengal discussed in chapter-3: ... *The simplicity of the organization of production in these self-sufficing communities that constantly reproduce themselves in the same form, and when accidentally destroyed spring up again on the spot and with the same name - this simplicity supplies the key to the secret of the un-changeableness of Asiatic Societies, an un-changeableness in such striking*

contrast with the constant dissolution and re-founding of Asiatic States … (Emile Burns 1935; Kosambi 1965).

6.7. Summary

Settlements in Bengal Delta represent a kind of natural growth within the existing set of physical and cultural demands of the landscape. Although they do not express well-defined shapes and a very clear internal pattern, there is a considerable order both in the internal system and external outline of the settlements. With regards to a settlement, the built-up area is the most intensively used part where expression of various functions of physical and cultural attributes can be found. The built-up area becomes the community core for a functioning community that covers the surrounding space (Figure 6.57).

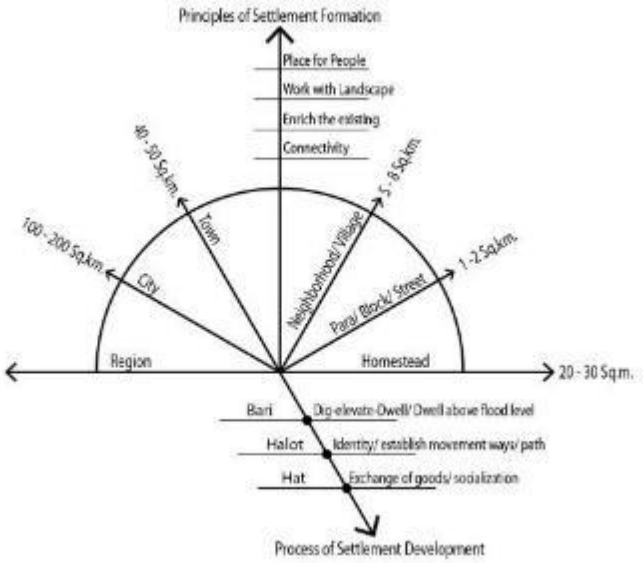


Figure 6.42: Same Generic module transforms from homestead to a region. (Refer to Fig: 3.20, 3.21 and 3.22)

The variance detected here is mostly due to the topography or external force. In the indigenous way of life, work, recreation/leisure and living comprise an interwoven system where, sometimes, it is difficult to segregate different components (Figure 6.43).

Some rural settlements have experienced significant variation due to a variety of factors such as rapid transplanted urbanization, induced social transformation and declining employment opportunities in natural areas. An urban settlement is a densely populated area comprising mostly of man-made structures where the Homogenous part is incorporated with the Central part having recreational areas. The circulatory part is the guiding factor providing shape to the built forms. It holds the other parts of the overall settlement. It is like the skeleton of the settlement. In the urban area, the social parts are also established generically like natural settlements to respond to the social demand. And in most of the cases they are positioned in some central places.

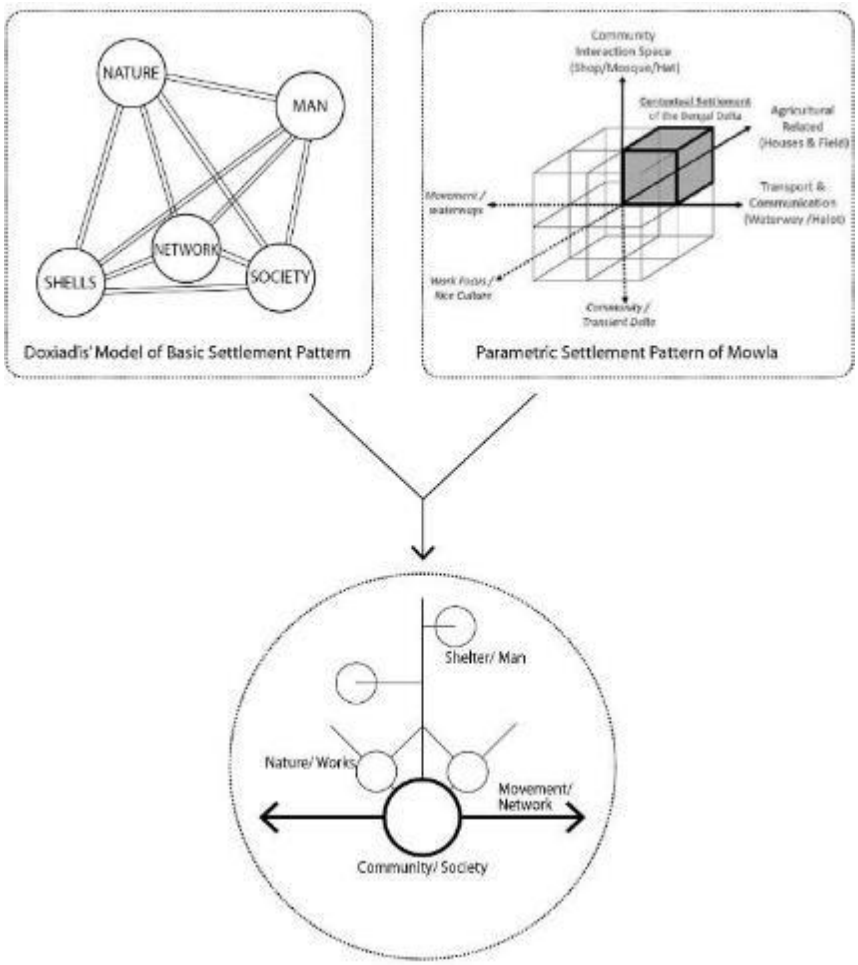


Figure 6.43: Generic Settlement Pattern Module in Bengal Delta.

The basic components of a generic settlement module are homestead surrounded by thick vegetation, paddy field/ open space, circulation system (waterway/path/halot) and exchange/socialization (hat/bazar/shops/mosque/school etc.). In whatever manner the settlement starts, it begins with the dig-elevate-dwell process with basic shelter, courtyard and pond which gradually expands and densifies. The basic module grows in clusters or a linear manner depending on the context in the Bengal Delta. Generally, the natural features mark the imaginary boundaries of a settlement. Apart from this, sometimes roads, fields determine the borderline. The group of homesteads connected both physically and socially is the generic settlement. They may not be under the same administrative unit constituted by the state, but socially they are a unit. This study attempts to add to the body of knowledge regarding human settlement and living patterns in the Bengal Delta.

The generic settlement pattern comprises four parts- homogeneous part, central part, circulatory part and community interaction part. These parts are closely associated with four dimensions such as height, length, width and time. Every settlement represents its own characteristics. Vernacular impacts help to give shape to the settlements by the people living and working thereby employing the wisdom, knowledge, and practices

handed down from generation to generation. They are often well-adapted to the geographical terrain, the society inhabiting the land, and their environmental contexts. This is called the generic pattern. Any settlement in this region when analysed, reveals this hidden order, the generic pattern. Unless externally forced, the same pattern consolidates to generate an urban settlement pattern. This basic pattern is the generic settlement pattern that gives rise to all scales and levels of settlement patterns in the Bengal Delta.

The generic settlement pattern is applicable to and gives rise to all types of settlement. If understood, this pattern can be used as a tool for the planning and development of the settlements in the Bengal Delta.

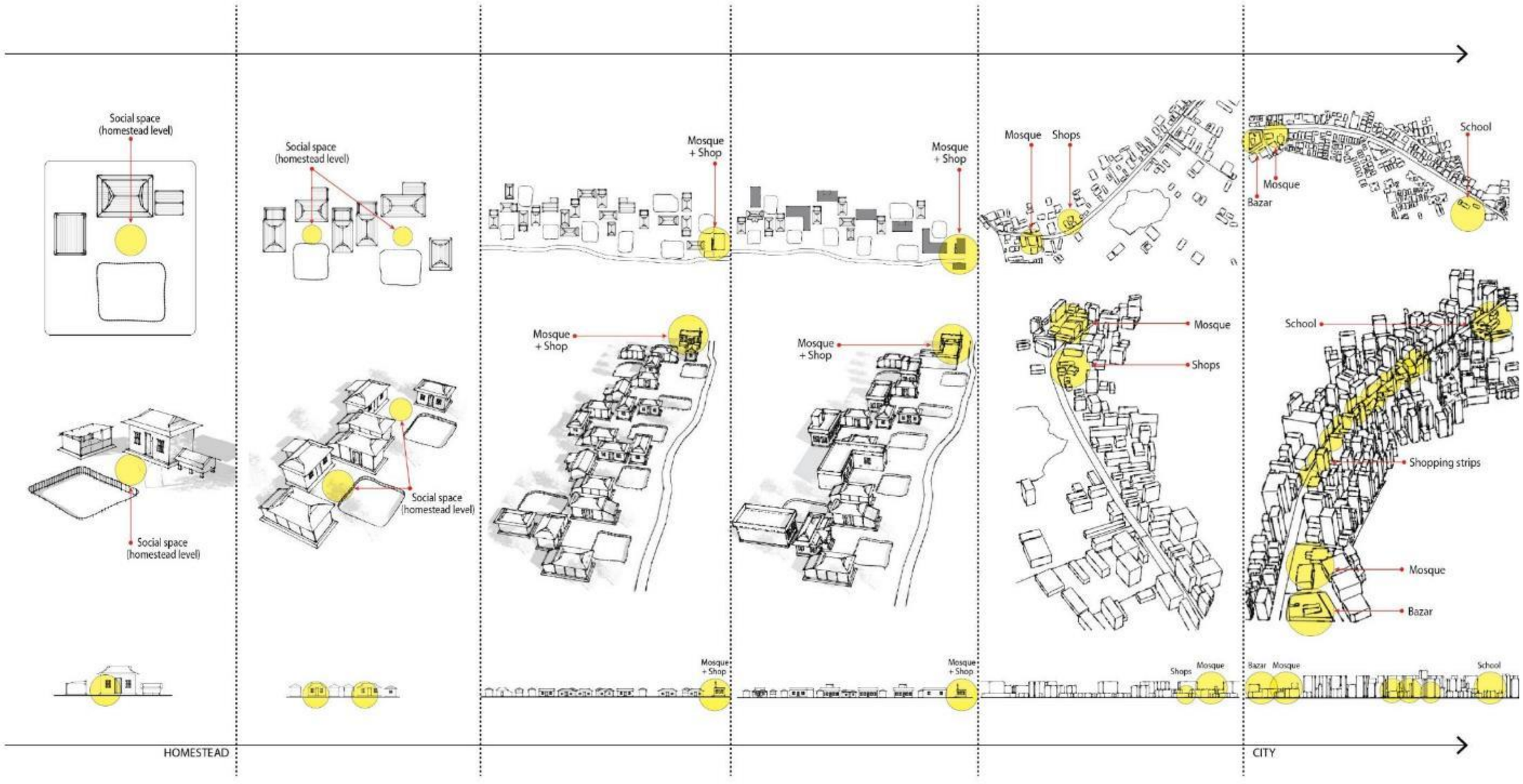


Figure 6.44: Evolution of Settlement Pattern in Bengal Delta. (Also refer to Figure 6.42 and 6.43)

Chapter 7

CONCLUSION AND RECOMMENDATIONS

7.1. Preamble

Bangladesh is a part of the Bengal Delta. Every nation has its identity based on certain attributes, of which settlement pattern is one and the most important. To reveal this identity, several researchers on different levels and scales have studied the settlements of Bengal Delta rain-fed rice culture, but none of these could provide a holistic chronological account and logical argument leading to their thesis of settlement transformation in time and space. There are studies on essential components of a viable settlement and also there are studies on the evolution of settlements in this region (Sec 1.1). No studies were however found that discusses or explains the "generic pattern" of a particular settlement anywhere in the world, excepting the hunters/gatherers and agricultural settlement concepts and their origin. Bengal settlements fall into the broad category of agricultural settlement. Experts however indicated the un-changeability or generic nature of settlement type in Bengal. The studies on settlement pattern and their formation were taken as the basis for the identification of a generic settlement pattern and the Bengal Delta was taken as the case context (Section 3.4). To rediscover the generic pattern of Bengal settlements, the present coastline, which is in the formative stage and represents the context of thousands of years back, has been analysed. When the settlement began, the coastal area is assumed (based on various studies) to provide an analogous environment of the Bengal Delta's historic past. It provides an analogous framework for studying the Bengal's remote evolving settlement pattern when the entire Bengal was an active delta. The studies found some basic attributes, therefore in a particular context, the common denominator provides the basis of a 'generic pattern' that are applicable in all levels and scales. This persistence of the basic components in all stages but adapting to newer conditions indicate the prevalence of a generic pattern. The objective of this research was therefore **To identify the generic settlement pattern in the Bengal Delta**. The sub-objectives were to find out the phenomenon behind the evolution of a particular settlement pattern in the Bengal Delta and to validate the settlement pattern as the generic one i.e. basis of all other settlement patterns in Bangladesh and which can be used as a basis for the future planning and design at any scale and level.

7.2. The Research Strategy

The research has been conducted through a triangulation of literature review, phenomenological approach and qualitative data analysis. After analyzing the various related literature, some fundamental principles for phenomenological research were

listed and collated. The analogical context is identified through historic phenomenological interpretation of available literature and a historic settlement pattern is reconstructed for the phenomenological study in the present context to verify the prevalence frequency and intensity of the historic pattern. From the analogous context, various geographical locations of the Bengal Delta were stratified on the basis of their evolving stage, from the three stratified contexts 22 case study settlements were selected at random for the survey and KII and FGD. For current spatial order and uses of space, observation and expert opinions and key informants perceptions and evidential information were gathered.

First, the historic settlement patterns in a similar geo-climatic context were framed from secondary sources to determine an outline for research. Secondly, the cases were selected from three different zones and types of Bengal Delta which are supposed to have geographic characteristics and landmass similar to the historic Bengal delta. After analysing all the data, historic interpretation of the settlement patterns and the logical phenomenon behind their development of a 'generic settlement pattern' come to the surface.

Some qualitative information and quantitative data are triangulated to logically support the argument. Basically, the historic interpretation and Phenomenological Approach of the Qualitative research process is applied to support the hypothesis, that **Bengal Delta has a generic settlement pattern**. This research essentially attempted to connect methodically, the various threads and fill up the gaps to identify the order that prevails in the settlement pattern of the Bengal Delta, thereby testing the hypothesis.

The literature review and theoretical analysis in chapters 2 and 3 show that independently developed Doxiadis's global principles of settlement components and Mowla's concepts of settlement growth in the Bengal delta are relevant to explain the researched and the reconstructed pattern from historic interpretations, is therefore bracketed to form the basis for further investigation and to fill up the gaps and test its validity. In a nut-shell, theoretically bracketed settlement components, growth pattern and their character is further scrutinized in the analogous historic delta context to 'establish' that they are tied up in a single thread and further validated that in both rural and urban context, thus to show that the settlement patterns found in the analogous Bengal Delta context are generic in nature.

7.3. Findings

7.3.1. Traditional Ecological Knowledge – TEK

Most settlements in Bangladesh are considered as growing organically responding to the context. In contrast, 'planned' settlements are transplantations. That is the settlements

that have evolved here in most cases, are a result of reacting to the possibilities provided and constraints imposed by local topography, climate, natural characteristics and local resource availability. Over time, this deltaic land has evolved in type and character in response to traditional ecological knowledge (TEK). Settlement patterns are also subject to change because of increased human influence and interference with the environment. However, in reaction, which we call TEK, to the local natural context and features, there is consistency and certain traditional characteristics have evolved and certain denominators always prevail.

The amorphous shape is uniformly distributed across the landscape, consisting of clustered or scattered settlements on raised land. On the high ground along natural levees of rivers or water channels, the elongated form is built. Nevertheless, there is dispersion both inside and in proximity to elongated settlements, which is influenced by the surrounding level and land configuration. Where high land is not available, the earth is dug up from the excavation of channels or wetlands to construct a mound on which to build a homestead. More earth can be added over time to expand the mound. The settlement steadily grows in this manner. Settlements thus built on raised mounds are scattered across the low-lying landscape in many places, and practically become islands during the rainy season. The dispersion allows individual homesteads to have privacy and protection, as households connected by kin usually settle on each mound and form homesteads. Homesteads and the settlement are surrounded by paddy field, which also works as a land bank.

Settlement pattern and organization is influenced by the context and culture in which it develops ie TEK, however, in its basic principles it confirms the bracketed assumptions for this study, proving that Bengal settlements fulfil the universally accepted criteria for being recognized as “settlement”. Societal norms and the geo-climatic context are found manifested spatially in the settlement pattern making it unique.

7.3.2. The Settlement Pattern in the Analogous Context

The emergence of settlement is predominantly guided by geo-climatic factors, and sometimes influenced by some other functional forces of nature or the occupation or circulation system and among the prevailing physical elements, but predominantly TEK plays a role from the people’s subconscious mind. The role of rivers, water channels, rice cultivation and paths/roads in creating a settlement pattern seems vital in the Bengal Delta.

Case studies helped identify some elements and stages of settlement formation. It is found that the communication route (in earlier days it was predominantly water-now it is surface paths) plays an important role to determine the location as well as the shape of a settlement. The path gives the settlement inter and intra-accessibility with the community

and community facilities. These organize the whole settlement in a spontaneous organic manner taking various shapes.

Homesteads act as the initial unit of the module for any settlement. The built forms, courtyard and the water body are the three major components of this module in the middle of the agricultural field. Survey shows that artificial waterbody (i.e. pond) is an integral part of a homestead which (waterbody) occupies 3.5 times the footprint area than the house forms do. Built-form and courtyard (*uthan*) are functionally complementary and forms the core or served area while pond and surrounding vegetation is the service area of a homestead.

Survey founds settlements to be evolving in a scattered manner but the houses are clustered. Thus it looks like a few clustered are placed scattered over a wide landmass. Settlements are scattered and dispersed at the primary stage of their emergence. Multiple homesteads make the clusters, often they share a source of water, social spaces and even homestead premises with each other. Such clusters connected with strong physical community elements making a '*para*'. The compact clustered settlement is a closely built-up area of houses. In this type of settlement, the general living area is distinct from the surrounding agricultural land. The closely built-up area and its intervening streets present some recognizable pattern or geometric shape, such as rectangular, radial, linear, etc. In such settlements, all the dwellings are concentrated in one central site. The inhabitants of the village live together and enjoy the benefits of community life. There is a well-ordered water (blue), vegetation (green) and road (grey) network, which reinforces the bracketed concept of this research for the spatial distribution and constituent components of a settlement, identified in the literature review. That is a scattered cluster taking different forms in response to the prevailing context of datum or TEK. Each cluster being consisting of homogenous part, circulatory part and special part. One or more clusters may form a village settlement. The group of homesteads are connected both physically and socially is a settlement, which may or may not be under the same official administrative unit constituted by the state, but definitely have socio-psychological cohesiveness and acts as a unit.

7.3.3. The Generic Settlement Pattern

Settlements in Bengal Delta represent a kind of natural growth within the existing set of physical and cultural demands, called TEK, of the landscape. Although they do not express well-defined shapes and a very clear internal pattern, there is an order both in the internal system and external outline of the settlements. With regards to a settlement, the built-up area is the most intensively used part where expression of functions of physical and cultural attributes can be found. The built-up area is the community core for a community that covers the surrounding space (Figure 6.57). The variance detected here

is mostly due to the topography or external force (sometimes planned transplantation). In the indigenous way of life, work, recreation/leisure and living comprise an interwoven system where, sometimes, it is difficult to segregate different components (Figure 6.59), but deep beneath there is an order. These settlements sometimes densify attracting more non-agricultural functions in the central part transforming the settlement into *hat/bazar/ganj* etc. the initial urban area.

The generic settlement pattern identified comprises four parts- homogeneous part, central part, circulatory part and community interaction part. Every settlement represents its own characteristics. TEK influences to give shape to the settlements by the people living and working there employing the wisdom, knowledge, and practices handed down from generation to generation. They are often well-adapted to the geographical terrain, the society inhabiting the land, and their environmental contexts. TEK generated settlement is called the generic pattern. Any settlement in this region when analysed, reveals this hidden order, the generic pattern. Unless externally forced, the same pattern consolidates to generate an urban settlement pattern. This basic pattern is the generic settlement pattern that gives rise to all scales and levels of settlement patterns in the Bengal Delta.

An urban settlement is a densely populated area where the homogenous part is less visible and is incorporated with the central part having recreational areas. The circulatory part is the guiding factor providing shape to the built forms. It holds the other parts of the overall settlement. It is like the skeleton of the settlement. In the urban area, the social parts are also established generically like natural settlements to respond to the social demand. And in most of the cases, they are positioned in some central places (Sec 6.6).

The generic settlement pattern is applicable to and gives rise to all types of settlement. If understood, this pattern can be used as a tool for the planning and development of the settlements in the Bengal Delta.

7.4. Components of Generic Settlement Pattern in The Bengal Delta

Location, site and context are three key factors that are considered in the study of human settlement. A settlement's location is determined and influenced by the combined influence of geo-climatic and socio-economic factors. It was observed that settlers are attracted to sites that provide them with adequate land and water including safety, connectivity, affordability and cultivability. Selection of the location is the point of beginning of a pattern. From an individual homestead to a large settlement, the process works to generate the pattern (Figure 7.1 & 7.2) underlying the same common principles.

Studies in chapters 4-6 helped to identify some variance of settlement group and in most of the cases, the settlement is generated along a communication route i.e. road or canal. The communication route plays an important role to determine the location as well as the

shape of a settlement. People tend to establish their homestead alongside a movement path. A path gives the settlement inter and intra-accessibility with the community and community facilities. These organize the whole settlement in a spontaneous and generic manner. In an earlier age, it is found that the settlements were developed alongside a natural canal which acts as a source of water or connection for transportation. A communication route, when developed spontaneously along a natural path or canal, influences the settlements to grow along with them.

Due to the geo-hydrological condition of the delta, people need to raise their land from the flood level. For this, they dig ponds and collect earth to prepare the viti. This can be named as the geo-hydrological phenomena of settlement. The raised lands are seen like islands in the vast agricultural fields during the monsoon. To protect the homesteads from the wind, heavy rainfall and other deltaic climatic devastation, people introduced vegetation around their homestead. Orientation and shape of the built forms and materials are also determined considering these. Because the study region is dominated by agricultural landscapes, hydrographic features such as river banks and canals attract more than one-third (42%) of the study region's settlements. The location of 50% of settlements is determined by physiographic characteristics. It can be claimed that agricultural land is one of the most important factors in the formation of a traditional settlement. According to the phenomenological research conducted on the 22 study settlements (and 220 respondents for quantification purposes), 63.6 per cent of the respondents are directly involved in agriculture. 78.2 per cent of the inhabitants own agricultural land within the settlement. In the historic context agricultural affiliation is assumed to be more.

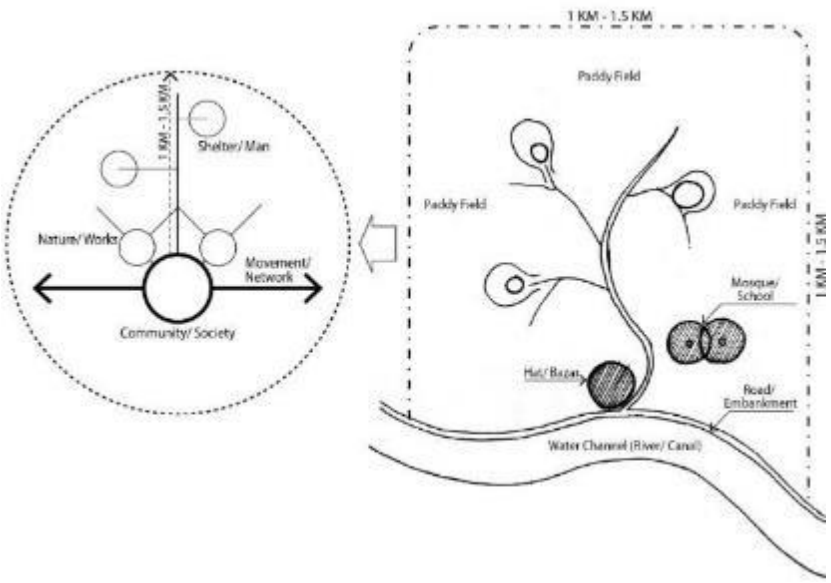


Figure 7.1: Module of a Generic Settlement Pattern in the Bengal Delta. (Based on Figure 3.12)

Despite the gradual societal transition, the Bengal Delta retains its basic socio-spatial identity. Most humans have lived in villages from the dawn of time, and most

communities were socially and geographically similar. A generic settlement module was therefore found to vary between (1 km to 1½ km) x (1 km to 1½ km) with a population residing in 30 – 100 homesteads. The basic components of the module are homesteads surrounded by thick vegetation, paddy field/ open space, circulation system (waterway/path/halot) and exchange/ socialization (hat/bazar/shops/mosque/school etc.).

The lowest settlement unit is the homestead which is a space for family and social cohesion. The dig-elevate-dwell process begins with a simple shelter, courtyard, and pond that eventually grows and densifies. Bengal homesteads evolved on an elevated platform above the flood level known as a *viti*, which is created by digging earth from ponds. Built-form and courtyard (*uthan*) are functionally complementary and comprise the core or served area, whereas a homestead's service is the pond and surrounding vegetation. The homesteads are all in close proximity to one another, constituting the settlement as a whole. Individual homesteads gradually become connected by elevated *viti* and/or path following consolidation or densification.

The elements of a settlement are connected both physically and psychologically. Agricultural fields surround the settlements in general, although there are no tangible physical borders, they merely have a nebulous knowledge of the settlement's outskirts, which is psychological. The community socialization spaces are linked to the homesteads. Two such social spaces are identified, one associated with the market/shops and the other with the community pond/school/mosque. However, depending on the population density and travel distance, there are several such areas. The settlement's form is determined by *viti* and *path*.

The morphological form and structure of the generic settlement pattern which is the product of several natural, socio-economic and religious forces are divided into four basic parts. They are the homogeneous part, the central part, the circulatory part and the community interaction part. They may be organized in any one of the following manners depends on the local context and circumstances (Figure 7.2).

a) Where the community interaction part is connected to the settlement.
b) Where the community interaction part is at the centre of the settlement.
c) Where the community interaction parts are integrated with the central part.

These parts are closely associated with four dimensions such as height, length, width and time. Indigenous influence shapes the settlements by the people living and working thereby employing the wisdom, knowledge, and practices handed down from generation to generation. They are often well-adapted to the geographical terrain, the society inhabiting the land, and their environmental contexts. Settlements at any level and scale in this region when analysed, reveals a hidden order, that is called the generic settlement pattern.

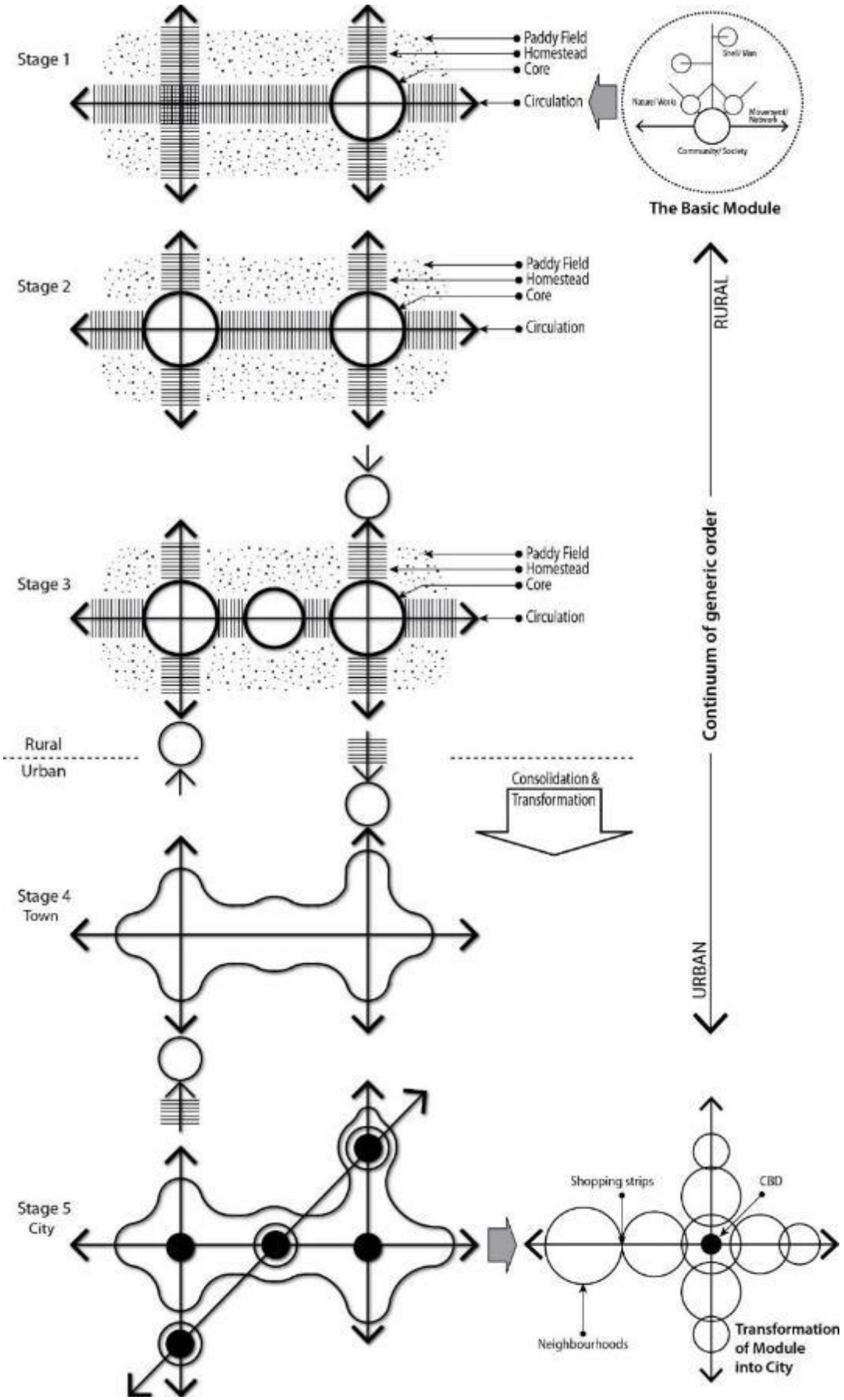


Figure 7.2: Generic settlement pattern unique to Bengal Delta in different stages and scales, using the same principle and module.

The design and shape of a generic settlement are determined by social organisation, traditions, and social control evolved from the context. Social order is interposed between human members in the settlement, provided forces that form a cohesive system. Some forces function as catalysts for the settlement. The natural features and sometimes roads or fields mark the boundaries of a settlement. The same pattern consolidates to generate an urban settlement pattern unless externally influenced. This basic module is the generic settlement pattern giving rise to all scales and levels of settlements in the Bengal delta (Figure 6.59, 6.60, 7.1 and 7.2) and it is unique to Bangladesh.

Unless externally forced, the same pattern consolidates to generate in an urban context. A settlement in an urban context is a densely populated area comprising mostly of man-made structures where the homogenous part is incorporated with the central part having recreational areas. As fields are the source of livelihood in the rural area and this part is incorporated with the central part of the settlement as the business districts. The circulatory part is the guiding factor providing shape to the built forms. Unlike planned developments, the road is a social area and not only the connecting corridor. It holds the other parts of the overall settlement and caters for many social functions. In the urban area, the social parts are also established generically to respond to the social demand.

7.5. Recommendations

The identified generic settlement pattern can be used as a tool for the planning and development of the settlement in the contemporary context for sustainability rather than transplantation from any other part of the world. This study attempts to add to the existing body of knowledge regarding human settlement and living patterns in the Bengal Delta.

Most settlements in Bangladesh have developed without any formal professional planning input. This implies that in most cases settlements have evolved here largely responding to possibilities offered and constraints imposed by the context i.e. regional topography, climate, natural features, and availability of local resources. This predominantly deltaic land has changed in physical shape and character over time. Because of increased human impact and intervention on the environment, settlement pattern is also subject to transformation/adaptation, sometimes, beyond recognition. Already, the colonial impact of two hundred years and recent universal planning has brought unsustainable changes on the settlement of Bengal Delta which was sustainable and unchangeable for thousand of years (Section 3.7). Nonetheless, there is continuity and the same typical characteristics, order and relationship that have evolved in response to local natural characteristics. If the generic pattern is employed in future settlement planning and design, it will be more sustainable and transformation and adaptations would be smoother.

7.6. A Way Forward

The study will serve its purpose well, if it is used as a professional tool and a guiding document for future research and/or development programs, taking into consideration the generic character of the settlement pattern that has been identified for future sustainable developments.

Identified ‘generic settlement pattern’ for Bengal Delta (about 60% of present Bangladesh) may be tested in other geologically older lands, to validate this identified pattern in other parts of the Bengal Delta and Bangladesh. Thus enable theorizing the generic pattern and helping professionals in Bangladesh engaged in planned interventions in the built environment, for its sustainability.

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APPENDICES

Appendix- 1: Semi-structured Questionnaire (SSQ)

বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়

গবেষণা জরিপ | (Semi-Structured Questionnaire for 10 homestead from each of 22 settlements. 220 in total) | **SSQ**

A. ব্যক্তিগত ও পারিবারিক তথ্য

A-1	তথ্যদাতার নাম									
A-2	ঠিকানা									
A-3	বয়স									
A-4	লিঙ্গ	a	নারী			b	পুরুষ			
A-5	শিক্ষাগত যোগ্যতা	a	অশিক্ষিত	b	প্রাইমারি	c	হাইস্কুল	d	কলেজ	e	বিশ্ববিদ্যালয়
A-6	পেশা	a	কৃষি	b	মৎস	c	চাকুরী	d	ব্যবসা	e	অন্যান্য
A-7	ধর্ম	a	ইসলাম	b	হিন্দু	c	খ্রীষ্টান	d	বৌদ্ধ	e	অন্যান্য
A-8	পরিবারের ধরণ	a	একক পরিবার			b	যৌথ পরিবার				
A-9	পরিবারের সদস্য সংখ্যা										
A-10	পরিবারের উপার্জনক্ষম সদস্য সংখ্যা										
A-11	মাসিক পারিবারিক আয়	a	৫০০০ এর কম	b	৫০০০-১০০০০	c	১০০০০-১৫০০০	d	১৫০০০-২০০০০	e	২০০০০ এর বেশি

B. বাসস্থান সংক্রান্ত তথ্য

B-1	কত বছর যাবৎ এই গ্রামে বসবাস করছেন?									
B-2	কত বছর যাবৎ এই বাড়িতে বসবাস করছেন?									
B-3	বাড়ির বয়স (বসবাসের সময় থেকে ভিন্ন হলে)									
B-4	বাড়ির মালিকানার ধরণ	a	পৈতৃক/ওয়ারিশ	b	স্বনির্মিত	c	ক্রয়কৃত	d	আশ্রিত	e	ভাড়া
B-5	বসতভিটার জমি কিভাবে প্রাপ্ত?	a	পৈতৃক/ওয়ারিশ	b	ক্রয়কৃত	c	আশ্রিত	d	ভাড়া		
B-6	বসতভিটায় জমির পরিমাণ								শতাংশ		
B-7	মোট ঘরের সংখ্যা										

B-8	নির্মাণ উপকরণ					
		ছাদ	দেয়াল	মেঝে	মাপ	নির্মাণকাল
B-8.1	বসবাস					
B-8.2	বৈঠকঘর					
B-8.3	রান্নাঘর					
B-8.4	স্টোর					
B-8.5	গোয়ালঘর					
B-8.6						

B-9	টয়লেটের ধরণ	a	পাকা	b	আধাপাকা	c	কাচা	d	নেই
B-10	গোয়াল ঘর	a	আছে			b	নেই		
B-11	হাস মুরগীর ঘর	a	আছে			b	নেই		
B-12	নিজস্ব পুকুর	a	একটি	b	দুইটি	c	তিনটি	d	নেই
B-13	এজমালী পুকুর	a	আছে	b	নেই	B-13.1	কতগুলো বাড়ির জন্য?		

B-14	খাবার পানির উৎস	a	নিজস্ব টিউবওয়েল	c	নিজস্ব পুকুর	e	নদী/ খাল		
		b	এজমালী টিউবওয়েল	d	এজমালী পুকুর	f	বৃষ্টি		
B-15	গৃহস্থলী পানির উৎস	a	নিজস্ব টিউবওয়েল	c	নিজস্ব পুকুর	e	নদী/ খাল		
		b	এজমালী টিউবওয়েল	d	এজমালী পুকুর	f	বৃষ্টি/ অন্যান্য		
B-16	বিদ্যুৎ উৎস	a	পল্লীবিদ্যুৎ	b	সৌর	c	নেই	d	অন্যান্য
B-17	জ্বালানী উৎস	a	লাকড়ি	b	গ্যাস	c	কেরোসিন	d	বিদ্যুৎ	e	অন্যান্য
B-18	বৈদ্যুতিক সরঞ্জামাদী	□	লাইট	□	ফ্যান	□	পাম্প	□	চুলা	□	

B-19	গবাদী পশু- পাখির সংখ্যা	a	গরু	c	ছাগল	e	মুরগী	
		b	মহিষ	d	ভেড়া	f	হাঁস	
B-20	পুকুরের মাছ	a	চাষ হয়	b	প্রাকৃতিক	c	নেই	
B-21	উল্লেখযোগ্য গাছ কি কি							

C. অন্যান্য

C-1	NGO প্রদত্ত ঋণ আছে কি না?	a	আছে	b	নেই		
	C-1.1 (যদি থাকে) কিসের জন্য?	a	গৃহনির্মাণ	c	টয়লেট নির্মাণ	e	সৌর বিদ্যুত
		b	পানির ব্যবস্থা	d	কৃষি/ খামার	f	অন্যান্য
C-2	কোন সমবায় সমিতির সদস্য কি না?	a	হ্যা	b	না		
C-3	চাষযোগ্য জমি আছে কি না?	a	হ্যা	b	না		
	C-3.1 (যদি থাকে) প্রধান ফসল কি কি?						
C-4	নির্মাণ উপকরণ কিভাবে সংগ্রহ করেছেন?						
C-5	প্রাকৃতিক দুর্যোগে কোথায় আশ্রয় গ্রহণ করেন?						
C-6	এই গ্রামে বসবাস করার কারণ কি? পূর্বপুরুষেরা কোথায় বসবাস করতেন?						

তথ্য গ্রহণকারীর স্বাক্ষর ও তারিখ

Appendix- 2: Questionnaires for Key Informant Interviews (KII)

বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়

গবেষণা জরিপ

(Key Informant Interviews- one from each of 22 settlements. Older People or Local Head of the settlement)

KII

A. তথ্যদাতা সংক্রান্ত

A-1	তথ্যদাতার নাম						
A-2	গ্রামের নাম						
A-3	ফোন নম্বর						
A-4	বয়স	বছর	A-5	লিঙ্গ	a	নারী	b	পুরুষ
A-6	পেশা/ পরিচয়						
A-7	কত বছর যাবৎ এই গ্রামে বসবাস করছেন?						

B. গ্রাম সংক্রান্ত

B-1	এই গ্রামে মোট বাড়ি/ খানার সংখ্যা কত?	
B-2	গ্রামের অধিবাসীদের প্রধান পেশা কি?	
B-3	গ্রামের অধিবাসীদের ধর্ম কি?	
B-4	কিভাবে এবং কত বছর আগে এই গ্রামের উৎপত্তি হয়েছে?	
B-5	এই গ্রাম শেষ কবে ঘূর্ণিঝড় আক্রান্ত হয়েছে?	
B-6	এই গ্রাম শেষ কবে বন্যা কবলিত হয়েছে?	
B-7	প্রাকৃতিক দুর্যোগে নিরাপদ থাকার জন্য কোন ব্যবস্থা আছে কি?	
B-8	বর্তমানে কোন কোন NGO তাদের কর্মকান্ড পরিচালনা করছে?	
B-9	NGO গুলো কি ধরণের কর্মকান্ড করছে?	

C. সামাজিক স্থান সংক্রান্ত

		সংখ্যা	প্রতিষ্ঠাকাল			সংখ্যা	প্রতিষ্ঠাকাল
C-1	প্রাথমিক বিদ্যালয়			C-2	মাধ্যমিক বিদ্যালয়		
C-3	এনজিও স্কুল			C-4	ক্লাব		
C-5	মাদ্রাসা			C-6	মোক্তব		
C-7	মসজিদ			C-8	মন্দির		
C-9	ঈদগাহ			C-10	গণ পুকুর		
C-11	খেলার মাঠ			C-12	কোরবানীর স্থান		
C-13	বাজার/ হাট			C-14	শশ্মান		
C-15	সাইক্লোন শেল্টার			C-16	কবরস্থান		

তথ্য গ্রহণকারীর স্বাক্ষর ও তারিখ

Appendix- 3: Questionnaires for Focused Group Discussions (FGD)

বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়

গবেষণা জরিপ | (Focused Group Discussion- one from each zone. Total Three FGD.) | FGD

A. তথ্যদাতা সংক্রান্ত

A-1	তথ্যদাতার নাম							
A-3	ফোন নম্বর							
A-4	বয়স	বছর	A-5	লিঙ্গ	a	নারী	b	পুরুষ
A-6	পেশা/ পরিচয়							

B. মতামত

B-1	এ অঞ্চলের গ্রামের অধিবাসীদের অর্থনৈতিক স্বচ্ছলতা কেমন?
B-2	এ অঞ্চলের গ্রামের অধিবাসীদের শিক্ষার হার কেমন?
B-3	এ অঞ্চলের প্রধান ফসল কি?
B-4	নতুন কোন চরের ভূমি বন্টন কিভাবে হয়?
B-5	এ অঞ্চলের অধিবাসীদের বাসস্থানের প্রধান সমস্যাগুলো কি কি?
B-6	প্রাকৃতিক দুর্যোগ মোকাবেলায় সরকারের ভূমিকা কি থাকে?
B-7	দুর্যোগ ব্যবস্থাপনায় ভবিষ্যতে কি করা যেতে পারে?
B-8	বসতবাড়ি টেকসই করার জন্য কি কি পদক্ষেপ গ্রহণ করা যেতে পারে?

তথ্য গ্রহণকারীর স্বাক্ষর ও তারিখ

Appendix- 4: Computer Generated Three Dimensional (3D) View of the Case Study Settlements

Figure (A)4.1: Settlement of Jinntola at Zone-A.

Figure (A)4.2: Settlement of Balar Char of Char Kajal at Zone-A.

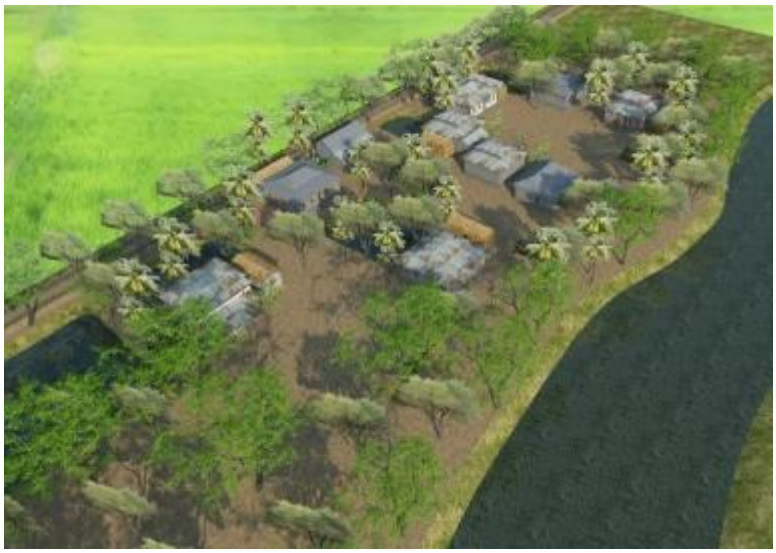

Figure (A)4.3: Settlement of Babuganj of Char Kukrimukri at Zone-A.

Figure (A)4.4: Settlement of Shababpur of Char Kukrimukri at Zone-A.

Figure (A)4.5: Settlement of Boyatibari of Char Kukrimukri at Zone-A.

Figure (A)4.6: Settlement of Char Folkan at Zone-B.

Figure (A)4.7: Settlement of Char Jogbondhu at Zone-B.

Figure (A)4.8: Settlement of Char Alexander at Zone-B.

Figure (A)4.9: Settlement of Char Mehar at Zone-B.

Figure (A)4.10: Settlement of Char Elahi (para-1) at Zone-B.

Figure (A)4.11: Settlement of Char Elahi (para-2) at Zone-B.

Figure (A)4.12: Settlement of Dakkhin Moghadia at Zone-C.

Figure (A)4.13: Settlement of Saidpur at Zone-C.

Figure (A)4.14: Settlement of Muradpur at Zone-C.

Figure (A)4.15: Settlement of Nadalia, Bashbaria at Zone-C.

Figure (A)4.16: Settlement of Boalia, Bashbaria at Zone-C.

Figure (A)4.17: Settlement of Kumira Jele Para at Zone-C.

Appendix- 5: Organization of Settlement

Based on many influencing factors the organization of the study settlements take various shapes. The shapes are summarized as follows:

i) Datum (Reference point)
ii) Scattered and Clustered
iii) Scattered and dispersed
iv) Connection of multiple clusters
v) Compact cluster
vi) Nucleated

(A)5.1. Datum or Reference Point

It is found that the settlements have come up along a road or a canal, which may be both natural or man-made. In earlier days natural topography were the motivating factors for the settlement form but in the contemporary time, the government interventions like roads, embankments also determine the settlement form.

(A)5.1.1. Datum as Road

A road or a path plays an important role in determining the location as well as the development trend of a settlement. Communication root works as a skeleton of a body (settlement). People have a tendency to settle alongside a communication route. Roads give the settlement needed accessibility with the community and the other social or community facilities. These organizes the whole settlement in a generic pattern along a communication line.

In Jinntola of Zone-A approximately 50 homesteads are connected with a pathway which has a width of 8-10 feet. The pathway is made by earth and maintained by the local community. Padma Char of Zone-A is established along a curvilinear path which starts and ends at a bigger road. This road is made by the government. In Char Duani of Zone-A, peoples resettle their homesteads beside an embankment right after the Sidr disaster. The long embankment gives the settlement a linear shape as it is yet in a growing stage, the homesteads are in a scattered position along the embankment.

In Char Montaj of Zone-A, there is flood protecting embankment around the char and well-established road networks inside the char were made and maintained by the Government. This road network gives the framework for any settlement and thus roads become prominent for growth datum.

Figure (A)5.1: Google earth view shows the grid of road network at Char Montaj.

Char Folkan of Zone-B, the settlement developed along a road, or on the other hand, the road was established in an organic way to connect the homesteads at an early age. Over time, the width of the settlement is growing as it cannot be expanded along the roadsides more. The homesteads of Char Jogobondhu and Char Alexander of Zone-B is connected by a pathway. The connecting roads give these settlements a linear pattern and a direction of expansion along sides the road. In Char Mehar of Zone-B, a pathway divided the settlement into two organic villages. One side is occupied by the old inhabitants and another side is developed by the re-settler who are the victim of river erosion.

The studied village of Saidpur of Zone-C is an expansion of more than hundreds of years old settlement. The extension started taking place around 50 years ago along a generically developed pathway towards the sea. The path is east-west elongated and wide agriculture lands on both sides. In the course of time, the path is taking shape of a formal road and gives the homesteads physical connection. Thus a linear settlement is taking shape.

Figure (A)5.2: Google earth view shows the road towards the bay at Saidpur.

(A)5.1.2. Datum as Canal

It is found in cases that the settlements have come up alongside natural canals. These canal act as a source of water or connection for transportation. This type of datum also gives the settlement linearity like a road does.

In the settlement of Koralia of Zone-A, the canal and a road alongside the canal works as datum line for the settlement. This gives the settlement a linear shape that terminates at a bigger road where some social common functions agglomerates. The settlement o Jaliaghata of the same Zone was developed beside a canal and canal-side road. The canal lost its connection with the river 30 years back by a riverside embankment. After that, the canal is acting as a lake. This linear lake is the source of many household water for the homesteads. The lake and its adjacent road acts as the datum for the linear settlement.

Figure (A)5.3: Google earth view shows settlements in Datum with canal in Zone-A.

(A)5.1.3. Datum as Road and Canal

Roads or pathways sometimes developed in a generic manner along a natural canal. As canals are not private properties, it is easy to establish roads alongside the canals. These roads act as communication line for a settlement and also connects several settlements. The length of such connections might be several miles long. The settlements of Koralia and Jaliaghata of Zone-A and Dakkhin Moghadia of Zone-C are developed by creating datum in such a way. In all of these cases pathway were created in a generic manner along the natural canal and later the pathways are developed into formal roads.

Babuganj of Zone-A is situated at the centre of the island Char Kukrimukri. The settlement is inside a natural boundary created by a road and a natural canal. Both the road and canal make a two-way datum for the settlement and holding the ten homesteads. Similar condition is found in Kumira Jele Para of Zone-C.

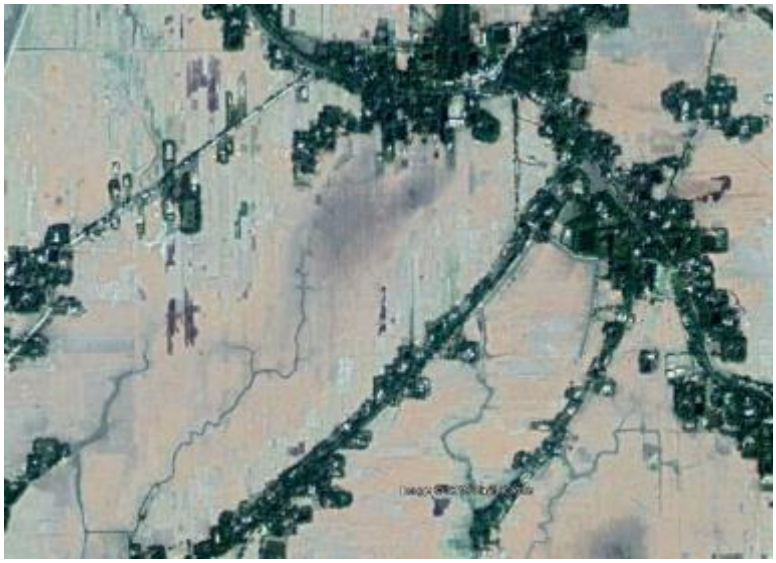

Figure (A)5.4: Google earth view shows settlements in Datum with road and canal in Char Kukrimukri.

(A)5.2. Scattered and Clustered

Scattered development of settlement, is one of the main types of settlement patterns in a delta identified by this study, landscape historians and geographers. Typically, there are a number of separate homesteads scattered throughout the area. Generally, homesteads are organized in clusters in Bengal delta. Multiple houses become parts of a single homestead and multiple homesteads together form a gram/ village.

In the survey cases, it is found that there are settlements developed in a scattered manner and the houses are clustered. In the settlement of Balar Char of Char Kajal of Zone-A, there are only fifteen homesteads and are growing. They are clustered in the middle of wide agriculture land. But there is no formal road connecting them. Fieldside aisle and informal pathway connects the homestead clusters.

Figure (A)5.5: Google earth view shows Scattered and Clustered settlements in Char Kajal.

In Dakkhin Moghadia of Zone-C, the settlement comes up in a scattered way. There are some scattered clustered that make a pattern that like moving from the ancient village towards the coast.

(A)5.3. Scattered and Dispersed

Settlements become scattered and dispersed at the primary stage of its development. Char Elahi (Para-2) of Zone-B is a combination of some scattered homesteads. There is no formal connection among them. Small ponds are dug to raise the homesteads. The overall settlement is at a primary stage of its development. New homesteads are being developed on the paddy fields. This connect the total village gradually physically. During monsoon, the paddy fields are flooded by water and thus islands of homesteads are visible. This typology is the initial stage of a settlement formation in Bengal delta.

Figure (A)5.6: Google earth view shows Scattered and dispersed settlements in Char Elahi in Zone-B.

(A)5.4. Connection of Multiple Clusters

Multiple homesteads make clusters. They share a source of water, some social spaces and even homestead premises with each other. Number of such clusters are connected with strong physical connections. In the case study settlement of Nadali in Zone-C, scattered clusters were developed with individual homesteads and over time the clusters grew bigger with new homesteads due to household expansion. the path also taking shape of a formal road and gives the homesteads physical connection. Thus a linear settlement with clusters takes shape. This is a stage of consolidation of the previous type.

Figure (A)5.7: Google earth view shows settlements that are connection of multiple clusters in Zone-C.

The studied settlement of Boalia of Zone-C is a two hundred years old settlement. There are few clusters that had developed in a scattered manner in the early stage. Later they were connected with a north-south elongated pathway. The pathway, then, was converted into a formal roadway.

(A)5.5. Compact Cluster

The compact clustered rural settlement is closely built-up area of houses. In this type of village, the general living area is distinct from the surrounding agricultural land. The closely built-up area and its intervening streets present some recognizable pattern or geometric shape. In such a village all the dwellings are connected to one centralized site. The inhabitants of the village live together and enjoy the benefits of community life.

The cluster of the settlement of Char Elahi (Para-1) of Zone-B is a compact one consisting of 12 homesteads. It has been established 15 years ago by some river eroded people from distant locations. As always, the clusters were developed on a raised mound created by earth taken from few ponds in the middle. The settlement is still at growing stage and new ponds are being excavated to extend the mound.

The studied settlement of Muradpur of Zone-C took shape of compact cluster. The cluster is connected with an organic pathway. There are more than 40 homesteads physically connected by the outer courtyard. The cluster is growing with the growing number of homesteads. The hundreds of years old settlement of Kumira Jele Para is of very compact nature. There are narrow pathways like branches of tree and house forms are settled on both sides of this narrow pathway. Each house form is a part of an individual homestead however; compactness depends on the economic status. The narrow pathway act as a breathing space for the inhabitants. This is a more advanced form of settlement after initial scattered setting.

Figure (A)5.8: Google earth view shows Compact cluster of Kumira Jele Para settlements in Zone-C.

(A)5.6. Nucleated

A nucleated village is a type of settlement where the homesteads are clustered around a central point or datum called a nucleus. The focal point depends on the location and culture. In nucleated settlements, people live close to their neighbours.

Settlement of Shababpur of Zone-A is situated at the western side of the island Char Kukrimukri. The settlement is clustered along an intersection of roads. The intersection shaped the village nucleus.

Figure (A)5.9: Google earth view shows Nucleated settlements in Char Kukrimukri in Zone-A.

Appendix- 6: Some Sketches of Homesteads

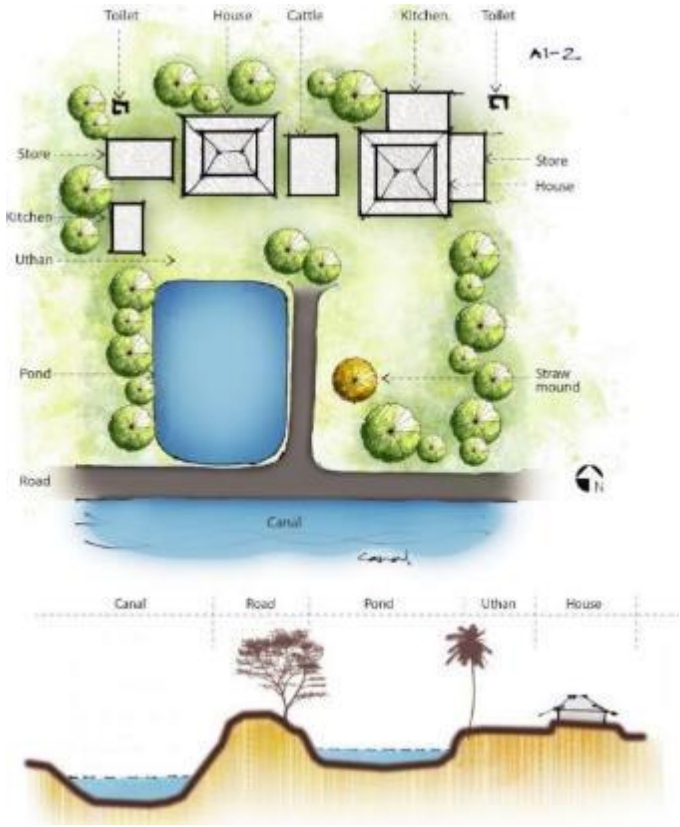

Figure (A)6.1: Layout and section of a homestead at Jinntola of Zone-A.

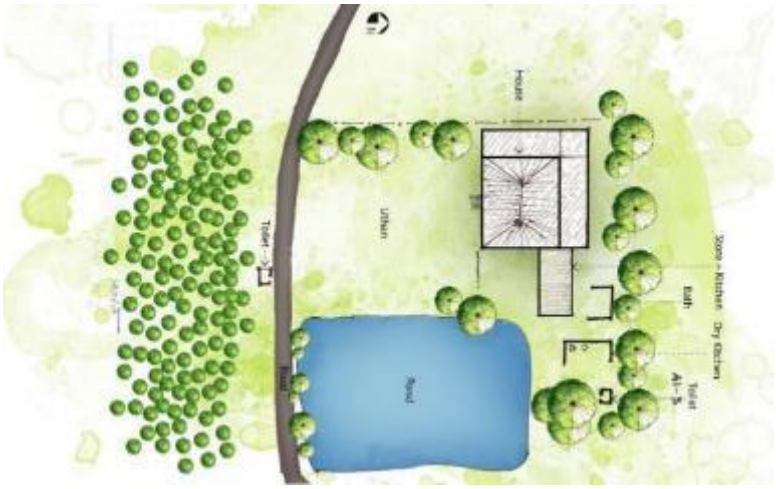

Figure (A)6.2: Layout of a homestead at Padma Char of Zone-A.

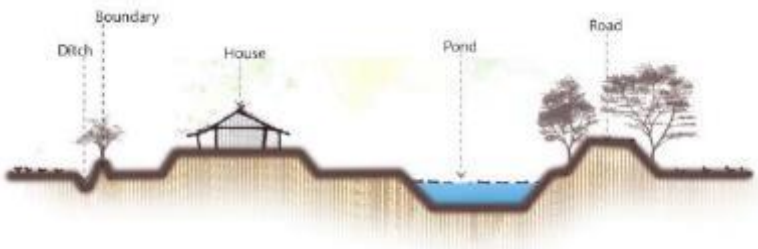

Figure (A)6.3: Section of a homestead at formation level at Char Montaj of Zone-A.

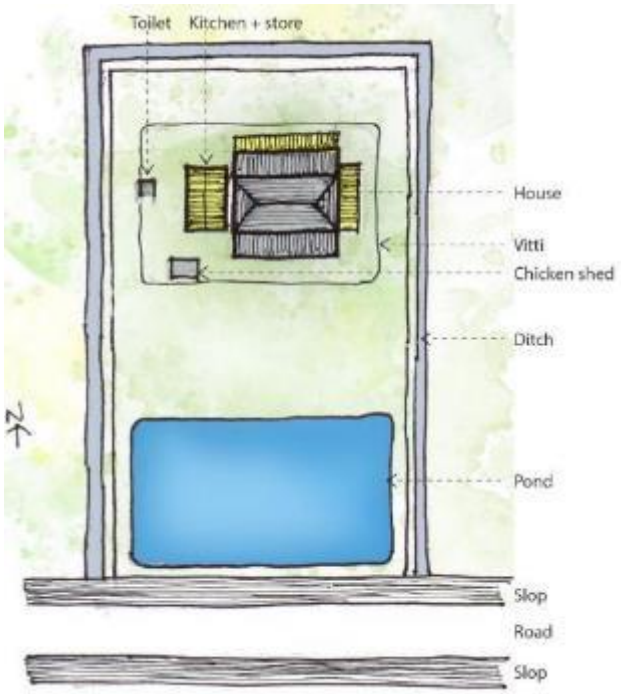

Figure (A)6.4: Layout of a homestead at formation level at Char Montaj of Zone-A.

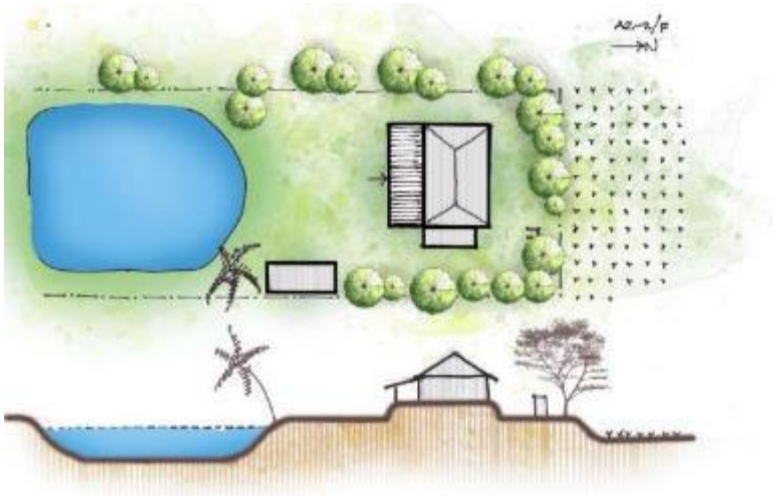

Figure (A)6.5: Layout and section of a homestead at Char Kajal of Zone-A.

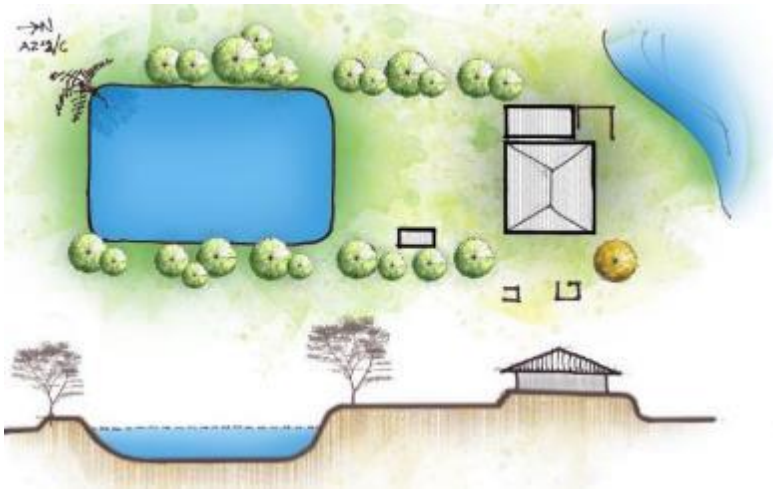

Figure (A)6.6: Layout and section of a homestead at Char Kajal of Zone-A.

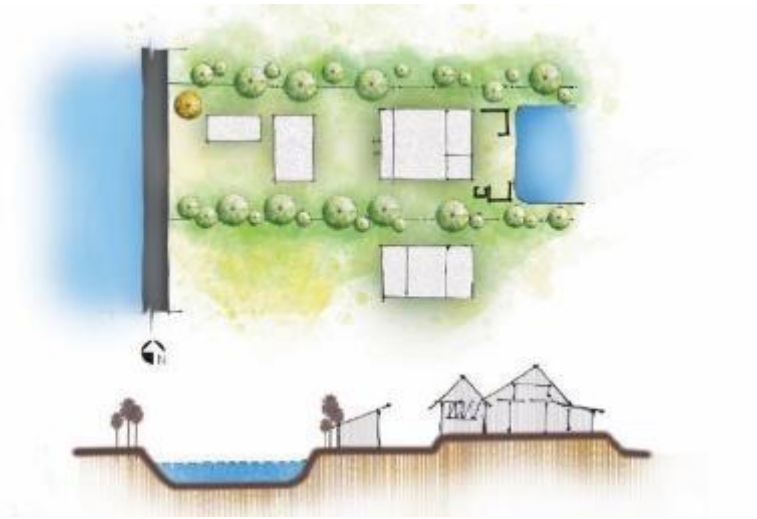

Figure (A)6.7: Layout and section of a homestead at Jaliaghata of Zone-A.

Figure (A)6.8: Section and layout of a homestead at Char Duani of Zone-A.

Figure (A)6.9: Layout of a homestead at Koralia of Zone-A.

Figure (A)6.10: Layout and section of a homestead at Jaliaghata of Zone-A.

Figure (A)6.11: Layout and section of a homestead at Char Duani of Zone-A.

Appendix- 7: Data Sheets

(From next page)

Data Sheet of Semi-Structured Questionnaire (SSQ) Survey

Appendix- 7: Data Sheets

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	SSQ		A. Personal and Family Information											B. Related to Homestead							B-8. Construction Materials				
2			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7			B-8.1		
3																									
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
6	A1	1	Abdul Barek	Jinntola, Patharghata, Barguna	55	b	a	a	a	a	6	1	a	8	3		b	c	6	1	CI sheet	Bamboo	Earth	15	3
7		2	Shohidul Islam	Jinntola, Patharghata, Barguna	45	b	b	b	a	a	5	1	c	10	4		b	b	12	1	CI sheet	CI sheet	Earth	20	4
8		3	Jobeda Begum	Jinntola, Patharghata, Barguna	62	a	a	e	a	b	8	2	d	14	14		b	b	15	2	CI sheet	CI sheet	Earth	35	14
9		4	Monir Hossain	Jinntola, Patharghata, Barguna	28	b	c	a	a	b	7	2	c	12	12		a	b	20	1	CI sheet	CI sheet	Earth	35	12
10		5	Md. Shohag	Jinntola, Patharghata, Barguna	36	b	d	b	a	b	9	3	c	13	13		b	b	25	1	CI sheet	CI sheet	Earth	28	13
11		6	Khalek Mia	Jinntola, Patharghata, Barguna	40	b	b	b	a	a	4	1	b	12	10		b	b	8	1	CI sheet	Leaves	Earth	18	10
12		7	Barkot Ullah	Jinntola, Patharghata, Barguna	62	b	a	b	a	b	10	3	d	14	14		b	b	32	2	CI sheet	CI sheet	Earth	50	14
13		8	Rahmot Munshi	Jinntola, Patharghata, Barguna	45	b	c	b	a	a	5	1	b	14	8		c	a	12	1	CI sheet	CI sheet	Earth	28	8
14		9	Hazera Khatun	Jinntola, Patharghata, Barguna	52	a	b	e	a	b	11	3	d	14	14		b	b	14	2	CI sheet	CI sheet	Earth	35	14
15		10	Abdul Momen	Jinntola, Patharghata, Barguna	32	b	a	a	a	b	9	2	c	13	13		b	b	16	1	CI sheet	CI sheet	Earth	50	13
16	A2	1	Harun Akond	Padma Char, Patharghata, Barguna	59	b	a	a	a	b	9	2	c	30	30		b	b	28	1	CI sheet	CI sheet	Earth	35	30
17		2	Rafiqul Islam	Padma Char, Patharghata, Barguna	26	b	c	a	a	b	10	3	d	20	20		b	b	18	1	CI sheet	CI sheet	Earth	28	20
18		3	Ainal Hakim	Padma Char, Patharghata, Barguna	52	b	d	a	a	b	8	1	b	25	25		b	b	9	1	CI sheet	CI sheet	Earth	15	25
19		4	Bahera Bibi	Padma Char, Patharghata, Barguna	65	a	b	e	a	b	12	3	e	34	34		b	b	18	1	CI sheet	CI sheet	Earth	22	34
20		5	Hashem Mia	Padma Char, Patharghata, Barguna	47	b	a	b	a	a	6	1	b	18	4		b	b	12	1	CI sheet	CI sheet	Earth	22	4
21		6	Karim Shekh	Padma Char, Patharghata, Barguna	36	b	a	a	a	a	4	1	c	12	10		b	b	10	1	CI sheet	CI sheet	Earth	22	10
22		7	Barek Shekh	Padma Char, Patharghata, Barguna	28	b	c	a	a	b	9	2	c	17	17		b	b	35	2	CI sheet	CI sheet	Earth	56	17
23		8	Joinal Abedin	Padma Char, Patharghata, Barguna	43	b	b	b	a	a	5	1	b	21	8		b	b	7	1	CI sheet	Bamboo	Earth	22	8
24		9	Alyea Begum	Padma Char, Patharghata, Barguna	50	a	a	e	a	b	10	4	e	30	30		b	b	31	2	CI sheet	Wood	Earth	42	30
25		10	Fazlar Rahman	Padma Char, Patharghata, Barguna	42	b	b	b	a	a	13	4	e	22	14		b	b	8	1	CI sheet	Bamboo	Earth	18	14
26	A3	1	Abdur Razzak	Koralia, Patharghata, Barguna	58	b	b	a	a	b	12	3	e	58	58		a	a	38	3	CI sheet	CI sheet	Earth	120	46
27		2	Josmot Ali	Koralia, Patharghata, Barguna	27	b	d	d	a	a	5	1	c	27	1		b	a	10	1	CI sheet	CI sheet	Earth	35	1
28		3	Dildar Hossain	Koralia, Patharghata, Barguna	36	b	c	c	a	a	4	1	b	36	8		b	a	8	1	CI sheet	CI sheet	Earth	35	8
29		4	Md. Jalal	Koralia, Patharghata, Barguna	46	b	c	a	a	b	13	3	e	46	46		a	a	55	3	CI sheet	Wood	Cement	76	46
30		5	Nur Alam	Koralia, Patharghata, Barguna	63	b	a	a	a	b	10	2	c	60	60		b	b	24	2	CI sheet	CI sheet	Earth	56	60
31		6	Md. Belal	Koralia, Patharghata, Barguna	44	b	b	a	a	b	8	1	c	44	44		a	a	15	1	CI sheet	CI sheet	Earth	42	44
32		7	Shamim Islam	Koralia, Patharghata, Barguna	33	b	e	d	a	a	3	1	b	33	6		b	b	6	1	CI sheet	Bamboo	Earth	18	6
33		8	Shahera Khatun	Koralia, Patharghata, Barguna	58	a	b	e	a	b	8	2	c	58	58		a	a	18	2	CI sheet	CI sheet	Earth	42	58
34		9	Hazrat Ali	Koralia, Patharghata, Barguna	36	b	a	a	a	a	4	1	c	36	5		b	a	12	1	CI sheet	CI sheet	Earth	22	5
35		10	Md. Miraj	Koralia, Patharghata, Barguna	58	b	a	a	a	b	11	3	e	58	58		a	a	33	2	CI sheet	CI sheet	Earth	76	58
36	A4	1	Monju Akond	Char Duani, Patharghata, Barguna	53	b	c	a	a	b	11	3	d	12	12		b	b	18	2	CI sheet	CI sheet	Earth	65	12
37		2	Nasima Begum	Char Duani, Patharghata, Barguna	30	a	b	e	a	b	8	2	c	12	12		b	a	14	1	CI sheet	CI sheet	Earth	35	12
38		3	Hazrat Munshi	Char Duani, Patharghata, Barguna	27	b	b	a	a	b	7	1	b	12	12		b	b	12	1	CI sheet	CI sheet	Earth	28	12
39		4	Meher Ali	Char Duani, Patharghata, Barguna	38	b	c	b	a	a	3	1	b	12	4		b	c	8	1	CI sheet	Bamboo	Earth	22	4
40		5	Md. Rasel Mia	Char Duani, Patharghata, Barguna	26	b	d	d	a	a	4	1	b	12	1		b	a	6	1	CI sheet	Leaves	Earth	18	1
41		6	Mohin Akond	Char Duani, Patharghata, Barguna	47	b	b	a	a	b	10	3	d	12	12		b	b	22	2	CI sheet	CI sheet	Earth	55	12
42		7	Nasir Akond	Char Duani, Patharghata, Barguna	47	b	b	a	a	b	9	2	d	12	12		b	b	16	1	CI sheet	CI sheet	Earth	42	12
43		8	Younus Ali	Char Duani, Patharghata, Barguna	56	b	a	a	a	b	9	2	b	12	12		b	b	13	1	CI sheet	CI sheet	Earth	35	12
44		9	Shiraj Uddin	Char Duani, Patharghata, Barguna	46	b	b	a	a	a	4	1	b	12	7		b	a	15	1	CI sheet	CI sheet	Earth	24	7
45		10	Sharif Uddin	Char Duani, Patharghata, Barguna	24	b	d	b	a	b	9	2	c	12	12		b	b	10	1	CI sheet	Leaves	Earth	18	12

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1																															
2	**SSQ**																							**B-9**	**B-10**	**B-11**	**B-12**		**B-13**		**B-14**
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	**Case No.**	**SSQ no.**	**Boithakghar**					**Kitchen**					**Store room**					**Cattle house**					Total Built-form	**Toilet**	**Cattle house**	**Poultry house**	**Pond**	Area for pond	**Community Pond**	Catchment	**Source of Drinking Water**
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
6	**A1**	1						Leaves	Leaves	Earth	6	3											21	b	b	a	d	0	a	60	b
7		2						Leaves	Leaves	Earth	6	4	Leaves	Leaves	Earth	8	4						34	b	b	a	a	120	a	60	f
8		3	CI sheet	CI sheet	Earth	28	14	CI sheet	Bamboo	Earth	12	14	CI sheet	Wood	Wood	8	12	CI sheet	Bamboo	Earth	10	10	93	a	a	a	a	310	a	60	f
9		4						Leaves	Leaves	Earth	12	12											47	b	b	a	a	180	a	60	f
10		5						Bamboo	Leaves	Earth	6	13											34	b	b	a	a	225	a	60	f
11		6						Bamboo	Bamboo	Earth	7	10	Bamboo	Bamboo	Earth	7	10	Leaves	Leaves	Earth	8	5	40	b	a	a	d	0	a	60	f
12		7	CI sheet	CI sheet	Earth	35	7	CI sheet	CI sheet	Earth	14	14	CI sheet	CI sheet	Earth	10	14	CI sheet	Leaves	Earth	12	10	121	a	a	a	a	360	a	60	f
13		8						Leaves	Leaves	Earth	9	8											37	b	b	a	d	0	a	60	f
14		9	CI sheet	CI sheet	Earth	28	12	CI sheet	Wood	Earth	8	14	CI sheet	Wood	Earth	8	10	CI sheet	Leaves	Earth	10	10	89	a	a	a	a	270	a	60	f
15		10						CI sheet	Leaves	Earth	10	13						Leaves	Bamboo	Earth	12	13	72	a	a	a	a	220	a	60	f
16	**A2**	1						CI sheet	CI sheet	Earth	10	17	CI sheet	Leaves	Earth	10	10	CI sheet	Leaves	Earth	10	12	65	a	a	a	a	240	a	150	f
17		2						CI sheet	Leaves	Earth	8	15	CI sheet	Wood	Wood	8	20	CI sheet	Leaves	Earth	8	10	52	a	a	a	a	220	a	150	f
18		3						CI sheet	Wood	Earth	10	25	CI sheet	Leaves	Earth	8	15						33	b	b	a	a	150	a	150	f
19		4						CI sheet	CI sheet	Earth	10	8	CI sheet	Leaves	Earth	10	18						42	b	b	a	a	180	a	150	f
20		5						CI sheet	Leaves	Earth	9	9											31	b	b	a	a	120	a	150	f
21		6						CI sheet	CI sheet	Earth	8	10											30	b	b	a	a	165	a	150	f
22		7	CI sheet	CI sheet	Earth	22	17	CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	7	20	CI sheet	CI sheet	Earth	12	10	109	a	a	a	b	425	a	150	f
23		8						Leaves	Leaves	Earth	7	8						CI sheet	Leaves	Earth	8	5	37	b	a	a	d	0	a	150	f
24		9	CI sheet	CI sheet	Earth	28	25	CI sheet	CI sheet	Earth	12	15	CI sheet	CI sheet	Earth	8	12	CI sheet	CI sheet	Earth	12	15	102	a	a	a	b	360	a	150	f
25		10						CI sheet	Leaves	Earth	6	14						Leaves	Leaves	Earth	8	8	32	b	a	a	d	0	a	150	f
26	**A3**	1	CI sheet	CI sheet	Earth	56		CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	10	12	210	a	a	a	b	750	b	0	a
27		2						CI sheet	CI sheet	Earth	8	1						CI sheet	Leaves	Earth	12	1	55	b	a	a	a	165	b	0	b
28		3						CI sheet	Bamboo	Earth	7	8											42	b	b	a	a	144	b	0	b
29		4	CI sheet	Wood	Earth	42		CI sheet	CI sheet	Earth	12	22	CI sheet	Wood	Earth	10	20	CI sheet	CI sheet	Earth	12	15	152	a	a	a	b	625	b	0	a
30		5	CI sheet	CI sheet	Earth	24		CI sheet	CI sheet	Earth	8	10	CI sheet	Bamboo	Earth	10	8	CI sheet	Bamboo	Earth	12	10	110	a	a	a	a	330	b	0	b
31		6						Leaves	Leaves	Earth	8	18						CI sheet	Leaves	Earth	8	18	58	b	a	a	a	220	b	0	b
32		7						Leaves	Leaves	Earth	6	6											24	a	b	a	d	0	b	0	b
33		8	CI sheet	CI sheet	Earth	22		CI sheet	Bamboo	Earth	7	7	CI sheet	CI sheet	Earth	8	6	CI sheet	Bamboo	Earth	10	7	89	a	a	a	a	280	b	0	b
34		9						CI sheet	CI sheet	Earth	8	5	CI sheet	Bamboo	Earth	8	3	CI sheet	Leaves	Earth	10	5	48	b	a	a	a	160	b	0	b
35		10	CI sheet	CI sheet	Earth	22		CI sheet	CI sheet	Earth	10	8	CI sheet	Wood	Earth	10	18	CI sheet	Leaves	Earth	8	8	126	a	a	a	b	420	b	0	b
36	**A4**	1	CI sheet	CI sheet	Earth	24	12	CI sheet	CI sheet	Earth	8	10	CI sheet	Wood	Earth	8	12	CI sheet	Leaves	Earth	8	12	113	a	a	a	a	360	a	50	d
37		2						Bamboo	Leaves	Earth	7	9											42	b	b	a	a	155	a	50	d
38		3						CI sheet	Bamboo	Earth	6	12											34	b	b	a	a	110	a	50	d
39		4						CI sheet	Leaves	Earth	7	4						CI sheet	Bamboo	Earth	11	4	40	a	a	b	d	0	a	50	d
40		5						Leaves	Leaves	Earth	6	1											24	b	b	a	d	0	a	50	d
41		6	CI sheet	CI sheet	Earth	42	12	CI sheet	CI sheet	Earth	10	8	CI sheet	CI sheet	Earth	10	12	CI sheet	Bamboo	Earth	10	8	127	a	a	a	b	440	a	50	d
42		7						CI sheet	Bamboo	Earth	7	8	CI sheet	Bamboo	Earth	8	8	CI sheet	Leaves	Earth	8	12	65	b	a	a	a	212	a	50	d
43		8						CI sheet	CI sheet	Earth	6	12	CI sheet	CI sheet	Earth	10	12	CI sheet	Bamboo	Earth	10	6	61	a	a	a	a	225	a	50	d
44		9						Leaves	Leaves	Earth	6	7											30	b	b	a	a	120	a	50	d
45		10						Leaves	Leaves	Earth	8	12											26	b	b	a	a	90	a	50	d

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ													C. Others						
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
6	A1	1	d	c	a						4	6	c	a	e	b	a	Rice	From surroundings	Shelter centre
7		2	d	b	a	a,b					6		c	a	e	a	b		Local source	Shelter centre
8		3	c	b	a	a,b	2				4	8	b	b	e	a	a	Vegetables	Local source	Shelter centre
9		4	d	b	a	a					7		b	a	e	b	a	Rice	Local source	Shelter centre
10		5	d	b	a	a,b					12	6	b	a	e	a	b		Local source	Shelter centre
11		6	c	b	a	a,b	4				4	3	c	a	e	a	b		Local source	Shelter centre
12		7	c	b	a	a,b	6				3		b	b		b	a	Rice	Local source	Shelter centre
13		8	d	b	a	a					5	5	c	a	e	a	b		Local source	Shelter centre
14		9	c	b	a	a,b	3				6	6	b	b		b	a	Rice	Local source	Shelter centre
15		10	d	b	a	a,b	5				3	4	b	a	e	a	a	Vegetables	Local source	Shelter centre
16	A2	1	c	b	a	a,b	4				4	5	b	b		b	a	Rice	Local source	School Building
17		2	c	b	a	a,b	2	2			3	6	b	b		b	a	Vegetables	Local source	School Building
18		3	c	b	a	a,b					6	4	c	a	e	b	a	Rice	Local source	School Building
19		4	d	b	a	a,b					5	4	b	a	e	a	a	Rice	Local source	School Building
20		5	d	b	a	a,b					4	3	c	a	e	a	b		Local source	School Building
21		6	d	b	a	a,b					3	4	b	a	e	a	a	Vegetables	Local source	School Building
22		7	c	b	a	a,b	4	2			8		a	b		b	a	Rice	Local source	School Building
23		8	d	b	a	a	3				4		c	a	e	b	b		Local source	School Building
24		9	c	b	a	a,b	5				6	6	b	b		b	a	Rice	Local source	School Building
25		10	d	b	a	a,b	2				4	10	c	b	e	a	b		Local source	School Building
26	A3	1	a	b	a	a,b	5				6		a	b		b	a	Rice	Local source	School Building
27		2	c	b	a	a,b	3				6	8	c	a	e	a	b		Local source	School Building
28		3	c	b	a	a,b	1				2	3	b	a	e	a	b		Local source	School Building
29		4	a	b	a	a,b	6				8	8	a	b		b	a	Rice	Local source	School Building
30		5	c	b	a	a,b	4				5	6	b	b		b	a	Rice	Local source	School Building
31		6	c	b	a	a,b	3				5		b	a	e	b	a	Sunflower	Local source	School Building
32		7	b	b	a	a,b					5	6	c	a	e	a	b		Local source	School Building
33		8	c	b	a	a,b	4				7	5	b	b		b	a	Rice	Local source	School Building
34		9	c	b	a	a,b	2				3		c	a	e	a	a	Sunflower	Local source	School Building
35		10	c	b	a	a,b	5				6		a	b		b	a	Rice	Local source	School Building
36	A4	1	c	b	a	a,b	3				5	8	b	b		b	a	Vegetables	Local source, Reused	Shelter centre
37		2	d	b	a	a,b					3	13	b	a	e	a	a	Rice	Local source, Reused	Shelter centre
38		3	d	b	a	a						6	c	a	e	b	a	Vegetables	Local source, Reused	Shelter centre
39		4	d	c	a	a	2					8	c	b		b	b		Local source, Reused	Shelter centre
40		5	d	c	a	a					2	6	c	b		a	b		Local source, Reused	Shelter centre
41		6	c	b	a	a,b	4					12	a	b		b	a	Rice	Local source, Reused	Shelter centre
42		7	d	b	a	a,b	2				4		a	a	e	a	a	Vegetables	Local source, Reused	Shelter centre
43		8	d	b	a	a	2					8	c	a	c,e	a	a	Rice	Local source, Reused	Shelter centre
44		9	d	b	a	a					6	5	b	a	c,e	b	a	Rice	Local source, Reused	Shelter centre
45		10	d	c	a	a					4	12	c	b		b	b		Local source, Reused	Shelter centre

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	SSQ		A. Personal and Family Information											B. Related to Homestead							B-8. Construction Materials				
2			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8.1				
3																									
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
46	A5	1	Tajom Ali Hawlader	Jaliaghata, Patharghata, Barguna	55	b	d	a	a	b	12	4	e	55	55		b	b	60	3	CI sheet	Wood	Cement	160	50
47		2	Kalam Molla	Jaliaghata, Patharghata, Barguna	60	b	b	a	a	b	8	3	e	60	60		b	b	54	2	CI sheet	CI sheet	Earth	76	60
48		3	Rejaul Karim	Jaliaghata, Patharghata, Barguna	47	b	c	a	a	b	8	2	d	47	47		b	b	33	1	CI sheet	CI sheet	Earth	56	47
49		4	Aroj Ali Hawlader	Jaliaghata, Patharghata, Barguna	24	b	c	a	a	b	6	2	c	24	24		b	b	33	1	CI sheet	CI sheet	Earth	42	24
50		5	Md. Sumon	Jaliaghata, Patharghata, Barguna	27	b	d	d	a	a	3	1	b	27	2		b	a	11	1	CI sheet	Bamboo	Earth	35	2
51		6	Abdul Gani	Jaliaghata, Patharghata, Barguna	49	b	b	a	a	b	10	3	e	49	49		b	b	56	2	CI sheet	CI sheet	Cement	120	55
52		7	Forid Uddin	Jaliaghata, Patharghata, Barguna	61	b	c	a	a	b	9	3	d	60	60		b	b	33	1	CI sheet	CI sheet	Earth	76	60
53		8	Kamrul Islam	Jaliaghata, Patharghata, Barguna	36	b	e	a	a	b	7	2	d	35	35		b	b	25	1	CI sheet	CI sheet	Earth	56	35
54		9	Aminul Islam	Jaliaghata, Patharghata, Barguna	42	b	c	c	a	a	4	1	c	42	12		b	b	16	1	CI sheet	CI sheet	Earth	35	42
55		10	Masud Parvez	Jaliaghata, Patharghata, Barguna	30	b	d	d	a	a	4	1	b	30	5		b	a	16	1	CI sheet	Bamboo	Earth	35	5
56	A6	1	Tajra bibi	Char Kajal – Balar Char, Golachipa, Patuakhali	55	a	a	a	a	b	12	4	a	15	15		d	c	44	1	CI sheet	Leaves	Earth	36	15
57		2	Saleha Begum	Char Kajal – Balar Char, Golachipa, Patuakhali	60	a	a	e	a	b	10	4	b	50	50		b	b	33	3	CI sheet	CI sheet	Earth	98	50
58		3	Md. Fazlu Munshi	Char Kajal – Balar Char, Golachipa, Patuakhali	45	b	c	a	a	b	7	3	b	45	35		a	a	18	2	CI sheet	CI sheet	Earth	60	30
59		4	Matlob Munshi	Char Kajal – Balar Char, Golachipa, Patuakhali	80	b	a	a	a	b	14	4	c	50	50		b	b	12	1	CI sheet	Bamboo	Earth	56	50
60		5	Faisal Khan	Char Kajal – Balar Char, Golachipa, Patuakhali	40	b	d	a	a	a	5	1	b	40	12		a	a	10	1	CI sheet	Bamboo	Earth	35	12
61		6	Minto Khan	Char Kajal – Balar Char, Golachipa, Patuakhali	33	b	e	a	a	a	4	1	b	33	8		c	c	8	1	CI sheet	Leaves	Earth	22	8
62		7	Hasan Ali	Char Kajal – Balar Char, Golachipa, Patuakhali	53	b	b	a	a	b	9	3	b	50	50		b	a	33	3	CI sheet	CI sheet	Cement	110	50
63		8	Hatem Ali Khan	Char Kajal – Balar Char, Golachipa, Patuakhali	42	b	b	a	a	b	8	3	b	42	42		a	a	24	2	CI sheet	CI sheet	Earth	68	40
64		9	Rafiq Munshi	Char Kajal – Balar Char, Golachipa, Patuakhali	48	b	c	a	a	b	9	2	b	48	15		a	a	18	1	CI sheet	Bamboo	Earth	56	15
65		10	Anis Munshi	Char Kajal – Balar Char, Golachipa, Patuakhali	55	b	b	a	a	b	10	3	c	50	30		a	a	15	1	CI sheet	CI sheet	Earth	48	40
66	A7	1	Alom Shikder	Char Montaj, Golachipa, Patuakhali	46	b	b	a	a	b	8	3	d	35	22		b	b	44	3	CI sheet	CI sheet	Earth	110	22
67		2	Adus Sobahan Molla	Char Montaj, Golachipa, Patuakhali	58	b	b	a	a	b	7	3	d	35	28		b	b	22	1	CI sheet	CI sheet	Earth	35	28
68		3	Mohammad Ali	Char Montaj, Golachipa, Patuakhali	42	b	c	a	a	b	8	2	c	35	28		b	a	18	1	CI sheet	CI sheet	Earth	35	28
69		4	Tomij Molla	Char Montaj, Golachipa, Patuakhali	36	b	c	d	a	a	4	1	b	35	8		a	a	9	1	CI sheet	Bamboo	Earth	22	8
70		5	Hanif Molla	Char Montaj, Golachipa, Patuakhali	57	b	a	a	a	b	12	4	e	28	28		b	a	42	2	CI sheet	CI sheet	Earth	76	28
71		6	Ashraf Molla	Char Montaj, Golachipa, Patuakhali	43	b	b	a	a	b	9	2	d	35	35		b	b	53	2	CI sheet	CI sheet	Earth	56	35
72		7	Shihab Uddin	Char Montaj, Golachipa, Patuakhali	58	b	b	d	a	b	10	3	c	35	25		b	a	26	1	CI sheet	CI sheet	Earth	28	25
73		8	Imam Hossain	Char Montaj, Golachipa, Patuakhali	28	b	c	a	a	a	4	1	b	28	12		b	a	12	1	CI sheet	Bamboo	Earth	28	12
74		9	Md. Ibrahim	Char Montaj, Golachipa, Patuakhali	65	b	a	a	a	b	9	3	d	35	35		b	a	33	2	CI sheet	CI sheet	Earth	60	35
75		10	Shahin Khan	Char Montaj, Golachipa, Patuakhali	62	b	a	a	a	b	8	2	c	35	16		b	b	18	1	CI sheet	CI sheet	Earth	48	16
76	A8	1	Abdul Alim	Babuganj, Char Kukrimukri, Bhola	72	b	a	a	a	b	10	4	e	30	30		b	a	33	3	CI sheet	CI sheet	Earth	98	30
77		2	Fazlu Bepari	Babuganj, Char Kukrimukri, Bhola	52	b	b	a	a	b	10	2	c	30	30		b	b	24	2	CI sheet	CI sheet	Earth	68	30
78		3	Kamal Bepari	Babuganj, Char Kukrimukri, Bhola	55	b	b	a	a	b	7	3	d	25	25		b	a	18	1	CI sheet	CI sheet	Earth	56	25
79		4	Rahim Bepari	Babuganj, Char Kukrimukri, Bhola	40	b	c	d	a	a	5	1	c	8	8		b	b	22	1	CI sheet	CI sheet	Earth	28	8
80		5	Abdul Latif	Babuganj, Char Kukrimukri, Bhola	36	b	c	a	a	a	4	1	c	4	4		b	b	10	1	CI sheet	CI sheet	Earth	22	4
81		6	Alamgir	Babuganj, Char Kukrimukri, Bhola	55	b	a	a	a	b	12	3	e	25	25		b	a	52	3	CI sheet	Wood	Cement	108	25
82		7	Hashem Howlader	Babuganj, Char Kukrimukri, Bhola	45	b	b	a	a	b	9	2	c	30	30		a	b	20	1	CI sheet	CI sheet	Earth	56	30
83		8	Mostafa Bepari	Babuganj, Char Kukrimukri, Bhola	57	b	a	a	a	b	8	3	d	30	30		b	b	42	2	CI sheet	CI sheet	Earth	76	30
84		9	Akhter Hossain	Babuganj, Char Kukrimukri, Bhola	48	b	b	c	a	b	11	3	d	27	27		b	b	26	1	CI sheet	CI sheet	Earth	35	27
85		10	Al Mamun	Babuganj, Char Kukrimukri, Bhola	42	b	c	a	a	a	4	1	c	8	8		b	a	15	1	CI sheet	CI sheet	Earth	35	8

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1																															
2	SSQ																							B-9	B-10	B-11	B-12		B-13		B-14
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	Case No.	SSQ no.	Boithakghar					Kitchen					Store room					Cattle house					Total Built-form	Toilet	Cattle house	Poultry house	Pond	Area for pond	Community Pond	Catchment	Source of Drinking Water
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
46	A5	1	CI sheet	CI sheet	Cement	56	30	CI sheet	CI sheet	Earth	18	22	CI sheet	CI sheet	Earth	18	20	CI sheet	CI sheet	Earth	25	20	277	a	a	a	b	1020	b	0	b
47		2	CI sheet	CI sheet	Earth	35	22	CI sheet	CI sheet	Earth	15	18	CI sheet	CI sheet	Earth	10	18	CI sheet	Bamboo	Earth	12	12	148	a	a	a	a	460	b	0	b
48		3						CI sheet	Bamboo	Earth	10	15	CI sheet	Bamboo	Earth	10	15	CI sheet	CI sheet	Earth	16	15	92	a	a	a	a	286	b	0	b
49		4						CI sheet	Leaves	Earth	15	24											57	b	b	a	a	235	b	0	b
50		5						Leaves	Leaves	Earth	10	2	Bamboo	Bamboo	Earth	8	2	Leaves	Leaves	Earth	8	2	61	b	a	a	d	0	b	0	b
51		6	CI sheet	CI sheet	Cement	56	25	CI sheet	CI sheet	Earth	16	20	CI sheet	CI sheet	Earth	12	30	CI sheet	CI sheet	Earth	18	30	222	a	a	a	b	770	b	0	b
52		7						CI sheet	Bamboo	Earth	8	8	CI sheet	Bamboo	Earth	7	8	CI sheet	Bamboo	Earth	16	8	107	a	a	a	a	320	b	0	b
53		8						CI sheet	CI sheet	Earth	10	15						CI sheet	Bamboo	Earth	10	15	76	a	a	a	a	256	b	0	b
54		9						CI sheet	CI sheet	Earth	12	12						Leaves	Leaves	Earth	10	12	57	b	a	a	a	220	b	0	b
55		10						CI sheet	Bamboo	Earth	8	5	CI sheet	Leaves	Earth	14	5	CI sheet	Leaves	Earth	12	5	69	b	a	a	d	0	b	0	b
56	A6	1						Leaves	Leaves	Earth	5	15	Leaves	Leaves	Earth	8	20						49	b	b	a	d	0	b	0	b
57		2	CI sheet	CI sheet	Earth	35	20	CI sheet	Bamboo	Earth	12	20	CI sheet	Bamboo	Earth	8	18	CI sheet	Bamboo	Earth	10	20	163	a	a	a	b	525	b	0	b
58		3	CI sheet	Bamboo	Earth	22	12	CI sheet	Leaves	Earth	10	8	CI sheet	Leaves	Earth	7	8	CI sheet	CI sheet	Earth	8	8	107	a	a	a	a	320	b	0	b
59		4						CI sheet	Bamboo	Earth	8	24	CI sheet	CI sheet	Earth	10	14	CI sheet	CI sheet	Earth	14	24	88	b	a	a	a	285	b	0	b
60		5						CI sheet	CI sheet	Earth	12	12						CI sheet	Bamboo	Earth	9	16	56	b	a	a	a	220	b	0	b
61		6						Leaves	Leaves	Earth	8	8						Leaves	Leaves	Earth	10	4	40	b	a	a	a	200	b	0	b
62		7	CI sheet	CI sheet	Earth	56	30	CI sheet	CI sheet	Earth	15	15	CI sheet	CI sheet	Earth	10	22	CI sheet	CI sheet	Earth	16	15	207	a	a	a	b	620	b	0	a
63		8	CI sheet	CI sheet	Earth	35	18	CI sheet	Leaves	Earth	10	12	CI sheet	CI sheet	Earth	8	12	CI sheet	Bamboo	Earth	8	12	129	a	a	a	a	390	b	0	b
64		9						CI sheet	Bamboo	Earth	8	15						CI sheet	Bamboo	Earth	12	15	76	a	a	a	a	244	b	0	b
65		10						CI sheet	CI sheet	Earth	8	28						CI sheet	Leaves	Earth	12	22	68	b	a	a	a	220	b	0	b
66	A7	1	CI sheet	CI sheet	Earth	42	16	CI sheet	CI sheet	Earth	12	16	CI sheet	CI sheet	Earth	10	18	CI sheet	CI sheet	Earth	18	10	192	a	a	a	a	660	b	0	a
67		2						CI sheet	CI sheet	Earth	7	25	CI sheet	Bamboo	Earth	12	25	CI sheet	Leaves	Earth	9	12	63	b	a	a	a	225	b	0	a
68		3						CI sheet	CI sheet	Earth	10	22	CI sheet	Bamboo	Earth	8	12	CI sheet	Leaves	Earth	8	7	61	b	a	a	a	280	b	0	a
69		4						Leaves	Leaves	Earth	6	8											28	b	b	a	d	0	b	0	b
70		5	CI sheet	CI sheet	Earth	56	22	CI sheet	CI sheet	Earth	12	22	CI sheet	CI sheet	Earth	10	22	CI sheet	CI sheet	Earth	16	10	170	a	a	a	a	580	b	0	a
71		6	CI sheet	CI sheet	Earth	35	32	CI sheet	CI sheet	Earth	8	30	CI sheet	CI sheet	Earth	7	25	CI sheet	Bamboo	Earth	12	7	118	a	a	a	d	0	b	0	a
72		7						CI sheet	Bamboo	Earth	8	14											36	b	b	a	a	220	b	0	a
73		8						Leaves	Bamboo	Earth	8	12						Leaves	Bamboo	Earth	12	12	48	b	a	a	a	240	b	0	a
74		9	CI sheet	CI sheet	Earth	48	18	CI sheet	CI sheet	Earth	10	18	CI sheet	CI sheet	Earth	8	20	CI sheet	CI sheet	Earth	10	8	136	a	a	a	a	426	b	0	a
75		10						CI sheet	Bamboo	Earth	8	16						CI sheet	Bamboo	Earth	15	8	71	b	a	a	a	220	b	0	a
76	A8	1	CI sheet	Wood	Earth	42	30	CI sheet	CI sheet	Earth	10	22	CI sheet	CI sheet	Earth	7	16	CI sheet	CI sheet	Earth	10	16	167	a	a	a	b	670	b	0	a
77		2	CI sheet	CI sheet	Earth	35	22	CI sheet	CI sheet	Earth	8	23	CI sheet	Bamboo	Earth	10	23	CI sheet	CI sheet	Earth	8	23	129	a	a	a	a	425	b	0	a
78		3						CI sheet	Bamboo	Earth	8	18											64	b	b	a	a	220	b	0	a
79		4						Leaves	Bamboo	Earth	9	8						CI sheet	Leaves	Earth	8	10	45	b	a	a	a	140	b	0	b
80		5						CI sheet	Bamboo	Earth	7	4					4	CI sheet	Leaves	Earth	10	4	39	b	a	a	d	0	b	0	b
81		6	CI sheet	Wood	Cement	56	25	CI sheet	CI sheet	Earth	12	25	CI sheet	CI sheet	Earth	8	18	CI sheet	CI sheet	Earth	14	12	198	a	a	a	b	736	b	0	a
82		7						CI sheet	Leaves	Earth	7	27	CI sheet	Bamboo	Earth	12	27	CI sheet	Bamboo	Earth	12	27	87	a	a	a	a	290	b	0	a
83		8	CI sheet	CI sheet	Earth	48	28	CI sheet	CI sheet	Earth	9	18	CI sheet	CI sheet	Earth	6	8	CI sheet	CI sheet	Earth	11	8	150	a	a	a	a	525	b	0	a
84		9						CI sheet	CI sheet	Earth	10	16						CI sheet	Bamboo	Earth	9	8	54	b	a	a	a	220	b	0	a
85		10						CI sheet	CI sheet	Earth	6	8	CI sheet	Bamboo	Earth	8	8						49	b	b	a	a	170	b	0	b

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ		C. Others																	
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
46	A5	1	c	b	a	a,b	10					20	a	b		b	a	Rice	Local source	School Building
47		2	c	b	a	a,b	6				3	8	b	b		b	a	Rice	Local source	School Building
48		3	e	b	a	a,b					6	6	b	b		a	a	Rice	Local source	School Building
49		4	e	b	a	a,b					6	8	b	a	e	b	a	Rice	Local source	School Building
50		5	e	b	a	a	2				5	6	c	a	c,e	b	a	Vegetables	Local source	School Building
51		6	c	b	a	a,b	8				4	22	a	b		b	a	Rice	Local source	School Building
52		7	e	b	a	a,b	4				3	4	b	b		a	a	Rice	Local source	School Building
53		8	e	b	a	a,b	4					10	b	b		a	a	Rice	Local source	School Building
54		9	e	b	a	a,b	3				5	5	b	a	e	a	a	Rice	Local source	School Building
55		10	e	b	a	a,b	2					4	c	a	e	b	a	Rice	Local source	School Building
56	A6	1	e	c	a						6		c	a	d	b	b		Local source	Shelter centre
57		2	c	b	a	a,b	6				2	3	a	b		b	a	Vegetables	Local source	Shelter centre
58		3	c	b	a	a,b	5				5	6	a	b		b	a	Rice	Local source	Shelter centre
59		4	c	b	a	a,b	3				5	6	b	a	e	b	a	Rice	Local source	Shelter centre
60		5	c	b	a	a,b	5						b	a	e	a	a	Rice	Local source	Shelter centre
61		6	c	b	a	a,b	2				6		b	a	e	a	a	Vegetables	Local source	Shelter centre
62		7	c	b	a	a,b	3				6	8	a	b		b	a	Vegetables	Local source	Shelter centre
63		8	c	b	a	a,b	6					8	a	b		b	a	Vegetables	Local source	Shelter centre
64		9	c	b	a	a,b	4				5		b	a	e	a	a	Rice	Local source	Shelter centre
65		10	c	b	a	a,b					7	5	b	a	e	b	a	Vegetables	Local source	Shelter centre
66	A7	1	c	b	a	a,b	3				12	15	a	b		b	a	Rice	Local Source	Shelter centre
67		2	c	b	a	a,b	3				8	6	a	b		a	a	Vegetables	Local Source	Shelter centre
68		3	c	b	a	a,b	3				5	5	c	a	e	a	a	Vegetables	Local Source	Shelter centre
69		4	e	b	a	a					8	6	c	a	e	a	a	Vegetables	Local Source	Shelter centre
70		5	c	b	a	a,b	4				4	2	a	b		b	a	Rice	Local Source	Shelter centre
71		6	e	b	a	a,b	2				5		c	b		b	a	Vegetables	Local Source	Shelter centre
72		7	c	b	a	a,b					2		b	a	e	a	a	Vegetables	Local Source	Shelter centre
73		8	c	b	a	a,b	5				5	8	c	a	e	a	a	Vegetables	Local Source	Shelter centre
74		9	c	b	a	a,b	4				3	5	a	b		b	a	Rice	Local Source	Shelter centre
75		10	c	b	a	a,b	2				6	6	b	b		b	a	Rice	Local Source	Shelter centre
76	A8	1	c	b	a	a,b	2				5	7	a	b		b	a	Rice	Local Source	Shelter centre
77		2	c	b	a	a,b	6				6	8	a	a	c	b	a	Rice	Local Source	Shelter centre
78		3	c	b	a	a,b					6	8	b	a	c	a	a	Vegetables	Local Source	Shelter centre
79		4	c	b	a	a,b	3					5	a	a	e	b	a	Rice	Local Source	Shelter centre
80		5	e	b	a	a,b					8	5	c	a	c,e	b	a	Vegetables	Local Source	Shelter centre
81		6	c	b	a	a,b	5					5	a	b		b	a	Rice	Local Source	Shelter centre
82		7	c	b	a	a,b	4				5	5	a	a	c	a	a	Rice	Local Source	Shelter centre
83		8	c	b	a	a,b	3				15	12	a	b		a	a	Rice	Local Source	Shelter centre
84		9	c	b	a	a,b	3				2	4	b	a	e	a	a	Vegetables	Local Source	Shelter centre
85		10	c	b	a	a,b	3					2	c	a	e	b	a	Rice	Local Source	Shelter centre

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	SSQ		A. Personal and Family Information											B. Related to Homestead											
2			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8. Construction Materials				
3																					B-8.1				
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
86	A9	1	Jahangir Sowdagar	Shababpur, Char Kukrimukri, Bhola	55	b	d	a	a	b	12	4	d	35	35		b	b	44	3	CI sheet	Wood	Earth	98	35
87		2	Ekabbor Munshi	Shababpur, Char Kukrimukri, Bhola	52	b	c	a	a	b	7	2	c	52	52		b	a	18	2	CI sheet	CI sheet	Earth	56	52
88		3	Mostafa Munshi	Shababpur, Char Kukrimukri, Bhola	24	b	d	a	a	b	9	1	b	24	24		a	a	10	2	CI sheet	CI sheet	Earth	56	24
89		4	Mujibor Munshi	Shababpur, Char Kukrimukri, Bhola	49	b	c	a	a	b	9	3	d	49	49		a	a	33	2	CI sheet	CI sheet	Earth	48	49
90		5	Masud Rana	Shababpur, Char Kukrimukri, Bhola	36	b	c	a	a	a	5	1	b	8	8		b	a	18	1	CI sheet	Bamboo	Earth	36	8
91		6	Shohag Mia	Shababpur, Char Kukrimukri, Bhola	42	b	d	d	a	a	4	1	b	8	8		b	a	15	1	CI sheet	Bamboo	Earth	22	8
92		7	Belal	Shababpur, Char Kukrimukri, Bhola	60	b	b	a	a	b	10	3	d	60	60		b	b	33	3	CI sheet	Wood	Cement	87	60
93		8	Nur Nabi	Shababpur, Char Kukrimukri, Bhola	47	b	c	a	a	b	14	2	b	47	47		a	a	12	2	CI sheet	CI sheet	Earth	76	47
94		9	Amir Hossain	Shababpur, Char Kukrimukri, Bhola	27	b	b	a	a	b	10	3	c	27	27		a	a	8	1	CI sheet	CI sheet	Earth	76	27
95		10	Ershad Ali	Shababpur, Char Kukrimukri, Bhola	61	b	a	a	a	b	8	2	d	50	50		b	a	24	2	CI sheet	Bamboo	Earth	35	50
96	A10	1	Mojibor Boyati	Char Kukrimukri - Boyatibari	43	b	b	a	a	b	8	2	c	43	43		b	b	33	3	CI sheet	CI sheet	Earth	92	43
97		2	Abu Taher Boyati	Char Kukrimukri - Boyatibari	28	b	c	a	a	b	4	3	d	28	28		a	a	12	2	CI sheet	CI sheet	Earth	68	28
98		3	Zakir Bishwas	Char Kukrimukri - Boyatibari	62	b	a	a	a	b	10	2	c	62	62		a	b	8	1	CI sheet	CI sheet	Earth	56	62
99		4	Bachchu Bepari	Char Kukrimukri - Boyatibari	52	b	b	a	a	b	8	3	d	52	35		b	a	24	1	CI sheet	Bamboo	Earth	36	35
100		5	Hashem Howlader	Char Kukrimukri - Boyatibari	55	b	b	a	a	b	9	2	c	55	47		b	a	18	1	CI sheet	Bamboo	Earth	36	47
101		6	Kalam Boyati	Char Kukrimukri - Boyatibari	57	b	a	a	a	b	9	3	d	57	57		b	b	44	3	CI sheet	Wood	Earth	98	57
102		7	Rafiqul Islam	Char Kukrimukri - Boyatibari	65	b	a	a	a	b	12	2	b	65	65		a	b	10	1	CI sheet	CI sheet	Earth	56	65
103		8	Imam Bishwas	Char Kukrimukri - Boyatibari	72	b	a	a	a	b	7	1	b	70	50		a	b	33	1	CI sheet	CI sheet	Earth	48	50
104		9	Ulu Shordar	Char Kukrimukri - Boyatibari	40	b	c	a	a	a	4	1	b	40	4		b	a	15	1	CI sheet	Bamboo	Earth	28	4
105		10	Abdul Latif	Char Kukrimukri - Boyatibari	58	b	b	a	a	b	11	4	d	58	34		b	a	18	2	CI sheet	CI sheet	Earth	76	34
106	B1	1	Shahida Begum	Char Folkan, Kamalnagar, Lakhsmipur	58	b	c	a	a	b	7	2	c	58	58		a	a	18	3	CI sheet	CI sheet	Earth	56	58
107		2	Hasna	Char Folkan, Kamalnagar, Lakhsmipur	48	a	a	a	a	b	9	1	b	12	12		b	b	12	2	CI sheet	CI sheet	Earth	48	12
108		3	Mofijul Islam	Char Folkan, Kamalnagar, Lakhsmipur	28	b	b	c	a	b	8	1	c	22	22		b	b	9	2	CI sheet	CI sheet	Earth	36	22
109		4	Jahangir Alam	Char Folkan, Kamalnagar, Lakhsmipur	36	b	c	d	a	a	5	1	c	7	7		b	d	12	2	CI sheet	CI sheet	Earth	36	7
110		5	Monir Hossain	Char Folkan, Kamalnagar, Lakhsmipur	55	b	b	a	a	b	12	4	d	55	55		a	a	33	4	CI sheet	Bricks	Cement	60	55
111		6	Ibrahim Khalil	Char Folkan, Kamalnagar, Lakhsmipur	67	b	a	a	a	b	10	3	d	15	15		b	a	28	3	CI sheet	CI sheet	Earth	56	15
112		7	Md. Hanif	Char Folkan, Kamalnagar, Lakhsmipur	60	b	b	a	a	b	10	3	d	15	15		b	b	14	2	CI sheet	CI sheet	Earth	36	15
113		8	Monir Hossen	Char Folkan, Kamalnagar, Lakhsmipur	36	b	b	a	a	b	9	2	c	25	25		b	b	10	2	CI sheet	CI sheet	Earth	32	25
114		9	Alamgir Kabir	Char Folkan, Kamalnagar, Lakhsmipur	45	b	d	c	a	a	4	1	b	8	8		b	d	8	1	CI sheet	CI sheet	Earth	22	8
115		10	Jesmin Akhter	Char Folkan, Kamalnagar, Lakhsmipur	55	a	b	a	a	b	11	3	a	5	5		b	d	6	1	CI sheet	CI sheet	Earth	22	5
116	B2	1	Ainal Hoq	Char Jogbondhu, Kamalnagar, Lakhsmipur	32	b	d	a	a	b	8	3	d	7	7		b	b	14	2	CI sheet	CI sheet	Earth	48	7
117		2	Masum Shekh	Char Jogbondhu, Kamalnagar, Lakhsmipur	65	b	a	a	a	b	11	2	d	7	7		b	b	10	2	CI sheet	CI sheet	Earth	36	7
118		3	Afzal Hossain	Char Jogbondhu, Kamalnagar, Lakhsmipur	62	b	b	a	a	b	8	2	d	7	7		b	b	12	2	CI sheet	CI sheet	Earth	42	7
119		4	Azizul Hakim	Char Jogbondhu, Kamalnagar, Lakhsmipur	47	b	c	a	a	b	12	3	c	7	7		b	b	12	2	CI sheet	CI sheet	Earth	36	7
120		5	Bir Hamza	Char Jogbondhu, Kamalnagar, Lakhsmipur	28	b	d	d	a	a	3	1	b	7	7		b	b	10	1	CI sheet	CI sheet	Earth	22	7
121		6	Abul Khayer	Char Jogbondhu, Kamalnagar, Lakhsmipur	70	b	a	a	a	b	12	4	e	7	7		b	b	24	4	Concrete	Bricks	Cement	72	2
122		7	Abul Fazal	Char Jogbondhu, Kamalnagar, Lakhsmipur	43	b	b	a	a	b	10	3	e	7	7		b	b	18	3	CI sheet	Bricks	Cement	56	7
123		8	Jainal Abedin	Char Jogbondhu, Kamalnagar, Lakhsmipur	58	b	a	a	a	b	7	4	d	7	7		b	b	12	3	CI sheet	CI sheet	Earth	56	7
124		9	Badrul Alam	Char Jogbondhu, Kamalnagar, Lakhsmipur	55	b	b	a	a	a	5	1	c	7	7		b	b	8	2	CI sheet	CI sheet	Earth	36	7
125		10	Kamrul Hasan	Char Jogbondhu, Kamalnagar, Lakhsmipur	36	b	d	a	a	a	4	1	c	7	7		b	b	8	1	CI sheet	CI sheet	Earth	22	7

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1																															
2	**SSQ**																							**B-9**	**B-10**	**B-11**	**B-12**		**B-13**		**B-14**
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	**Case No.**	**SSQ no.**	**Boithakghar**					**Kitchen**					**Store room**					**Cattle house**					Total Built-form	**Toilet**	**Cattle house**	**Poultry house**	**Pond**	Area for pond	**Community Pond**	Catchment	**Source of Drinking Water**
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
86	**A9**	1	CI sheet	Wood	Earth	48	35	CI sheet	CI sheet	Earth	12	35	CI sheet	CI sheet	Earth	14	28	CI sheet	CI sheet	Earth	14	28	186	a	a	a	b	560	a	30	a
87		2	CI sheet	CI sheet	Earth	35	28	CI sheet	CI sheet	Earth	8	18	CI sheet	CI sheet	Earth	8	18	CI sheet	CI sheet	Earth	14	18	121	a	a	a	a	320	a	30	a
88		3	CI sheet	CI sheet	Earth	36	24	CI sheet	Bamboo	Earth	8	20	CI sheet	Bamboo	Earth	7	20	CI sheet	Leaves	Earth	10	20	117	a	a	a	a	144	a	30	a
89		4						CI sheet	Leaves	Earth	12	18	CI sheet	Bamboo	Earth	6	18	CI sheet	Bamboo	Earth	12	18	78	a	a	a	a	220	a	30	a
90		5						CI sheet	Bamboo	Earth	9	8						CI sheet	Bamboo	Earth	9	6	54	b	a	a	d	0	a	30	b
91		6						CI sheet	Bamboo	Earth	10	8											32	b	b	b	d	0	a	30	b
92		7	CI sheet	CI sheet	Earth	32	40	CI sheet	CI sheet	Earth	10	20	CI sheet	CI sheet	Earth	12	20	CI sheet	CI sheet	Earth	10	20	151	a	a	a	a	360	a	30	a
93		8	CI sheet	CI sheet	Earth	36	32	CI sheet	CI sheet	Earth	8	16	CI sheet	Bamboo	Earth	6	16	CI sheet	Leaves	Earth	12	16	138	a	a	a	a	110	a	30	a
94		9						CI sheet	CI sheet	Earth	7	22						CI sheet	CI sheet	Earth	8	12	91	a	a	a	a	120	a	30	a
95		10						CI sheet	Leaves	Earth	7	28						CI sheet	CI sheet	Earth	11	8	53	b	a	a	a	166	a	30	b
96	**A10**	1	CI sheet	Wood	Earth	36	43	CI sheet	CI sheet	Earth	10	22	CI sheet	CI sheet	Earth	12	18	CI sheet	CI sheet	Earth	12	16	162	a	a	a	a	515	a	12	a
97		2	CI sheet	CI sheet	Earth	28	28	CI sheet	Bamboo	Earth	8	18	CI sheet	CI sheet	Earth	6	8	CI sheet	Leaves	Earth	9	12	119	a	a	a	a	135	a	12	a
98		3						CI sheet	Leaves	Earth	10	8	CI sheet	Bamboo	Earth	7	12						73	b	b	a	a	90	a	12	a
99		4						CI sheet	Bamboo	Earth	9	12						CI sheet	CI sheet	Earth	12	8	57	b	a	a	a	120	a	12	a
100		5						CI sheet	Bamboo	Earth	8	12						Leaves	Bamboo	Earth	10	6	54	b	a	a	d	0	a	12	a
101		6	CI sheet	CI sheet	Earth	48	42	CI sheet	CI sheet	Earth	12	25	CI sheet	CI sheet	Earth	10	20	CI sheet	CI sheet	Earth	15	18	183	a	a	a	a	550	a	12	a
102		7	CI sheet	CI sheet	Earth	36	24	CI sheet	CI sheet	Earth	7	16	CI sheet	Bamboo	Earth	7	8	CI sheet	Leaves	Earth	10	20	116	a	a	a	a	144	a	12	a
103		8						CI sheet	Leaves	Earth	7	8	CI sheet	Bamboo	Earth	4	4	CI sheet	Bamboo	Earth	12	12	71	b	a	a	a	260	a	12	a
104		9						CI sheet	Leaves	Earth	6	4						Leaves	Leaves	Earth	6	6	40	b	a	a	d	0	a	12	b
105		10	CI sheet	CI sheet	Earth	36	34	CI sheet	CI sheet	Earth	9	20	CI sheet	CI sheet	Earth	8	16	CI sheet	CI sheet	Earth	10	20	139	a	a	a	a	280	a	12	a
106	**B1**	1	CI sheet	CI sheet	Earth	24	16	CI sheet	CI sheet	Earth	8	24	CI sheet	CI sheet	Earth	15	10	CI sheet	CI sheet	Earth	10	24	113	a	a	a	a	320	a	120	a
107		2						CI sheet	CI sheet	Earth	9	12	CI sheet	Bamboo	Earth	7	7	CI sheet	Bamboo	Earth	9	12	73	b	a	b	a	186	a	120	a
108		3						CI sheet	Bamboo	Earth	8	10						CI sheet	Bamboo	Earth	10	10	54	b	a	a	a	160	a	120	a
109		4						Leaves	Bamboo	Earth	8	7						Leaves	Bamboo	Earth	12	7	56	b	a	a	a	170	a	120	a
110		5	CI sheet	CI sheet	Earth	36	40	CI sheet	CI sheet	Earth	12	30	CI sheet	CI sheet	Earth	10	15	CI sheet	CI sheet	Earth	12	30	130	a	a	a	b	390	a	120	a
111		6	CI sheet	CI sheet	Earth	28	15	CI sheet	CI sheet	Earth	10	15	CI sheet	CI sheet	Earth	8	12	CI sheet	CI sheet	Earth	10	20	112	a	a	a	a	296	a	120	a
112		7						CI sheet	Leaves	Earth	10	15	CI sheet	Bamboo	Earth	6	8	CI sheet	Bamboo	Earth	12	15	64	b	a	a	a	186	a	120	a
113		8						CI sheet	Bamboo	Earth	10	12						CI sheet	CI sheet	Earth	8	12	50	b	a	a	a	135	a	120	a
114		9						Leaves	Leaves	Earth	7	8						Leaves	Leaves	Earth	10	8	39	b	a	a	d	0	a	120	a
115		10						Leaves		Earth	6	5						Leaves		Earth	8	5	36	c	a	a	d	0	a	120	a
116	**B2**	1	CI sheet	CI sheet	Earth	24	7	CI sheet	CI sheet	Earth	9	7	CI sheet	CI sheet	Earth	7	7	CI sheet	Bamboo	Earth	7	7	95	a	a	a	a	220	a	7	a
117		2						CI sheet	CI sheet	Earth	8	7	CI sheet	CI sheet	Earth	6	7	Leaves	Bamboo	Earth	12	7	62	a	a	a	a	105	a	7	a
118		3						CI sheet	Bamboo	Earth	6	7						CI sheet	Leaves	Earth	8	7	56	a	a	a	a	135	a	7	a
119		4						CI sheet	Bamboo	Earth	8	7						Leaves	Bamboo	Earth	8	7	52	b	a	a	a	120	a	7	a
120		5						Leaves	Leaves	Earth	6	7											28	b	b	a	a	110	a	7	b
121		6	Concrete	Bricks	Cement	32	2	CI sheet	CI sheet	Earth	12	7	CI sheet	CI sheet	Earth	12	7	CI sheet	CI sheet	Earth	13	7	141	a	a	a	a	420	a	7	a
122		7	CI sheet	CI sheet	Earth	28	7	CI sheet	CI sheet	Earth	10	7	CI sheet	CI sheet	Earth	8	7	CI sheet	CI sheet	Earth	12	7	114	a	a	a	a	220	a	7	a
123		8	CI sheet	CI sheet	Earth	24	7	CI sheet	CI sheet	Earth	8	7	CI sheet	CI sheet	Earth	10	7	CI sheet	CI sheet	Earth	10	7	108	a	a	a	a	190	a	7	a
124		9						Leaves	Bamboo	Earth	8	7											44	b	b	a	a	120	a	7	b
125		10						Leaves	Leaves	Earth	7	7											29	b	b	a	a	96	a	7	b

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ													C. Others						
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
86	A9	1	c	b	a	a,b	6				6	5	a	b		b	a	Rice	Local Source	Shelter centre
87		2	c	b	a	a,b	4				4	4	a	b		b	a	Rice	Local Source	Shelter centre
88		3	c	b	a	a,b	4				8	2	b	b		a	a	Vegetables	Local Source	Shelter centre
89		4	c	b	a	a,b	2				6	3	a	a	c,e	b	a	Vegetables	Local Source	Shelter centre
90		5	d	b	a	a	4				8	3	b	a	e	a	a	Rice	Local Source	Shelter centre
91		6	d	b	a	a							c	a	e	a	a	Rice	Local Source	Shelter centre
92		7	c	b	a	a,b	2				2	8	a	b		b	a	Rice	Local Source	Shelter centre
93		8	d	b	a	a,b	5					5	c	a	c	b	a	Rice	Local Source	Shelter centre
94		9	d	b	a	a,b	2				5	5	c	a	c,e	b	a	Rice	Local Source	Shelter centre
95		10	c	b	a	a	6				7	6	b	a	e	a	a	Rice	Local Source	Shelter centre
96	A10	1	d	b	a	a,b	4				4	5	a	b		b	a	Vegetables	Local Source	Shelter centre
97		2	d	b	a	a,b	3					7	b	b		b	a	Rice	Local Source	Shelter centre
98		3	d	b	a	a,b					3	8	b	b		a	a	Vegetables	Local Source	Shelter centre
99		4	d	b	a	a,b	4					5	b	a	e	a	a	Rice	Local Source	Shelter centre
100		5	d	b	a	a,b	5				6	5	c	a	e	a	a	Rice	Local Source	Shelter centre
101		6	d	b	a	a,b	5				8	8	a	b		b	a	Rice	Local Source	Shelter centre
102		7	d	b	a	a,b	3				5	8	b	b		a	a	Rice	Local Source	Shelter centre
103		8	d	b	a	a,b	2				6		a	a	e	a	a	Rice	Local Source	Shelter centre
104		9	d	b	a	a	4				4	2	c	a	c	a	a	Rice	Local Source	Shelter centre
105		10	d	b	a	a,b	3				5	6	a	b		b	a	Rice	Local Source	Shelter centre
106	B1	1	a	b	a	a,b	2				8	12	a	b		a	a	Rice	Local Source	
107		2	a	b	a	a,b	6						a	b		b	a	Rice	Resettled	
108		3	a	b	a	a	4				5		a	a	e	a	a	Vegetables	Local Source	
109		4	b	c	a		2				5		a	a	c	a	b		Resettled	
110		5	a	b	a	a,b	4				5	6	a	b		b	a	Rice	Local Source	
111		6	a	b	a	a,b	2				6		a	b		b	a	Rice	Local Source	
112		7	a	b	a	a,b	4				8		b	a	e	b	a	Rice	Resettled	
113		8	a	b	a	a	3				6		c	a	e	b	a	Vegetables	Local Source	
114		9	b	c	a		2				2		c	a	c	a	b		Resettled	
115		10	b	c	a		1				4		c	b		a	b		Resettled	
116	B2	1	a	b	a	a,b	3				5		a	b		b	a	Rice	Resettled	
117		2	a	b	a	a,b	4				2	6	b	a	e	b	a	Rice	Resettled	
118		3	a	b	a	a,b	3				4		b	a	e	b	a	Rice	Resettled	
119		4	a	b	a	a,b	1				2	10	a	a	e	b	a	Rice	Resettled	
120		5	d	b	a	a					5		c	a	c.e	b	b		Resettled	
121		6	a	b	a	a,b	4				8		a	b		b	a	Rice	Resettled	
122		7	a	b	a	a,b	2				6		a	b		b	a	Rice	Resettled	
123		8	a	b	a	a,b	2				5	8	a	b		b	a	Rice	Resettled	
124		9	a	b	a	a,b					6		c	a	e	b	a	Rice	Resettled	
125		10	a	b	a	a,b					5		a	a	c.e	b	a	Rice	Resettled	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	SSQ		A. Personal and Family Information											B. Related to Homestead							B-8. Construction Materials				
2			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7					
3																					B-8.1				
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
126	B3	1	Md. Shahabuddin	Char Alexander, Ramgati Upazila, Lakhsmipur	65	b	a	a	a	b	12	4	e	30	30		b	b	55	4	CI sheet	Bricks	Cement	68	10
127		2	Nur Nobi Majhi	Char Alexander, Ramgati Upazila, Lakhsmipur	63	b	b	a	a	b	10	3	d	30	30		b	b	44	4	CI sheet	CI sheet	Earth	56	30
128		3	Shamim Hossain	Char Alexander, Ramgati Upazila, Lakhsmipur	50	b	b	a	a	b	9	2	c	30	30		b	b	12	2	CI sheet	CI sheet	Earth	28	30
129		4	Zakir Shikder	Char Alexander, Ramgati Upazila, Lakhsmipur	52	b	c	a	a	b	10	2	c	8	8		b	b	10	2	CI sheet	CI sheet	Earth	36	8
130		5	Moslem Uddin	Char Alexander, Ramgati Upazila, Lakhsmipur	36	b	e	d	a	a	3	1	b	25	8		b	d	9	1	CI sheet	Bamboo	Earth	18	8
131		6	Muhib Shikder	Char Alexander, Ramgati Upazila, Lakhsmipur	42	b	b	c	a	b	5	3	c	26	26		b	b	14	1	CI sheet	CI sheet	Earth	22	26
132		7	Solaiman Mia	Char Alexander, Ramgati Upazila, Lakhsmipur	40	b	e	e	a	a	4	1	b	22	12		b	a	8	1	CI sheet	CI sheet	Earth	22	12
133		8	Md. Rahat	Char Alexander, Ramgati Upazila, Lakhsmipur	48	b	b	a	a	b	7	2	c	25	25		b	b	18	3	CI sheet	CI sheet	Earth	56	25
134		9	Omar Faruk	Char Alexander, Ramgati Upazila, Lakhsmipur	57	b	b	a	a	b	8	4	d	28	28		b	b	12	3	CI sheet	CI sheet	Earth	48	28
135		10	Forhad Hossain	Char Alexander, Ramgati Upazila, Lakhsmipur	55	b	b	a	a	b	11	3	d	15	15		b	b	14	3	CI sheet	CI sheet	Earth	46	15
136	B4	1	Abu Taleb	Char Mehar, Ramgati Upazila, Lakhsmipur	65	b	c	a	a	b	10	3	d	12	12		c	a	45	4	CI sheet	Bricks	Cement	68	12
137		2	Md. Dewar Hossain	Char Mehar, Ramgati Upazila, Lakhsmipur	58	b	d	a	a	b	8	2	d	14	14		a	b	20	3	CI sheet	CI sheet	Earth	56	14
138		3	Nazimuddin	Char Mehar, Ramgati Upazila, Lakhsmipur	48	b	b	a	a	b	7	2	b	8	8		c	b	12	2	CI sheet	CI sheet	Earth	36	8
139		4	Ismail Mia	Char Mehar, Ramgati Upazila, Lakhsmipur	42	b	d	c	a	a	5	1	b	18	18		a	b	24	2	CI sheet	CI sheet	Earth	32	18
140		5	Sumon Howlader	Char Mehar, Ramgati Upazila, Lakhsmipur	32	b	e	d	a	a	3	1	b	11	11		a	b	10	1	CI sheet	CI sheet	Earth	22	11
141		6	Haji Md. Abul Hossain	Char Mehar, Ramgati Upazila, Lakhsmipur	60	b	d	a	a	b	7	2	c	15	15		a	b	33	3	CI sheet	CI sheet	Earth	56	15
142		7	Md. Shah Alam	Char Mehar, Ramgati Upazila, Lakhsmipur	75	b	c	a	a	b	9	2	d	20	20		a	a	66	4	Concrete	Bricks	Cement	72	8
143		8	Haidar Ali	Char Mehar, Ramgati Upazila, Lakhsmipur	53	b	c	a	a	b	9	3	c	10	10		a	b	18	3	CI sheet	CI sheet	Earth	48	10
144		9	Liakat Ali	Char Mehar, Ramgati Upazila, Lakhsmipur	44	b	c	e	a	a	5	1	b	20	20		a	b	33	2	CI sheet	CI sheet	Earth	36	20
145		10	Awlad Hossain	Char Mehar, Ramgati Upazila, Lakhsmipur	36	b	e	d	a	a	4	1	b	15	15		a	b	12	2	CI sheet	CI sheet	Earth	36	15
146	B5	1	Md. Hanif	Char Elahi, Companiganj, Noakhali	45	b	d	a	a	b	12	4	d	15	15		b	b	16	3	CI sheet	CI sheet	Earth	56	15
147		2	Gowhor Shekh	Char Elahi, Companiganj, Noakhali	58	b	c	a	a	b	8	2	b	12	12		b	b	10	3	CI sheet	CI sheet	Earth	42	12
148		3	Suruj Nabi	Char Elahi, Companiganj, Noakhali	27	b	c	e	a	a	5	1	b	14	14		b	b	8	2	CI sheet	CI sheet	Earth	36	14
149		4	Sohel Khan	Char Elahi, Companiganj, Noakhali	36	b	d	d	a	a	3	1	b	14	14		b	d	7	1	CI sheet	Bamboo	Earth	18	14
150		5	Majid Mia	Char Elahi, Companiganj, Noakhali	55	b	b	a	a	b	10	3	d	14	14		b	b	11	3	CI sheet	CI sheet	Earth	48	14
151		6	Kamal Uddin	Char Elahi, Companiganj, Noakhali	60	b	c	a	a	b	8	2	c	13	13		b	b	13	3	CI sheet	CI sheet	Earth	48	13
152		7	Monir Hossain	Char Elahi, Companiganj, Noakhali	42	b	b	a	a	b	9	2	b	15	15		b	b	9	2	CI sheet	CI sheet	Earth	36	15
153		8	Halima Khatun	Char Elahi, Companiganj, Noakhali	45	a	b	e	a	a	5	1	c	15	15		b	b	12	2	CI sheet	CI sheet	Earth	32	15
154		9	Mujibur Rahman	Char Elahi, Companiganj, Noakhali	50	b	a	e	a	a	4	1	c	13	13		b	d	6	2	CI sheet	CI sheet	Earth	28	13
155		10	Taraz Uddin	Char Elahi, Companiganj, Noakhali	27	b	c	e	a	a	3	1	b	12	12		b	d	8	2	CI sheet	Bamboo	Earth	36	12
156	B6	1	Mahbub Islam	Char Elahi, Companiganj, Noakhali	55	b	d	e	a	a	3	1	b	5	5		b	b	8	1	CI sheet	CI sheet	Earth	25	5
157		2	Tanvir Hasan	Char Elahi, Companiganj, Noakhali	36	b	e	d	a	a	4	1	b	4	4		b	b	17	1	CI sheet	CI sheet	Earth	22	4
158		3	Zahir Uddin	Char Elahi, Companiganj, Noakhali	50	b	c	a	a	b	11	3	e	10	10		b	b	44	4	CI sheet	CI sheet	Earth	68	10
159		4	Rajib Hasan	Char Elahi, Companiganj, Noakhali	36	b	c	a	a	a	6	1	c	8	8		b	b	14	3	CI sheet	CI sheet	Earth	48	8
160		5	Tarek Hossain	Char Elahi, Companiganj, Noakhali	42	b	b	e	a	a	5	1	b	6	6		b	b	12	2	CI sheet	CI sheet	Earth	32	6
161		6	Masud Sheikh	Char Elahi, Companiganj, Noakhali	67	b	a	a	a	b	8	3	d	15	15		b	a	36	3	CI sheet	CI sheet	Earth	62	15
162		7	Md. Sirajul Islam	Char Elahi, Companiganj, Noakhali	47	b	b	a	a	b	7	2	c	15	15		b	a	33	3	CI sheet	CI sheet	Earth	56	15
163		8	Shaheb Uddin	Char Elahi, Companiganj, Noakhali	58	b	b	a	a	b	8	2	d	15	15		b	a	18	3	CI sheet	CI sheet	Earth	56	15
164		9	Mahmud Ullah	Char Elahi, Companiganj, Noakhali	65	b	b	a	a	a	5	1	b	10	10		b	b	10	2	CI sheet	CI sheet	Earth	36	10
165		10	Zafar Ali	Char Elahi, Companiganj, Noakhali	57	b	c	e	a	a	4	1	b	8	8		b	b	16	2	CI sheet	CI sheet	Earth	36	8

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1																															
2	SSQ																							B-9	B-10	B-11	B-12		B-13		B-14
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	Case No.	SSQ no.	Boithakghar					Kitchen					Store room					Cattle house					Total Built-form	Toilet	Cattle house	Poultry house	Pond	Area for pond	Community Pond	Catchment	Source of Drinking Water
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
126	B3	1	CI sheet	CI sheet	Earth	30	10	CI sheet	CI sheet	Earth	10	10	CI sheet	CI sheet	Earth	8	10	CI sheet	CI sheet	Earth	14	10	130	a	a	a	b	420	a	50	a
127		2	CI sheet	CI sheet	Earth	28	30	CI sheet	CI sheet	Earth	12	25	CI sheet	CI sheet	Earth	7	25	CI sheet	CI sheet	Earth	12	25	115	a	a	a	a	345	a	50	a
128		3						CI sheet	CI sheet	Earth	6	14	CI sheet	Bamboo	Earth	8	14	CI sheet	Leaves	Earth	8	14	50	b	a	a	a	120	a	50	a
129		4						CI sheet	Bamboo	Earth	10	8	Leaves	Bamboo	Earth	6	8	CI sheet	Bamboo	Earth	8	8	60	b	a	a	a	180	a	50	a
130		5						Leaves	Leaves	Earth	5	8						Leaves	Bamboo	Earth	9	4	32	b	a	a	d	0	a	50	b
131		6						CI sheet	Bamboo	Earth	8	15						Leaves	Bamboo	Earth	9	15	39	b	a	a	a	96	a	50	b
132		7						Leaves	Leaves	Earth	7	12											29	b	b	a	d	0	a	50	b
133		8	CI sheet	CI sheet	Earth	22	25	CI sheet	CI sheet	Earth	9	22	CI sheet	CI sheet	Earth	10	22	CI sheet	CI sheet	Earth	9	22	106	a	a	a	a	336	a	50	a
134		9	CI sheet	CI sheet	Earth	25	28	CI sheet	CI sheet	Earth	9	10	CI sheet	CI sheet	Earth	9	10	CI sheet	CI sheet	Earth	11	10	102	a	a	a	a	120	a	50	a
135		10						CI sheet	CI sheet	Earth	8	15	CI sheet	CI sheet	Earth	6	15	Leaves	Bamboo	Earth	10	15	70	b	a	a	a	96	a	50	a
136	B4	1	CI sheet	CI sheet	Earth	36	12	CI sheet	CI sheet	Earth	10	12	CI sheet	CI sheet	Earth	8	12	CI sheet	CI sheet	Earth	10	12	132	a	a	a	b	420	b	0	a
137		2	CI sheet	CI sheet	Earth	26	14	CI sheet	CI sheet	Earth	9	12	CI sheet	CI sheet	Earth	10	12	CI sheet	CI sheet	Earth	9	12	110	a	a	a	a	320	b	0	a
138		3						CI sheet	Bamboo	Earth	6	8	CI sheet	Bamboo	Earth	6	8						48	a	b	a	a	120	b	0	a
139		4						CI sheet	Bamboo	Earth	9	18						Leaves	Bamboo	Earth	8	18	49	a	a	a	a	140	b	0	b
140		5						Leaves	Leaves	Earth	6	11						Leaves		Earth	6	11	34	b	a	a	d	0	b	0	b
141		6	CI sheet	CI sheet	Earth	28	15	CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	8	12	CI sheet	CI sheet	Earth	10	12	114	a	a	a	a	355	b	0	a
142		7	CI sheet	CI sheet	Earth	36	20	CI sheet	CI sheet	Earth	12	10	CI sheet	CI sheet	Earth	11	10	CI sheet	CI sheet	Earth	12	12	143	a	a	a	b	460	b	0	a
143		8	CI sheet	CI sheet	Earth	28	10	CI sheet	CI sheet	Earth	10	8	CI sheet	Bamboo	Earth	7	8	CI sheet	Bamboo	Earth	10	8	103	a	a	a	a	275	b	0	a
144		9						CI sheet	Bamboo	Earth	8	20											44	a	b	a	a	360	b	0	b
145		10						Leaves	Leaves	Earth	7	15						Leaves	Leaves	Earth	10	15	53	b	a	a	d	0	b	0	b
146	B5	1	CI sheet	CI sheet	Earth	22	15	CI sheet	CI sheet	Earth	10	15	CI sheet	CI sheet	Earth	8	15	CI sheet	CI sheet	Earth	10	15	106	a	a	a	b	220	b	0	b
147		2	CI sheet	CI sheet	Earth	18	12	CI sheet	CI sheet	Earth	8	12	Leaves	Bamboo	Earth	7	12	CI sheet	Leaves	Earth	9	12	84	b	a	a	a	96	b	0	b
148		3						CI sheet	Bamboo	Earth	8	14											44	b	b	a	a	84	b	0	b
149		4						Leaves	Leaves	Earth	6	12											24	c	b	b	d	0	b	0	b
150		5	CI sheet	CI sheet	Earth	24	14	CI sheet	CI sheet	Earth	8	14	CI sheet	CI sheet	Earth	7	14	CI sheet	CI sheet	Earth	8	14	95	b	a	a	a	110	b	0	b
151		6	CI sheet	CI sheet	Earth	28	13	CI sheet	CI sheet	Earth	9	13	CI sheet	Bamboo	Earth	9	13	CI sheet	CI sheet	Earth	6	13	100	b	a	a	a	124	b	0	b
152		7						CI sheet	Bamboo	Earth	6	15						CI sheet	Leaves	Earth	10	12	52	b	a	a	a	96	b	0	b
153		8						CI sheet	Bamboo	Earth	8	15						CI sheet	Leaves	Earth	8	15	48	b	a	a	a	110	b	0	b
154		9						Leaves	Bamboo	Earth	7	13											35	b	b	a	a	86	b	0	b
155		10						Leaves	Leaves	Earth	6	12											42	c	b	b	d	0	b	0	b
156	B6	1						Leaves	Leaves	Earth	7	5						CI sheet	CI sheet	Earth	7	5	39	b	a	a	a	160	b	8	b
157		2						Leaves	Leaves	Earth	6	4						CI sheet		Earth	8	4	36	b	a	a	d	0	b	9	b
158		3	CI sheet	CI sheet	Earth	32	10	CI sheet	CI sheet	Earth	10	10	CI sheet	CI sheet	Earth	12	10	CI sheet	CI sheet	Earth	12	10	134	a	a	a	b	660	b	0	a
159		4	CI sheet	CI sheet	Earth	18	8	CI sheet	Bamboo	Earth	8	8	Leaves	Bamboo	Earth	10	8	CI sheet	CI sheet	Earth	10	8	94	b	a	a	a	196	b	4	b
160		5						Leaves	Bamboo	Earth	8	6						Leaves	Bamboo	Earth	11	6	51	b	a	a	a	160	b	7	b
161		6	CI sheet	CI sheet	Earth	28	12	CI sheet	CI sheet	Earth	9	15	CI sheet	CI sheet	Earth	6	15	CI sheet	CI sheet	Earth	9	12	114	a	a	a	a	360	b	1	a
162		7	CI sheet	CI sheet	Earth	24	15	CI sheet	CI sheet	Earth	8	15	CI sheet	Bamboo	Earth	8	15	CI sheet	CI sheet	Earth	10	10	106	a	a	a	a	440	b	2	b
163		8	CI sheet	CI sheet	Earth	24	8	CI sheet	CI sheet	Earth	9	15	Leaves	Bamboo	Earth	6	15	CI sheet	CI sheet	Earth	8	8	103	b	a	a	a	286	b	3	b
164		9						CI sheet	CI sheet	Earth	10	10						CI sheet	Leaves	Earth	8	10	54	b	a	a	a	160	b	5	b
165		10						CI sheet	Bamboo	Earth	8	8						CI sheet	Bamboo	Earth	12	8	56	b	a	a	a	172	b	6	b

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ		C. Others																	
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
126	B3	1	a	a	b	a,b,c	6				12		a	b		b	a	Rice	Local Source	School Building
127		2	c	a	b	a,b	4				4		a	b		b	a	Rice	Local Source	School Building
128		3	c	b	a	a,b	2				2	6	c	b		b	a	Rice	Local Source	School Building
129		4	c	b	a	a,b	1				4	3	b	a	e	b	a	Vegetables	Local Source	School Building
130		5	d	b	a	a	1				5	7	c	a	c.e	a	b		Local Source	School Building
131		6	d	b	a	a,b	4				2		c	a	e	a	b		Local Source	School Building
132		7	d	b	a	a					7		c	a	e	a	b		Local Source	School Building
133		8	c	a	a	a,b	3				3	8	a	b		b	a	Rice	Local Source	School Building
134		9	c	a	a	a,b	4				8		a	b		b	a	Rice	Local Source	School Building
135		10	c	b	a	a,b	2				5		b	b		a	a	Rice	Local Source	School Building
136	B4	1	c	a	b	a,b,c	2				2	10	a	b		b	a	Rice	Local Source	Shelter centre
137		2	c	a	a	a,b	6				8		a	b		b	a	Rice	Local Source	Shelter centre
138		3	c	a	a	a,b					5		c	b		b	a	Rice	Resettled	Shelter centre
139		4	c	b	a	a,b	2				2		c	a	e	a	b		Resettled	Shelter centre
140		5	d	b	a	a	1				5		c	a	c	a	b		Resettled	Shelter centre
141		6	c	a	b	a,b	2				4		a	b		b	a	Rice	Local Source	Shelter centre
142		7	c	a	b	a,b,c	4				5		a	b		b	a	Rice	Local Source, Resettled	Shelter centre
143		8	c	a	a	a,b	4				6		b	b		a	a	Rice	Resettled	Shelter centre
144		9	c	b	a	a,b					5	6	b	a	e	b	b		Resettled	Shelter centre
145		10	d	b	a	a	2					18	c	a	c.e	a	b		Resettled	Shelter centre
146	B5	1	c	b	a	a,b	3				5		a	b		b	a	Rice	Resettled	Shelter centre
147		2	c	b	a	a	3				4	7	a	a	e	b	a	Rice	Resettled	Shelter centre
148		3	c	c	a						10	6	b	b		a	b		Resettled	Shelter centre
149		4	d	c	a						8		c	b		b	b		Resettled	Shelter centre
150		5	c	b	a	a,b	2				5		c	b		b	a	Rice	Resettled	Shelter centre
151		6	c	b	a	a	2				2		a	b		b	a	Rice	Resettled	Shelter centre
152		7	c	b	a	a	2				2		b	a	e	b	b		Resettled	Shelter centre
153		8	c	c	a		1				6		b	a	c	a	b		Resettled	Shelter centre
154		9	c	c	a							10	b	b		a	b		Resettled	Shelter centre
155		10	d	c	a								c	b		a	b		Resettled	Shelter centre
156	B6	1	d	c	a		3				5		b	b		b	b		Resettled	Shelter centre
157		2	d	c	a		2				5		c	b		b	b		Resettled	Shelter centre
158		3	c	b	a	a,b	5				4		a	b		b	a	Rice	Resettled	Shelter centre
159		4	c	c	a		2				5	8	b	b		a	a	Rice	Resettled	Shelter centre
160		5	c	c	a		1				5	6	b	b		b	b		Resettled	Shelter centre
161		6	c	b	a	a,b	2				8		a	a	e	b	a	Rice	Resettled	Shelter centre
162		7	c	b	a	a	1				6		a	a	e	b	a	Rice	Resettled	Shelter centre
163		8	c	b	a	a	3				5		a	a	c,e	a	a	Rice	Resettled	Shelter centre
164		9	c	c	a		2				2		b	b		b	a	Rice	Resettled	Shelter centre
165		10	c	c	a		3					12	b	b		b	b		Resettled	Shelter centre

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	SSQ		A. Personal and Family Information											B. Related to Homestead							B-8. Construction Materials				
2			A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7					
3																							B-8.1		
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
166	C1	1	Hafez Munshi	Dakkhin Moghadia, Mirsharai, Chattogram	68	b	a	a	a	b	12	4	d	60	12		b	a	44	4	CI sheet	CI sheet	Earth	72	12
167		2	Hasmot Ali	Dakkhin Moghadia, Mirsharai, Chattogram	28	b	d	a	a	b	9	2	d	28	14		a	a	12	3	CI sheet	CI sheet	Earth	58	14
168		3	Shamsuddin	Dakkhin Moghadia, Mirsharai, Chattogram	65	b	b	a	a	b	10	3	d	50	8		b	a	10	3	CI sheet	CI sheet	Earth	48	8
169		4	Gafur Ali	Dakkhin Moghadia, Mirsharai, Chattogram	52	b	b	d	a	a	5	1	c	45	6		b	b	24	2	CI sheet	CI sheet	Earth	32	6
170		5	Shopon Mia	Dakkhin Moghadia, Mirsharai, Chattogram	55	b	d	d	a	a	4	1	b	36	4		b	b	18	2	CI sheet	CI sheet	Earth	32	4
171		6	Mobarak Hossain	Dakkhin Moghadia, Mirsharai, Chattogram	40	b	e	d	a	a	4	1	b	40	4		b	b	15	1	CI sheet	Bamboo	Earth	22	4
172		7	Anwar Hossain	Dakkhin Moghadia, Mirsharai, Chattogram	45	b	b	a	a	b	10	3	d	45	12		b	a	33	4	CI sheet	CI sheet	Earth	68	12
173		8	Ali Bepari	Dakkhin Moghadia, Mirsharai, Chattogram	58	b	b	a	a	b	7	2	c	40	10		b	a	18	3	CI sheet	CI sheet	Earth	58	10
174		9	Fahim Sheikh	Dakkhin Moghadia, Mirsharai, Chattogram	62	b	b	a	a	b	9	2	c	50	10		b	a	16	2	CI sheet	CI sheet	Earth	36	10
175		10	Azmot Bepari	Dakkhin Moghadia, Mirsharai, Chattogram	70	b	c	c	a	b	8	1	c	40	8		b	a	33	2	CI sheet	CI sheet	Earth	36	8
176	C2	1	Neyamat Ali	Saidpur, Sitakunda, Chattogram	68	b	b	a	a	b	10	3	e	50	30		b	a	45	4	CI sheet	Bricks	Cement	56	30
177		2	Shafayet Mollah	Saidpur, Sitakunda, Chattogram	33	b	c	a	a	b	10	2	c	33	25		c	a	33	3	CI sheet	CI sheet	Earth	36	25
178		3	Hedayet Khan	Saidpur, Sitakunda, Chattogram	58	b	b	c	a	b	5	3	c	26	26		a	d	24	2	CI sheet	CI sheet	Earth	48	26
179		4	Rahmatullah	Saidpur, Sitakunda, Chattogram	36	b	e	e	a	a	4	1	b	36	45		a	d	26	2	CI sheet	CI sheet	Earth	42	45
180		5	Khalek Bepari	Saidpur, Sitakunda, Chattogram	65	b	e	d	a	a	3	1	b	50	35		b	d	28	2	CI sheet	CI sheet	Earth	48	35
181		6	Enayet Ali	Saidpur, Sitakunda, Chattogram	45	b	b	a	a	b	7	2	c	45	25		c	a	33	4	CI sheet	CI sheet	Earth	56	25
182		7	Mir Kashem	Saidpur, Sitakunda, Chattogram	58	b	b	a	a	b	8	4	d	35	28		b	a	20	3	CI sheet	CI sheet	Earth	48	28
183		8	Noor Ali	Saidpur, Sitakunda, Chattogram	63	b	b	a	a	b	11	3	d	50	50		b	b	18	3	CI sheet	CI sheet	Earth	46	50
184		9	Faruk Mollah	Saidpur, Sitakunda, Chattogram	44	b	b	a	a	b	9	2	c	32	30		a	a	22	3	CI sheet	CI sheet	Earth	54	30
185		10	Omar Ali	Saidpur, Sitakunda, Chattogram	58	b	a	a	a	b	12	4	e	40	30		b	a	56	4	CI sheet	Bricks	Cement	68	30
186	C3	1	Shaher Ali	Muradpur, Sitakunda, Chattogram	68	a	c	a	a	b	12	4	e	55	55		b	b	66	4	Concrete	Bricks	Cement	98	55
187		2	Amir Ali	Muradpur, Sitakunda, Chattogram	48	a	c	a	a	b	11	3	d	48	48		a	a	45	3	CI sheet	CI sheet	Cement	46	48
188		3	Torab Munshi	Muradpur, Sitakunda, Chattogram	60	a	b	a	a	b	9	2	c	50	50		a	a	33	3	CI sheet	CI sheet	Earth	54	50
189		4	Minhaj Khondker	Muradpur, Sitakunda, Chattogram	36	a	c	c	a	b	10	2	c	36	36		a	a	55	2	CI sheet	CI sheet	Earth	36	36
190		5	Suruj Khondker	Muradpur, Sitakunda, Chattogram	28	a	e	d	a	b	5	3	e	50	50		a	a	42	2	CI sheet	CI sheet	Earth	48	50
191		6	Babor Ali	Muradpur, Sitakunda, Chattogram	36	a	e	e	a	a	4	1	b	36	36		a	a	36	2	CI sheet	CI sheet	Earth	42	36
192		7	Jahan Munshi	Muradpur, Sitakunda, Chattogram	55	a	d	e	a	a	3	1	b	50	50		b	a	33	2	CI sheet	CI sheet	Earth	48	50
193		8	Matlub Ali	Muradpur, Sitakunda, Chattogram	55	a	c	a	a	b	10	3	e	55	55		b	a	45	4	CI sheet	Bricks	Cement	88	55
194		9	Ekram Hossain	Muradpur, Sitakunda, Chattogram	67	a	d	a	a	b	7	2	c	40	40		b	a	33	3	CI sheet	Bricks	Cement	76	40
195		10	Bulbul Ahmed	Muradpur, Sitakunda, Chattogram	58	a	d	a	a	b	8	4	d	28	28		a	a	56	3	CI sheet	CI sheet	Cement	65	28
196	C4	1	Hasan Sheikh	Nadalia, Bashbaria, Sitakunda, Chattogram	67	a	a	a	a	b	8	3	e	67	67		a	a	57	3	CI sheet	Bricks	Cement	56	67
197		2	Hali Mohajon	Nadalia, Bashbaria, Sitakunda, Chattogram	47	a	b	a	a	b	7	2	c	47	47		a	a	33	4	CI sheet	CI sheet	Earth	76	47
198		3	Haji Shafiuddin	Nadalia, Bashbaria, Sitakunda, Chattogram	65	a	b	a	a	b	10	3	e	65	65		a	a	47	3	CI sheet	CI sheet	Earth	65	65
199		4	Mokbul Hossain	Nadalia, Bashbaria, Sitakunda, Chattogram	57	a	c	e	a	b	9	2	e	57	57		a	a	38	2	CI sheet	CI sheet	Earth	36	57
200		5	Abdul Ali	Nadalia, Bashbaria, Sitakunda, Chattogram	36	a	e	d	a	a	4	1	b	36	6		b	a	36	2	CI sheet	CI sheet	Earth	28	6
201		6	Akhter Imam	Nadalia, Bashbaria, Sitakunda, Chattogram	50	a	c	a	a	b	11	3	e	50	50		a	a	70	3	Concrete	Bricks	Cement	68	50
202		7	Keramot Mowla	Nadalia, Bashbaria, Sitakunda, Chattogram	58	a	b	a	a	b	8	2	d	58	58		a	a	33	3	CI sheet	CI sheet	Earth	88	58
203		8	Alamgir Hossain	Nadalia, Bashbaria, Sitakunda, Chattogram	58	a	c	a	a	b	6	2	c	58	58		a	a	56	3	CI sheet	CI sheet	Earth	76	58
204		9	Rahmot Ali	Nadalia, Bashbaria, Sitakunda, Chattogram	42	a	b	e	a	b	8	3	b	42	42		a	a	55	2	CI sheet	CI sheet	Earth	48	42
205		10	Newaj Sharif	Nadalia, Bashbaria, Sitakunda, Chattogram	42	a	d	e	a	a	5	1	b	42	12		b	a	42	2	CI sheet	CI sheet	Earth	42	12

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1																															
2	SSQ																							B-9	B-10	B-11	B-12		B-13		B-14
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	Case No.	SSQ no.	Boithakghar					Kitchen					Store room					Cattle house					Total Built-form	Toilet	Cattle house	Poultry house	Pond	Area for pond	Community Pond	Catchment	Source of Drinking Water
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
166	C1	1	CI sheet	CI sheet	Earth	36	12	CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	12	12	CI sheet	CI sheet	Earth	10	12	142	a	a	a	b	525	a	110	a
167		2						CI sheet	CI sheet	Earth	9	14	CI sheet	Bamboo	Earth	8	14	CI sheet	Leaves	Earth	9	14	84	b	a	a	a	166	a	110	a
168		3						CI sheet	Leaves	Earth	8	8						CI sheet	Leaves	Earth	8	8	64	b	a	a	a	136	a	110	a
169		4						Leaves	Bamboo	Earth	8	6						CI sheet	CI sheet	Earth	9	6	49	b	a	a	a	120	a	110	b
170		5						Leaves	Leaves	Earth	7	4						Leaves	Bamboo	Earth	7	4	46	b	a	a	a	212	a	110	b
171		6						Leaves	Bamboo	Earth	6	4						Leaves	Bamboo	Earth	8	4	36	b	a	a	d	0	a	110	b
172		7	CI sheet	CI sheet	Earth	28	12	CI sheet	CI sheet	Earth	10	12	CI sheet	CI sheet	Earth	9	12	CI sheet	CI sheet	Earth	8	12	123	a	a	a	b	360	a	110	a
173		8	CI sheet	CI sheet	Earth	32	10	CI sheet	CI sheet	Earth	8	10	CI sheet	CI sheet	Earth	8	10	CI sheet	CI sheet	Earth	6	10	112	b	a	a	b	255	a	110	a
174		9						CI sheet	Bamboo	Earth	6	10						CI sheet	CI sheet	Earth	9	10	51	b	a	a	a	140	a	110	b
175		10						CI sheet	Bamboo	Earth	8	8						CI sheet	Bamboo	Earth	11	8	55	b	a	a	a	366	a	110	b
176	C2	1	CI sheet	CI sheet	Earth	28	30	CI sheet	CI sheet	Earth	12	15	CI sheet	CI sheet	Earth	8	25	CI sheet	CI sheet	Earth	10	25	114	a	a	a	b	660	a	42	a
177		2						CI sheet	Bamboo	Earth	10	25	CI sheet	CI sheet	Earth	10	8	CI sheet	CI sheet	Earth	10	8	66	a	a	a	a	200	a	42	a
178		3						Leaves	Bamboo	Earth	8	26	CI sheet	Bamboo	Earth	8	15	CI sheet	CI sheet	Earth	10	15	74	a	a	a	a	240	a	42	a
179		4						Leaves	Leaves	Earth	10	18						CI sheet	CI sheet	Earth	9	18	61	b	a	a	a	210	a	42	a
180		5						Leaves	Leaves	Earth	8	22						CI sheet	Bamboo	Earth	10	22	66	b	a	a	a	236	a	42	a
181		6	CI sheet	CI sheet	Earth	24	25	CI sheet	CI sheet	Earth	10	25	CI sheet	CI sheet	Earth	8	22	CI sheet	CI sheet	Earth	10	22	108	a	a	a	b	420	a	42	a
182		7	CI sheet	CI sheet	Earth	32	28	CI sheet	CI sheet	Earth	9	22	CI sheet	CI sheet	Earth	10	10	CI sheet	CI sheet	Earth	9	10	108	a	a	a	b	310	a	42	a
183		8						CI sheet	CI sheet	Earth	8	32	CI sheet	Bamboo	Earth	7	15	CI sheet	Bamboo	Earth	10	15	71	a	a	a	a	185	a	42	a
184		9						CI sheet	Bamboo	Earth	9	30	CI sheet	Bamboo	Earth	6	14	CI sheet	Bamboo	Earth	12	14	81	a	a	a	a	236	a	42	a
185		10	CI sheet	CI sheet	Earth	36	30	CI sheet	CI sheet	Earth	10	16	CI sheet	CI sheet	Earth	11	10	CI sheet	CI sheet	Earth	14	10	139	a	a	a	b	1090	a	42	a
186	C3	1	CI sheet	Bricks	Cement	36	55	CI sheet	CI sheet	Earth	14	20						CI sheet	CI sheet	Earth	16	20	164	a	a	a	b	1190	a	20	a
187		2						CI sheet	CI sheet	Earth	10	20					20	CI sheet	CI sheet	Earth	10	20	66	a	a	a	a	680	a	20	a
188		3						CI sheet	CI sheet	Earth	12	25					25	CI sheet	Bamboo	Earth	14	25	80	a	a	a	a	540	a	20	a
189		4						CI sheet	CI sheet	Earth	10	30	CI sheet	CI sheet	Earth	10	30	CI sheet	CI sheet	Earth	11	20	67	a	a	a	a	990	a	20	a
190		5						CI sheet	CI sheet	Earth	12	35	CI sheet	Bamboo	Earth	8	35	CI sheet	CI sheet	Earth	10	25	78	a	a	a	a	460	a	20	a
191		6						CI sheet	Bamboo	Earth	9	12						CI sheet	CI sheet	Earth	12	12	63	a	a	a	a	380	a	20	a
192		7						CI sheet	Bamboo	Earth	10	15						CI sheet	Bamboo	Earth	12	15	70	b	a	a	d	0	a	20	a
193		8	CI sheet	Bricks	Cement	32	55	CI sheet	CI sheet	Earth	12	25						CI sheet	CI sheet	Earth	14	25	146	a	a	a	b	870	a	20	a
194		9	CI sheet	CI sheet	Earth	28	40	CI sheet	CI sheet	Earth	10	28	CI sheet	CI sheet	Earth	8	20	CI sheet	CI sheet	Earth	18	28	140	a	a	a	b	630	a	20	a
195		10						CI sheet	CI sheet	Earth	11	22	CI sheet	CI sheet	Earth	10	20	CI sheet	CI sheet	Earth	12	22	98	a	a	a	b	990	a	20	a
196	C4	1	CI sheet	CI sheet	Earth	28	67	CI sheet	CI sheet	Earth	14	20						CI sheet	CI sheet	Earth	10	20	108	a	a	a	a	650	b	0	a
197		2	CI sheet	CI sheet	Earth	24	47	CI sheet	CI sheet	Earth	12	25	CI sheet	CI sheet	Earth	8	12	CI sheet	CI sheet	Earth	10	25	130	a	a	a	a	430	b	0	a
198		3						CI sheet	CI sheet	Earth	12	16						CI sheet	Bamboo	Earth	10	16	87	a	a	a	a	345	b	0	a
199		4						CI sheet	Bamboo	Earth	10	17						CI sheet	CI sheet	Earth	14	17	60	a	a	a	a	380	b	0	a
200		5						CI sheet	Leaves	Earth	8	6						CI sheet	Bamboo	Earth	12	6	48	b	a	a	d	0	b	0	a
201		6						CI sheet	CI sheet	Earth	10	25						CI sheet	CI sheet	Earth	14	25	92	a	a	a	b	1080	b	0	a
202		7						CI sheet	CI sheet	Earth	10	12	CI sheet	CI sheet	Earth	10	12	CI sheet	CI sheet	Earth	18	12	126	a	a	a	a	450	b	0	a
203		8						CI sheet	CI sheet	Earth	11	14	CI sheet	CI sheet	Earth	8	14	CI sheet	CI sheet	Earth	12	14	107	a	a	a	a	420	b	0	a
204		9						CI sheet	Bamboo	Earth	14	15						CI sheet	CI sheet	Earth	10	15	72	a	a	a	a	575	b	0	a
205		10						CI sheet	Leaves	Earth	10	12						CI sheet	CI sheet	Earth	8	12	60	b	a	a	a	355	b	0	a

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ		C. Others																	
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
166	C1	1	a	a	a	a,b,c	6				11		a	b		b	a	Rice	Local Source	School Building
167		2	c	a	a	a,b	4				8		a	b		a	a	Rice	Local Source	School Building
168		3	c	a	a	a,b	2				5	4	b	b		a	a	Rice	Local Source	School Building
169		4	c	a	a	a,b	4				2		a	a	c	a	a	Rice	Local Source	School Building
170		5	c	a	a	a,b	2				7		c	a	c	b	a	Rice	Local Source	School Building
171		6	d	a	a	a,b	2				5		c	a	c	b	a	Rice	Local Source	School Building
172		7	b	a	a	a,b,c	4				8		a	b		b	a	Rice	Local Source	School Building
173		8	b	a	a	a,b,c	3				3	8	a	b		b	a	Rice	Local Source	School Building
174		9	d	a	a	a,b	2				2	6	b	b		a	a	Rice	Local Source	School Building
175		10	d	a	a	a,b	1				4	12	a	b		a	a	Rice	Local Source	School Building
176	C2	1	c	a	b	a,b,c	4				10	6	a	b		b	a	Rice	Local Source	School Building
177		2	c	a	a	a,b	2				8		b	b		a	a	Rice	Local Source	School Building
178		3	d	a	a	a,b	6				6	9	b	b		a	a	Rice	Local Source	School Building
179		4	d	a	a	a,b	4				5		a	a	c	a	a	Rice	Local Source	School Building
180		5	d	a	a	a,b	3				5		a	a	c	a	a	Rice	Local Source	School Building
181		6	c	a	a	a,b	2				8	10	a	b		b	a	Rice	Local Source	School Building
182		7	c	a	a	a,b	3				10		a	b		b	a	Rice	Local Source	School Building
183		8	c	a	a	a,b	6				8		a	b		b	a	Rice	Local Source	School Building
184		9	c	a	a	a,b	3				4	12	a	b		b	a	Rice	Local Source	School Building
185		10	c	a	b	a,b,c	5				6		a	b		b	a	Rice	Local Source	School Building
186	C3	1	c	a	a	a,b,c	4				5	6	a	b		b	a	Rice	Local Source	School Building
187		2	c	a	a	a,b,c	4				8		b	b		b	a	Rice	Local Source	School Building
188		3	c	a	a	a,b	2				3	8	b	b		b	a	Rice	Local Source	School Building
189		4	c	a	a	a,b	3				8		a	b		a	a	Rice	Local Source	School Building
190		5	d	a	a	a,b	6				5	4	b	b		a	a	Rice	Local Source	School Building
191		6	d	a	a	a,b	3				2	6	c	b		a	a	Rice	Local Source	School Building
192		7	d	a	a	a,b	2				4	12	c	b		a	a	Rice	Local Source	School Building
193		8	c	a	a	a,b,c	2				5		a	b		b	a	Rice	Local Source	School Building
194		9	c	a	a	a,b,c	2				5		a	b		b	a	Rice	Local Source	School Building
195		10	c	a	a	a,b,c	5				11		a	b		b	a	Rice	Local Source	School Building
196	C4	1	a	a	a	a,b,c	3						a	b		b	a	Rice	Local Source	School Building
197		2	a	a	a	a,b,c	1				6	6	a	b		b	a	Rice	Local Source	School Building
198		3	c	a	a	a,b,c	6				10		a	b		b	a	Rice	Local Source	School Building
199		4	c	a	a	a,b,c	4				8		a	b		b	a	Rice	Local Source	School Building
200		5	a	a	a	a,b	1				6	12	c	a	c	a	b		Local Source	School Building
201		6	a	a	a	a,b,c	2				12		a	b		b	a	Rice	Local Source	School Building
202		7	c	a	a	a,b,c	3				8		a	b		b	a	Rice	Local Source	School Building
203		8	c	a	a	a,b,c	2				7		b	b		b	a	Rice	Local Source	School Building
204		9	a	a	a	a,b	3				12	8	a	b		a	a	Rice	Local Source	School Building
205		10	a	a	a	a,b	4				14		c	b		b	b		Local Source	School Building

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1			A. Personal and Family Information											B. Related to Homestead											
2	SSQ		A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8. Construction Materials				
3																					B-8.1				
4	Case No.	SSQ no.	Name	Address	Age	Gender	Education	Occupation	Religion	Family type	Family members	Income Gen. Person	Monthly Fam. Income	Duration of stay in this village	Duration of stay in this House	Age of house	House Ownership Source	Land Ownership Source	Total Homestad area	Number of houses	Living place				
5					Years	a= Female b= Male	a= No b= Primary c= HS d= Secondery e= Tertiary	a= Agriculture b= Fishing c= Service d= Business e= Others	a= Islam b= Hindu c= Christian d= Buddhist e= Others	a= Single b= Joint	Nos.	Nos.	a= <5000 b= 5000-10000 c= 10000-15000 d= 15000-20000 e= >20000	Years	Years	(If different from the time of residence) Years	a= Ancestral b= Self built c= Purchased d= Sheltered e= Rental	a= Ancestral b= Purchased c= Sheltered d= Rental	Decimal	Nos.	Roof	Surface	Floor	Area (SQM)	Age (years)
206	C5	1	Nayeb Ali Chowdhury	Boalia, Bashbaria, Sitakunda, Chattogram	67	b	b	e	a	b	10	3	d	67	67		a	a	52	3	CI sheet	CI sheet	Earth	68	67
207		2	Hekmot Ali Chowdhury	Boalia, Bashbaria, Sitakunda, Chattogram	58	b	c	e	a	b	9	2	c	58	58		a	a	45	3	CI sheet	CI sheet	Earth	76	58
208		3	Baikhil Hossain	Boalia, Bashbaria, Sitakunda, Chattogram	48	b	d	c	a	b	8	2	c	48	48		a	a	26	2	CI sheet	CI sheet	Earth	68	48
209		4	Tofazzal Munshi	Boalia, Bashbaria, Sitakunda, Chattogram	60	b	c	d	a	b	5	2	e	60	60		a	a	55	2	CI sheet	CI sheet	Earth	67	60
210		5	Sharfat Haji	Boalia, Bashbaria, Sitakunda, Chattogram	36	b	e	d	a	b	4	3	d	36	36		a	a	65	2	CI sheet	CI sheet	Earth	76	36
211		6	Shariot Ullah	Boalia, Bashbaria, Sitakunda, Chattogram	42	b	e	d	a	a	4	2	b	42	8		b	a	28	2	CI sheet	CI sheet	Earth	57	8
212		7	Haji Nurul Islam	Boalia, Bashbaria, Sitakunda, Chattogram	70	b	b	a	a	b	12	4	e	70	70		a	a	88	2	Concrete	Bricks	Cement	56	70
213		8	Komor Ali Chowdhury	Boalia, Bashbaria, Sitakunda, Chattogram	65	b	b	a	a	b	10	3	e	65	65		a	a	76	2	Concrete	Bricks	Cement	48	65
214		9	Roman Hossain	Boalia, Bashbaria, Sitakunda, Chattogram	68	b	b	a	a	b	7	2	d	68	68		a	a	55	3	CI sheet	CI sheet	Earth	88	68
215		10	Badiul Alom	Boalia, Bashbaria, Sitakunda, Chattogram	55	b	d	a	a	b	9	2	d	55	55		a	a	33	3	CI sheet	CI sheet	Earth	76	55
216	C6	1	Shairu Bala	Kumira Jele Para, Sitakunda, Chattogram	55	a	a	e	b	b	8	2	b	55	55		a	a	4	2	CI sheet	CI sheet	Earth	22	55
217		2	Rupom	Kumira Jele Para, Sitakunda, Chattogram	58	b	a	b	b	b	10	3	b	58	58		a	a	2	2	CI sheet	CI sheet	Earth	20	58
218		3	Bondona	Kumira Jele Para, Sitakunda, Chattogram	27	a	b	e	b	b	12	4	c	27	27		a	a	3	1	CI sheet	CI sheet	Earth	18	27
219		4	Srijon Moitri	Kumira Jele Para, Sitakunda, Chattogram	36	b	c	b	b	b	8	2	b	36	36		a	a	3	1	CI sheet	CI sheet	Earth	16	36
220		5	Mrinal	Kumira Jele Para, Sitakunda, Chattogram	46	b	b	b	b	a	6	2	b	46	18		b	b	2	1	CI sheet	Bamboo	Earth	11	18
221		6	Nondi	Kumira Jele Para, Sitakunda, Chattogram	63	b	b	b	b	b	4	1	b	63	63		a	a	1	1	CI sheet	Others	Earth	10	63
222		7	Konkona	Kumira Jele Para, Sitakunda, Chattogram	44	a	b	e	b	a	5	1	b	44	22		b	b	3	1	CI sheet	Others	Earth	9	22
223		8	Nitai	Kumira Jele Para, Sitakunda, Chattogram	33	b	b	b	b	a	4	1	a	33	8		b	b	2	1	CI sheet	Others	Earth	8	8
224		9	Kanu Kumar	Kumira Jele Para, Sitakunda, Chattogram	58	b	a	b	b	a	3	1	a	58	16		b	b	1	1	Others	Bamboo	Earth	8	16
225		10	Rongon	Kumira Jele Para, Sitakunda, Chattogram	36	b	a	b	b	a	4	1	a	36	10		b	b	1.5	1	Others	Bamboo	Earth	9	10

	A	B	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	BB	BC	BD	BE
1	SSQ																														
2																								B-9	B-10	B-11	B-12		B-13		B-14
3			B-8.2					B-8.3					B-8.4					B-8.5										B-12.2		B-13.1	
4	Case No.	SSQ no.	Boithakghar					Kitchen					Store room					Cattle house					Total Built-form	Toilet	Cattle house	Poultry house	Pond	Area for pond	Community Pond	Catchment	Source of Drinking Water
5			Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Roof	Surface	Floor	Area (SQM)	Age (years)	Area (SQM)	a= Pucca b= Semipucca c= Katcha d= No	a= Yes b= No	a= Yes b= No	a= One b= Two c= Three d= No	SQM	a= Yes b= No	Nos. of Homestead	a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain
206	C5	1						CI sheet	CI sheet	Earth	8	22						CI sheet	CI sheet	Earth	12	22	88	a	a	a	a	435	a	19	a
207		2						CI sheet	Bamboo	Earth	11	20						CI sheet	CI sheet	Earth	14	20	101	a	a	a	a	680	a	20	a
208		3						CI sheet	Bamboo	Earth	12	25						CI sheet	CI sheet	Earth	10	25	90	a	a	a	a	530	a	21	a
209		4						Leaves	Bamboo	Earth	10	28						CI sheet	CI sheet	Earth	10	28	87	a	a	a	a	566	a	22	a
210		5						Leaves	Leaves	Earth	14	22						CI sheet	Bamboo	Earth	18	22	108	a	a	a	a	490	a	23	a
211		6						Leaves	Leaves	Earth	12	12						CI sheet	Bamboo	Earth	8	12	77	a	a	a	a	355	a	24	a
212		7						CI sheet	CI sheet	Earth	16	30	CI sheet	CI sheet	Earth	12	20	CI sheet	CI sheet	Earth	14	30	98	a	a	a	b	1330	a	15	a
213		8	CI sheet	CI sheet	Earth	28	65	CI sheet	CI sheet	Earth	12	25	CI sheet	CI sheet	Earth	10	25	CI sheet	CI sheet	Earth	11	25	109	a	a	a	a	556	a	16	a
214		9	CI sheet	CI sheet	Earth	32	68	CI sheet	CI sheet	Earth	10	26	CI sheet	CI sheet	Earth	8	15	CI sheet	CI sheet	Earth	10	26	148	a	a	a	a	660	a	17	a
215		10	CI sheet	CI sheet	Earth	36	55	CI sheet	CI sheet	Earth	11	18	CI sheet	CI sheet	Earth	10	18	CI sheet	CI sheet	Earth	12	18	145	a	a	a	a	365	a	18	a
216	C6	1						CI sheet	CI sheet	Earth	4	25											26	a	b	b	d	0	b	0	b
217		2						CI sheet	Bamboo	Earth	5	22											25	a	b	b	d	0	b	0	b
218		3						CI sheet	Bamboo	Earth	4	12											22	a	b	b	d	0	b	0	b
219		4																					16	b	b	b	d	0	b	0	b
220		5																					11	b	b	b	d	0	b	0	b
221		6																					10	b	b	b	d	0	b	0	b
222		7																					9	b	b	b	d	0	b	0	b
223		8																					8	b	b	b	d	0	b	0	b
224		9																					8	b	b	b	d	0	b	0	b
225		10																					9	b	b	b	d	0	b	0	b

	A	B	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BR	BS	BT	BU	BV	BW	BX
1	SSQ		C. Others																	
2			B-15	B-16	B-17	B-18	B-19						B-20	C-1		C-2	C-3		C-4	C-5
3															C-1.1			C-3.1		
4	Case No.	SSQ no.	Source of Household Water	Power Source	Fuel Source	Electronic Equip.	Number of cattle						Fish in Pond	Any Loan from NGO	If yes, What for?	Membership of Cooperative Society	Any arable land	If yes, What crops?	How the construction materials were collected?	Where do you take shelter in natural disasters?
5			a= Hom. Tubewell b= Com. Tubewell c= Hom. Pond d= Com. Pond e= River/Canal f= Rain/others	a= Palli Biddut b= Solar c= No d= Others	a= Wood b= Gas c= Kerosine d= Electricity e= Others	a= Light b= Fan c= Pump d= Stove e= Others	Cow	Buffalo	Goat	Sheep	Chicken	Duck	a= Cultivated b= Natural c= No	a= Yes b= No	a= Housing b= Water c= Toilet d= Agrci e= Solar P. f= Others	a= Yes b= No	a= Yes b= No			
206	C5	1	c	a	a	a,b,c	2				8		b	b		b	a	Rice	Local Source	School Building
207		2	d	a	a	a,b,c	3				6	10	a	b		b	a	Rice	Local Source	School Building
208		3	d	a	a	a,b	5				5		a	b		a	a	Rice	Local Source	School Building
209		4	d	a	a	a,b	3				5		a	b		a	a	Rice	Local Source	School Building
210		5	d	a	a	a,b	2				5	6	b	b		a	a	Rice	Local Source	School Building
211		6	d	a	a	a,b	6				5		b	b		a	b		Local Source	School Building
212		7	a	a	a	a,b,c	3				8	12	a	b		b	a	Rice	Local Source	School Building
213		8	a	a	a	a,b,c	6				10		a	b		b	a	Rice	Local Source	School Building
214		9	c	a	a	a,b,c	3				8		a	b		b	a	Rice	Local Source	School Building
215		10	c	a	a	a,b,c	4				4	10	a	b		b	a	Rice	Local Source	School Building
216	C6	1	b	a	b	a,b,c							c	a	b	a	b			
217		2	b	a	b	a,b,c							c	a	b	a	b			
218		3	b	a	b	a,b,c							c	a	b	a	b			
219		4	b	a	b	a,b,c							c	a	c	a	b			
220		5	b	a	a	a,b							c	a	c	a	b			
221		6	b	a	a	a,b							c	a	f	a	b			
222		7	b	a	a	a,b							c	a	f	a	b			
223		8	b	a	a	a,b							c	a	f	a	b			
224		9	b	a	a	a,b							c	a	f	a	b			
225		10	b	a	a	a,b							c	a	f	a	b			

Summary of Semi-Structured Questionnaire (SSQ) Survey

SUMMARY OF SSQ			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	B6
A-3	Age of respondant	Average	46	45	46	39	43	51	50	50	45	53	49	50	51	51	45	51
A-4	Gender of respondant	Female	2	2	1	1	0	2	0	0	0	0	2	1	0	0	1	0
		Male	8	8	9	9	10	8	10	10	10	10	8	9	10	10	9	10
A-5	Education	No	4	4	3	1	0	3	3	3	1	4	2	3	1	0	1	1
		Primary	3	3	3	5	2	3	4	4	2	4	5	3	6	1	3	4
		High School	2	2	2	2	4	2	3	3	4	2	2	1	1	4	4	3
		Secondery	1	1	1	2	3	1	0	0	3	0	1	3	0	3	2	1
		Tertiary	0	0	1	0	1	1	0	0	0	0	0	0	2	2	0	1
A-6	Occupation	Agriculture	3	5	6	6	7	9	8	8	9	10	7	9	7	6	5	6
		Fishing	5	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0
		Service	0	0	1	0	1	0	0	1	0	0	2	0	1	1	0	0
		Business	0	0	2	1	2	0	2	1	1	0	1	1	1	2	1	1
		Others	2	2	1	1	0	1	0	0	0	0	0	0	1	1	4	3
A-7	Religion	Islam	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Hindu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Christian	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Buddhist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A-8	Family Type	Single	4	4	4	3	3	2	2	3	2	1	2	3	2	4	5	6
		Joint	6	6	6	7	7	8	8	7	8	9	8	7	8	6	5	4
A-9	Family size	Average	7.4	8.6	7.8	7.4	7.1	8.8	7.9	8	8.8	8.2	8.5	8	7.9	6.7	6.7	6.1
A-10	Income Gen. Person	Average	1.9	2.2	1.8	1.8	2.2	2.8	2.4	2.3	2.2	2.3	2.1	2.4	2.5	1.8	1.8	1.6
A-11	Monthly Income	<5000	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
		5000 - 10000	2	3	2	5	2	7	2	0	4	3	2	1	2	5	5	5
		10000 - 15000	4	3	5	2	2	2	3	5	2	3	4	3	4	2	3	2
		15000 - 20000	3	1	0	3	3	0	4	3	4	4	3	4	3	3	2	2
		>20000	0	3	3	0	3	0	1	2	0	0	0	2	1	0	0	1
		Average	12000	15250	15250	11500	16750	8000	14750	16500	12500	13000	12000	16500	14250	11500	11000	12250
B-1	Duration of stay in this village	Average (years)	12.4	22.9	45.6	12	42.9	42.3	33.6	21.7	36	53	22.2	7	23.9	14.3	13.7	9.6
		Minimum (years)	8	12	27	12	24	15	28	4	8	28	5	7	8	8	12	4
		Maximum (years)	14	34	60	12	60	50	35	30	60	70	58	7	30	20	15	15
B-2	Duration of stay in Present House	Average (years)	10.5	19.2	34.4	9.6	34.9	30.7	23.7	21.7	36	42.5	22.2	7	21.2	14.3	13.7	9.6
		Minimum (years)	3	4	1	1	2	8	8	4	8	4	5	7	8	8	12	4
		Maximum (years)	14	34	60	12	60	50	35	30	60	65	58	7	30	20	15	15
B-4	House ownership	Ancestral	1	0	5	0	0	5	1	1	4	4	2	0	0	8	0	0
		Self built	8	10	5	10	10	3	9	9	6	6	8	10	10	0	10	10

SUMMARY OF SSQ			C1	C2	C3	C4	C5	C6	Zone-A	Zone-B	Zone-C	Average
A-3	Age of respondant	Average	54	53	51	52	46	46	47	49	50	**49**
A-4	Gender of respondant	Female	0	0	10	10	0	3	8.0%	6.7%	38.3%	**15.9%**
		Male	10	10	0	0	10	7	92.0%	93.3%	61.7%	**84.1%**
A-5	Education	No	1	1	0	1	0	4	26.0%	13.3%	11.7%	**18.6%**
		Primary	5	6	1	4	4	5	33.0%	36.7%	41.7%	**36.4%**
		High School	1	1	4	3	2	1	26.0%	25.0%	20.0%	**24.1%**
		Secondery	2	0	3	1	2	0	12.0%	16.7%	13.3%	**13.6%**
		Tertiary	1	2	2	1	2	0	3.0%	8.3%	13.3%	**7.3%**
A-6	Occupation	Agriculture	6	7	6	6	4	0	71.0%	66.7%	48.3%	**63.6%**
		Fishing	0	0	0	0	0	7	10.0%	0.0%	11.7%	**7.7%**
		Service	1	1	1	0	1	0	3.0%	6.7%	6.7%	**5.0%**
		Business	3	1	1	1	3	0	9.0%	11.7%	15.0%	**11.4%**
		Others	0	1	2	3	2	3	7.0%	15.0%	18.3%	**12.3%**
A-7	Religion	Islam	10	10	10	10	10	0	100.0%	100.0%	83.3%	**95.5%**
		Hindu	0	0	0	0	0	10	0.0%	0.0%	16.7%	**4.5%**
		Christian	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		Buddhist	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
A-8	Family Type	Single	3	2	2	2	1	5	28.0%	36.7%	25.0%	**29.5%**
		Joint	7	8	8	8	9	5	72.0%	63.3%	75.0%	**70.5%**
A-9	Family size	Average	7.8	7.9	7.9	7.6	7.8	6.4	8.0	7.3	7.6	**7.7**
A-10	Income Gen. Person	Average	2	2.5	2.5	2.2	2.5	1.8	2.2	2.0	2.3	**2.2**
A-11	Monthly Income	<5000	0	0	0	0	0	3	2.0%	1.7%	5.0%	**2.7%**
		5000 - 10000	2	2	2	3	1	6	30.0%	33.3%	26.7%	**30.0%**
		10000 - 15000	4	4	3	2	2	1	31.0%	30.0%	26.7%	**29.5%**
		15000 - 20000	4	2	2	1	4	0	25.0%	28.3%	21.7%	**25.0%**
		>20000	0	2	3	4	3	0	12.0%	6.7%	20.0%	**12.7%**
		Average	13500	15000	16250	16500	17750	6500	13550	12917	14250	**13568**
B-1	Duration of stay in this village	Average (years)	43.4	39.7	44.8	52.2	56.9	45.6	32.2	15.1	47.1	**32**
		Minimum (years)	28	26	28	36	36	27	4.0	4.0	26.0	**4**
		Maximum (years)	60	50	55	67	70	63	70.0	58.0	70.0	**70**
B-2	Duration of stay in Present House	Average (years)	43.4	39.7	44.8	52.2	56.9	45.6	26.3	14.7	39.7	**29**
		Minimum (years)	4	25	28	6	8	8	1.0	4.0	13.2	**1**
		Maximum (years)	14	50	55	67	70	63	65.0	58.0	70.0	**70**
B-4	House ownership	Ancestral	1	3	6	8	9	5	21.0%	16.7%	53.3%	**28.6%**
		Self built	9	5	4	2	1	5	76.0%	80.0%	43.3%	**68.2%**

SUMMARY OF SSQ			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	B6
		Purchased	1	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0
		Sheltered	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
		Rental	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B-5	**Land ownership**	Ancestral	1	0	8	3	2	6	6	4	8	5	3	0	1	2	0	3
		Purchased	8	10	2	6	8	2	4	6	2	5	4	10	8	8	7	7
		Sheltered	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
		Rental	0	0	0	0	0	0	0	0	0	0	3	0	1	0	3	0
B-6	**Homestead Area**	Minimum (Dec)	6	7	6	6	11	8	9	10	8	8	6	8	8	10	6	8
		Maximum (Dec)	32	35	55	22	60	44	53	52	44	44	33	24	55	66	16	44
		Average (Dec)	16	17.6	21.9	13.4	33.7	21.5	27.7	26.2	21.5	21.5	15	12.8	19.6	27.3	10	20.8
	Built form Footprint	Minimum (SQM)	21	30	24	24	57	40	28	39	32	40	36	28	29	34	24	36
		Maximum (SQM)	121	109	210	127	277	207	192	198	186	183	130	141	130	143	106	134
		Average (SQM)	58.8	53.3	91	56.2	116.6	98.3	92.3	98.2	102.1	101.4	72.7	72.9	73.3	83	63	78.7
		% of Homestead Area	**9%**	**7%**	**10%**	**10%**	**9%**	**11%**	**8%**	**9%**	**12%**	**12%**	**12%**	**14%**	**9%**	**8%**	**16%**	**9%**
B-7	**Number of houses**	One	7	8	5	8	7	6	6	6	3	6	2	2	3	1	1	2
		Two	3	2	3	2	2	2	3	2	5	2	5	5	2	4	5	3
		Three	0	0	2	0	1	2	1	2	2	2	2	2	3	3	4	4
		More than 3	0	0	0	0	0	0	0	0	0	0	1	1	2	2	0	1
B-9	**Condition of Toilet**	Pucca	4	4	6	4	6	5	4	5	7	5	3	6	4	8	1	3
		Semi-pucca	6	6	4	6	4	5	6	5	3	5	6	4	6	2	7	7
		Katcha	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0
		No	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B-10	**Cattle house**	Yes	5	6	8	5	9	9	8	8	9	9	10	7	9	8	6	10
		No	5	4	2	5	1	1	2	2	1	1	0	3	1	2	4	0
B-11	**Poultry house**	Yes	10	10	10	9	10	10	10	10	9	10	9	10	10	10	8	10
		No	0	0	0	1	0	0	0	0	1	0	1	0	0	0	2	0
B-12	**Pond**	One	7	6	6	7	6	7	8	7	7	8	7	10	7	6	7	8
		Two	0	2	3	1	2	2	0	2	1	0	1	0	1	2	1	1
		Three	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		No	3	2	1	2	2	1	2	1	2	2	2	0	2	2	2	1
	Pond Area	Minimum (SQM)	0	0	0	0	0	0	0	0	0	0	0	96	0	0	0	0
		Maximum (SQM)	360	425	750	440	1020	620	660	736	560	550	390	420	420	460	220	660
		Average (SQM)	168.5	186	309.4	171.2	356.7	302.4	285.1	339.6	200	209.4	184.3	173.6	171.3	245	92.6	259.4
		% of Homestead Area	**26%**	**26%**	**35%**	**32%**	**26%**	**35%**	**25%**	**32%**	**23%**	**24%**	**30%**	**33%**	**22%**	**22%**	**23%**	**31%**
B-14	**Source of Drinking**	Homestead Tubewell	0	0	2	0	0	1	9	7	7	9	10	7	7	6	0	2

SUMMARY OF SSQ			C1	C2	C3	C4	C5	C6	Zone-A	Zone-B	Zone-C	Average
		Purchased	0	2	0	0	0	0	2.0%	3.3%	3.3%	**2.7%**
		Sheltered	0	0	0	0	0	0	1.0%	0.0%	0.0%	**0.5%**
		Rental	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
B-5	**Land ownership**	Ancestral	7	6	9	10	10	5	43.0%	15.0%	78.3%	**45.0%**
		Purchased	3	1	1	0	0	5	53.0%	73.3%	16.7%	**48.6%**
		Sheltered	0	0	0	0	0	0	4.0%	0.0%	0.0%	**1.8%**
		Rental	0	3	0	0	0	0	0.0%	11.7%	5.0%	**4.5%**
B-6	**Homestead Area**	Minimum (Dec)	10	18	33	33	26	1	6	6	1	**1**
		Maximum (Dec)	44	56	66	70	88	4	60	66	88	**88**
		Average (Dec)	22.3	30.5	44.4	46.7	52.3	2.25	22.1	17.6	33.1	**23.9**
	Built form Footprint	Minimum (SQM)	36	61	63	48	77	8	21	24	8	**8**
		Maximum (SQM)	142	139	164	130	148	26	277	143	164	**277**
		Average (SQM)	76.2	88.8	97.2	89	105.1	14.4	86.9	73.9	78.5	**81.0**
		% of Homestead Area	**8%**	**7%**	**5%**	**5%**	**5%**	**16%**	**10%**	**10%**	**6%**	**8%**
B-7	**Number of houses**	One	1	0	0	0	0	8	62.0%	18.3%	15.0%	**31.8%**
		Two	4	3	4	4	6	2	26.0%	40.0%	38.3%	**34.8%**
		Three	3	4	4	5	4	0	12.0%	30.0%	33.3%	**25.1%**
		More than 3	2	3	2	1	0	0	0.0%	11.7%	13.3%	**8.3%**
B-9	**Condition of Toilet**	Pucca	2	8	9	8	10	3	50.0%	41.7%	66.7%	**52.3%**
		Semi-pucca	8	2	1	2	0	7	50.0%	53.3%	33.3%	**46.4%**
		Katcha	0	0	0	0	0	0	0.0%	5.0%	0.0%	**1.4%**
		No	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
B-10	**Cattle house**	Yes	10	10	10	10	10	0	76.0%	83.3%	83.3%	**80.0%**
		No	0	0	0	0	0	10	24.0%	16.7%	16.7%	**20.0%**
B-11	**Poultry house**	Yes	10	10	10	10	10	0	98.0%	95.0%	83.3%	**93.2%**
		No	0	0	0	0	0	10	2.0%	5.0%	16.7%	**6.8%**
B-12	**Pond**	One	6	6	5	8	9	0	69.0%	75.0%	56.7%	**66.9%**
		Two	3	4	4	1	1	0	13.0%	10.0%	21.7%	**14.9%**
		Three	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		No	1	0	1	1	0	10	18.0%	15.0%	21.7%	**18.2%**
	Pond Area	Minimum (SQM)	0	185	0	0	355	0	0	0	0	**0**
		Maximum (SQM)	525	1090	1190	1080	1330	0	1020	660	1330	**1330**
		Average (SQM)	228	378.7	673	468.5	596.7	0	252.8	187.7	390.8	**272.7**
		% of Homestead Area	**25%**	**31%**	**37%**	**25%**	**28%**	**0%**	**28%**	**26%**	**29%**	**28%**
B-14	**Source of Drinking**	Homestead Tubewell	5	10	10	10	10	0	35.0%	53.3%	75.0%	**50.9%**

SUMMARY OF SSQ			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	B6
	Water	Common Tubewell	1	0	8	0	10	9	1	3	3	1	0	3	3	4	10	8
		Homestead Pond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Community Pond	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
		River/Canal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Rain	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B-15	Source of Household Water	Homestead Tubewell	0	0	2	0	0	0	0	0	0	0	7	9	1	0	0	0
		Common Tubewell	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0
		Homestead Pond	4	5	7	2	3	9	8	9	6	0	0	0	6	8	8	8
		Community Pond	6	5	0	8	0	0	0	0	4	10	0	1	3	2	2	2
		River/Canal	0	0	0	0	7	1	2	1	0	0	0	0	0	0	0	0
		Rain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B-16	Power Source	Palli Biddut	0	0	0	0	0	0	0	0	0	0	0	0	4	6	0	0
		Solar	9	10	10	7	10	9	10	10	10	10	7	10	6	4	5	4
		No	1	0	0	3	0	1	0	0	0	0	3	0	0	0	5	6
		Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B-17	Fuel Source	Wood	10	10	10	10	10	10	10	10	10	10	10	10	8	7	10	10
		Gas	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0
		Kerosine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-1	Any Loan from NGO	Yes																
		No.																
C-3	Any Arable land	Yes	6	7	7	7	10	9	10	10	10	10	7	9	7	6	4	6
		No	4	3	3	3	0	1	0	0	0	0	3	1	3	4	6	4

SUMMARY OF SSQ			C1	C2	C3	C4	C5	C6	Zone-A	Zone-B	Zone-C	Average
	Water	Common Tubewell	5	0	0	0	0	10	36.0%	46.7%	25.0%	**35.9%**
		Homestead Pond	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		Community Pond	0	0	0	0	0	0	10.0%	0.0%	0.0%	**4.5%**
		River/Canal	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		Rain	0	0	0	0	0	0	19.0%	0.0%	0.0%	**8.6%**
B-15	Source of Household Water	Homestead Tubewell	1	0	0	6	2	0	2.0%	28.3%	15.0%	**12.7%**
		Common Tubewell	2	0	0	0	0	10	1.0%	5.0%	20.0%	**7.3%**
		Homestead Pond	4	7	7	4	3	0	53.0%	50.0%	41.7%	**49.1%**
		Community Pond	3	3	3	0	5	0	33.0%	16.7%	23.3%	**25.9%**
		River/Canal	0	0	0	0	0	0	11.0%	0.0%	0.0%	**5.0%**
		Rain	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
B-16	Power Source	Palli Biddut	10	10	10	10	10	10	0.0%	16.7%	100.0%	**38.9%**
		Solar	0	0	0	0	0	0	95.0%	60.0%	0.0%	**51.7%**
		No	0	0	0	0	0	0	5.0%	23.3%	0.0%	**9.4%**
		Others	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
B-17	Fuel Source	Wood	10	8	10	10	10	6	100.0%	91.7%	90.0%	**95.0%**
		Gas	0	2	0	0	0	4	0.0%	8.3%	10.0%	**5.0%**
		Kerosine	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		Electricity	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
		Others	0	0	0	0	0	0	0.0%	0.0%	0.0%	**0.0%**
C-1	Any Loan from NGO	Yes							53.0%	41.7%	26.7%	**40.4%**
		No.							47.0%	58.3%	73.3%	**59.6%**
C-3	Any Arable land	Yes	10	10	10	8	9	0	86.0%	65.0%	78.3%	**78.2%**
		No	0	0	0	2	1	10	14.0%	35.0%	21.7%	**21.8%**

Data Sheet of Key Informant Interviews (KII)

	A	B	C	D	F	G	H	I	J	K	L	M	O	P
1	KII		A. Informant Related						B. Related to the Settlement					
2			A-1	A-2	A-4	A-5	A-6	A-6	B-1	B-2	B-3	B-4	B-6	B-7
3														
4	Case No.	KII no.	Name	Name of the Village	Age	Gender	Occupation/Affiliation	Duration of stay in this village	Total number of household in this village	Main occupation of the Villagers	Religion of the Villagers	How many years ago did this village originate?	Hydrographic features	Are there any measures to stay safe in natural disasters?
5					Years	F= Female M= Male		Years	Nos.			Years	a= river b= canal c= Confluence	
6	A1	1	Jobeda Begum	Jinntola	62	F	Senior Inhabitant	14	60	Fishing	Islam	14	c	No
7	A2	2	Asaduzzaman	Padma Char	68	M	Chairman	30	300	Agriculture, Fishing	Islam	34	c	Kewra Forest
8	A3	3	Abdur Razzak	Koralia	58	M	Member	58	34	Agriculture	Islam	60	b	No
9	A4	4	Abdul Hye	Char Duani	45	M	Member	12	50	Agriculture	Islam	12	a	Embankment
10	A5	5	Noya Mia Hawladar	Jaliaghata	60	M	Senior Inhabitant	60	120	Agriculture	Islam	60	b	No
11	A6	6	Matlob Munshi	Char Kajal – Balar Char	80	M	Senior Inhabitant	50	15	Agriculture	Islam	50	b	No
12	A7	7	Hanif Molla	Char Montaj	57	M	Local Leader	28	40	Agriculture	Islam	35	b	Embankment
13	A8	8	Shajeda Bibi	Char Kukrimukri - Babuganj	62	F	Senior Inhabitant	30	10	Agriculture	Islam	30	b	No
14	A9	9	Jahangir Sowdagar	Char Kukrimukri - Shababpur	55	M	Local Leader	35	30	Agriculture	Islam	60	b	No
15	A10	10	Mohajon Munshi	Char Kukrimukri - Boyatibari	70	M	Senior Inhabitant	70	12	Agriculture	Islam	70	-	No
16	B1	11	Monir Hossain	Char Folkan	55	M	Local Leader	55	120	Agriculture	Islam	60	-	No
17	B2	12	Abul Khayer	Char Jogbondhu	70	M	Member	7	7	Agriculture	Islam	7	a	No
18	B3	13	Abdul Malek	Char Alexander	65	M	Senior Inhabitant	18	50	Agriculture	Islam	30	a	Embankment
19	B4	14	Md. Shah Alam	Char Mehar	75	M	Senior Inhabitant	20	50	Agriculture	Islam	20		No
20	B5	15	Md. Hanif	Char Elahi (para-1)	45	M	Local Leader	15	12	Agriculture	Islam	15		Embankment
21	B6	16	Zahir Uddin	Char Elahi (para-2)	50	M	Local Leader	10	22	Agriculture	Islam	15		Embankment
22	C1	17	Kamrul Haidar Chowdhury	Dakkhin Moghadia	52	M	Chairman	50	110	Agriculture	Islam	60	b	Embankment
23	C2	18	Khalek Bepari	Saidpur	65	M	Senior Inhabitant	50	42	Agriculture	Islam	50		Embankment
24	C3	19	Shaher Ali	Muradpur	68	M	Senior Inhabitant	55	40	Agriculture	Islam	70	b	Embankment
25	C4	20	Alamgir Hossain	Nadalia, Bashbaria	58	M	Senior Inhabitant	58	70	Agriculture	Islam	100	a	Embankment
26	C5	21	Haji Nurul Islam	Boalia, Bashbaria	70	M	Senior Inhabitant	70	30	Agriculture	Islam	100	b	Embankment
27	C6	22	Shairu Bala	Kumira Jele Para	55	F	Senior Inhabitant	55	500	Fishing	Hindu	100	a	No

	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1		**C. Related to Community Interaction Space**															
2	**B-8**	**C-1**	**C-2**	**C-3**	**C-4**	**C-5**	**C-6**	**C-7**	**C-8**	**C-9**	**C-10**	**C-11**	**C-12**	**C-13**	**C-14**	**C-15**	**C-16**
3																	
4	**Type of NGO activities**	**Primary school**	**Secondary School**	**NGO School**	**Club**	**Madrasa**	**Moktob**	**Mosque**	**Temple**	**Eid gah**	**Community pond**	**Play field**	**Qurbani place**	**Bazar/ Haat/Shops**	**Crematorium**	**Cyclone Shelter**	**Graveyard**
5		Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.
6	Micro credit for Solar power	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0
7	Micro credit for Solar power, sanitation	1	0	0	1	0	1	1	0	0	2	1		1	0	0	0
8	Micro credit for Solar power, sanitation	1	0	0	0	0	0	1	0	1	0	1	1	1	0	0	0
9	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
10	Micro credit for Solar power, sanitation	1	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0
11	Micro credit for Solar power, irrigation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
12	Micro credit for Solar power	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
13	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
14	Micro credit for Solar power, sanitation	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0
15	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
16	Micro credit for Solar power, sanitation	0	0	0	0	0	0	2	0	1	1	0	0	1	0	0	0
17	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0
18	Micro credit for Solar power, sanitation	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0
19	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
20	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
21	Micro credit for Solar power, sanitation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
22	Micro credit for sanitation	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0
23	Micro credit for sanitation	1	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0
24		0	0	0	0	0	0	1	0	0	2	0	0	1	0	0	0
25	Micro credit for sanitation	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
26		1	0	0	0	0	0	1	0	1	2	0	0	1	0	0	0
27	Micro credit for water, sanitation and trade	1	0	3	0	0	0	0	3	0	0	0	0	3	0	0	0