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Geographical Study of Local NGO's Contribution to Rural Development:

A Case on the Riverside of Jamuna, Bangladesh

（ローカルＮＧＯによる農村開発に関する地理学的研究 –バングラデシュ、ジャムナ

川流域の事例– ）

HOKKAIDO
UNIVERSITY

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"A DISSERTATION SUBMITTED TO THE DOCTORAL PROGRAM IN REGIONAL SCIENCES, DIVISION OF HUMAN SCIENCES, GRADUATE SCHOOL OF LETTERS, HOKKAIDO UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY"

Sapporo, Japan
February, 2018

Declaration

The work contained in this thesis is entirely written and conducted by the author. Material from the published work of others, which is referred to in this thesis, is credited to the author in the text. No part of this work has been submitted for any other degree in this or any other university.

The main body of text (including references and annexes) is approximately **104,460** words in length.

(Tanjinul Hoque Mollah)

Abstract

Non-governmental Organizations (NGOs) play a significant role in rural development across Bangladesh. The key sectors of NGOs' contribution are- education, health, agriculture, environment, child protection, vocational training, economic empowerment, livelihood rehabilitation, human rights, infrastructure development, and disaster management, etc. In this study, I explored three important contribution sectors of NGOs i.e. education, agriculture, and micro-credits to support rural inhabitants of Bangladesh. The study was performed along the riverside of Jamuna, Bangladesh; a remote rural area where many local NGOs support local people to improve their lives and livelihoods. This study involved 30 NGOs in 126 union councils (a smallest administrative hierarchy consists of 3-5 villages) of 5 districts. This study has conducted 533 Household Surveys (HHS), Key Informant Interviews (KII), 50 Focused Group Discussions (FGD) and participatory observations to get the firsthand experience of all the services provided to the local people by the NGOs. ArcGIS 10.2 was used for detailed mapping and analyzing of NGOs' contribution areas in providing educational, agricultural and micro-credit services and the areas that still lack those facilities. Furthermore, it was used to identify suitable agricultural lands for crop production and identify the concentration of NGOs, offering micro-credit programs in rural areas and find potential areas in need of such programs. A Garmin GPS device has been used to locate all MFIs (175 branches of 30 NGOs), educational institutions (358 schools) and growth/commercial centers (42 commercial centers) accurately and collected waypoints were converted to KML format. Furthermore, Statistical Package for the Social Sciences' (SPSS 16.0) software was also used for analyzing the socioeconomic characteristics. Besides, the correlation was analyzed between profit from agriculture and six dependent variables and also between monthly income and selected eight dependent variables (luxurious assets) using SPSS. This study used satellite images of Landsat TM and WorldView from the year of 1975 to 2015 to identify spatial and temporal dynamics of alluvial char as well as to plan for the NGOs distribution to ensure the proper services for the rural poor. Data needed for GIS and RS analysis were taken from the Bangladesh Bureau of Statistics (BBS), Center for Environmental and Geographic Information Services (CEGIS), Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and Char livelihood Program (CLP).

The research has illustrated that poverty, lack of transportation/communication facilities, insufficient and unplanned educational infrastructure, lack of awareness, unequal spatial distribution of rural schools, and natural barriers are the main causes of educational backwardness in rural areas of Bangladesh. Local NGO facilitates education sectors by increasing consciousness, development of a need-based curriculum, creation

of graded learning materials, non-formal education and food for rural poor students. Unfortunately, donors' have not taken any initiative for providing clean water, playgrounds, providing access to internet, computers, electricity and other facilities. Moreover, male and female literacy rates are 38.85% and 32.26% respectively. Evidently, the female literacy rate is less than the male literacy rate due to religious barriers, transportation systems and the perpetuation of poverty. The duration of the projects and the condition of the local NGOs and infrastructure designed for rural schools create an unstable situation in rural education. Therefore, local NGOs should emphasize on project duration and the proper utilization of local resources and services.

This research has also investigated NGOs' services provided in the agriculture sector, including a suitable location for agricultural crops in the study area using GIS technology. The results revealed that local NGOs facilitate farmers by giving various agricultural aids such as agricultural inputs (seed, fertilizer, pesticide), agricultural tools, cash loans, agricultural training, irrigation facility, support for women in kitchen gardening, etc. People in remote rural areas were mainly involved in farming, while those near the capital (Dhaka) of Bangladesh or other developed areas were primarily engaged in either industry or other service sectors. Correlation analysis revealed that farmers' income is being increased with the increase of farmer's training, access to agricultural inputs, availability of domestic animals in the household and access to agricultural loans. The results further showed that all the land in the study area is not suitable for farming. The study suggests, both the Government Organizations (GOs) and NGOs should raise awareness among farmers and help them to identify best suitable crop production areas.

On the contrary, this study presented the contributions made by micro-credit in poverty alleviation by increasing the income generating activities and empowerment. There are a few prominent micro-credit institutions, e.g. BRAC, Grameen Bank, RDRS Bangladesh and ASA those are working particularly towards the poverty alleviation, empowerment and improvement of living standards of the rural poor. Correlation analysis revealed that farmer's income is significantly related to the use of luxurious products. However, in terms of poverty alleviation, some individual achievements have been made, while net welfare achievements at the union level are remaining absent. Finally, this study plans for sustainable development and make the optimal distance from the centers of commerce and social services areas to ensure proper services to the local poor people along the riverside of Jamuna, Bangladesh.

Acknowledgements

(Tanjinul Hoque Mollah)

List of Abbreviations

AMUS	Atto Mohila Unnaion Somity
ARBAN	Association for Realization of Basic Needs
ARCHES	Association for Renovation of Community Health Education Services
ASA	Association for Social Advancement
BANBEIS	Bangladesh Bureau of Educational Information and Statistics
BBP	Brahmaputra Biodiversity Plan
BBS	Bangladesh Bureau of Statistics
BCLDP	Brahmaputra Char Livelihood Development Plan
BFMP	Brahmaputra Flood Management Plan
BIDP	Brahmaputra Integrated Development Plan
BIDS	Bangladesh Institute of Development Studies
BMUS	Bhomukhi Mohila Unnaion Somity
BRAC	Bangladesh Rural Advancement Committee
BSP	Brahmaputra Stabilization Plan
BWRDP	Brahmaputra Water Resources Development Plan
CEGIS	Center for Environmental and Geographic Information Services
DLRS	Directorate of Land Records and Surveying
DORP	Development Organization of the Rural Poor
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FSP	Financial Support for the Poorest
GB	Grameen Bank
GBM	Ganges, Brahmaputra and Meghna
GCA	Gross Cropped Area
GCP	Ground Control Points
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information System
GKS	Gano Kallyan Sangstha
GPS	Global Positioning System
GUK	Gana Unnayan Kendra
HES	Household Economic Survey
HHS	Household Survey

HYV	High Yielding Variety
KII	Key Informant Interviews
LRP	Livelihood Restoration Program
ME	Micro Enterprise
MFIs	Micro Finance Institutions
MMS	Mukti Mohila Samity
NDP	National Development Programme
NGOs	Non-government Organizations
PDBF	Palli Daridro Bimochon Foundation
PRA	Participatory Rural Appraisal
RDP	Rural Development Program
RDRS	Rangpur Dinajpur Rural Service
RMC	Rural Micro Credit
RS	Remote Sensing
RSDA	Rural Society Development Association
RWECP	Rural Women Employment Creation Project
SAP	South Asia Partnership-Bangladesh
SATU	Social Advancement Through Unity
SF	Sajida Foundation
SKS	Samaj Kalyan Samity
SSS	Society for Social Services
TMSS	Thangara Mara Mohila Sabuj Songo
TMSS	Thakurgan Mohila Sobuj Sango
UDDIPAN	United Development Initiatives for Program Actions
UDPS	Uttara Development Program Society
UN	United Nations
UNDP	The United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
UPP	Ultra-Poor Program
US	Udayan Songha
WARPO	Water Resources Planning Organization
WBS	World Bank Staff
WMO	World Meteorological Organization

Dedications

To my beloved MOTHER

and the departed soul of my FATHER

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Non-governmental Organization (NGO) activities started in Bangladesh after the war of liberation in 1971 for the purpose of relief and rehabilitation (Hashemi, 1999). It is legally constituted corporations created by legal people for the betterment of the rural poor people that operates independently from any form of government in Bangladesh (Kamal, 1997). Right now Non-Governmental Organizations have become an extensively discussed subject in top thirteen underprivileged countries whereas NGOs have appeared as the savior of the countless number of people without food, cloth, education and basic health facilities (Chowdhury et al., 2004). It is expected that approximately 13,000 NGOs are engaged in micro-credit operations, whereas nearly about 80% of the villages in Bangladesh are now sheltered under NGOs activities (Develtere and Huybrechts, 2002). The majority of NGOs are small and a few number of large NGOs are Grameen Bank, BRAC, RDRS Bangladesh and ASA. Self-employment, agricultural training, health, sanitation, vocational training, economic empowerment, education both formal and non-formal, livelihood rehabilitation, women's rights, infrastructure development, disaster management, income-generating activities like a business using NGOs credit, rural plantation and other poverty reduction program are the key sectors in which NGOs have made numerous contributions to support remoter of Bangladesh (Hashemi, 1999).

The quality of rural life in Bangladesh is declined sometimes due to the absence of social desires such as education, employment, and recreation, etc. (Bhuyan, 2006; Monzoor and Kabir, 2008). Besides that, There are also some other obstacles i.e. poverty, unemployment, lack of skill, lower production, which make delay the improvement of rural life (UNICEF, 2009; General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh and UNDP Bangladesh, 2012). Therefore, Non-government Organizations (NGOs) in Bangladesh have significantly expanded their services in the rural areas by providing innovative facilities in educational sectors (Nath, 2002). Now, there are many NGOs engaged in formal and non-formal education that are specifically designed to address the crucial issues of income generation to improve the quality of life, livelihood skill training and gender empowerment program of the targeted population in the rural areas of Bangladesh (Nath et al., 1999). By the NGOs' provision in the educational sector, local community and individuals are benefited in the different sectors like; they are contributing to family income, living conditions of the family has improved, increased social awareness, conscious about health and sanitation, have knowledge of disaster management, reduction in unemployment and crime, delay of early marriage, women empowerment

and improvement in the overall social environment (Sukontamarn, 2003; CAMPE, 2006).

Bangladesh is a low lying riverine country which was formed by a deltaic plain at the confluence of the Padma, Jamuna and Meghna Rivers as well as their tributaries (Ahmed, 2010). Therefore, the pride of Bangladesh is its largest river networks in the world with approximately 700 rivers, including tributaries, which have a total length of about 24,140 km. There are about 80% of the people live in rural areas and more than 75 % are directly or indirectly depends on agriculture (Mahmud, 1996; Shamsuddoha, 2005). Although agriculture sector is the main source of income for the remoter, unfortunately, this sector is gradually shrinking due to natural disasters namely food, drought and other natural calamities in Bangladesh (Mina and Alam, 1995). Considering these situations, the NGOs are working on poverty eradication by providing NGOs credit in home-based income generating activities like cattle and poultry rearing, food processing, apiculture and rural handicrafts and so on. Their target groups are basically the extremely poor and vulnerable ones (Alam, 2009; Subrahmanyam, 2000; Rahman et al., 2001; Khaleque, 1999).

Microcredit programs (MCP) are implemented by various formal financial institutions specialized government organizations and non-government financial institutions in Bangladesh (Mahmud, 1996; Siddiqi, 1985). The majority of the institutions are working on improving the economic situation by building their business of the members (Rahman and Ahmed, 2001). There are 67.6 million families have been reached with microcredit in 2002 around the world, whereas 59.6 million clients are in Asia and Bangladesh covered 13 million (22.6%) clients (Microcredit Summit Campaign Report, 2003). In Bangladesh, the microcredit programs main target is women. NGOs are working to make empowerment of the women in the rural society (Milli, 1995; Rahman et al., 2002). Now they can take a decision on family planning, child marriage, buying and selling of properties and sending daughters to school (Khanam, 2007). Furthermore, NGOs have been providing credits combined with savings facilities, non-productive loan facilities, insurance facilities, enterprise development like production oriented and management training as well as marketing support, welfare-related services like educational facilities, health facilities, human rights and finally social awareness trainings (Siddiqui et al., 2002; Roodman and Morduch, 2009; Rogaly, 1996).

Along the Jamuna River, the number of people living in a *Char* land in adverse environments is significant, as they have no land and capital. There they live in dangerous conditions, even in the natural disaster times, significantly in heavy rainfall and flood time while they are under serious threat of being wiped away. Furthermore, they lead their life without general civic services like educational facilities, NGOs credit

facilities, lack of transportation facilities, electricity, sanitation, proper communication and medical facilities. Besides that, the rural poor people live in remote areas that are often huge distances from centers of commerce and social services areas. As a result, they are facing difficulties in accessing market opportunities and do not get proper civic facilities from the government. Additionally, the rural poor also have bigger families where they are working in insecure and relatively unproductive jobs. For all sequent reasons, the remoter along the riverside of Jamuna are suffering from lack of employment opportunities, lack of civic rights, educational facilities, agricultural facilities, health and sanitation and environmental vulnerabilities.

1.2 Aim and objectives of the research

In Bangladesh, the ongoing and vital issues are socio-economic development and poverty alleviation through the NGOs' provision in the rural areas of Bangladesh, whereas the micro-credit is considered as one of the vital tools for poverty alleviation along with community and individual development. The aim of this research project is to analyze and evaluate the local NGO's contribution to rural development and its impact on socio-economic conditions along the riverside of Jamuna, Bangladesh. The NGOs have been working in various sectors like education sectors, providing health and sanitation facilities, agricultural loan and tools, training on environment management, child protection, vocational training, economic empowerment both men and women, livelihood rehabilitation, human rights, NGOs credits combined with savings facilities, enterprise development like production oriented training and management training, marketing support, reduce child marriage, infrastructure development, disaster management, etc. This research discovers three most significant sectors in which NGOs have made frequent contributions to support rural poor people of Bangladesh. Those three sectors include; education, agriculture, and micro-credits. To fulfill the aim, specific objectives are being set for this study includes;

Specific objectives to achieve

(1) To explore NGOs' education services at district-level along the river Jamuna, Bangladesh using GIS and remote sensing approaches.

Sub-objectives:

a. The role of NGOs' in provision of educational services;

b. Performing spatial analysis of schools, NGOs, and facilities provided by those NGOs with respect to population density;

c. Mapping the available schools within a two-kilometer buffer zone of the study area along the river Jamuna; and

d. Analyzing the socio-economic status after the provisions of NGOs in the educational sectors along the riverside of Jamuna, Bangladesh.

(2) To identify the role of local NGOs in agriculture and identifying potential suitable areas for farming along the Jamuna River, Bangladesh.

Sub-objectives:

a. Investigate the agricultural facilities provided by local NGOs in the study area;

b. Discuss the suitability of land for different crops and identify agricultural cropping season in the study area;

c. Explore socioeconomic situation of the inhabitants along the riverside of Jamuna; and

d. Finally, analyze the correlation between profit from agriculture and six dependent variables at union level along the riverside of Jamuna, Bangladesh.

(3) To know the role of local NGOs in poverty reduction through micro-credit services to the rural poor along the Jamuna River, Bangladesh.

Sub-objectives:

a. Study the micro-credit facilities provided by local NGOs in the study area;

b. Map the spatial distribution of local NGOs with number of borrowers, savers, savings and total outstanding's;

c. Analyze the spatial location of local NGOs with growth centers/ commercial centers; and

d. Finally, to explore the socio-economic situation of the rural inhabitants and make correlations of monthly income and selected eight dependent variables (luxurious products) along the riverside of Jamuna.

(4) And finally, to make a proper plan of local NGOs distribution at district level along the riverside of Jamuna, Bangladesh.

Sub-objectives:

a. Explore the spatial distribution of local NGOs in the study area;

b. Study the relationship between NGOs' activities and population density;

c. Investigate the chronological changes of *char* lands from 1985 to 2015 of Jamuna, Bangladesh; and

d. Finally, to make a plan for the local NGOs' distribution to minimize the distance from the centers of commerce and social services areas along the river side of Jamuna, Bangladesh.

1.3 Research questions

To complete the above objectives, it is vital to focus on some of the basic issues. The issues are:

(1) What are the available sources of micro-credit, educational and agricultural data as well as images for the study? Are they well-suited? Is it possible to use them in a single platform to achieve the aim?

(2) What are the imageries suitable for the study of agricultural land use? How can images help to interpret the current land use?

(3) How can we integrate GPS data with population census? How can RS and GPS data help to generate a better educational facilities and agricultural maps?

(4) Is it possible to measure the rural development regarding the facilities provided by NGOs? How can we judge micro-credit program works properly in the rural areas of Bangladesh?

(5) Is there any way to assess the impact of micro-credit on a micro scale? Can we apply a Participatory Rural Appraisal (PRA) approach to understand rural development?

(6) Can we measure the chronological changes and shifting of the Jamuna River using Landsat TM images and how can we integrate socio-economic data with GPS and Census data?

In order to get the appropriate responses to the above queries, a very carefully plan was followed where time and budget were the main constraints.

1.4 Tasks to be involved for achieving targets of research

To achieve the above aim, objectives and research queries, the following steps will be required as a part of the integrated approach of the thesis:

(1) In Bangladesh, there are almost no data freely available for higher research work, especially when the modern technologies like GIS and remote sensing data are concerned. Therefore, I needed to develop suitable databases which are very time consuming and complicated and needs to careful planning and skill prior to start of the fieldwork and analysis. Besides that, what form of data is available, and the quality of data sometimes is not easy to discover. My major work involved here:

    (a) Collecting GPS data by the local NGOs (Name of the NGOs, working area, latitudinal and longitudinal information's of each NGO, total number of savers, borrowers, amount of saving deposits and amount of outstanding's) whose are working on poverty alleviation, agricultural development and educational sectors and integrated with GIS data (union level).

    (b) Collecting the educational data (name of the schools, total number of the students both male and female, type of the school, current condition of the schools, geographical location of the school, facilities provided by the schools such as, electricity, computer facilities, playground facilities, source of drinking water, distance from the house) from the rural schools using GPS and analyzing the spatial distribution of NGOs and schools.

    (c) Developing GIS databases (NGOs, commercial centers and schools) and collecting population data like total number of population in a union level, total number of households, literacy rate of male and female, population

density, total number of agro-workers involved in agricultural activities both male and female, total number of industrial workers involved in industrial activities both male and female from the census reports of 2011 in a GIS format.

      (d) Collecting data on trained farmers at a union level, their profit per *Bigha,* their education, income and writing the facilities provided by local NGOs, the involvement of local poor people to NGOs micro-credit program and those are integrated with census and GIS data.

(2) Digitize google earth images and Landsat TM images for identifying agricultural land use and identify the chronological changes of river shifting, agricultural attributes collected from censuses, educational attributes collected from BANBEIS, from the fieldwork where census and social data can be integrated. I also needed a GPS survey for the major landmarks and features like ponds and roads and to locate union and mouza boundaries and plot numbers (depending on the availability of data) based on the lowest administrative units using DLRS (Directorate of Land Records and Surveying) and LGED (Local Government Engineering Department) maps.

(3) All of the images and GIS format data should be digitally geo-corrected and geo-referenced with sufficient GCP (Ground Control Points) based on GPS surveying.

(4) There is a need to talk to the local people about the seasonal variation and context of a seasonal crop calendar and historical land use dynamics.

(5) Population census data and the settlements on the images have direct links. I need to identify the various types of settlements like *pakka, semi-pakka* and *katcha* and their distribution pattern with respect to local land types and the physical condition to measure rural development.

(6) Carry out a detailed survey of 126 unions of 5 districts using 533 questionnaire survey (semi-structured), 50 Focus Group Discussion (FGD) where each group consist 5 to 6 persons, Key Informant Interviews (KII) and Household Survey (HHS) randomly and try to assess the impact of micro-credit to the rural development.

(7) Collecting growth centers/ rural markets data using GPS and integrate with NGOs information's and socio-economic data along the riverside of Jamuna, Bangladesh.

So, the main objectives of the study is to identify the facilities provided by NGOs, particularly in three sectors such as education sector, micro-credit sector and agricultural sector to rural development along the riverside of Jamuna, Bangladesh. Appropriate methods will be developed to co-ordinate between the technology (GIS and RS) and information (Census and Maps) media.

1.5 Definitions of the special terms

There are some geographical and statistical terms used in my thesis. It is particularly important for a clear and concise definition, which enables us to have a common understanding of a word or subject. Some definitions are described below:

(1) Rural area and rural development

Rural area is an isolated area with low population that is positioned on the outside of the towns or cities where roads, communication facilities, electricity, gas, water supply, sewerage connections usually do not exist and the majority of the population involved in non-agricultural occupations. Different countries have different perceptions on rural areas.

According to the FAO, the definition of a rural area should have two principles. First one connected to the place of residence and land settlement pattern and the other associated with the type of work that inhabitants engage in. Rural areas are usually open areas, where there is a low concentration of population densities. A high proportion of the land used is for primary production, i.e. mining, agriculture, livestock, forestry, fisheries (BBS, 1988). Besides that, the inhabitants of rural areas are mainly directly or indirectly dependent on primary production activities. Alternatively, population in the rural area of Bangladesh is highly dense with respect to UN standard and it is about 800 to 900 people are living in per square kilometer in the rural area of Bangladesh (UNICEF, 2011). According to Ashley and Maxwell in 2001,

> "The concept of rurality, some authors had used a multi-criteria approach defining rural areas as a space where human settlement and infrastructure occupy only a small share of the landscape; natural environment controlled by pastures, forests, mountains and deserts; settlements of low density about 5-10,000 persons; places where most people work on farms; the availability of land at a relatively low cost and a place where activities are affected by a high transaction cost, associated with long distance from cities and poor infrastructures".

On the other side, rural development is the way of improving the quality of life with economic development of individuals or community level who are living in relatively isolated and sparsely populated areas (BBS, 1996). It is a social and economic improvement of the rural areas. Rural development generally used to take initiatives to improve the standard of living in non-urban remote villages (BBS, 1988). Besides that, rural development can be defined as a process leading to sustainable improvement in the quality of life of rural poor people by providing credit service for improving economic status, provide basic educational facilities, investment in basic infrastructure and ensure social services, justice, equity and security, dealing with the injustices of the past, safety and security of the rural population, especially that of women (Quisumbing, 2007). According to Robert chambers,

"Rural development is an approach to assist a specific group of people, poor rural women and men, to improvement for themselves and their children more of what they want and need. It includes helping the poorest among those who seek a livelihood in the rural areas to demand and control more of the benefits of rural development. The group includes small-scale farmers, tenants and the landless".

Rural development is being well-defined as the development in the living standard of the rural inhabitants by connecting them in different productive activities like developing rural industries, improvement in fisheries sectors, making agricultural industry and village forest that will increase their monthly income. It is seen by the scholars that sustainable living of the rural poor by giving them the opportunity in economic sectors to develop and show their full potentials (Serajuddin et al., 2006).

(2) Rural population and rural poverty

Rural population refers to the people who are living in rural areas, which were defined by national statistical offices. The rural population is calculated to determine the difference between total population and urban population. According to World Bank Staff estimates based on the United Nations, rural population in Bangladesh was 65.72% of the total population as of 2015. Its highest value over the past 55 years was 94.87% in 1960, whereas its lowest value was 65.72% in 2015.

Rural poverty refers to the economic circumstance in which, a person is incapable to enjoy a minimum standard of living because their earnings are too small to buy the basic necessities of life (Ratha, 2003). The rural poor people in Bangladesh suffer from unemployment, have no access to credit, lack of transportation and communication facilities as well as lack of access to resources that control their capability of carrying a comfortable life (Sen et al., 2007). The visibility conditions are in ill health, poor housing conditions, less agricultural production, illiteracy rate, maternal health, poor communication and lack of transportation facilities and so on. The cultural barrier, demographic condition, economic situations, social systems, political instability and natural disasters like flood, drought, and cyclone are the main causes for the development of the rural areas in Bangladesh (Ratha, 2003).

Rural poverty refers to the poverty, which is found in the rural areas. Poverty is a situation in which a person or community is in deficiencies of essentials for a minimum standard of life. Although poverty is assumed in many senses, these essentials may be material resources such as food, safe drinking water, and shelter or maybe social resources like access to information, education, healthcare, social status, political power, or the opportunity to develop meaningful connections with other people in society (Quisumbing, 2007). The economy of the country is predominantly rural where the government of Bangladesh along with non-government organizations had been undertaking and implementing rural development and poverty alleviation activities by

providing them credit program, making infrastructural development and improvement in transportation and communication systems, irrigation facilities, rural industries, area development, livestock and fisheries development as well as input distribution and training (Sharma, 2007).

(3) Agriculture, economic and population census

An agricultural holding is a techno-economic unit of agricultural production under single management, including all livestock and entire land used or partly for agricultural production purposes (BBS, 2011). The specific objectives of the Agricultural Census are-

"to determine the number of agricultural holdings, area of holdings and average size of holding; to determine the number and distribution of households engaged in agriculture; to determine the economic and employment size of the agriculture sector; to determine the number of wage labour by gender employed in agriculture sector; to determine the irrigated area under different crops; to determine the stock of livestock and poultry; to measures of the state and changes in attributes relating to the structure of agriculture such as the size and distribution of holding, tenure ship, size and type of farming, extent of agriculture resources etc; to provide benchmark data for improving current estimates of crop acreage, production and livestock resources and to form a basis for the formulation, development and implementation of the programme and policies of agricultural development of the country".

According to the Economic Census (2010), economic census is defined as

"an economic census is a statistical survey conducted on the full set of economic units belonging to a given population. It is the complete enumeration of a population or groups at a point in time with respect to well-defined characteristics. An economic census is the processes of collecting, compiling, evaluating, analyzing and publishing or otherwise disseminating economic data relating at a specified time, to all units in a country or in a well-delimited part of a country".

Sometimes, some economic activities like agriculture may be carried out in the household places which are called household economic activities and treated to be economic units (BBS, 2011). Economic Census covering the whole of Bangladesh was conducted in four broad types of economic units: (1) permanent establishments (2) temporary establishment (3) household premise based activities and (4) household floating activities (BBS, 2011).

Population census is the authorized count of the population in a country. It is well defined by the United Nations through total process of collecting, compiling and publishing demographic, economic and social data concerning at a specified time or

times including all persons in a country or defined region. According to the UN, the census includes some aspects such as Individual record, Universality within a defined territory, Simultaneity and Defined periodicity. The Population Census covered some useful aspects; first one is geographic characteristics which includes place where found at time of census or place of usual residence, place of birth, duration of residence, place of previous residence, place of work, total population, locality, urban and rural; second one is personal and household characteristics which includes sex, age, relationship to head of household/ relationship to head of family, marital status, duration of marriage, marriage order, children born alive, children living, citizenship, literacy, school attendance, educational attainment/educational qualification, national/ethnic group, language, religion, household composition, family composition; third one is economic characteristics which include type of activity, occupation, industry and main sources of livelihood, socio-economic status, dependency rate (BBS, 2011).

(4) Household

Persons who are living under one roof or resided in a separate housing unit (residence, such as a house, apartment), having either direct contact to the public area or a separate cooking facility is known as a household. Where the members of a household are related by blood or by law, they constitute a family. The report on a matrix of statistical terms, concepts and definitions used in census, surveys of the BBS, and other national and international agencies defined household as-

> "Person or persons related or unrelated, living together and taking food from the same kitchen form a household. The household is divided into three categories: dwelling, institutional and other. Household may be either (a) a one-person household, that is, a person who makes provision for his own food or other essentials for living without combining with any other person to form part of a militia person household or (b) a militia person household, that is, a group of two or more persons who make common provision of food or other essentials for living. The person in a group may pool their incomes and have a common budget to a greater or less extent; they may be related or unrelated persons or a combination of both" (BBS, 2011).

Another definition from BBS in 2011,

> "A household means a group of persons normally living together and eating and cooking in common arrangement with their dependents, relatives, and servants. A household may be a one-person household or a multi-person household. In other words, when a group of persons living together generally maintain a family or family-like relations and take meals from the same kitchen is termed as a household. In some cases, there may be more than one household in a single house or in one dwelling arrangement. Similarly, a household may have more than one house or structure or shed".

(5) Household income

Household income means which are earned from wages and salaries, pensions, contribution and professional fees by household members are estimated on a monthly basis. There is some income counted on the yearly basis such as income from interest, bonuses, earnings from agricultural activities, business, commercial and industrial establishment, land property, rent, gift and assistance and insurance benefits (Bangladesh Bureau of Statistics, 2011).

(6) Household Economic Survey (HES)

The Household Economic Survey (HES) includes information on household expenditure and income, as well as a wide range of demographic information on individuals and households. It also includes source of income like wages and salaries, self-employment, investments, or benefits. Purchases are recorded and services are added in the household economic survey such as fruit and vegetables, footwear, cars, electricity, telecommunications and health. The primary objective of HES is to know personal and household income, housing costs, and living standards have changed over time. Information from HES is used to support policy development and decision making by government agencies.

(7) Literacy and adult literacy rate

According to the Bangladesh Bureau of Statistics (BBS, 2011):
"Literacy is defined as ability to write a letter in own language. Literacy rates may be calculated in relation to (a) population of all ages (b) population 5 years and above and (c) population fifteen years and above. The last one is the adult literacy rate. According to population census, a person who is able to write a letter has been considered as literate".

According to the Bangladesh Bureau of Statistics (BBS), 2011: "The adult literacy rate is defined as the ration of the literate population of age 15 years and above as a percentage of total population of the same age group".

(8) Questionnaire and interview survey

Surveys can be divided into two broad categories (BBS, 2012). The first one is questionnaire survey and another one is the interview. A questionnaire survey is a research tool containing a series of questions and other prompts for the purpose of collecting information from the respondents (BBS, 2012). Questionnaires have some benefits such as cheap, do not require as much strength from the questioner as verbal or telephone surveys and often have consistent answers that make it simple to compile information's. In the interview survey, the interviewer works directly with the respondent whereas the interviewer has the opportunity to an inquiry or ask to follow up questions and interviews are generally easier for the respondent (Bangladesh Bureau of Statistics, 2011).

(9) GIS and GPS survey

A geographic information system (GIS) gives us to visualize, question, analyze and interpret data to understand relationships, patterns, and trends (Frank, 1984). It can help individuals and organizations and better interpretations of spatial patterns and relationships (ESRI, 1999). GIS stored locations information's that expressed in different ways, such as latitude and longitude. GIS includes a variety of data, such as population, income, or education level. It also can include information about the landscape, such as the location of streams, different kinds of vegetation, erosional and depositional information's and different kinds of soil, sites of factories, farms, and schools or storm drains, roads, and electric power lines (Enwistle et al., 1998).

Global Positioning System (GPS) is used for surveying and mapping community because it gives more accurate and reliable latitudinal and longitudinal data (Doll, 2000). The features are measured by the GPS, which can be displayed on maps, and in Geographic Information Systems (GIS) that stores, manipulates and displays geographically referenced data. Recently, GPS is a vital part of surveying and mapping activities around the world (Cudlip, 1999).

(10) Remote sensing

Remote sensing is gaining information about an object or phenomenon without making physical interaction with the object and thus in contrast to on-site observations. Remote sensing has a wide range of applications in many different fields such as coastal applications, ocean applications, hazard assessment and natural resource management (Kauth et al., 1976). The applications of RS in the field of coastal applications are analyzed sediment transport in the coastal areas, observe chronological shoreline changes, mapping coastal features and finally used for coastal mapping and erosion prevention (Carlson et al., 1999). The applications of RS in the field of oceanic zones are measured ocean temperature, oceanic slope, wave heights, monitor ocean circulation and current systems and then monitoring and management of ocean resources (Chen, 1998). The applications of RS in the field of hazard assessment, monitoring erosion and deposition in the river area, tracking hurricanes, earthquakes, and flooding (Collins and Woodcock, 1996). Furthermore, remote sensing data is used to mitigate before and after a hazardous event, create preparedness strategies and reduces the impact of hazards and disasters (Cowen and Jensen, 1998). The applications of RS in the field of natural resource management have identified chronological changes of vegetation cover, monitoring the land use and landform, changes of river shifting, map wetlands, monitoring land level, monitoring and mapping mining area, monitoring forest area, monitoring water resources and chart wildlife habitats (Ormsby, 1992).

(11) Growth center

The definition of growth center doesn't carry the same meaning throughout the world. According to Economic and Social Commission for Asia and the Pacific (ESCAP), the centers that contribute directly to the basic desires of agricultural producers, both in respect of economic and social services are designated as growth centers. These services contain the facilities of the marketing of agricultural products and the preparation for agricultural inputs that are fundamental for the production of agricultural commodities. In the context of Bangladesh, growth centers are actually rural markets that are commonly known as a *hat* or *bazaar* (Adam, 2010). A hierarchy exists in the rural market/ growth centers of Bangladesh. There are three types of rural markets had seen in Bangladesh. These are primary market, local assembly market and finally secondary market (Ramesh, 1971).

(12) NGO and local NGO

The term Non-government Organization (NGO) is very well known in Bangladesh and the administration has developed certain constitutions and laws to authorize the NGO activities. NGOs are usually defined as an association of persons organized on a voluntary basis through the initiative of one or more dedicated person committed to the planning and implementation of development projects at the grass root level (Zaman, 2006). NGOs are working in the various sectors such as agriculture, education, health, and sanitation as well as micro-credit sectors to the betterment of rural poor people (BRAC and Save the Children, 2005). There are mainly two types of NGOs that are working in Bangladesh such as level of orientation and level of operation. NGOs type by level of orientation are charitable orientation, service orientation, participatory orientation and empowering orientation. NGOs type by level of operation are community-based organizations (CBOs), city-wide organizations, national NGOs and international NGOs (Ahmed, 2009).

The definition of local NGOs is defined as an organization, which runs their programs in only a few villages, collecting funds mostly from local sources or from national or international organizations. Local NGOs are also working on rural development by providing the facilities in education sector, agricultural sector, health, and sanitation as well as micro-credit sectors to the betterment of rural poor people (BRAC and Save the Children, 2005).

(13) *Char* land

Char land is defined as an island surrounded by the river that is unsustainable because of geographical settings. There are two types of *char* like island *chars* and attached *chars* had seen in Bangladesh (Kabir, 2006). A difference should be made between island *chars* which are surrounded by water year round and attached *chars* which are linked to the mainland under normal flow, such lands are commonly called

chars in Bangladesh. The island *chars* are found to be flooded more vigorously than the attached *chars*. *Chars* are in the relatively lower reaches, where land is more fertile and the cropping intensity is very high. Every year a large portion of the *char* areas is flooded. If a flood comes early, it damages the crops and homestead. Therefore, the rural poor in the *chars* build their house on the highest land to avoid annual inundation (Baqee, 1986).
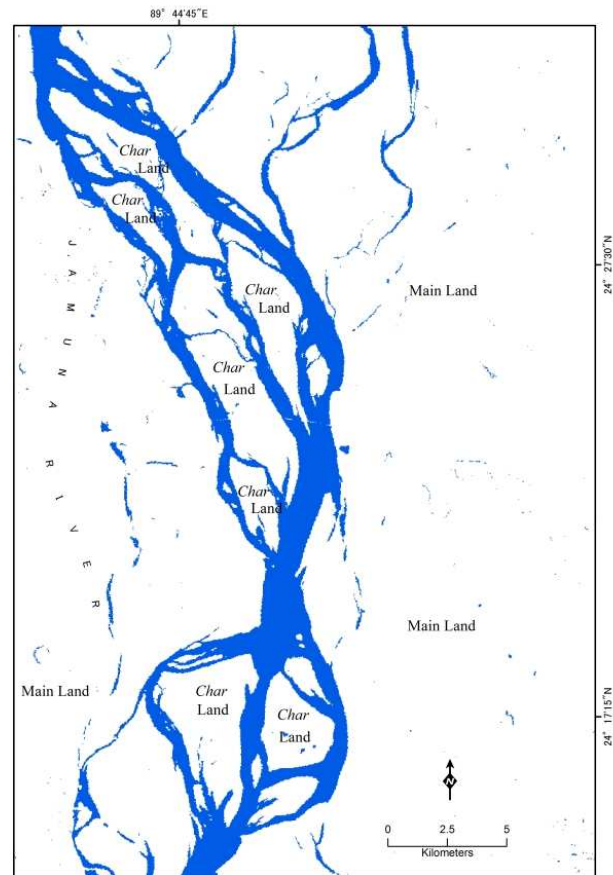
Figure 1-1: *Char* formation within the braided belt of the Jamuna, Bangladesh
Source: Made by the author, 2017

(14) *Pakka* and *katcha* infrastructure

In Bangladesh, Infrastructure in general is classified into four types according to location. First one is *Jhupri* which is made of jute sticks, tree leaves and jute sacks. Second one is *katcha* infrastructure which is a temporary structure and made of mud brick, bamboo, sun grass, wood and rarely used iron sheets as roofs. Third one is semi *pakka,* which is semi-permanent and partially made of bricks, floors are cemented as well as used iron sheets as roofs. Finally, *Pakka* infrastructure that is a permanent structure and lifespan over 25 years. The walls and roofs are made of bricks and concrete. The dominant type of housing by building material is *katcha* type in the rural areas of Bangladesh (World Bank, 1996).

Table 1-1: Infrastructural types in Bangladesh, 2001

Structure	Total		Urban		Rural	
	Number (*000)	Percent	Number (*000)	Percent	Number (*000)	Percent
Jhupri	2202	8.8	434	7.6	1768	9.2
Katcha	18625	74.4	2732	47.7	15893	82.3
Semi-pakka	2535	10.1	1321	23.1	1214	6.3
Pakka	1672	6.7	1241	21.7	431	2.2
Total	25034	100.0	5728	100.0	19306	100.0

Source: Population Census 2001, Volume 3, Urban Area Report (BBS, 2008)

(15) Administrative boundary

The administrative divisions of Bangladesh are mainly Division, District, Upazila (Sub district), and Union (Sub-upazila). The Union is comprised of several villages, mouzas, and wards. It is the lowest order electoral unit. The hierarchy of the administrative boundary from small to large likes Union- Upazila- District- Division. Bangladesh is divided into 8 Divisions (*Bibhag*) and 64 Districts (*Zila*), although these have only a limited role in public policy. For the purposes of local government, the country is divided into Upazila and Union Council. The below table outlines the six tiers of government in Bangladesh (Bangladesh Bureau of Statistics, 2011).

Table 1-2: Administrative orders of Bangladesh and their respective average population and area size

Administrative Order/Units	Total Subunits	Average size in 2011	
		Population	Area in km²
Division	8	123.1 million	18,446
District	64	20.5 million	2,306
Upazila	490	1.9 million	301
Union	4,553	228.1 thousand	32
Mouzas	59,990	27.7 thousand	2

Source: Bangladesh Bureau of Statistics (BBS), 2011

(16) *T. Aman, Boro* and *T. Aus rice*

Bangladesh is one of the largest agricultural producing countries, whereas agriculture has a good impact to the national GDP. The land of Bangladesh is very fertile where diversified crops have grown. Several types of crops are produced in this country and these crops have been characterized into two major types such as food crops and cash crops. Rice is cultivated in Bangladesh throughout the year. There are three major

types of rice found such as *Aus, Aman* and *Boro*. Broadcast and transplanted *aman* is commonly cultivated in December to January, *Boro* in March to May and *Aus* in July to August cropping seasons. Among these cropping's transplanted *aman* is most important and occupied about 46% of the rice cultivated land in the year of 2009-2010 (Banglapedia, 2014).

Table 1-3: Area and production of rice in Bangladesh (2009-10)

| Crops | Crops Types | 2009-2010 | | |
		Area (*000) Acres	Yield per Acre (kg)	Production (*000) m tons
Aman Rice	Broadcast	1,175	482	567
	T. Local *Aman*	3,495	640	2,237
	T. HYV *Aman*	9,323	1,008	9,403
	Transplanted *Aman*	12,818	908	11,641
Total *Aman*		13,993	872	12,207
Boro Rice	Local *Boro*	265	807	214
	HYV *Boro*	9,671	1,511	14,622
	Hybreed *Boro*	1,694	1,902	3,222
Total *Boro*		11,631	1,553	18,059
Aus Rice	Local *Aus*	832	472	393
	HYV *Aus*	1,600	822	1,316
Total *Aus*		2,432	702	1,709
Total Rice		28,057	1,139	31,957

*T. Local= Transplanted Local, T. HYV= Transplanted High yielding Variety, HYV= *Transplanted High yielding Variety*
Source: Banglapedia (National Encyclopedia of Bangladesh), 2014

Broadcast *Aman* or local transplant *Aman* has been cultivated in Bangladesh from the beginning. However, the local variety of *Aman* gives lower rate of production, but its rice tastes good and nutrition value are higher. High yielding variety (HYV) *Aman* has been created for its high yielding capability. HYV *Aman* is generally transplanted in the higher zone, which is mainly flood free area. Due to high yield rate and low coat irrigation, growing demand of cereals, local variety is being replaced by HYV. Hybreed *Aman* is another type of paddy in the country. The planting and harvesting time of Hybreed *Aman* is the same as HYV *Aman* (Banglapedia, 2014).

BANGLADESH
Crops Cultivation Area of T. Aman, Boro and Aus Paddy
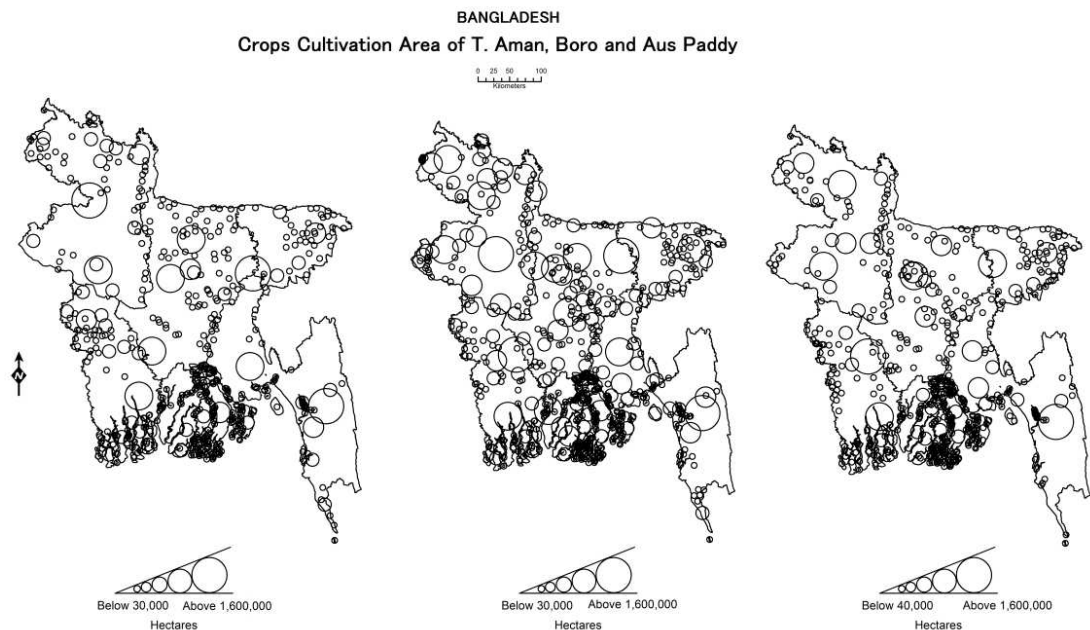
Figure 1-2: Cultivation area of *T. aman, Boro* and *T. aus* rice in 2009-2010, Bangladesh
Source*:* Made by the author, 2017

(17) Arable land

Arable land is the total area that is normally used for the crop production such as cereals and vegetables. On the other hand, land capable of being cultivated and used to grow crops (Banglapedia, 2014). Arable land is the land of temporary agricultural crops such as multiple-cropped areas are counted only once, temporary meadows for mowing and land under market and kitchen gardens and land temporarily fallow (less than five years).

1.6 Major local NGOs provisions to rural development

Numerous non-governmental organizations were found in the study area working on almost every sector. The purpose and scope for their work change along with the type of project, for which they receive funding. NGOs like ASA, BRAC, Grameen Bank, RDRS Bangladesh are national level NGOs and work exclusively all around the country. A complete list of all NGOs presently working in our study area is being identified during household surveys and Focused Group Discussions (FGD) as well as in existing government reports is given below in Table 1-4.

Table 1-4: List of NGOs in the study area

No	Branch Name	Frequency	No	Branch Name	Frequency
1	AKOTA	2	16	PRODIPON	1
2	ARBAN	1	17	PROGRESS	1
3	ARCHES	3	18	RDRS Bangladesh	22
4	ASA	35	19	RSDA	1
5	Atto Mohila Unnaion Somity	1	20	Sajida Foundation	1
6	Bhomukhi Mohila Unnaion Somity	1	21	SAP	1
7	BRAC	31	22	SATU	1
8	DORP	1	23	SKS	7
9	GKS	1	24	SSS	6
10	Grameen Bank	31	25	Thangara Mara Mohila Sabuj Songo	1
11	GUK	9	26	TMSS (Thakurgan Mohila Sobuj Sango)	4
12	MMS	2	27	UDDIPAN	1
13	NDP	3	28	Uddog	1
14	PDBF	1	29	UDPS	2
15	Porosh	1	30	US	2
				Total	175

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

There are 30 NGOs with 175 branches working along the riverside of Jamuna, Bangladesh. They are working in the several sectors i.e. education, agriculture, health and sanitation and micro-credit sectors to improve the quality of the daily lifestyle of the rural poor people. The description of the prominent NGOs is as below:

(1) Association for Social Advancement (ASA)

The Association for Social Advancement (ASA) is non-governmental organization intended to improve the socio-economic conditions of the poor community in the rural area of Bangladesh since it's beginning in 1991. It is a non-profit and a self-sufficient microfinance institution. ASA's program focused on awareness-raising, social and economic development and making a peaceful society, free from social discriminations as well as group formation for integrated development of the remoter through asserting the rights of the poor like education, mini-irrigation, primary health, credit for income generation. The main mission of the ASA is to make a positive and sustainable socio-

economic change in the lives of the rural poor through micro-finance by various social development programs and services. The strategic goals of ASA are as below:

   (a) Making livelihood opportunities for the rural poor people by involving them in credit program;

   (b) Ensure basic social services such as health and sanitation, formal and non-formal education and nutrition;

   (c) Making sense of sustainable management of the environment within the rural community to reduce the impact of climate change and disaster;

   (d) Raise of human rights, social justice and legal rights of the needy rural poor people through the NGOs awareness building program;

   (e) Development of skilled labour through training;

   (f) Reduction of child labour and human trafficking; and finally

   (g) Prevention of spreading HIV and drug addiction amongst vulnerable portion of the population.

ASA works in diversified fields of sustainable development in the rural areas of Bangladesh. Major focus areas are: microfinance, water and sanitation, health sector, renewable energy, carbon reduction and generation of green energy, climate change and the environment, bi-product recycling, waste management, education, promotion of local honey, capacity building for disadvantaged communities through IGA training, empowerment of the poor, especially women through the provision of diversified microfinance products (ASA, 2015).

(2) Bangladesh Rural Advancement Committee (BRAC)

BRAC is an international and non-governmental development organization started its journey in early 1972 as a relief measures subsequent of the war of liberation. Thereafter, they are working on community development, providing health, family planning, education and economic support to different sectors of the rural poor community. Particularly, they give more importance to the women, fishermen and the landless who are unprivileged from education, health and sanitation. However, BRAC has been working entirely with deprived people of the community since 1977. One of the major program of BRAC is Rural Development Program (RDP). BRAC's rural development programmes are as below:

   (a) Making sustainable organizations of the rural poor for getting desired changes in their own socio-economic and political environments;

   (b) Improving the socio-economic status of the rural poor people through the provision of a credit program for income generating activities; and

   (c) Inspiring rural poor to develop the managerial and entrepreneurial capabilities.

To reach the above objectives, RDP works through different mechanisms in the below sequential order:

(a) Conscientization: RDP starts conscientization program through BRAC's efficient education curriculum and classes are held separately for men and women;

(b) Institution building: The efficient education classes usually lead to the development of village organizations for both men and women;

(c) Training: Different types of training are organized for the members of newly formed groups, whereas some training are held at BRACs own training centers and others are held in RDP's local offices. The programs also provide legal awareness to group members;

(d) Credit program: Provide easy credit services to the rural poor people for income and employment generating activities;

(e) Credit for agricultural activities: Provide credit facilities to the rural poor for the agricultural development; and

(f) Technical and logistical support. Sometimes, income generation activities like vaccines for livestock and poultry and marketing of locally produced items such as garments may require a higher level of technical and logistical support which are delivered by BRAC.

The principles of credit program under Rural Development Program (RDP):

(a) Borrowers are normal use the loan according to their said purpose and no loan is given for consumption purposes. Loan repayment is started on a weekly basis;

(b) Loans are given to members by the recommendation of their village organizations;

(c) No collateral is demanded. BRAC has to inquire earlier about the borrower's ability to carry out the proposed project and its potential profitability. Once loan is given to procure an income producing asset, however, the asset remains hypothecated to BRAC until the full recovery of the loan.

(d) The amount of the loan depending on the nature of the scheme.

(e) There are three lengths of duration for credit. These are:
1. Short-term for a period of 12 months or less
2. Medium-term credit for a period greater than 1 year but less than 3 years
3. Long-term credit for 3 years or more.

BRAC works in various fields of sustainable development in the rural areas of Bangladesh. Major focus areas are: microfinance, education, health and sanitation, climate change and environment, capacity building for underprivileged communities, disaster relief as well as agricultural sectors like provide credits, seeds, fertilizer and agricultural tools. They are also working on malnutrition and diseases through the Integrated Development Programme (IDP) in the rural areas of Bangladesh (BRAC, 2017).

Table 1-5: Chronological history of BRAC at a glance

Year	Activities
1972	Started its journey after the independence of Bangladesh.
1974	BRAC had started providing micro credit facilities to the rural poor and had started evaluating the usefulness of credit inputs in the lives of the poor.
1977	BRAC shifted from community development towards a more targeted approach (Targeted the poorest of the poor) by organizing village groups called Village Organizations (VO).
1979	Started working on health and sanitation sector and established Oral Therapy Extension Programme (OTEP)
1985	Started non-formal primary education in the rural areas of Bangladesh
1986	BRAC had started Rural Development Programme (RDP) that included four major activities i.e. institution building including functional education and training, credit operation, income and employment generation and support service programmes.
1991	Working on women's health through women's health development program and established a Centre for Development Management (CDM).
1996	Working on social Development, human rights and legal services
1998	Launched BRAC's Dairy and Food project by establishing information technology Institute.
2001	BRAC established a university called BRAC University.

Source: Wikipedia, The free encyclopedia, 18 July 2017.

(3) Grameen Bank

The Grameen Bank is a microfinance organization and community development bank initiated in Bangladesh. The name Grameen is derived from the word *"gram"* which means "rural" or "village" in the local Bengali language. Grameen Bank had started its journey in 1976. Muhammad Yunus, who took the first initiative toward establishing the Grameen Bank in Bangladesh and initiated a project to study how to design a credit delivery system to provide banking services to the rural poor people in Bangladesh. According to project findings, in October 1983 the Grameen Bank was certified by national legislation as an independent bank. The major objectives of the Grameen Bank are as below:

(a) Spread the banking services to the rural poor people, both men and women;
(b) Reduce the exploitation of the money lenders;

(c) Make opportunities for self-employment for the vast unutilized and underutilized manpower resources;

(d) Carry the underprivileged people within the framework of some organizational format where they can find socio-political and economic strength through mutual support;

(e) Grameen Bank targets the poorest of the poor and their emphasis on women, who receive 95% of the bank's loans; and

(f) Grameen has diversified the types of loan, such as seasonal agricultural loans, housing loans and loan for equipment and livestock;

Credit delivery system of Grameen Bank:

Grameen Bank credit delivery system has the following features:

1. Exclusive focus on the poorest of the poor

   Ensuring and establishing eligibility criteria for the targeted people and women gets priority to Grameen credits.

2. Borrowers are organized into small uniform groups

   Such characteristics assist group harmony as well as participatory interaction among the group members.

3. Special loans are particularly suitable for the poor

   Special loans are particularly suitable for the poor and it includes

   A) Grameen loans given to the rural poor without any collateral

   B) Loans are repayable in weekly instalments

   C) Eligibility for a consequent loan depends upon repayment of the first loan

   D) Individual, self-chosen, quick income generating activities which make eligibility for special loan

   E) Intense supervision of credit by the group members as well as the bank staff

   F) Special safe guards through savings to minimize the risks that the poor confront

   G) Transparency in bank transactions, most of which take place at centre meetings.

4. Immediate responsibility of a social development program addressing basic needs of the clients.

   A) Increase the social and political awareness

   B) Focus more gradually on women from the poorest households

   C) Inspire their monitoring of social and physical infrastructure projects such as housing, sanitation, drinking water, education and family planning.

5. Development of organization and management systems

6. Expansion of loan to meet various development needs of the poor

   A) Credit for making sanitary latrines

   B) Credit for fitting tube wells that supply drinking water and irrigation for kitchen gardens as well as the agricultural land

C) Credit for seasonal cultivation to buy agricultural inputs like seeds, fertilizer and agricultural tools

D) Credits for rental equipment's or machinery

E) Finance plans started by the entire family of an experienced borrowers

Loans are small, but ample to investment in the micro-enterprises started by borrowers in several sectors like rice-husking, machine repairing, purchase of rickshaws, buying of milk cows, goats, cloth and pottery. The interest rate on all loans is 16 percent (Grameen Bank, 2017).

Table 1-6: Chronological history of Grameen Bank at a glance

Year	Activities
1974	He was motivated during the famine in1974 of Bangladesh to make a small loan of US$27 to a group of 42 families as business money.
1976	Grameen Bank was initiated by the Professor Muhammad Yunus.
1979	Grameen Bank was extended towards Tangail district which is nearer to capital city of Dhaka.
1983	Grameen Bank was authorized and established as an independent bank.
1984	Grameen applied to the Bangladesh Bank for setting up a housing loan program for rural poor people who are engaged in Grameen Bank program.
1998	Grameen Bank's repayment rate hurt from the economic disruption due to flood in Bangladesh, but it recovered in the successive years.
1999	Grameen has prepared housing loans totaling $190 million to build over 560,000 homes
2006	The Bank remains to expand across the Bangladesh and thereafter, the number of Grameen Bank branches increase to 2,100.

Source: Wikipedia, The free encyclopedia, 18 July 2017.

There are four principles of Grameen Bank such as discipline, unity, courage and hard work. Grameen Bank is working on community development by providing credits and trainings and information in different sectors such as constructing new houses, trained farmers to grow vegetables all the year round, training on seedlings and plantation, plan to keep our families small, educate their children and ensure that they can earn to pay for their education, making clean environment, build and use pit-latrines, drink water from tube wells, discourage to practice child marriage, collectively undertake bigger investments for higher incomes and finally encourage to all to part in all social activities jointly (Grameen Bank, 2017).

(4) RDRS Bangladesh

RDRS Bangladesh started its journey in 1972 to support with relief and rehabilitation of greater Rangpur-Dinajpur region immediately subsequent the War of Independence of Bangladesh in 1971. The vision and mission of RDRS are as below:

(a) The vision of RDRS is making "peaceful society where citizens live in dignity, freed from poverty, distress and ignorance in a sustainable environment".

(b) The mission is to "works with the rural poor and their organizations in order to build their capacity to advance their empowerment; create resilience to withstand adversity; and improve access to opportunities for the poor to realize decent lives free from poverty and distress" (RDRS, 2017).

Table 1-7: RDRS Bangladesh at a glance

Categories	Current Status
Core values	Core values are compassion, long-standing commitment to empowerment, equality and participation, integrity, dedication, and professionalism, responsibility, accountability and transparency.
Governance	RDRS is governed by a Board of Trustees.
Legal Status	RDRS Bangladesh is registered under NGO Affairs Bureau and registration number is 003.
Working area	RDRS working with underprivileged rural poor in the northwest (24,376 sq. Km) Bangladesh and they delivers development facilities and services to 3,720,458 landless remoter and marginal families in 15 districts as well as working with 385 community based organizations.
Upazilas (sub-districts)	93 (of 490 nationwide)
Unions	683 (of 4,451 nationwide)
Population of Working Area	25 million (of 156 million)
Groups	30,000
Federations	385

Source: RDRS Bangladesh, Associate program of LWF/DWS, Geneva.

(5) Prodipon

Prodipon derived from the Bengali term, which means enlightenment. Prodipon come into the field of social and community development in 1983 as a voluntary NGO. They are working on human basic needs through socio-economic development

initiatives. Prodipon gives special importance on human development, raising social awareness and empowerment of the beneficiaries who are involved in NGOs credit program which finally support local people to make a development institution (Prodipon, 2017). The mission of Prodipon is

"To assist the process of organization building of the poor and deprived towards socio-economic empowerment with the specific target for children, gender, environment and climate change needs".

Major programs taken by Prodipon:

(a) **Child Protection:** Strengthening local bodies to decrease child poverty and promote the rights of vulnerable children. The child feeding programme is also initiated by Prodipon.

(b) **Economic Empowerment:** Prodipon initiated many projects for the socio-economic development of the rural poor such as Financial Support for the Poorest (FSP); Livelihood Restoration Program (LRP); Micro Enterprise (ME); Rural Micro Credit (RMC); Ultra Poor Program (UPP) and finally Rural Women Employment Creation Project (RWECP).

(c) **Livelihood Rehabilitation in Climate Change:** Bangladesh is highly vulnerable to climate change where the extreme poor suffer a lot in the rural areas. Therefore, Prodipon had taken major projects like household economic and food security of extreme poor and ensure technical support in livelihood recover to serve rural poor people during the vulnerable time.

(d) **Education:** Prodipon had taken the basic education project for the poor people and started the feeding program in school.

(e) **Environment and Climate Change:** For making clean environment, Prodipon had taken solid waste management project, clinical waste management project and finally climate change adaptive livelihood program.

(f) **Human Rights:** Prodipon also works on ensuring human rights of the rural poor people.

(g) **Water and Sanitation:** Prodipon is working on pure drinking water supply and providing health and sanitation support.

(6) Gana Unnayan Kendra (GUK)

Gana Unnayan Kendra (GUK) started its journey in 1985 as a socio-economic and community development organization that has been working in northern part, i.e. Gaibandha, Rangpur, Kurigram, Nilphamari, Lalmonirhat, Dinajpur, Panchagarh, Thakurgoan, Joypurhat and Kustia of Bangladesh. Mainly they are putting emphasis on social and economic development of the poor and extreme poor people in Bangladesh. GUK's working areas are as below:

(a) They are working particularly in the arena of strengthening leadership quality of grassroots poor by providing credits;

(b) Take many initiatives to make empowerment of women in the rural areas of Bangladesh;

(c) Making employment opportunities and ensuring the livelihood of poor and extreme poor in the rural areas of Bangladesh;

(d) Working on disaster management and ensuring mitigate facilities among the poor and extreme rural poor people;

(e) Give health and sanitation facilities to the rural poor people;

(f) Ensuring maternal health support to the rural villagers;

(g) GUK takes initiative for training program where they trained local poor people how to utilize local resources in their daily life activities; and

(h) Working on primary education in the rural areas of Bangladesh

Strategic objectives of GUK's are:

(a) Human resource development and sustainable institution building

(b) Quality education for all children

(c) Sustainable livelihood for extreme poor

(d) Gender equality and women empowerment

(e) Community resilience on disaster management and climate change

(f) Basic health, nutrition and WASH supports

(g) Good governance and democratic environment

(h) Action research and Innovation

Finally, there are approximately 65,000 families came out from extreme poverty situation through the technical backing and credit support of GUK. Besides that, approximately 150,000 families are directly involved in different sectors of the organization.

(7) Association for Renovation of Community Health Education Services (ARCHES)

The Association for Renovation of Community Health Education Services (ARCHES) has been working in socio-economic development of the extreme poor people. At the beginning ARCHES worked only within a few villages of Sirajganj, Bogra and Gaibandha district. But now it has been launching different socio-economic and development projects in several districts of Rajshahi division in the northern area of Bangladesh. The main objectives of the ARCHES are:

(a) Make people self-sufficient by providing credit facilities including poor and landless people;

(b) Generate employment opportunities for the rural poor and extreme poor by providing technical support;

(c) Ensure health and sanitation facilities to the poor;

(d) Provide legal support to ensure the rights of the women and children;

(e) Make a long term strategic plan for sustainable social and economic development of the poor community;

(f) Developing network with local, national and international organizations;

(g) Ensure required advocacy for the wellbeing of women and children;

(h) Prevent early marriage and women's violence by executing different activities and programs;

(i) Make people aware about health and family planning;

(j) Make unity and empowerment of men and women of the working areas;

(k) Mobilize human resource to rise socio-economic status of the poor by dropping vulnerability;

(l) Rise organic farming practice in the working areas and make man-made forest to reduce environmental pollution; and finally,

(m) Reduce loss of life and wealth during post disaster period in the working areas.

There are some major programs initiated by ARCHES to make rural peoples life comfortable. These are:

(a) Micro-credit program;

(b) Social development program;

(c) Livelihoods program;

(d) Education program;

(e) Arsenic mitigation water supply;

(f) Urban sanitation program;

(g) Fisheries program; and

(h) Social forestry projects

The main goal of ARCHES is making and implementing different development project to improve the social and economic development of the rural poor in different sectors such as agricultural sectors, developing infrastructure using local resources, food, communication, health and sanitation, family planning, adult education, child education, shelter, livelihoods and environmental issues (ARCHES, 2017).

(8) Association for Realization of Basic Needs (ARBAN)

The Association for Realization of Basic Needs (ARBAN) had started its journey in 1984 to develop the economic and social condition of the unprivileged poor people. ARBAN had initiated some important programs and projects that include savings and credit assistance programs, non-formal education, the provision of water and sanitation and primary health care, human rights and disaster management (ARBAN, 2017). The core working areas of ARBAN:

(a) **Education and Vocational Training**: Education and vocational training is for both children and adults, which includes language training and computer skills courses;

(b) **Micro-credit:** ARBAN initiated micro-credit or small loan program to develop individuals and engaged rural poor people in the economic activities;

(c) **Primary Health care and Sanitation**: ARBAN have delivered latrines and water pumps as well as set up community groups to maintain them;

(d) **Housing:** ARBAN is making accommodation for the poor people in the working areas; and

(e) **Preservation, Promotion and Protection of Human Rights:** ARBAN worked to ensure human rights for the poor people.

Important programs or projects of ARBAN are:

(a) Community development program;

(b) Education and training;

(c) Environment and climate change;

(d) Financial accessibility and management;

(e) Gender issue; and

(f) Human rights

(9) Gano Kallyan Sangstha (GKS)

The Gano Kallyan Sangstha is working in the northern part of Bangladesh. The main aim of the GKS is to ensure sustainable socio-economic development of the extreme poor people; both men and women in the rural areas of Bangladesh.

The core working areas of Gano Kallyan Sangstha (GKS) are below:

Gano Kallyan Sangstha (GKS) is a local NGO established to work with disadvantaged and powerless rural poor people along the river side of Jamuna, Bangladesh. The organization is dedicated to democratic values, human rights and equality between men and women. Programs and projects include:

(a) Savings and credit assistance program;

(b) Non-formal education;

(c) Supported in agricultural aids such as seeds, fertilizer, credit for agricultural activities and agricultural tools;

The provision of water and sanitation and primary health care; and

(d) Human rights and disaster management.

(10) Development Organization of the Rural Poor (DORP)

Development Organization of the Rural Poor (DORP) is a national non-government organization started its journey in 1987 and has been working in the field of development sectors like micro credits, education, health and agricultural sectors in the rural areas of Bangladesh.

Mission of the DORP:

The mission of DORP is to improve the social, educational, agricultural, economic, environment and cultural status of the deprived people through undertaking various sustainable development programs.

The core working areas of DORP:

The core areas of Development Organization of the Rural Poor (DORP) are as below:

(a) Health and sanitation;

- Maternal/Reproductive Health
- Newborn Health

(b) Priority action area(s);

- Advocacy
- Tracking Progress and Commitments for MNCH

(c) Education;

- Formal education
- Non-formal education

(d) Housing sectors; and

(e) Livelihood and credit program.

(11) Palli Daridro Bimochon Foundation (PDBF)

PDBF has been working in the field of socio-economic development in 44 districts of Bangladesh. Micro credit is playing an important role in the development of socio-economic sectors, particularly poverty reduction by improving economic condition, improve household's status, increasing living standards, empowering rural women, creating self-employment and ensuring better education and health care.

The core working area of PDBF:

(a) Micro-credits facilities

The PDBF is providing micro-credit facilities and training to improve their capacity for self-support and obtaining various skills for income generation of the rural poor people. PDBF is also giving economic facilities through collecting regular savings and disbursing credit.

(b) Educational facilities

PDBF is serving formal and non-formal education among the poor people.

(c) Health and sanitation sectors

(d) Maternal health sector

(e) Infrastructural development

(f) Disaster management

(g) Training on social development

PDBF is providing training on social development issues to empower members and increase awareness.

1.7 Methods and data sources of the study at a glance

It is very important to review the sources of major data which will be linked with the methods. Furthermore, for every analysis chapter, I will give further details of the methods applied in that chapter as and where necessary.

Primary data sources: Primary data sources are explained by the following steps. GPS data: GPS data of NGOs, growth centers and educational institutions were collected from the study area (Annex-II). There are 30 NGOs have been working in the field of development sectors to improve the rural people lifestyle. Therefore, this paper analyzes the NGOs spatial distribution along with working area using ArcGIS 10.1 software. The number of growth centers is linked with social development of the rural poor people, where people meet up their basic desires of agricultural producers, both in respect of economic and social services. These services include the facilities of the marketing of agricultural products and agricultural inputs that are the essential for the production of agricultural commodities. There are only 42 commercial/growth centers in the study area. The spatial distribution of commercial/growth centers was analyzed by modern technological tools named ArcGIS 10.1 and find out their spatial gaps. Finally, the information's of 358 schools were collected through GPS where included the information about NGOs provided facilities, number of teachers, number of male and female students, problems faced by educational services and so on (Annex-II). The GPS survey was essential for several reasons, for example:

(1) For geo-correction of the images and maps (e.g. raw IRS-1D satellite image);

(2) To verify the quality of existing data (e.g. existing road maps);

(3) To map the landmark or major land features (e.g. different types of agricultural land) on the image;

(4) To identify and analyze the number of local NGOs, educational institutions and growth/commercial centers;

(5) Make a proper spatial distribution of local NGOs along the river side of Jamuna, Bangladesh; and finally,

(6) To map the river shifting along the Jamuna river, Bangladesh

Questionnaires Survey: There were 533 questionnaires survey (semi-structured) conducted and 50 focus group discussions (each group consist 5 to 6 persons) randomly at different levels. This paper finds out the contribution of local NGOs to rural development regarding on three sectors such as educational sectors, agricultural sectors and micro-credit sectors. Therefore, this paper makes one common questionnaire sheet, which includes all information's of educational sectors, agricultural sectors and micro-credit sectors (Annex-I).

Fieldwork (June to July, 2015 and May to June, 2016): My two months of fieldwork involved observation, interviewing, questionnaire survey, collecting

published and unpublished documents, photography and video (Annex-I; Annex-III). Prior to this, I developed the necessary paper work and printings. The elements of fieldwork were as follows:

(1) Visiting Jahangirnagar University (JU) and selecting and training of field assistants;

(2) Buying and digitizing of union maps and attribute data entry;

(3) Observing selected villages and ice-breaking with local peoples;

(4) Identifying 'Key informants' and interviewing them (Educational, agricultural and micro-credit purpose);

(5) Surveying selected unions and identifying agricultural land-use;

(6) Surveying villages with GPS and marking tracts on printed maps;

(7) Collecting GPS data of 30 NGOs (175 branches) along the river Jamuna, Bangladesh (Annex-II);

(8) Collecting GPS data of 358 schools and overlapped on the Google Earth images (Annex-II);

(9) Identifying 42 commercial/growth centers in the study site and compared with local NGOs distributions;

(10) Surveying roads, infrastructures and land features with GPS and Landsat TM Images;

(11) Landsat TM images were traced, digitized and scanned;

(12) Meeting with local poor people through questionnaire and FGD methods;

(13) Meeting 'key informants' with maps and images/getting necessary feedback;

(14) Collecting demographic information's of the local poor people;

(15) Collecting published and unpublished materials/documents of educational, agricultural and micro-credit sectors from the different governmental and non-governmental organizations;

(16) Interviews with non-government organizations and local authorities and villagers;

(17) Videoing and photographing fields, people and key interviews;

(18) Verifying both population census data and maps;

(19) Field data tabulation and entry in computer and primary output; and finally,

(20) Reviewing field data and consistency checking and correcting.

The details of the maps are a very important part of this research. All GIS data/ coverage/ layouts and RS images have been digitized, clipped and overlapped on the basis of this information. Moreover, GPS survey during the fieldwork was conducted with the help of the map information. Some historical information like chronological changes of Jamuna river shifting was also collected and compiled from maps. Projection information (Latitude and Longitude or Geo-references) was gathered as well, particularly the location of NGOs, schools and growth/commercial centers.

Secondary Data Sources: The main data sources of this research were Bangladesh

Bureau of Statistics (BBS), Bangladesh Bureau of Educational Information and Statistics (BANBEIS), The Center for Environmental and Geographic Information Services (CEGIS), Directorate of Land Records and Surveying (DLRS), Soil Resources Development Institute (SRDI), Local Government Engineering Department (LGED) and different NGOs whose have been working in the study area.

Table 1-8: Summary information of the maps commonly available to study

Name	Scale	Organization
Mouza Map (1967)	1: 3,960	Directorate of Land Records and Surveying (DLRS)
Demographic Map	1:50,000	Bangladesh Bureau of Statistics (BBS)
Educational Map (2015)	1:50,000	Bangladesh Bureau of Educational Information and Statistics (BANBEIS)
Land use map (2015)	1: 3,960	Directorate of Land Records and Surveying (DLRS)
River Map (2015)	1:50,000	The Center for Environmental and Geographic Information Services (CEGIS)
Thana Map (2015)	1:63,360	The Center for Environmental and Geographic Information Services (CEGIS)
Upazila Map (2015)	1:50,000	Local Government Engineering Department (LGED)
Soil Map (2015)	1:50,000	Soil Resources Development Institute (SRDI), Dhaka
Road Map (2015)	1:50,000	The Center for Environmental and Geographic Information Services (CEGIS)
Homestead (1993)	1:50,000	The Center for Environmental and Geographic Information Services (CEGIS)
Irrigation Map (1994)	1:50,000	The Center for Environmental and Geographic Information Services (CEGIS)
District Map (1958)	1: 253,440	Directorate of Land Records and Surveying (DLRS)

Sources: Made by the author, 2017 and field survey, 2016

Data analysis: This research is using SPSS 16.0 software for detailed analysis of the socio-economic survey in three different sectors such as educational sector, agricultural sector and micro-credit sector. This study analyzes the facilities, which were provided by NGOs to the rural poor and make a correlation between NGO's provided facilities and income. This study also makes correlations between monthly income and the number of luxurious products used by people to measure rural development along the riverside of Jamuna, Bangladesh in micro-credit chapter.

1.8 Why the integration of GIS and RS?

A brief definition of a Geographical Information System (GIS) is a computer-oriented system for the efficiency of the input, storage, manipulation, analysis,

representation and retrieval of all forms of spatially indexed and related descriptive data. In recent times, much importance has been sited on the integration of remotely sensed imagery from Image Analysis Systems (IAS) with other digital spatial data from GIS. GIS is a means of accumulating and exploring diverse data, concerning to specific geographic areas, using the spatial locations of the data as the basis for the information system. Estes (1992) indicates that GIS can:

(a) Facilitate access to information;

(b) Facilitate the creation, updating and modification of the maps;

(c) Improve our ability to model important science research questions and operational resource management tasks;

(d) Enhance graphic display of complex phenomena; and

(e) Provide tools for enhancing decision-making.

Remote Sensing delivers a source of data for such systems and has the potential to progress the quality and quantity of data available. In some ways, remote sensing can contribute data in such systems, which never existed before (Donoghue, 2001; Estes, 1981). "The true effectiveness of RS inputs to information systems, then, can be measured by the appropriateness, timeliness and accuracy of data provided to the system. These are the functions of the effectiveness of GIS as a whole. The data accumulated based on RS systems can be put to their best use if they are incorporated in a system capable of efficient data storage and expedient data processing and retrieval. Therefore, the basic differences between GIS and RS systems are narrowing rapidly. GIS is a demonstrably powerful tool for the management and analysis of spatial data. RS systems are demonstrably powerful tools for the collection and classification of spatial data" (Rashid, 2003). Many researchers think that the use of GIS and RS together can lead to important advances in research and operational applications. Merging these two technologies can result in a tremendous increase of their potential for a wide range of applications.

According to Estes (1992), the applications of Integrated GIS are as below:

(a) Enhancements in the quality and quantity of data;

(b) Increases in computer hardware and software;

(c) Increasing population and competition for natural resources;

(d) Decreasing resource availability and environmental quality;

(e) Recognition of the global nature of problems; and

(f) An increase in the number of public and private organizations working on local, national, regional and international problems, and the creation of larger and larger databases to provide information on these matters at various scales.

1.9 Data capturing methods in GIS

This paper considers some basic principles of GIS, which are relevant for this study. The most principle point is the ability of GIS to handle large amounts of data. Data capturing methods in GIS are as below (Table 1-9):

Table 1-9: Data processing methods in GIS using ArcGIS 10.1 software

Major Features	Feature Class	Input Attribute in table	Main Purposes to select the layers
Roads	Lines	Type of roads	To know the road services of any development factors and to understand the chronological changes according to types (e.g. highways, *pakka, katcha, semi-pakka* or rural roads)
Growth centers	Points	Name of the commercial/growth centers	Compare with NGOs concentration area
NGOs	Points	Information on savers, borrowers, total loan and outstanding	Analyze and evaluate the spatial distribution of NGOs and make a plan for proper and equal distribution according to the population density
Rivers	Lines	Types i.e. *khals* (Canal), distributaries, rivers etc.	To track down the water bodies in the study area and show the potential risk zones (i.e. flood and river bank erosions)
Beels (Pond)	Polygons	id numbers	To point out the areas which are suitable for fisheries
Union boundaries	Polygons	Union names and statistical data and attributes	To show the intra-unions differences of facilities and related items.
Settlements	Polygons	Census data	To analyze and evaluate the population density in the study site
Land type	Polygons	Inundation data	To categorize the agricultural crops and their production in the particular season
Agriculture	Polygons	Area in production	Identify the production area of each crop
Schools	Points	GPS coordinates of Primary Schools	To draw the buffer of schools and evaluate their location according to the government Act with settlement pattern

Source: Made by the author, 2017

For all GIS, GPS and geometric correction of Images, the parameters shown in Table 1-10 are commonly used in Bangladesh. CEGIS, a famous non-government organization, uses the BTM (Bangladesh Transverse Marcator) and LGED, a leading government GIS centre, use Lambert Conformal Conic Projection. However, to match the dataset, I used the parameters of CEGIS.

Table 1-10: Projection parameters used in Bangladesh

Input Coordinate System:	BTM of EGIS	LCC of LGED
Name:	Custom	Custom
POSC:	-1	-1
Unit:	Metre	Metre
Geographic CSYS:	GCS_Everest_Bangladesh	GCS_Everest_1830
Datum:	D_Everest_Bangladesh	D_Everest_1830
Prime Meridian:	Greenwich	Greenwich
False Easting:	500000	2743185.699
False Northing:	-2000000	914395.233
Base Projection:	Transverse_Mercator	Lambert_Conformal_Conic
Central_Meridian:	90.00	90.00
Central_Parallel:	0.00	26.00
Scale_Factor:	0.9996	-------
Standard_Parallel_1:	--------	23.15
Standard_Parallel_2:	--------	28.80

Sources: LGED and EGIS of Bangladesh, 1999 (Unpublished)

1.10 Fieldwork strategy

There was a plan to visit the study area in mid of first and second year of my research for two months. The fieldwork strategies were basically for the following purposes:

(1) Intensive GPS (Global Positioning Systems) survey: GPS Survey played a significant role to analyze the concentration of NGOs' distribution of commercial/growth centers and in identifying an ample number of GCPs (Ground Control Points) for georeferencing and geometrical correction of remotely sensed images which was used for detailed understanding of Jamuna river shifting. A GPS survey of all metaled *(pakka)* and mud *(katcha)* roads of the study area was georeferenced.

(2) Ground verification: Initial classified satellite images were verified during the fieldwork. There are some unidentified features like newly created islands were visible on the remote sensing images, and the field survey helped to explain this properly.

(3) In situ investigation: A detailed questionnaire survey, interviewing and observation techniques was conducted during the field visit. It was important to understand the facilities which were provided by NGOs to the rural poor in educational agricultural and micro-credit sectors. Besides that, it helped to analyze and evaluate the population patterns, socio-economic condition, agricultural land usage and land type as well as the overall interpretation of educational data in the study sites.

(4) Observing and collecting census data 2011: The census data of 2011 of Bangladesh was being collected and processed during the fieldwork. The information's of total number of population, population density, number of household, number of people both men and women who engaged in agriculture, industry and other economic activities as

well as literacy rate at union level were collected from population census 2011 of Bangladesh and integrate with GIS data. These data were also verified and checked during the fieldwork.

(5) Data collection: There were relevant maps both hard copy and soft copy of the study sites, information's on educational sectors, agricultural sectors and micro-credit sectors and data published by the local or national authorities in Bangladesh were collected and photocopied. For instance, I intended to conduct a detailed survey on 126 unions of 5 districts during the field work. The union maps were available in the DLRS (Directorate of Land Records and Surveying) of Bangladesh. These maps were purchased at that time. The data and information were collected using questionnaires and interviewing of the selected focus group (e.g. elderly local people, local community, members of the union parishad, teachers, employers and students of the school, manager of each NGOs, borrowers and savers of the NGOs), observation and other related methods. A standard land use map and current crop calendar were prepared of the areas with the help of local people's perceptions.

1.11 Various research gaps

The main aim of the study is to identify the provided NGOs' provision to the rural poor in three sectors such as education, agriculture and micro-credit sectors and analyze their current socio-economic status. Therefore, this paper had collected NGOs, schools and growth centers spatial locational data through GPS survey. After that, these data were analyzed by GIS and statistical tools. Secondary data were collected from different government and non-government organization through questionnaire survey. In the period of data collection, various research gaps were identified in this research. These are:

(a) Some local NGOs in the study sites were unable to provide borrowers, savers, deposits and total loans information;

(b) Remote sensing and GIS data like shapefile of administrative boundary are not freely available in the organization and sometimes maps were purchased from the organizations;

(c) There were some schools unable to provide information's about NGOs facilities; and

(d) Land use and land type Information's were missing sometimes because of heavy flooding during the field survey.

1.12 Relevant literature review

There has been a burgeoning volume of literature on the issue of NGO's activities in several sectors; namely education sectors, agricultural sectors and poverty alleviation

and development sectors. Therefore, in recent years rural development became an important issue for the researchers and they have done experiments to make the relationship between rural development with NGOs and GOs provided services. There are several studies on NGOs provided formal and non-formal education, rural agriculture and micro-credit sectors have been undertaken along the river side of Jamuna, Bangladesh. There are several researchers study on rural education, agriculture, and poverty alleviation in social perspectives, but this paper tries to analyze NGOs spatial distribution, educational institutions' spatial distribution and identify the potential suitable agricultural yield for farming using GIS and remote sensing approaches. Besides that, this paper also focuses on infrastructure development in different areas were same, which plays a devastating role in expansion rural educational development. There are several studies on rural development are as below:

Ali (2003) provided a summary on the Information and Communication Technology (ICT) revolution which executes particular challenges on education systems in Bangladesh. He said, "ICT has contributed to ever-increasing inequalities in Bangladesh through the so-called "digital divide" that splits the Bangladesh between those who are "ICT-literate" and the majority who are not and most of the women have no access to a computer and the Internet". A series of factors, including literacy and education, language, time, cost, geographical location of facilities, social and cultural norms, and women's computer and information search and dissemination skills constrain women's access to information technology". He also emphasized on the different initiatives of Dhaka Ahsania Mission through creating opportunities to address and eliminate poverty and hunger through education and technological intervention.

Davis (2006) highlighted an important part of NGOs and Development in Bangladesh in the Global Poverty, Sustainable Solutions. Proceedings of the Anti-Poverty Academic Conference with International Participation, Institute for Sustainability and Technology Policy, Murdoch University, Perth. In Bangladesh, NGOs have performed as the savior of the number of people without food, cloth, education and basic health facilities. Bangladesh is one of the most densely populated countries on earth and the lacking of skilled manpower. In his paper, he also provides a description of population concerning agriculture sector, which is the main source of income for this rural-agro-based community. Besides that, NGOs are working on poverty eradication by directly involving the poverty-stricken population. Their target groups are mostly the vulnerable poor people with hardly any belongings.

Amin (1998) also emphasized on NGOs significant initiatives to handle the poverty situation in Bangladesh considering certain aspects, i.e. speedier economic growth achievement process, human resource development and specific target setting for poor. He also describes the women's empowerment with an involvement in microcredit

programs in his paper titled on NGO-promoted microcredit programs and women's empowerment in rural Bangladesh in the Journal Of Developing Areas in 1998. Consequently, Begum (2004) given an information and analyze the NGOs provided services to the local poor people in her paper titled on the role of NGOs in rural poverty eradication: a Bangladesh observation which was published in the BRAC University Journal. According to her, NGO is a non-profit agency that serves some public interest and an association of peoples structured on a voluntary basis through the initiative of one or more dedicated person committed to the planning and implementation of any development projects at the grass root level.

Haider (2013) provided a statistics of the socio-economic situation of the local poor who were engaged in the NGOs microcredit program in his paper titled on the impacts of NGOs on the socio-economic situation of the poor: a case study in Rajshahi city, Bangladesh which was published in the international journal of community development. He used Rajshahi city as a case study. He describes that NGOs are commonly familiar with their unique ability to reach the grassroots poor people and bring sustainable improvement of the lives of the rural poor. This study had focused on the socio-economic condition of the poor people in the rural areas being developed through the programs taken by the local NGOs. In the journal of information and knowledge management, Hasnain described the knowledge and socio-economic development of the rural poor in 2013. This paper is on the contribution of local NGOs to socio-economic development in Bangladesh. This paper showed about 22,000 NGOs are in operations in Bangladesh with a view to developing the socio-economic conditions of their beneficiaries. The NGO facility recipients are the main stakeholders who are involved in receiving the knowledge transferred by the NGOs. In recent years NGOs have put more attention and efforts on income generation that having an involvement with micro-credit program, employment generation in different sectors, giving formal and informal education of rural children and adults, health, nutrition, family planning, establishment of financial services at the grassroots level, women's rights, environment, poultry and livestock, water supply and sanitation, human rights and legal aid.

Microcredit is being recognized as an operational means of poverty alleviation. Although, there are significant debates on the effectiveness of microcredit program and the characteristics of the recipients who are benefited from the local NGOs credit program (Chowdhury et al. 2004). The existing literature determined that microfinance has varied impacts on the livelihood of the rural poor. Microcredit has carried millions of poor people, especially women out of poverty and stimulated economic sustainability likely they are able to increase their household income, decreased economic vulnerability and in some cases, wipe out poverty completely. (Glazer, 2010; Bansal, 2011). Besides that, they have been enjoying better nutrition, health facilities, and

greater empowerment as a result of microfinance operations (Bauer et al. 2008; Swope, 2005). Their arguments are supported by Yunus, 2004 in his paper titled on expanding microcredit outreach to reach the millennium development goals: some issues for attention in the journal of attacking poverty with microcredit. He said microcredit has lots of positive impacts on families that receive from the local NGOs credit program. Murdock and Haley (2002) led a widespread analysis of the effects of microfinance in poverty reduction and there has a sufficient positive impact of credit program on poverty reduction of the rural villagers as well as it relates to millennium development goals. These interpretations were supported by the findings of an evaluation study commissioned by the Asian Development Bank (ADB, 2007) on the effect of microfinance operations on rural households and the status of women of Bangladesh, Philippines, and Uzbekistan. The study established that the microfinance program had positive impacts on the status of rural poor people by generating higher volume of cash in the household, making program on formal and non-formal education with food, greater participation in making of major expenditure decisions and savings, ability to earn more income by using NGOs credit, greater role in business decision making, gaining more skills and increasing their network of friends and support system, and increased gaining of assets. Besides that, there are some countries like Bangladesh, Nepal, India, Vietnam, China and the Philippines have commissioned for an assessment of MFIs (Microfinance Institutions). These assessments explored the benefits of the microcredit program provided by NGOs such as better food security and nutrition, housing and health, school enrolment for children and adults, higher levels of literacy, food for school going children, women empowerment and mobility, emphasis higher average household income, building of human capital and assets and community participation, self-employment and employment of family members (Bedson, 2009).

Panjaitan-Drioadisuryo et al. (1999) had conducted a research titled on Gender, self-employment and microcredit programs and published it in the journal of the Quarterly Review of Economics and Finance. They found that 90 % of sample participants of Bank Rakyat Indonesia (BRI) increased their income by joining NGOs credit program and these families exceeded the poverty line by making different income sources. Income of only 10 % participants did not increased because of mishandling the credit by their husbands. Furthermore, Hossain in 2008 had analyzed the community development and livelihood security and this paper presented to the Tokyo Peace Builders' symposium, 2008 and Ghalib et al. (2011) in their research tried to study whether microcredit reduced poverty and to what extent and which dimensions of poverty relieved. Their study confirmed that microfinance programs improved deliberately in education, agricultural system, household income, improved the facilities on health care, clothing, water supply and sanitation as well as building a quality of dwelling house.

Hossain (2012) studied measuring the impact of BRAC microfinance operations, which had published in the journal of International Business Research. He tried to measure the impact of BRAC microfinance operations on the livelihood of the borrowers on the rural village. The income of the Borrower's and their contribution to the family expenditures increased significantly after joining NGOs credit program. Besides that, he also found that the volume of monthly savings was not significant, but the approach of the borrowers towards savings was noticeable. Besides that, Reddy had studied that microfinance makes the socio-economic conditions better for the rural poor people in 2000. He found that "the credit program of MFIs is highly successful, which is evidenced by the high repayment rate, awareness generated among the target group and beneficial developmental impact created on the receivers of the credit". However, there are some critics disagreeing because poverty cannot be removed with a small amount of money provided by NGOs. The answer of criticism had found in a statement given by Adam Smith, 2010 and Ahmed, 2004 in their research. They said "when you have got a little, it is often easy to get more. The great difficulty is to get that little". The economic condition of the needy poor people in the rural areas is so terrible that they do not have enough opportunities to get little amounts. In addition, this little amount is the necessity of the poor at the right time to help them income generating activities (Ahmed, 2004; Ahsan, 2005).

Fruttero and Gauri (2005) had studied on the strategic choices of NGOs in rural Bangladesh which was published in the journal of Development Studies. They showed that Non-governmental Organizations (NGOs) play a progressive role in the delivery of public services to the rural poor in developing countries, whereas tiny systematic data exists through their strategic choices. They said that they had developed two strategies for NGOs. First one is pragmatic and organizational concerns determine location decisions and the other one is charitable motivations are the principal determinants. Besides that, Fisher (1997) in his paper titled on doing good ? The politics and antipolitics of NGO practices, which have been published in the annual review of anthropology argued that "current literature concerned with the growing numbers, changing functions, and intensifying networks of nongovernmental organizations which have had significant impacts upon globalization, international and national politics, and local lives". He also said that this study has deep understandings of trans-local flows of ideas, knowledge, funding, and people. He also gave an attention to the political consequences of discourses about NGOs, the difficulty of micro-politics of these associations and the importance of situating them as evolving process within complexes of competing and overlapping practices and discourses.

Sharma and Zeller wrote a paper on placement and outreach of group-based credit organizations and used major NGOs, i.e. ASA, BRAC, and PROSHIKA as a case study

of Bangladesh, which was published in the journal of World Development. They studied that the extensive assumption regarding non-governmental financial institutions in Bangladesh has been positioned in special poverty-stricken areas. They said NGOs credit program institutions should locate in the rural areas, whereas the number of rural communities have been suffering from heath nutrition, deprived from education facilities, underprivileged from using modern technological tools in the agricultural sectors. They also discussed the usage of *upazila*-level data to analyze the spatial distribution of three credit programs in Bangladesh. This paper also provides an information that branches were located relatively well developed areas than remote areas (less developed regions). As of late, Bangladesh has made major works in providing credit services to the rural poor for developing their financial activities. These credit programs have been delivered to the rural poor in deprived areas run by several Non-governmental Organization (NGOs) in Bangladesh. There are a number of studies that had described how these new institutional locations distributed with physical collateral and facilitated access of the poor to savings and credit facilities (Zeller et al., 1996; Hossain, 1998).

Godquin (2004) studied on microfinance repayment performance in Bangladesh and how to improve the allocation of loans by MFIs which was published in the World Development journal. He studied a widespread exploration of the performance of Microfinance Institutions (MFIs) in terms of repayment. He also focused the effect of group lending, nonfinancial facilities and dynamic incentives on repayment performance. He said that the main objective of the NGOs is to provide financial facilities, both as credit and savings to the rural poor in order to release financial limitations. He also said that "high repayment rates are largely linked with benefits both for the microfinance institutions and the borrower". According to Nieto et al. Microfinance Institutions (MFIs) are unusual financial organizations. They said NGOs have two nature, namely social nature and for profit nature. Microcredit is the delivery of small loans to rural poor people for self-development or community development projects that generate income. It is a new approach to fight against poverty by increasing income using NGOs credit (Morduch, 1999). There are many non-government organizations have been working as a non-profit organization, whose aim is to help those people who would not have access to a loan from a traditional bank. They said that Microfinance Institutions (MFIs) are not operated in the same way as traditional banks does and the activities of traditional banking systems may not be appropriate within this new context.

Safa (2005) wrote a paper on the NGOs' role in improving social forestry practice: does it help to increase livelihood, sustainability and optimum land use in Bangladesh? In his paper he basically highlighted NGOs work for the development for increasing the level of livelihood to rural poor people. Besides that, some environmental problems, i.e.

flood, erosion, deposition, deforestation and land sliding are the challenges for the rural development. Local NGOs are now making a new plan for forest management by artificial planting involving with community people. NGOs take an initiative to improve sustainable livelihood using social forestry practice. There are some prominent NGOs, i.e. BRAC, PROSHIKA, GRAMEEN bank, and ASA are working in the social or community-based forestry development sectors.

Goni and Saito (2010) studied on fertility decline and women's status- the role of non-government organizations (NGOs) in Bangladesh. He had used microcredit data for women's data analysis and which was published in the international NGO journal. In their paper they said that rural development and women's fertility rate are interrelated. For the rural development, we should give priority to women's fertility rate, especially in the remote areas of Bangladesh. Bangladesh has achieved fertility decline through the proper attempt of NGOs. Besides that, NGOs are given much significance to some sectors such as the awareness of personal health issue, growth in family income through joining NGOs credit program, growing economic status using modern agricultural tools and socio-medical activities. They also talked about some prominent NGOs, especially BRAC and GRAMEEN Bank. These NGOs are working on health and sanitation, educational development in formal and non-formal sectors, working on agricultural loan, increasing new lifestyle with free education to the women, food for school going children and micro-credit sectors. On the other hand, Salam and Hossain (2012) had analyzed the communication strategies of NGOs' child labour elimination programme and he used Bangladesh as a case study. He said that, Bangladesh is a developing country caring with large number of rural poor people, whereas children are being forced to involve in risk work to run the family income smoothly. There are some NGOs and governmental organizations that have launched and education and rehabilitation for child labors with the concern of the international community. He furthermore wrote that shifting strategies for social development, communicating training, supplying books to children and using posters, leaflets, brochures, rally, seminar, documentary video for educating children can be very operative. The authors found, "direct beneficiaries are effective and impressive, whereas the child labor rate is declining in the recent years and parents are interested to educate their children for the betterment of their individuals.

Khanam et al. (2013) and Khaleque (1999) studied on the employment patterns of selected NGOs participants of farm households in Bangladesh which was published in the journal of science and technology. In their paper, he wrote that Bangladesh is a densely populated country, whereas a lot of people are unemployed due to lack of employment opportunities. Therefore, different NGOs are working to improve the unemployment status by providing diverse facilities to the rural poor. They said that development curriculums have different scopes in different political and social

perspectives, but among them most prominent is the need to decrease the rate of unemployment, poverty, and inequality with the participation of the rural people. Women contributes to income generating activities and now they are counted as an important part of the economic expansion of the country. Therefore, now NGOs are playing a significant role in rural development by promoting women's involvement in income generating activities with NGOs credit program. The study showed that after joining the credit program, a significant percentage of the participants, especially women got involved in income generating activities (Mahmud, 1996). As a consequence, women participants had expanded significant financial development with social status and they were benefited financially and their awareness also increased terrifically in different sectors like health, education, sanitation, village gardening and agricultural sectors. They also found that all NGOs were successful in involving women in economic sectors. Thus, there was positive change of women participant with respect to the growth rate in production, savings, total income, technical knowledge and attitude, improvement in health and sanitation sectors which had improved economic solvent of their families.

Islam and Mia in 2007 studied on the innovative elements in the informal education of Bangladesh in perspective of income generating programs for poverty alleviation. It was published in the International Journal of Education and Development using Information and Communication Technology (IJEDICT). They explored the innovative components of non-formal education of Bangladesh in terms of its influence towards poverty reduction through income generating activities. They said that rural poor family is benefiting from non-formal education which was given by the local NGOs. The benefits they have mentioned are contributing to family income; family members are more aware of the importance of education; the life style of the family members has improved; increased social awareness; members are not worried about the future of children who could not avail general education from the formal schools and they help younger children in their families to get education. They also said that rural communities are also benefited like, reduction in unemployment, reduction in crimes, delay of girls' marriage, empowerment of girls and improvement in the overall social environment.

Mamun and Rahman (2013) had studied Non-formal Education (NFP) in improving the quality of life of underprivileged children and used Bangladesh as a case study, which was published in the Journal of Education, and Learning. They explored the role of Non-formal Primary Education (NFPE) is improving the quality of the life of underprivileged children in rural Bangladesh; considering their educational status, economic growth, health and sanitation, environmental concerns and daily life skills. They have derived data from 6 NGO officers, 9 teachers, 90 students and 18 guardians by using two questionnaire methods. A major number of students were involved in

income generating activities, i.e. agricultural activities, business and selling daily labor before involving in the NFPE program (Ministry of Education, 2004). But after getting admitted into the NFPE school program, rural children cannot get enough time to earn. Besides that, local organizations have no income generating program for the learners along with education. Therefore, the scope of their income has reduced gradually, although awareness on health and environmental issues have increased. For this reason, many of them are unwilling to participate in this educational program. According to Nath 2002, NFPE programs initiated in Bangladesh in the middle of 1980s along with formal primary education. NFPE program takes three or four-year session, but completes five-year national curriculum determined by the National Curriculum and Textbook Board (NCTB) of Bangladesh. Non-formal Primary Education (NFPE) schools located closer to the doorstep of the rural villagers. According to him "every school has community teacher who knows the beginners and closer to them. No school uniform is needed during school time. NGOs provide basic essentials to learning, including the workbooks and pencils. Therefore, the learner can get education without any educational expenses in the remote areas".

Ahmed and Haque (2011) studied on economic and social analysis of primary education in Bangladesh and found that some rural poor children were involved in the income generating activities and they realized that poverty is also connected with the continuation of children in the school. Therefore, it makes late enrollments, low attendance rates, and high drop-out rates. Ashley (2005) studied on from margins to mainstream- private school outreach inclusion processes for out-of-school children in India, which was published in the international journal of educational development (IJED). He studied that non-government organization should give them equality of opportunity in the education sectors. The main job of the NGOs is to provide services to the most vulnerable people in the rural communities to make them empowered, self-dependent, educated, capable and organized. NGOs are now working on enhancing the quality of life and living standard of the rural communities. He said that NGOs are required to go where the government is not amply reaching and the areas where the government has no satisfactory attention.

According to General Economics Division (GED), Planning Commission, Government of the People's Republic of Bangladesh and UNDP Bangladesh were found that getting involved in NFPE program, life skill of the learners has improved. Now they are able to help their parents to write a letter if needed. They also gave some suggestions i.e. the schools should provide some occupational skills and training during school period; teachers must need to understand the students' psychology to identify the needs and lacking students; teachers must have good motivating capacity to inspire the students; NGOs should make an attempt in order to increase awareness and motivate

guardians and finally should increase the physical facilities of the classroom to support better learning.

According to Bhuyan (2006) education can play an important role to improve the quality of life of the rural communities. In this regard, the Government of Bangladesh (GoB) has given emphasis on universal primary education to the rural villagers. He also said that the majority of people in the rural areas of Bangladesh is deprived of basic education. The majority of the students have not enrolled in primary schools and those who got enrolled in the primary school, drop out before completing fifth grade. Therefore, the number of illiterate people in the remote areas is increasing gradually. He suggested that government organizations could have provided basic education to the illiterate and semi-illiterate through non-formal education program in the rural areas and government should give attention towards vast illiterate's people who are also rural poor. Akyeampong in 2004 studied on complementary education in Northern Ghana and it was published in the journal of International Co-operation in Education. He said that most of the NGOs are working with the people in rural areas, where their primary objective is not to deliver basic education, but they provide basic education as a necessity to teach the people about health, sanitation, family planning and the environment. There are some NGOs who provide training on women's development programs like family planning programs, health and sanitation program and environmental protection program and it has been found that without providing basic education the people cannot efficiently grip and apply knowledge and skills. In this regards, there are some NGOs which specifically work on basic education services.

Rose (2006) wrote a paper titled on "collaborating in education for all?" Experiences of government support for the non-state provision of basic education in South Asia and sub-Saharan Africa, which was published in the Journal of Public Administration and Development. He said that government is the main provider of primary education with most of the stakeholders (including NGOs and the government itself). NGOs facility delivery has been found to be most effective in Bangladesh (Government of People's Republic of Bangladesh, 2005) where there are a comparatively weak state and strong civil society, allowing NGOs to operate independently. Instead, Malawi characterized by a relatively weak civil society where international NGO wants to support children in basic education, but the centralized ministry had dominated over the sector.

Faruque (2010) wrote a paper on microfinance for agriculture in Bangladesh and he predicted the current status and future potential of the agricultural sectors in Bangladesh. He said that increasing access to microcredit is more significant for agricultural growth for the rural poor people in the remote areas of Bangladesh. There are some formal micro finance institutions have played their roles in the agricultural development sectors. For example, they are already playing a significant role in financing agriculture, reform in

operation, loan products and make a modern management information system. There are 80% small and marginal farmers in Bangladesh whereas only 17% of the small farmers have direct access to institutional credit. Accessibility of agricultural credit has a positive influence on agricultural productivity, which has already been verified in research works of various researchers. The agricultural sector is playing very nearly 19.21% to the national GDP of Bangladesh which comprises almost one-fifth of the national GDP (IFI Watch Bangladesh, 2008). To stand the national GDP growth and economic development of the country, the trend of agricultural production should be maintained by the government as well as make ensure to access of agricultural credits that help village farmers smooth continuation of agricultural production (Bayes, 2012; CPD, 2001).

Alam and Khalifa (2009) wrote a paper titled on the impact of introducing a business marketing approach to education, which was published in the African Journal of Business Management. They said that research and development of new crops, methods, and training are more significant for the development of agricultural sector in the rural areas of Bangladesh. Private organizations should give an attention to the development of modern technologies for commercialization of agricultural crops. Furthermore, Non-government Organizations (NGOs) should develop the new variety of seeds, appropriate fertilizer, pesticides and other items to grow better agricultural crops. On the other hand, Ahmed in 1987 said that agriculture plays an important role in countries economic growth. He said that there are some important internal and external variables, i.e. extensive irrigation, high-yielding crop varieties, more efficient markets, and mechanization, policy reforms, investments in agriculture research, human capital and roads that have driven agricultural expansions. However, two-thirds of rural households depend on both farm and non-farm income generating activities in Bangladesh.

Recently, NGOs are working on a goat farm and they distributed goats to their beneficiaries. They said that there are many benefits of goat farming. The main of those are goat is a small animal and their food demand is pretty low, needs short space to live, capital needs to build goat farm is low, diseases are comparatively less, produce more goats in short time, female goat became pregnant twice a year and give birth 2-3 baby goats every time, meat, skin, and milk of goat have a huge demand in our country and abroad as well as goat milk prevents tuberculosis and asthma (Halim et al. 2011).

Non-governmental Organizations (NGOs) in rural Bangladesh are reaching out to poor rural women with credit programs for improving poverty and increasing women's status in the rural communities (Amin et al., 1998; Zohir, 2004; Amin and Pebley, 1994). NGO credit programs that are increasing substantial improvements of women's social and economic status, without the long delays related to education or employment opportunities in the formal sector. According to Hashemi and Schuler in 1996, women's

empowerment basically depends on methods which help to empower women, internet as a tool of empowerment, barriers and measurement and finally, the role of women in societies and economic benefits.

1.13 Organization of the thesis

This thesis consists of seven chapters. All chapters are unique and well define and evaluate NGOs provision to the rural poor along the riverside of Jamuna, Bangladesh. The descriptions of seven chapters are as below:

Chapter 1: This chapter focuses on the primary issues of the study, including the aim and objectives of the research along with definitions of different special terms related to the NGOs activities and with rural areas. This chapter also has highlighted the relevant literature review for the study of NGOs provision under various contexts and themes. The various aspects of the methodology, basis sources of data, gaps in the research, mission, vision and the core working areas of NGOs have been described properly.

Chapter 2: This chapter has highlighted the study areas information's such as geographical settings, brief description of physiography, topography and relief, soil type, geological structure, road network, rivers and drainages, climatic conditions and seasonal diversity. All essential aspects of the available sources of data and their digital conversion for the analysis are discussed.

Chapter 3: This chapter has described the NGO's education services at district level along the riverside of Jamuna, Bangladesh using GIS and remote sensing technology. This chapter describes the specific methodology and data sources to analyze and evaluate the NGOs spatial distribution along with NGOs provided facilities in education sectors to the rural poor people along the riverside of Jamuna Bangladesh. The socio-economic data have been analyzed after getting supports and joining the NGOs educational program for the poor.

Chapter 4: This chapter has discussed NGOs agricultural services at district-level along the riverside of Jamuna, Bangladesh, using GIS and remote sensing approaches. This chapter has described NGOs activities on agricultural development, agriculture research system in Bangladesh, spatial location of local NGOs and it's provided services to the agricultural sector, current land use and land cover type and potentialities of different agricultural yield as well as develop geo-spatial attributes of local poor people, mapping and analyzing the current situation regarding on processing and marketing to ensure the better income of farmers.

Chapter 5: This chapter has highlighted the NGOs credit program along the riverside of Jamuna, Bangladesh. This chapter includes NGOs provided facilities to the rural poor, spatial locations of each NGO with the number of borrowers, savers, savings and total outstanding. This paper has also tried to link spatial location of local NGOs with growth

centers/ commercial centers and finally, evaluated the impact of micro credit to poverty reduction along the riverside of Jamuna, Bangladesh.

Chapter 6: This chapter has emphasized on planning and spatial distribution of NGO's provided services in education, agricultural sector, and micro-credit to the rural poor people at the district level along the riverside of Jamuna, Bangladesh. It highlights the chronological changes of *char* lands from 1985 to 2014 along the river Jamuna, Bangladesh and finally, developed a plan of the local NGOs for sustainable development of the rural poor. This chapter also makes plan how to reduce the distance from the centers of commerce and social services areas.

Chapter 7: This chapter is the final section of the research where the concluding remarks have been placed and the overall scenarios of the thesis has discussed briefly, with some recommendations and issues involved with land transformation, planning and policies.

1.14 Conclusion

Bangladesh is facing difficulties to meet up the basic needs, i.e. food, education and health of the rural poor people along the riverside of Jamuna, Bangladesh. There is a large portion of the population in the study sites are deprived from the access of food, clothes, shelter, education and treatment as well as recreational facilities. There is no balance between the human resource and employment opportunity. Therefore, thousands of people have migrated from rural to urban areas to improve their daily lifestyle. From the overall discussion and from relevant literature, we can find the current situation of the NGOs activities and rural poor. These are:

(a) A large number of NGOs are reaching out to the rural poor with credit programs to improve poverty and social status;

(b) NGOs are working in social welfare through educational, health, consciousness-raising, functional literacy training, plantation program, reduce child marriage, flood mitigation program and vocational training;

(c) NGOs are working in agricultural sectors by providing agricultural aids such as seeds, fertilizer, pesticides and agricultural loan;

(d) NGOs are working on formal and non-formal educational sectors in the rural areas of Bangladesh;

(e) NGOs provided micro-credit facilities to the rural poor for the economic development of individuals;

(f) Working on women's empowerment by involving them to the NGOs credit program;

(g) NGO credit programs are targeting women, not only for their rapid economic improvement, but also their faster than normal empowerment without the long wait for female advancement through education or employment in the formal

sector;

(h) Lack of employment opportunities and fundamental rights in rural areas;

(i) They have no access to shelter during the disaster period, such as floods, cyclone and drought.

Finally, it can be said that, social and economic disruption would have been happening if a large portion of the population becomes unemployed in the rural society. It is very essential for service-oriented organizations to come forward to overcome this situation along with the government programs.

2.1 Introduction

The main attention of this chapter is to give in-depth information about study sites and the rural development concept regarding three sectors and they are agricultural sectors, education sectors and micro-credit sector where NGOs made an enormous contribution to the social and economic development of the remote areas. The sections of the study area have been documented here that are not discussed in the later chapters, which are highly relevant as the basis for an insight into the area. Therefore, the sources of primary and secondary data, including remotely sensed images are discussed here. The entire structure and content of the thesis are highly dependent on the foundation laid in the following sections.

2.2 Study area and its context

There are 126 unions (unions are the smallest rural administrative organogram and local government units in Bangladesh) of 5 districts along the river Jamuna in the study area, and 30 NGOs with 175 sub-branches are working in the said area; the districts are Sirajganj, Bogra, Jamalpur, Gaibandha and Kurigram (Figure 2-1). Jamuna is the second largest among those three main rivers in Bangladesh. It is the notable distributary channel of the Brahmaputra River which runs from India to Bangladesh. The Jamuna River have originated in the glacial are of the Kailash peak in the Himalayas, then flows to the east over Tibet and finally passes through Assam to the west and after that, the Jamuna River enters into Bangladesh. Riverbank erosion and deposition are common in this area. Road networks of rural areas are very poor. A significant part of Bangladesh (around 80%) is covered by floodplains formed by different rivers in the country (Sarker et al., 2003). Floodplains are a very important type of landscape in the context of agriculture and culture of Bangladesh. Most of the fertile, cultivable lands belong to this physiographic region and the culture of the country is very much influenced by the landscape.

(1) Geographic setting

The study site is geographically located between 24.018949° and 26.214036° north and between 88.991656° and 90.190923° east. The study site consists of Old Brahmaputra and Ganges river floodplain. The study site is bounded on the north by Lalmonirhat district, on the south by Pabna and Rajbari districts, on the west by Natore and Joypurhat district and finally, on the east by Tangail and Sherpur district.
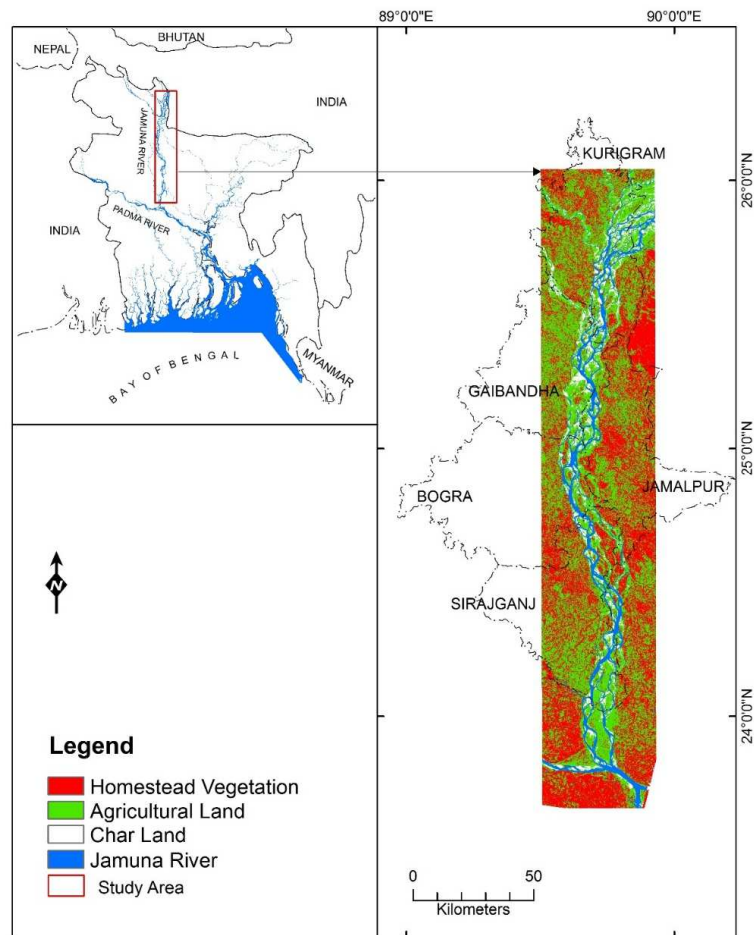
Figure 2-1: Study site includes 126 unions of 5 districts, i.e. Sirajganj, Bogra, Jamalpur, Gaibandha and Kurigram along the river Jamuna, Bangladesh

Source: Made by the author, 2016

According to the Bangladesh Bureau of Statistics (BBS), 2012 defines an urban area as the developed area, includes around an identifiable central place, have facilities like metalized roads, communication facilities, electricity, gas, water supply, sewerage connections usually exist and finally, which is densely populated and a majority of the population involved in non-agricultural occupations (Ibrahim et al., 2009). As opposed to, rural area is the underdeveloped and unprivileged area, where have no facilities of metalized roads, communication facilities, electricity, gas, water supply, sewerage connections and a majority of the population involved in agricultural activities. Therefore, it can be said that along the river Jamuna is a rural area. The rural population in Bangladesh was 65.72% according to the statistics of 2015. Its highest value over the past 55 years was 94.87% in 1960, while its lowest value was 65.72% in 2015.
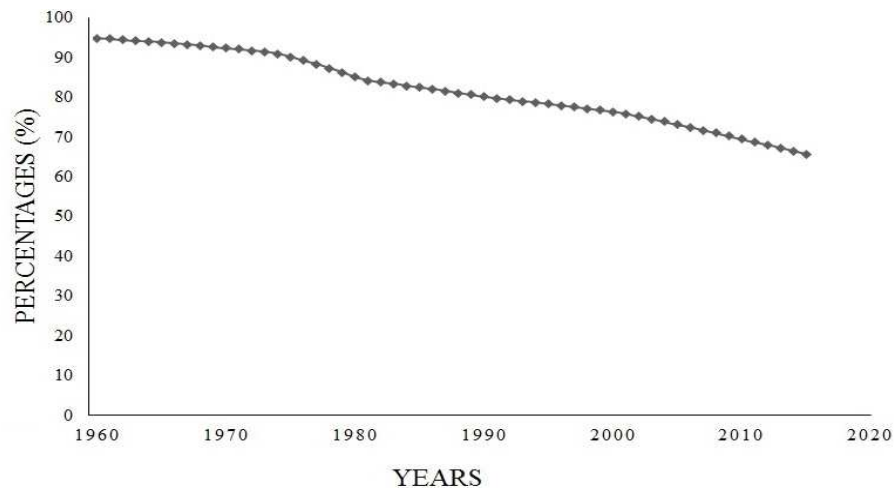
Figure 2-2: Decreasing rural poor people from 1960 to 2015 in Bangladesh

Source: Made by the author and data from Bangladesh Bureau of Statistics (BBS), 2015

(2) Jamuna *char l*ands

Char is the common name of islands. Most of the rural people (65%) live in the Jamuna *char*s. Thus, *char*s significance in providing land for human habitation in Bangladesh is growing (Hossain and Deb, 2010). There are two types of *char* land called islands that are attached *char*s and the other type is island *char*s; are always inaccessible without crossing the river, whereas attached *char*s are generally reachable from the mainland during the dry season (ISPAN, 1993). *Char*s are enormously vulnerable to both erosion and flood hazards. The Recent analysis of time series satellite images shows that about 75 percent of the *char*s had been destroyed between one and nine years, while only about 10 percent lasted for 18 years or more. In certain areas, *char*s can be quite stable (for example, in the lower Jamuna area). *Char*s have occupied 40 percent of active river floodplain, which comprises about 6 percent of Bangladesh's total land. Island *Char*s are found to be flooded more expansively than attached *char*s. Each year a large percentage of *char*s are flooded. If the flood comes early it can damage crops in the fields and people living in *char* lands; build their homesteads on the highest existing land (EGIS, 1997b). The Jamuna is an extremely braided river and ordered its morphology as first (includes two or more large), second (anabranches and multiple) and third order (channels may be produced during the falling stage) channels (Bristow, 1987). The first order channel comprises of the whole river, which has an average width of about 12 km and annually eroded about 5000 ha of the mainland, which makes thousands of people landless and/or homeless (Sarkar et al., 2014).
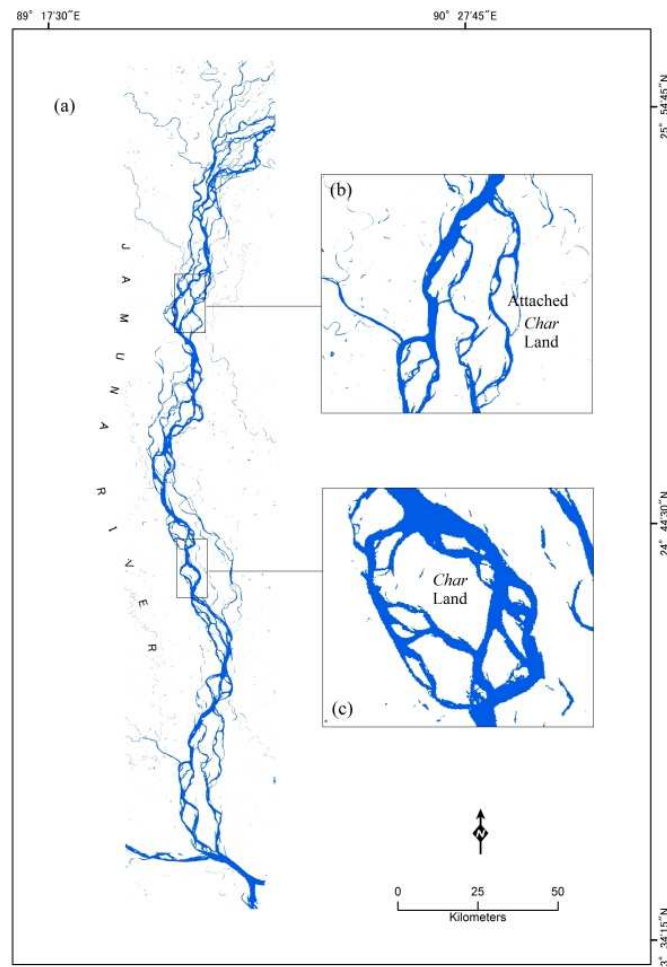
Figures 2-3: Figure 2-3a shows the Jamuna River as an extremely braided river whereas NGOs had made an enormous contribution in the social and economic sectors. Figure 2-3b shows the attached *char*/ island, where transportation and communication comparatively better than the *chars* land and finally, figure 2-3c shows the *char* lands along the riverside of Jamuna, Bangladesh

Source: Made by the author, 2017

(3) A brief physiography

Physiography is defined as the description including form, substance, arrangement, and changes of especially, natural features. Furthermore, physiography is a description of the surface features of the earth like geology, pedology, meteorology, and oceanography. According to the context of physiography, Bangladesh is classified into three distinct regions, such as floodplains, terraces, and hills each having distinguishing characteristics of its own. The physiography of Bangladesh has been divided into 24 sub-regions and 54 units. Major sub-regions and units are Old Himalayan Piedmont Plain, Tista Floodplain, Old Brahmaputra Floodplain, Jamuna

(Young Brahmaputra) Floodplain, Haor Basin, Surma-Kushiyara Floodplain, Meghna Floodplain (Middle Meghna Floodplain, Lower Meghna Floodplain, Old Meghna Estuarine Floodplain and Young Meghna Estuarine Floodplain), Ganges River Floodplain, Ganges Tidal Floodplain, Sundarbans, Lower Atrai Basin, Arial Beel, Gopalganj-Khulna Peat Basin, Chittagong Coastal Plain, Northern and Eastern Piedmont Plain, Pleistocene Uplands (Barind Tract, Madhupur Tract and Tippera Surface) and finally, Northern and Eastern Hills which includes Low Hill Ranges (Dupi Tila and Dihing Formations) and High Hill or Mountain Ranges (Surma and Tipam Formations).

The study area covers the Old Brahmaputra, Jamuna (Young Brahmaputra) floodplain and Ganges River floodplain which are highly productive for agricultural activities. Floodplains can support access to fresh water, the fertility of floodplain land for farming, cheap transportation and ease of development of flat land.
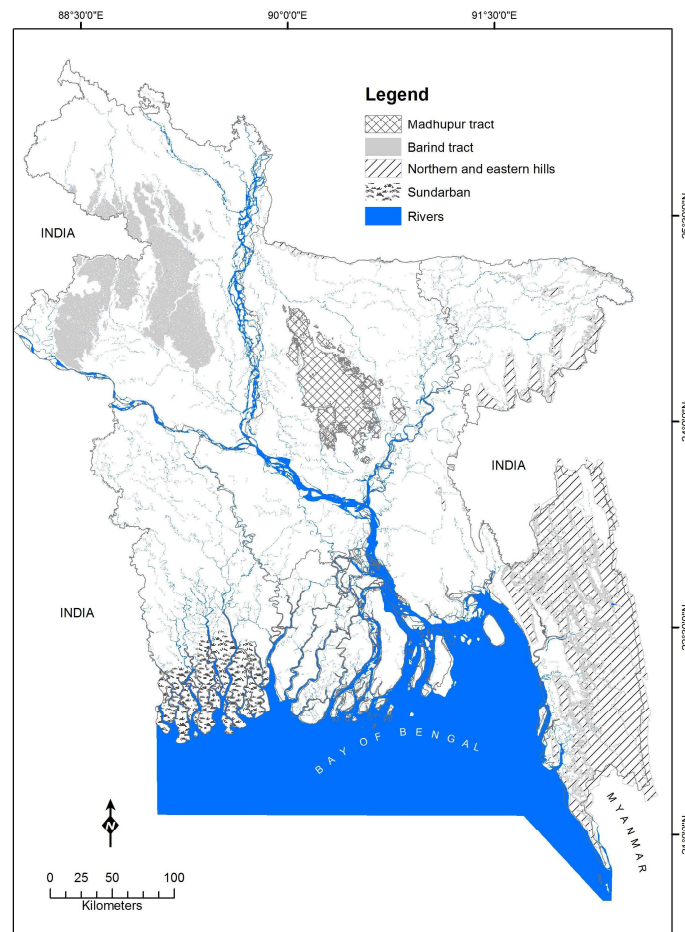
Figure 2-4: Physiography of Bangladesh.
Yellow boundary on the map is the study area of the thesis which includes Old Brahmaputra, Jamuna (Young Brahmaputra) floodplain and Ganges River floodplain
Source: Made by the author, 2017

The brief description of Old Brahmaputra floodplain, Jamuna (Young Brahmaputra) floodplain and Ganges river floodplain are as below:

(4) Old Brahmaputra floodplain

A significant change (the river shifted from a course around the eastern edge to the western side of the Madhupur Tract) in the course of the Brahmaputra River occurred in 1787. This new portion of the Brahmaputra River is known as Jamuna. The basin of the Brahmaputra River is 651,334 km2 ((EGIS, 1997a). The length of the Brahmaputra is approximately 3,848 km, whereas the average depth of the river is 124 ft (38 m) and the maximum depth is 380 ft (120 m) (Goodbred and Kuehl, 2000b). The average discharge is about 19,800 m3/s and floods can reach over 100,000 m^3/s (EGIS, 1997b).
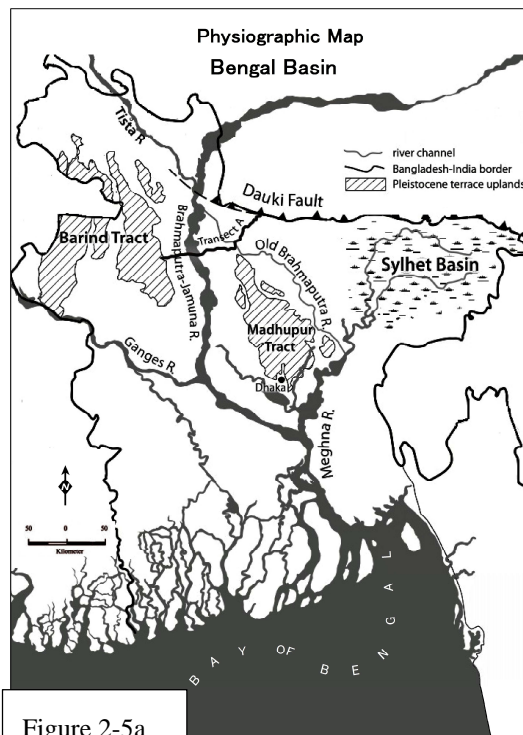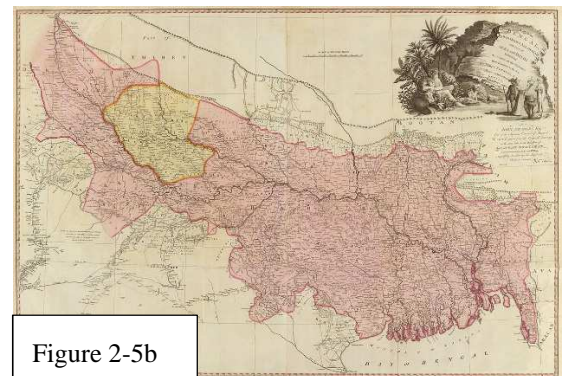
Figures 2-5 (a-c): Physiographic map of the Bengal Basin including location of the Brahmaputra–Jamuna River and the Madhupur Tract which are shown in figure 2-5a. Figure 2-5b shows the Brahmaputra River course in the 1770s and finally, figure 2-5c shows the total width of the Brahmaputra-Jamuna and Old Brahmaputra valleys
Source: Pickering et al., 2013 which was modified by the author

The Brahmaputra River is a good example of a braided and meandered river quite a bit where frequently forms temporary sand bars (Sarker et al., 2014). The lives of many poor people of Bangladesh depend on the Brahmaputra River. In the Brahmaputra and Jamuna basin flooding, agriculture, and agricultural practices are

closely associated with each other. The effects of flooding sometimes shocking and destructive which cause major damage to agricultural crops and houses, serious bank erosion with resulting loss of homesteads, school, roads, land, loss of many lives, livestock and fisheries. There are about over 70% of the land of Bangladesh was flooded in 1998s flood, affecting 31 million people with claimed 918 human lives, 1 million homesteads, damaging 6,000 km of roads and embankments and finally, affecting 6,000 km^2 of standing crops (Bristow, 1987). During the 2004 flood, there are about 25% of the total population were directly affected whereas 800 lives were lost, 952,000 houses were badly damaged, 24,000 educational institutions were affected; including 1,200 primary schools, 2 million tube wells. Over 3 million latrines were washed away resulting in the expansion of the risks of waterborne diseases including diarrhea and cholera (Das, 2000; Mipun, 1989; Shrivastava and Heinen, 2005).Old Brahmaputra River at a glance:

Table 2-1: Tributaries, geographical information's and discharge of Old Brahmaputra River, Bangladesh

Old Brahmaputra River		
Tributaries	Left	Dibang River, Lohit River, Dhansiri River, Kolong River
	Right	Kameng River, Manas River, Raidak River, Jaldhaka River, Teesta River, Subansiri River
Geographic Information	Source	Angsi Glacier
	Location	Himalayas, Tibet
	Elevation	5,210 m (17,093 ft)
	Coordinates	30°23′N and 82°0′E
	Mouth	Bay of Bengal
	Location	Ganges Delta, Bangladesh
	Elevation	0 m (0 ft)
	Coordinates	25°13′24″N and 89°41′41″E
	Length	2,900 km (1,800 mi)
	Basin	651,334 km^2 (251,500 sq mi)
Discharge	Average	19,300 m^3/s (681,600 cu ft/s)
	Maximum	100,000 m^3/s (3,531,500 cu ft/s)

Source: EGIS, 1997b

Most of the settlements and seasonal crop lands are located in this region. There are no large government and semi-government (autonomous) institutions in the

Brahmaputra flood plain. The majority of low land is found in this area, which is very good as agricultural land. The major characteristic of the southern very low land is the location of several large brick fields (locally known as *eater bhata*) in the dry season (in general October to July) and earth moving (locally known as *mattee-kata*) by trucks to meet the existing demand for all types of construction work in Dhaka Metropolitan City. The Brahmaputra flood plain is now active mostly in the form of *char* lands, which are consist of predominantly raw sandy soils and are seasonally deeply flooded. These areas are mostly used for aus or jute on the relatively higher areas and broadcast aman in the lower areas in the monsoon season. In the dry season, a good portion of the land remains barren, with only sparse grasses used for grazing. The main crops are cheena, kaon, groundnut, water-melon, sweet potato and Rabi pulses. Boro paddy is locally grown in depressions using traditional devices of irrigation or low lift pumps, if irrigation water is available nearby. Non-agricultural land-use is isolated or on small raised platforms (*vita*), often surrounded by banana trees or permanent crops. All of the developing activities receiving low priority in this region are due to its physical barriers and it is also a backward region of Savar upazila from every aspect (Rashid, 2003).

(5) Jamuna (Young Brahmaputra) floodplain

The Jamuna River, which is mainly a distributary of the Brahmaputra River and is one of the main rivers of Bangladesh. In the past, the course of the lower Brahmaputra was passed through the Jamalpur and Mymensingh districts. For the high magnitude of the earthquake in 1762, the main course of the Brahmaputra River at Bhahadurabad point was moved southwards and created a new river course named Jamuna due to the result of tectonic uplift of the Madhupur tract. The Jamuna is a very wide river where the width is approximately 5–8 miles (8.0–12.9 km) and in the dry season when the waters subside, the breadth is hardly less than 2–3 miles (3.2–4.8 km) from bank to bank.
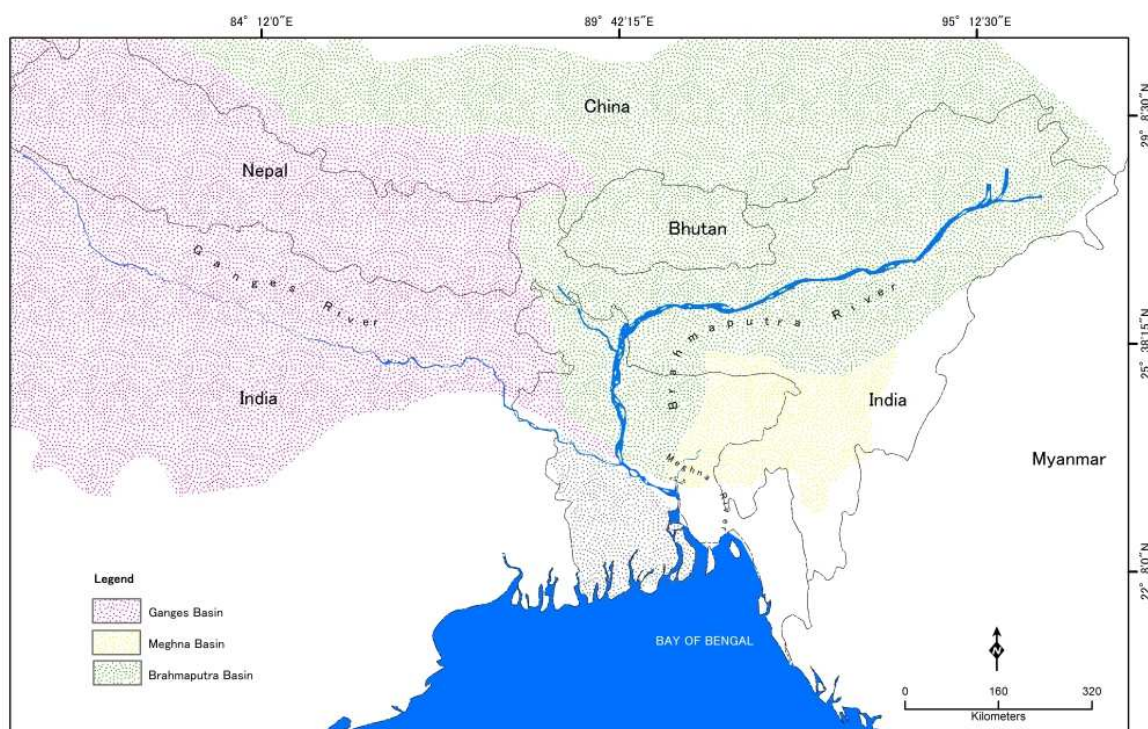
Figure 2-6: The catchment area of Ganges River floodplain, Brahmaputra (including Jamuna or Young Brahmaputra and Old Brahmaputra) River and Meghna River

Source: Modified by the author, 2017; cited from Akter et al., 2015

Bangladesh is occupying low-lying floodplains formed by the Ganges, the Brahmaputra, and the Meghna (GBM) river system and most disaster-prone deltas in the world. This delta is characterized by flat terrain with about 700 rivers, canals, and streams with a total length of around 22,155 km (BBS 1979, 1984), which carry huge quantity of sediment-water into the downstream. There are over 92% of the annual runoff made in the GBM area flows through Bangladesh (Ahmad, 2000). Major crops in the Jamuna floodplain:

Table 2-2: Major agricultural crops in the *Rabi, Kharif-I and Kharif-II* seasons

	Rabi	*Kharif-I*	*Kharif-II*
Rainfed condition	Wheat/Potato/Pulses/Oilseeds/Sugarcane	Boro Aus/Jute	Fallow
Irrigated condition	Wheat/Boro/Wheat/Potato/ Tobacco/Vegetables	Fallow T Aus	T Aman Fallow

Source: Bangladesh Meteorological Department (BMD), 2017

Cropping pattern in the Jamuna (Young Brahmaputra) floodplain is largely determined by physical, biological, and socio-economic factors like land type, soil texture, flooding regimes, rainfall (amount and distribution). There are three major cropping seasons, i.e. Rabi, *Kharif-I* or *Pre-Kharif,* and *Kharif-II* during a year in Bangladesh, where rice is the major crop. Rice cropping is single, double or sometimes tri-seasonal depending on the land type, soil characteristics, and water availability along the river Jamuna. The double or triple cropping is practiced in high the lands whereas mixed cropping of *Aus* and broadcast *Aman* are common practice in medium lands and single cropping of broadcast *Aman* is cropping in deeply flooded lands.

Table 2-3: Bangladesh land classification due to flood condition

Land type	Description	Nature of flooding
High land	Land above normal inundation	Intermittent of flooded
Medium high land	Land normally inundated up to 90 cm deep	Seasonal
Medium low land	Land normally inundated up to 90-180 cm deep	Seasonal
Low land	Land normally inundated up to 180-300 cm	Seasonal
Very low land	Land normally inundated deeper than 300 cm	Seasonal or perennial

Source: Bangladesh Meteorological Department (BMD), 2017

(6) Cumulative erosion and accretion from 1973 to 2010 of Brahmaputra/Jamuna River

From 1973 to 2010 the cumulative erosion and accretion of both banks of Brahmaputra/Jamuna River had occurred due to geological shape, mature stage of the river, sedimentation in the river bed. There are other factors that accelerate the river bank erosion like stream bed lowering or infill, flooding of banks soils followed by rapid drops in flow, saturation of banks from off-stream source, redirection and acceleration of flow within the channel, poor soil drainage, wave action, excessive sand/gravel extraction and finally, intense water from rainfall. The erosion appears to have stopped recently due to the natural process and bank protection works which have been constructed since the mid-1990s. In the middle stream of Jamuna River, substantial accretion has occurred whereas in both bank erosion has been observed (Sarker et al., 2011). The erosion rate in the western bank is approximately 6.5 km and on the eastern bank is around 5 km within the year of 1973 to 2010 of the Jamuna

River (Figure 2-7).
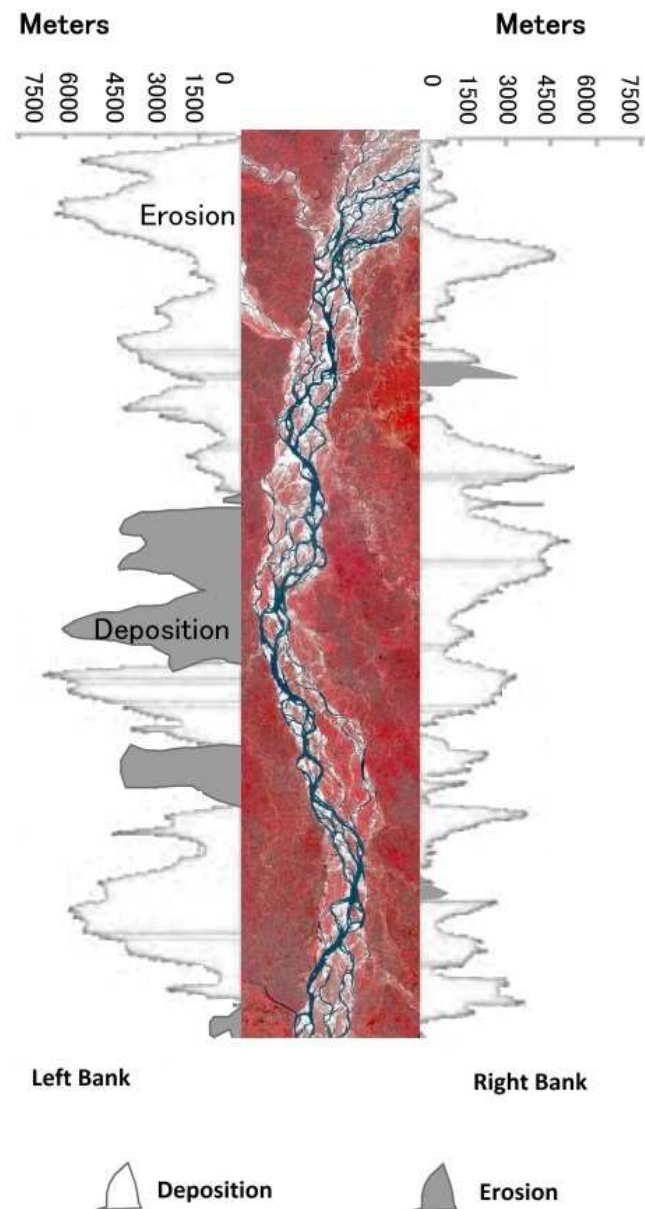
Figure 2-7: Overall erosion and accretion of the both bank namely right and left bank of the Brahmaputra/Jamuna River in the period 1973-2010
Source: Modified by the author, 2017; cited from ADB, 2013 (Technical Assistance Consultant's Report)

The expected shifting both rights and left bank of the Brahmaputra/Jamuna for the period 2006 to 2020, Bangladesh. The rate of erosion in the middle part of the Jamuna River is much higher than the upstream and the downstream of Jamuna in the predicted

year.

The river of Jamuna, Bangladesh has extended its bank from 8.3 km to 11.8 km in the mid-1990s. The lower stream of Jamuna river has experienced a similar transformation process, where the average width was 6 km in the 1970s and it increased to 10 km in the early 1990s. In the lower part of Jamuna River continued its widening process at a lower rate up to 2001, when the average width was around 10.8 km (Figure 2-8).
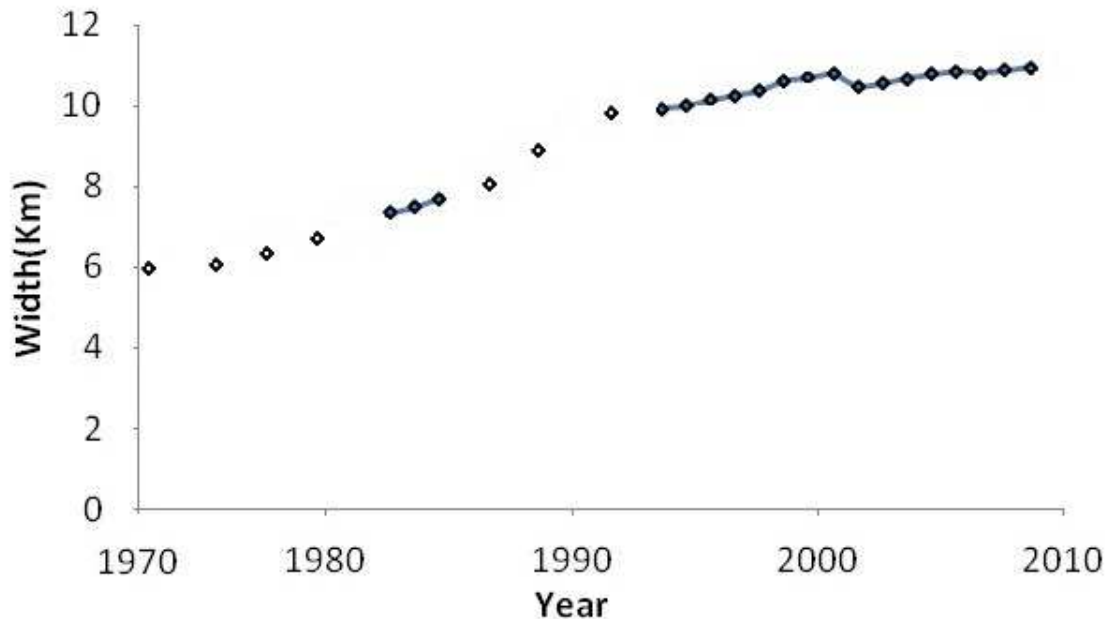
Figure 2-8: Increase in average width of the lower Jamuna River over the period 1973-2010, Bangladesh
Source: Modified by the author, 2017; cited from ADB, 2013 (Technical Assistance Consultant's Report)

The strength of *chars* can be achieved through the assessment of the age and the persistence of *chars*. The age of *chars* calculated in the dry season, which was assessed by superimposing the 17 classified images spanning the period 1973 to 2000 (Figure 2-9). Seventeen types of *chars* are identified whereas majorities (68%) are young *chars* with ages up to six years. There are about 15% of it have lasted for 12 years or more. The persistence of *chars* signifies a statistical probability of the life period of *chars,* which would be a better needle for stability (ADB, 2013). Lastly, it is stated that there are approximately 53% of the *char* area was found less than 10 years old in 2013. For the whole Brahmaputra-Jamuna River, the percentage was about 71% and 76% in the year of 1992 and 2000 respectively (EGIS, 1997a; EGIS, 1997b). For the

persistence of *chars,* some important aspects should be considered like flooding, water quality and minimum flows, sediment management, bank stabilization, land reclamation, navigation; social aspects, like the conditions of the *char* people; fisheries and ecology. For the betterment of the rural poor people, the Brahmaputra Integrated Development Plan (BIDP) had initiated several projects namely Brahmaputra Stabilization Plan (BSP), Brahmaputra Flood Management Plan (BFMP), Brahmaputra Water Resources Development Plan (BWRDP), Brahmaputra Char Livelihood Development Plan (BCLDP) and finally, Brahmaputra Biodiversity Plan (BBP) (ADB, 2013).
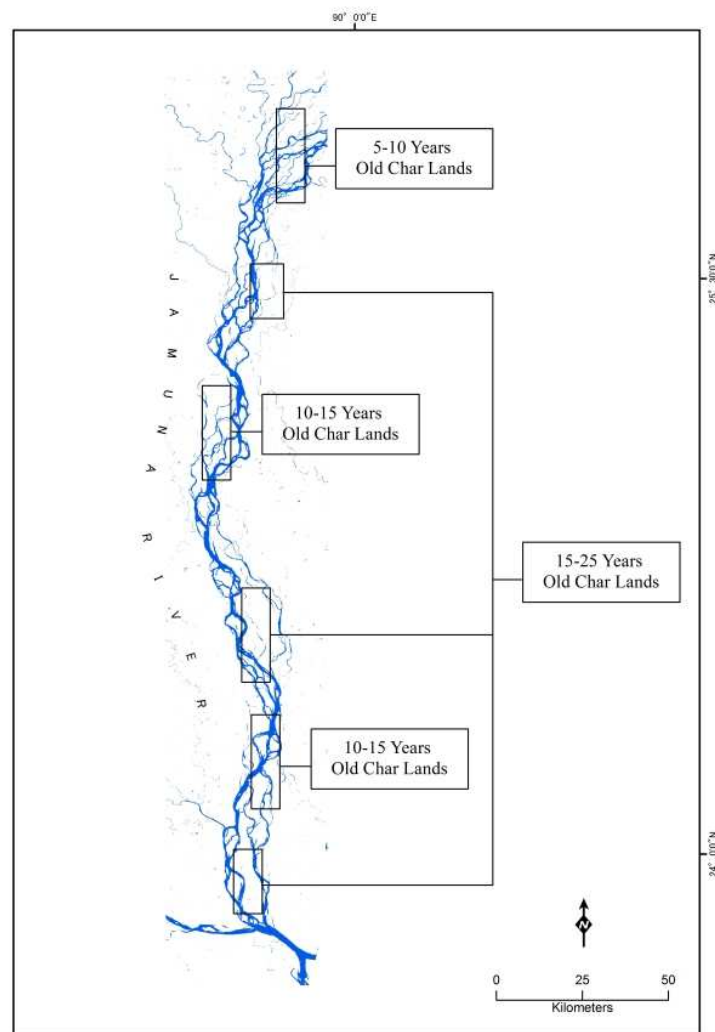
Figure 2-9: *Char* dynamics (age of *chars*) in Brahmaputra-Jamuna River in period 1973-2000

Source: Modified by the author, 2017; cited from the Center for Environmental and Geographic Information Services (CEGIS), 2000

The Brahmaputra Integrated Development Plan (BIDP) plan which were collected from ADB (Technical Assistance Consultant's Report, 2013) are:

(a) BSP had initiated a program for river bank protection, navigation and land recovery projects, including medium term investment plans;

(b) BFMP is providing a program of future embankments considering the minimum width of the different river;

(c) BWRDP is developing and initiated a programme for the development of the different offtakes, considering the accessibility of water resources in the internal rivers of Bangladesh;

(d) BCLDP, through a program for relocating of *char* people affected by the proposed Brahmaputra Stabilization Plan (BSP); and

(e) Finally, BBP is making a program to confirm satisfactory biodiversity in the main rivers and the floodplains, including mitigating and remedial measures in relation to the BSP.

The river management wing will play the significant role in the development of riverbank issues and bordering zones. Governmental organizations to be included as stakeholders are:

(a) Ministry of Water Resources (WARPO);

(b) Ministry of Communications (including BBA);

(c) Ministry of Environment;

(d) Ministry of Land; and

(e) Ministry of Finance through Planning Commission.

(7) Topography and relief

The Jamuna floodplain is seasonally flooded, is characterized by an irregular relief. Planning of annual agricultural crops growth and identify the sources, causes and accumulation of arsenic in the groundwater's are depending on the floodplain sedimentation and inundation in a particular area. According to ISPAN, 1995 define few significant types of relief within the Jamuna floodplain. These are:

(a) Bars, scroll bars and sand dunes: Bars, scroll bars and sand dunes are formed by flood waters at the edge of the floodplain. The formation of Bars, scroll bars and sand dunes also seen in the margin of the main stream or cross-floodplain channels frequently. The elevation differences between top and bottom is hardly more than 1-2m.

(b) River levees: River levees are formed by the deposition from overbank flow in the edges of the active channels. The height difference between the levee top and surroundings floodplain can be 1m over a distance of 100m along small channels whereas 2-3m over 500m or more along the major rivers (CEGIS, 2005).

(c) Crevasse splays: Crevasse splays is formed due to a breach in the levee that forms a lobe of the sediment. The grain size gradually decreases with distance from the initial breach.

(d) Flood basin: Flood basin is nearly enclosed depressions between the levees of the neighboring channels and the flood basins may contain silts and clays that settle in the quiet water whereas more permanently flooded areas/older floodplains contain peat accumulations.

(8) Soil type

Three explanations can be made on the basis of an assessment of the cross profiling the soil layers along the river of Jamuna. The major observations are the upper 2 m of all cross-profiles collected on the *chars* land studied contain of a sequence order of sandy and clayey/silty layers; the total thickness of the clay and silt layers in the upper 2 m varies between 0.3 and 0.6 m; the upper layer nearly all the time consists of a layer of silt and clay (ADB, Technical Assistance Consultant's Report, 2013).

Soil Profile (cm)	Soil Bar	Soil Visual Classification	Layer Thickness (cm)	Lithologic Unit No
0-19		Soil	19	U-12
20-35		Mud stone	16	U-11
36-44		Light coloured fine SAND	9	U-10
45-76		Fine SAND with silt lense	32	U-9
77-93		CLAY	17	U-8
94-104		Fine SAND with silt lense	11	U-7
105-113		Silty Clay	9	U-6
114-137		Medium to coarse SAND with mica flakes	24	U-5
138-151		Medium to fine cross bedded SAND	14	U-4
152-162		Silty to Clayey dark coloured layer	13	U-3
163-175		Blush gray coloured mud layer	13	U-2
176-200		Fine grain sand layer	25	U-1

Figure 2-10: Cross-profiling with measuring stick (length 2 m) and interpretation of the soil layers

Source: Modified by the author, 2017; cited from ADB (Technical Assistance Consultant's Report, 2013)

(9) Isotherm Maps

Bangladesh is situated in the tropical monsoon region and its climate is categorized by high temperature, heavy rainfall, and excessive humidity as well as seasonal variations. There are separate seasons can be documented in Bangladesh, i) the cool dry season from November through February ii) the pre-monsoon hot season from March to May whereas April is the hottest month which means temperatures range from 27°C in the east and south to 31°C in the west-central part of the country (Ahmed and Alam, 1998). Sometimes it reaches up to 40°C and iii) the rainy monsoon season which lasts from June through October (Banglapedia, 2015).
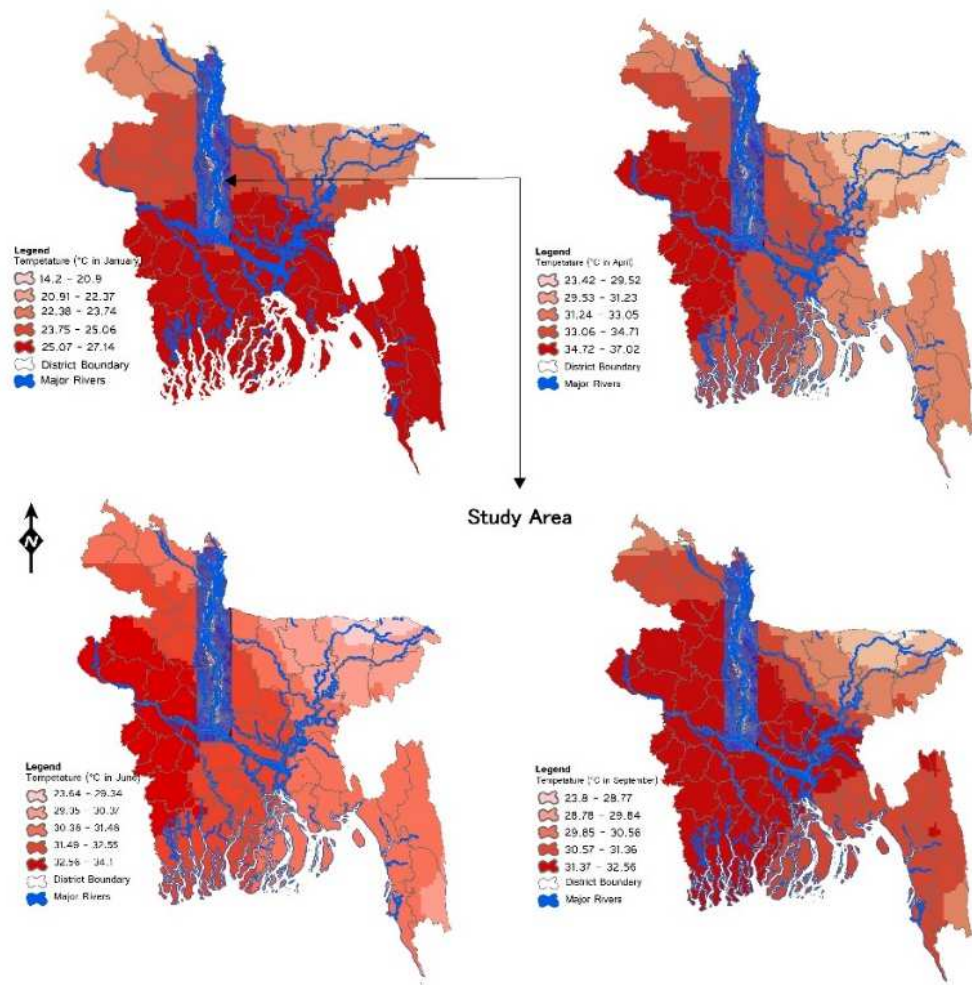
Figure 2-11: Temperature in different month of Bangladesh

Sources: Made by the author and data from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and Field survey, 2016
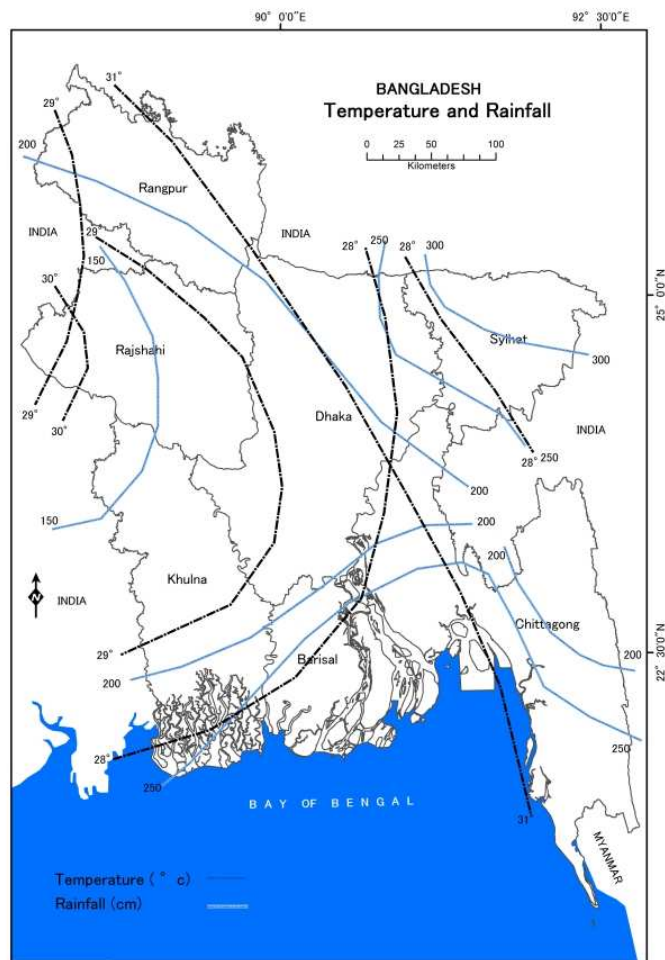
Figure 2-12: Average temperature and rainfall of Bangladesh

Source: Made by the author and data collected from Center for Environmental and Geographic Information Services (CEGIS)

Bangladesh is situated in the subtropical monsoon climatic region that is characterized by extensive seasonal deviations in rainfall and high temperatures. There are three seasons in Bangladesh. The first is the hot and humid summer from March to June consisting of temperatures of 30°C to 40°C with April being the warmest month. The second is the rainy monsoon season from June to October and the third is the dry winter from October to March with about 10°C temperatures, with January being the coldest month in most parts of the country (World Meteorological Organization, 2003). The month of March is considered as the spring season and the period from mid-October through mid-November is called the autumn season. The average temperatures in the month of January vary from about 17°C in the northwestern and northeastern parts to 21°C in the coastal areas of Bangladesh as well as in July average

temperatures vary from about 27°C in the southeast to 29°C in the northwestern part of the country.

(10) Rainfall

Bangladesh has a tropical monsoon climate with around 80% of the total rainfall occurring during the monsoon and the average annual precipitation being 2,320 mm (Hassan and Hossain, 2010). It varies from 1,110 mm in the northwest to 5,690 mm in the northeast (Hashizume et al., 2008). It indicates that the annual lake evaporation is roughly 1,040 mm, which is about 45% of the mean annual rainfall. According to the Flood Forecasting and Warning Centre, the danger level of river water is 24m PWD, which may be the consequences of floods that damage nearby crops and homesteads in rural Bangladesh every year.
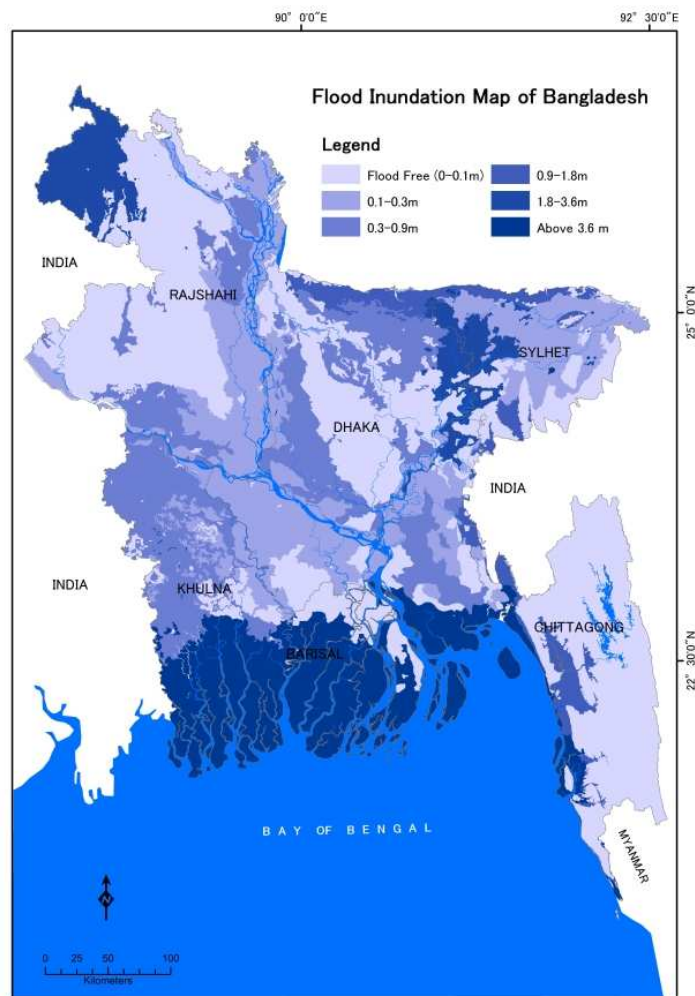
Figure 2-13: Flood inundation map of Bangladesh, 2017

Source: Made by the author and data collected from Flood Forecasting and Warning Centre (FFWC), 2017

The amount of rainfall varies from 100 cm in the west central part to over 200 cm in the south and northeast region. Tropical depression that enters the country from the Bay of Bengal is the major cause for the rainy season. The average rainy days throughout the season differ from 60 days in the west-central part to 95 days in the southeastern and over 100 days in the northeastern part. Geographic distribution of annual rainfall demonstrates a variation from 150 cm in the west-central part and more than 400 cm in the northeastern and southeastern parts of the country. The maximum amount of rainfall has been documented in the northern part of Sylhet district and in the southeastern part of the country (Cox's Bazar and Bandarban districts) (Banglapedia, 2015).

(11) Geological structure and stratigraphy

Bangladesh is divided into three major categories by the physiographic unit such as Tertiary hills; Pleistocene terraces and recent floodplains. However, the study area consists of only recent floodplains. The shifting of the Brahmaputra reflects geological activities in this region.

Table 2-4: A very brief stratigraphic succession of the rocks of the study site

Age	Formation	Lithological Description	Thickness In Meters
Recent	Alluvium	clayey soil, silty soil, earthy grey clay and very fine sand, massive loose and unconsolidated	±3
		Unconformity	
Pleistocene	Madhupur Clay	Reddish brown clay, mottled, well oxidized, ferruginous and calcareous nodules present, compacted	0-31
		Unconformity	
Pliocene to late Miocene	Dupitila	Light grey fine sand together with considerable medium sand at the bottom, loose to moderately compacted Light brown medium to coarse sand, gravels	32-65 30-61

Sources: Monsur, 1990 and Alam, 1995

The total area of Bangladesh is 144.80 thousand km^2, whereas the hilly land, terrace land, beels and rivers is 22.18K km^2, 30.26K km^2 and 1.22K km^2 respectively and rest of the land is mainly floodplain, which is the most dominant land feature in the country (Rashid, 2003). The major physiographic regions and the broad land use of Bangladesh at a glance:

Table 2-5: Major physiographic regions of Bangladesh and the broad land use

Physiography	Area in km^2	Area in Percentage	Dominant land types	Key Land-use
Floodplains	113,370	78.32	Medium High land, Medium Low land, and low lands	Agriculture (mainly Rice and Jute) and Homestead Vegetation
Tertiary Hills	18,172	12.56	Flood free and High land	Mainly Forest, Grassland and Tea Gardens
Pleistocene Terraces	11,971	8.27	High Land and Medium High land	*Shaal* Forest and Agriculture
Beels and Rivers	1,224	0.85	Low Land and Very low land	Fishing and Deepwater rice

Source: Rashid, 2003 and Area Calculated from FAO, 1988

(12) Seasons

The climatic condition in the study site and its surroundings belong to sub-tropical monsoon and humid climatic conditions characterized by the three distinct seasons:

(a) *Garam Kaal* (Summer or Hot seasons): March-May

(b) *Barsha Kaal* (Rainy or Monsoon season): June-October

(c) *Syeth Kaal* (Winter or Cool season): November-February

(a) *Garam Kaal* (summer or hot seasons)

Garam Kaal is characterized by high temperatures along with frequent thunderstorms. The maximum and average temperature ranges from 35ºC to 40ºC and from 20ºC to 30ºC respectively throughout the year. There are sudden storms with high wind velocity ranging from 60 to 150 km/hr, known as 'Nor-westers' in the pre-monsoon period. Rainfall during these months accounts for around 10% of the annual rainfall. Wind speed varies remarkably throughout the year. In general (excluding wind speed of sudden storms), the highest wind speed is 4-5 knots (1 Knot = 1.852 km/hr). This season is also known as *Pre-Kharif* Period to indicate a certain range of crops (Rashid, 2003).

(b) *Barsha Kaal* (rainy or monsoon season)

Barsha Kaal is characterized by long duration and heavy rainfall, cyclonic storms with destructive winds are frequent during both the early and later stage of the monsoon season. The monsoon rains are not usually stormy where the rainfall sometimes ranging from 50mm to 75 mm per day. Rainfall during the rainy or monsoon season is about 90% of the annual precipitation that is roughly 2,000mm. The maximum rains fall in the months of June and July (Uddin et al., 2006). During the monsoon, the relative humidity ranges between 85-90%. The maximum temperatures are relatively low in comparison to *Garam Kaal* (summer or hot seasons) due to the presence of extensive cloud cover during this period. This period is known as *Kharif* period (Rashid, 2003).

(c) *Syeth Kaal* (winter or cool season)

Syeth Kaal is characterized by dry and foggy weather conditions and very rare rainfall events. To indicate the wide range of dry season crops, this season also known as *Rabi* period. The evaporation rate is lowest in November, whereas the average temperature differs from 15ºC to 20ºC in December and January with the lowest temperature about 4-6ºC. The lowest wind speed of the year is recorded during November and December at about 1-2 Knots (Rashid, 2003).

Table 2-6: The basic climatic data of study sites based on local seasons, 2017

Cropping Seasons	Pre-Kharif			Kharif					Rabi			
	(Hot Summer)			(Monsoon or Rainy Season)					(Dry Winter)			
Months	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Highest Temp ºC	40.6	42.3	40.6	38.4	35.2	35.9	35.3	38.8	33.3	31.2	34.2	36.6
Lowest Temp ºC	10.4	15.6	18.4	20.4	21.7	21.0	22.0	10.4	10.6	6.7	5.6	4.5
Average Temp ºC	26.4	28.7	28.9	28.7	28.7	28.7	28.7	27.4	23.6	19.8	18.8	21.5
Average Rainfall mm	52.3	124.0	283.0	398.2	391.4	328.0	264.0	160.0	25.2	7.4	6.5	20.2
Relative Humidity %	63	71	79	86	87	86	86	81	75	74	70	66
Evaporation mm	81	77	78	83	87	130	118	106	75	105	104	79
Days of Rain per month	4	8	14	19	22	22	16	9	2	1	1	2
Wind Velocity (knot)	3	5	5	4	4	4	3	2	1	1	2	2

Source: Bangladesh Meteorological Department, 2017

(13) Crops

The agricultural crops are divided in to two categories, namely major crops and minor crops in Bangladesh. Rice dominates the cropping pattern throughout Bangladesh. It is broadly categorized into three major classes. First one is *Aman* which is transplanted and broadcasted varieties (transplanted *Aman* covers around 46.30% and broadcast *Aman* covers around 9.26% of the paddy area), second one is *Boro (*covers around 26.85% of the paddy area*)* and finally, *Aus* (covers around 17.59% of the paddy area) according to the season in December-January, March-May and July-August respectively.

Table 2-7: Distribution of land by season, broad variety and associated water management (thousand hectares)

Paddy type	Harvested area	Irrigated	Upland	Flood prone	Drought prone	Rain fed
Aus **Paddy**						
Local	859.17	21.48	837.69	0	0	0
HYV	466.06	93.21	372.85	0	0	0
Sub-total	1,325.23	114.69	1,210.54	0	0	0
Aman **Paddy**						
B. Aman local	769.87	0	0	769.87	0	0
T. Aman						
Local	2,143.56	214.36	0	0	964.60	964.60
HYV	2,796.63	559.33	0	0	1,118.65	1,118.65
Sub-total	4,940.19	773.69	0	0	2,083.25	2,083.25
Total	5,710.06	773.69	0	769.87	2,083.25	2,083.25
Boro **paddy**						
Local	201.74	201.74	0	0	0	0
HYV	3,650.10	3650.1	0	0	0	0
Sub-total	3,851.84	3761.8	0	0	0	0
Total	10,887.13	4,740.22	1,210.54	769.87	2,083.25	2,083.25

Source: Yearbook of Agricultural Statistics of Bangladesh, 2015

Rice (73.94%), wheat (4.45%) grown mainly in the drier parts of the north and is cultivated only as a winter crop, jute (3.91%) grown to the low-lying areas of the Brahmaputra-Jamuna floodplains, rape and mustard (3.08%) is also grown mainly in the low-lying areas of Brahmaputra-Jamuna floodplains, lentil (1.54%), chickling

vetch (1.25%) is usually found in sandy islands, potato (1.13%) is the most important of the winter vegetables and is widely grown in Munshiganj, Comilla, Rajshahi, Rangpur, Dinajpur, Bogra, Joypurhat and Nilphamari districts of Bangladesh, sugarcane (1.12%), and chilli (1.05%) are grown on 1% or more of the crop land (14.61 million ha) and may be considered as major crops (Banglapedia, 2015).
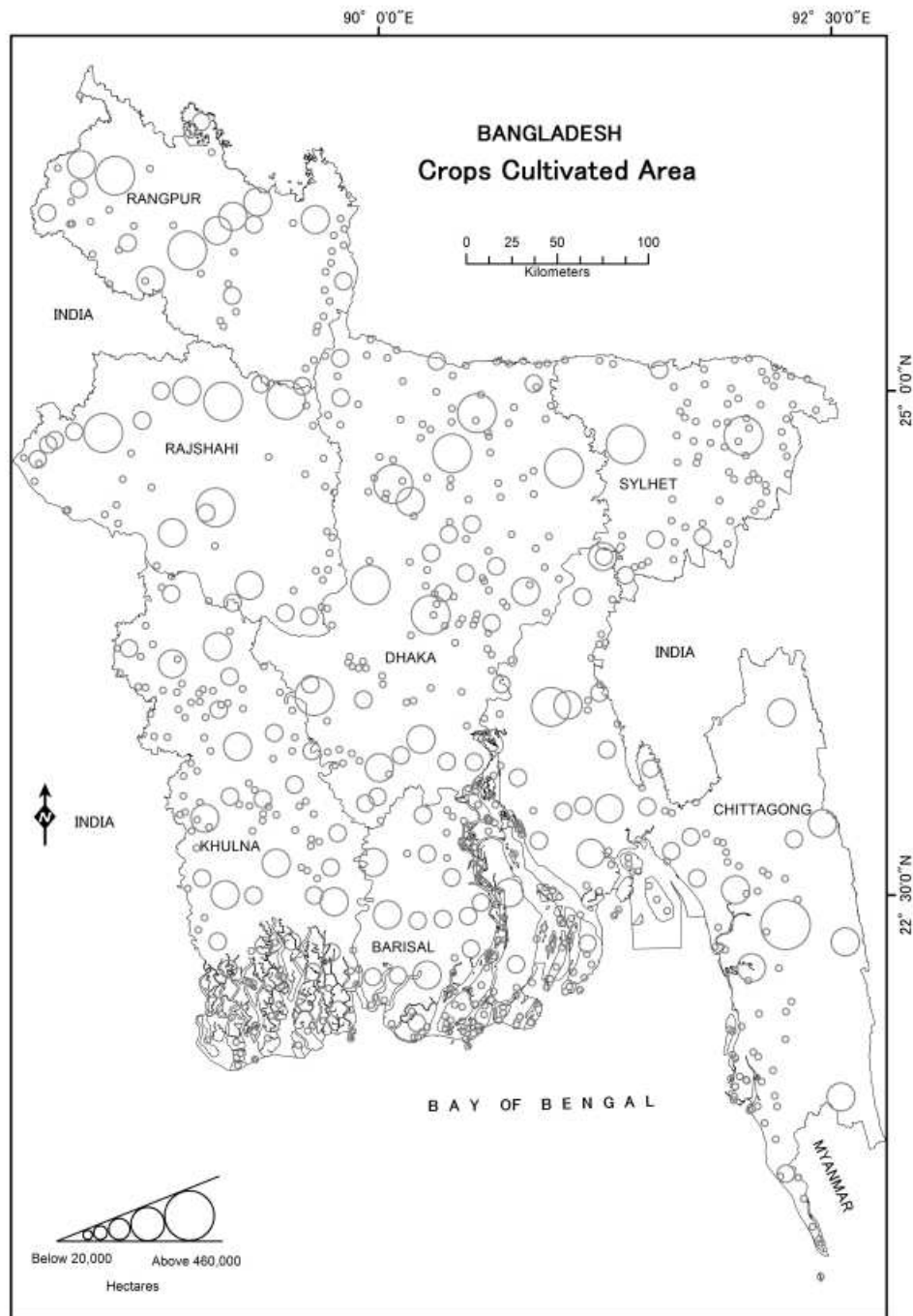
Figure 2-14: Major cultivation for different agricultural crops of Bangladesh
Source: Made by the author, 2017; data collected from CEGIS, 2016

Minor crops are grown on less than one percent of the gross cropped area (GCA) of the country. The minor crops are gram (0.78%), millets and maize (0.60%), onion (0.58%), black gram (0.51%), sweet potato (0.45%), groundnut (0.40%), green pea (0.36%), sesame (0.33%), linseed (0.30%), garlic (0.20%), pea (0.12%) and barley (0.10%).Some crops such as vegetables and spices are occupying a very insignificant proportion of the GCA which is 1.57% of the total. Tea is a minor crop in terms of area, which comes second as an export crop and mainly grown in the hills areas such as Maulvi Bazar, Habiganj, Sylhet, Chittagong and Cox's Bazar districts of Bangladesh.

(14) Water resources

Bangladesh is a riverine country bordered by hills on three sides. River flows are mainly controlled by generation of flow in the upstream catchments of the Ganges, Brahmaputra and Meghna (GBM) basins (PDO-ICZMP, 2004 and Mukherjee et al., 2010). There are 57 international rivers originating outside the boundary of Bangladesh, whereas 1.18 million cubic meters of water flows annually to the sea, of which 1.07 million cubic meters (91%) enter Bangladesh from India (Rashid, 1991 and Rahman, 2001). Bangladesh can be divided into eight hydrological regions according to water management purposes (WARPO, 2001a). The rivers of Bangladesh either tributaries or distributaries of the GBM and receive enough water flow to inundate the entire catchment area under 6 metres every year (Chowdhury et al., 1997). The Brahmaputra has the largest flood flow where about 54% (598.908 km³) is contributed by the Brahmaputra, 31% (343.932 km³) by the Ganges and nearly 15% (162.772 km³) by the tributaries of the Meghna and other minor rivers (Salehin et al., 2007). Besides that, the Bengal delta is formed with alluvial soil, which contains a large groundwater aquifer. The storage coefficient of the alluvial aquifer differs from 1 to 15%, where the transmission rate is 500 to 3000 m^3 per day per meter width (GEF, Government of the People's Republic of Bangladesh and UNDP, 2012).

(15) Forest resources

There are 17% of Bangladesh's area occupies forest lands whereas 0.27 million hectares forest area are considered as homestead or village forests which is the most productive source of floral resource in Bangladesh. The Forest Department copes 1.52 million hectares out of 2.52 million hectares of forest land. The Ministry of Land controls 0.73 million hectares of forest area as Unclassified State Forest (USF). The hill forests occupies a significant class o forests, covering 670,000 hectares of land of Bangladesh (GEF, Government of the People's Republic of Bangladesh and UNDP, 2012).

Table 2-8: Types of forest managed by forest department

Types of forest	Area (million hectares)	Percentages (%)
Natural mangrove forests and plantation	0.73	4.95%
Tropical evergreen and semi-evergreen forests	0.67	4.54%
Tropical moist deciduous forests	0.12	0.81%
Total	1.52	10.3%

Source: Forest Department, 2016

The Sundarbans are covering 6,017 km^2 (4.07%) of the forest land that represent the world's largest contiguous natural mangrove forest. The Sundarbans area covers around 139,700 hectares of land which declared as a UNESCO World Heritage Site in 1997 (Gani et al., 2017). The major mangrove species in the Sundarbans are Sundri (*Heritiera fomes*), Gewa (*Excoecaria agallocha*), Keora (*Sonneratia apet*ala), Baen (*Avecennia officinalis*), Dhundul (*Xylocarpus granatum*) and Passur (*Xylocarpus mekongensis*). The Sundarbans is a unique territory for wildlife which includes the Bengal tiger (*Panthera Tigris)*, the Gangetic dolphin (*Platanista gangetica*), monkeys (*Macaca mulatta*), the Indian fishing cat (*Felis viverrina*), the Indian otter (*Lutra perspicillata*), and the spotted deer (*Axis axis*). Reptiles are estuarine crocodile (*Crocodylus porosus*), the monitor lizard (*Varanus salvator*), the rock python (*Python molurus*) and the green turtle (*Chelonia mydas*). The Sundarbans provides many livelihood and environmental services including crucible of biodiversity in Bangladesh. When the cyclone Sidr hit in the southern part of Bangladesh in 2007, the Sundarbans protected and saved many lives, homesteads and the properties. The plain land forest and village or homestead forests are covering 120,000 hectares (0.81%) and 270,000 hectares respectively (GEF, Government of the People's Republic of Bangladesh and UNDP, 2012).

(16) Livestock and fisheries

The livestock is considered a significant part of a country's economy. The number of livestock in Bangladesh was totalled 48 million whereas half of cattle and buffalo (nearly 23 million were cattle and the rest buffalo) and the other half was goats and sheep (most are goats) in 2007 to 2008. The expected share of the livestock sub-sector in GDP was 2.79% in the fiscal year of 2007-2008.

Table 2-9: Livestock population of Bangladesh (in 10 million number)

Livestock	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Cattle	228.70	229.00	229.76	230.51	231.21	231.95	233.41	234.88	236.36	237.85
Buffalo	12.10	12.60	13.04	13.49	13.94	14.43	14.50	14.57	14.64	14.71
Sheep	26.80	27.80	28.77	29.77	30.02	30.82	31.43	32.06	32.70	33.35
Goat	207.50	215.60	224.01	232.75	241.49	251.16	252.77	254.39	256.02	257.66
Total Ruminant	475.10	485.00	495.58	506.52	516.84	528.36	532.11	535.90	539.72	543.57
Chicken	2,068.90	2,124.70	2,213.94	2,280.35	2,346.86	2,428.66	2,490.11	2,553.11	2,617.70	2,683.93
Duck	390.80	398.40	412.34	426.77	441.20	457.00	472.54	488.61	505.22	522.40
Total Poultry	2,459.70	2,523.10	2,626.28	2,707.12	2,788.06	2,885.66	2,962.64	3,041.72	3,122.93	3,206.33
Total Livestock	2,934.80	3,008.10	3,121.86	3,213.64	3,304.90	3,414.02	3,494.75	3,577.62	3,662.65	3,749.90

Notes: Livestock units (LU) for Bangladesh is computed as Bovine (cattle/buffaloes/horses) = 0.5 LU; sheep's/goats = 0.1 LU and poultry (fowls and ducks) = 0.1 LU as defined in FAO (2005)
Source: Livestock Economy, 2015-2016

Contribution of livestock and poultry in the national economy of Bangladesh*:* The contribution of livestock and poultry in the national economy of Bangladesh is shown in the table below:

Table 2-10: Contribution of livestock and poultry in the national economy of Bangladesh

Sectors	Percentage (%)
Contribution of Livestock in Gross Domestic Product (GDP), (2015-16)	1.66%
GDP growth rate of Livestock (2015-16)	3.21 %
GDP volume (Current price) in Crores (Taka), (2015-16)	32, 910
Share of Livestock in Agricultural GDP (2015-16)	14.21%
Employment (Directly)	20%
Employment (Partly)	50%
Cultivation of land by livestock	50%
Fuel supply from livestock and poultry	20%

Source: Livestock Economy, 2015-2016

The fisheries resources of Bangladesh include a wide range of fishes, prawns, lobsters, crustaceans, molluscus, turtles and other fish resources that inhabit the

country's widespread marine and inland open waters (Das and Saha, 2008). The fisheries sector in Bangladesh is broadly divided into three sub-sectors such as inland capture, inland culture and marine fisheries. The diverse aquatic ecosystem of Bangladesh is divided into three categories namely freshwater, estuarine and marine aquatic ecosystem. There are 264 species of finfish, 4 species of crabs, 10 species of shrimps/prawns and 20 species of turtles have been recorded in the freshwater of Bangladesh. Furthermore, seasonally inundated floodplains, rivers and their tributaries i.e. beels, *haors* and *baors* as well as estuarine and brackish waters in the south are the main sources of rich fisheries resources (GEF, Government of the People's Republic of Bangladesh and UNDP, 2012).

Table 2-11: Marine and freshwater fish production and area in Bangladesh (taken from (DoF, 2016)

Types of fisheries	Fisheries sector	Water Area (Hectare)	Production (Metric Tons)
Inland Fisheries	**Inland open water (capture)** Rivers, Estuary, Sundarbans, Beel, Kaptai Lake, Floodplain	3,906,434	1,023,991
	Inland closed water (culture) Pond, Seasonal cultured water body, Baor, Shrimp/Prawn, Farm, Pen Culture, Cage Culture	794,361	2,060,408
	Total	4,700,795	3,084,399
Marine Fisheries	Industrial (Trawl) fishing	12,111,000	84,846
	Artisanal fishing		515,000
	Total		599,846
Total production			3,684,245

Source: Fisheries Resources Survey System (FRSS), 2015.
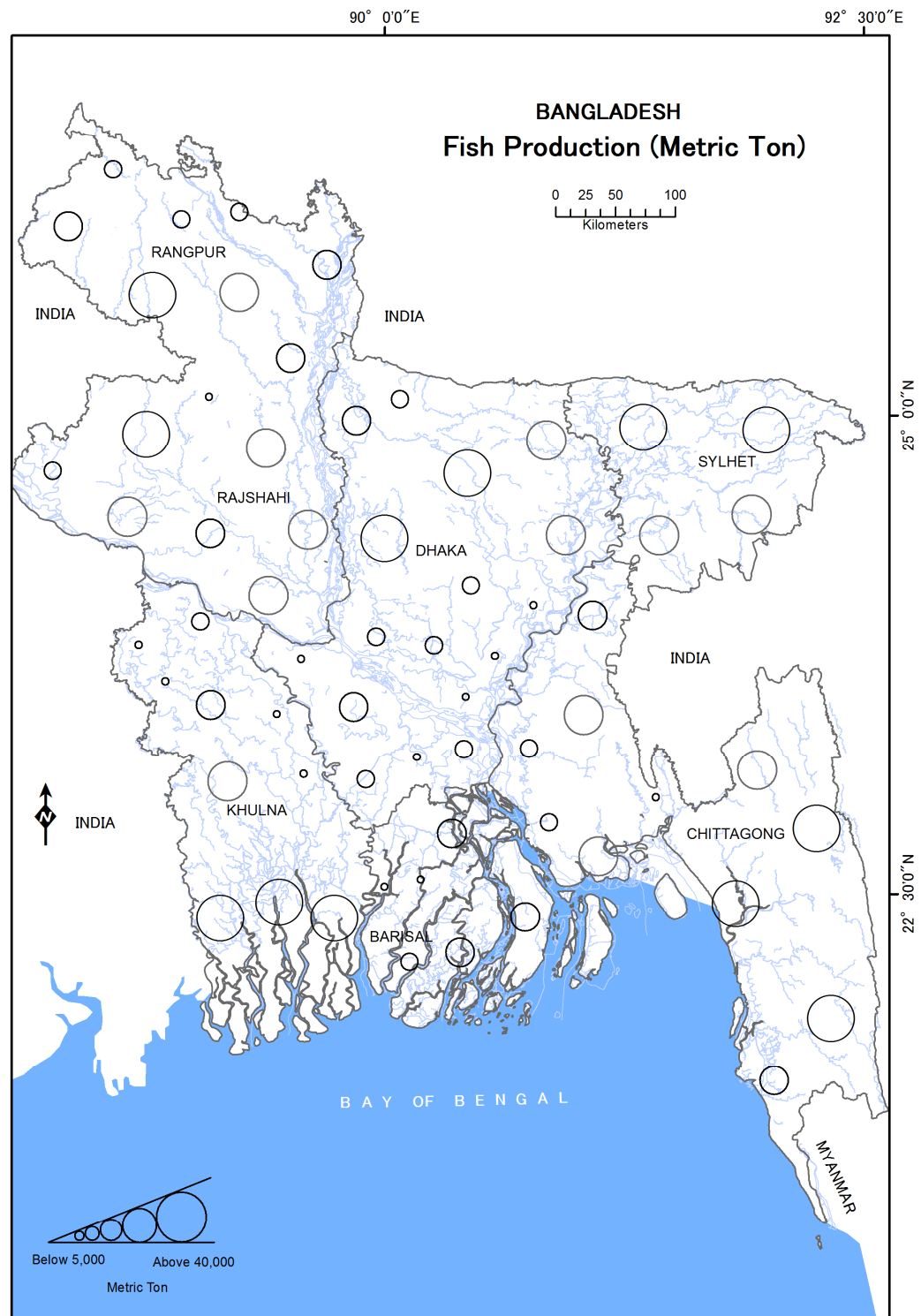
Figure 2-15: District wise inland open water (capture) fisheries production
Source: Made by the author, 2017 and data collected from Fisheries Resources Survey
System (FRSS), 2015

(17) Demographics of Bangladesh

The population of Bangladesh remained almost static because of the high birth rate and equally mortality rate in the beginning of the eighteenth century. The mortality rate was declined because of improvement in the medical sectors in 1921 where high birth rate was till continued. The population of Bangladesh in 1991 and 2001 was 755 and 881 per square kilometer respectively. It is being projected that the population of the Bangladesh will be doubled by 2050. There are 98% of population comprises of homogeneous Bengali people and rest of 2% includes the ethnic tribal population and non-Bengali Muslims in Bangladesh. The demographics information of Bangladesh are given below:

Table 2-12: Demographics of Bangladesh, 2015

Categories	Count
Population	168,957,745
Population density	1,237 persons per square kilometer
Growth rate	1.6%
Birth rate	21.14 births/1,000 population
Death rate	5.61 deaths/1,000 population
Life expectancy	70.94 years
male	69.02 years
Female	72.94 years
Fertility rate	2.4 children born/woman
Infant mortality rate	44.09 deaths/1,000 live births
Literacy rate	
Total	75.4%
Male	77.1%
Female	71.5%
Age structure	
0–14 years	31.62
15–64 years	63.25
65 and over	5.13
Sex ratio	
Total	0.95 male(s)/female
At birth	1.04 male(s)/female
Under 15	1.03 male(s)/female
15–64 years	0.91 male(s)/female
65 and over	0.97 male(s)/female

Source: BBS, 2015

The population is estimated at 169 million in 2015 whereas approximately 86% of Bangladeshis are Muslims, followed by Hindus (12%), Buddhists (1%) and Christians (0.5%) and others (0.5%). The minor ethnics are Chakma, Marma, Mundas, Garos (Achiks), Oraons, Santhals, Mro, Manipuri, Zomi, and Bihari.
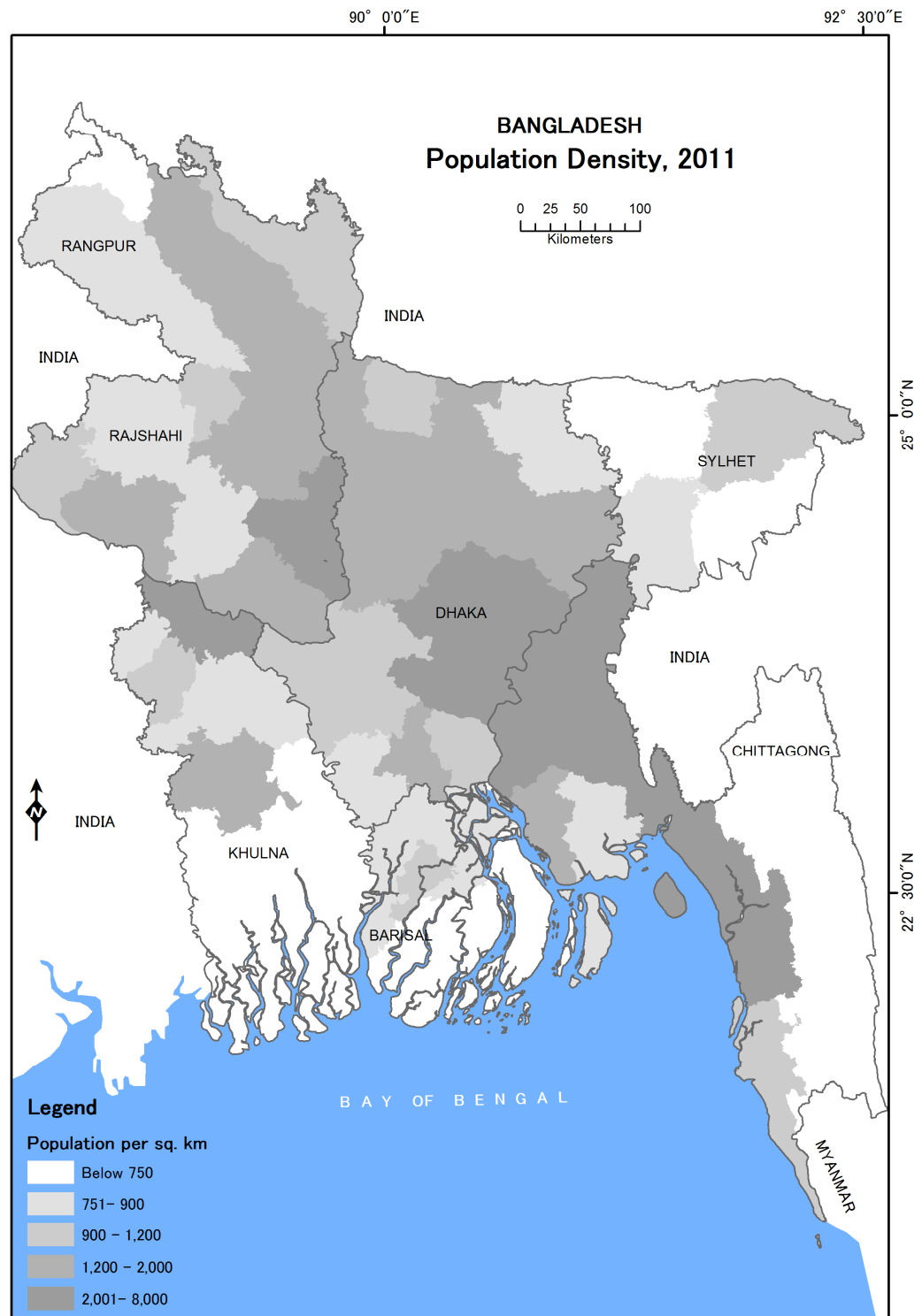
Figure 2-16: Population density of Bangladesh, 2011
Source: Made by the author, 2017

2.3 Rural development concept

For the progress of the rural sectors, policy makers and the planners have given the most preference to development. Prop up rural development planners have pursued strategies in the different levels. Rural development may be conceived as an important aspect of development intervention. As a concept, rural development runs basic function of the public administration; community participation as well as voluntary activities of NGO's and rural poor people are the target beneficiaries. However, the rural development is all embracing surrounding multidimensional aspects of rural life. Conceptually rural development is inter-disciplinary topic relating to economics, administration, health and sanitation, business management, co-operative, credit and the community action. Government and Non-government organizations are edifying the rural people how resources are mobilized, how the community of people is organized and how participating values are manifested in real life function (Mashreque and Nasrullah, 2005).

Facing the challenge of providing sufficient employment and food rights to the nearby population almost all the developing countries in the world. Slowing the rate of population growth to secure convenient level and generating an annual increase in food output that keeps up the demand of increasing population. Thus by the term of rural development, this paper indicates the lifting the productivity and accordingly the real income of families earning their livelihood by increasing employment opportunities in the farm and non-farm activities, in that way facilitating their levels of physical, social and cultural well-being (Sen, 1995). The World Bank defines rural development as "A Strategy designed to improve the economic and social life of a specific group of people. It involves extending benefits of development to the groups who seek a livelihood in the rural areas. The group includes small-scale farmers, tenants and the landless" (Obaidullah, 1995). It gives the impression that the rural development is needed not only for the economic development but also for the social development of the specific group of rural people includes the marginal farmer, landless, sharecroppers, tenants, small traders and the other occupational groups who lived at subsistence levels. Rural development defines as a micro-level concept based on the relevant literature review and the perception of the local people of the study area. This paper defines rural development as:

(1) Rural development as educational development;
(2) Rural development as agricultural development; and
(3) Rural development as poverty development.

(1) Rural development as educational development

Educational development is one of the most key indicators of the rural development. This paper aims at the development of a methodology to evaluate the activities and contribution of different NGO`s to the education sectors in the rural area of Bangladesh. To make a plan for the rural educational development of the rural poor villagers by using the community learning methods and develop the community learning centers in different villages to combine learning with community development. Education and training need to be placed at the center of the rural development agenda in order to contribute to eradicating extreme poverty and hunger, to ensure sustainable agriculture, and to build human capacity for rural development (Education for rural development, FAO, and UNESCO, 2006). For several grounds young people in Bangladeshi rural communities usually leave school early. These are needed to work at home; religious causes; limited transportation systems and lack communication facilities; long distances to school; perceived irrelevant educational content; the perpetuation of poverty; lack of jobs and finally, lack of productive opportunities which could support community development. For the development of the rural education, need to emphasis on the following concepts:

(a) Adaptation of school curricula to the rural environment;
(b) Making friendly relation between teacher and students;
(c) Recreational facilities for the students;
(d) Recruiting and training rural teachers;
(e) Involvement of parents in school management and teacher training; and
(f) Providing accessible and nearby facilities and infrastructure.

The main activities undertaken by this paper is:

(a) Collecting GPS data of each educational institute of the rural areas;
(b) Making a table regarding on spatial distributions or locations, number of students with male and female, yearly result, teachers qualifications, distance from the home to school both teachers and students;
(c) Contribution of the government and non-government organization;
(d) Participation of the local people to the educational sectors;
(e) Draw the mapping with different variables for examples map of spatial distributions or locations, spatial analysis of the ratio of the male and female students, concentration area of the schools, buffering the distance from the home to the schools;
(f) Developing meta data for the each school for the long-term planning;
(g) Analyzing the natural and environmental barriers;
(h) Knowing the cultural barrier for the female students;

(i)   Evaluating the adult literacy program; and

(j)   Knowing about the teaching and learning materials.
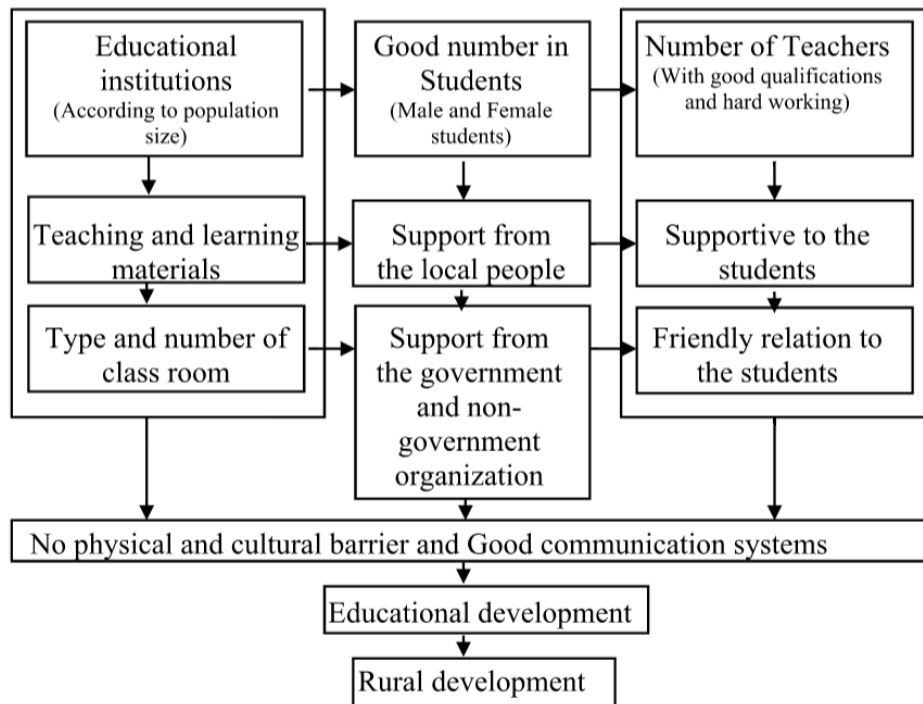
Figure 2-17: Educational development showing in a flow chart

Source: Made by the author, 2015 based on Mashreque and Nasrullah, 2005

(2) Rural development as Agricultural development

Bangladesh is predominantly an agricultural country and its economy is intensely connected with tangible success in the field of agriculture (Islam et al., 2008). This paper analyzes the agricultural development to the rural areas of Bangladesh and the factors that are contributing to it. The population is rising much faster than the agricultural production as of late. In recent years, it is observed that there are many non-government organizations have taken strategies on the development of agricultural sectors for rural development whereas they supported local groups to seed production and distribution, fertilizer distribution, multiplication of planting, plant breeding, irrigation management and land use development planning, kitchen gardening and home level food processing, small farmers and landless laborer's development and one House one farm construction (Yu et al., 2010). Rural Development signifies the growth of agriculture, which is the mainstay of traditional occupational structures of present society. Agricultural sector operates in traditional peasant economy to facilitate rural development in Bangladesh. It actively holds the key to micro-economic resilience and contributes to self-sufficient in food. During the 70's the government

agencies initiated irrigation in agriculture in Bangladesh. But it was not flourishing in small farmland. In small size farming land, deep and shallow tube-well was not appropriate for growing vegetables and spices. For the small and seasonal farmers, the NGOs have developed bamboo/cane tube-well, oar pump, star pump, dheki pump etc. type of irrigation technology with minimum cost (Mashreque and Nasrullah, 2005).

(a) Natural barrier for the agricultural development in the rural Bangladesh

There are some major natural barriers like changes of Temperature Pattern, increase or decrease of agricultural yield due to riverbank erosion, Drought (water scarcity), heavy rainfall, cyclone, distribution of rivers which make insecure agricultural development in the rural Bangladesh. The description of major natural barriers are below:

Changes of temperature pattern: The analysis of monthly average maximum and minimum temperature shows that monthly average maximum temperature has increased at the rate of 0.010C per year, whereas monthly average minimum temperature increased at a rate of 0.040C per year (IPCC, 2001 and IPCC, 2007). Therefore, changing pattern of the monthly average of maximum temperature is significantly higher than the minimum temperature. On an average, the total change of monthly average maximum and minimum temperature for the particular months has increased about 10 C during this period. Moreover, yearly average maximum and minimum temperature have increased at the rate of 0.030 C and 0.010C respectively (Schaerer, and Ahmed, 2004; Climate Change Cell, 2009a).

Increase or decrease of agricultural yield due to riverbank erosion: Riverbank, which includes attached *char* and deltaic islands and coastal erosion are the significant consequences of reducing the agricultural land in Bangladesh (Koudstaal et al., 1999). The rate of bank erosion becomes more severe while floods and cyclones are accelerating their dynamic energy (Schwartz et al., 2006). The total agricultural land is gradually decreasing due to the riverbank erosion every year and it makes millions of people landless (Khan et al., 2012). WARPO in 2005 had calculated that in 1991, there were 100 out of the 462 administrative units in the country were subject to study riverbank erosion. 35 upazilas were severely affected (about 1 million people were affected) whereas around 87 sq km of the mainland were eroded and damages agricultural crops each year due to massive riverbank erosion. A study by EGIS (1997b) calculated that the river has been shifting at an average rate of about 130 m/year. This corresponds to a loss of about 70,000 ha in 23 years, while only 11,000 ha had been accreted.

Drought (water scarcity): Drought is a lengthy and continuous period of dry weather with insufficient rainfall which occurs when evaporation and transpiration

exceed the amount of precipitation for a particular period (Selvaraju et al., 2006). In the perspective of Bangladesh, when the content of soil moisture is less than the required amount for suitable crop-growth during the normal crop-growing season is called drought (Cruz et al., 2007 and Tanner et al., 2007a). Drought mostly affects agricultural crops in pre-monsoon and post-monsoon periods. The below figure shows the drought scenario in the *Kharif* and *Rabi* season.
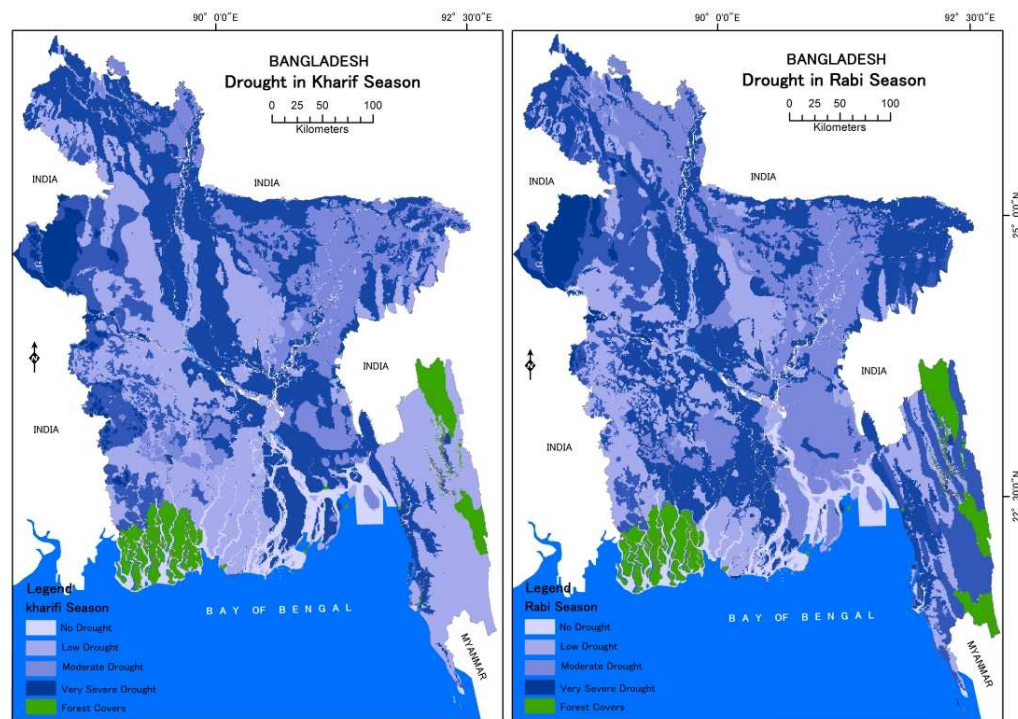
Figures 2-18: Medium type of drought occurs along the riverside of Jamuna, Bangladesh. The 1st figure shows the drought in the *Kharif* season and 2nd figure shows the *Rabi* season drought in Bangladesh.
Source: Made by the author, 2017

(b) Political and cultural barrier for the agriculture in the rural Bangladesh

Political instability and corruption of the local government in the rural areas is one of the significant barriers to the improvement of the rural poor (Ahmed, 2010). In the cropping season, the farmers did not have the fertilizer properly that is why they buy the fertilizer at a high rate from the market. Farmers facing electricity crisis in the island areas for irrigation, therefore, they make use of oil to diminish the crisis. To remove economic, political and cultural barriers for the improvement of agricultural sectors in the rural areas of Bangladesh and prevent farmer's rights by undertaking policy reforms, and strong affirmative action's. The agricultural policy maintained that

in the socio-economic context of Bangladesh women's involvement in agriculture is very important (Rahman and Ahsan, 2001). Agriculture-related activities like post-harvest operations, seed preservation, nursery business, jute stripping, vegetable cultivation, homestead gardening, floriculture, production of horticulture seeds, establishment, and management of cottage industries based on locally produced agricultural commodities etc. are suitable for women (The national agricultural policy of 1999). But for the religious perspectives, women should not have participated those types of agricultural activities.

(3) Rural development as poverty development

What kind of strategies should be taken to alleviate poverty? At a micro level, small-scale enterprises and microfinance including the Grameen Bank model have been recently referred to by various agencies in the Bangladesh. In this circumstance, it is significance referring to Jeffrey D. Sachs's strategy (2005), for alleviating poverty. According to Sachs, a 'poverty trap' must be solved first in combating poverty. Although the poor have the willingness to overcome their ill-being, they are not able to do it by using their own resources. There are so many factors that trap the poor until they are in powerless conditions, such as diseases, climate stress, environmental degradation, physical isolation, and also extreme poverty itself (Sachs, 2005). With an intention of helping the poor to climb out of poverty, NGOs use two approaches: supply-side and demand-side (Clark, 1995). In a similar sense, Fowler (1997) identifies two types of NGO tasks: micro-tasks and macro-tasks. From the supply-side or micro-tasks approach, NGOs provide various basic public services to the poor. It is argued that especially in countries where government lack public services, NGOs play a significant role in the direct provision of social and economic services. In general, NGOs emerge and play the roles as service providers (Fowler, 1997).

For each branch, the following information will be recorded
(a) GPS coordinates (latitude and longitude) of the branch;
(b) Geographical conditions of the coverage's area;
(c) Population density of the converges area;
(d) Year of establishment;
(e) Number of savers;
(f) Total value of savings deposits;
(g) Number of borrowers;
(h) Total value of loans outstanding;
(i) Employment status; and
(j) Merits and demerits of the non-government organizations.

2.4 Conclusion

The above discussion of the study area and its relevant databases to the forthcoming chapters has been described for the purpose of the establishing a background of necessary information. All the information was needed to be converted into digital format and careful planning was required to make them compatible with each other. I have established the list of databases and datasets required for this study and this has been extremely valuable for an understanding of the rural development where NGOs made an enormous contribution in the educational, agricultural and finally, micro-credit sectors. Due to limited space, I have not discussed the attributes of each dataset and image but these will be cited in the following chapters as and when appropriate.

3.1 Introduction

Education is considered as the prime component of human resource development across the globe. But not all counties are successfully providing education to their citizens for numerous reasons, where poverty acts as the main reason. According to the report on Bangladesh education sector overview (Japan Bank for JBIC International Cooperation, 2002), the country faces serious problems in providing education to all citizens, especially poor rural communities. Since the creation of Bangladesh in 1971, numerous developments have been made to improve education and ensure everyone gets an opportunity to receive basic education with a focus on rural areas (Asian Development Bank, 2003). For instance, community-initiated schools i.e. Registered Non-Government Primary School (RNGPS), where roughly a quarter of children are joined in a year (Tietjen, 2003). These schools have served mainly the poor areas of the country. Recent studies show a higher proportion of those enrolled in RNGPSs come from below the national poverty line compared to those in government schools (Asian Development Bank, 2003). Once these schools become govt. registered, they share individualities with government schools (Chowdhury and Rose, 2004). According to the United Nations Development Programme (UNDP) 2013, the Human Development Index (HDI) value for Bangladesh increased from 0.461 to 0.558 in the period from 1998 to 2013, whereas the average years of schooling were 5.07 and the expected years of schooling was 10 years. Primary school dropout rate was 33.8% in the rural areas of Bangladesh. Gross enrolment ratio of pre-primary, secondary and tertiary levels were 26%, 51%, and 13% respectively in 2013.

Non-Governmental Organizations (NGOs) are one of the major stakeholders in providing education to the people of Bangladesh. There are over 400 NGOs involved in basic education programs working mostly with poor children in rural areas of Bangladesh. Most of these NGOs are working on educational renovation and structural changes to the curriculums of particular age-groups of students (NGOs and Global Advocacy, 2000). However, the role and the identity of NGOs as providers of non-formal education have changed over the last two decades because of shifts in government education policies. New initiatives have been taken to target populations such as NGOs' basic education for children and adults (Hossain et al., 2002). However, few NGOs are still working on a contractual basis formal and non-formal education programs (Basic Education and Policy Support Activity. 2002).

In Bangladesh, NGOs were the only providers of non-formal education before 1991. Since then, the Government has motivated NGOs to execute the government's Non-formal Education (NFE) program. This was the first time that the government has

been keen to disburse education funds to NGOs. Therefore, NGOs have gone through contract agreements and have executed government-approved NFE programs. NGOs also executed their own NFE programs. As a consequence, the relationship between the government and NGO programs in education became complex. The government's programs covered all age groups and grade levels from early childhood to adult education, where NGOs programs focused only on primary and adult level education (Jones, 1988).

National NGOs such as the Bangladesh Rural Advancement Committee (BRAC) and Char Livelihood Program (CLP) provide Non-formal Primary Education (NFPE) to over one million children in 34,000 education centers nationwide. On the other hand, there are some community-based organizations that run a very small number of NFPE centers along the Jamuna River. Most of these NGOs work with underprivileged children under different specific projects and their standard of education is considered high (Islam and Mia, 2007). The NFPE offered by most of the NGOs is same because the smaller NGOs simply copied the NFPE program used by leading organizations like BRAC and CLP. There are some other NGOs significantly different in their models in terms of basic education and vocational skills development to empower poor children (Islam and Mia, 2007). In the temporary arrangement for the delivery of basic education, the majority NGOs propose three to four years of schooling. These schools neither annually enroll new students nor continue schooling because of the short duration of the projects (Basic Education and Policy Support Activity, 2002). The rural poor along the Jamuna live in remote areas that are often located at huge distances from centers of commerce and social services. As a result of difficulties in accessing market opportunities, rural people do not have access to proper health facilities. In addition, there is an increase in the illiteracy rate. The rural poor also have bigger families and tend to have insecure and relatively unproductive jobs. For all the aforementioned reasons, the poor suffer from hunger, illness, lack of education and lack of respect from government officials who are often unresponsive to their concerns. Further, other environmental problems like flooding (overflow of water that submerges land with seasonal changes in every year), cyclones, riverbank erosion, flash floods (rapid and sudden flooding of geomorphic low-lying areas) are common disasters found in Bangladesh. 80% of the landscape in the study area is on a flood plain; which is why flooding and riverbank erosion is common and severely affects the landscape (World Meteorological Organization, 2003; Char Development and Settlement Project Phase IV, 2015). These environmental hazards are of great concern to not only the people but also in terms of infrastructure along the river of Jamuna.

Hence, in this study we explore; (1) the role of NGOs in provision of educational services (2) perform spatial analysis of schools, NGOs, and facilities provided by those

NGOs with respect to population density; (3) map the schools available within a two kilometer buffer zone of the study area; and finally, (4) analyze the socio-economic status after the provisions of NGOs in the educational sectors along the riverside of Jamuna, Bangladesh.

3.2 Existing situation and the difficulties in the educational development of the study area

The education system in Bangladesh is mainly divided into a five-tier system namely (1) primary education (grade 1 to 5); (2) junior secondary education (grade 6 to 8); (3) secondary education (grades 9 to 10). Secondary education also includes trace certificate/ secondary school certificates; (4) higher secondary education (grades 11 to 12); (5) after graduating from college, students can enter into university for a 4 year bachelors program (grade 13 to 16) which is later followed by one year's masters (grade 17). Since majority of the population in Bangladesh is Muslim, many people prefer religious study. Therefore, religious education system is divided into two types- Fazil and Kamil. Fazil Islamic education is equivalent to grade 13 to 14, while Kamil, to 15 to 16. Besides that, vocational schooling is also an important part of education in Bangladesh. After passing higher secondary schooling, students are eligible to enroll in a diploma program (mostly for 1 or 3 years) in the fields of nursing and clinical training, and engineering diplomas, i.e. electrical, mechanical, and civil. Vocational education is provided in separate colleges aimed at promoting professional training.

Natural hazards such as flood and river bank erosion hit hard Bangladesh every year affecting the lives of millions of people and damaging infrastructure especially in remote rural areas where the majority of the population is poor and lacks resources to cope with such disasters. Therefore, local people and the authorities have faced many difficulties to develop the education sector in the study site. The concrete difficulties are:

(1) Effect of natural calamities

As the water level of the Jamuna is rising, the misery of existing inhabitants of *chars* in the middle of the river is also increasing equally. They have lost their hope, in relentlessly fighting against various calamities. Their dreams of staying home for a longer period are continually fading as a consequences of natural calamities occurring frequently. They are losing their lives, properties, homes, bonds of relationships and much more.

(2) Imbalance with mainstream life style

People living on the *char* lands have minimal opportunities compared to people living on the main land. They are not connected with the mainstream life style and lack in each and every sector of civic rights, having problems with healthcare facilities, education, financial activities, security issues, land ownership and so on. They are

somewhat deprived of fundamental civic rights like food, clothing, housing, education and medical facilities that are supposed to be ensured by the government. Some facilities like food, clothing and housing have been ensured by their own efforts, but medical facilities are unstable, and educational facilities are very poor.

(3) Local perceptions of education

Maximum *char* dwellers live hand to mouth. Education is a sort of luxury for them. The rural people are not much interested in sending their children to school. The time that children spend in school is considered to be a waste of time for some of the illiterate *char* people. They count their children as a premature capital for their family's financial security from a very early age (Islam and Mia, 2007).

(4) Distance matter and cost effectiveness

Parents used to send their children to existing government primary schools, even though those schools were located far from the respective *char* lands. The educational cost of the government primary schools is too high for many poor families. For all these issues, instead of sending the likely candidates to school, parents often engage those children in income-generating activities like agriculture, weaving and day laboring.

(5) Topological change, poor communication

There are different impediments that hamper the education of rural people i.e. topological change, poor communication systems, lack of NGO activities, lack of higher grade institutions, lack of government attention, and displacement (*Char* Development and Settlement Project Phase IV, 2015; Rose, 2009). As the *char* lands are in the middle of the river, topological or erosional changes play a significant role in hindering the educational opportunities of these people. The continuous changes by erosion and deposition make them unstable and consequently, they do not have a secure and safe system of education for a long period. These kinds of natural disturbances harm the continuation of education of the children, who are already deprived of most of the civic facilities. Guardians lose their interest in sending their children to schools after migrating from one place to another.

Communication systems of the *char* lands are a great drawback for education facilities. The prime medium of communication for the *char* people is boat. These boats are run on a private basis and help people to move from one *char* to another. They have no schedule and so it is difficult for students going to school regularly. Sometimes the boat fare proves to be too expensive for the students, and their parents are not even interested in providing it. As there is no alternative medium of communication, it gets difficult in dry season to go to school by walking. Students have to walk a long way to reach the schools and sometimes teachers fail to reach the school in time due to poor transportation facilities. This counts as great problem in spreading the light of education to the people of *char* lands.

(6) Constitutional complications of NGOs project

BRAC is a prominent NGO working for the betterment of rural people of Bangladesh since its inception in the early 1970s. It started an education program in 2006 that was mostly non-formal but shut the initiative down after a few years due to that program's closure (Raza, et al., 2011). There is a tactic of local NGO that run education program along with micro-credit and their educational facility is only extended to elementary level. Local NGOs intend to provide educational facilities only to the children of the people who are their organization's borrower and sometime to the people whose residents are near to the borrowers. This is how the non- borrowers are discouraged by the intentional acts of these organizations. Only 30 percent of students have access to education facilities by these types of organizations on a temporary basis. Sometimes the people of *char* lands are scared of sending their children to schools due to their inability to pay loans in time to their respective NGO (Kabir, 2006; Rose, 2009).

(7) Problem of delineation of boundaries

To improve the literacy of *char* people, the government certainly has an important role to play. It is seen that the people of *char* lands are always more deprived of facilities than mainland people in various parameters such as economic and administrative. In some cases, union boundary is counted to be the base parameter for the rural development of the government. It creates problem in setting up new educational institutions by the government, as they do not know to which union the *char* belongs. If the delineation is exact, then it would be good for the students, authorities and people to take initiatives to develop a better education system.

The major factor hindering government intervention towards promoting education in the *char* lands is a jurisdictional one. More specifically, these newly emerged *char* lands are not being brought under the jurisdiction of local government. As most government programs/projects consider the unions as the basic geographic unit of operation, this situation creates a problem in case of introducing public educational institutions in the *char* lands (Raza et al., 2011).

3.3 Data and methods

The study was based on both primary and secondary data. Primary data was collected from different groups of respondents and from selected NGOs. Absolute locational information of 358 schools and 30 NGOs with 175 sub-branches were collected by GPS. There were 533 questionnaires conducted and 50 focus group discussions at different levels. Secondary data was acquired from NGOs reports and documents of government organizations i.e. the Bangladesh Bureau of Statistics (BBS), Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and different NGOs that support

planning, development and backing of education systems. The study interviewed the following groups:

a. Local communities (interviews i.e. facilities like food for school going students, infrastructure, clean water supply, computers, and the internet provided by local NGOs)

b. NGO employees who are involved in education systems (focus group discussions, i.e. facing problems with educational services)

c. Teachers in schools (interviews i.e. number of teachers, number of male and female students, and problems faced by educational services)

d. Employees of schools (interviews i.e. facilities and problems with educational services)

e. Students studying at the centers (focus group discussions i.e. learning environment and facilities)

f. Parents of the students (focus group discussions, i.e. learning environment and facilities)

This study will reflect some basic principles of GIS. Computer-based spatial analysis using ArcGIS 10.2 has been used for detailed mapping and analysis of NGO schools. GPS data of NGOs and schools were overlapped on satellite imagery of SPOT 5 while it helps to make plans, identify the geographical problems and buffering area measurement for long term planning in educational institutions (Rashid, 2003).

3.4 Major findings of the study

(1) Contribution of local NGOs and their requirements in terms of educational development

(a) Contribution of local NGOs to educational development

In Bangladesh, the majority of people living along the river Jamuna are deprived of basic education. At present, governmental and non-governmental organizations have given attention in non-formal education towards illiterate poor people. The contribution of local NGOs to educational development along the Jamuna had identified with the help of local people's perceptions, are as follows:

a. Some NGOs work to increase consciousness about the importance of education and try to teach how to read and write and raise awareness about daily life skills;

b. Development of need-based curriculum for poor rural students;

c. Development of a methodology to adopt the national curriculum to the local situation (local curriculum development);

d. Preparing and disseminating graded learning materials to illiterate and neo-literate students, especially to poor rural girls and women (adult literacy);

e. NGOs run non-formal schooling (catering mainly to drop-out students);

f. Improvement of learning materials related with quality of life and income generation;

g. Food for school-going students in rural areas of Bangladesh;

h. Organization of training of literacy instructors, supervisors and local organizers working with NGOs;

i. Various evaluation and research studies;

j. Development of community learning and development approaches, and setting up community learning centers in different villages to combine learning with community development; and

k. Educational institutions and infrastructural development in the rural areas of Bangladesh.

(b) The management system and local committee of the schools

In developing countries, educational structures are often centrally located in a top-down structure while localized information plays an important role. This study evaluates the school-based management system and capacity building program for the students which has the help of the local community. To run a local school committee is absolutely essential for educational development. Local communities with committees are working together to ameliorate the quality of learning for children. However, in figure 3-1, there are 327 schools with local committees out of 358 schools while 31 schools have no local committee. This study imparts that most of the school management systems are run by non-government agencies (347 out of 358).
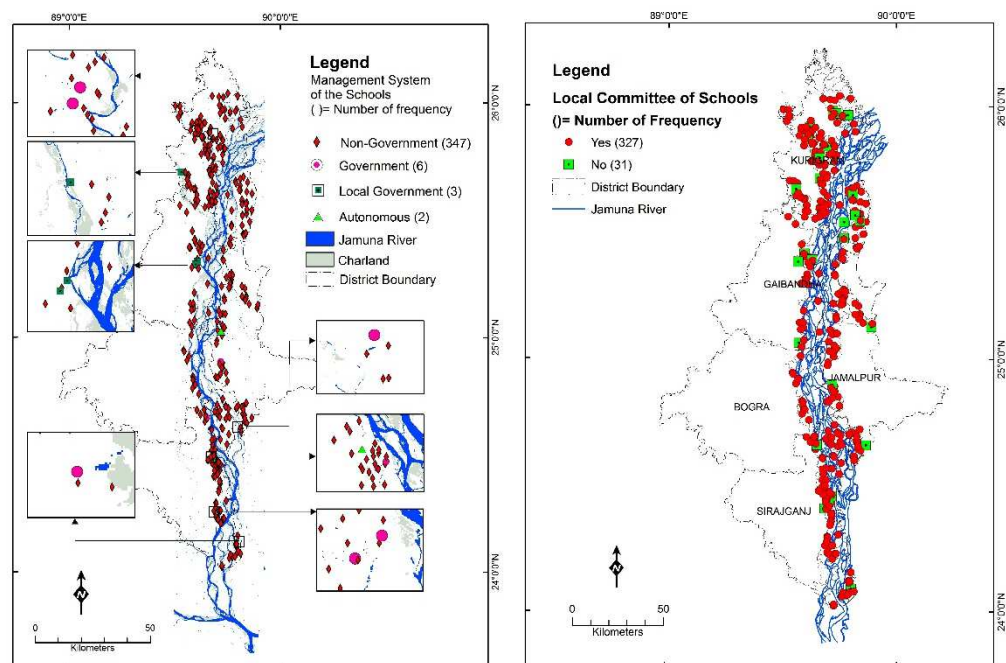
Figures 3-1: Management system and local committee of the schools along the river Jamuna, Bangladesh

Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Government and autonomous schools constitute only 2.2% and 6.0% respectively of total 358 schools. Local government takes responsibility for only 3 schools. After evaluating the study area, this study gathers some important information, i.e. only 304 schools get their monthly pay order (teachers of the educational institutions that get their salaries and allowances under the government's pay scale) out of 358 schools. So, it is impart that if teachers and other official staffs do not get the proper facilities or timely salary, education sectors will not be developed. Besides that, there are 31 schools have no committee members. Members are the planners and decision makers for the betterment of educational activities and also for institutions.

(c) Electricity and playground facilities

Electricity is one of the most significant blessings to mankind which has many usages in our daily life. Right now, along the river Jamuna, schools are running completely by light provided by the sun. But, some NGOs are providing solar-powered electricity, rather than the expensive generator-created alternatives. The government and non-government organizations provide computers; however, without electricity, they are useless. So, electricity is very important for increasing basic computer proficiency and understanding modern technology. On the other hand, playgrounds deliver crucial and vital openings for children to play. By analyzing various significant research it is found that, there is a strong connection between play and brain development. Different types of play are vital for a child's cognitive, emotional, physical and social development.
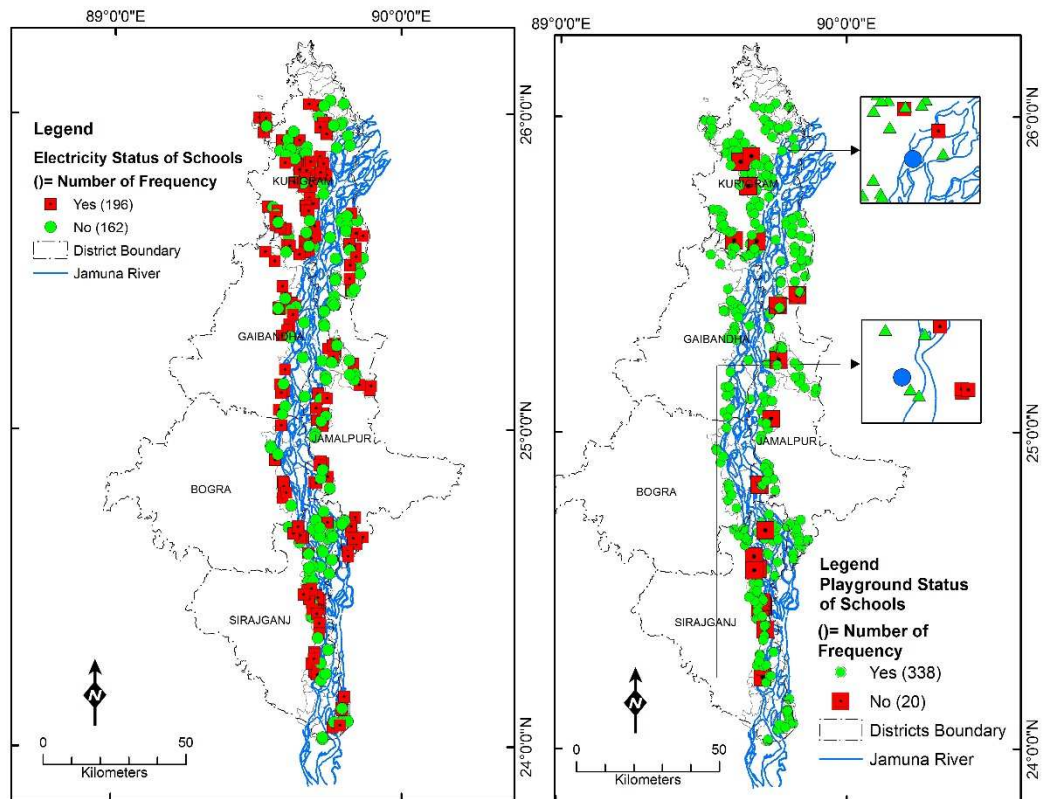
Figures 3-2: Electricity and playground status of the schools along the river Jamuna, Bangladesh

Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Observing figure 3-2, there is no electricity in a huge number of schools (162 out of 358). Meanwhile 338 schools out of 358 have their own playgrounds. So, NGOs working along the river Jamuna should take proper steps to increase institutional facilities.

(d) Water supply status of the schools

Water supply is one of the most important aspects of educational institutions for safe drinking water and appropriate sanitation. It is a vital factor in human health and quality of life. More than half of the population already lives in rural areas of Bangladesh. As a result, public health requires a strong groundwork of knowledge to improve water-management practices at the school level. So, local NGOs along the river Jamuna should think clearly about pure water and its sources for schools, because a lack of pure water causes diseases like dehydration, mental derangement, kidney problems etc.
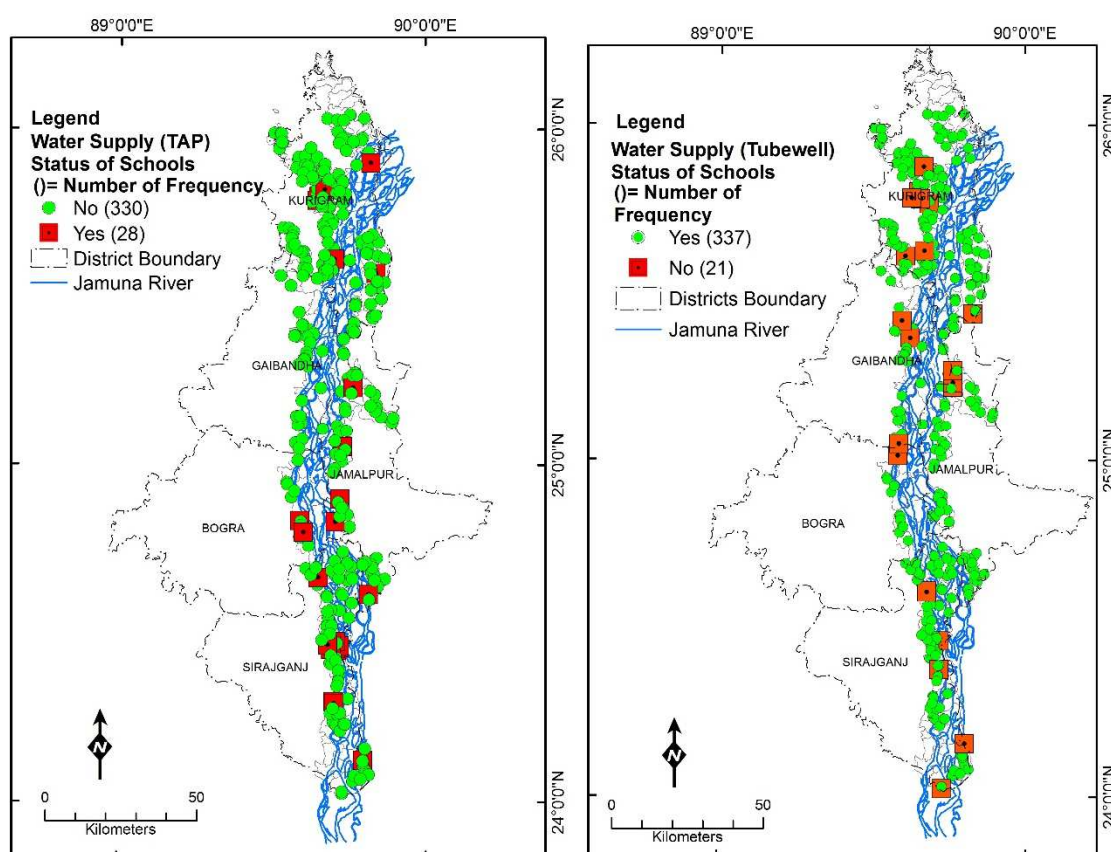
Figures 3-3: Water supply status of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Chapter 3: Local NGO's provision in education sector 95

Looking figure 3-3 and the BANBEIS data, 327 schools have tube wells, whereas 21 schools have no tube wells among the 358 schools. Along the river Jamuna, tap water is used only 28 schools while 330 schools have no tap water supply system. In Bangladesh, tap water is known as running water, city water or municipal water is provided to a tap for drinking, washing, and cooking purposes. For rural development, particularly in educational institutions, NGOs should take proper steps to ensure pure drinking water supply with management.

(e) Computer and internet facilities

Computers are the way to learn scientific knowledge in the world. It is significant that educational institutions should emphasize the development of analytical, practical, or vocational skills. As of late, a major challenge for educational institutions is to develop teaching and learning methods, school environment and children's learning equipment's by using modern technology. Nevertheless, poor qualifications and lack of teachers' motivation are also major challenges.
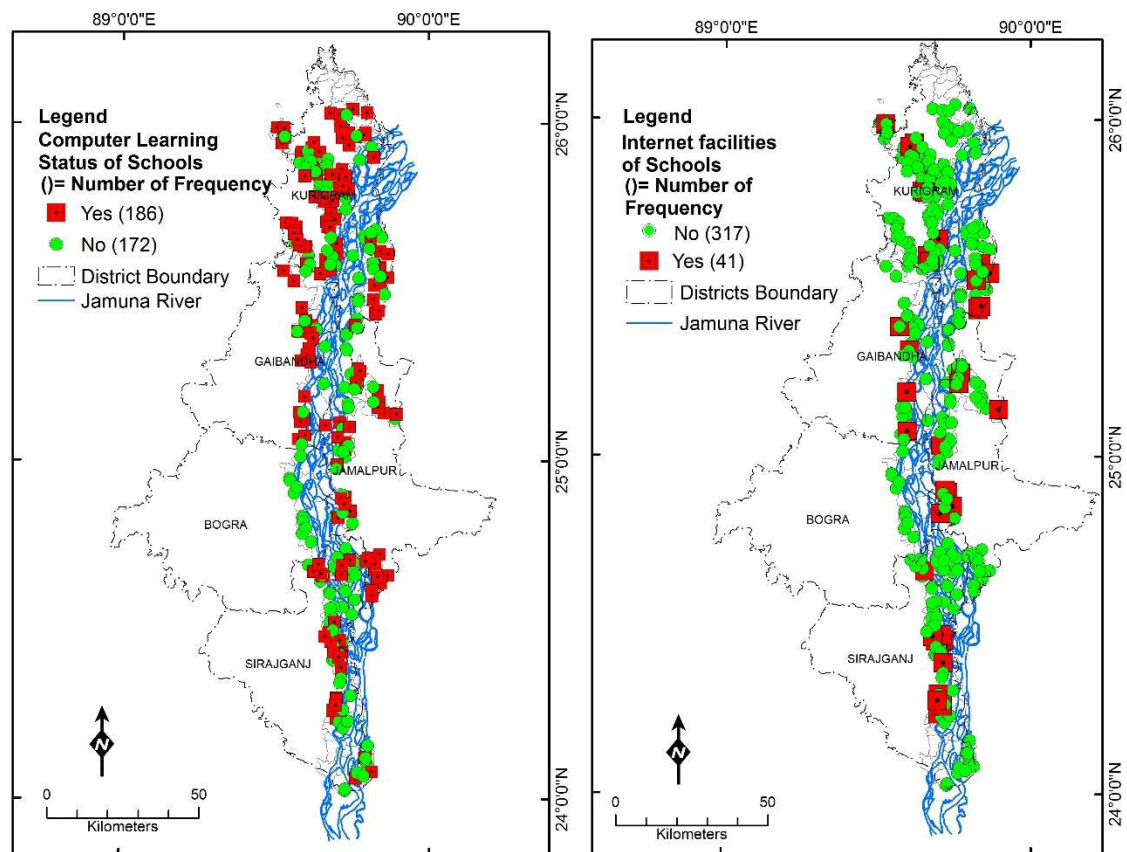
Figures 3-4: Computer and internet facilities of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

By observing figure 3-4, there are 186 (out of 358) schools have own computer technology for developing basic computer skill of the students, whereas 172 schools have no computer technology. As of late, the government has emphasized the development of a basic computer skills curriculum for school going children in Bangladesh. For the school going students, usage of the internet acts as a learning tool. In this study, 358 schools were subjected whereas a huge number of schools lacked internet facilities. Only 41 schools have internet connections out of 358. So, local NGOs along the river Jamuna should emphasize computer and internet facilities in rural schools.

(2) Mapping and analyzing the current scenario of the educational development
(a) Concentration area of schools and NGOs

Most NGOs are working in the downstream area of the Jamuna River which is near to the capital city of Dhaka. Therefore, transportation and accommodation facilities are available here. As a result, international and local donor agencies donate more to improve infrastructure and provide educational facilities. Consequently, the number of schools as well as educational activities are also increasing progressively.
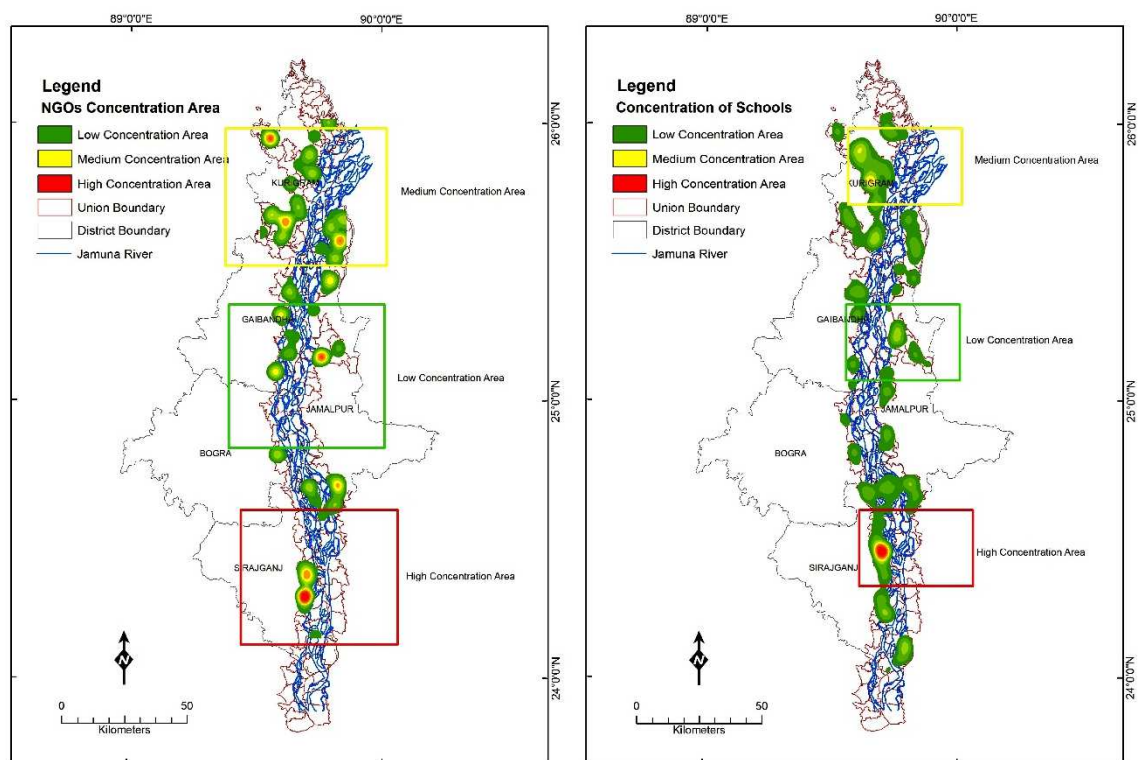
Figures 3-5: Concentration area of schools and NGOs along the Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Figure 3-5 shows the area of concentration of schools and NGOs along the river Jamuna. In the case of schools, there are 347 non-governmental schools, 6 governmental

schools, 3 local government schools and 2 autonomous schools. This figure indicates the high concentration of schools and NGOs displayed in red, medium concentration in yellow and low concentration in green. It would be helpful for the donors who are willing to donate to the low concentration areas while primary education remains tremendously low.

(b) Concentration of NGOs linked with population density

It is an utter surprise that the education system of Bangladesh has not acquired modern standards, which is due to poverty in rural areas particularly along the river Jamuna.
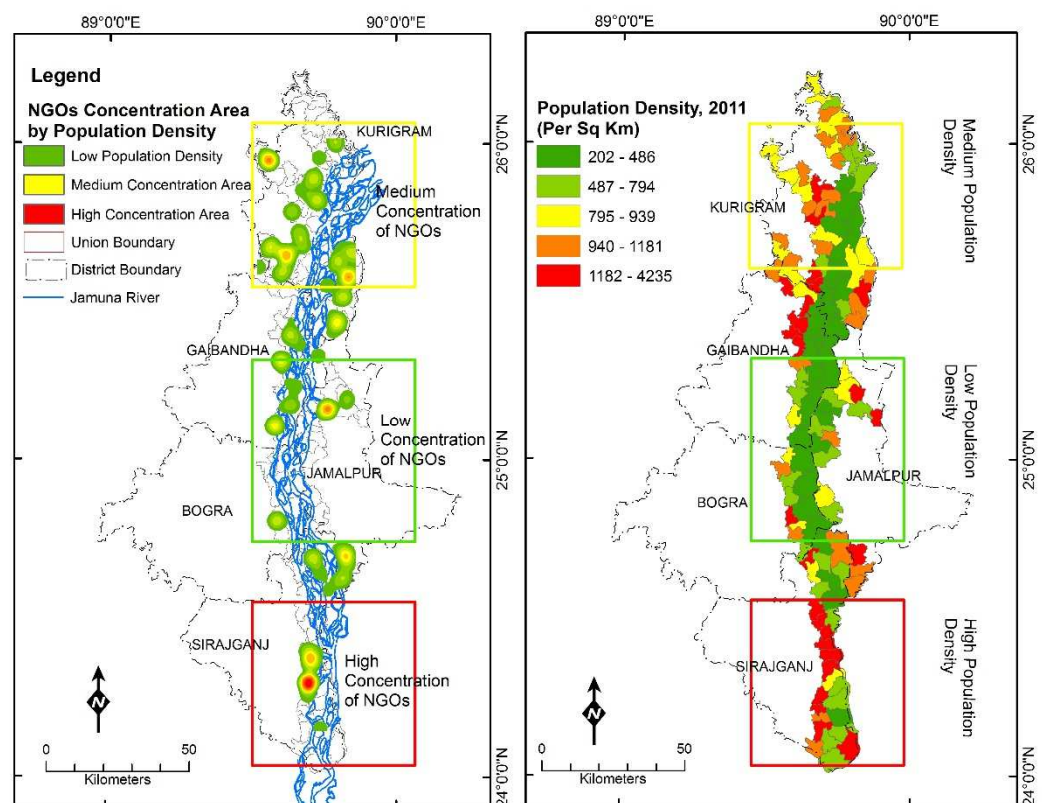
Figures 3-6: Concentration of NGOs areas with the population density along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Figure 3-6 links population data with the number of NGOs working in the study area, particularly in the education sector. Population density is higher in the downstream Jamuna River where the NGOs are highly active. It was estimated that the population density in the study site was 928/km², whereas the maximum and minimum values were 4,235 and 202 per km^2 respectively. Additionally, the population density in Bangladesh is 1,222 per km^2.

(c) Concentration of NGO areas with the literacy rate

The literacy rate is comparatively higher where the NGOs activities are higher. The literacy rate in Bangladesh is 69.8% on average (BBS, 2011). Using figure 3-7, it is estimated that the literacy rate of the study site is 35.48%, whereas the minimum and maximum literacy rates are 15.1% and 63.2% respectively. In the up and downstream of the Jamuna River, the literacy rate is higher compared to the other areas because the number of NGOs and their activities are greater.
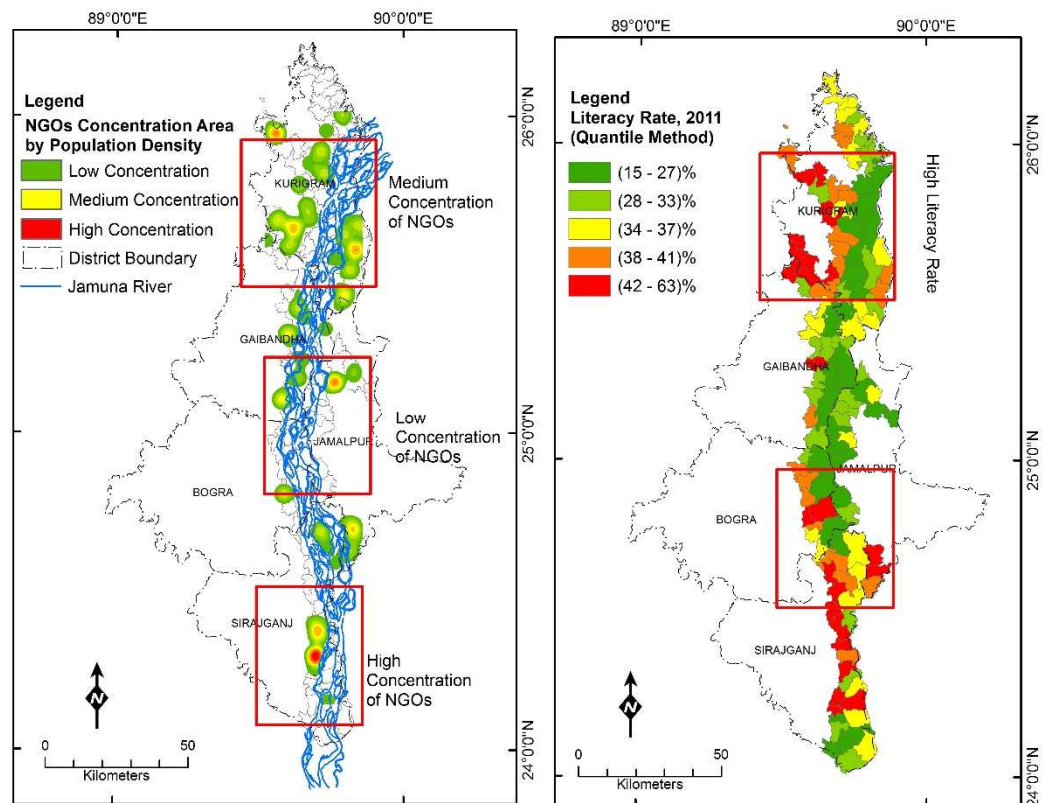
Figures 3-7: Concentration of NGOs areas with the literacy rate along the river Jamuna, Bangladesh
Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

In the middle part of the Jamuna River, the literacy rate is not satisfactory compared to the other areas, because the transportation and accommodation facilities which are provided by local NGOs to officials are not sufficient. Besides that, in the rainy season, erosional and depositional actions occur more in the middle part of the Jamuna River therefore, it is very difficult to travel from one place to another. If governmental and other private organizations provide facilities for the officials in a proper way, educational standards will be increased in the remote areas of Bangladesh.

(d) Male and female literacy rate in NGOs activities areas

The female literacy rate is less than the males along the river Jamuna because of early marriage (Center for Research and Information, 2015). The male literacy rate in Bangladesh is 64.6% on average. Using figure 3-8, it is estimated that the literacy rate of male in the study site is 38.86%, whereas the minimum and maximum literacy rates are 19.1% and 67.1% respectively.
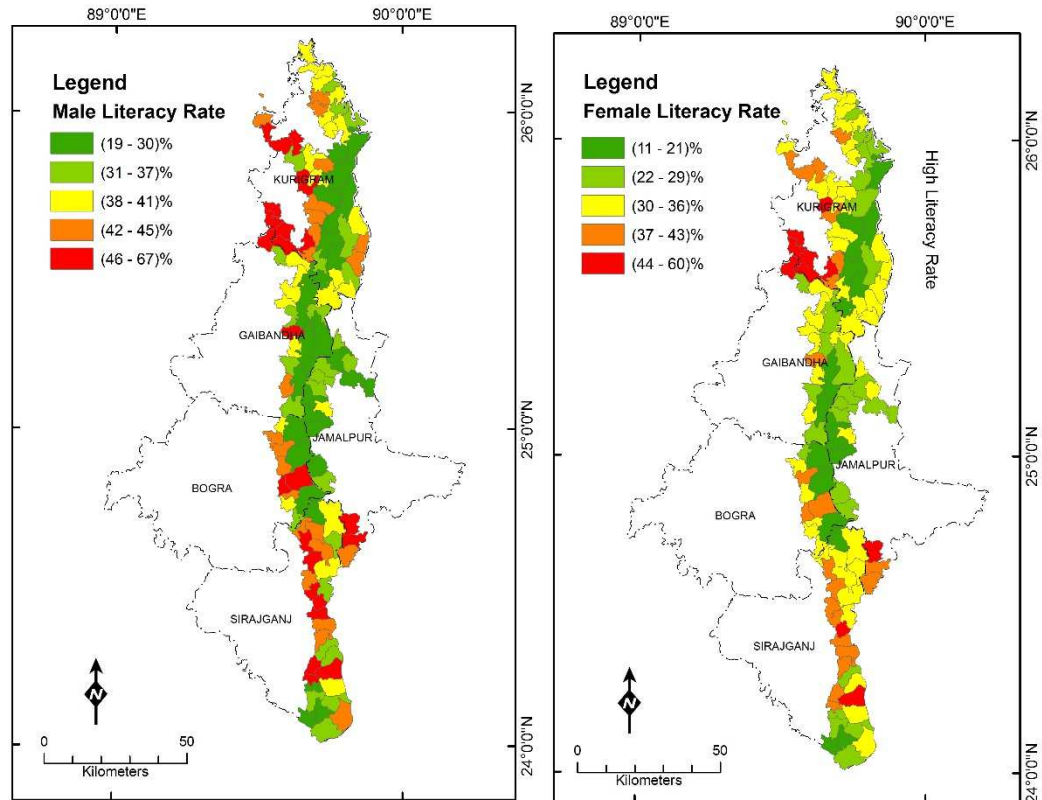
Figures 3-8: Male and female literacy rate along the river Jamuna, Bangladesh
Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

On the other hand, the literacy rate of female in the study site is 32.26%, whereas the minimum and maximum values are 11.2% and 60.1% respectively. The female literacy rate of Bangladesh is 58.5% on average (Center for Research and Information, 2015). The rural poor living in remote areas are often huge distance from centers of commerce and social services, whereas female students cannot go there because of social and religious restrictions.
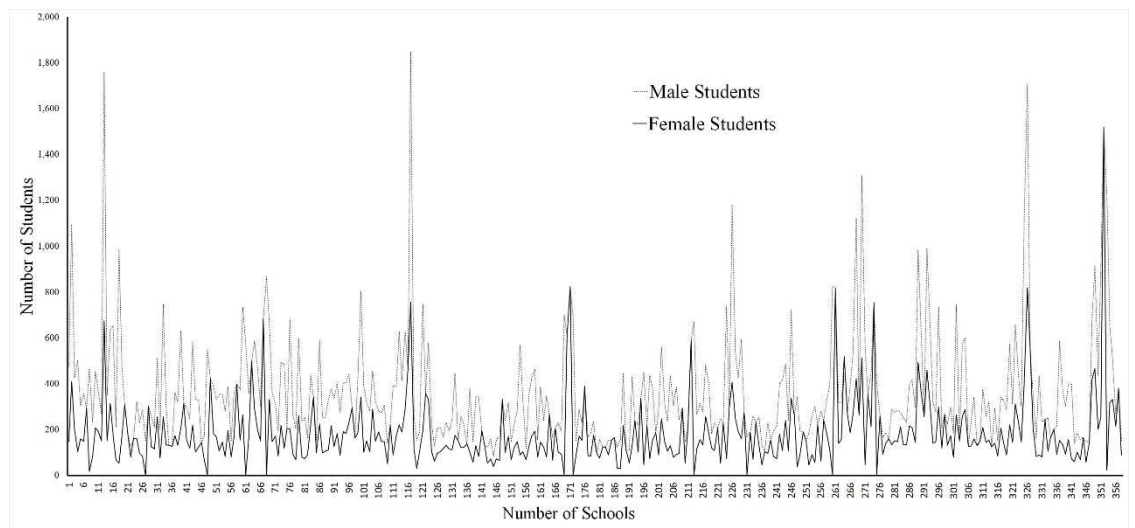
Figure 3-9: Male and female student's ratio of the schools along the river Jamuna, Bangladesh
Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS), 2015

Looking at figure 3-9, it can be observed that there are more male students than female students in every school. This is for several reasons, young people in rural communities usually leave school early, i.e. are needed to work at home; religious causes; no transportation and lack of communication facilities; long distances to school; perceived irrelevance of educational content; perpetuation of poverty; lack of jobs; and lack of productive opportunities that could support community development (Basic Education and Policy Support Activity. 2002). In addition, there is an increase in levels of illiteracy particularly for female students. For all of these reasons, the poor suffer from lack of education services and other environmental vulnerabilities. Therefore, local NGOs and the government should take proper initiatives to increase the male and female literacy rate by creating a community-based curriculum, friendly relations between teachers and students, recreational facilities for the students, recruiting and training rural teachers, involvement of parents in school management and teacher training, providing accessible and nearby facilities and infrastructure.

(3) Analysis of the buffer zone, type and geographical location of the schools
(a) The 2-km buffer zones of schools according to government rules
The area and population served by different categories of schools were identified and reasons for gaps were analyzed. According to the 1990 Primary Education Act "The non-availability of a primary education institute within 2 kilometers of the dwelling place of the child" (The Bangladesh Gazette, Extra, 13 February, 1990).
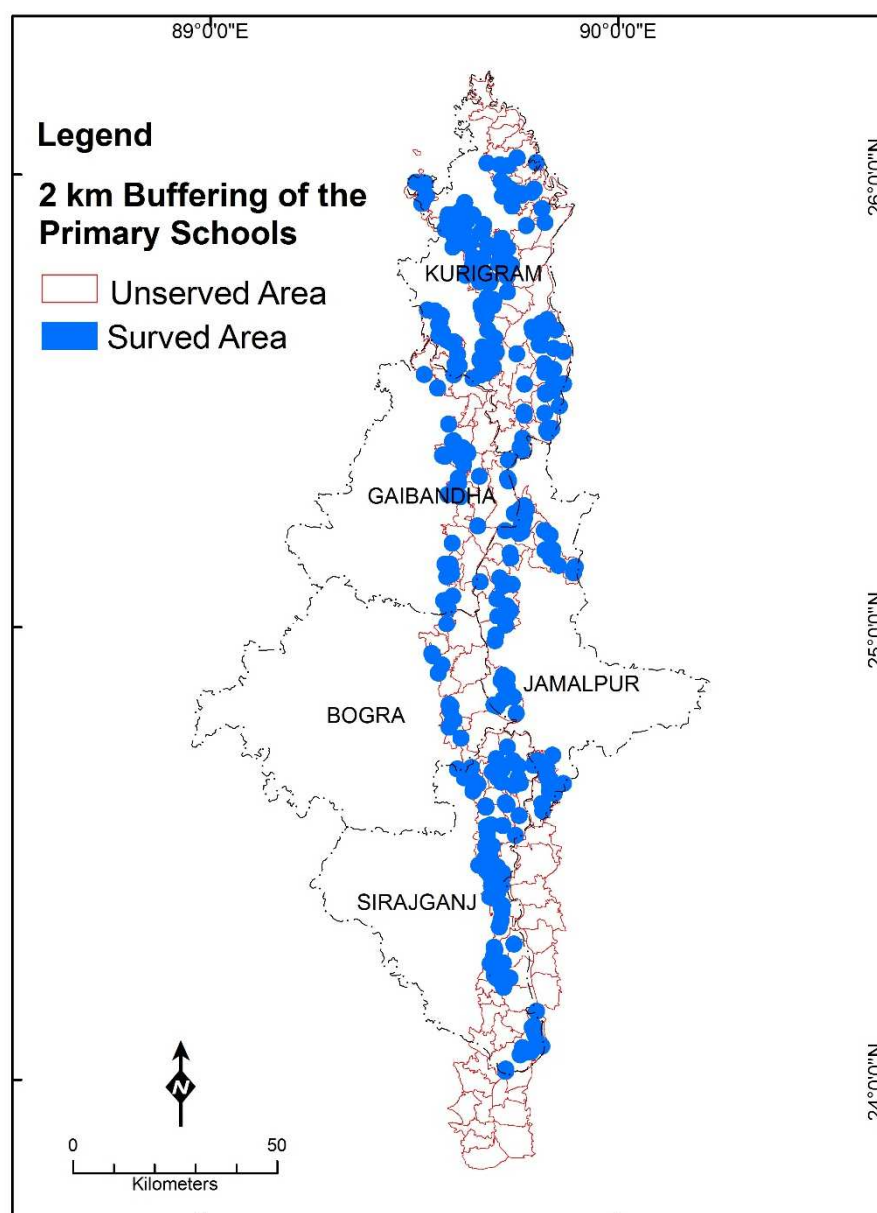
Figure 3-10: Two km buffering zones of the schools according the government rules along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Figure 3-10 shows that the governmental rules were not accentuated according to the act. There is huge distance among the rural schools. This paper creates 2-km buffer zones of each school and determines the gaps among the schools. Therefore, if the government applies the act in the rural areas of Bangladesh, it needs to make more schools in the study site.

(b) Types and geographical location of schools

There are three types of school buildings in the study site: *katcha* (made of unsubstantial material such as mud, straw, and wood); *pakka* (made of substantial

material such as brick and concrete); and semi-*pakka*. Some are located in the *haor/beel* areas, some in plain lands and the rest of them in riverside areas. Of a total of 358 schools, there were 91 *katcha* schools, representing 25% of the total. *Pakka* schools numbered 238 that convey 92% of the total. There are 29 *semi-pakka* schools representing 8.1% of the total (Figure 3-11).
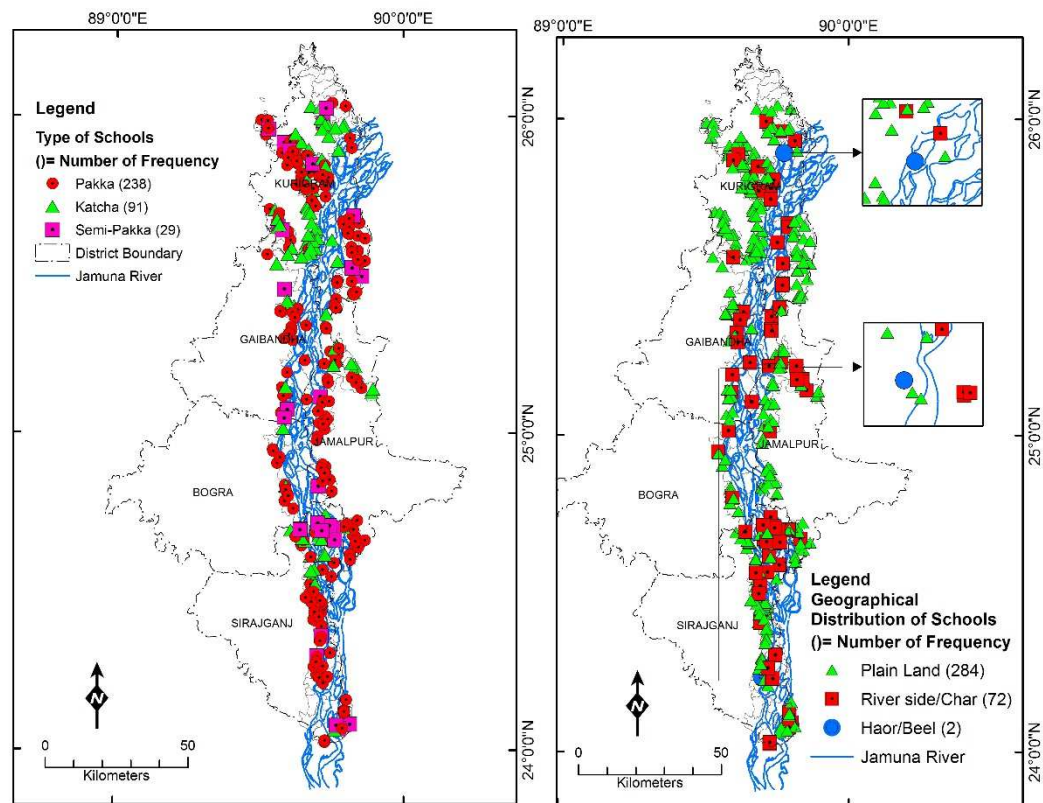
Figures 3-11: Types of schools and geographical location of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

This study found *pakka* schools are greater in number than others. It is analyzed that the number of schools in the *haor* or *beel,* plain land, riverside or *char* land areas were 2, 284 and 72 respectively. So, most of the schools are found in the plain land and riverside areas. All educational infrastructures are of same identical design for the particular project, which creates a problem for hilly areas, riverbank erosion prone areas, flood, and flash flood areas. In Bangladesh, different donors including the ADB, World Bank, and JICA select the same design across the country, which resembles a tin-shed building; *pakka* buildings those are being constructed without any Environmental Impact Assessment (EIA) or without any survey of the physical condition of the local areas.

Table 3-1: Geographical condition of the schools

Categories	Frequency	Percent	*Katcha*	*Pakka*	Semi-*Pakka*
Plain Land (mainland)	284	79.3%	70	191	23
Riverside/*Char* (island)	72	20.1%	20	46	6
Haor/Beel (lake-like wetland with static water)	2	0.6%	1	1	0
Total	358	100.0%	91	238	29

Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

**Note: *Pakka* structure that is a permanent structure and lifespan over 25 years. The walls and roofs are made of bricks and concrete. Besides that, *katcha* infrastructure which is a temporary structure and made of mud brick, bamboo, sun grass and wood. Finally, semi *pakka*, which is semi-permanent and partially made of bricks, floors are cemented as well as used iron sheets as roofs.

Flooding normally occurs during the monsoon season from June to September. Table 3-1 shows there are 46 *pakka* and 6 *semi-pakka* schools located in the riverside or *char* areas that are very unrealistic and unplanned as far as the geographical location is concerned. These 46 *pakka* and 6 *semi-pakka* structures will not exist for long term if riverbank erosion is occurred by wave actions. For the long term sustainability of educational infrastructure, *katcha* buildings should be constructed using local resources. The *char* people shift their residence 3 to 5 times in their lives because of bank erosion and riverbank shifting. A similar pattern of educational infrastructure facilities will not be functional for all regions of the country.

(4) Socio-economic analysis

This socio-economic analysis explores the role of NGOs Education services in improving the quality of the life of underprivileged children in the study sites, considering their economic, health, environmental issues and life skills. There were 533 questionnaires conducted and 50 focus group discussions at different levels. Information's were derived from the students of 358 schools, along the riverside of Jamuna, Bangladesh. Socio-economic attributes of the interviewed students during questionnaire survey are presented in this section. Socio-economic attributes include; age, sex, student's daily behavioral activities before and after joining NGOs Education program, making students aware of environment, student's life skill improvement and finally, income generating activities through NGOs education program in the study sites.

(a) Age and sex of the respondents

Results reveal that most of the students (20.1%) were below or equal to 12 years old

followed by 80.9%, in the age group of 13 to 15 years old. There are 30.4% of the respondents were female, whereas the male respondents were 69.6%; both participating in NGOs education program in the study sites.

(b) Student's daily behavioral activities before and after joining NGOs education program

In the study sites, student's daily behavioral activities have changed after getting NGOs educational support. There are major 10 indicators such as using sanitary latrine and sandals, wash hands properly after using latrine and before meal, safe water for drinking and daily use, cut their nail and hair regularly, wearing clean dresses and no walking on bare foot were set to measure the student's daily behavioral activities.

Table 3-2: Student's daily behavioral activities before and after joining NGOs education program along the river Jamuna, Bangladesh

Statement	Option	Before Education	After Education
Activities of the students which show their awareness on their health	Using sanitary latrine	18.4%	22.9%
	Using sandals at latrine	12.6%	27.3%
	Wash hands properly after using latrine	38.7%	45.9%
	Wash hands properly before meal	80.5%	90.1%
	Use safe water for drinking	76.9%	85.7%
	Use safe water for daily use	20.1%	25.4%
	Students cut their nail regularly	11.5%	25.6%
	Students cut their hair regularly	15.9%	21.3%
	Wearing clean dresses	9.8%	12.5%
	No walking on bare foot	13.4%	17.6%

Source: Field survey, 2015

Table 3-2 illustrates that in the study sites, student's daily behavioral activities after joining NGOs education program are not significantly improved but there is a positive impact of NGOs education on all learners' daily behavioral activities. Results reveal that, among 533 students, using sanitary latrine and sandals are improved to 22.9% and 27.3% respectively. Besides that, after involving with the NGOs education program, students of the study sites wash their hands properly before meal (90.1%) and after using the latrine (45.9%). Before NGOs education program, there were 76.9% people who use to drink safe water, which was 76.9% of the total respondents but now it is increased up to 85.7%. On the contrary, there are 25.4% respondents using safe water for daily life activities. Furthermore, students cut their nail and hair regularly which is 25.6% and 21.3% respectively. Finally, 12.5% students in the study are wearing clean dress after

joining NGOs education program. There are 17.6% of the students using sandals after getting educational support from the local NGOs in the study sites.

(c) Making students aware of environment, natural disasters, early marriage and child labour

In the study sites, students are aware about environment, natural disasters, early marriage and child labour but results reveal that after joining NGOs education program, students aware on environment, natural disasters, early marriage and child labour are not significantly changed. In this section, information's were collected on knowledge on environmental protection, tree plantation, pollution, natural disasters, mitigation strategy, flood shelter, early marriage and finally knowledge on child labour through focus group discussion (FGD) and questionnaire survey.

Table 3-3: Making students aware of environment, natural disasters, early marriage and child labour

Statement	Option	Before Education	After Education
NGOs provision in educational sector brings positive change in students' knowledge and attitude	Environment protection knowledge	20.1%	61.4%
	Importance of tree plantation	90.1%	100%
	knowledge on environmental pollution	10.6%	81.5%
	knowledge on natural disasters	39.4%	76.9%
	knowledge on mitigation strategy	23.6%	69.1%
	Know about flood shelter	60.3%	75.4%
	Knowledge on early marriage	9.5%	39.9%
	Knowledge on child labour	11.9%	45.7%

Source: Field survey, 2015

Table 3-3 demonstrates that there are 20.1%, 90.1%, 10.6%, 39.4%, 23.6% and 60.3% students have knowledge on environmental protection, tree plantation, pollution, natural disasters, mitigation strategy and flood shelter before joining NGOs education program but after joining NGOs education program it increased to 61.4%, 100%, 81.5%, 76.9%, 69.1% and 75.4% respectively. Besides that, among the respondents, there are 9.5% respondents had knowledge on early marriage but now it increased to 39.9% in the study sites. Furthermore, there are 45.7% respondents have knowledge on child labour after joining NGOs education program.

(d) Student's life skill improvement

NGOs are working on students' life skill improvement in the study sites. To measure students' life skill, this paper sets 6 major indicators such as can write and read, can keep daily accounts, can make saline, use computer and internet and aware about own right.

Students' life skill improvement information's were collected through Focus Group Discussion (FGD) and questionnaire survey.

Table 3-4: Activities which show students' life skill improvement

Statement	Option	Before Education	After Education
Students' life skill improvement through NGOs education program	Can write and read	10.3%	100%
	Can keep daily accounts	8.7%	46.1%
	Can make saline	1.8%	93.6%
	Can use computer	0.0%	7.6%
	Can use internet	0.0%	6.3%
	Aware about own right	2.6%	19.6%

Source: Field survey, 2015

Table 3-4 shows that, within 6 major indicators, can write and read (100%) is higher than others after joining the NGOs education program in the study sites. Can make saline is in the second highest position which is 93.6% of the total respondents. There are only 7.6% and 6.3% can use the computer and internet respectively. It indicates that, there are very few numbers of students who have basic computer knowledge due lack of proper facilities on computer and Internet education, which was provided by the local NGOs in the study sites. Besides that, there are 46.1% of the students can keep daily accounts and 19.6% are aware about their own rights after joining NGOs education program in the study sites.

(e) Income generating activities through NGOs education

In the study sites, now NGOs are taking initiatives to increase learner's income by providing training on different sectors such as vocational training and computer, training on fisheries, agricultural practice, kitchen gardening and finally, training on handicrafts. Information's were collected through focus group discussion (FGD) and questionnaire survey from 533 respondents in the study sites.

Table 3-5 demonstrates that there are only 2.6% respondents had vocational training before joining NGOs' education program. Thereafter, it increased to 11.3% of the total after joining NGOs' education program. It indicates that after NGOs' education, the number of trained students (vocational training) is not significantly improved. This might cause due to the lack of resources (infrastructures, machineries and teaching staffs) for vocational training in the study sites. Furthermore, there are 7.6%, 32.1%, 20.3%, 13.1% and 8.2% respondents involved in computer, fisheries, agricultural practice, kitchen gardening and finally, handicrafts training in the study sites.

Table 3-5: Income generating activities of the students through NGOs education

Statement	Option	Before Education	After Education
Initiatives taken to increase students income	Vocational training	2.6%	11.3%
	Computer training	0.0%	7.6%
	Training on fisheries	2.8%	32.1%
	Training on agricultural practice	0.0%	20.3%
	Training on kitchen gardening	0.0%	13.1%
	Training on handicrafts	0.0%	8.2%

Source: Field survey, 2015

3.5 Conclusion and recommendations

This study provides insights into the educational facilities provided by NGOs along the river Jamuna, the concentration of schools within a 2km buffer zone from the dwelling place, NGO working area, literacy rate and location of schools.

NGOs are working along the river Jamuna based on the project. These projects mostly cover health, education, and irrigation facilities are given to the rural communities in the study area. NGOs work closely with the government on setting a nationwide educational curriculum, raising educational awareness, and ensuring the provision of learning material to all schools, especially in remote areas. Food and nutrition programs have been newly initiated by the government with the help from NGOs to disburse food to children. Community learning centers are also run by local NGOs and provide both formal and non-formal education to males and females in the study area. Water, playgrounds, the internet, computers, toilets, and electricity are among the basic needs for education but NGOs so far have not provided any such facilities to the schools along the river Jamuna.

Places where more NGOs were present, had a higher concentration of schools due to higher population density and availability of transportation and accommodation facilities. The Higher number of schools and NGOs were observed in upper and lower parts of the Jamuna River while there were less number in the middle part. Places where a higher number of NGOs were present (upper and lower streams), also had a higher literacy rate because of the presence of schools in those areas. Most of the NGOs provided educational facilities to males, not females. The male literacy rate was higher than the female rate in the study site, the overall literacy rate was lower than the overall literacy rate in Bangladesh. The majority of the schools were in the plain land along the river Jamuna. Among the 72 schools located in the vicinity of the river, most of them (46) were cement buildings (*Pakka*).

A common concern was seen among respondents that due to riverbank erosion, these buildings are at high risk due to seasonal floods. Contrary to the national government rule (one primary school within 2km buffer zone from the dwelling place), not every 2km zone had a primary school. NGOs must ensure the provision of basic facilities in schools such as electricity, water supply, toilets, playgrounds, and the internet. We emphasize that both local and international NGOs should focus not only on male education but also female literacy rate which is lower than male in the study area and also lower than the national literacy rate. Though population density in the middle region along the river Jamuna is low we strongly encourage NGOs to work in those remote areas as well, as they need urgent educational assistance like any other area in Bangladesh. The government must ensure provision all types of educational facilities in collaboration with NGOs. Site selection for new school buildings should be in plain areas where there is less chance of damage due to floods and riverbank erosion. Implementation of national rules regarding availability of primary schools in every 2km buffer zone should be fulfilled to ensure every child gets the opportunity of access to education across the country.

CHAPTER 4: LOCAL NGO'S PROVISION IN AGRICULTURE SECTOR

4.1 Introduction

Agriculture is a primary source of livelihood for people in Bangladesh (Mahjabeen, 2008; Ali et al., 1998). Like other parts of the world, rural economic activities in Bangladesh are largely dependent on agriculture (Bala et al., 2010; BBS, 2016; BIDS, 1981; BIDS, 2011). There are about 90% of rural workers in Bangladesh directly engaged in agricultural sector, whereas the sector pays 48% of the total labor force of the country, contributing 19.3% to the total national GDP (Gross Domestic Product) (Bala et al., 2013; BBS, 2011; Alauddin and Biswas,2014). In Bangladesh agriculture is mainly performed through conventional outdated methods; especially in rural remote areas (Borggaard et al., 2003; Bayes and Patwary, 2012; Begum et al., 2004). In addition, there are many constraints, for example, political situation, natural calamity, people's choice, modernization, and globalization, etc. and that hinder the development of agriculture sector in Bangladesh (Khan and Khisa 2000; Alam et al., 2009; Anonymous, 2003).

One of the major drawbacks of the agricultural activities along the riverside of Jamuna is lack of capital and to some extent the environmental threats (Islam et al., 2010). The natural calamities occurred during the rainy season and miles along the riversides swept away due to the extreme rise of water level (Haggblade et al., 1986; Grogan, 2012; Holloway and Richard, 1995). Crops and crop field had destroyed by the river bank erosion (Birkhaeuser et al., 1991; Christoplos and Kidd, 2000; Davis et al., 2012). Thus, rural poor people lose their crops, money, food, and capital as well. Therefore, they failed to raise capital for the next year's agricultural practice (ISPAN, 1993; Khan and Khisa, 2000). So, to practice agricultural activity they need help from different mediums (Mahjabeen, 2008; Knudsen and Khan 2002). The mediums can be Government or non-government agencies, commonly known as NGOs in Bangladesh (Khan and Khisa, 2000).

NGOs run a different kind of activities to encourage and implement the government orders for the economic improvement of the poor people of the country (Mahmud, 2012; Ministry of Finance, 2015). Some NGOs are lending monetary value to the rural poor people and some are helping them by providing the seed and fertilizer, which has flourished the agricultural sector mostly (Rahman and Islam, 2014; Rahman and Islam, 2011). The NGOs run development activities on agricultural sectors along the riverside of Jamuna like easy access to credit, diversified loan and savings products, client-friendly doorstep services, right financing at the right time and quick service and response (Quazi and Rahim, 2000). As of later, some local NGOs are attracting local poor people to horticulture and timber plantations which are economically and environmentally more attractive and sound (Rahman and Sousa, 2010; Rahman et al.,

2012). NGO's working interests are mainly focused on home-based income-generating activities like cattle and poultry rearing, food processing, apiculture and rural handicrafts, combined with the terms of micro-credit (Rasul et al., 2004; Robbani et al., 2007). It is expected that nearly about 80% of the villages in Bangladesh are now sheltered under NGOs activities but not necessarily 80% of the poor who need help (Roy, 2002; Saleque, 2004). About 13000 NGOs are engaged in micro-credit operations with agricultural activities (Haque, 2002; BBS, 2016; Holloway and Richard, 1995).

Farmers along the riverside of Jamuna are mostly illiterate, thus they do not know how to take loans from the formal institutions or banks where proper documentation process will be needed (World Bank, 2005; Roy, 2002). Therefore, rural poor people had got the micro-credit facilities with higher interest form the local non-government institutions without major documentation processes (Robbani et al., 2007; World Bank, 1996). This easy process is making them enable to get small amount loans as they need it during their production time (Saleque, 2004; World Bank, 2005). In the rural areas agricultural extension and counselling services are an acute means of addressing rural poverty, since such organizations have an obligation to support about agricultural practices, backing farmers in problem-solving, allocating technology, and allowing farmers to become more actively surrounded by the agricultural knowledge and information system (Christoplos and Kidd, 2000: 11; Davis et al., 2012).

The broad aim of this research is to know and evaluate local NGOs agricultural services at district level along the riverside of Jamuna, Bangladesh. To fulfill the aim, specific objectives are being set for this study includes; 1) to investigate agricultural facilities provided by local NGOs in the study area; 2) to discuss the suitability of land for different crops and identify agricultural cropping season in the study area; 3) to explore socioeconomic situation of the inhabitants along the riverside of Jamuna; 4) and finally, to analyze correlation between profit from agriculture and six dependent variables at union level along the riverside of Jamuna, Bangladesh.

4.2 NGOs activities on agricultural development

Microfinance programs have continued to work primarily in the rural areas of the country. Major sectors of NGO in Bangladesh are micro-credit, health, and sanitation, education, women empowerment through credit facilities and agriculture. Agriculture is one the most significant parts of the rural economy of Bangladesh. Local NGOs have more opportunities to play an important role in the agricultural development by providing credit facilities and agricultural aids, while they have a wider range of branches throughout the country. But it was observed that local NGOs mainly disbursed their credit in profitable activities like a business which generates income quickly. Therefore, NGOs credit investment pattern along the river Jamuna is not directed towards individual necessities. The common activities of local NGOs along the riverside

of Jamuna are agricultural training on seed distribution, cattle/animal distribution, financial loan, community-based fisheries management by the NGOs, agricultural employment generation, innovating appropriate technology for small and seasonal farmers, social capital for agriculture, cattle and poultry and food processing (Bayes and Patwary, 2012). Along the river Jamuna, local NGOs arrange training for the rural poor to teach them appropriate technology for agricultural activities along with cattle and poultry, food processing and other agricultural sectors, which also includes rural handicrafts.

(1) Agricultural training

Local NGOs are working for the agricultural development along the riverbank of the Jamuna by providing agricultural training to the farmers for their further economic development and sustainable food security as well as economic safety. Farmers along the riverside of Jamuna are mostly illiterate and unaware of the proper agricultural methods and prospects. They find it difficult to practice modern agriculture in a critical situation, whereas flood and riverbank erosion is a very common phenomenon. To make the rural people dependent on proper agricultural activities, NGOs should provide them agricultural training. Most of the time farmers meet with the local NGOs employee in a selected place to be trained through theoretical practices. From the theoretical knowledge, the farmers try to implement the training on the field level with proper directions from the local NGOs instructors. This process helps the farmers to grow more food for their family and the extra produced crops can be sold to the local market/commercial centers for their future financial benefits. It also inspires new people who are not engaged in local NGOs agricultural programs. Family members of the farmer can also participate in the field to produce agricultural crops (Islam et al. 2010).

(2) Cattle distribution

Cattles and animals are the major assistance of the rural poor for cultivation along the riverside of Jamuna and also provide financial assistance to farmer's necessity in the disaster time. These animals deliver them a lot of economic and agricultural support during their cultivation period. Although farmers don't have enough economic ability to buy cattle and animal for farming along the river Jamuna, Bangladesh (Rahman and Islam, 2014). For this purpose, some local NGOs were providing animals to the local poor people of the char areas, who don't have the ability to buy animal by their own to cultivate the land. Local NGOs had provided animals based on the economic and social status of the rural people. Some people can be vulnerable poor, some can be moderate poor and some can be extremely poor. The authority prefers to give an animal to the extreme poor by refereeing from local people who recognize about the real scenario of poverty grade of the residents.

(3) Financial loan for agriculture

Local NGO credit programs development is one of the main causes for growing rural and social development. As of late, local NGOs credit program covers approximately 43% of all rural households and around 70% of poor households. The Grameen Bank, BRAC, ASA, RDRS Bangladesh, Proshika and others NGO have provided loans to nearly 87% of all borrowers from non-government institutes since the beginning of the NGOs in Bangladesh (Mahmud, 2012). There are several poverty pockets in the country especially along the riverside of Jamuna, whereas credit coverage is relatively lower for the agricultural development. A significant number of the poorest people of local NGOs are involved with credit programs, whereas it will help them to meetup financial crisis by investing money to different business (Handicrafts, crops and fisheries business) and agricultural sectors (Produce different profitable crops). The local NGOs along the riverside of Jamuna are working on household vulnerability, micro-credit for agricultural development with female empowerment, education along with health and sanitation. Micro-credit program of local NGOs have played a noteworthy role in community development and economic growth. Financial sustainability makes the rural poor people more development in different sectors like female empowerment, education, and health and sanitation sector (Mahmud, 2012).

(4) Creating facilities for poor to enjoy government owned khas land

The proportion of land per head is reducing at an alarming rate in Bangladesh due to population growth in a higher rate. In 2011, the census shows that total arable land has decreased around 27% from the beginning. Furthermore, per head arable land was decreased to 10 *katha* from 16 *katha* (Begum et al., 2004 and BBS, 2011). Local NGOs are helping rural poor to become the owner of deep tube-well, shallow tube-well and low-lift pump under the project of irrigation for landless through organizing the landless people along the river Jamuna, Bangladesh. Local NGOs had provided training on social forestation and cluster irrigation system for the landless poor people, which had created the exceptional prospect to enjoy the land facility with higher production. The government-owned Khas land especially along the roadside, are now being used by the landless poor people for social forestation and their habitation. Local NGOs are managing the landless people and taking lease of Khas land and dry riverbed to use it for shared fish culture. There are some local NGOs, which had established a village based nursery and assisting in social forestation and tree plantation along the riverside of Jamuna, Bangladesh (Begum et al., 2004).

(5) Community-based fisheries management by the NGOs

There are three types of water resource system like closed beel, open beel and river that differ in terms of physical characteristics in Bangladesh. Flood lands were changed according to seasonal variations along the river Jamuna, Bangladesh, with dry season characterized by private property rights and rainy season by common property. The local

NGOs, local government, community-based organizations, and individual fishermen have cooperated each other to manage community-based fisheries along the riverside of Jamuna, Bangladesh (Haggblade et al., 1986).

(6) Agricultural employment generation

Local NGOs along the riverside of Jamuna have worked on encouraging the rural poor to take part in different economic activities and to increase their income through employment generation. NGOs usually create employment opportunities in two ways. Firstly, they offer employment opportunities in their own organization since they also need human resource to operate credit facilities and encourage rural poor to involve in NGOs development and social programs. Secondly, they provide loans and management assistance to individuals, which make new employment opportunity (BIDS, 2011). Currently, local NGOs are generating some ideas for the generating agricultural employment like irrigation project for landless, fishery in ponds (Khas), equipment supplies for landless share cropper, bee keeping, rice and popcorn production, sericulture, handicrafts and developing nursery as well as providing training to hundreds of men and women on vaccination and treatment of domestic animals and poultry, construction of sanitary laboratory and slabs (Begum et al. 2004).

(7) Innovating technology for small farmers

Deep and shallow tube-well was not appropriate for growing vegetables and spices in farming land of small size. There are several types of irrigation technology made by the local NGOs along with farmers, like bamboo tube-well, oar pump, star pump and dheki pump for the small and seasonal farmers with low cost along the river Jamuna. Therefore, marginal farmers can easily adopt these technologies and grow vegetables and spices on a small scale around the homestead which is called kitchen gardening. The local NGOs along the riverside of Jamuna arrange trainings to teach technology of the rural poor for growing fruits, vegetables and fishing through the transfer of suitable technology among the community level (Rahman et al., 2010 and Begum et al., 2004).

(8) Social capital for agriculture

The rural poor people along the riverside of Jamuna, Bangladesh become isolated from the mainland in the disaster time and to recover from the unexpected consequence of social bonding and capital is very essential to overcome the critical period. By relating all the existing interested people, social capital can play the significant role in the agricultural development along with social development by integrating method. Local NGOs have a significant role to flourish the social capital system among the rural poor people in developing community-based economic security during the disasters time. Local NGOs are to combine the poor people of same mentality for the purpose of agricultural development as well as development of rural economy. They collect money from the people on a weekly basis who are participating in the initiative of community development. The current initiative is generally distributed, based on

share basis to their amount of contribution. Sometimes local NGOs had provided required amount of loan to keep the agricultural development as well as development of rural economy (Rahman et al., 2011 and Begum et al., 2004).

(9) Food processing and storage

Proper food processing and storage is still one of the major difficulties of the agricultural arrangement of Bangladesh as well as the districts along the riverside of Jamuna. Farmers along the river Jamuna, cannot afford enough money for food processing and storage; therefore they had traded their goods very cheaply before the actual time of the business. Local NGOs are playing a substantial role in this sector by helping the poor farmers with storage and food processing facilities. Now farmers are able to store their crops in those storages and sell it to the market in a proper time. For example, Community Paddy Bank (CPB) which is recently introduced by an NGO could be established as a model to storage crops in the flood-prone areas of Bangladesh. Local NGOs activities and initiatives for the development of the rural people and their agriculture along with other agriculture-related activities play a significant role in the country's economic and social development. Through this process, the root people will be getting their benefits and consequently the development of Bangladesh is progressing faster than ever before (Rahman, 2000 and Saleque, 2004). There are different types of loans in micro-credit institutions varies from one to another. Major institutions have their own loan types. If a farmer wants to take seed loan (loan for buying seeds), local NGOs are only entitled to lend money to the rural poor for a certain period of time in return of interests. The poor people along the river Jamuna are well aware of the institutions like government organizations, which are not there to help them instantly; therefore they mostly depend on local NGOs credit program (Anonymous, 2003).

(10) Client friendly

Usually, the formal institutions in Bangladesh do not go door to door in the rural areas to provide financial services to improve economic status of the rural poor people. But the microcredit institutions (Non-government organizations) reach the doorsteps of the rural atmosphere. Local NGOs usually reach all the houses of an area, where they are operating their credit program with credit facilities. They make everything clear about the loan interest; therefore the client can come up with a decision about the benefits and stigmas of the intention of their loan paying (Alam et al., 2009).

(11) Right time financing

If a farmer needs loan for agricultural production along the river Jamuna, then he doesn't have the necessity of taking loan for the purpose of storing crops. The rural poor people expect loan facilities from the local organization in the right time of cultivation. Most of the local NGOs are providing agricultural aids (Seeds, fertilizer, pesticides and agricultural tools), loan facilities, instrumental and other technical facilities to the farmers during the productive time. On the contrary, sorting facility of loan timing helps

the farmer to encourage agriculture planning during their hard times (Alauddin and Biswas, 2014).

Local NGOs micro-finance program along the river Jamuna has earned a new pace after the construction of Jamuna Bridge during the late 90s. Micro-credit institution didn't have the comfort to operate their credit program due to remoteness and lack of proper communication systems before. Thereafter, most of the local NGOs became willing to operate their activities not only in the summer time but also in the hostile environmental situations like flood, cyclone, drought and other natural calamities in a short period of time (Birkhaeuser et al., 1991). Furthermore, Bangladesh is a low-lying riverine country, which is formed by a delta plain due to the confluence of the Padma, Jamuna and Meghna Rivers as well as their tributaries. The pride of Bangladesh is its rivers, with one of the largest networks in the world along with a total number of about 700 rivers including tributaries, which have a total length of about 24,140 km. Therefore, about 80% of the people live in rural areas and more than 75% of it depends on agriculture. Bangladesh is one of the most underdeveloped countries in terms of human development. The poverty situation declined day by day due to growing landlessness and slow growth of productive non-firm activities (BIDS, 1981).

4.3 Agriculture research system in Bangladesh

The National Agricultural Research System (NARS) of Bangladesh comprises of ten research institutes under the Bangladesh Agricultural Research Council (BARC). Six research institutes belongs to Ministry of Agriculture (MOA) out of ten, two to Ministry of Fisheries and Livestock (MOFL), one to Ministry of Commerce, and one to the Forest and Environment Ministry. The ten research Institutes under the NARS are:

1. Bangladesh Rice Research Institute (BRRI);
2. Bangladesh Agricultural Research Institute (BARI);
3. Bangladesh Jute Research Institute (BJRI);
4. Bangladesh Institute of Nuclear Agriculture (BINA);
5. Bangladesh Livestock Research Institute (BLRI);
6. Bangladesh Fisheries Research Institute (BFRI);
7. Bangladesh Sugarcane Research Institute (BSRI);
8. Bangladesh Tea Research Institute (BTRI);
9. Bangladesh Forest Research Institute (BFRI); and
10. Soil Resources Development Institute (SRDI).

The Bangladesh Agricultural Research Council (BARC) is the peak body of the NARS. The Council assists as the national level coordinating organization for planning, assimilation and operating research on crops, livestock, soil, water, crop protection, agricultural engineering, forestry, fisheries, economics and social science. BARC also identifies problem areas in agriculture and prepares national plans for agricultural

research within the framework of national policies and development goals (Bulletin of Institute of Vocational and Technical Education, 2008). There are some universities who are providing higher agricultural education for extended services enlisted in below:

1. Bangladesh Agricultural University;
2. Sher-E-Bangla Agricultural University;
3. Bangabundhu Sheikh Muzibur Rahman Agriculture University;
4. Hazi Md. Danesh University of Science and Technology;
5. Patuakhali Science and Technology University;
6. University of Rajshahi;
7. Sylhet Agricultural University; and
8. Chittagong Veterinary and Animal Science University.

4.4 Data sources and methods

Primary and secondary data were collected from the different group of respondents and some selected NGOs. Absolute information regarding the locations of 30 NGOs with 175 sub-branches were collected using GPS (Global Positioning System). In total 533 respondents were interviewed using household survey method and 50 focus group discussions were also conducted at district and union council (combination of few villages) level along the riverside of Jamuna, Bangladesh. The information on age of the respondents, sex, number of family members, occupation, monthly income (Before and after joining to local NGOs credit program), distance from the NGOs to the respondents, distance from the growth centers/ hat, bazar to the respondents and facilities provided by the local NGOs in agricultural sector along the riverside of Jamuna, Bangladesh, 2016 were collected through household questionnaire survey and analyzed by SPSS 16.0.

Secondary data were acquired from Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and different NGOs that supported for developing proper planning on agricultural systems. The study interviewed these following groups:

(a) Local community (total 533 respondents and 50 FGDs, information gathered includes; age of the respondents, sex, number of family members, occupation, monthly income before and after joining to local NGOs credit program, distance from the NGOs to the respondents, distance from the growth centers/ hat, bazar to the respondents and facilities had provided by local NGOs).

(b) Local NGOs employees who are involved in agricultural services of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs and provided services to rural poor people namely agricultural training, fertilizer, domestic animals, seeds traditional agricultural tools and agricultural loan).

Finally, Data needed for land and crop suitability along the Jamuna river was

borrowed from Bangladesh Bureau of Statistics (BBS, 2011), Bangladesh Agricultural Census (2011 to 2016) and Center for Environmental and Geographic Information Services (CEGIS) and analyzed using ArcGIS 10.1.

(1) Data analysis

ArcGIS 10.2 has been used for detailed mapping and analysis of productive area of agricultural crops in the sample sites. 10 major crops were identified regarding on farmers demand. Using ArcGIS 10.2, this paper had identified the production area of each crop in different categories, i.e., very high productive, high productive, medium productive, low productive and finally very low productive. Besides that, the rural poor people who engaged in different economic activities, i.e., agricultural, industrial, services and others were also analyzed in ArcGIS 10.2.

Statistical Package for the Social Sciences (SPSS 16.0) software was also used for Socio-economic characteristics analysis, i.e., age, sex, number of family members, occupation, monthly income, distance from the NGOs office to the respondent's home, distance from the growth centers/ hat, bazar to the respondents and facilities provided by the local NGOs in agricultural sectors of the study site. Besides that, correlation between profit from agriculture and six dependent variables were also analyzed using SPSS. This paper has tried to show the relation between six dependent variables with income by the following correlation equation:

$$r = [\Sigma xy-\{(\Sigma x)(\Sigma y)/n\}]/[\{\Sigma x^2-(\Sigma x)^2/n\}\{\Sigma y^2-(\Sigma y)^2/n\}]^{1/2}\dots\dots\dots\dots\dots\dots(I)$$

Whereas, X= Dependent variables, Y= Income, n= Number of unions and results, r lies between -1 and +1. Value near 0 means no correlation and near -1 and +1 means there have less or strong correlations between the variables with income.

(2) GIS and remote sensing approaches

Computer-based spatial analysis using ArcGIS 10.2 has been used for detailed mapping and analysis of NGOs activities. Using integrated approaches of GIS and remote sensing, both GPS data of NGOs and growth centers data were overlapped on satellite imagery of SPOT 5 and compared distances of central places to the rural settlements. It will helps us to identify the gaps of development among the villages and within the villagers. Due to transportation systems and lot of natural barriers make the rural areas underdevelopment particularly in economic sector. Without GIS and remote sensing approaches it would quiet possible to make a proper plan for rural development particularly in agricultural sectors. It would be easy to make planning, identify the geographical problems, problems of monitoring, buffering area measurement and to help forecasting of forthcoming events with the help of GIS and remote sensing approaches. GPS data have been developed using SPSS and geo-linked with remote sensing imagery that help to comprehensive and long term planning on agricultural development. The

determination of this analyzing is to develop union level planning, proper policy making and quick program formulation etc. on agricultural development within a short period of time.

4.5 Major findings of the study

As we know our rural life covers a wide range elements and components; both natural and man-made like population, environment, religion, culture, health, education, agriculture, economy and so on. The NGOs have concentrated their efforts specially on removing economic crisis through functional agricultural system. They have been particularly working on agricultural system and trying to minimize the rate of cracked.

(1) What does NGO bring to agricultural development

With the help of 533 questionnaires and 50 focus group discussions with the perception of local people, this paper was tried to accumulate all the information's in one frame. Local NGOs along the riverside of Jamuna have been providing agricultural facilities to the poor people as below:

1. Developing new variety crops and methods as well as training the farmers;
1. Distribution of seeds, fertilizers, pesticides;
2. Created a skilled labour force amongst the agricultural labourers ;
3. Making participatory approach for identifying poor peoples' needs and priorities to deliver the destined livelihood within the project's timeframe;
4. Employment and income generating activities;
5. NGOs supported local groups in seed production and distribution;
6. Multiplication of planting and plant breeding;
7. Irrigation management and land use development planning;
8. Kitchen gardening and home level food processing;
9. Working on small farmers and landless laborer's skill development and making one house one farm planning for the rural people;
10. NGOs are providing agricultural tools; and
11. Give the local poor uniform loan with interest for cultivation.

(2) The problems being faced by NGOs

With the help of 533 questionnaires and 50 focus group discussions along with NGOs employees' perception, this paper was tried to accumulate all the information's in a one frame. Local NGOs along the riverside Jamuna were provided agricultural facilities to the poor people and they were faced lots of problem are as below:

1. Beneficiaries are not satisfied with the services delivered recently, because of late timing of agricultural seeds or fertilizer distributions;
2. Some members of the community do not want to cooperate with the NGO because when farmers are not capable of paying the loans, they (NGO agents) mannered inhumanely to collect the loans and accessories;

3. In long-term projects particularly in agricultural sectors, donor withdraws his financial support as a result planned outputs, outcomes and impacts are not achieved;

4. Production processes are not stable due to natural disasters like flood, cyclone, riverbank erosion and drought;

5. Raw materials, semi-finished and finished products get stolen from the warehouse;

6. Supplies do not arrive on time due to the transportation and communication systems;

7. Customers, donors and grant makers pay later than agreed in any projects, because sometimes grant makers are not satisfied with the quality of project reports;

8. Conflicts among NGOs employees, local communities and within the local NGOs;

9. Governmental authorities do not approve an application for a project extension due to the corruptions of NGOs employee; and

10. Sometimes some militant groups threaten the donor organizations for money.

These problems revealed a clear gap between the values that NGOs espouse and what actually happens in practice. Balancing the needs of the different stakeholders who each feel they have an equal right to the decision-making process, which has created a number of management problems for these organizations.

(3) Evaluating NGOs contribution particularly in agricultural sectors

NGOs have to make strategic choices between challenging, complementary or collaborative strategic relationships with the government. The process of making these strategic choices gives a rise to internal pressures concerning; expenditure priorities, the conflicting demands of clients and donors, which result in disagreements over an appropriate balance between quality services and meeting fundraising targets. Service-providers are pulled towards clients, fund-raisers and donors. The result can be a split within the organizations, which can be resolved by the voluntary organization acting as a mediator or bridge between donor and client focus on fostering the participation of all sectors of society in environmental decision-making and in supporting regional cooperation. The NGOs are offering the following services like information exchange and publications; with an emphasis on facilitating access to information, training and capacity building and grants programs for NGOs with limited access to local resources. Consisting of a network of national offices, as well as a head office that acts as a coordination and information center with financial authority. To develop the organization, individuals have to be able to contribute in the decision-making process and they need to learn a lot about it. All participants should understand their

responsibility to represent their particular stakeholders and to support the implementation activities.

(4) Developing database of current agricultural land use

The channel of Jamuna River has several types of landforms throughout its journey to the Bay of Bengal. The landforms are enormously influenced by its boundless nature of erosion and depositional activities taking various seasons due to heavy water flow during the rainy season and dry during the winter. The agricultural activities and types are not the same in all the parts of the course of Jamuna River. Different parts of the Jamuna River has different types of landforms. According to figure 4-1, some of the forms are old connected with the mainland; some of the lands are lost to the main channel of the Jamuna. There are seven types of different landforms are identified from the satellite image analysis of the area; mentionable types are *char* land attached to mainland, new *char* land, new *char* land with low population, new *char* land with moderate population, old *char* land with high population, old *char* land with low population and old *char* land with moderate population.

The land formation along the river bank of Jamuna are different along its journey. Among all the landforms with population distribution mentioned above, *char* land attached to mainland has a vast majority of the landforms. The total number of such type of land is found to be 35 in number. The majority of the attached lands are found in the upper stream of Jamuna, counting very small number in the lower part of the river channel. Middle stream has a moderate number of the land of this type. The total area of attached land is around 46,698.92 hectors (Table 4-1); which is second most dominant landform after old *char* land with high population. The major agricultural crops of this landform are paddy, wheat, chili, mustard, brinjal, pumpkin, cabbage, zucchini, onion, garlic, ginger, and turmeric. This is because of the stability of the land near to the mainland connection. The boat is being used as the major transportation system.

There is some new *char* land also found along the bank of Jamuna. These are created mainly because of recent deposition of land in the river. *Char*s of these type are found in the middle of the river or along the main channel of Jamuna River. The number of these small *char*s is 95 and the total area is 13,241.8 hectares (Table 4-1). The major crops grown in this area are wheat, chili, mustard, peanut, maize and sweet potato. These *char*s are mostly in the upper stream of the Jamuna River.

New *char* land with low population is another dominant land portion. The total number of *Chars* is 39 and the total area is 15,692.81 hectares of land, where wheat, chili, mustard, peanut, maize and sweet potato are mainly produced. People travel from one place to another by boat. During the rainy season, it becomes harder for local people along the riverside of Jamuna to cope with natural disasters like flood and riverbank erosion as well as other hazardous diseases.
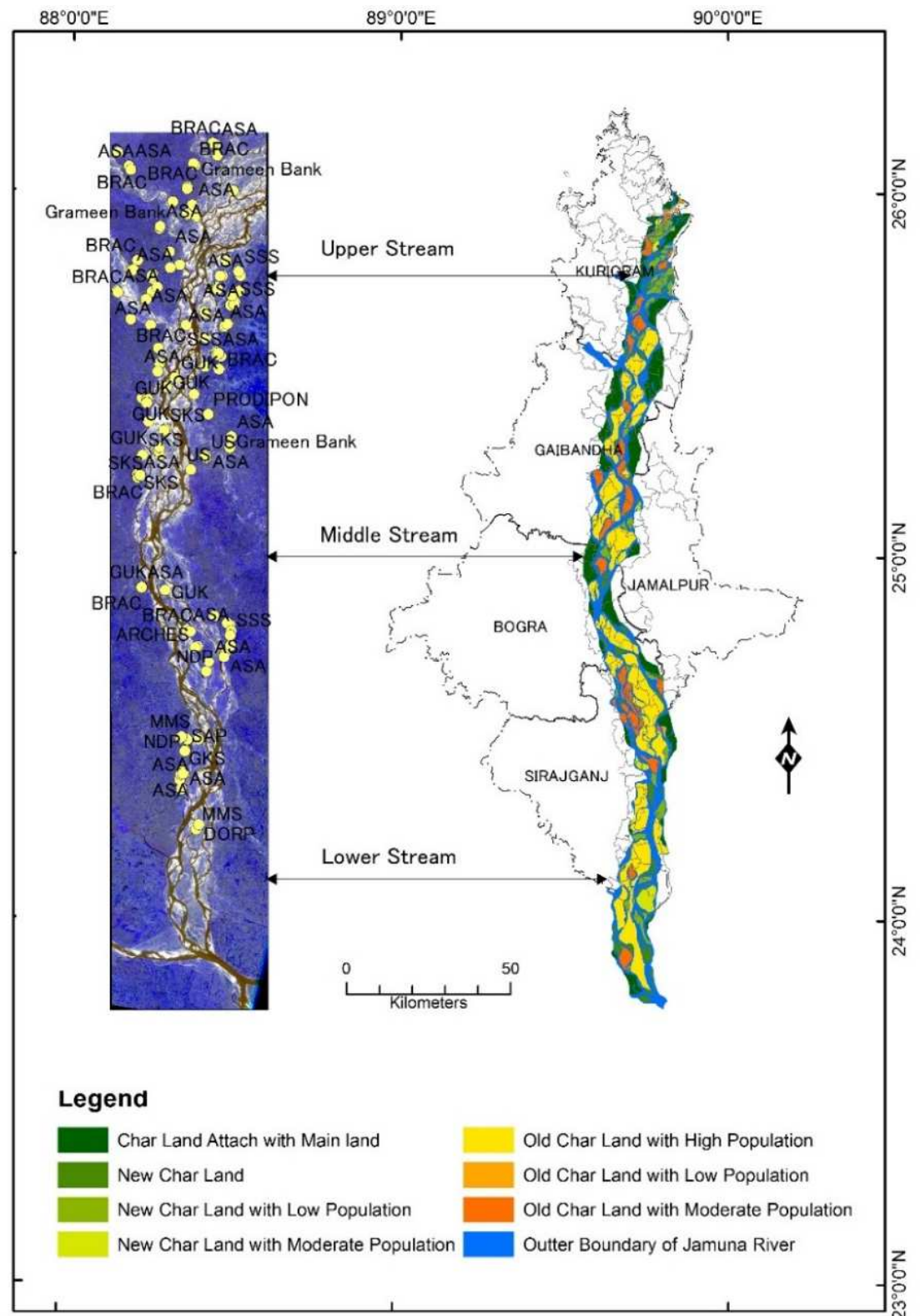
Figure 4-1: Distribution of land cover type along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and Field survey, 2016

The most dominant type of landform along the river Jamuna is old char land with high population. These landforms are found all over the river course of Jamuna. Starting from the upper-middle stream of the Jamuna to the lowest part of Jamuna. The lower-middle part is covering the most of the old char lands. The number of total landform with very high population is 32 but area coverage is very huge counting 83,130 hectors of land; almost the double to the next best land types. This chars have more population because of their long stability of the land. Some of the lands are 15 years (BIDS, 2011) old some are less. But the population is living there since the chars had become stable. The major crop of this land type is paddy as the agricultural lands are very flat in nature, that's why the people mostly prefer to cultivate the rice. Because it takes less hard work to produce rice in the char.

The other crops yielded are jute, sugarcane, wheat, chili, mustard, brinjal, pumpkin, cabbage, zucchini, onion, garlic, ginger, and turmeric. People normally use a boat as the transportation system to sell and carry their crops, as they mostly live in the middle of the river. At the lower stream at the junction of Bogra and Sirajganj, the land type is cluster type with the huge assimilation of land. But comparatively the upper part has a straighter combination of old char lands. There are very few land with old land formation containing low population. The number of such lands is only three. The total area of this type is only 1,204.39 hectares of land, which is very negligible in comparison to other landforms. This type of land is mostly found in the lower stream of the Jamuna river bank shown in light orange color in the map (Figure 4-1). The main medium of transportation to this land is a boat. There are no other alternative options for traveling. The major crops of this area are paddy, jute, sugarcane, wheat, chili, mustard, brinjal, pumpkin, cabbage, zucchini, onion, garlic, ginger, and turmeric.

Old char land with moderate population is 33 in number. The landform is almost equally distributed throughout the entire river course of Jamuna. In the upper stream of Jamuna in Kurigram district, some old char land observed. Travelling to the middle stream in Gaibandha district, some major landform of this type are found; a cluster of old char land with moderate population is found in the northern part of Bogra very close to the main channel of Jamuna. At the lower stream in Sirajganj, two or three small land piece with moderate population distribution is found. The major crops of this area the like other landforms are paddy, jute, sugarcane, wheat, chili, mustard, brinjal, pumpkin, cabbage, zucchini, onion, garlic, ginger, and turmeric. People mainly travel there by boat, as there is no other transportation facility available.

Table 4-1: Number of *char* lands, areas, crop suit and transportation system along the riverside of Jamuna, Bangladesh, 2016

Categories	Count	Area in Hectors	Crop Suit
Char land attached with main land	35	46,698.92	Paddy, wheat, chili, mustard , brinjal, pumpkin, cabbage, zucchini, onion , garlic, ginger and turmeric
New *char* land	95	13,241.80	Wheat, chili, mustard , peanut, maize sweet potato
New *char* land with low population	39	15,692.81	Wheat, chili, mustard , peanut, maize, sweet potato,
New *char* land with moderate population	4	45,53.88	Linseed, green pea, pea, sesame, wheat, chili, mustard
Old *char* land with high population	32	83,130.08	Paddy, jute, sugarcane, wheat, chili, mustard , brinjal, pumpkin, cabbage, zucchini, onion , garlic, ginger and turmeric
Old *char* land with low population	3	1,204.39	Paddy, jute, sugarcane, wheat, chili, mustard , brinjal, pumpkin, cabbage, zucchini, onion , garlic, ginger and turmeric
Old *char* land with moderate population	33	23,070.88	Paddy, jute, sugarcane, wheat, chili, mustard , brinjal, pumpkin, cabbage, zucchini, onion , garlic, ginger and turmeric

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and Field survey, 2016

NGOs are working along the riverside districts of Jamuna mainly based in the upper stream. A few numbers of NGOs are working in the lower stream. In comparison to the upper stream, the lower stream NGOs are very negligible. In the upper stream, the NGOs are densely distributed. In Kurigram and Gaibandha district the local NGOs are mainly working and distributing their services to the poorer in return of the share of profit. Hardly little number of local NGOs are working in Bogra district. In Jamalpur and Sirajganj a few NGOs are working based on some specific *char*s where the sufferings are never-ending for the inhabitants of *char*s.

(5) Potentialities of different agricultural yield along the riverside of Jamuna, Bangladesh, 2016

This section provides results from household surveys (533 respondents) and 50 focus group discussions (5 to 6 participants in each discussion) and reports on agricultural land suitability from Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Census and CEGIS on the appropriateness of land for agricultural crops in our sample sites. The total area of land included in the analysis was 340,659.49 hectares. Results are analyzed

using a five-point Likert scale, i.e., very high, high, medium, low and very low; which is summarized in Table 4-2. Crops being included in the analysis are; rice, wheat, Jute potato, chili, ginger and turmeric, onion and garlic, mustard and sugarcane. Results show that three varieties of rice namely; *T. Aman, Boro and T. Aus* are grown in the study area whereas *Boro* rice suits the best for farmers of the study site. The land for jute and potato cultivation is moderately suitable. Furthermore, the production of chili, ginger, and turmeric is perceived very low among sampled respondents due to unavailability of suitable land.

(a) *T.Aman* paddy production and potential areas

Production of *T. Aman* rice along the Jamuna River is not very satisfactory in terms of its production in the different scale. *T. Aman* rice fields are located in very limited areas in the study sites. The northeastern part of Kurigram, the western part of Jamalpur along with river bank and the eastern part of Bogra district have some areas where the production of *T. Aman* is very high (figure 4-2) which consists 5.58% hectares of the total land. Besides that, there are some scattered part in the southern part of Kurigram and the eastern part of Gaibandha district which is mentioned as the high production zone of *T. Aman* rice. The total very high productive area of *T. Aman* rice is 19,009.97 hectares of the total land in the study sites (Table 4-2). Furthermore, the high productivity of *T. Aman* rice is also located very least in the study sites. The total area of the highly productive zone is only around 13,529.14 hectares of land, which is 3.97% of the total land. There are some parts in the upper stream of the Jamuna (Kurigram district) and the middle part (Part of Gaibandha and Jamalpur district) is highly productive for *T.Aman* paddy. The upper stream of Jamuna containing the district of Kurigram and Gaibandha are filled with medium productive zones of *T. Aman* rice. Some areas of Sirajganj and Jamalpur district are also mentionable. Around 75,536.43 hectares of land are the medium productive area of *T. Aman* rice which accounts for nearly 22.17% land of the total area. Besides that, the low production of *T. Aman* rice is mostly noticed in the lower middle stream of Jamalpur and Sirajganj district. The western part of Jamalpur and the eastern part Sirajganj has the most frequency of land with low productivity. The total area coverage of low productivity of *T. Aman* rice is 34,800 hectares of land, which is almost 10.22% of the total *T. Aman* cultivated area. Some low productive area is also noticed in between the highly productive zones of Kurigram district.

Figure 4-2: *T.Aman* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

The remaining area of Jamuna stream is a very low productive area for *T. Aman* rice production. The middle stream of Jamuna river is a completely low productive area for *T. Aman* rice. There are 1,997,783.80 hectares of land (very low productive area for *T. Aman*) were found in the middle and lower part Jamuna River, which counts to around 58.06% of the total. The low productive zone is mostly very close to the main channel

of the Jamuna, which has a very different nature all over the year (Erosion and depositional action).

Table 4-2: *T. Aman* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

T. Aman (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	2,383.65	19,009.97	5.58%	
High productive	3,600.15	13,529.14	3.97%	Not enough suitable for *T. Aman* rice
Medium productive	7,999.49	75,536.43	22.17%	
Low productive	3,198.05	34,800.15	10.22%	
Very low productive	10,069.83	1,977,83.80	58.06%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

It's clearly apparent that the *T. Aman* rice production is most effective where the land is stable enough for a longer period. Lands situated far from the main channel of the Jamuna has a very high production to high productive zones of *T. Aman* rice. In contrast to, the attached land with the main channel has very limited and low in productivity. Moreover, the upper stream of Jamuna has more old char land with the high density of population. It causes more agricultural practice there. The lower part more erosional in the confluence of Meghna causes the low production of *T. Aman* rice. It indicates that the river stream of Jamuna is not suitable for the production of *T. Aman* rice. The land suitability of its production is very minimalistic in this zone. More fertilizer and modern techniques can bring the good day for this rice type's production in the bank of Jamuna.

(b) *Boro* paddy production and potential areas

Boro paddy production in the riverbank of Jamuna is hugely beneficial, as the land suitability for this types of rice are very high. The areas of Kurigram Gaibandha and Sirajganj are the very high productive zone of *Boro* paddy. The countryside of each and every district is very much enriched with the production of *Boro* paddy. The district which seems to be the most productive zone of Boro paddy is Kurigram. The upper part of Jamuna is highly productive in comparison to the middle and lower part of Jamuna stream. Almost all districts are very highly productive for *Boro* paddy. The total area of *Boro* with very high effectiveness is 124,605 hectares of land, which is almost 36.58% of the total *Boro* production area. The vast majority is seen mostly not along the river but a little far away from the main channel of the Jamuna. In Kurigram, the eastern side is mostly facilitated with this type of crops. Besides that, the eastern part of Jamalpur district is another mine of *Boro* rice cultivation. Relatively the southern side

of Jamalpur and eastern side of Sirajganj, lack in very high productivity zones of *Boro* paddy cultivation, which is not as alarming as the other parts are complacent for the crop (Figure 4-3).

The main channel of Jamuna is facilitated with the much highly productive area of *Boro* paddy. Almost all the channel of Jamuna has the high zones of *Boro* cultivation. The upper part of the river stream is some less in *Boro* production. But the middle stream of Jamuna is completely dominant with *Boro* production. The total area of High *Boro* production in the Jamuna channel is around 136,328.78 hectares of land, which is the highest ratio among all types of productivity with 40.02% of the total production area. In the middle stream of Gaibandha is most frequent zones of *Boro* production as shown in the inset image on the map (Figure 4-3). Besides that, in the lower middle part of the river stream, which connects the district of Bogra, has a huge high productive zone for *Boro* paddy.

Figure 4-3: *Boro* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

In the upper stream of Jamuna, there are some area which are medium productive zones of *Boro* paddy. The northern part and south-eastern part of Kurigram district near the main stream of Jamuna has the highest frequency of *Boro* cultivation. Furthermore, from the upper to the middle part of the Jamuna river has many land pieces with medium *Boro* paddy cultivation zones. The total area for medium *Boro* production is 36,302.69 hectares of land, which is nearly 10.66% of the total production area (Table 4-3). On the contrary, in the district of Bogra, Jamalpur and Sirajganj almost have no medium zones of *Boro* production, where the production is very high.

Table 4-3: *Boro* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Boro (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	10,069.83	124,605.49	36.58%	
High productive	6,653.12	136,328.78	40.02%	Suitable for
Medium productive	3,244.17	36,302.69	10.66%	*Boro* Paddy
Low productive	3,600.15	43,422.55	12.75%	

Low productive zones of *Boro* rice found to be very minimal in the alongside districts of Jamuna river. As most of the area is highly productive in this region; medium productive and low productive zones have very small places. The total low productive zone of *Boro* crop is around 43,422.55 hectares, which counts to around 12.75% of the total *Boro* production area (Table 4-3). In the inset figure 4-3, in upper stream, there are some area which has some low productive areas found in the northern part of Kurigram district. The eastern part of Jamalpur, Bogra, and Sirajganj has some area where the productivity of *Boro* rice is pretty low in amount.

If the whole scenario of the *Boro* paddy production taken in comparison, it will apparently show that, the upper and middle stream of Jamuna is the heaven for *Boro* production. Due to some seasonal variations over the district of Kurigram, the production has seen some changes from medium to low in some certain parts. As far as the production of *Boro* is very much suitable in the riverbank of Jamuna. The background statistics and the visualization in the map will highly support to the

statement. The effective cultivation of *Boro* paddy will lead the farmer to more enthusiasm in the cultivation of this species in the bank of river Jamuna.

(c) *T. Aus* paddy production and potential areas

One of the major cereal food grains in Bangladesh is *T. Aus* paddy. For the crop production in Bangladesh, fertilizer plays the most vital role to improve the soil nutrient, where the use of fertilizer mostly depends on the types of soil, growing season, irrigation and the cultivars used as well as agro-climatic conditions of the locations. *T. Aus* paddy production is not evenly distributed along the bank of Jamuna. Production of *T. Aus* is different between the two banks of the river. The western side of the river is mostly very high production dominant and the eastern side of the river has some scattered distribution of *T. Aus* paddy (Figure 4-4). Besides that, in the upper stream of Kurigram district has some very high productive areas, which is very minimal in comparison to the other production types. In the lower stream of Jamuna, Bogra has some highly productive zones near the main channel of Jamuna River. There are 3,726.54 hectares of total land, which is considered as a very high productive zone of *T. Aus* paddy covering barely 1.09% of the total *T. Aus* production (Table 4-4).

The majority of Kurigram, Gaibandha is dominantly covered with high productive zones of *T. Aus* paddy. Furthermore, these production areas expanses from the upper stream to the middle stream of the river channel. Besides that, there are some scattered high production areas, which are also found in the above-mentioned districts, which is very close to the main channel of the river. Some areas in Bogra, Jamalpur, and Sirajganj are also blessed with the high production of *T. Aus*. It's obvious to say that the upper stream has higher productivity than the lower or middle stream as far as the paddy type *T. Aus* is a concern. In Jamalpur, the larger portion of the land of a highly productive zone is close to the main channel. The situation is not similar to other districts, as all the districts have the combination of all types of production scales of *T. Aus* paddy. The total area for a highly productive zone is some 73,155.10 hectares, which is nearly 21.47% of total area of *T. Aus* cultivation.

The upper stream of Jamuna is most suitable for the medium productivity of *T. Aus* rice. Around 20.15% of the total area is covered by medium production that accumulates nearly 68,642.28 hectares of land (Table 4-4). A single piece of continuous medium production land is around 10,000 hectares, which indicates the bigger land sizes of single continuous land for *T. Aus* production in the different parts of the stream. From the upper to the middle stream of the Jamuna covering the district of Kurigram, Gaibandha and the northern part of Jamalpur have the highest density of medium production of *T. Aus* paddy. The southernmost part of Kurigram, situated along the Jamuna has a huge land portion, which is most suitable for medium productivity. In the middle stream, Gaibandha, Jamalpur, and Bogra have some lands with a medium production area of *T. Aus* paddy.

Figure 4-4: *T. Aus* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Table 4-4: *T. Aus* paddy production and potential areas along the riverside of Jamuna, Bangladesh, 2016

T. Aus (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	1,607.92	3,726.54	1.09%	
High productive	7,999.49	73,155.10	21.47%	Not Suitable for *T. Aus* Paddy
Medium productive	10,069.83	68,642.28	20.15%	
Low productive	6,653.12	66,750.88	19.59%	
Very low productive	3,244.17	128,384.70	37.67%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Jamalpur, a part of the middle stream of Jamuna River is moderately unsuitable for *T. Aus* production. The district is mostly covered with the low productive zone of this paddy. The total area of low production is 66,750.88 hectares, which is almost as same as the medium production zones, which is also nearly 19.59% of the total cultivated land. The middle part of Kurigram, the eastern part of Bogra, a part of Sirajganj district and the main channel of Jamuna have a larger flat land which is very productive for *T. Aus* paddy. On the contrary, most of the middle to the lower stream of Jamuna, covering Jamalpur, Bogra and Sirajganj are very low productive for *T. Aus* paddy. There are some parts of northern and southern Kurigram, which is also not suitable for the production of *Aus* paddy. Around 37.67% of total cultivable land for *T. Aus* counts to be 128,384.70 hectares causes very low productive for *T. Aus* being the most dominant land types. If the pattern of production is taken into account; it will be clearly seen that the upper stream of Jamuna has very high fertile landforms of *T. Aus* production, while the lower to middle streams of Jamuna River is not much suitable for the production of *Aus*. The area where productivity is less being most suitable for other types crops or paddy.

(d) Wheat production and potential areas

The second most important grain crop after rice is wheat, which is the most vital winter crop considering the temperature sensitivity of Bangladesh. The production zones of wheat are located in the river channel of Jamuna from the upper to lower stream. The distribution of production is almost even among all the districts. The northern part of Kurigram (in the upper stream), the eastern part of Jamalpur district (in the middle stream), Bogra (in the lower middle stream) and Sirajganj district (in the lower stream) have the equal distribution of very high production of wheat. The total land coverage of very high production is 24,143.73 hectares of land, which is 7.09% of the total land cultivation. Besides that, in comparison to the stream order, the middle stream has the highest productive area which includes Jamalpur and Bogra district. A maximum land portion as a single most productive area, which is found in Jamalpur is nearly 3,600 hectares of land.

On the contrary, the highly productive zones of wheat production are spread all over the Jamuna channel and all over the districts. A total of 250,645.53 hectares of land are highly cultivable for wheat production. Of the total land distribution of wheat production, it counts to be 73.58%, which is almost three-quarters of the total cultivable land. No other landform is as dominant as wheat production among all types of agricultural crops possible to be cultivated in the Jamuna channel. The total area for wheat cultivation now extends to about 804,703 hectares. Among all the land on the river bank of Jamuna has 340,659.49 hectares of cultivable wheat production land, which is almost half of the total cultivable land for wheat production. All the districts have the huge land types eligible for wheat cultivation. Lands from the upper to lower stream of the Jamuna is highly suitable for wheat cultivation.

Figure 4-5: Wheat production and potential areas along the riverside of Jamuna, Bangladesh, 2016

There is very dismal area of the total wheat production capacity is the medium productive area. The medium cultivable land is hardly found in the figure 4-5, as there is very small portion of lands, which covers the production of wheat in medium extent. In the middle stream of Jamuna, under Jamalpur district and some area in the lower stream under Sirajganj district have medium productivity zones of wheat production. The total area of this sort is 11,888.8 hectares of land covering only 3.49% of the total production area (Table 4-5).

Table 4-5: Wheat production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Wheat (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	36,00.15	24,143.73	7.09%	High productive area for wheat
High productive	10,069.83	250,645.53	73.58%	
Medium productive	1,630.85	11,888.80	3.49%	
Low productive	3,244.17	53,981.43	15.85%	

In the upper and middle stream of Jamuna under, Kurigram Gaibandha and Jamalpur district have some area with a very low production of wheat. Mostly the southeastern part of Kurigram has a very limited land suitable for wheat yields. Along the main channel of the river stretches from the upper to the middle stream has some low productive zones of wheat cultivation. Besides that, the eastern part of Bogra has some smaller portion of land along the riverbank, which is not suitable for wheat production and yields. The total low production area is 53,981.43 hectares covering around 15.85% of the total suitable area for wheat production (Table 4-5). It's very obvious from the above scenario is that the wheat production is almost same in all the parts of Jamuna though the lower to middle part has an edge over the upper stream. As wheat is a winter season crop, the cultivation takes place when the channel shrinks down to its minimum width. This leads the farmers to acquire more land for agriculture along the riverbank. The total cultivable area is 340,659.49 hectares of land and the dominant portion of the land is 250,645.53 (73.58%) hectares, gaining a status of very high production area. Furthermore, the support from the respective organizations will help the farmer to get the most of the total land utility as the demand of second cereal crop after rice is very increasing and demanding.

(e) Jute production and potential areas

Jute is cultivated in the Bengal Delta, which is largely occupied by Bangladesh. Jute fibers are extracted from jute plants through several processes such as retting, stripping, washing, and drying. Jute color varies from light dark to brown and it can be easily dyed. Jute is the second most significant vegetable fiber after cotton in terms of usage, production, and availability. In Bangladesh, jute is known as 'golden fiber' because of its production quality and dominance in the world market for its higher quality of fibers. The riverside of Jamuna is more or less suitable for the production of jute along its run. Throughout the channel of Jamuna, there is some area with high to the medium production of jute. Extreme high productive zones are found very hardly. Along the river, most of the lands are medium to low productive zone (Figure 4-6).

A small portion of land in the upper stream of the district of Kurigram has a very high productive zone for jute production. As the land is not much of suitable for jute; the very high production of jute is not expected to that extent from the land category. The total extreme high productive zone is only 527.4 hectares of land; which is 0.15% of the total production.

From upper to the lower stream, in all the districts, there are some areas, where the production of jute is high. The total high productive jute land is around 65,372.29 hectares which count to be around 19.19% of the total productive area (Table 4-6). Besides that, the largest single continuous landform for high jute production is 7,999.49 hectares. Kurigram has the highest productive zones. Like the northern part, middle southern part of the district is also a huge landform for jute production. The western part of Jamalpur, Bogra and Sirajganj have some scattered areas, which are very highly productive zones and also very close to the main channel of Jamuna.

Mostly Gaibandha district has the highest amount of land piece with the medium production of jute. The total amount of land for jute production is around 82,171.64 hectares, which is more or less distributed between Kurigram and Gaibandha district (Table 4-6). Some smaller portions are distributed in the southern part of Jamalpur and Sirajganj. The distribution of high and medium production of jute is almost similar to each other. Of the total area, the medium production area for jute is nearly 24.12%. Besides that, the most eastern part of Kurigram in the upper stream and the western part of Jamalpur in the middle stream of Jamuna river has the highest density of low jute production area. Bogra has also some low productive zones, which are very close to the main channel of Jamuna. Around 67,700.35 hectares of land along the bank of Jamuna has the low productive zone of jute which is 19.87% of the total area.
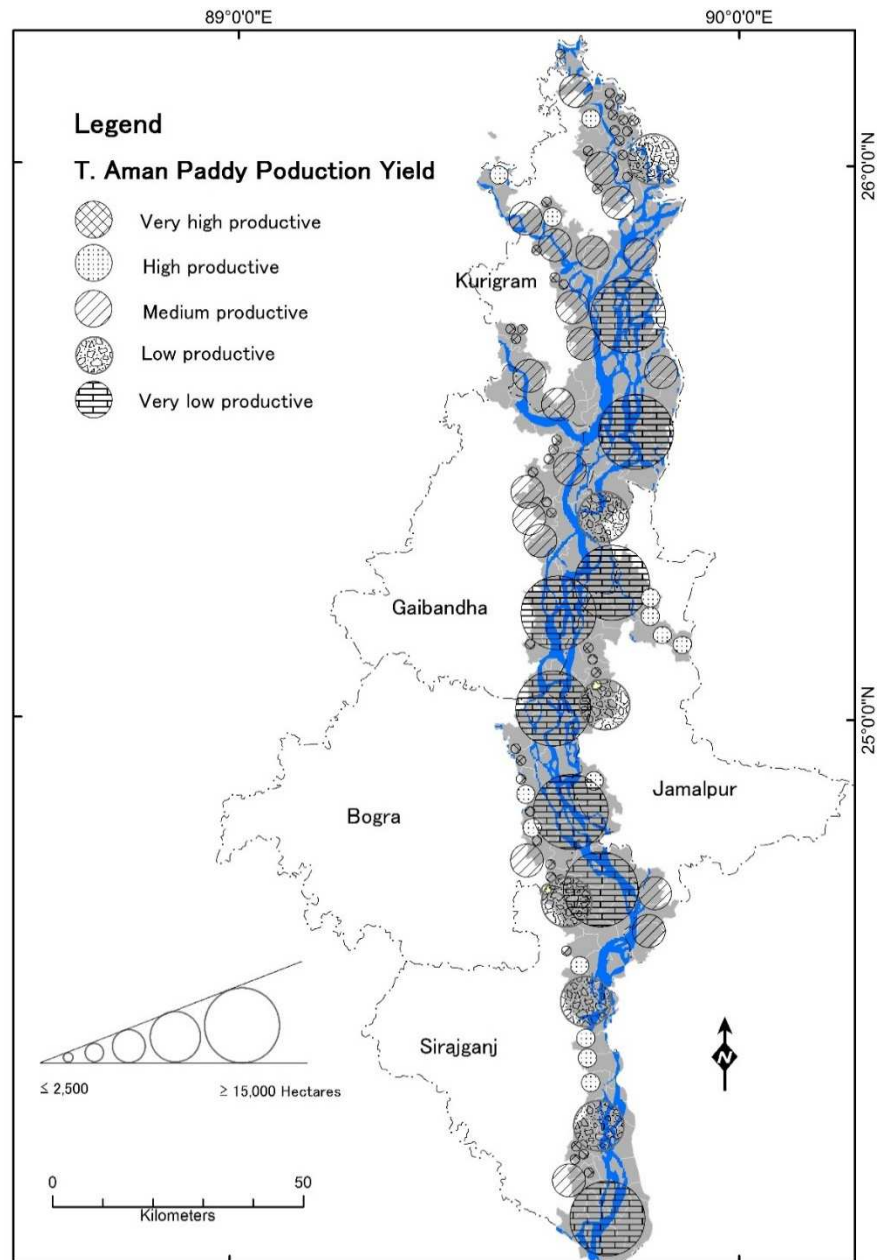
Figure 4-6: Jute production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Table 4-6: Jute production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Jute (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	59.35	527.40	0.15%	
High productive	7,999.49	65,372.29	19.19%	Moderate suitable for Jute cultivation
Medium productive	4,532.36	82,171.64	24.12%	
Low productive	10,069.83	67,700.35	19.87%	
Very low productive	3,244.17	124,887.81	36.66%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Except for some scattered area in Kurigram and Gaibandha in the upper stream of Jamuna, mostly the very low productive zones of jute situated in the very lower stream of the channel. Near the main channel of Jamuna crossing Bogra and Sirajganj has almost no productive area for jute. Sirajganj is almost not suitable for jute production. The southernmost part of the district and the northernmost part of Bogra has the very similar situation of jute unproductive area. A huge portion of around 36.66% (124,887.81 hectares) of the total area is very inappropriate for jute production claiming very low production area in the productivity index (Table 4-6). In contrast to the lower stream production, the channel of Jamuna in the upper stream has some suitability for jute production but; the area should be considered as moderately suitable for jute production.

(f) Potato production and potential areas

During winter, the potato is widely cultivated in all the districts of Bangladesh. There were total 1,36,273.8 hectares of land used for potato cultivation during 1997-98, 1,13,540, 2,18,445 and 1,924.28 hectares were for local, high yielding and Indian varieties respectively (BBS, 2016), as well as well-fertilized, sunny weather with sufficient moisture in the soil, is appropriate for potato plantation. Sometimes farmers planted a potato in October to harvest the crop early and almost all the potatoes are planted manually. Farmers determine the spacing (row spacing is usually from 45 to 60 cm) in between the seed tubers and the adjacent rows according to the soil quality and potato variety. The optimal depth of planting seeds depends on temperature and the moisture of the soil. The soil must be steadily ridged over the row to cultivate if planting is shallow or only about 5 cm deep. Of the total area of potato production, around 340,659 hectares of land is located alongside the Jamuna River (Table 4-7).

The bank of Jamuna is not highly productive for potato. In Kurigram, there are some places along the river with the highly productive zone of potato. The eastern part of the upper stream has the red marked area in the map with high production of potato. The high production area is 7,401.37 hectares in total, which is only 2.17% of the total

land. Besides that, almost all the land along the Jamuna River is the medium productive zone for potato. Of all the land used for potato production in the area, the total of 63.25% is medium productive zone, which accumulates an amount of around 215,457.19 hectares of land. From the upper stream to the all of the middle streams of Jamuna is an entire medium productive zone of potato. The dominance of production in Gaibandha district. In comparison to upper stream lands, the lower stream has less dominance of medium production.
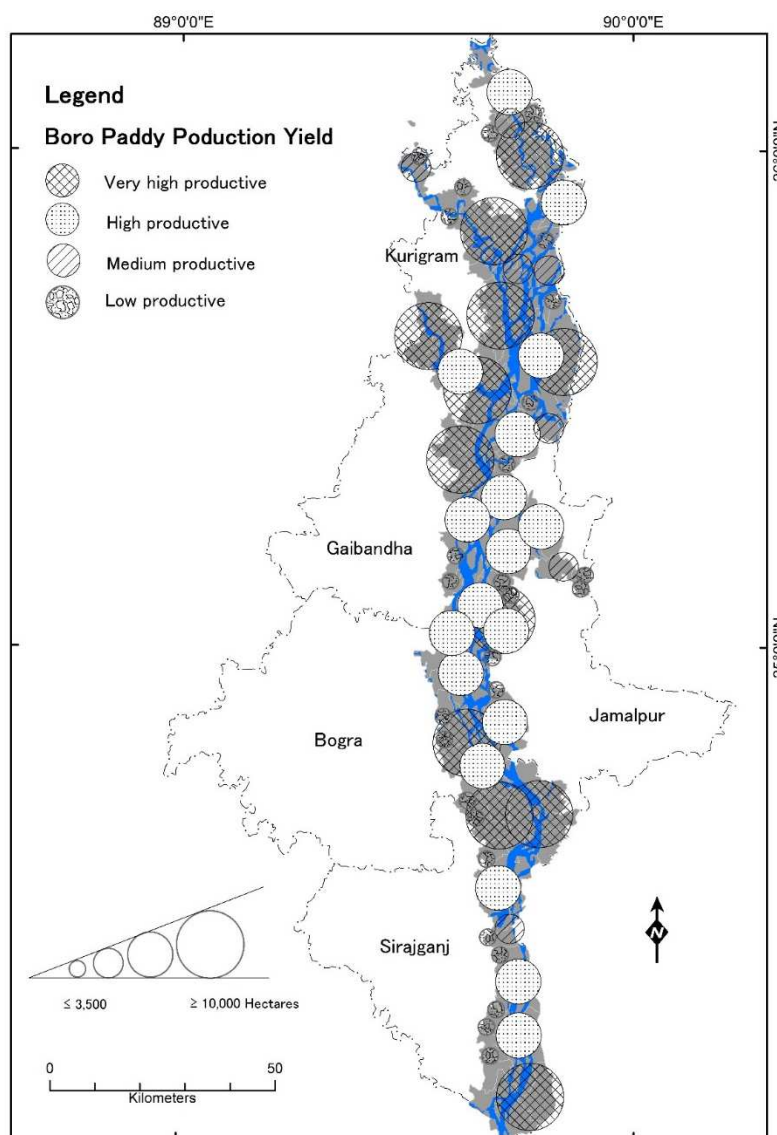

Figure 4-7: Potato production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

On the other hand, the northern and southernmost part of Kurigram, some scattered part of Gaibandha in the middle stream and the lower stream the eastern side of Bogra and Sirajganj have the highest landforms of low production of potato. It is seen in the map that almost the whole Sirajganj district is not much suitable for potato production because of its locational disadvantages being situated in the very lower part of the Jamuna stream (Figure 4-7). There are around 107,900.47 hectares of land is occupied by the low production of potato. The percentage of low production of the total land is 31.67% which causes two third of the total productive land.

Table 4-7:   Potato production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Potato (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
High productive	1,083.87	7,401.37	2.17%	Moderate suitable for potato cultivation
Medium productive	7,999.49	215,457.19	63.25%	
Low productive	10,069.83	107,900.47	31.67%	
Very low productive	1,984.40	9,900.47	2.91%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Low productive zone of potato in the study area is hardly found. Some scattered parts of land in Kurigram and some areas in Sirajganj in the lower stream are a very low productive zone for potato production. In the southernmost area of Kurigram, there is a big piece of land shown on the inset map where the productivity is very minimum (Figure 4-7). The total area of very low production is 9,900 hectares of land, which is almost 2.91% of the total land of potato production. As the production of potato in the entire river bank of Jamuna is almost homogenous. There is not much of a significant change in production or any sudden landform. Extreme production of potato is missing in this area. A huge portion of total land is dominated by the medium and low production of potato. In comparison to the different streams of the channel; the upper channel has some advantages over the lower stream. This area can be called a modern suitable area for potato production since the production is not noticed on that very high level.

(g) Chili production and potential areas

One of the major spice crops in Bangladesh is Chili. There is almost no curry in Bangladesh made without the mixture of chili. Not all the land along the river bank of Jamuna is equally suitable for the production of chili. Along the riverside of Jamuna, there are hardly a few areas where the production of chili is high. Some scattered parts of the river channel are pretty much suitable for chili production. In the figure 4-8, indicates that the chili production is not that kind of satisfactory taken the whole scenario into account. The production of chili is not very high in the river bank districts of Jamuna.

From the figure 4-8, it was calculated and visualized that a very small portion of Jamalpur area to the north and northern part of Kurigram is highly suitable for the production of chili. A small portion is also found in the middle of Jamalpur in the middle stream of Jamuna. Apart from those areas rest of the land has an average production of chili. The total area of very high production is only 18,195 hectares of land, which covers only 5.34% of the total cultivable land (Table 4-8). In the lower stream, there is hardly any land found to be very highly productive for chili production.

The high productivity of chili is spread to all over the districts along the bank of Jamuna River. A total of 61,255.73 hectares of land is very highly suitable for chili production. The northern and western part of Kurigram in the upper stream along with some scattered parts, the northernmost part of Jamalpur, the straightened part of Bogra and Sirajganj along the riverbank has highly suitable land for chili production. In comparison to the upper stream, the lower and middle stream has high eligibility for chili production. The highly productive land coverage is 17.98% of the total cultivable land.

Figure 4-8: Chili production and potential areas along the riverside of Jamuna, Bangladesh, 2016

A very small portion of land in the northernmost part of Kurigram to southern part along the river bank and a small part of southern Jamalpur have a land of the medium productive zone for chili (Figure 4-8). Both the land is situated along the riverbank of Jamuna. The total land area is only 8,372.28 hectares which are very negligible in comparison to the total land of production. It counts only a very low 2.46% of the total land used for chili production. In the figure 4-8, it indicates that the medium productivity land is situated very close to the river bank where the land is not much stable than the other lands. Mostly the land was chosen by fewer farmers to cultivate where the ownership of land is not easily and quickly identified even though the production capacity is medium to low in that area. Farmers are bound to cultivate in that area because of their livelihood demands.

As we discussed earlier the different production capacity of land along the bank of Jamuna for chili production; now the most dominant land type has come into the discussion. Almost all the land along the channel is not suitable for chili production. The cultivable land for chili with low production is very high in amount. A total of 252,835.99 hectares of land of the total 340,659.51 hectares is a very low productive zone for chili (Table 4-8). Nearly two-thirds of the total land is not suitable for chili production which is a huge 74.22% of the total land. In the upper to lower stream, the land is almost not suitable for chili production apart from some area of the northern part of the upper stream. All the land is very far from the main channel of the riverbank.

Table 4-8: Chili production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Chili (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	10,069.83	18,195.51	5.34%	
High productive	3,198.05	61,255.73	17.98%	Low productive chili yield
Medium productive	2,021.35	8,372.28	2.46%	
Low productive	1,984.40	252,835.99	74.22%	

The production of chili in the river bank of Jamuna doesn't have any favorable condition. It is clearly visualized in the figure 4-8 that almost all the portion of total cultivable land the river stream of Jamuna is more or less not suitable for chili production.

Some exceptional area is Bogra and Sirajganj and some small area in Kurigram. The less production might be a cause of inappropriate land type or the seasonal variations in this area (Figure 4-8).

(h) Ginger and turmeric production and potential areas

In Bangladesh, ginger and turmeric are one of the most significant spices in agricultural production. Bangladesh produces about 49,405 m tons of ginger annually from about 19,055 hectares of land (BBS, 2016 and Banglapedia). Most Ginger-growing districts are Dinajpur, Rangpur, Tangail, Chittagong, and Rangamati and many farmers produce gingers in their homestead lands. Turmeric is a spice produced from the roots of the Curcuma longa plant referred as "Queen of Spices". The spice is produced by boiling the roots and bulbs and drying it to gain the characteristic yellow color and grinding them into powder. Besides that, turmeric is reflected as a vital spice in Bangladesh and in many of the countries curry is considered to be imperfect without it. It has also medicinal potentials. Furthermore, turmeric is the most important and significant spice crop which shares about 9% of total spices production (BBS, 2011-12). The turmeric production generally depends on the use of fertilizer, irrigation, pesticide. The government of Bangladesh has given importance to the cultivation of turmeric by providing the subsidy to the farmers on different segments like seeds, fertilizer, and irrigation for self-sufficiency in turmeric production.

The bank of Jamuna is not suitable for the production of Turmeric and ginger. The land suitability is not preferable for the production. There are very few areas where the lands are highly productive for those two types of crops. Some area in Kurigram and Jamalpur are highly productive for turmeric and ginger. A very small amount of 6,405.27 hectares of land are highly productive for the production of ginger and turmeric, which barely covers only 1.88% of the total area (Table 4-9). In the middle part of Kurigram to the north, there are some highly suitable areas for ginger and turmeric production. The northern part and southern part of Jamalpur has two small areas of ginger and turmeric production suitable land. Apart from those areas, there is no highly productive area (Figure 4-9).

Throughout the whole river bank of Jamuna, the production of ginger and turmeric suitable land in medium context is available in a scattered way. Nearly 5.66% of the land is moderately suitable for ginger and turmeric production. The total of 19,273.3 hectares of land is very negligible for the production of ginger and turmeric. In the upper stream, the district of Kurigram and in the middle stream the district of Jamalpur and Gaibandha and in the lower stream; Bogra and Sirajganj have some scattered distributed area where the production of ginger and turmeric are moderate. This happens mostly very close to the main channel of Jamuna.
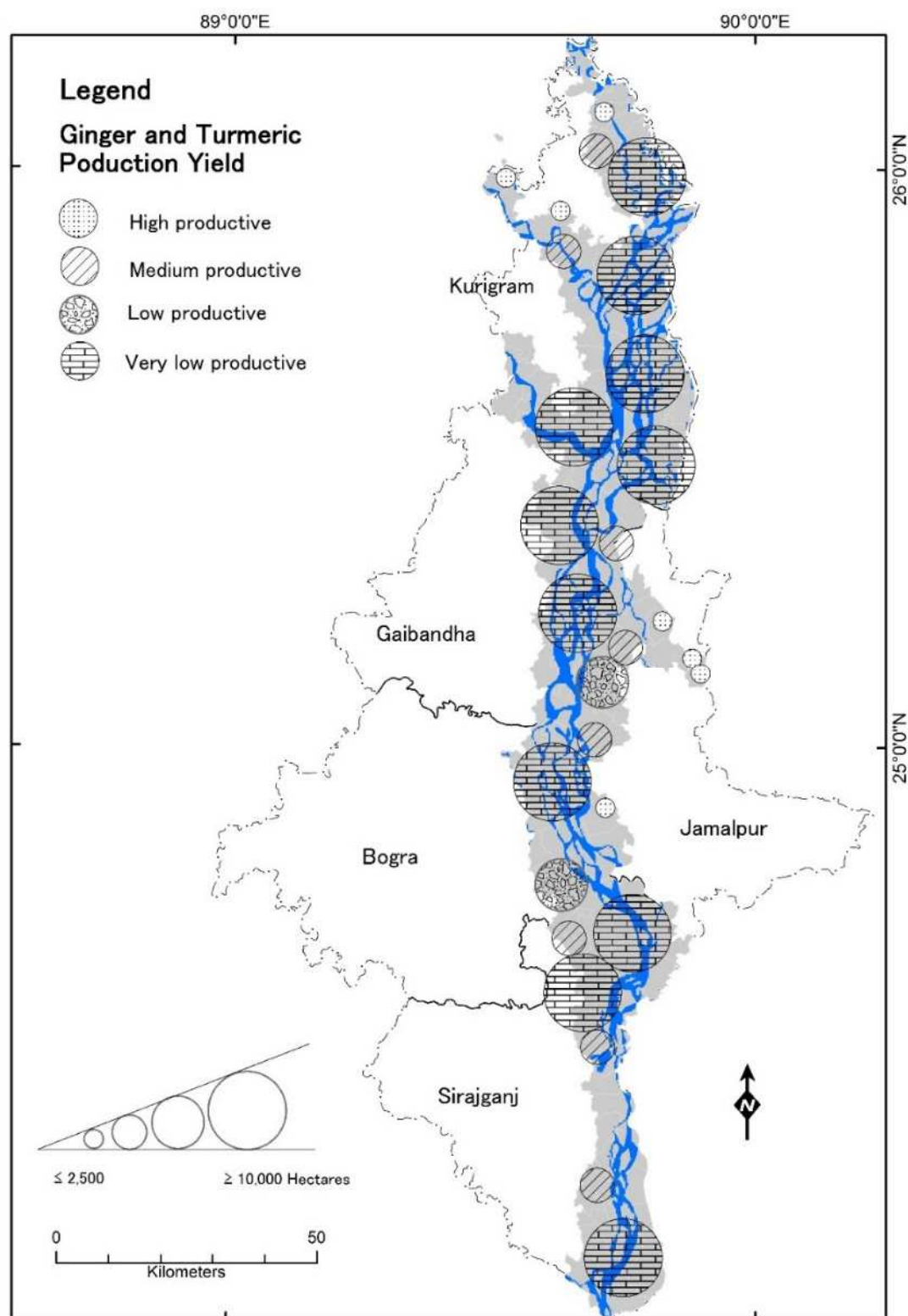
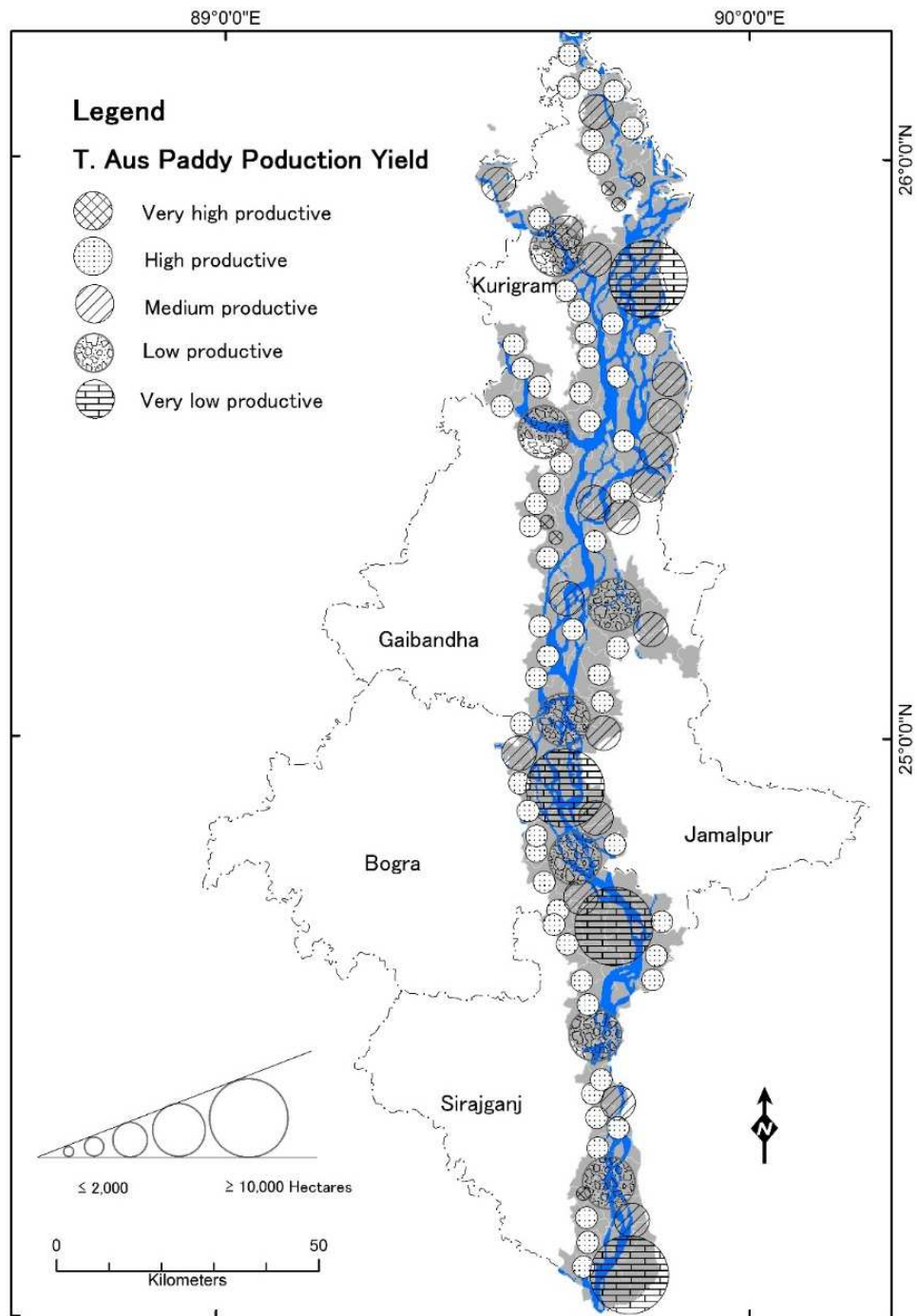Figure 4-9: Ginger and turmeric production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Table 4-9: Ginger and turmeric production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Ginger and Turmeric (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
High productive	3600.15	6405.27	1.88%	Very low
Medium productive	2021.35	19273.30	5.66%	productive yield
Low productive	1642.61	6690.66	1.96%	for ginger and
Very low productive	10069.83	308290.26	90.50%	turmeric

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

There are some areas where the productivity of ginger and turmeric is low. In the middle stream of Jamuna (Jamalpur district) and in the middle stream of Bogra, there are some areas where the production of ginger and turmeric is low. This covers minimum 6,690.66 hectares of land. This causes a percentage of only 1.96% among all the lands being used for ginger and turmeric production. On the other hand, apart from the land suitability mentioned above almost every land along the bank of Jamuna is mostly unsuitable for ginger and turmeric production. There are a total of 308,290.26 hectares of the total land, which is very unsuitable for ginger and turmeric. The production type is categorized as very low in term of indexing. It covers a huge 90.50% of the total land of the river bank of Jamuna. The production and cultivation of ginger and turmeric need a stable landform. Because of the above-mentioned reasons and arguments, the land type is considered as a very low productive field for ginger and turmeric. There is no impact on seasonal variations and other related causes to support the statement.

(i) Onion and garlic production and potential areas

Onions can be grown on all types of soil. The best time of transplanting onion in Bangladesh is December or the first week of January. Onion is grown in all districts, but Faridpur is the biggest producer of onion. It is used as a fresh vegetable, as a spice. Garlic is another significant spicy produced all over the country. The best time of transplanting garlic in Bangladesh is November-December, clove is ready for harvest when the tops turn yellowish or brownish. Garlic is grown all over the country but in Faridpur, Jessore, Rajshahi, Rangpur, Dinajpur, Pabna, Dhaka and Comilla regions are the biggest producer of garlic. Currently, the country produces about 90,170 metric tons of garlic on 25,593 hectares of land (BBS, 2016 and Banglapedia). Average yield per hectares is 3.5 metric tons.

In the upper stream, the northern part of Kurigram has a very high production zone for onion and garlic (Figure 4-10). Besides that, in the middle part of Jamuna, Jamalpur and Bogra have a very high productivity of onion and garlic cultivation and in the lower stream Sirajganj leading the way for high productivity. There is total of 25,227.03

hectares of land is very highly productive which is almost 7.41% of the entire cultivation area. The biggest land piece of very high productivity is 3,600 hectares, which shows high continuity (Figure 4-10).
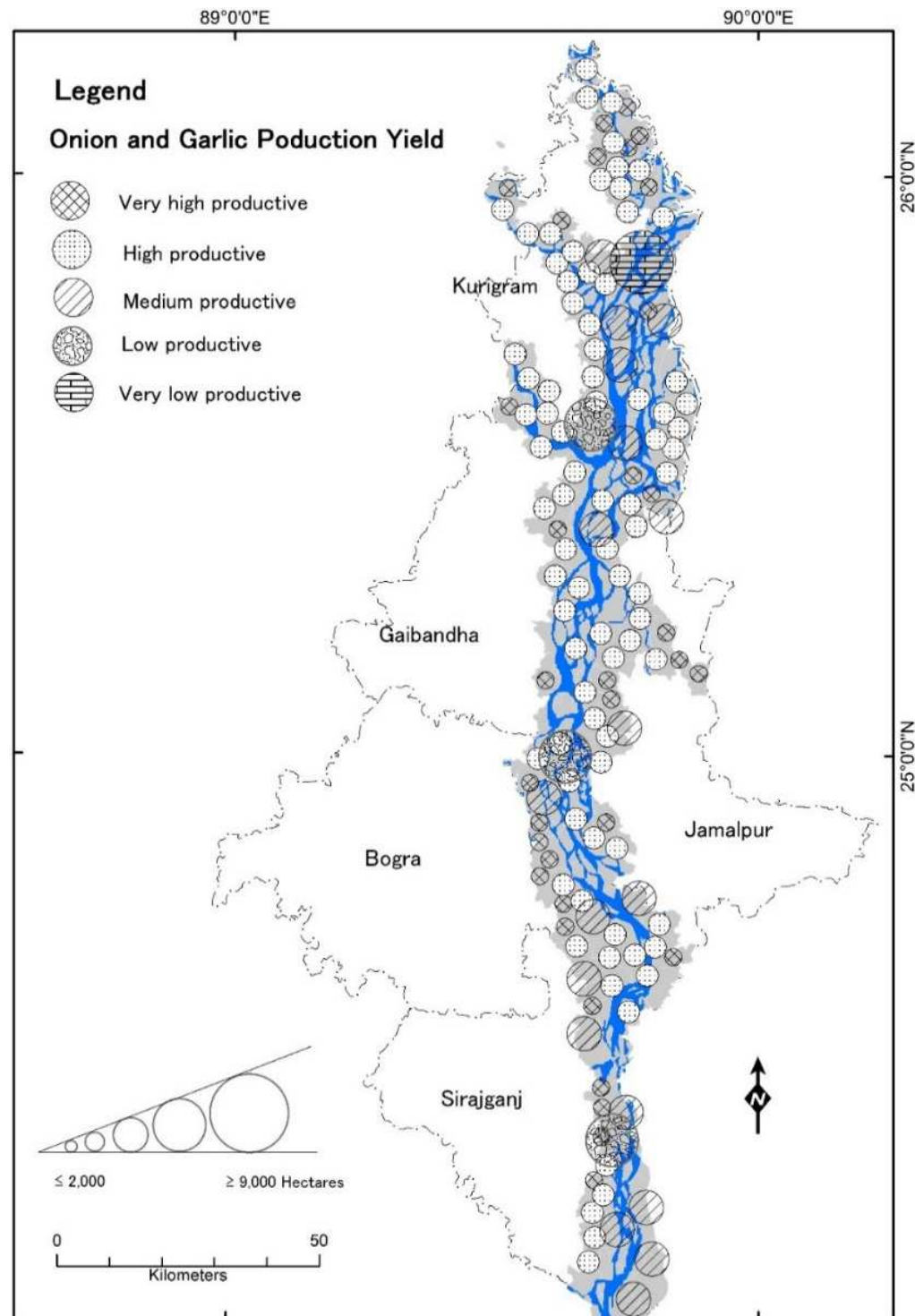
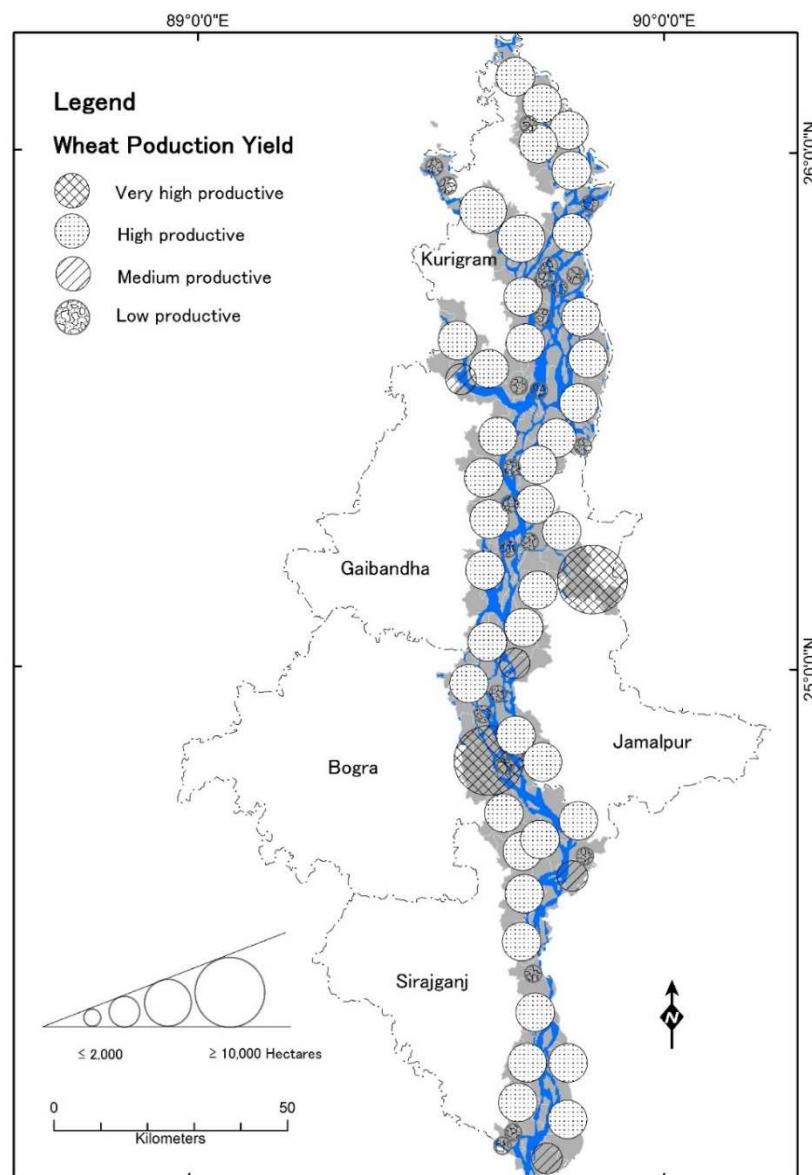Figure 4-10: Onion and garlic production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

In the entire river bank nearing district of Jamuna has the same distinction of equal and productive land for the cultivation of onion and garlic. The highest portion of total cultivable land is 220,773.15 hectares which are almost 64.81% and two third of the total area. Except for some area in the upper stream in Kurigram and in the lower stream in Sirajganj district, almost all the districts produce a huge amount of onion and garlic. The upper stream to the middle has the highest productive land being covered in garlic and onions (Figure 4-10). Along the main channel of Jamuna River, most of the lands are medium productive land. In the middle of Kurigram district, there is a huge land portion where the garlic and onion are being produced moderately. In the lower bank of Jamuna, in Sirajganj some big portion of land is cultivated for the medium production of garlic and onion. A total of 77,047.59 hectares of land is causing the medium production of the entire land, which is almost 22.62% of the total land (Table 4-10).

Table 4-10: Onion and garlic production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Onion and Garlic (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	3,600.15	25,227.03	7.41%	
High productive	10,069.83	220,773.15	64.81%	Suitable for onion and garlic cultivation
Medium productive	3,244.17	77,047.59	22.62%	
Low productive	1,591.91	9,239.45	2.71%	
Very low productive	1,984.40	8,372.28	2.46%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

From low to very low production combines a total of 5 % land of the entire area covering only around 18,000 hectares. Those areas are distributed among all the districts along the river bank. Low and very low production lands are mostly located at very close to the main channel of Jamuna. In southern Kurigram a big piece of land is very unpredictable for onion and garlic have shown in the figure 4-10. Besides that, figure 4-10 also shows the land productivity or land suitability for onion and garlic that is a very high productivity zone compared to others agricultural crop. It clearly shows that the land along the riverbank of Jamuna is literally suitable for onion and garlic production.

(j) Mustard production and potential areas

Mustard is one of the most cultivated oil plants in Bangladesh. The quality and its usability are unmatched to other similar plants used for oil manufacturing. Mustard needs different types of suitable soil where the sand particles are typically existing for its production (BBS, 2016 and Banglapedia). Riverbanks are very much suitable for the production of mustard where the land suitability is very high. The riverbank of Jamuna

is highly enabled for mustard production. From the upper to the downstream of Jamuna, the land is equally fertile for mustard production (Figure 4-11). In the upper stream, the district of Kurigram and the northern part of Gaibandha are very highly productive zones of mustard. In the middle stream, the northern part of Jamalpur and Bogra has a very high density of mustard production. The total high productive land covers nearly 243,789.45 hectares, which is nearly 71.56 % of the total cultivable land and it clearly shows the high land suitability for mustard production (Table 4-11).

High productive zones of mustard production along the bank of Jamuna are spread in scattered (Figure 4-11). Not all the lands are located together like the high productive zones. Most of the highly productive zones are very closely located to the river bank. Lands close to the river cultivated with mustard get less time for production because of incoming water flow in a rainy season. Northern and southernmost part of Kurigram (the upper stream) district, in the middle stream of Gaibandha district, has some area where the production is higher. Besides that, in the northern part, there is a landmass, which is different from being close to the river of high production. The down middle stream (Bogra district) has some area along the riverbank where the production is also higher for mustard. Around 65,919.89 hectares of land is counted for high productive zones which is an accumulation of 19.35% of the total cultivable land.

There is a very limited land where the production of mustard is medium. In the upper stream of Kurigram and Gaibandha district, there is no medium productive zone, as most of the areas in those two zones are very high productivity. From the middle stream to the northeastern part of Bogra district along the close bank of the river has some area where the productivity is medium. But on the other side of the river in Jamalpur district, there is no medium productive land for mustard cultivation. In the lower stream, the southernmost part of Sirajganj and some scattered parts all over the district, close to the riverbank have some medium productive zones. A total of 22,395.15 hectares of land, which counts to be around 6.57% of the total cultivated area. The maximum utility of land available for mustard production is 2,167.5 hectares in the medium land category.
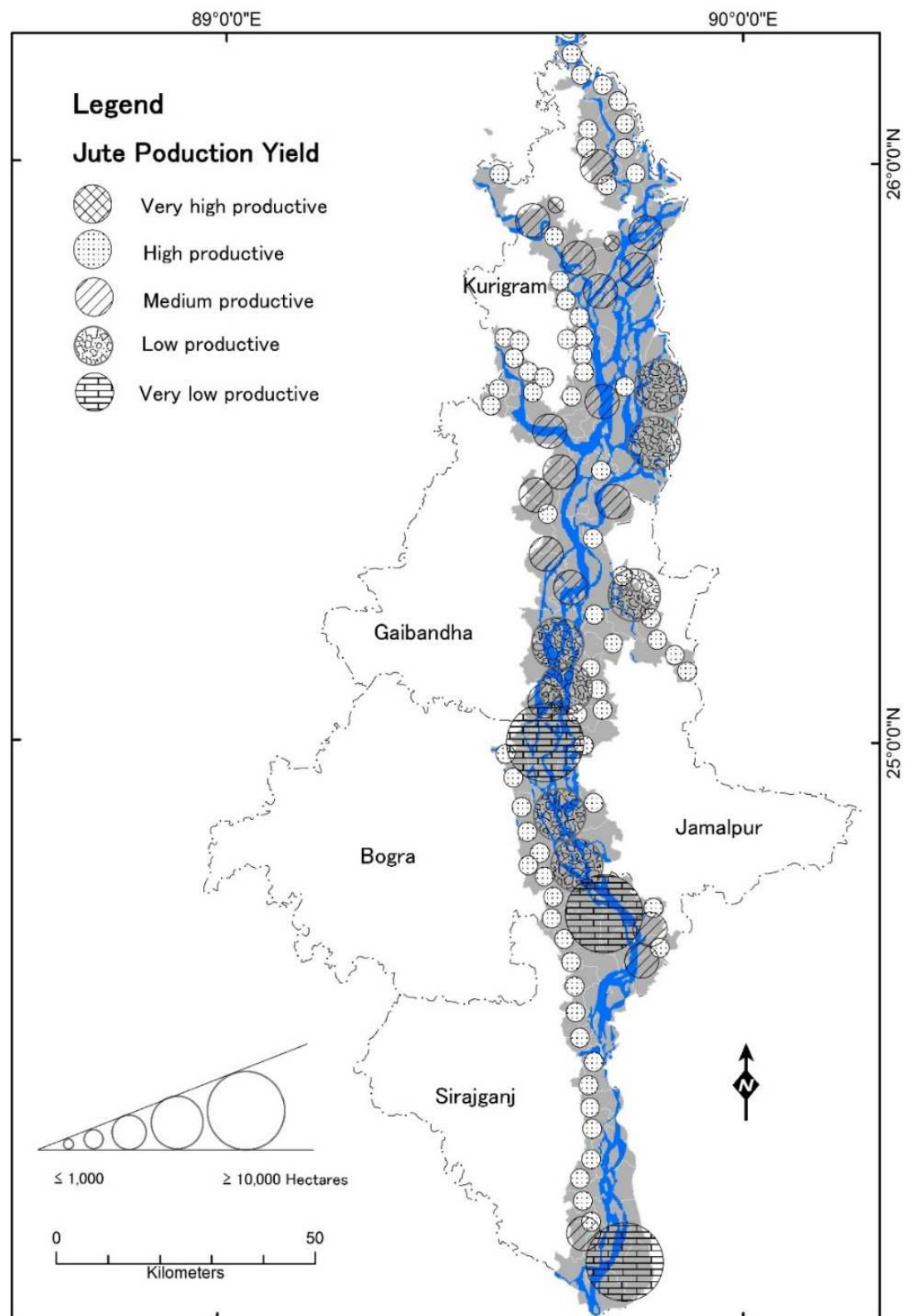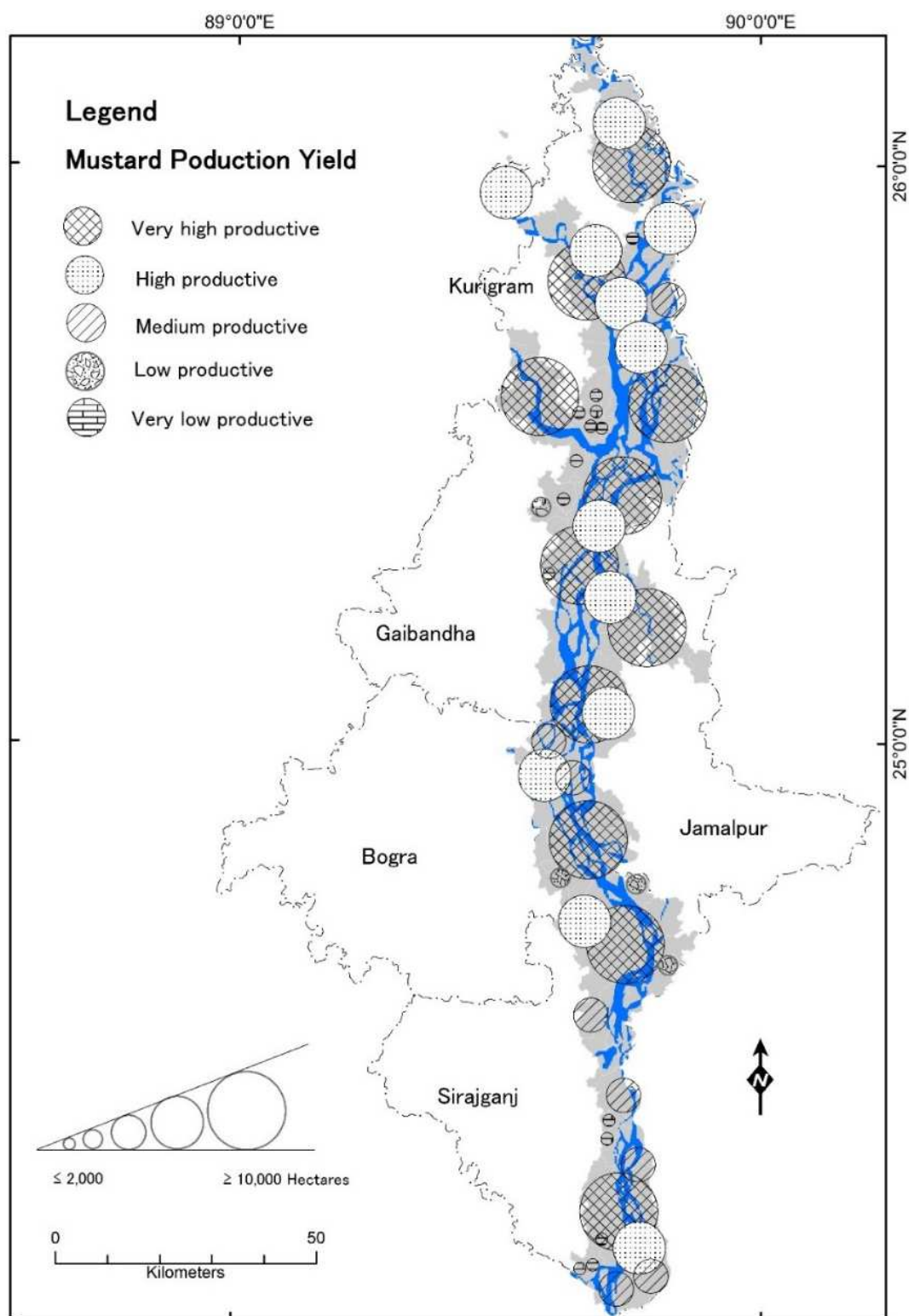
Figure 4-11: Mustard production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Table 4-11: Mustard production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Mustard (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
Very high productive	10,069.83	243,789.45	71.56%	
High productive	3,604.31	65,919.89	19.35%	
Medium productive	2,167.50	22,395.15	6.57%	Highly suitable for mustard cultivation
Low productive	169.55	182.72	0.05%	
Very low productive	1,984.40	8,372.28	2.46%	

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

The low production area is literally being non-existing. Over the course of the Jamuna River bank, there could be any land cover where the low production zone is available. The total area of this category is about 182.72 hectares and only available in a smaller part of southern Jamalpur far away from the main river course. In the upper stream, there are few areas available where the productivity of mustard is very low. In Kurigram there are some scattered areas all over the district and some part in the south have some very low production zones. Low mustard productive zones are hardly found in the middle stream, which includes the district of Gaibandha, Jamalpur, and Bogra. In the lower stream across the riverbank of Jamuna, crossing Sirajganj district has some spots where the productivity of mustard is very low (Figure 4-11). The total land amount is 8,372.28 hectares that are collectively 2.46% of the total suitable land for mustard production. If we assume the production capability of mustard based on those statistics and discussion that the production capability is very high here. Almost all the land area is suitable for mustard production suggests that the land is most fertile during the season of mustard production. It also indicates that the land close to the river has most suitability for it.

(k) Sugarcane production and potential areas

Sugarcane is a crop grown in almost all the districts of the country and occupies the land throughout the year for its grooming. The main areas are Chittagong, Comilla, Sylhet, Dhaka, Faridpur, Jamalpur, Kishoreganj, Tangail, Jessore, Kushtia, Bogra, Dinajpur, Pabna, Rajshahi, and Rangpur. The farmers mostly harvest sugarcane during the months of October to March. Sugarcane is one of the major crop produced in Bangladesh. Not all the land along the river bank is equally suitable for the production of Sugarcane. It takes enough suitable land and patience to grow sugarcane. In Bangladesh, there are hardly few areas where the production of sugarcane is high. Some scattered part of the river channel is pretty much suitable for sugarcane production. In

figure 16, it has been clearly shown that the sugarcane production is not that kind of satisfactory taken the whole scenario into account.

The production of sugarcane is not very high in the river bank districts of Jamuna. In the figure 4-12, it was calculated and visualized that very small portion of Jamalpur area to the north, the northern part of Kurigram are highly suitable for the production of sugarcane. A small portion is also found in the middle of Jamalpur near the middle stream of Jamuna. Apart from those areas, all the land is average production land. The total area of very high production is only 6,405.27 hectares of land that covers only 1.88% of the total cultivable land (Table 4-12). In the lower stream, there is hardly any land found to be very highly productive for sugarcane production.

The medium productivity of sugarcane is spread in all over the districts along the bank of Jamuna River. A total of 7,561.22 hectares of land which is medium suitable for sugarcane production and that covers 2.22% of the total area. Besides that, the northern and western part of Kurigram (in the upper stream along with some scattered parts), the northernmost part of Jamalpur, the straightened part of Bogra and Sirajganj are the medium suitable for sugarcane production. In the comparison of the upper stream, the lower and middle stream has high eligibility for sugarcane production.

A very small and negligible portion of land in the northernmost part of Kurigram to southern part along the river bank and a small part of southern Jamalpur have a piece of land from the low productive zone for sugarcane (Figure 4-12). Both the land is nearly situated along the river bank of Jamuna. The total land area is only 64,679.46 hectares which are very negligible in comparison to the total land of production. It counts only a very low 18.99% of the total land for sugarcane production. In the figure 4-12, indicates that the low productivity land is situated very close to the river bank where land is not much stable than the other areas. Mostly the landless farmers choose to cultivate along the river bank where the ownership of land is not easily and quickly identified even though the production capacity is medium to low in those areas.
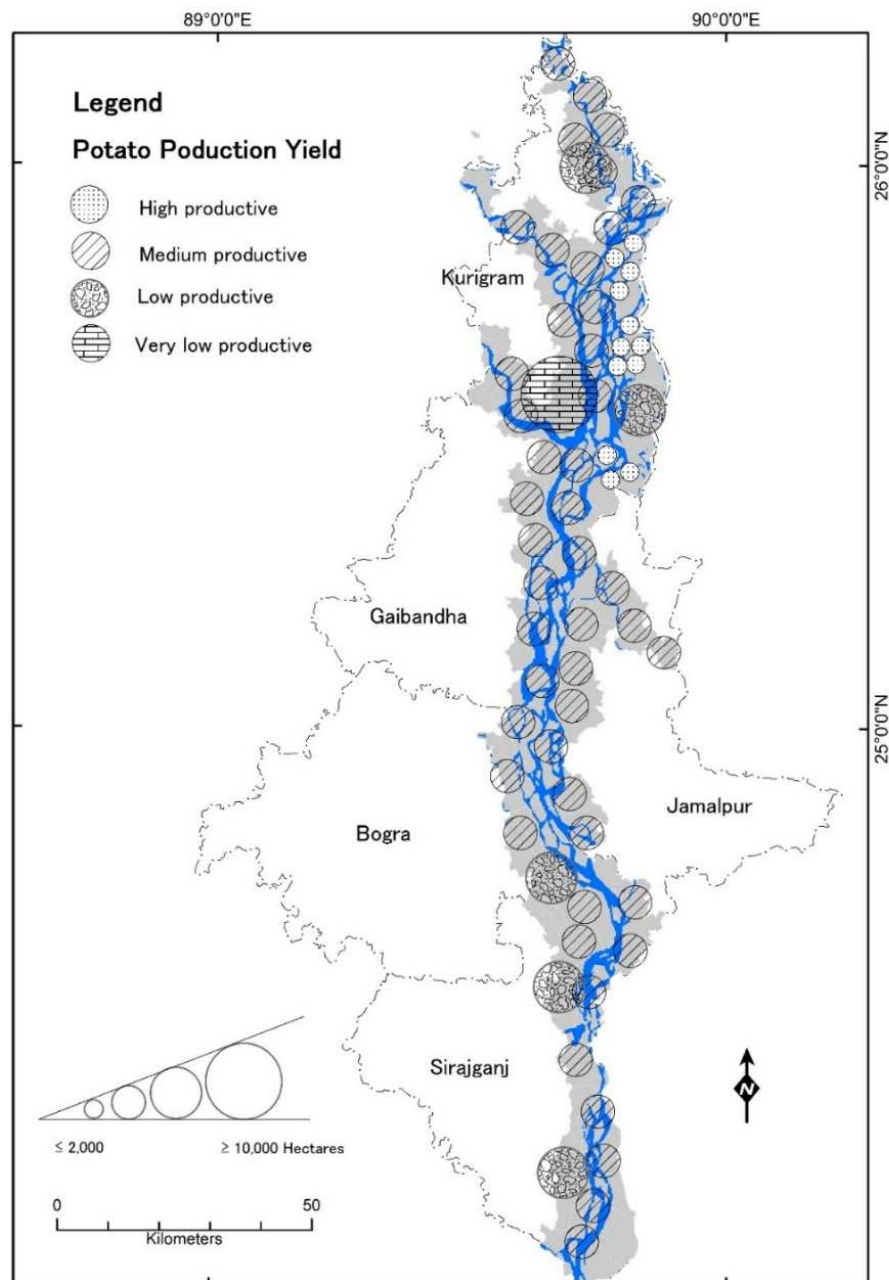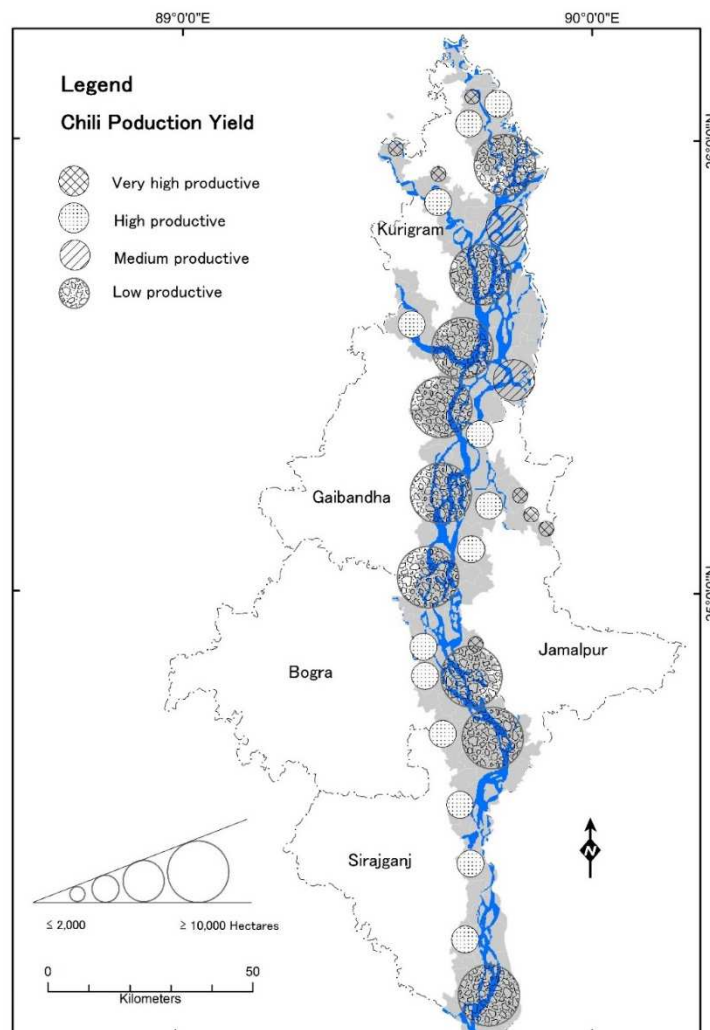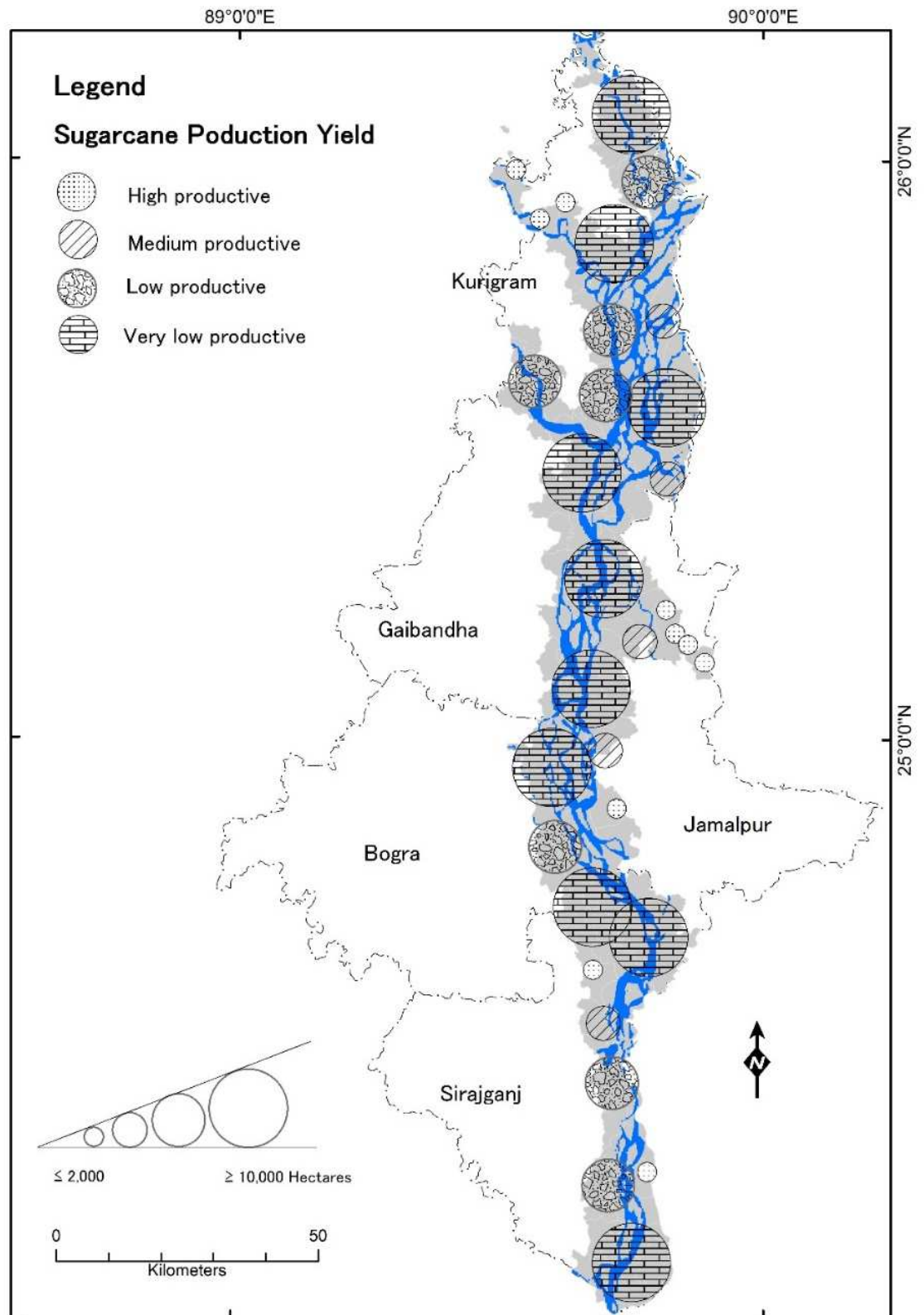
Figure 4-12: Sugarcane production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

Table 4-12: Sugarcane production and potential areas along the riverside of Jamuna, Bangladesh, 2016

Sugarcane (Yield)	Maximum (Area in hectares)	Sum (Area in hectares)	Percentage (%)	Statement
High productive	3,600.15	6,405.27	1.88%	Very low
Medium productive	1,642.61	7,561.22	2.22%	productive
Low productive	7,999.49	64,679.46	18.99%	yield for
Very low productive	10,069.83	262,013.55	76.91%	sugarcane

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS)

As we discussed earlier the different production capacity of land along the bank of Jamuna for sugarcane production; now the most dominant land type is coming into the discussion. Almost all the land along the channel is not suitable for sugarcane production. The cultivable land for sugarcane is with very low production is very high in amount. A total of 262,013.55 hectares of land out of 340,659.51 hectares is a very low productive zone for sugarcane. Nearly two-third of the total land is not suitable for sugarcane production which is 76.91% of the total area. In the upper to lower stream, the land is almost not suitable for sugarcane production apart from some area of the northern part of the upper stream. All the land is very close to the main channel of the riverbank. The production of sugarcane in the river bank of Jamuna doesn't have any favorable condition. It is clearly visualized in the figure 4-12 that almost all the portion of total cultivable land in the river stream of Jamuna is more or less not suitable for sugarcane production. Some exceptional areas are Bogra and Sirajganj and some small area in Kurigram. The less production might be a reason for an inappropriate land type or the seasonal variation in this area.

(6) Population engaged in agriculture, industry and services sector in the study

In this section, we provide gender based (male/female) union council wise results on population engaged in three different sectors (agriculture, industry and services) to support to their livelihood shown in figure 4-13 (a-f). The result presented in this section borrows data from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and Bangladesh Bureau of Statistics (BBS) and also includes field data in 2016.

As discussed earlier and shown in figure 4-13 (a, b), majority of male and female respondents were involved in agriculture. Figure 4-13(a) shows that, upper and middle stream of Jamuna has a very high rate of male participating in agricultural activities. In some areas there are around 5,180-8,630 farmers participating in agricultural activities in some unions. In least cases, there are no less than 798 people participating in

agricultural practice. The lower part of Jamuna stream has a less density of male working in agricultural sectors. The highest density found in the Jamalpur district, where most of the male take part in cultivation. The figure 4-13(b) indicates nearly the same proportion of women's participation in agriculture as men. Some area in Jamalpur district in the upper stream and in the middle stream which crosses the district of Bogra are mostly agriculture dominated. In some unions nearly 296-488 female participate in agricultural activities ranked very high among all the unions (Figure 4-13b). Kurigram and Jamalpur have the highest portion where females mostly take part in this kind of activities. Some unions in the southern part of Sirajganj are also agriculture dominant by females.

Figure 4-13(c, d) show that in the lower stream of Jamuna river, most of the population are engaged in industry as this area is the closest to most developed part of the country, i.e., Dhaka, the capital of Bangladesh. Both male and female were almost equally involved in industry sector. People live in Sirajganj has a high ratio of participating in industrial work than any other areas of the people living across the stream. At most over 4,000 thousand people in some unions work in industry for their livelihood and in rest of the areas have very minimum number of people who works in industry (Figure 4-13c). In the 4-13(d) figure of the series shows the females' participation in industrial sector along the Jamuna river bank. The number of female participant in industrial sector is very much limited like males. In the downstream, females of Sirajganj mostly participate in industrial work. Some other areas in Kurigram and the southern part of Bogra have some workers who choose industrial labor as their priority for livelihood. It clearly indicates that, people of these areas are not industry dominated and their economic activities are driven by other mediums.

Figure 4-13(e, f) shows male and female involvement in services sector. Uneven distribution of both male and female can be seen across the study area indicating that not many of the inhabitants of the region are involved in services sector compared to agriculture and industry. Compare to other parts of the study area, lower stream area has relatively more people involved in service sector. This may be due to its close proximity to the most developed part of the country, i.e., Dhaka, the capital of Bangladesh. If we look into the comparison between those three medium of livelihood; agriculture clearly lead the way. But the other two sources have also some role to play in the livelihood pattern and economic activities alongside Jamuna riverbank districts.
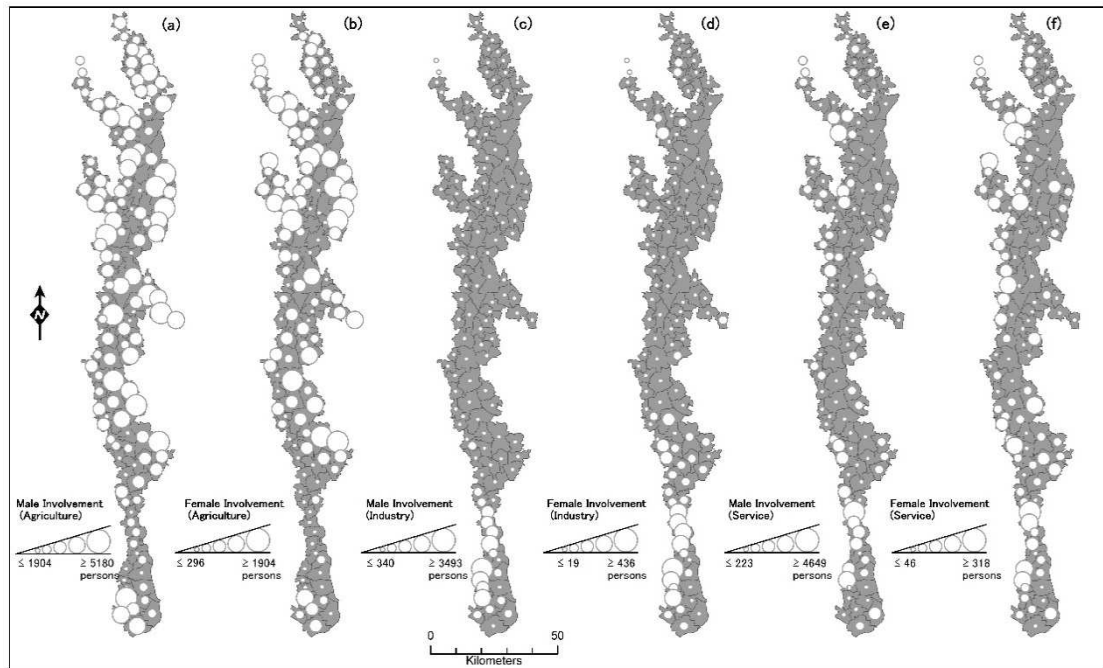
Figures 4-13 (a-f): Population engaged in agricultural sectors in union wise and linked to the BBS data sets along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental, BBS, 2011 and Geographic Information Services (CEGIS)

(7) Identify the cropping pattern system

A spatial and chronological organization of crops largely determined by physical, biological and socio-economic factors. There are three cropping seasons during a year in Bangladesh namely *i) Rabi, ii) Kharif-I or Pre-Kharif and iii) Kharif-II*. Rice is the most significant crop in Bangladesh. Rice cropping system is sometimes single, double, or triple in Bangladesh and it depends on land type, soil characteristics and availability of water. Single cropping system is in the floodplain areas and double or triple rice cropping is practiced in high land areas of Bangladesh.

(a) *Kharif* crop

Kharif season starts from April to November, when the supply of moisture from rainfall is enough to support rainfed crops. *Kharif* crops are grown in the spring or summer season and harvested in late summer or in early winter. The season is divided into *Kharif* I (*Pre-kharif*: it starts from the last week of March and ends in May) and *Kharif II* (Characterized concerning high temperature, rainfall and humidity). The main crops are grown during the *kharif* season as follows: (i) cereals- *aus*, *aman* (ii) root crops- panikachu, mukhikachu, olkachu, mankachu and pancha mukhikachu; (iii) oilseeds- sesame, groundnut, and soybean; (iv) pulses- black gram, mungbean, and pigeon pea; (v) summer vegetables- lady's finger, red amaranths, amaranths, Indian

Spinach, sweet gourd, ash gourd, bitter gourd, squash, palwal, snake gourd, teasle gourd, yardlong bean, brinjal, and summer tomato; (vi) spices- green chillies, ginger, and turmeric; (vii) fibre crops- jute, cotton; (viii) sugar crops- sugarcane; (ix) stimulant- tea and (x) fruit plants- banana, pineapple, papaya, and melon (Banglapedia).

(b) *Rabi* season

Rabi season (Characterized by dry sunny weather; warm at the beginning and end but cool in the months December-February) or *Rabi* crops grows in the month of November and extends up to the end of March. Major *Rabi* crops grows in the country include: (i) cereals- wheat, maize, barley, and *boro* rice (ii) roots crops- potato and sweet potato (iii) oilseeds- mustard, sesame, groundnut, niger, sunflower, linseed, and safflower (iv) pulses- chickpea, lentil, grass pea, and cowpea (v) winter vegetables- cabbage, cauliflower, brinjal, tomato, carrot, turnip, radish, spinach, lettuce, bottle gourd, country bean, and garden pea (vi) spices- chili, onion, garlic, coriander, sweet cumin, black cumin, and fenugreek (vii) fibre crops- sunhemp (viii) sugar crop- sugarcane (ix) stimulant- tobacco and (x) fruit plants- watermelon (Banglapedia).

(8) Cropping season in the study area

Agriculture in the study villages is crop-oriented. A variety of crops are grown in different agricultural seasons and under different physical conditions (especially rainfall and elevation of land in relation to the flood level). This paper makes crop calendar with growing period, high labor demand for the rural farmers to choose the plants and seeds in proper time to cultivate according to local people perceptions and on the basis of local NGOs information's. The Crop calendar is showing below:
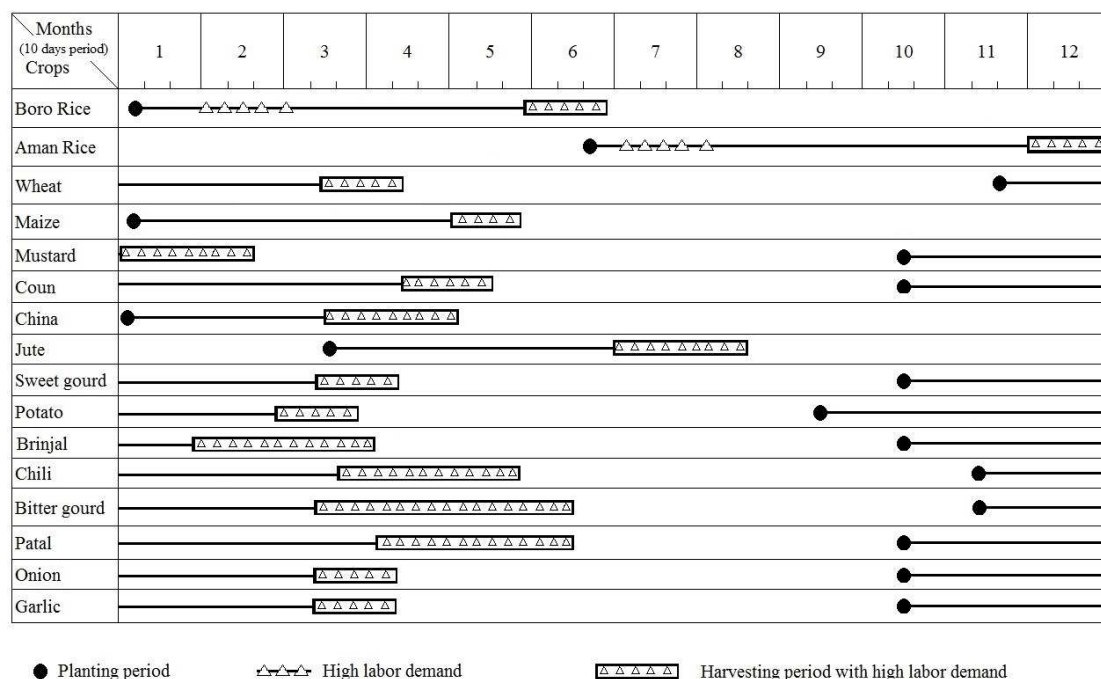
Note: *Aman* rice, *Boro* rice, *Coun, China* are local variety of crops

Figure 4-14: Suitable crop calendar along the river Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS) and field survey, 2016

As a flood plain, several types of crops have been growing along the riverside of Jamuna (Nye and Greenland, 1960). Main crops are *aman* rice, *boro* rice, wheat, maize, mustard, *coun, china,* jute, sweet gourd, potato, brinjal, chili, bitter gourd, onion and garlic. *Boro* rice is planted in the month of January and harvesting and threshing is done in the month of June. It is very high labor period for harvesting *boro* rice. February is the peak time for irrigation and pesticides. There are three types of rice namely *Aus, Aman and Boro* are called major cereal crops in Bangladesh. *Aman* rice is harvested in the month of November and December. Wheat is grown under a wide range of climatic conditions and requires dry weather and bright sunlight. Depending on variety and weather conditions, it takes 100-120 days for sowing to harvest. Wheat is planted in the month of November and harvesting and threshing happens in the month of March or mid-April. Maize is cultivated to a limited extent in Kharif and Rabi seasons along the riverside of Jamuna, Bangladesh. The cultivation of maize and food prepared from it is not very familiar and extensive. Wheat is planted in the month of January and harvested and threshed in the month of mid-April or May. The large quantity of oil comes from mustard seeds. It is more expensive than soybean. Mustard seeds are sowed in the month of October and harvested and threshed in the month of February.

Jute is cultivated in the rainy season. Jute is known as golden fibre of Bangladesh. It was the most important cash crop for the country. Jute fibre is produced primarily from two commercially important species, namely White Jute and Tossa Jute. Along the riverside of Jamuna, depending on the species sowing usually starts at the end of February or March and continues up to the end of June. Clay to sandy loam soil with optimum fertility is appropriate for jute and soil pH ranging from 5.0-8.6.

Potato is the major crop in Bangladesh (Lal, 1987). Potato is needed to be cultivated in well-fertilized, sunny land along the riverside of Jamuna during winter. Potato plantation is required sufficient moisture in soil. The first October is appropriate for potato plantation and March and April for harvesting. Potatoes in this country are planted manually. Generally row spacing is from 45cm. to 60 cm. The optimum depth of planting depends on moisture of the soil and temperature. Chili is cultivated in both the summer and winter seasons. Chili is widely cultivated along the riverside of Jamuna during summer and winter seasons. There are various local varieties of chili like *balijuri, bona, bain, saita, suryamukhi, paba, halda, dhani, shikarpuri and patnai* (Yearbook of Agricultural Statistics of Bangladesh, 2015).

As we know our rural life covers a wide range elements and components both natural and man-made like population, environment, religion, culture, health, education,

agriculture, economy and so on. The NGOs have concentrated their efforts specially on removing economic crisis through functioning agricultural system. They have been particularly working on agricultural system and trying to minimize the rate of cracked (Yearbook of Agricultural Statistics of Bangladesh, 2015; Ramesh et al., 1971).

(9) Identify the political and cultural barrier to the agricultural development in the rural area of the Bangladesh

With the help of 533 questionnaires and 50 focus group discussions with NGOs employees and local people, this paper was tried to accumulate all of the information in a one frame. Local NGOs along the riverside Jamuna were provided agricultural facilities to the poor people and there have political and cultural barrier to the agricultural development are as below:

(a) **Political instability:** Political instability in Bangladesh is very high since it's independence. Despite being the major force for the economy of Bangladesh farmers doesn't have political support for prosperous growth in agricultural sector. Sometimes farmers hardly get their due payment because of the political problems. They produce crops in rural area of Bangladesh but due to political unrest sometimes they are deprived of legal price for their crops. Often they fail to sell their crops to urban market through which they can get handsome return. For this reason they become discouraged for further agricultural crop production by choosing some other means of livelihood.

(b) **Role of local politics:** Local politics sometimes play an important in shaping the agricultural system of rural area of Bangladesh. Poor farmers are often tortured for not being able to pay the demanded money by the local politicians. Sometimes the government supports for seeds and fertilizers come to the local leading politicians in union parishad level. But hardly the marginal farmers get the benefit of those services provided by the government. They sell the seeds and fertilizers to other farmers in cheap price for their financial benefit by depriving the real poor people.

(c) **Rule of brokers and intermediaries:** Farmers produce food with patience and enthusiasm. But the local and national level brokers and entrepreneur create syndicate to control the price of goods for their economic benefit and in the process the farmers get left out. Intermediaries buy the crops in cheap price from the farmers but they sell it to the end customers for a very high price. This is how the real people who deserve the benefit of agriculture left deprived. They do whatever they want but the poor farmers have no option but to choose the way the brokers want.

(d) **Parents oppose entrepreneurship:** Parent's dreams of rural Bangladesh are mostly agriculture dominant. They don't love the idea of participating in business activities as it is risky to take part in business. For this reason, parents in rural area hardly encourage their children to take part in agricultural entrepreneurship as there is a risk of losing money. They want always to keep it at a private level. They don't even

allow corporate entrepreneurship in their land for high production agriculture.

(e) **Lack of women's participation:** Women in rural Bangladesh are still home centric. People do not let them work in agricultural field because of social values towards women. The real productivity of women is not coming in this process. Women are doing only household works. If women participate in agriculture by maintaining the proper social status, then the family they are living will be prosperous and the agricultural growth will better than ever.

(f) **Lack of services:** Farmers are not always capable of managing their own medium of transportation to take the produced crops in the market. People producing crops in the river area are incapable of transporting their crops to the market due to lack of proper transportation system. Farmers from distant deposited land in the middle of the river are not in a position to take part in agricultural activities due to lack of transportation for their produced crops. They need help from other service sector to take their crops to the market and in this regard local and some other sectors that are serving in transportation sector should take initiatives for this purpose.

(g) **Lack of government involvement:** Government of Bangladesh is directly involved in helping the rural farmer even though it's an agriculture economy dominated country. The high government authority helps the related people who are involved in union level and where the direct profit could be earned by government. Otherwise farmers produce their crops by their own methods and materials.

(10) Identify the natural barrier for the agricultural development in the rural area of the Bangladesh

Bangladesh is an underdeveloped low lying flood prone country. Natural disaster and calamity is a part and parcel of people of this country. No natural condition can be ignored in Bangladesh whenever and wherever people want to do something. Being an agriculture-dominated country, the farmers of this country have to combat lots of natural barriers to produce their crops. Sometimes they win the battle sometimes they don't. Natural barriers, which are affecting the agriculture of Bangladesh, are discussed below shortly:

(a) **Flood:** Flood is a very common natural incident in Bangladesh. Every year flood affects around 18% or 26000 sq. km of land. Flood causes damage to our agricultural system badly. The upstream water from river sweeps our agricultural land devastatingly. Sometimes flash flood causes hamper to our agricultural crops very badly. The farmers of our country are not well aware of the natural disaster precautions. Considering all the warning system, there is no action fight against the flood. Every year farmers in different regions across the country loss huge amount of money for not being able to fight against the odds of floods.

(b) **Soil erosion:** Soil erosion is one of the major force affecting the agricultural growth in Bangladesh. Every year lands in the river bank area get affected by soil erosion.

This process cause huge back drop in the agricultural production in Bangladesh. Where soil erosion is frequent; the farmers get affected badly during this period. Soil erosion is the most widespread form of agricultural devastation in Bangladesh. Degradation of soil affecting 25% of agricultural land of Bangladesh.

(c) **Drought:** Drought is the continuous lack of rainfall in the environment. In the northern part of Bangladesh, drought is one of the major natural barriers for agricultural prosperity. During summer season farmers in this region suffers hugely for agricultural production. Crops like sugarcane, tobacco, wheat etc. as well as to perennial agricultural resources, such as, bamboo, betel nut, fruits like litchi, mango, jackfruit, banana etc. are considered to be a project towards loss which will be substantially much higher due to drought.

(11) Growth centers (Hat, Bazar) linkage with agriculture and rural development

The highest number of people in the rural areas of Bangladesh is engaged in agricultural activities (Ali et al. 1998). It employed 47% of the total labor force and comprised 16% of the country's GDP in 2016. Economic activities in the rural areas is largely influenced by physical and social infrastructures. Sometimes rural people make the opportunity like community market for new economic activities that have never existed. The infrastructure has a significant role on rural economy in Bangladesh. It is mainly the rural markets which have been developed through the establishment of infrastructures. So, the centers or rural centers that provides the basic needs of agricultural producers directly both in respect of economic and social services are termed as growth centers (Ramesh et al. 1971).
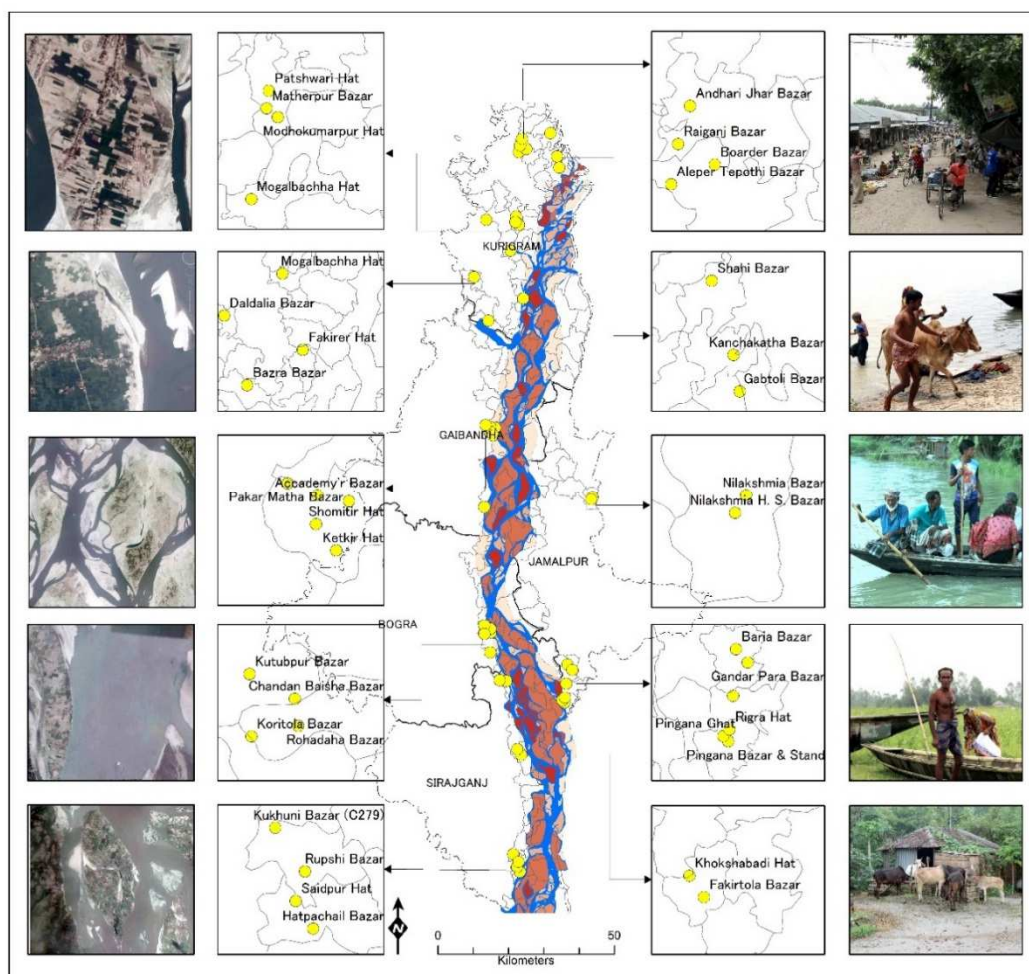
Figure 4-15: Growth centers (Hat, bazar) linkage with agriculture and rural development along the riverside of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data used from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS), BBS, 2011 and field survey, 2016

Growth centers are one of the major indicators of economic development of any territory. The more growth center, the more economic activity is likely to occur in the region. In the highland area, there are more growth centers in comparison to other parts of the low-lying area in the rural Bangladesh. People living in the riverbank of Jamuna are char inhabitants most of the time. In the chars there is hardly any growth center. People suffer very much living close to the river and they have got a very rare facility to sell their produced good to the nearest market. The only mode of transportation is a boat in the river. People get the facility to transport their product during rainy season very easily. But when the rainy season ends, the river area gets dried up and farmers have to bring the crops to the long-distance market. That's why they suffer heavily during the dry season to transport their goods.

In the upper stream of Jamuna, the district of Kurigram has the huge number of growth center. But the growth centers close to the riverbank are rare. Hardly there are any growth centers in the middle of the char land. In the northern part of Kurigram, there is some growth center close to the char land but not exactly in the main char land. In Gaibandha district, there is some growth center close to each other. The number of growth center close to the char land is not satisfactory. In the southern part of Gaibandha, there is a growth center close to the char land which is definitely helpful for the people living in the far char land away from the mainland. This image indicates the ignorance of local authority to establish growth canter in the close char land area, which is lagging the char land people behind mainland people in participating in economic activities. In the lower stream starting from the southern part of Bogra district there are a huge number of growth centers responsible for economic activities of the rural char land people. The southern part of Jamalpur is facilitated with a few growth center along the river bank of Jamuna. The closeness of this growth centers is helping the people of char land to participate in economic activities in an open fashion. The farmer produces crops in the mainland and they can go to sell their produced crops to nearest local market. This process causes great economic benefits to the rural poor farmers.

This above discussion can be concluded by saying that the number of growth centers existed in the alongside the bank of Jamuna, which is not sufficient at all. Farmers suffer a lot during transporting their crops to the local market due to the lack of proper transportation system. If enough growth centers are established in the middle of main char land, people of char land will be able to conduct economic with their own market. This process will lead them to better social and economic life. The government and the local NGOs working in the chars can play a huge role to provide the necessary facilities needed for the establishment of enough growth centers. A hierarchy exists in the rural markets in Bangladesh. The different categories of markets along with their characteristics have been shown in the below table:

Table 4-13:   Types of rural markets along the riverside of Jamuna Bangladesh

Type of Market	Characteristics
Primary market (Bazar)	Farmers selling surplus produce to local consumers and local traders.
Local Assembly Market (Hat)	Farmers and local traders exchanging with intermediary traders who move agricultural produce up to higher levels of the marketing system and for the sale of foodstuffs, agricultural inputs and retail goods.
Secondary Market	Intermediary traders exchanging with large buyers and also focal point for wholesale and retail sale of agricultural and non-agricultural goods and services at upazila level.

Source: The World Bank, 1996

There are three types of rural markets along the riverside of Jamuna, Bangladesh namely primary market (bazaar), local assembly one time in a week in the market (hat) and last one is secondary market where traders exchanging with large buyers and also focal point for wholesale and retail sale of agricultural and non-agricultural goods. Rural development depends on the number of growth centers, where they can easily trade their agricultural products for a better price though lack of roads, electricity, infrastructure, storage facilities and transportation systems have not developed yet. If local NGOs emphasis on those lacking's and make proper planning on said sectors then it can play a significant role in helping farmers capitalize on their investments and efforts.

(12) Agricultural machinery used along the riverside of Jamuna

Machinery for land preparation includes all kinds of hand tools, kits, and accessories that are used in agricultural land for land preparation. Use of machinery depends on socio-economic conditions of farmers. In Bangladesh, several kinds of traditional, improved and imported machinery are used for agricultural purposes. Especially the poor people along the riverside of Jamuna were using traditional equipment for the cultivation because of economic crisis. Following are the different kinds of land preparation equipment generally used for cultivating along the riverside of Jamuna, Bangladesh.

Table 4-14: Agricultural machinery used along the riverside of Jamuna, Bangladesh

Instrument Name/ Methods	Purpose
Plough *(Langal)*	The farmers along the riverside of Jamuna used it for land preparation. There are more than 100 kinds of country ploughs. It has three different parts: (i) bottom and handle, (ii) beam, and (iii) shar
Spade *(Kodal)*	Spade has two parts I) a steel blade for cutting soil, and II) a wooden handle for operation. There are different sizes and shapes of spades available in different regions of Bangladesh.
Ladder *(Moi)*	It is used to level the ploughed land and also to break soil clods after cultivation. Ladder is very simple which makes from bamboo
Traditional methods	Paddy seedlings are transplanted by traditional methods
Traditional water lift	This device made by a long bamboo pole rotated as a lever on two sides
Traditional harvesting	Sickle is the only implement used to harvest both rice and wheat crops
Methods of Threshing	There are four types of threshing methods using in Bangladesh like Beating on the bamboo platform, Using domestic animals, With the help of Power Thresher and With the help of Pedal Thresher

Instrument Name/ Methods	Purpose
Traditional winnowing	Kula is the common winnowing tool traditionally used in rural Bangladesh. It is usually made from bamboo splits.
Transportation Methods	Bicycle is only the transportation system along the riverside of Jamuna, Bangladesh. Sometimes Cattle/Buffalo cart used for crop grains transportation

Sources: Bangladesh Institute of Development Studies (BIDS), Bangladesh Bureau of Statistics (BBS) and field survey, 2016

As of late, the agriculture worker was gradually decreasing. The main causes were gradual declination of agriculture and a rise of services, employment growth in urban areas and movement away from agriculture, toward industry and services.

(13) Socio-economic condition along the riverside of Jamuna Bangladesh

The socio-economic impact of agricultural development to the rural poor people is discussed. A questionnaire survey was conducted for data collection. The information's about local people like age of the respondents, sex, number of family members, occupation, monthly income (Before and after joining the local NGOs credit program), distance from the NGOs to the respondents, distance from the growth centres/ hat, bazar to the respondents and facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh, 2016 were collected through questionnaire survey. Riverbank erosion and flood along the riverside of Jamuna have both short-term and long-term impacts. It has an excessive impact on livelihood, agriculture, environment and other sectors. Therefore, local NGOs and the other foreign donors have invested money in several sectors for the rural development.

(a) Respondents age groups

The rural people along the riverside of the Jamuna were interviewed through formal questionnaire. Most of the interviews were conducted with age group 22-25 years (Table 4-15).Table 4-15 shows that 25.9% of the respondents were in the age group of 26 to 30 years whereas 16.9% and 1.1% of the respondents were in the age group of 31 to 35 years and equal or above 36 years respectively.

Table 4-15: Respondents age groups along the riverside of Jamuna, Bangladesh, 2016

	Age	Frequency	Percent	Cumulative Percent
1	Less than or equal 21	56	10.5%	10.5
2	22 to 25	243	45.6%	56.1
3	26 to 30	138	25.9%	82.0
4	31 to 35	90	16.9%	98.9
5	Equal or above 36	6	1.1%	100.0
	Total	533	100.0%	

Source: Made by the author, 2017; data collected through field survey, 2016

In Bangladesh people younger than 15 or older than 64 are in the dependents group and working population's age is 15 to 64 years. Most of rural people along the riverside of Jamuna belong to the age group of 15 to 45 years, engaged in agricultural activities and low-income jobs with limited productivity.

(b) Number of male and female respondents

Agriculture plays a significant role in country's economy and is a source of rural employment and livelihood. The rural poor people along the riverside of Jamuna are engaged in agricultural activities due to families' food security and over all well-being of families' future security. Studies have shown that local NGOs agricultural services to the rural poor people for protecting and enhancing their economic activities by providing different types of facilities with a control over productive resources. Table 4-16 shows the number of male and female respondents along the riverside of Jamuna, Bangladesh, 2016

Table 4-16: Number of male and female respondents along the riverside of Jamuna, Bangladesh, 2016

	Sex	Frequency	Percent	Cumulative Percent
1	Female	194	36.4%	36.4
2	Male	339	63.6%	100.0
	Total	533	100.0%	

Source: Made by the author, 2017; data collected through field survey, 2016

The total number of male and female respondents along the riverside of Jamuna, Bangladesh, 2016 represents separately (Table 4-16). There are 36.4% of the respondents were female, whereas the male respondents were 63.6% among 533 respondents.

(c) Family members of the respondents

Rural poor people along the riverside of Jamuna believed that more children can make the more economic opportunity. Therefore, there have no family planning and rural poor people think that more children especially male are the blessings for their own economy. Family provides the majority of labor to the farming operation. Family farming comprises all family-based agricultural activities and it is connected to several areas of rural development.

Table 4-17: Total family members of the respondents along the riverside of Jamuna, Bangladesh, 2016

	Number of family members	Frequency	Percent	Cumulative Percent
1	Equal or less than 4	11	2.1%	2.1
2	5 to 6	147	27.6%	29.6
3	7 to 8	334	62.7%	92.3
4	9 to 10	41	7.7%	100.0
	Total	533	100.0%	

Table 4-17 shows the total family members of the respondents along the riverside of Jamuna, Bangladesh, 2016. Most of rural poor have 7 to 8 persons which is 62.7% of the total respondents. Only 2.1% have equal or less than 4 family members. There are 27.6% respondents have 5 to 6 family members and rest of the 7.7% have 9 to 10 members. Family farming is a means of forming agricultural, forestry, fisheries, pastoral and aquaculture production which is managed by the family members and primarily dependent on family labor, including both women's and men's. Both in developing and developed countries, family farming is the principal form of agriculture in the food production sector.

(d) Occupational structure of the respondents

The growth rate in agriculture declined to 3.04% in FY 2014-15 from 4.37% in FY 2013-14, representing 1.33% decrease. The growth rate in agriculture fall down from 5.24% in fiscal year FY 2009-2010 to 5.13%, and then to 3.11% and 2.17% in FY2010-2011, FY2011- 2012 and FY2012-2013 individually (Ministry of Finance, 2015). Lack of sufficient support for agricultural research and training, limited size of the domestic market, instability in property rights, industrial expansion and missing of institutions are the major causes for declining of agricultural activities.

Table 4-18: Occupational structure of the respondents along the riverside of Jamuna, Bangladesh, 2016

	Occupation	Frequency	Percent	Cumulative Percent
1	Agricultural activities	198	37.1%	37.1
2	Business	66	12.4%	49.5
3	Daily Labour	40	7.5%	57.0
4	House wife	196	36.8%	93.8
5	Industry	33	6.2%	100.0
	Total	533	100.0%	

The occupational structure of the respondents along the river side of jamuna is presented in the table 4-18. Most of the interviews were conducted with age group 22-30 years. Most of the respondents (36.8%) are housewife involved with kitchen gardening. There are majority of respondents which is 37.1% is involved in agricultural activities and rest of the 12.4%, 7.5% and 6.2% are involved in business, daily labour and industry respectively.

(e) Monthly income (Before and after joining to local NGOs)

Local NGOs have targeted the landless people who are living below the poverty line. The local NGOs are mainly focusing on their socio-economic empowerment. The

collateral free loans, ranging from Tk. 1000-10,000 are disbursed within NGOs' members, which are repayable within one year. Thereafter, local NGOs are supporting on agricultural research and training, kitchen gardening, forestry and fisheries activities. The poor people along the riverside of Jamuna are especially invested their money to different sectors like agricultural purpose, business and poultry business purposes.

Table 4-19: Monthly income (Before and after joining to local NGOs) of the respondents along the riverside of Jamuna, Bangladesh, 2016

Sl no	Monthly income	Before Frequency	Before Percent	After Frequency	After Percent
1	Equal or less than 5000 tk	479	89.9%	220	41.3%
2	5001-10000 tk	41	7.7%	293	55.0%
3	10001 tk to above	13	2.4%	20	3.8%
	Total	533	100.0%	533	100.0%

Source: Made by the author, 2017; data collected through field survey, 2016

Table 4-19 indicates that before getting involved with credit program, majority of the respondents (89.9%) were in low-income group, 7.7% in medium income and the rest of 2.4% in high-income groups. Thereafter joining the micro-credit program, low-income group decreased intensely (89.9% from 41.3%), medium income group increased significantly (7.7% from 55.0%) and little number of respondents also improved their income with high amount (2.4% from 3.8%).

(f) Distance from the NGOs offices to the respondents

Easy access services are the main reason for the rural development. The rural poor along the riverside of Jamuna live in remote areas that are often located at a huge distance from centers of commerce and social services areas. Therefore, rural poor are suffering from transportation facilities, accessing market opportunities, health facilities, agricultural facilities as well as educational facilities. The rural poor also have bigger families and tend to perform insecured and relatively unproductive jobs.

Table 4-20: Distance from the NGOs office to the respondents along the riverside of Jamuna, Bangladesh, 2016

Sl no		Frequency	Percent	Cumulative Percent
1	Less than or equal 5 km	248	46.5%	46.5
2	6 km to 9 km	271	50.8%	97.4
3	10 km or above	14	2.6%	100.0
	Total	533	100.0%	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 4-20 shows the distance from the NGOs offices to the respondents along the

riverside of Jamuna, Bangladesh, 2016. 50.8% of the respondents were getting facilities from 6 km to 9 km. There were less than or equal 5 km representing 46.5% of the respondents and rest of 2.6% respondents were getting facilities from 10 km or above distance.

(g) Distance from the growth centers/hat/bazar

The growth centers can play an important role to rural development especially along the riverside of Jamuna, Bangladesh because transportation facilities are absent there. Growth centers are especially improved in both formal and informal sectors; the participation and involvement of the people; the linkages and interactions among centers and their surroundings; the identification of the most likely centers for potential growth and diffusion of innovations and the spatial patterns of the centers together with the distribution of population.

Table 4-21: Distance from the growth centers/ hat, bazar to the respondents along the riverside of Jamuna, Bangladesh, 2016

Sl no		Frequency	Percent	Cumulative Percent
1	1 km to 3 km	136	25.5%	25.5
2	4 km to 6 km	259	48.6%	74.1
3	7 km to 9 km	138	25.9%	100.0
	Total	533	100.0%	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 4-21 shows the distance from the growth centers/ hat, bazar to the respondents along the riverside of Jamuna, Bangladesh, 2016. There are 48.6% of the respondents were getting facilities from 4 km to 6 km. There are 1 km to 3 km representing 25.5% of the respondents and rest of the 25.9% respondents were getting facilities from 7 km to 9 km distance.

(h) Facilities provided by the local NGOs to agricultural sectors

The local NGOs along the riverside of Jamuna are working on agricultural sectors by providing agricultural loan, agricultural tools, fertilizer, seeds, agricultural training, cattle/ domestic animals, handicraft training and pesticides to the rural poor people. Table 4-22 shows the facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh, 2016. Among the 533 respondents, there were 63.6% had received agricultural loan from the local NGOs and rest of 36.4% had not received such type of loan. Table 4-22 also represents the facilities of agricultural tools that were provided by the local NGOs for the agricultural development. There were 64.0% of respondents who had got agricultural tools from the local NGOs and rest of 36.0% had not got agricultural tools.

The cumulative number in population along the riverside of Jamuna makes higher demand of food. For producing more food, it is necessary to develop fertile land. Therefore, fertilizers can play an important role to grow healthy plants. It gives nutrition to the crops. While fertilizers added to soil or water, plants can develop tolerance against pests like weeds, insects and diseases and producing healthier crops. Table 4-22 represents the facilities of agricultural fertilizer that are provided by the local NGOs for the agricultural development to the rural poor. Here, there were 69.0% had got agricultural fertilizer from the local NGOs and rest of 31.0% had not got agricultural fertilizer among 533 respondents. Agricultural fertilizer have a significant role to produce good amount of agricultural goods and can make the rural farmer economically solvent.

Table 4-22: Facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh, 2016

Facilities	Sl No	Response	Frequency	Percent (%)
Agricultural loan	1	No	194	36.4%
	2	Yes	339	63.6%
		Total	533	100%
Agricultural tools	1	No	192	36.0%
	2	Yes	341	64.0%
		Total	533	100%
Fertilizer	1	No	165	31.0%
	2	Yes	368	69.0%
		Total	533	100%
Seeds	1	No	119	22.3%
	2	Yes	414	77.7%
		Total	533	100%
Agricultural Training	1	No	137	25.7%
	2	Yes	396	74.3%
		Total	533	100%
Cattle/ domestic animals	1	No	137	25.7%
	2	Yes	396	74.3%
		Total	533	100%
Handicraft training	1	No	380	71.3%
	2	Yes	153	28.7%
		Total	533	100%
Pesticides	1	No	169	31.7%
	2	Yes	364	68.3%
		Total	533	100%
Electricity (Solar panel)	1	No	385	72.2%
	2	Yes	148	27.8%
		Total	533	100%

Source: Made by the author, 2017; data collected through field survey, 2016

Figure 4-16 also shows the facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh, 2016. Local NGOs along the

riverside of Jamuna had provided seeds facilities to the poor every year for increasing the agricultural crops production. There are 77.7% of the respondents were getting seeds facilities whereas only 22.3% respondents did not got seeds facilities from the local NGOs.

As of late, Bangladesh cannot meetup its own food demand. There are many reasons for the reduction of crop's production like political, natural calamity, people choice, modernization, industrialization and globalization along with lack of multi diversified excellence agriculture education, training and research that obstruct the development of the agriculture sector in Bangladesh. Figure 4-16 shows the number of trained person on agricultural sectors along the riverside of Jamuna. Among the 533 respondents, there were 74.3% respondents had got agricultural training from the local NGOs and rest of 25.7% had not got such type of training.
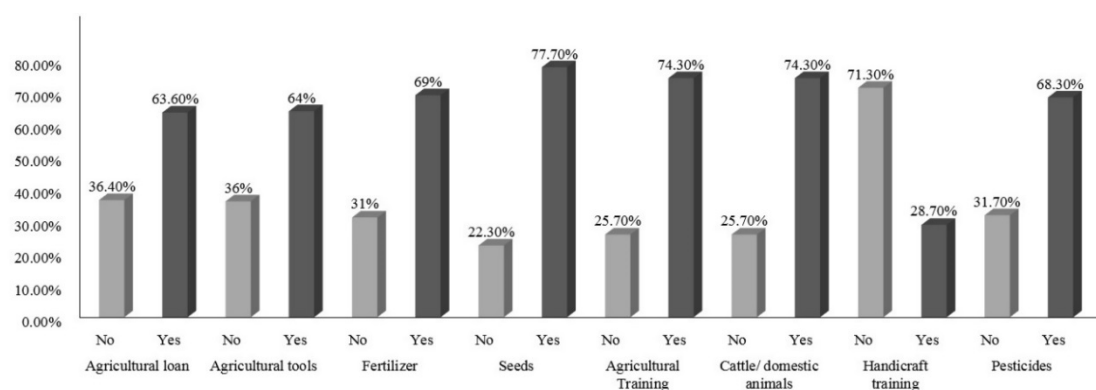
Figure 4-16: Facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh, 2016
Source: Made by the author, 2017; data collected through field survey, 2016

Along the riverside of Jamuna, local NGOs had provided cattle or domestic animals for land cultivation to the poor in a certain time. As a remote area, it is quite impossible to impose modern technology for cultivation as well as the use of modern technology is very much expensive to bear for them. Figure 4-16 indicates the number of respondents who were getting cattle or domestic animals for land cultivation along the riverside of Jamuna. Among the 533 respondents, there were 74.3% respondents had got cattle or domestic animals for land cultivation from the local NGOs and rest of 25.7% had not got cattle or domestic animals for land cultivation.

The handicrafts sector is a home based industry which require minimum infrastructure and training to operate. Skills and locally available materials are used for producing handicrafts. For income generation, it plays a significant role within the community. Many agricultural goods are used in producing handicrafts and it's a secondary economic source of income in the time of lean harvesting of the rural poor people along the riverside of Jamuna, Bangladesh. Figure 4-16 indicates the number of

respondents, who were getting handicraft training from the local NGOs. Among the 533 respondents, there were only 28.7% respondents had got handicraft training from the local NGOs and rest of 71.3% had not got handicraft training. On the other hand, there were 68.3% respondents had got pesticides facilities from the local NGOs and rest of 31.7% had not got pesticides facilities among the 533 respondents along the riverside of Jamuna, Bangladesh in 2016. On the other hand there are 27.8% respondents have electricity and rest of 72.2% have no electricity (Solar panel).

(14) Correlation results of profit and selected dependent variables

In this section we present a correlation analysis performed for six dependent variables, i.e., agricultural training, fertilizer, domestic animals, seeds and agricultural loan; to show how they correlate with profit farmers receive annually. Results show that, out of the total number of farmers (432,550), 3,737 were trained, selected from 126 union councils in 2016. Here union council refers to lowest administrative boundary and consist of few villages. The correlation analysis presented in Table 4-23 show that the correlation of coefficient for training (r) equals to 0.952, indicating a significant relationship between trained farmers and their profit per Bigha (r = 0.952, p <0.001). This might be due to the fact that during the practical training, NGOs also advise farmers to share knowledge and resources and encourage them to cultivate same type of crops on adjacent lands so that the farmers can utilize the experiences from the trainings with each other. In total, 4,590 farmers received fertilizer. The correlation analysis between numbers of people who had received fertilizer was able to increase profit from farming. The correlation coefficient (r) equals to .250, indicating a significant relationship between increase in annual profit and access to fertilizer. This had happened because; local NGOs had provided fertilizer facility to the rural poor in proper way and time. Besides that, there were also positive correlation among the number of farmers who had gotten domestic animal, agricultural seeds and agricultural loan with an increment in annual income and their correlation of coefficient (r) equals to .270, .085 and .527 respectively as shown in Table 4-23. Access to agricultural training workshops, provision of livestock and agricultural loans made farmers able to improve profit from farming. Domestic animals given by NGOs are used for ploughing instead of using expensive modern technologies resulting in saving money. One of the major facilities that was provided by local NGOs is agricultural loan. In proper time and proper way of distribution of agricultural loan to the rural poor people had made them economically self-sufficient. Traditional agricultural tools namely plough, spade, ladder were only used for producing agricultural crops. A negative correlation (r = -.046) was found between profit from farming and availability of traditional agricultural tools.

Table 4-23: Descriptive statistics of the selected indicators along the riverside of Jamuna, Bangladesh, 2016

	TNP	PP	APY (USD)	p-value	df	Coefficient (r)
TFA and PPB Pearson Correlation Sig. (2-tailed)	3,406,272	3,737	94.09	0.000	1	.952**
FL and PPB Pearson Correlation Sig. (2-tailed)	3,406,272	4,590	59.30	0.005	1	.250**
DA and YINC Pearson Correlation Sig. (2-tailed)	3,406,272	3,519	87.25	0.002	1	.270**
TAT and PPB Pearson Correlation Sig. (2-tailed)	3,406,272	3,237	18.45	0.606	1	-.046**
AS and PPB Pearson Correlation Sig. (2-tailed)	3,406,272	3,264	9.54	.346	1	.085**
AL and PPB Pearson Correlation Sig. (2-tailed)	3,406,272	2,865	69.78	0.000	1	.527**

Source: Made by the author, 2017; interview with local NGOs employee of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs
** Correlation is significant at the 0.01 level (2-tailed).
* 1 Bigha = 0.16055846 hectares
* TFA= Trained farmers in agriculture, PPB= Profit per Bigha, FL= Fertilizer, DA= Domestic animals, YINC= Yearly income, TAT= Traditional agricultural tools, AS= Agricultural seeds, AL= Agricultural loan, NU= Number of unions, TNP= Total number of population, PP= Privileged population and APY= Average profit in yearly.

4.6 Conclusion and recommendations

The NGOs are playing a significant role in the agricultural development along the riverside of Jamuna, Bangladesh. Major activities are done by local NGOs in an undisciplined way and the activities are agricultural training for the poor; agriculture services like distribution of tools, fertilizer, pesticides, and seeds; poverty alleviation; environment; health and population; education etc. Numerous non-governmental organizations that are found in the study area are working in almost every sector. The purpose and scope of their work change with the type of project, for which they receive

the fund. The study has revealed that the local NGOs in the study area have supported farmers by giving agricultural aids such as; agricultural inputs (seed, fertilizer, pesticide), agricultural tools, cash loans, agricultural training, irrigation facility, kitchen gardening etc. Farmers are selected for aids based on their socio-economic condition, i.e., poorest people are given priority. Analysis regarding population engaged in agriculture; industry and services revealed that in rural remote areas people mostly do agriculture compare to those located in relatively developed areas in the vicinity of Dhaka, the capital of Bangladesh. Correlation analysis showed that annual profit from farming increases with the growth of access to agricultural training, inputs like fertilizer, seed access to domestic animals and availability of agricultural loan provide by NGOs. GIS analysis is performed for identifying the suitable location for different crops that are grown in the study area and shows that three varieties of rice named as; *T. Aman, Boro,* and *T. Aus* are grown in the study area. *Boro* and *T. Aus* paddy suites best the soil of our study area while the land for jute and potato is moderately suitable. Furthermore, the production of chili, ginger, and turmeric is perceived very low among sampled respondents due to unavailability of suitable land. The study concludes that most of the farmers in the study area are from the poorest of the poor communities of the country. Regardless of the fact NGOs are providing agricultural support to those poor farmers. It is advised that government's agricultural extension institutions should also train farmers on improving agricultural production as well as raising awareness among the farmers to identify the suitable location for crops beforehand. Besides that, setting the clear policy goals on improving farming, improving the use of advanced technology for farming, improving market access and other technical assistance will help farmers to improve crop yield.

This paper having all sorts of graphical evidences, local people interviews and perceptions, focus group discussions in different categories, and documentary reviews for ensuring the proper facilities provided by the local NGOs to the poor people along the riverside of Jamuna. The above-mentioned analysis of NGOs spatial distribution, current situations and other observations that can be make the following recommendations.

1. Farmers from developed countries use large and very expensive equipment like tractors; combines and storage bins but farmers are Bangladesh still using limited mechanized equipment. So NGOs should emphasis on the farming equipment for developing the agricultural sectors;

2. Transportation and road networks can play a significant role in helping farmers for profitable business. So NGOs should emphasis on developing transportation and road networks to develop agricultural sectors along the riverside of Jamuna;

3. Lack of storage facilities and containers make the rural area underdevelopment whereas it can play a substantial role in helping farmers capitalize;

4. Create the opportunities of food processing and marketing to ensure the better income of farmers;
5. Making the international marketing opportunities to export the agricultural crops;
6. Local NGOs should protect the environment using environ friendly fertilizers and pesticides;
7. Need to develop the irrigation systems and make power plant for the electricity facilities;
8. To encourage and facilitate greater investment and should distribute all agricultural facilities equally to the rural poor along the riverside of Jamuna;
9. Making the mobile communication systems for marketing and supporting the agricultural sector; and
10. Increasing access to financial assets and markets for the rural poor people along the riverside of Jamuna.

CHAPTER 5: ASSESSING NGOS MICRO-CREDIT PROGRAMS

5.1 Introduction

In Bangladesh, socio-economic development and poverty alleviation are now current crucial issues, whereas micro-credit is considered as one of the vital tools for poverty alleviation (Rahman, 2011; The Role of Micro-Credit in Poverty Alleviation, 2009; Adam, 2010; Copestake, 2007; Copestake et al., 2005; Raihan, 2014). Consequently, in the last few years' micro-credit services, particularly in Bangladesh had established by the local NGOs. They are providing a lot of attention to the welfare of the rural poor people (Ahlin and Jiang, 2008; Hasan, 1991; Hashemi and Schuler, 1996; Rahman et al., 2003). Grameen Bank, BRAC, RDRS Bangladesh, ASA and other Microfinance Institutions (MFI) in Bangladesh are working for improving lives and livelihoods of the poor people living in rural areas (primarily targeting the poorest of the society, especially women) (Wahid, 1993; Mahjabeen, 2008; BBS, 2010; BBS, 2012; BRAC, 1990; Bangladesh Ministry of Finance, 2014; Rahman and Hossain, 1986).

Furthermore, according to United Nations report published in 2005, microfinance or micro-credit is defined as small-scale financial services to the poor and low-income people from rural areas, such as credit and savings accounts. Most of these investments or financial supports are profit oriented (Copestake, 2007; Jehangir, et al., 2002; Khatun et al., 2013; White, 1992). Thus, the amount of loan, high interest rate (national policymakers and also PKSF fixed 12.5% interest rate or so-called service rate to be charged by MFIs to the poor people of the country) and early perseverance of microcredit payment; field workers make it difficult to generate quick economic return and thereby forces the borrowers into a grave sunken condition in the study sites (Rashid et al., 2011; Raihan et al., 2017). Microfinance is a powerful tool to fight poverty and help poor people from rural areas in order to raise their incomes, provide assets, empower women and uplift the entire community as well as mitigating themselves against external obstacles like natural disasters (Mandelbaum, 1988; CGAP, 2004a; The Role of Micro-Credit in Poverty Alleviation, 2009; Rahman, 1986; Ray, 1987; Schuler and Hashemi, 1994; Simmons et al., 1988).

In Bangladesh, the idea of micro-credit system was originally proposed by a Nobel Laureate Professor Muhammad Yunus (Hye and Islam, 2012). These micro-credit services, offered by NGOs have no limits in terms of which sectors it can focus on; unless it is taking place due to financial or economic reasons (Rahman, 2004; Rashid and Bashar, 2010; Mason, 1987; Pitt and Khandker, 1998; Nilanjana, 2013). Until now, the most prominent sectors these micro-credit programs have been engaged in includes, agriculture, health, and sanitation, women empowerment, forest management, fisheries and educational programs (Mazumder and Wencong, 2013; Proshika, 1999; Rahman,

1986; The World Bank Report, 2106). These services are mostly provided in rural areas of Bangladesh; in order to support their lives and livelihoods (Zohir et al., 2001; Uddin, et al., 2012; Hasan, 1998).

Most of the people in Bangladesh have no savings; even sometimes they have negative savings (Uddin, et al., 2014; CARE, 2000; Arndt et al., 2002; GoB, 1993; GoB, 1998). So, they are not being able to go for big investment from any formal banking institutions. In order to provide such credit facilities to the poor people, there is a good number of NGOs/MFIs at present in the country (Hashemi and Schuler, 1993). Rural women are benefitted to a great extent from such NGOs/MFIs. Many studies claiming that women have improved their financial situation with the help of NGO's/MFI's credit facilities (Hossain, 1988). Despite these positive impacts, some studies found that micro-credit is not reaching the extremely poor (Goetz and Sengupta, 1996; Khatun et al., 2013). The overall goal of this paper is to identify the micro-credit services provided by NGOs along the riverside of Jamuna. The study also seeks to investigate the areas, which still need such services to boost their lives and livelihoods.

The broad goal of the study is to investigate the role of local NGOs in remediating poverty through micro-credit services in the landscaped along the riverside of Jamuna, Bangladesh. In the study area, around 3.5 million people inhabit *chars* which are mostly in the intervention areas; with around 1 million living on island *chars* that are surrounded by water for the majority of the year (Haque and Masahiro, 2009; Hasan, 1985). This study provides GIS, GPS and Google Earth based NGO's baseline information of microfinance services by recording the physical location and basic portfolio data of all MFI branches (175 branches) in the study area; mostly located in and along the Jamuna River Systems. The specific objectives set to fulfill this aim includes; (1) to explore NGOs and its contribution in alleviating poverty with a focus on women empowerment; (2) to identify areas where NGOs have more/less concentration versus people dependent on its services; (3) to identify NGOs and its linkage with growth/commercial centers in the study area and finally (4) to investigate the socioeconomic attributes of the rural inhabitants who were part of this study.

5.2 Data sources and methods

The primary data was collected from a distinctive group of respondents. In total 533 respondents were interviewed using household survey method and 50 focus group discussions were also conducted at union council (combination of few villages) level along the river side of Jamuna, Bangladesh. The information on age of the respondents, sex, number of family members, educational background, condition of residential facilities, purpose of getting loan, occupational status (before and after joining to local NGOs credit program), monthly income (before and after joining to local NGOs credit

program), current economic status, if they are facing problem in installment and finally, significant assets of the rural poor before and after the involvement in to micro-credit were collected through household questionnaire survey. Absolute information regarding the locations of 30 NGOs with 175 sub-branches was collected using GPS (Global Positioning System). The study interviewed these following groups:

(a) Local community (total 533 respondents and 50 FGDs); and

(b) Local NGOs managers who are involved in micro-credit program of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs).

Secondary data, such as year of establishment, number of savers, the total value of savings deposits, number of borrowers, the total value of loans outstanding, name and telephone number of the branch manager were collected from 30 NGOs (total 175 sub-branches). Furthermore, secondary data were acquired from Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS), Center for Environmental and Geographic Information Services (CEGIS).

Survey Track during Fieldwork: Automated track records of the GPS device have been mapped during the field survey of MFIs. The survey work is being done by boats, rickshaws, bikes, on feet, bus, tempo, baby-taxi, rail, horse carts and so on.

Data analysis

ArcGIS 10.2 is being used for detailed mapping and analysis of NGOs working area of the sample sites. A Garmin GPS Device has been used to locate all MFIs accurately and converted the collected Waypoints in GIS and KML format. The purpose of the GPS survey was to record the latitude and longitude of each MFI branch in the listed island/*char* unions of Jamuna River, and also to report the year of establishment, number of savers, total value of savings deposits in Taka, number of borrowers, total value of loans outstanding and, finally name and cell number of Branch Manager. NGO's baseline information on micro finance services, especially number of borrowers, number of savers, total value of savings deposits and total value of loans outstanding were analyzed regarding on their spatial distribution. Based on physical location of MFI branches (175 branches), this paper tried to find out working gaps area in the study sites using ArcGIS 10.2. Besides that, this paper had analyzed microfinance services (especially loans) with a number of borrowers of major four NGOs (ASA, BRAC, Grameen Bank and RDRS Bangladesh). In addition, financial growth or commercial centers were analyzed with the spatial distribution of NGOs in the study sites.

Statistical Package for the Social Sciences' (SPSS 16.0) software was also used for socioeconomic characteristic analysis, i.e., age of the respondents, sex, number of family members, educational background, condition of the residential facility, purpose of getting loan, occupational status (Before and after joining the local NGOs credit program), monthly income (Before and after joining the local NGOs credit program),

current economic status, if they are facing problem regarding installment and finally, significant assets of the rural poor before and after involvement in to micro-credit program of the study sites. Besides that, the correlation between monthly income and selected eight dependent variables (luxurious assets) were also analyzed using SPSS. This paper has tried to make relation between eight dependent variables and income by the following correlation equation:

$$r = [\Sigma xy - \{(\Sigma x)(\Sigma y)/n\}]/[\{\Sigma x^2 - (\Sigma x)^2/n\}\{\Sigma y^2 - (\Sigma y)^2/n\}]^{1/2}\ldots\ldots\ldots\ldots\ldots\ldots(i)$$

Whereas, X= Dependent variables, Y= Income, n= Number of unions and results, r lies between -1 and +1. A value near 0 means no correlation and near -1 and +1 means there have less or strong correlations between the variables and income.

5.3 Major findings in the study sites

There are 30 NGOs (Non-Government Organizations) with 175 sub-branches helping locals to raise their economic status through micro-credit services in rural Bangladesh. The services of micro-credit include crops production, husking rice and rice frying, cattle fattening, domestic animal husbandry, fish farming, cultivation of vegetables, convenience store, bamboo and cane work, vegetables and raw materials business, cloth fabric, cottage industry, ready-made garments business, clothing business and finally, buying rickshaw or van.

NGO gives a loan to deprived people in different ways where landless are given priority. But they suffer most in terms of the payment system of loans with interest. Poor receive loans in the condition of 12.5% (fix the interest rate for NGOs by PKSF) interest monthly. Once they go through the installment weekly, it is calculated that at the end of installment they paid more than 30% to 40% interest instead of 12.5%. The borrowed amount is reduced by paying weekly installment where the rate of interest never counts with the reduced capital. For example, capital is 100 $ with 10% interest and the number of the installment is 10 weeks. In 1st week, borrowers paid 11$ (10$ installment+1$ interest) where main capital reduced to 90$. In 2nd week, they also need to pay 1$ interest where it should be 0.9$ interest (10% of 90$). Consequently, at the last week of installment, they paid interest on 100$ where they should pay interest on 10$. Therefore, the higher number of installment makes more profit to the NGOs credit business.

The study area is a char-prone (island) area where approximately 15% of the total populations are still living below the poverty line due to lack of job opportunities. Among them, the women's are more vulnerable in terms of social, political and economic discriminations compared to male in the study sites. Therefore, local NGOs

are creating job opportunities for the rural women to reduce dependency rate. Thus, microcredit has been a major support for rural women in along the Jamuna, Bangladesh. The positive effects of NGOs credit program can help to reduce poverty along with increase women's equality in the rural area.

(1) Geo-spatial analysis of NGOs attributes

In this section, geospatial attributes of 30 NGOs (175 branches) are analyzed with borrowers, savers, saving deposits and total loan outstanding's. Local NGOs in the bank of Jamuna River are operating intensively microcredit activities for the development of the economic and social sector of the rural poor. The borrowers, savers, saving deposits and total loan outstanding's are categorized into major five classes to detail the understanding of the NGOs capacity with their spatial distribution.

Figure 5-1 shows the spatial distribution of local NGOs and its borrowers (Figure 5-1) are categorized into major five classes like (56 to 858), (859 to 1,850), (1,851 to 2,919), (2,920 to 4,632) and finally, (4,633 to 7,194). Results tell that local NGOs are not equally distributed along the riverside of Jamuna, Bangladesh. The concentration of local NGOs is focused in the upper and down part of Jamuna Rive whereas, in the middle part of Jamuna, numbers of local NGOs are very lower. Figure (5-1) also shows that there is a very high concentration of borrowers (4,633-7,194) in the upper and lower bank of Jamuna River, which indicates that there is a huge number of borrowers who are seeking money for greater utilization for agricultural or business purposes. Furthermore, results reveal that in the northern part of Jamalpur and Bogra district, there are very few scattered NGOs have been working where the borrower number (1,581-2,919) is smaller than upper and lower part of Jamuna River. Besides that, there is a very high concentration of borrowers (4,633-7,194) in the western part of Gaibandha district. Finally, it can be said that higher and lower number of borrowers are indicating the strength and weakness of local NGOs whereas upper and lower stream of Jamuna show higher strength and middle parts are frailer.
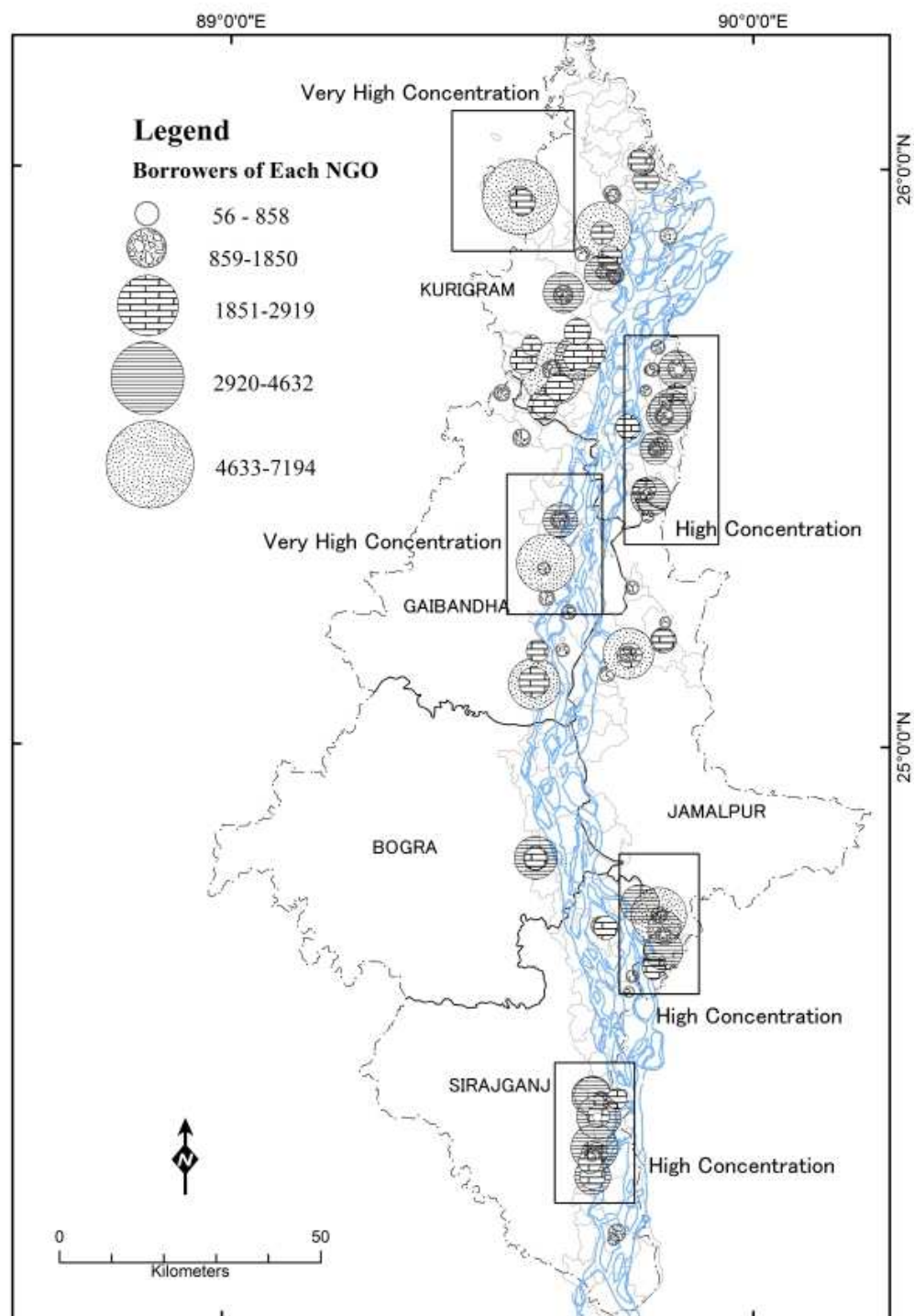
Figure 5-1: Borrowers of each NGOs and their distribution along the river Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2015

Figure (5-2) shows the number of the saver of local NGOs that are also categorized into major five classes like (100 to 722), (723 to 1,729), (1,730 to 2,641), (2,642 to 4,200) and finally, (4,201 to 9,026). In the maps, bubbles are indicating the strength and weakness of the local NGOs. Savers and borrowers concentration results along the river Jamuna are analyzed using a five-point Likert scale. According to that scale, there are five categories of bubble are located, first one is very higher concentration of savers (4,201 to 9,026), second one is higher concentration of savers (2,642 to 4,200), third one is medium concentration of savers (1,730 to 2,641), the fourth one is low concentration of savers (723 to 1,729) and finally, very low concentration of savers (100 to 722).

Results reveal that the total number of savers are highly linked with the economic development of individuals or families. The main target of the NGOs is to reach a large number of borrowers and savers with microfinance approaches. However, the general findings states, there is a very high concentration of savers in the upper bank of Jamuna River where the number of savers are 4,201 to 9,026 in the majority of the branches. In the southern part of Kurigram district and middle part of Gaibandha district, there are huge numbers of NGOs are located where the number of savers is higher. This might have happened because rural people have good opportunities to invest in the profitable sectors and earn more. Thereafter, they tried to save some money for future with the help of local NGOs with profitable interest. On the contrary, there are some scattered NGOs are located with the higher number of savers (4,201 to 9,026) in the northern part of Jamalpur district. In the western part of Gaibandha district, there are two major NGOs in terms of the number of their savers are working for the economic development of rural poor by providing microfinance facilities. Figure (5-2) shows that, in between Kurigram and Gaibandha districts, the lower part of Gaibandha district and upper part of Sirajganj district, there are the medium concentration of savers (1,730 to 2,641) are located. Furthermore, in the lower stream of Jamuna especially in Sirajganj district, there are a large number of NGOs in terms of their savers are located. In the middle stream of Jamuna especially Bogra and Jamalpur district have very low concentration of savers (100 to 722) compared to the other districts. This might be because of limited access to transportation and communication with the people of middle stream Jamuna. Finally, it can be said that higher and lower number of savers are indicating the strength and weakness of local NGOs as well as indicating the individual development along with social and economic development.
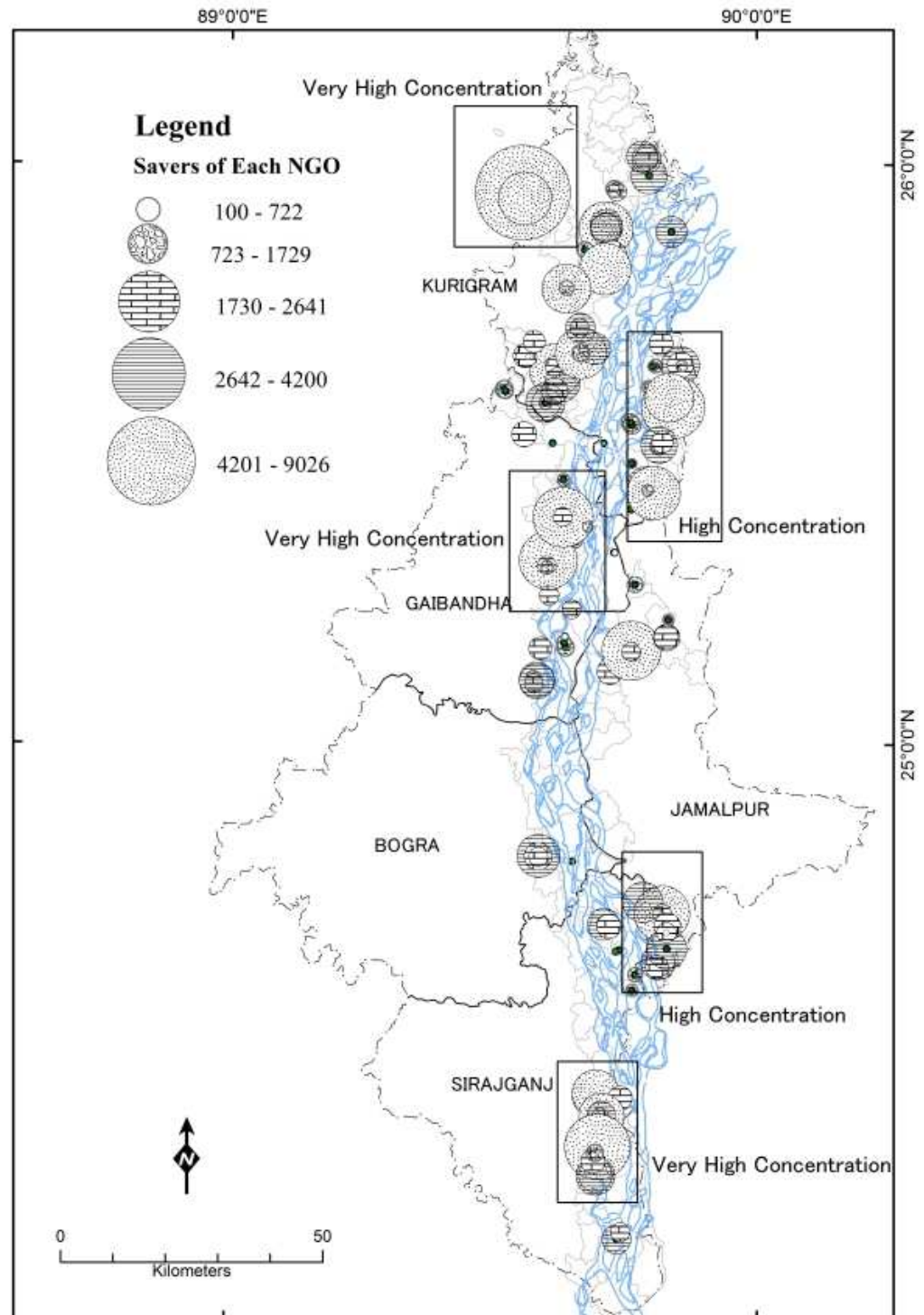
Figure 5-2: Savers of each NGOs and their distribution along the Jamuna, Bangladesh
Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics
(BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2015

Figure (5-3) demonstrations the saving deposits of local NGOs who are operating micro-credit activities along the Jamuna River that are also classified into major three classes. The first category has a saving limit of less than TK 5 million per MFI, the second category has a saving limit between TK 5 to TK 10 million per MFI and finally, the third and highest has a limit of more than TK 10 million per MFI. According to the financial capacity of local NGOs, there three types of bubbles are located in the figure (5-3) where more than TK 10 million per MFI indicates higher savings, between TK 5 to TK 10 million per MFI indicates medium savings and finally, less than TK 5 million per MFI shows lower savings. Results reveal that, in the upper part of Jamuna River especially in Kurigram district, there is high (more than TK 10 million per MFI) and medium (between TK 5 to TK 10 million per MFI) concentration of savings are observed. This is because nowadays, local NGOs are increasingly mobilized the rural poor people for savings for their future economic security. For the savers, NGOs have been creating new employment opportunities and making easy access to large loans for the business purpose of the rural poor. However, the higher and medium savings (more than TK 10 million per MFI and between TK 5 to TK 10 million per MFI) are also located in the upper and lower part of Sirajganj district. In the middle steam of Jamuna river (Gaibandha and Jamalpur districts), medium savings are found whereas the number of local NGOs are higher. Only five NGOs have saving deposits of 5 to 10 million range and the rest of the regions have a very poor rate of saving deposits comparison to other alongside districts. This savings trend suggested that the economic and social development of the remoter are faster in Sirajganj and Kurigram districts than other districts along the riverside of Jamuna, Bangladesh especially, in agriculture and business sectors.
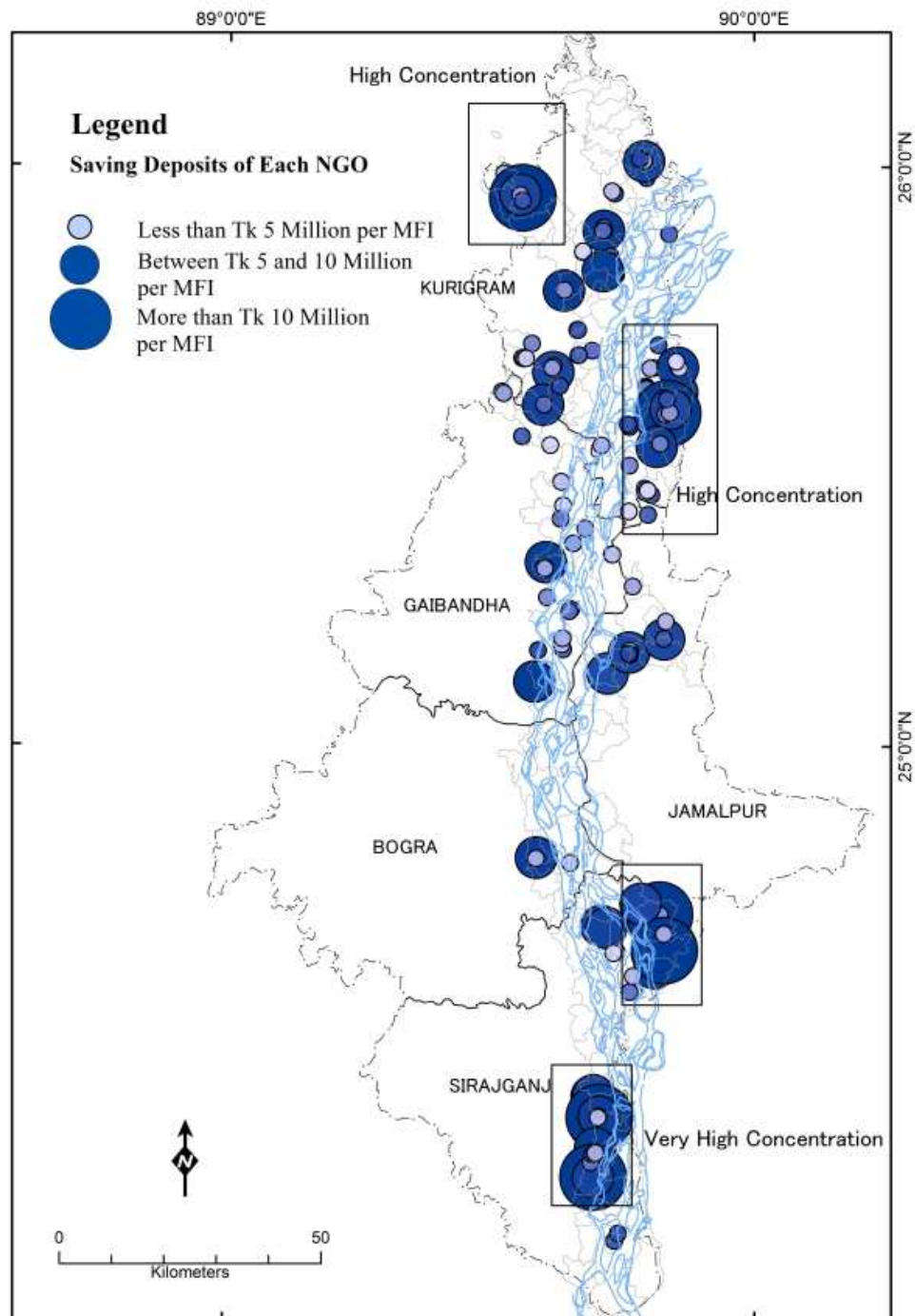
Figure 5-3: Saving deposits of each NGOs and their distribution along the river Jamuna, Bangladesh
Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2015

Figure (5-4) indicates the total loan outstanding of each NGOs are also categorized into three broad categories. The first category has a savings limit of less than TK 5 million per MFI (Lower loan outstanding's). The second category has a saving limit between TK 5 to 10 million per MFI (Medium loan outstanding's) and the third category has a limit of more than Tk 10 million per MFI (Higher loan outstanding's). According to the spatial location of NGOs and their loan distribution, there is higher and medium loan outstanding's (more than Tk 10 million per MFI and between TK 5 to 10 million per MFI) are located in the upper part of Jamuna river (Kurigram district). In the higher and lower part of Sirajganj district, there is medium loan outstanding's and rest of the area under lower loan outstanding's especially in the middle stream of Jamuna. The savings deposits are higher in the Gaibandha and Sirajganj districts whereas the total loans outstanding's are lower in Sirajganj district. There might be two reasons whether the organizations are not well willing to lend money to the people or people are not willing to take the money from the organizations. The high loan outstanding indicates a very positive sign of frequent economic and business activities that leads the rural people to prosperity.
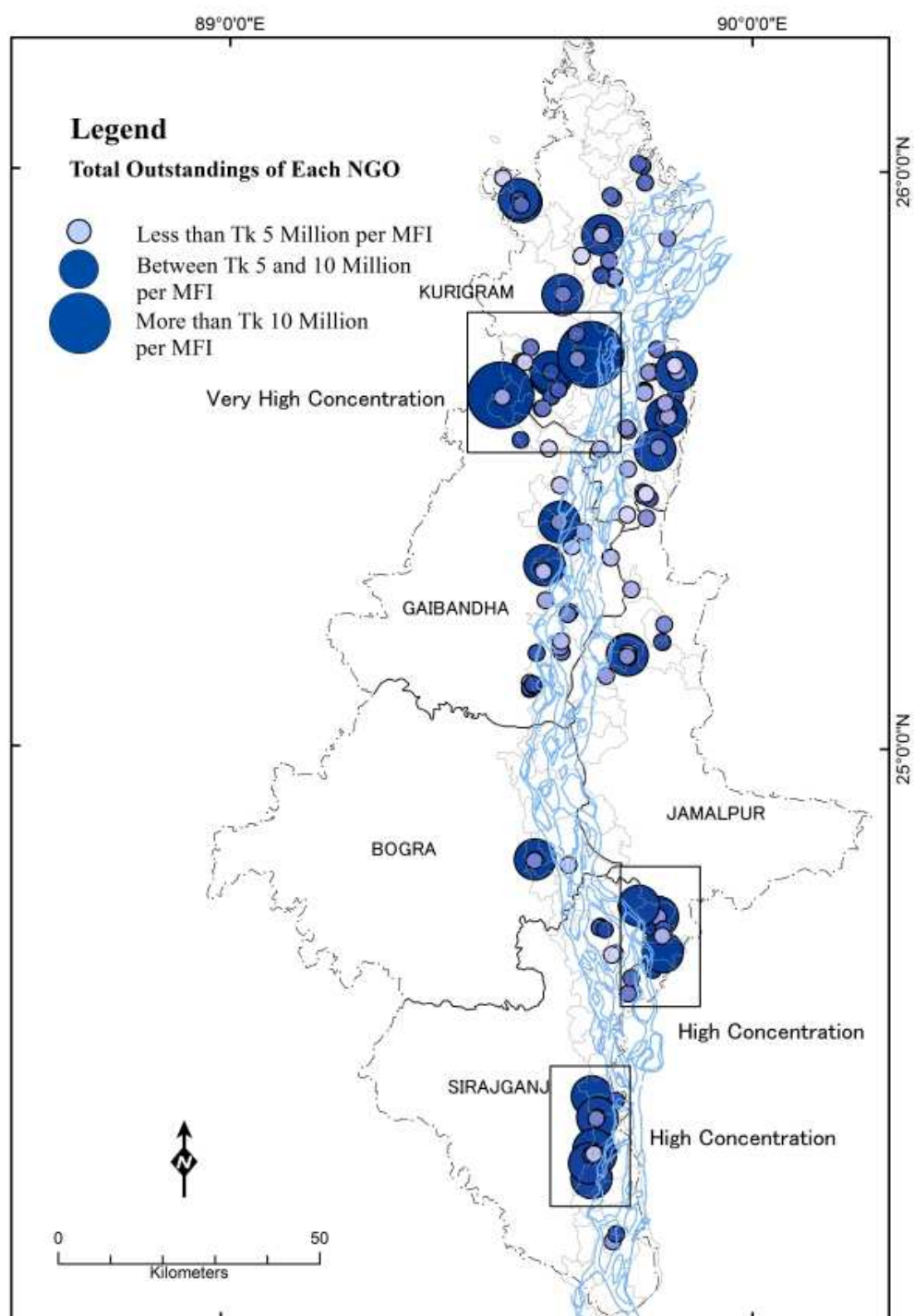
Figure 5-4: Total outstanding of each NGOs and their distribution along the river
Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics
(BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2015

(2) Evaluate the involvement of rural poor to micro credit program

There are 126 unions of 5 districts along the river side of Jamuna under the study area   and 30 NGOs with 175 sub branches working in the said area. Districts are Sirajganj, Bogra, Jamalpur, Gaibandha and Kurigram.

Table 5-1: Number of savers, borrowers, total savings and total outstanding's of local NGOs along the river side of Jamuna, Bangladesh

Name of NGOs	Number of Savers	Saving Deposits	Number of Borrowers	Total Outstanding
AKOTA	NA	NA	NA	NA
ARBAN	1,750	857,000	1,500	4,238,000
ARCHES	110	22,324	105	403,162
ASA	57,085	30,561,697	56,531	353,805,656
AMUS	200	105,438	107	229,455
BMUS	274	115,644	105	126,995
BRAC	103,647	104,759,268	89,050	284,864,091
DORP	1,815	2,802,043	1,623	10,000,000
GKS	310	509,824	245	1,258,740
GB	96,516	269,509,755	84,593	484,849,111
GUK	9,543	6,257,471	4,781	15,695,517
MMS	7,269	7,724,607	4,538	22,804,060
NDP	5,372	7,781,287	4,534	26,115,061
PDBF	600	528,334	536	2,200,000
Porosh	NA	NA	NA	NA
PRODIPON	1,500	584,000	1,260	2,000,000
PROGRESS	100	2,000	0	0
RDRS	46,130	53,851,944	37,115	109,182,834
RSDA	4,635	3,193,306	1,385	3,295,817
SF	NA	NA	NA	NA
SAP	1,537	860,138	1,467	5,621,475
SATU	1,700	1,400,000	1,300	10,000,000
SKS	10,648	11,097,369	7,801	33,910,424
SSS	9,125	9,233,432	6,846	28,964,535
TMMSS	2,000	2,010,550	1,850	6,032,823
TMSS	7,651	7,830,013	9,251	18,828,910
UDDIPAN	596	131,700	485	127,726
Uddog	1,195	117,590	200	300,000
UDPS	3,057	3,533,339	2,200	15,282,350
US	4,200	8,497,285	3020	8,493,341

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Table 5-1 shows the number of savers, borrowers, total savings and total outstanding's of local NGOs along the riverside of Jamuna, Bangladesh. There are four prominent NGO working along the riverside of Jamuna like Grameen Bank, Association for Social Advancement (ASA), Bangladesh Rural Advancement Committee (BRAC) and RDRS Bangladesh (Rangpur Dinajpur Rural Service). Each branch of local NGOs run by six people: a branch manager, an assistant branch manager, and four loan officers. The branch manager is specified with the right to accept all transactions within the branch. Each branch is a profit center and is estimated to fully recoverable costs between 9 and 12 months. There were total three NGOs information's like a number of savers, borrowers, total savings and total outstanding missing because the branch manager had no information on it and only local NGOs had no borrowers and outstanding information. In the association for social advancement (ASA), there are 57,085 savers and 56,531 borrowers involve with NGOs credit program and the total saving deposits and total outstanding's were 30,561,697 BDT and 353,805,656 BDT accordingly (1 USD = 78.7353 BDT). It means that the number of savers and borrowers are almost equal and the total outstanding is bigger than the total saving deposits. Therefore, rural poor people had got more loans and they capitalized money in different income generating activities like business, agricultural sectors, kitchen gardening, and poultry farm business as well as improved their economic condition and standard of living. ASA has currently made different groups and gives special importance on saving practice and 8,000 employees involved in disbursing and collecting loans and savings deposits from the rural poor people.

On the other hand, Grameen Bank is facilitating the rural poor with the loan to alleviate the poverty of individual or group of rural poor people. There are 96,516 savers and 84,5931 borrowers involve with Grameen Banks credit program and the total saving deposits and total outstanding's were 269,509,755 BDT and 484,849,111 BDT accordingly (1 USD = 78.7353 BDT).

Bangladesh Rural Advancement Committee (BRAC) firstly delivered relief and rehabilitation assistance to refugees returning from India after the war of liberation in 1971. Thereafter, BRAC tried to make long-term policy for poverty reduction and empowerment of the poor in rural areas of the country. As of late, BRAC encourages rural poor people to involve in microcredit programs. There are 103,647savers and 89,050 borrowers involve with BRACs credit program and the total saving deposits and total outstanding's were 104,759,268 BDT and 284,864,091 BDT accordingly (1 USD = 78.7353 BDT).
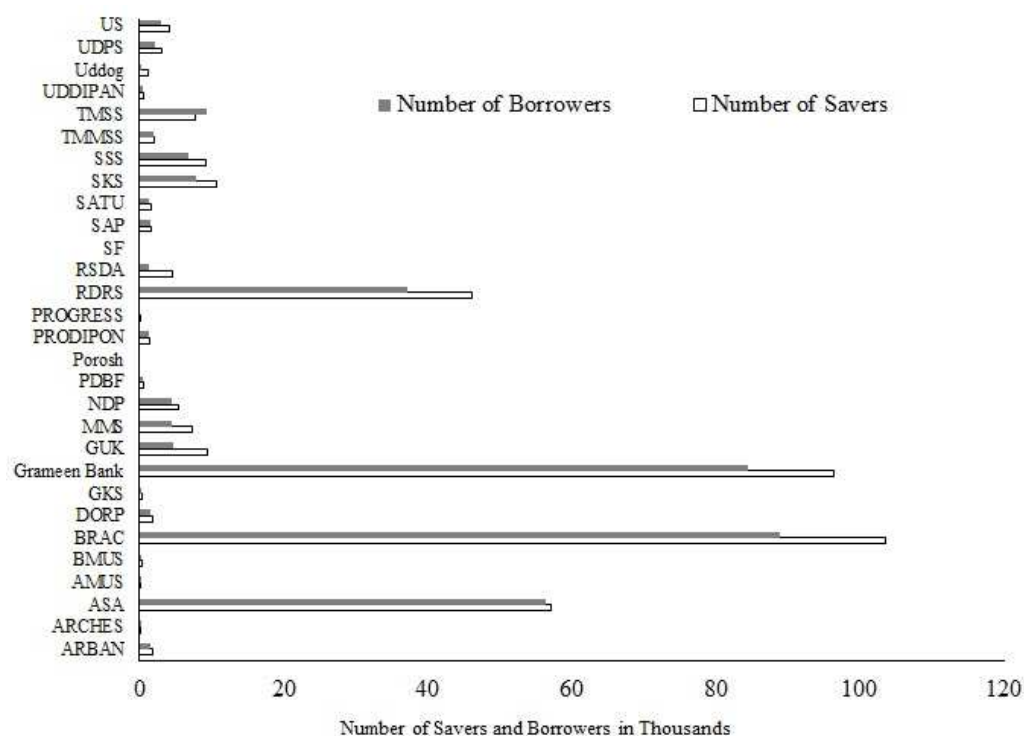
Figure 5-5: Total number of savers and borrowers along the river side of Jamuna, Bangladesh, 2106

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

It means that the number of savers and borrowers are almost equal and the total outstanding is bigger than the total saving deposit that is same as Grameen Bank. BRAC is investing more money in the socio-economic development of the rural poor people along the riverside of Jamuna, Bangladesh. Therefore, rural poor people had got more opportunities to capitalize money in different income generating activities like the business and other purposes as well as improved their economic condition and standard of living.

RDRS Bangladesh (Rangpur Dinajpur Rural Service) is working for poverty reduction and empowerment with rural poor's economic development by the NGOs credit program in northern areas of Bangladesh. There are 46,130 savers and 37,115 borrowers involve with RDRS Bangladesh credit program and the total saving deposits and total outstanding's were 53,851,944 BDT and 109,182,834 BDT accordingly (1 USD = 78.7353 BDT).
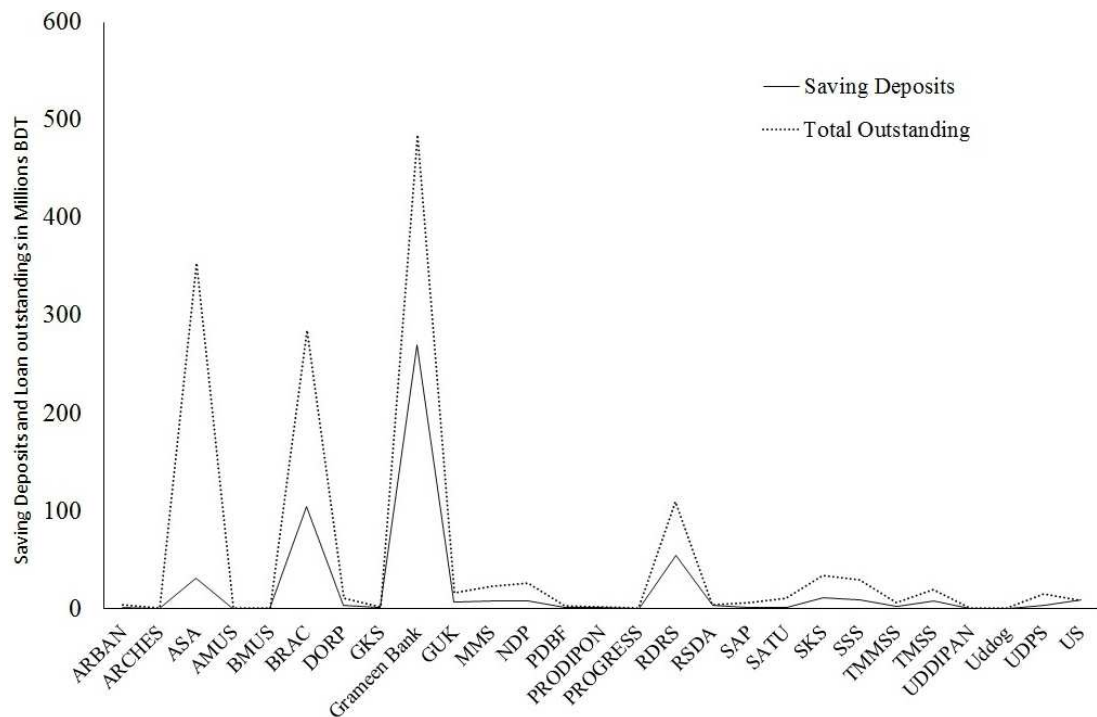
Figure 5-6: Total savings and outstanding of all NGOs along the river side of Jamuna, Bangladesh, 2016

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

It indicates that the number of savers and borrowers are almost equal whereas the total outstanding is bigger than the total saving deposit, which is same as Grameen Bank, ASA, and BRAC. RDRS Bangladesh is also investing more money in the socio-economic development of the rural poor people especially northern areas of Bangladesh.

(3) District wise involvement to NGOs micro credit

In this section, NGOs micro-credit were analyzed with the number of population, the total number of households, the total number of savers and borrowers within the 5 districts. The number of savers and borrowers are not same in different branches. It depends on the number of a population under NGOs working area. However, NGOs credit program were within 5 districts are described below:

Table 5-2: Comparison among total number of population, number of savers and borrowers in Bogra district of Bangladesh

District	Unions	Population	Households	No. of Savers	No of Borrowers
Bogra	Chandan Baisha	10,537	3,468	NA	NA
	Tekani Chukainagar	13,245	3,451	NA	NA
	Hat Sherpur	16,175	4,719	NA	NA
	Sariakandi	15,779	4,366	NA	NA
	Bhandarbari	17,973	4,810	NA	NA
	Pakulla	24,957	6,295	NA	NA
	Kutubpur	25,720	7,987	10,861	10,141
	Kamalpur	23,478	6,722	NA	NA
	Chaluabari	17,382	4,468	NA	NA
	Karnibari	24,479	6,950	NA	NA
	Bohail	23,339	5,728	106	75
	Kazla	26,191	6,671	NA	NA
	Total	239,255	65,635	10,967	10,216

*NA= Not Available

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

According to the table 5-2, the total population of 12 unions of Bogra district is 239,255 whereas the total household number is 65,635. The distribution of microcredit is spread among 13 unions of Bogra district among the 10,967 (4.58% of the total population) savers and 10,216 (4.26% of the total population) borrowers. The union of Kazla has the highest number of the population where local NGOs microcredit facilities are not located. In the Kutubpur union, the population is 25,720 and the household number is 7,987 whereas the number of savers and borrower is 10,861 and 10,141 respectively. From the available data, Bohail union has a population of 23,339 with a household of 5,728 and the number of savers is 106 along with 75 borrowers. This data shows the lower number of savers and borrowers in terms of population size in Bohail union. There are 10 unions such as Chandan Baisha, Tekani Chukainagar, Hat Sherpur, Sariakandi, Bhandarbari, Pakulla, Kamalpur, Chaluabari, Karnibari and Kazla of Bogra district have no savers and borrowers information.

Table 5-3: Comparison among total number of population, number of savers and borrowers in Gaibandha district of Bangladesh

District	Unions	Population	Households	No. of Savers	No of Borrowers
Gaibandha	Mollar Char	7,931	1,811	974	495
	Gazaria	19,322	4,886	NA	NA
	Kamarjani	13,196	3,482	10,039	7,089
	Sughatta	22,539	5,846	13,376	13,497
	Uria	17,057	4,294	1,866	1,388
	Kanchi Para	27,067	6,946	13,021	11,226
	Kapasia	14,011	3,660	NA	NA
	Malibari	27,615	7,356	NA	NA
	Haldia	21,862	5,775	NA	NA
	Gidari	29,043	7,867	NA	NA
	Erendabari	29,076	7,012	827	197
	Fazlupur	22,578	5,430	1,800	1,356
	Sreepur	40,357	10,676	1,310	632
	Haripur	21,846	5,894	NA	NA
	Tarapur	29,810	7,456	3,092	2,651
	Fulchhari	24,930	5,544	3,574	2,062
	Belka	27,065	7,608	2,384	1,638
	Chandipur	32,126	8,551	NA	NA
	Total	427,431	110,094	52,263	42,231

*NA= Not Available

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

According to the table 5-3, in Gaibandha district the microcredit was distributed within 18 unions. There are 427,431 populations and 110,094 households are located in the 18 unions of Gaibandha district whereas the total number of savers and borrowers are 52,263 (12.23%) and 42,231 (9.88%) respectively. According to population number, very few of the unions have a higher ratio of savers and borrowers comparison to the size of the population. Almost all unions, populations are equally distributed where the maximum number of population (40,357) in Sreepur union and lowest number of population (7,931) is in Mollar *char* union of Gaibandha district. Consequently, the highest number of household (10,676) is located in Sreepur union where the number of savers (1,310) and borrowers (632) are very limited, compared to the total size of the population. The total population of Sughatta union is 22,539 while the number of savers

and borrowers are 13,376 and 13,497 respectively. It indicates that the people of Sughatta union are more conscious about their economic development. On the contrary, there was lowest number of savers located in Erendabari union with a number of only 827 and with least number of the borrowers of 197.

Table 5-4: Comparison among total number of population, number of savers and borrowers in Jamalpur district of Bangladesh

District	Unions	Population	Households	No. of Savers	No of Borrowers
Jamalpur	Chukaibari	7,193	1,921	1,945	1,131
	Hatebhanga	21,509	5,435	1,500	1,260
	Sapdhari	9,130	2,132	NA	NA
	Kulkandi	10,825	2,765	2,458	1,448
	Chikajani	19,728	4,724	NA	NA
	Bahadurabad	37,520	8,857	NA	NA
	Balijuri	24,560	5,578	NA	NA
	Belgachha	20,799	5,171	NA	NA
	Pogaldigha	53,002	12,745	15,053	15,352
	Chinadulli	25,744	6,894	NA	NA
	Aona	29,756	7,347	3,800	3,700
	Sadhu Para	23,265	5,718	1,041	1,006
	Jorekhali	32,701	7,370	NA	NA
	Noapara	25,599	6,455	NA	NA
	Nilakshmia	25,937	6,210	NA	NA
	Pingna	28,935	6,837	6,773	5,575
	Merur Char	32,508	7,462	4,862	4,539
	Total	428,711	103,621	37,432	34,011

*NA= Not Available

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Table 5-4 indicates that in Jamalpur district, there are 17 unions under microcredit facilities where there are 428,711 numbers of people and 103,621 households were located along the riverside of Jamuna, Bangladesh. The higher and lower number of population was located in the Pogaldigha and Chukaibari unions which is 53,002 and 7,193 respectively. The number of households was also higher in Pogaldigha (12,745) union and lower in Chukaibari union (1,921). Among the total population, there are 37,432 (8.73%) savers and 34,011 (7.93%) borrowers under micro-credit facilities. The

higher number of savers and borrowers were located in the Pogaldigha union which was 15,053 and 15,352 respectively. The almost similar number of savers and borrowers indicates that in Pogaldigha union, most of the households are involved into NGOs microcredit program and they are more concern about their economic development. On the contrary, the lower number of savers and borrowers were located in Sadhu Para union which is 1,041 and 1,006 respectively. The total population Sadhu Para union (23,265) is comparatively higher than some others union along the river Jamuna where the number of savers and borrowers are very fewer. This might occur due to less number of NGOs are working in that area along with lack of economic opportunities to invest.

Table 5-5: Comparison among total number of population, number of savers and borrowers in Kurigram district of Bangladesh

District	Unions	Population	Households	No. of Savers	No of Borrowers
Kurigram	Andhari Jhar	23,318	5,930	NA	NA
	Ashtamir Char	17,701	4,077	3,374	4,426
	Ballabher Khas	26,443	5,912	3,421	2,472
	Bamandanga	18,258	4,654	NA	NA
	Bandaber	52,413	11,994	9,331	5,661
	Bangasonahat	20,257	5,171	NA	NA
	Bara Bhita	28,409	7,024	NA	NA
	Bazra	31,634	8,549	7,706	6,179
	Begumganj	17,309	3,720	NA	NA
	Berubari	21,851	5,235	3,392	2,771
	Bhangamon	29,129	6,881	NA	NA
	Bhogdanga	47,196	10,917	15,636	16,347
	Boldia	24,965	6,340	NA	NA
	Buraburi	33,090	8,458	4,596	4,208
	Char Bhurungamari	14,720	3,708	NA	NA
	Char Rajibpur	34,523	8,356	10,793	7,749
	Chilmari	6,902	2,024	255	240
	Daldalia	23,084	6,380	2,100	1,900
	Dantbhanga	37,911	9,527	8,563	7,414
	Ghogadaha	28,548	6,605	2,540	2,357
	Gunaigachh	28,239	7,409	21,759	20,618
	Hatia	28,933	7,610	9,559	9,938

Unions (Continued)	Population	Households	No. of Savers	No of Borrowers
Holokhana	32,412	7,690	NA	NA
Jadur Char	33,394	8,111	8,516	7,272
Jatrapur	20,994	4,744	3,386	2,778
Kachakata	20,618	5,632	7,984	6,466
Kedar	29,804	7,095	NA	NA
Kodailkati	14,703	3,438	900	757
Mogalbachha	20,995	5,317	1,981	1,794
Mohanganj	24,147	5,516	NA	NA
Naodanga	NA	NA	NA	NA
Naodanga	NA	NA	NA	NA
Naodanga	22,547	5,816	274	105
Narayanpur	27,437	5,151	2,976	1,596
Nayerhat	10,519	2,574	NA	NA
Noonkhawa	14,260	2,991	NA	NA
Paiker Chhara	24,802	6,310	NA	NA
Pourasabha	77,252	17,159	6,055	5,311
Punchgachhi	28,456	6,277	6,162	4,637
Ramna	28,729	7,188	NA	NA
Raniganj	20,513	5,405	NA	NA
Raumari	46,537	10,969	16,546	13,317
Royganj	23,123	5,723	NA	NA
Saheber Alga	20,427	4,564	2,306	1,318
Saulmari	26,162	6,270	2,344	2,006
Shilkhuri	22,191	5,364	NA	NA
Shimulbari	17,074	4,475	24,387	18,560
Thanahat	38,477	9,698	NA	NA
Thetroy	23,884	6,587	6,902	7,164
Tilai	16,111	3,960	NA	NA
Total	1,280,401	310,505	193,744	165,361

*NA= Not Available

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Table 5-5 illustrates that in Kurigram district, local NGOs were performing microcredit services to 50 unions along the Jamuna River where the total number of population is 1,280,401 and households are 310,505 respectively. The higher and lower

number of the population were located in the Kurigram Pourasabha and Chilmari union which is 77,252 and 6,902 respectively. Furthermore, the higher (17,159) and lower (2,024) number of households were also located in the Kurigram Pourasabha and Chilmari union along the river Jamuna, Bangladesh. It indicates that the number of the population is strongly connected with the number of households. Among 50 unions, the total number of population is 1,280,401 whereas the majority of the rural poor (359,105) involved with local NGOs micro-credit program. There are 193,744 (15.13%) savers and 165,361 (12.91%) borrowers among the total population. It indicates that there are approximately 28% of the population under NGOs credit program in 50 unions of Kurigram district. The higher number of savers and borrowers were located in the Shimulbari and Gunaigachh union of Kurigram district, which was 24,387 and 20,618 respectively. It indicates that in Shimulbari and Gunaigachh unions, most of the head of households are involved in NGOs microcredit program for their economic benefits. On the other hand, the lower number of savers and borrowers were located in Chilmari and Naodanga unions which is 255 and 105 respectively. The total population of Chilmari is fewer (6,902) than other unions of Kurigram district. As a result, small portions are involved with NGOs' credit program. But in the Naodanga union, the number of population is 22,547 where only 0.46% of them are involved to NGOs credit program. This might be because less number of NGOs in this area along with lack of economic opportunities to invest.

Table 5-6: Comparison among total number of population, number of savers and borrowers in Sirajganj district of Bangladesh

District	Unions	Population	Households	No. of Savers	No of Borrowers
Sirajganj	Bara Dhul	19,396	4,807	NA	NA
	Belkuchi	10,089	2,065	11,727	9,783
	Char Girish	21,289	5,553	3,850	3,690
	Chhangachha	38,179	9,011	NA	NA
	Daulatpur	88,236	18,069	9,157	8,121
	Gala	33,286	7,824	NA	NA
	Gharjan	18,748	4,763	4,325	1,865
	Jalalpur	18,831	3,924	NA	NA
	Kaijuri	47,404	11,818	NA	NA
	Kalia Haripur	50,400	10,945	NA	NA
	Kaoakola	17,713	3,957	NA	NA
	Kazipur	20,728	5,339	NA	NA
	Khas Rajbari	9,821	2,730	NA	NA

Unions (Continued)	Population	Households	No. of Savers	No of Borrowers
Khoksabari	30,275	7,038	NA	NA
Khukni	60,438	12,218	NA	NA
Maijbari	25,504	6,681	NA	NA
Mechhra	24,766	5,677	2,546	2,143
Mirkutia	25,064	6,279	NA	NA
Natuar Para	18,292	4,457	6,813	5,447
Nishchintapur	18,591	4,327	NA	NA
Omarpur	34,672	9,169	NA	NA
Pourasabha	158,913	35,556	NA	NA
Rajapur	48,331	10,271	17,093	14,264
Sadia Chandpur	28,495	6,515	NA	NA
Saidabad	47,610	10,485	13,453	11,096
Sonatani	24,231	5,662	NA	NA
Sthal	17,714	4,188	NA	NA
Subhagachha	14,412	3,880	NA	NA
Tekani	13,952	3,488	NA	NA
Total	985,380	226,696	68,964	56,409

*NA= Not Available

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Table 5-6 demonstrates that, in Sirajganj district along the river Jamuna, there are 29 unions under NGOs' credit program where the total number of population and household is 985,380 and 226,696 respectively. The higher and lower number of population were located in the Sirajganj Pourasabha and Bara Dhul union which is 158,913 (16.13%) and 19,396 (1.97%) of the total population respectively. Besides that, the higher (35,556) and lower (2,065) number of households were also located in the Sirajganj Pourasabha and Belkuchi union along the river Jamuna, Bangladesh. Furthermore, among 29 unions, the total number of population is 985,380 whereas the majority of the rural poor which is 12% (125,373) of the total population are involved to local NGOs micro-credit program. The number of savers and borrowers is 68,964 and 56,409 respectively in 29 unions of Sirajganj district. There are 6.70% were savers of the total population along the Sirajganj district. The higher and lower number of savers were located in the Rajapur and Mechhra union which is 17,093 (24.78%) and 2,546 (3.69%) respectively. It indicates that in Rajapur union, most of the head of households

are involved with NGOs' microcredit program for their economic benefits. On the contrary, there are 5.57% were borrowers of the total population along the Sirajganj district. The higher and lower number of borrowers were located in the Rajapur and Gharjan union of Sirajganj district which is 14,264 (25.29%) and 1,865(3.31%) distinctly. Finally, it can be said that the number of population and NGOs are strongly related to the number of savers and borrowers in the study sites.

(4) Comparison between borrowers and total outstanding's

This section shows the member coverage using bubble maps. The MFIs are classified here into 3 categories (i.e. 3 sizes of Bubbles) based on their total outstanding loans. The large bubble illustrates the value of outstanding loans more than 10 million taka while middle and small MFIs represent groups between 5-10 and less than 5 million taka respectively. Therefore, each bubble also indicates the strength or weakness of the respective MFIs in terms of borrowed money.
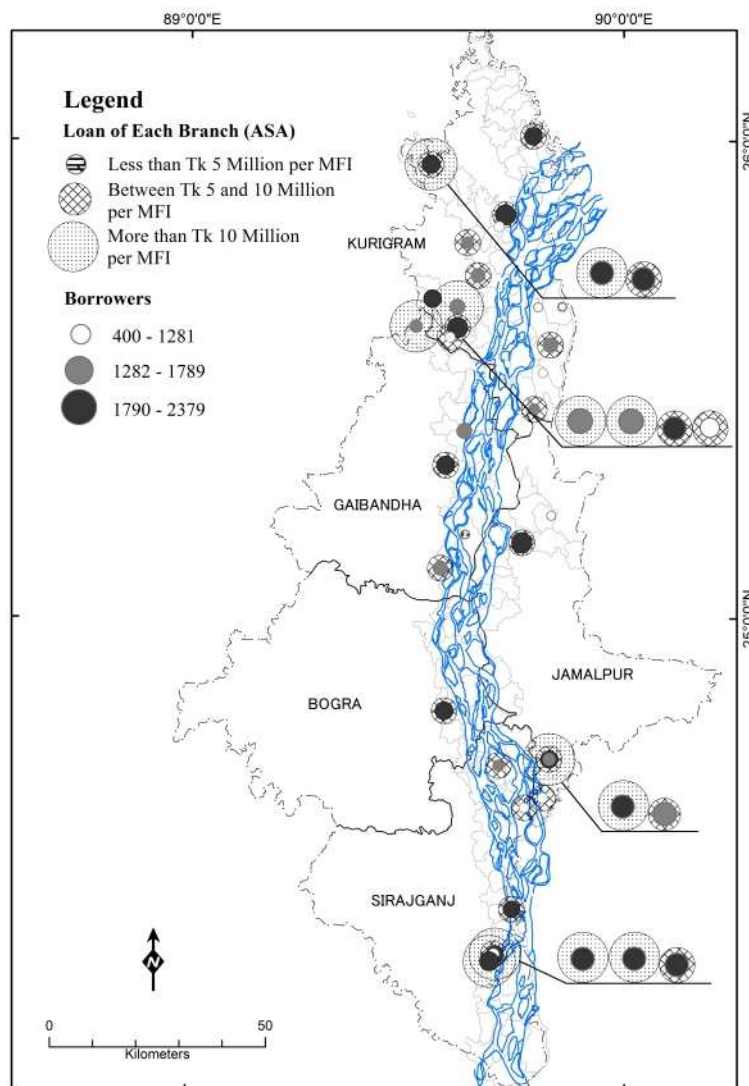
Figure 5-7: Comparison between total outstanding and borrowers (ASA) along the river

side of Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

ASA (Association for Social Advancement) is one of the prominent NGO in Bangladesh. Among the 30 NGOs, ASA is working for social and economic development by providing credit facilities amid rural poor. For detail understanding of ASA's strength in terms of loan outstanding and the number of borrowers in the study sites; the loan outstanding is categorized into three classes such as less than TK 5 million per MFI, between TK 5 and 10 million per MFI and the last one is more than Tk 10 million. Besides that, the total number of borrowers is also categorized into three major classes like (400 to 1,281), (1,282 to 1,789) and last is (1,790 to 2,379). Among 126 unions, a total number of savers, borrowers, savings deposits and loan outstanding are 57,085, 56,531, 30,561,697 and 353,805,656 respectively. There are 35 branches of ASA are working along the river Jamuna. Association for Social Advancement (ASA) is covering 15.07% savers and 17.53% borrowers respectively among the 30 NGOs in the study sites. The capacity of ASA along the Jamuna River is not same in terms of providing loans and their number borrowers. The distribution pattern of loan outstanding is different from district to district. ASA predominantly provides a loan in the district of Kurigram than the other districts of the study sites. The loan distribution pattern of ASA is some sort of uneven in Kurigram district. The loan outstanding of the three branches is more than Tk 10 million, whereas the number of borrowers is only 1,282 to 1,789. Besides that, in the northern part of Kurigram, the number of borrowers is higher, but the loan amount is lower that shows inequality in loan distribution. It indicates that once the less number of borrowers takes a high amount of loan from NGOs, they might go for bigger investment in business sectors where economic opportunities are higher than other study sites. In the middle part of Jamuna River, the number of the borrower is 400 to 1,281 where the loan outstanding is less than Tk 5 Million per MFI. This might happen because, in the middle part of Jamuna, population density is lower than upper and lower part of Jamuna River. As a result, the number of NGOs and NGOs activities in credit sectors also lower. Furthermore, in the lower part of Sirajganj district, the amount of the loan (more than Tk 10 million) and the number of borrowers (1,790 to 2,379) is higher. It also shows that the numbers of borrowers are strongly linked with the loan outstanding in the study sites. In Gaibandha and Jamalpur district, there is some branches borrower number is higher (1,790 to 2,379), but the loan amount is lower (between TK 5 and 10 million per MFI) in comparison to the other branches of ASA. Finally, it can be said that higher number of borrower and outstanding indicates a very high frequency of growth/commercial centers are situated in the sites where the rate of money transaction

is higher. There is also a risk of returning the allocated loan to the borrowers as the amount loan per borrowers is very high in comparison to other NGOs.
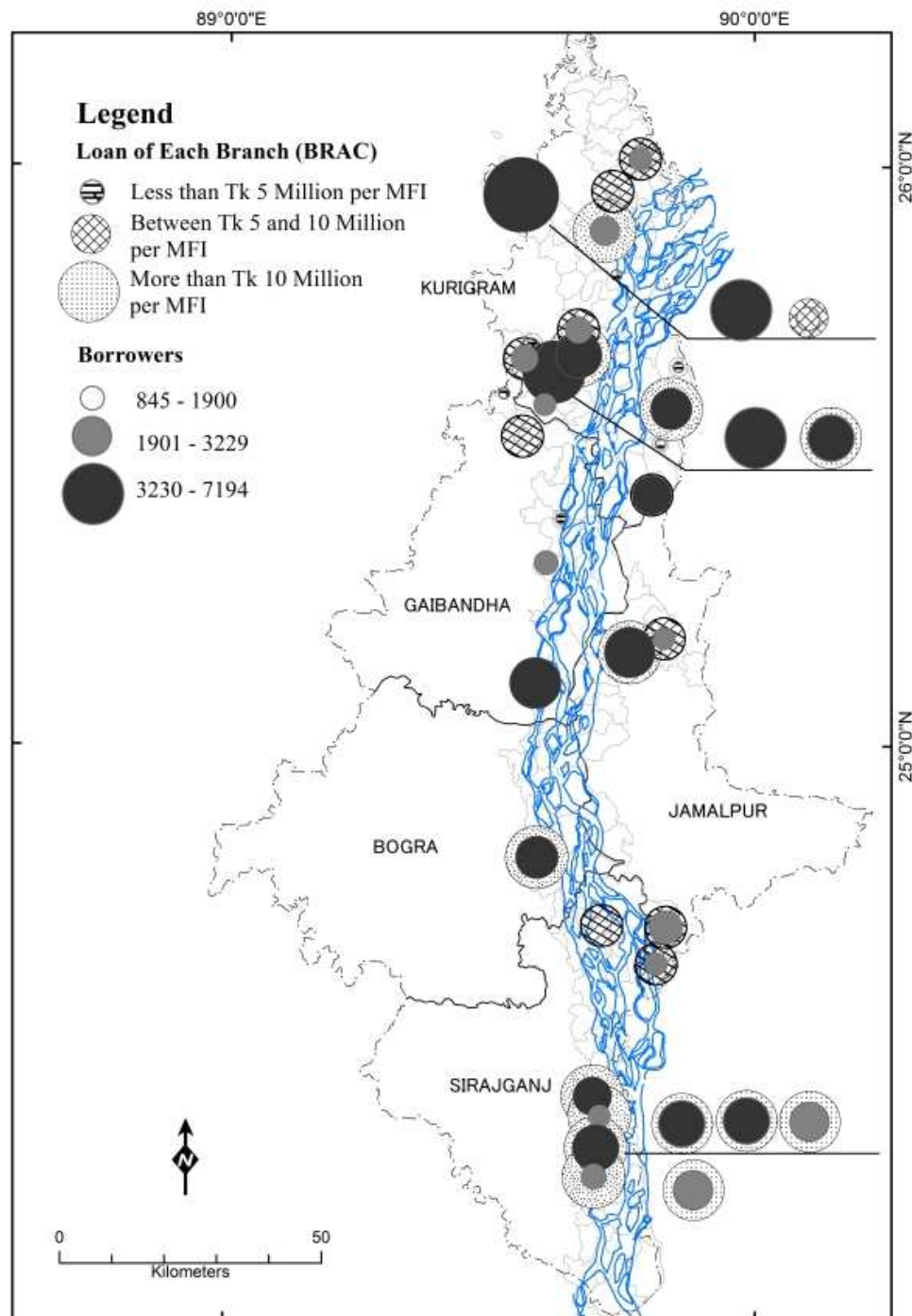
Figure 5-8: Comparison between total outstanding and borrowers (BRAC) along the river side of Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Figure 5-8 demonstrates the BRACs (Bangladesh Rural Advancement Committee) capacity in terms of loan outstanding and the number of borrowers in the study sites. The BRAC (Bangladesh Rural Advancement Committee) is one of the prominent and the famous NGO in Bangladesh that made an enormous contribution to the social and economic development by providing credit facilities amid rural poor. The loan outstanding is categorized into three classes such as less than TK 5 million per MFI, between TK 5 and 10 million per MFI and the last one is more than Tk 10 million. Besides that, the total number of borrowers is also categorized into three major classes like (845 to 1,900), (1,901 to 3,229) and last is (3,230 to 7,194). There are 31 branches of BRAC are working along the river Jamuna. BRAC is covering 27.38% savers and 27.61% borrowers respectively, among the 30 NGOs in the study sites. It indicates that along the river Jamuna, BRAC reaches to the higher number of rural poor who are willing to join in the BRACs credit program. BRACs credit service from the upper to lower stream is almost equal, except for the district of Kurigram. In Kurigram there are a large number of branches of BRAC, which provides a loan to the rural people for their economic purposes. There are only three branches that have a higher loan outstanding (more than Tk 10 million) along with the higher number of borrowers (3.230 to 7,194). On the other hand, in between Gaibandha and Kurigram district, there are some branches where higher concentrations of borrowers (3,230 to 7,194) are located but the loan outstanding is comparatively poor (less than TK 5 million per MFI). Besides that, in the middle of Kurigram district where the loan outstanding is higher, but the number of borrowers is less (1,901 to 3,229). It indicates that, in Kurigram district, there is no proper relation to loan outstanding and borrowers. In the middle stream of Jamuna, where part of Gaibandha, Bogra, and Jamalpur districts are located, the number of BRAC branches is very limited. This might be because here population density is a bit lower with a lack of transportation and communication facilities. The scenario changes drastically when it comes to Sirajganj district where the number of borrowers and the loan outstanding are higher. In some cases, the number of borrowers is medium (1,901 to 3,229) but the loan amount is higher. There are some areas (middle part of Sirajganj district) that have a minimum number of the borrower, but the outstanding level belongs in between Tk 5 and 10 million per MFI. The number of branches for BRAC is some sort of satisfactory, but their spatial distributions are not equal. Finally, it indicates that in Kurigram and Sirajganj district where the numbers of growth centers are higher, the concentration of NGOs' is higher in term of their loan distribution. This step will help to establish new branches of NGOs in the unserved areas to serve rural poor people who are suffering from poverty and daily basic needs.
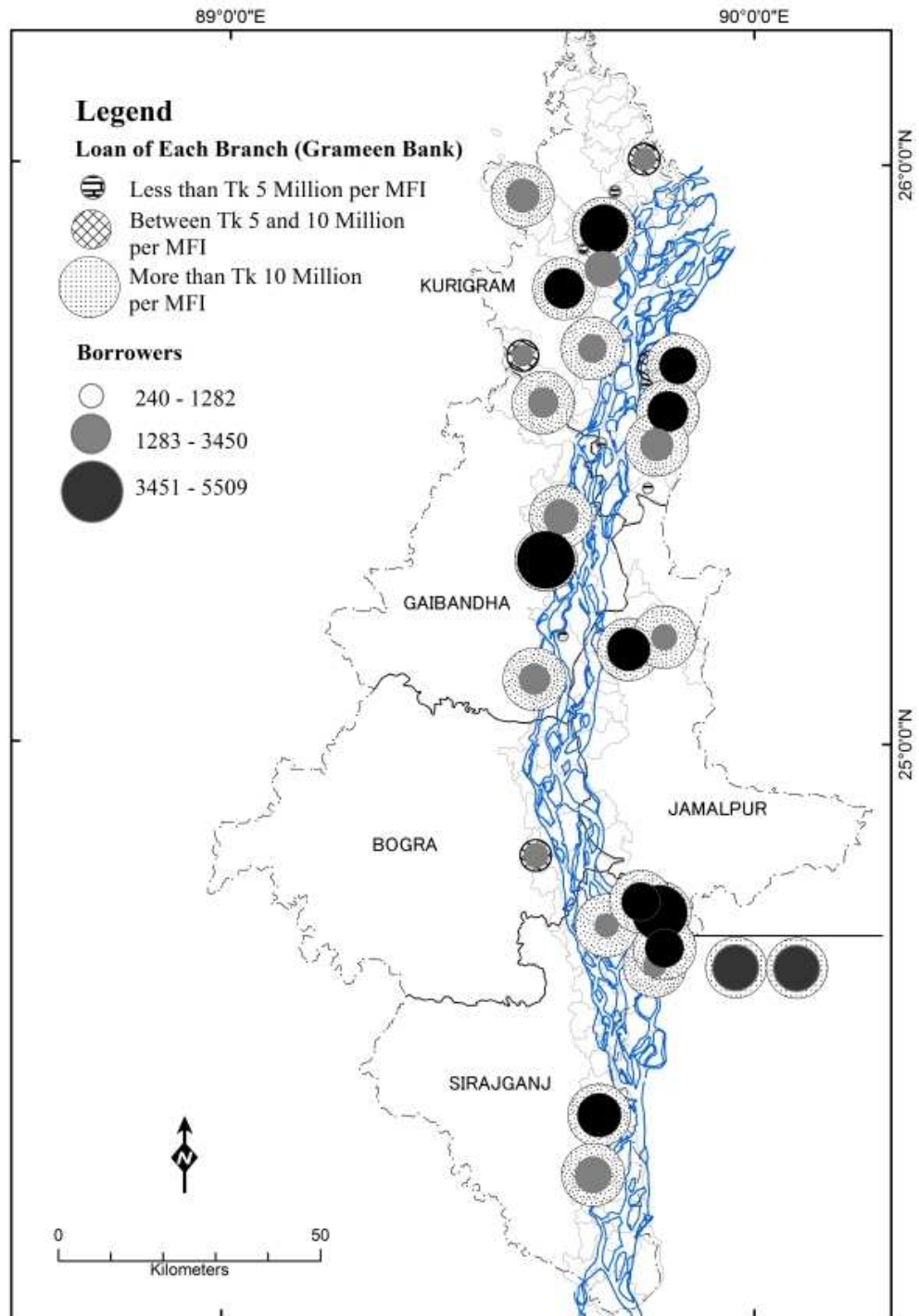
Figure 5-9: Comparison between total outstanding and borrowers (Grameen Bank) along the river side of Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Figure 5-9 illustrates that the Grameen Banks capacity also in terms of the loan outstanding and the number of borrowers in the study sites. The Grameen Bank is one of the prominent and well-known NGO in Bangladesh that made an enormous contribution to the educational, women empowerment in the society, initiated health and sanitation program and finally, working on poverty reduction through micro-credit program in the study sites. The loan outstanding of Grameen Bank is categorized into three classes such as less than TK 5 million per MFI, between TK 5 and 10 million per MFI and the last one is more than Tk 10 million. Besides that, the total number of borrowers is also categorized into three major classes like (240 to 1,282), (1,283 to 3,450) and last is (3,451 to 5,509). There are 31 branches of Grameen Bank are working along the river Jamuna. It covers 25.49% savers and 26.24% borrowers respectively, among the 30 NGOs in the study sites. The activities of the Grameen Bank along the river Jamuna is very notable since its journey. In the upper, middle and lower part of Jamuna River, the number of branches (Grameen Bank) is 15, 6 and 10 respectively. It indicates that in the middle part of Jamuna, Grameen Banks concentration is less than upper and lower parts. However, in the upper part, the concentration of Grameen Banks is higher where they disburse loans among borrowers (1,283 to 3,450) is more than Tk 10 million within 9 branches. Other rest of 6 branches, the amount of the loan outstanding is between TK 5 and 10 million per MFI and the borrowers are varied 1,283 to 3,450 in the study sites. This is because a higher number of population and commercial centers are located in the upper part of Jamuna River especially in the Kurigram district. On the other hand, in the part of the Jamuna, the number of branches of GB is lower (6 branches in total) but in the 5 branches, the loan outstanding is more than Tk 10 million where the number of borrowers is also higher (3,451 to 5,509). There is only one branch loan outstanding and borrowers are between TK 5 and 10 million per MFI and 1,283 to 3,450 distinctly. Furthermore, in the lower part of Jamuna (upper and lower part of Sirajganj district), the services of GB seems to be very operational and effective as well. Among the 10 branches of GB in the upper and lower part of Sirajganj district, all branches have better strength in terms of their borrower (3,451 to 5,509) number and total loan outstanding (more than Tk 10 million).
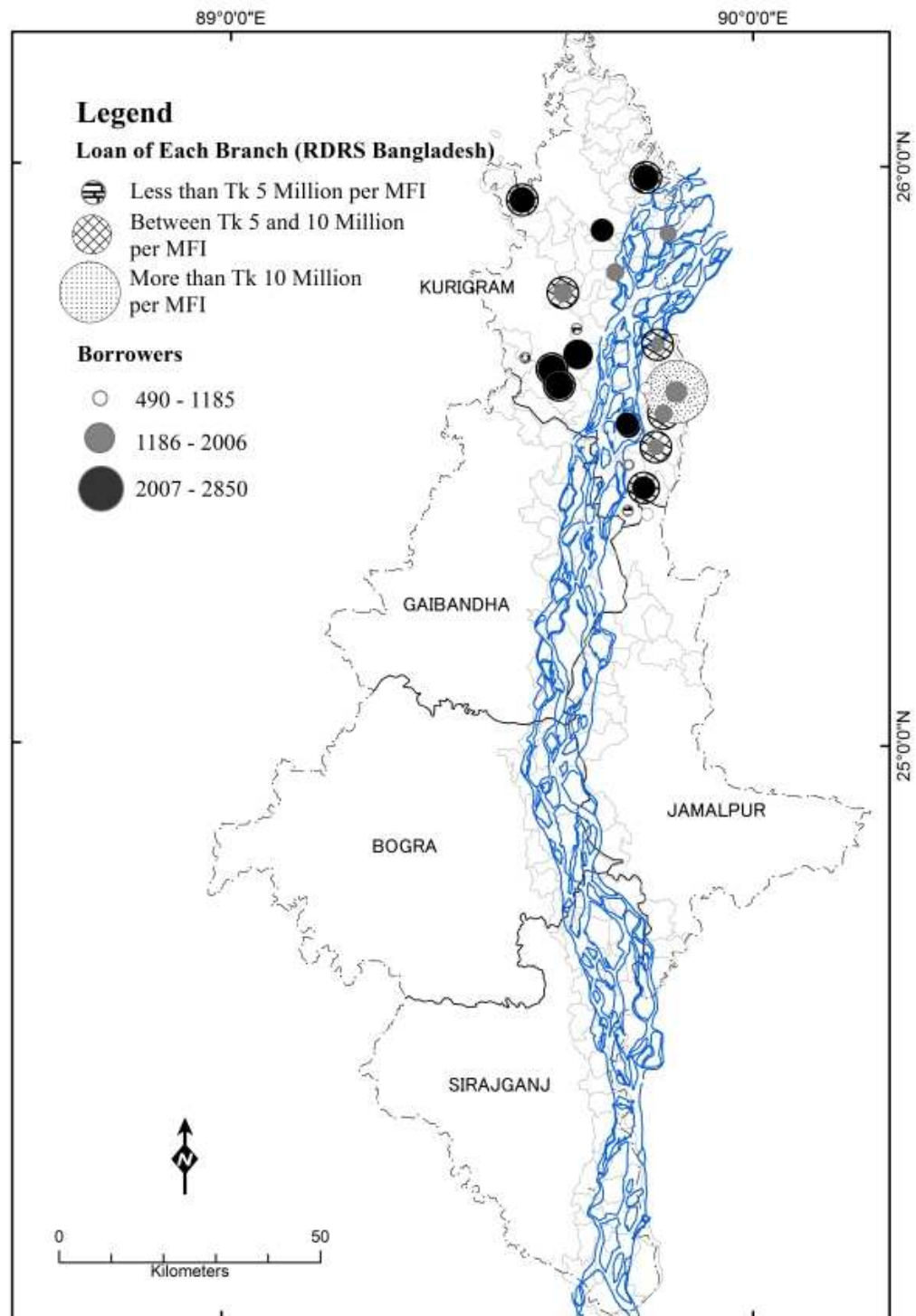
Figure 5-10: Comparison between total outstanding and borrowers (RDRS Bangladesh) along the river side of Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Figure 5-10 shows that the RDRSs' (Rangpur Dinajpur Rural Service) capacity' also in terms of its loan outstanding and the total number of borrowers in the study sites. RDRS is a national level development organization mainly working for the development of rural people in the northern part of Bangladesh. Along the river bank of Jamuna, RDRS only works in Kurigram district to improve rural people's economic status by providing credit facilities. Being an organization this solely works for the social and economic development. Unlike other NGOs, it provides comparatively less amount of financial service than the other organizations. The loan outstanding of RDRS is categorized into three major classes such as (1) less than TK 5 million per MFI, (2) between TK 5 and 10 million per MFI and the last one is (3) more than Tk 10 million per MFI. Besides that, the total number of borrowers is also categorized into three major classes like (490 to 1,185), (1,186 to 2,006) and last is (2,007 to 2,850). There are 22 branches of RDRS are working along the river Jamuna. It covers 12.18% savers and 11.51% borrowers respectively, among the 30 NGOs in the study sites. In the lower portion of Kurigram district, the number of borrowers is higher ranging in between 2,007 to 2,850 per MFI. In several branches of RDRS in Kurigram district, the loan outstanding is not very high in comparison to other NGOs as it has been mentioned earlier. The loan outstanding in several branches is lower (less than TK 5 million per MFI) than the number of borrowers (2,007 to 2,850). In terms of outstanding, there is only one branch that was located in the southern part of Kurigram where loan outstanding is higher (more than Tk 10 million per MFI), but the borrower's number is medium (1,186 to 2,006). It indicates that once a huge amount of loan taken by the borrower for bigger investment is a sign of great progress for the economic development of individuals. But at the same time, it is also considered a higher risk for both the NGO and the borrower, if there have a chance to fails to return the loan.
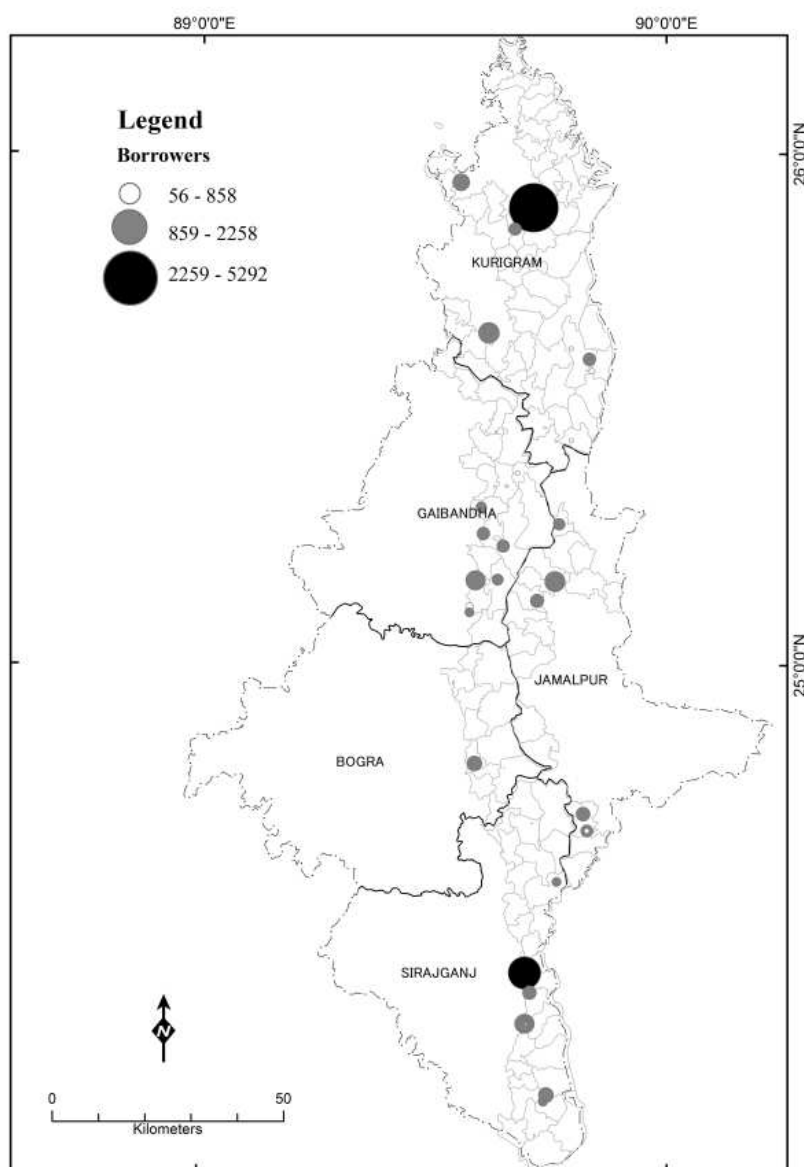
Figure 5-11: Distribution of borrowers (56 branches) along the river side of Jamuna, Bangladesh.

Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

Apart from the four major NGOs, there are 26 NGOs along with 56 branches were located who are working for the economic development of the poor by providing credit services to the poor in the study sites. They cover 19.86% savers and 17.10% borrowers in the study sites respectively. It indicates that the major four NGOs (ASA, BRAC, Grameen Bank and RDRS Bangladesh) are covering 80.14% of the savers and 82.90% of the borrowers in the study sites. In Kurigram, there are five NGOs that have a borrower in between 859 to 2,258, whereas the concentration of NGOs is lower, apart

from major four NGOs. It has been also noticed that very limited number of branches are working in the middle stream of the Jamuna. In the lower part of Sirajganj district, there are very few numbers of NGOs are working with the lower number of borrowers and loan outstanding. The discussions lead us to a conclusion that amount of NGOs is not sufficient to serve a large number of population in the study sites. It takes proper management along with equal distribution of local NGOs according to the population density in the study sites. Besides that, a total number of borrowers and loan outstanding illustrate the strength and weakness of the NGOs capacity. Apart from major four NGOs, rest of 26 NGOs of 56 branches need to increase their capacity by involving more savers and borrowers in the study sites. A number of growth centers are also a backdrop for the development of the rural economy in the study sites. NGOs are providing more loans to borrowers habituated close to the near growth centers. But the people habituated far away from the growth centers are missing from the services of NGOs. If these organizations establish new growth/commercial centers by providing loans to the poor people in the remote areas, then the integrated development will have resulted.

(5) NGOs working area linkage with growth centers and population density

Growth center or commercial center is the rural markets with trade facilities where rural poor people can access inputs for agricultural products such as seeds, fertilizers, agricultural tools, and pesticides. These centers play a significant role in the rural economy where people invest their money for the business purpose and trade their agricultural commodities. Hence, these growth centers have a strong relation with NGOs working area.

There are only 42 commercial/growth centers (used primarily by farmers for selling surplus production to local customers and local traders) and 30 NGOs (175 branches) working in the study sites. Majority of growth centers are located in the upper part of Jamuna River where NGOs loans providing facilities are higher than the middle and lower part of Jamuna River (Figure 5-12a). There are 15 growth/commercial centers and 102 branches of NGOs located in the upper stream of Jamuna river, whereas 8 centers lie in the middle part and 24 branches of NGOs work for the economic improvement of the rural poor. Furthermore, there are rest of 19 growth/commercial centers and 49 branches of NGOs located in the lower stream of Jamuna River (Figure 5-12a).

The distribution of loans (more than TK 10 million per MFI) are higher in Kurigram district than any other districts along the river Jamuna, Bangladesh. This might occur due to the number of commercial centers is higher in the upper part of Jamuna River, where rural people have good opportunities to invest in the profitable sectors. The loans distribution between TK 5 million to 10 million of NGOs are found in the lower part of Jamuna (Sirajganj districts), whereas in the middle part of Jamuna, distribution of loan

is lower (less than 5 million per MFI). The reason is, in the middle part, number of commercial centers and NGOs are lower in number.

On the contrary, NGOs working area is very strongly related to population density, where NGOs have initiated micro-credit facilities; not only due to business purpose but also, they have involved local people to profit-making economic activities. The figure (5-12b) shows that where population density is higher, NGOs concentration is more. For example, in the upper part (Kurigram district) and the lower part (Sirajganj district) of Jamuna River population density is 1,182 to 4,235 per sq km, whereas there are 102 and 49 branches of NGOs respectively. Besides that, in the middle part of Jamuna River population density is 202 to 486 per sq km with a lower number of NGOs as shown in figure (5-12b). In conclusion, distribution of commercial centers, NGOs working area, and population density are strongly related to each other in the study sites.

(a)   (b)
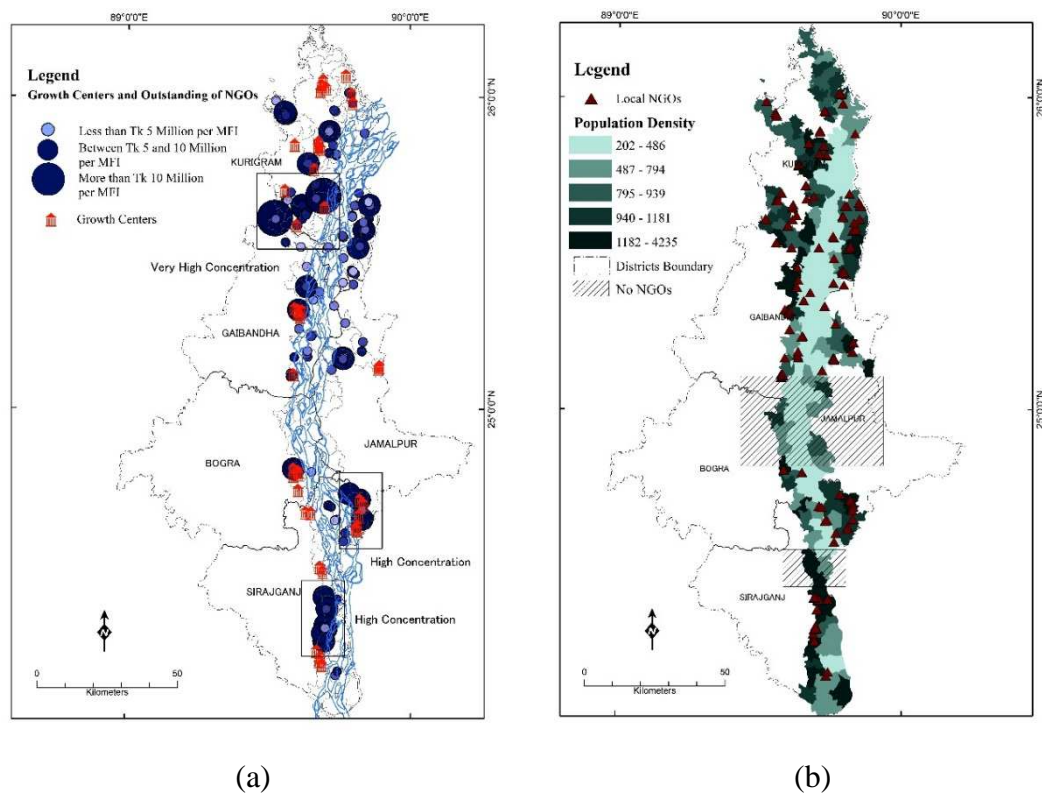
Figures 5-12: (a) NGOs working area linkage with growth centers and (b) NGOs spatial distribution with population density, 2016 along the riverside of Jamuna, Bangladesh
Sources: Made by the author, 2017; data collected from Bangladesh Bureau of Statistics (BBS), Char livelihood Program (CLP), census report 2011 and field survey, 2016

(6) Socio-economic condition

Socio-economic Status (SES) is an economic and sociological collective and total measure of individual's work skill and of a person's or family's economic and social status in relation to others based on income, education, and occupation. This paper has been analyzing family's SES, the household status, earners' education, and occupation status, housing condition, the purpose of getting a loan, before receiving credit, after receiving credit, facing problem in installment are examined. Micro-credit finance is familiar as an operational tool to fight poverty by providing financial services to the rural poor who do not have access to or are neglected by the different financial institutions. Financial services are providing by microfinance institutions (MFIs) generally include savings and credit. Currently, 67.61 million people around the world have access to microfinancing. This number is projected to grow gradually in the future since the target is to reach 100 million poor people with credit by the end of the year 2015. The main structures of the micro-credit institution which differentiate it from other commercial institutions are like

(a) The most deprived segments of population are efficiently targeted;

(b) Financial assistance of members of group in case of emergency;

(c) Generally, requires no security money;

(d) Simple dealings and less documentation;

(e) Mostly group loaning;

(f) Easy and flexible repayment structures; and

(g) Group's interaction with each other's.

The major objectives of micro-credit structures are:

(a) To reduce poverty, accelerate growth and improve the living standards;

(b) To empower women within households as decision makers and in society through active economic participation;

(c) To provide small loans to the poor people at relatively lower cost as compared to accessible informal loans;

(d) To finance economically and socially feasible projects;

(e) To make employment opportunities;

(f) To make self-sufficient and self-employed people; and

(g) To stop manipulation of the poor caused by costly informal credit.

(a) Age group of respondents

The rural people along the riverside of Jamuna were interviewed through a formal questionnaire. Most of the interviews were conducted with age group 22-25 years (Table 5-7) because in the perspective of Bangladesh the major reproductive age group is 15 to 64 years and interview mainly conducted with both male and female respondents. Table 5-7 also shows that 25.9% of the respondents were in the age group of 26 to 30 years

whereas 16.9% and 1.1% of the respondents were in the age group of 31 to 35 years and equal or above 36 years respectively.

Table 5-7: Respondents groups along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Less than or equal 21	56	10.5%	10.5%
2	22 to 25	243	45.6%	56.1%
3	26 to 30	138	25.9%	82.0%
4	31 to 35	90	16.9%	98.9%
5	Equal or above 36	6	1.1%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 5-7 provides the information about the age groups of the respondents. The percentage (%) of the working-age population in Bangladesh was last measured at 53.69% in 2014, according to the World Bank. In the Bangladesh people younger than 15 or older than 64 are in the dependents group and working-age population those ages are 15 to 64 years. Most of the rural people along the riverside of Jamuna are age group of 15 to 45 years engaged in agricultural activities and low-income jobs with limited productivity. Therefore, local NGOs have provided the micro-credit facilities with interest among the poor people for increasing their daily income. In June 2013, the World Bank announced that Bangladesh had reduced the number of people living in poverty line from 63 million to 46 million in the year of 2000 and 2010 respectively. This indicates that Bangladesh will touch its first United Nations-established Millennium Development Goal, that of poverty reduction, two years onward of the 2015 deadline. Bangladesh is also making progress in reducing poverty rate to 26% of the population (Nilanjana, 2013).

(b) Number of male and female respondents

The major shares of the respondents were men that appear to the fact that most of the beneficiaries of micro-credit are male because this research has selected people randomly without any bias towards the gender. Local NGOs along the riverside of Jamuna specially targeted to women for MFIs, because gender discrimination is one of the major causes of slower economic growth, poverty, weaker governance and lower standards of living. According to the facilities, women are poorer and more disadvantaged than men. In my research paper, there were more male respondents than the female respondents. There were religious reasons behind the more male respondents. However, women contribute assertively to the well-being of their family comparatively more than men in terms of age.

Table 5-8: Number of male and female respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Female	194	36.4%	36.4%
2	Male	339	63.6%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

In table 5-8, there are 63.6% of the respondents were male and 36.4% were female. This paper had also classified the respondents in terms of their education and income because sometimes it affects the way in which they could manage their daily lives, household, and business.

(c) Family members of the respondents

Bangladesh has the world's largest rates of population growth in the world. The human population of a country is an asset to control the economic growth but the excessive or unskilled population is a burden for a country. If population growth will accelerate with unskilled population, it is clear that this would seriously affect the economic and social development of the country. There are several causes for the population growth along the riverside of Jamuna, Bangladesh. These are education, healthcare, rural economy and employment. Family planning works if the accessibility of birth control methods is joined with education, employment opportunities for women and growing economic affluence that makes parents to make a plan for their children's education rather than maximizing family size as an economic survival strategy.

Table 5-9: Total family members of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Equal or less than 4	11	2.1%	2.1%
2	5 to 6	147	27.6%	29.6%
3	7 to 8	334	62.7%	92.3%
4	9 to 10	41	7.7%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 5-9 shows that 62.7% of respondents have more than seven members in their family, which indicates that respondents are either illiterate or have no knowledge about family planning. Only 2.1% have equal or less than 4 family members. There are 27.6% respondents have 5 to 6 family members and rest of the 7.7% have 9 to 10 members. There are some local people along the riverside of Jamuna, who believe that without a change in attitudes, achievement in family planning will not be possible. Some people have argued that religion can be an obstacle to family planning since most important

world religions favor large families.

(d) Educational status

Rural development of Bangladesh sometimes becomes exceptionally difficult to determine due to lack of literacy rate and resources. Rural development depends on agriculture development, education, infrastructure, health and sanitation, capacity-building for on-farm employment, making rural institutions and meet up the needs of vulnerable groups. The majority of the rural poor along the riverside of Jamuna, Bangladesh depend on agriculture for their livelihoods. Therefore, rural development faces a challenge to reach both poverty reduction and education. Rural development purposes at improving rural people's livelihoods in the reasonable and sustainable way both socially, economically and environmentally, through better access to assets like natural, physical, human, technological, social capital and services, and control over the productive capital that permit them to improve their livelihoods in a sustainable way.

Table 5-10: Educational status of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Can sign only	117	22.0%	22.0%
2	Illiterate	46	8.6%	30.6%
3	Primary	314	58.9%	89.5%
4	Secondary	56	10.5%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

This paper classified the respondents in terms of their educational status. Table 5-10 indicates that many of the respondents have at least basic education (primary education), which represents 58.9% of the total. There are 22.0% respondents can sign only. However, 10.5% have secondary educational experiences and rest of the 8.6% have no educational background. Education in rural areas takes place at many different levels, from pre-primary schools to secondary level. In rural areas of Bangladesh, social change and economic development have been structured by providing not only basic education but also specific training to improve techniques employed in the rural economy. Social capital with knowledge creates a rural poor more strengthening within rural communities and making their adaptation strategy properly.

(e) Housing condition

The major percentage of the rural poor along the riverside of Jamuna, Bangladesh lived in poor housing conditions. There were four types of houses in the study area: i) *Katcha* house made of bamboo fencing and roofing of one kind of weed leaves locally called *Shawn pata* and mud flooring, ii) *Pakka* house made of wood, bricks, cement, iron rods and steel, iii) Semi *pakka* house made of wood, bricks, cement, iron rods tin

shed with brick flooring and iv) Tin shed made of tin fencing, tin shed and brick or mud flooring. Housing facilities are one of the fundamental rights of human being. In the third world country like Bangladesh, housing facilities are very poor. There are approximately 80% of the people of Bangladesh lining in the rural settlements and 86% of the dwelling units are located in the rural areas (GoB, 1993). There has been very public sector involved in the rural housing. There is no land use plan for the rural areas of the country especially along the riverside of Jamuna which contains 85% of the total land area. The facilities regarding on housing and physical infrastructures are very insufficient in the rural areas of Bangladesh (GoB, 1998). The villagers make a traditional rural house using local resources. The Government or Non-government Organization could not take any significant initiatives for the development of rural housing as a relief measure (Hasan, 1991; 1998).

Table 5-11: Housing condition of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Katcha	417	78.2%	78.2%
2	Pakka	7	1.3%	79.5%
3	Semi Pakka	49	9.2%	88.7%
4	Tin shed	60	11.3%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

The housing condition of the respondents along the riverside of Jamuna is presented in the table 5-11. Among the respondents, most of them have *katcha* house, which is 78.2% of the total. There are 11.3% respondents have tin shed house and rest of the 1.3% and 9.2% respondents have *pakka* and semi *pakka* house respectively.

(f) Purpose of getting loan

Most of the rural poor people in Bangladesh, especially along the riverside of Jamuna have no savings and even sometimes they have negative savings. So, they are not capable to get a small or huge amount from any formal banking institutions. There is a good number of NGOs providing micro-credit facilities to the rural poor in the country. Rural women are greatly promoted by such NGOs. As of late, rural poor people enriched their present poverty condition with the help of NGOs credit facilities. Micro-credit is reaching the extreme rural poor along the riverside of Jamuna. The credit is delivered by mainly from big NGOs followed by Grameen Bank, BRAC, ASA, and RDRS. Most of the NGOs have own office at the union level and they disburse their credit in the remote area through their Centre on the basis of groups. The amount was taken from the organization and it varies from Tk. 0-5000. The loan was received by the rural poor people mainly for business purpose, agricultural tools, buy cattle, gardening, house loan,

making gardening and paltry farm business. Group meeting are held in weekly basis and one group leader designated for payment of the loan and after eight weeks one candidate considered for getting credit. After getting loan rural people give repayment loan as the weekly basis with interest. The interest rates charged by microfinance institutes are high compared to the traditional banks which are about 20%.

Table 5-12: Purpose of getting Loan of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Business Purpose	84	15.8%	15.8%
2	Buy Cattle	96	18.0%	33.8%
3	Buy agricultural tools	207	38.8%	72.6%
4	Kitchen gardening	94	17.6%	90.2%
5	House loan	19	3.6%	93.8%
6	Making gardening	8	1.5%	95.3%
7	Paltry farm	25	4.7%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

The purpose of getting Loan of the respondents along the riverside of Jamuna is presented in the table 5-12. Among the respondents, most of them were getting the loan for buying agricultural tools which are 38.8% of the total borrower. There are 18.0% respondents were getting loan for buying cattle and rest of 15.8%, 17.6%, 3.6%, 1.5% and 4.7% respondents are getting the loan for the purpose of business, kitchen gardening, house loan, making gardening and paltry farm business respectively.

(g) Before receiving credit (Occupational status)

The rural economy of Bangladesh has been a potential source of economic growth and has significantly reduced poverty. Agriculture activities are the main sources of rural jobs in Bangladesh. Agriculture has played a significant role in reducing Bangladesh's poverty from 48.9% in 2000 to 31.5% by 2010. Over 87% rural people originate at least some income from agricultural activities (World Bank, 2016). There is approximately one-fifth of GDP (20.01%) comes from agriculture sector (BBS, 2012). Women are contributing around half of the population in Bangladesh and the majority of them live rural areas (BBS, 2010). Women contribute to agricultural production but it has hardly been accepted. Because of the existence of traditional society male dominate in development activities generally. However, two-thirds of rural households depend on both farm and non-farm incomes like a business, daily labor, industrial activities and so on. Poor agriculture growth and river bank erosion have inspired to the rural poor for non-farm economic activities in Bangladesh.

Bangladesh is a developing country, therefore, many of the foreign organization donates in the different sectors through local NGOs for reducing poverty. Small loans

or micro-credit to the poor on special terms has existed for a long time in many countries. Receiving small credits from the local NGOs, rural poor people have invested money in different profitable sectors. Some have invested in the business sectors like shops, making boats for transportation business and some are investing to the kitchen gardening and to the agricultural sectors. Before receiving credit rural people suffers a lot. Some people engaged into the agricultural sectors, some are doing business, daily labor and some are in the industry. The poverty condition was classified into five categories in Bangladesh and these are (1) non-poor; (2) tomorrow's poor; (3) absolute poor; (4) hardcore poor; and (5) finally, ultra-poor (Extreme Poverty Policies of Donors in Bangladesh: An Overview, 2007).

Table 5-13: The status (Before receiving credit) of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Agricultural activities	214	40.2%	40.2%
2	Business	61	11.4%	51.6%
3	Daily Labour	37	6.9%	58.5%
4	House wife	194	36.4%	94.9%
5	Industry	27	5.1%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 5-13 shows that 40.2% of the respondents were involved with agricultural activities. Among the respondents, majority percent were housewife which is 36.4% of the total. There were 11.4% respondents involved into the business activities and rest of 6.9% and 5.1% respondents have involved with daily labor and industry respectively.

(h) After receiving credit

It usually seems that micro-credit program helps to progress socio-economic status of the rural poor people in Bangladesh. Consequently, this micro-credit program improved the economic status of the credit recipients and also increased the household assets. The majority of the respondents upgrade their poverty situation by properly utilizing the credit received. The participation of the rural poor in micro-credit program had a positive impact on the standard of living. This indicates that there is a positive affiliation between poverty reduction and micro-credit, i.e., after taking loan poverty level of the participants decreased significantly.

Table 5-14 shows that there is a significant contribution in receiving credit with income through proper utilization of credit with different activities like agricultural activities, agricultural activities with poultry farm, business, daily labor, and industry. Among these activities, income through proper utilization of credit is the most important backing factor to individual development. Jehangir et al. (2002) conducted similar study

who found that there was a positive and significant relationship between the amount of credit and the total income. Table 9 indicates that before involvement with credit program, the percentage of respondents engaged with agricultural activities were 40.2% and thereafter decreased to 38.8%. Accordingly, before involving with micro-credit, the percentage of a businessman was 11.4% and then increased to 18.0%. Before involving with micro-credit, the percent of the daily laborer and housewife were 6.9% and 36.4%, thereafter it decreased to 5.4% and 31.3% respectively. There are 5.1% of the respondents have involved to the industry sectors. This implies that frequency of poverty decreased through access to credit.

Table 5-14: The status (After receiving credit) of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Agricultural activities	207	38.8%	38.8%
2	Agricultural activities with paltry farm	7	1.3%	40.2%
3	Business	96	18.0%	58.2%
4	Daily Labour	29	5.4%	63.6%
5	House wife	167	31.3%	94.9%
6	Industry	27	5.1%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

(i) Monthly income

Respondents along the riverside of Jamuna, Bangladesh had increased their income by undertaking different productive activities utilizing credit received from the different local NGOs. Main sources of income were agricultural activities; agricultural activities with a paltry farm, business, daily labor, industry and other livelihood activities. On the basis of income per month, the respondents were classified into three different categories, such as low income: up to Tk. 5,000, medium income: Tk. 5,001 to Tk. 10,000 and high income: Tk 10,001 and above (1 USD = 78.7353 BDT).

Table 5-15: Monthly income (Before and after joining to local NGOs) of the respondents along the riverside of Jamuna, Bangladesh, 2016

	Monthly income	Before Frequency	Before Percent (%)	After Frequency	After Percent (%)
1	5000 tk	479	89.9%	220	41.3%
2	5001-10000 tk	41	7.7%	293	55.0%
3	10001 tk	13	2.4%	20	3.8%
	Total	533	100%	533	100%

Source: Made by the author, 2017; data collected through field survey, 2016

Table 5-15 indicates the earlier involvement with credit program, the majority of the respondents (89.9%) were in a low-income group, 7.7% in medium income and the rest of 2.4% in high-income groups. Thereafter joining the micro-credit program, low-income group decreased intensely (89.9% from 41.3%), medium income group increased significantly (7.7% from 55.0%) and a little number of respondents also improved their income with a high amount (2.4% from 3.8%). Similar results also found by Mazumder and Wencong (2013) who conducted research in six villages of three unions of Gangachhara Upazila of Rangpur district in the northwest region of Bangladesh. They found that majority of the respondents were in the low-income group which is 63.3% of the total and nearly one-fourth of them (26.7%) in medium income and the rest of 10% in high-income groups. Thereafter joining the micro-credit program, medium income group increased rationally (45.6% from 26.7%) and low-income group decreased significantly (40.0% from 63.3%). A few respondents (14.4%) also improved their income with high amount.

(j) Current economic status

Income and savings are positively connected which indicates that once their income increases, then they get the ability for savings. If the savings increase, then there will be a positive impact on the financial situation of the family because the establishment of economic empowerment associated with income, savings and employment opportunities.

Table 5-16: Current economic status of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	Bad	74	13.9%	13.9%
2	Good	459	86.1%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

The current economic status of the respondents along the riverside of Jamuna, Bangladesh, 2016 is presented in the table 5-16. Most of the respondents are in good economic status which is 86.1% of the total. There are 13.9% respondents have bad economic status because lack of training to utilize the money and difficulty in getting a large amount of loan.

(k) Facing problem in installment

Failure to utilize credits is the main causes for the repaying of the installment. There are some other causes for creating the unwillingness to take loan and husband's opposition, natural calamities, as well as unsupportive behaved of the official stuffs are the main reasons for repaying of the installment.

Table 5-17: Facing problem in installment of the respondents along the riverside of Jamuna, Bangladesh, 2016

		Frequency	Percent (%)	Cumulative Percent
1	No	458	85.9%	85.9%
2	Yes	75	14.1%	100%
	Total	533	100%	

Source: Made by the author, 2017; data collected through field survey, 2016

Facing problem in the installment of the respondents along the riverside of Jamuna, Bangladesh, 2016 is presented in the table 5-17. Among the respondents, most of them have no problem in repayment of installment which is 85.9% of the total. There are 14.1% respondents have a problem in repayment of installment.

(7) Significant assets of the rural poor before and after involvement to micro-credit

Household luxurious assets in the perspective of rural Bangladesh include electricity, *pakka* toilet, sources of drinking water like tube well, television, radio, bicycle, fan, boat and agricultural tools. Distribution of micro-credit to the respondents, almost all of them increased their assets after joining the credit program. After involvement with local NGOs credit program, they capitalized money in different income generating activities like business, agricultural sectors, kitchen gardening and poultry farming business and improved their economic condition. Similar findings also found by Haque and Masahiro (2009) by conducting NGOs-MFIs Members- Impact Assessment Survey, found that around 98.33% borrowers had some kind of luxurious assets and the others could not rise their current situation due to some unexplained reasons.

The significant assets of the respondents before and after getting involved with micro-credit along the riverside of Jamuna, Bangladesh, 2016 is presented in the table 5-18. Electricity consumption determined the rural development by everyday use of electricity facilities before and after joining the NGOs credit program. Table 5-18 shows that before involvement with local NGOs credit program, there were 98.9% respondents that are unable to connect with electricity facilities. But after involvement with NGOs credit program, electricity non-consumers percentage decreased to 72.2%. There are 1.1% respondents had electricity facilities before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 27.8% of the total respondents. It is observed that economic solvency may influence to consume more electricity facilities compared to an earlier situation. Similar results also found by Mazumder and Wencong, 2013 who conducted in six villages of three unions of Gangachhara Upazila of Rangpur district in the northwest region of Bangladesh. They found that before joining the NGOs credit, there were 55.6% respondents unable to connect with electricity facilities. But after involvement, electricity non-consumers percentage decreased to 37.8%. Another similar result also found by Rahman et al.

(2003) in their study "Microcredit Programs and Consumption Behavior: Are the Borrowers Better Off? Evidence from Bangladesh in 2003 and found that borrowers as a whole were good in consumption such as fuel and electricity. There is a positive relation between micro-credit and standard of living in all aspects. Adam (2010) found similar findings and it shows that there has been a positive relationship between financial expenditures and standard of living.

Table 5-18: Significant assets of the respondents before and after involvement with micro-credit along the river side of Jamuna, Bangladesh, 2016

Assets	Sl No	Response	Frequency (Before no involvement)	Before Percent (%)	Frequency (After involvement)	After Percent (%)
Electricity	1	No	527	98.9%	385	72.2%
	2	Yes	6	1.1%	148	27.8%
		Total	533	100.0%	533	100.0%
Toilet	1	No	500	93.8%	353	66.2%
	2	Yes	33	6.2%	180	33.8%
		Total	533	100.0%	533	100.0%
Drinking water	1	No	521	97.7%	313	58.7%
	2	Yes	12	2.3%	220	41.3%
		Total	533	100.0%	533	100.0%
Television	1	No	526	98.7%	448	84.1%
	2	Yes	7	1.3%	85	15.9%
		Total	533	100.0%	533	100.0%
Radio	1	No	108	20.3%	35	6.6%
	2	Yes	425	79.7%	498	93.4%
		Total	533	100.0%	533	100.0%
Bicycle	1	No	490	91.9%	465	87.2%
	2	Yes	43	8.1%	68	12.8%
		Total	533	100.0%	533	100.0%
Fan	1	No	527	98.9%	394	73.9%
	2	Yes	6	1.1%	139	26.1%
		Total	533	100.0%	533	100.0%
Boat	1	No	384	72.0%	240	45.0%
	2	Yes	149	28.0%	293	55.0%
		Total	533	100.0%	533	100.0%
Agricultural Tools	1	No	230	43.2%	192	36.0%
	2	Yes	303	56.8%	341	64.0%
		Total	533	100.0%	533	100.0%

Source: Made by the author, 2017; data collected through field survey, 2016

Sanitation system has changed within the NGOs credit respondents. There are different types of toilet users before and after joining the NGOs credit program. Table 5-18 shows that after involvement with credit program, the percentage of *pakka* toilet (metaled toilet) users increased from before. It shows that before involvement with local

NGOs credit program, there were 93.8% respondents had no *pakka* toilet. But after involvement with NGOs credit program, the percentage of *katcha* toilet users decreased to 66.2%. There are 6.2% respondents had *pakka* toilet before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 33.8% of the total respondents. The analysis shows that after involvement with NGOs credit program, the percentage of *katcha* toilet (without ring slab) and open space users decreased from 93.8% to 66.2% respectively. After getting involved with credit program respondents became more aware of health and sanitation practices. Similar findings were found by Nelly et al. (1999) from the study of the impact of microcredit in Bolivia that provided to women groups. They found that micro-credit increased income and savings, improved health/nutrition knowledge and practice, as it has empowered women. Similar results also found by Mazumder and Wencong, 2013 who conducted in six villages of three unions of Gangachhara Upazila of Rangpur district in the northwest region of Bangladesh. Their findings show that after involvement with credit activities, the percentage of *pakka* users increased from 44.5 to 82.3%. Significant assets of the respondents before and after involvement with micro-credit are as below:
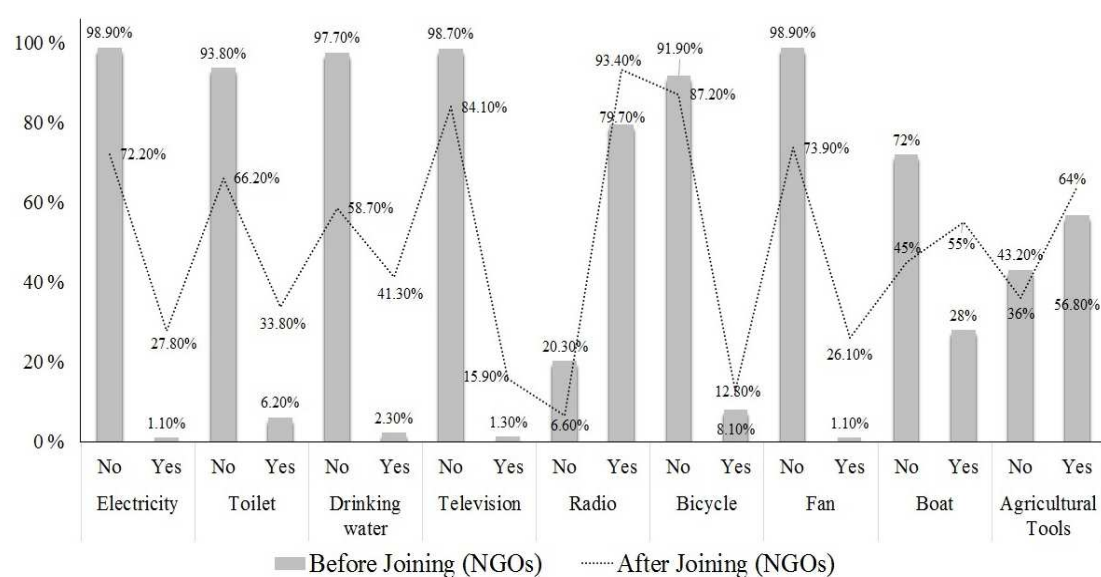
Figure 5-13: Significant assets of the respondents before and after involvement with micro-credit along the river side of Jamuna, Bangladesh, 2016
Source: Made by the author, 2017; data collected through field survey, 2016

The standard of living includes sources of drinking water. Sources of drinking water were changed by the number of respondents before and after joining the NGOs credit program. Table 5-18 shows that after involvement with credit program, the percentage of tube well users increased from before. Table 5-18 indicates that 97.7% of the respondents used pond water or river water to meet their daily life activities before

their involvement in NGOs credit program whereas before joining only 2.3% respondents used tube well. A substantial change within the respondents in respect of their use of drinking water is seen after joining to the NGOs credit program. Economic soundness of the NGOs credit respondent encourages to use tube wells. Table 5-18 indicates that 41.3% of the respondents used tube well to meet their daily life activities after joining in NGOs credit program' whereas the number of pond water or river water users decreased from 97.7% to 58.7% respectively. This indicates that NGOs credit increase the health consciousness within the respondents.

The luxurious asset like television of the respondents before and after involvement with micro-credit along the riverside of Jamuna, Bangladesh, 2016 shows in the table 5-18. There were 98.7% respondents, who had no television facilities. But after involvement with NGOs credit program, television non-consumers percentage decreased to 84.1%. There are 1.3% respondents had television before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 15.9% of the total respondents. After participating in credit program, respondents utilized their credit and earned more money the then situation. Table 5-18 shows the respondents asset like radio before and after involvement with micro-credit along the riverside of Jamuna, Bangladesh, 2016. There were 20.3% respondents, who had no radio facilities. But after involvement with NGOs credit program, radio non-consumers percentage decreased to 6.6%. There are 79.7% respondents had radio facilities before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 93.4% of the total respondents.

The bicycle is a small-scale local means of transport in the research sites. Especially along the riverside of Jamuna bicycle is used for traveling long distance and transportation facilities. Table 5-18 shows the respondents asset like bicycle before and after involvement with micro-credit along the riverside of Jamuna, Bangladesh, 2016. There were 91.9% respondents had no bicycle facilities. But after involvement with NGOs credit program, bicycle non-consumers percentage decreased to 87.2%. There are 8.1% respondents had bicycle facilities before getting involved with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 12.8% of the total respondents. Table 5-18 shows that after involvement with credit program, the percentage of electric fan users increased from before. It shows that before involvement with local NGOs credit program, there were 98.9% respondents had no electric fan. But after involvement with NGOs credit program, the percentage of electric fan non-consumers decreased to 73.9%. There are only 1.1% respondents had electric fan before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 26.1% of the total respondents.

The boats are loading out different functionalities ranging from catching fishes, transporting people or big goods, making business and providing shelter along the riverside of Jamuna. Table 5-18 shows that after being involved with credit program, the percentage of boat owners increased from before. It shows that before involvement with local NGOs credit program, 72.0% respondents had no personal boat. But after getting involved with NGOs credit program, the percentage of boat non-consumer decreased to 45.0%. There are only 28.0% respondents had to boat before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 55.0% of the total respondents. Mazumder and Wencong, 2013 had got parallel findings that there has been a positive affiliation between economic expenses and standard of living.

Rural farmers are the backbone of the country's economic development. Agriculture is the main source for the rural economy; therefore it should come with better access to the agricultural tools to the rural poor for producing better crops. In the study area, there were 43.2% respondents had no agricultural tools for producing crops before involvement with local NGOs credit program (Table 5-18). But after involvement with NGOs credit program, the percentage of agricultural tool non-consumer decreased to 36.0%. There are 56.8% respondents had agricultural tools before involvement with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 64.0% of the total respondents.

(8) Correlation results of income and selected eight dependent variables

This section presents a correlation analysis performed to show how the selected eight dependent variables correlate with farmer's annual income (independent variable). Eight dependent variables were selected for this analysis including; solar panel electricity, cemented toilet, tube-well water, television, radio, bicycle, electric fan and wooden boat. The correlation analysis presented in table 5-19 shows that the correlation of coefficient for solar panel electricity is (r) equals to 0.763, indicating a significant relationship between solar panel electricity and their income ($r = 0.763$, $p < 0.001$). Lack of access to electricity services is one of the reasons for poverty and minimal growth in economic development. This might happen because people with higher incomes tend to buy a solar panel for getting services from modern assets like television and electric fan. By using those assets, they want to improve their daily lifestyle as well as increase social status among the rural community.

In the rural areas, low-income householders cannot afford the cost for making latrines (cement, rod, and brick chips). The correlation coefficient is for making latrines equals to 0.519, indicating a significant relationship between the increase of income and cemented toilet. As a result of joining NGOs credit program, their income and awareness regarding clean environmental conditions, sanitation has improved. Besides that, there

were also positive and significant correlation between the number of luxurious assets such as tube-well water, television, radio, bicycle, electric fan and wooden boat with an increment in annual income and their correlation of coefficient (r) equals to 0. 250, 0.773, 0.192, 0.507, 0.673 and 0.571 respectively. Finally, results of correlation coefficient show that access to micro-credit facilities, provision of livestock and agricultural loans made farmers able to improve profit from farming as well as improve their social status within the community by using luxurious assets.

Table 5-19: Correlation results of income and selected eight dependent variables using equation (1)

	TNP	THH	p-value	df	Coefficient (r)
INC and SPE					
Pearson Correlation	3,406,272	828,183	0.000	1	0.763**
Sig. (2-tailed)					
INC and CT					
Pearson Correlation	3,406,272	828,183	0.000	1	0.519**
Sig. (2-tailed)					
INC and TW					
Pearson Correlation	3,406,272	828,183	0.005	1	0. 250**
Sig. (2-tailed)					
INC and TV					
Pearson Correlation	3,406,272	828,183	0.000	1	0.773**
Sig. (2-tailed)					
INC and RD					
Pearson Correlation	3,406,272	828,183	0.031	1	0.192**
Sig. (2-tailed)					
INC and BICY					
Pearson Correlation	3,406,272	828,183	0.000	1	0.507**
Sig. (2-tailed)					
INC and EF					
Pearson Correlation	3,406,272	828,183	0.000	1	0.673**
Sig. (2-tailed)					
INC and WB					
Pearson Correlation	3,406,272	828,183	0.000	1	0.571**
Sig. (2-tailed)					

Source: Made by the author, 2017; data collected through interview with local people of 126 unions (focused group discussions and interviews with 175 branches of

30 NGOs)

** Correlation is significant at the 0.01 level (2-tailed).

* INC= Income, SPE= Solar panel electricity, THH= Total Household, CT= Cemented Toilet, TW= Tube-well Water, TV= Television, RD= Radio, BICY= Bicycle, EF= Electric Fan, WB= Wooden Boat and TNP= Total number of population.

5.4 Conclusion and recommendations

This research studied NGOs micro-credit programs and its contribution to poverty alleviation in the rural areas of Bangladesh. The study has also performed a spatial analysis to identify areas where NGOs have initiated micro-credit programs along with the areas where such NGOs needs to shift their focus for the same purpose. Micro-credit program has helped rural poor people to improve the socio-economic status in the study area. Majority of the respondents had improved their poverty situation by proper utilization of the support they got from NGOs credit programs. It indicates that there is a positive relationship between access to micro-credit and poverty reduction. On the contrary, there are some important causes for dropout of rural poor from local NGOs including high-interest rate, higher repayments of installment, difficulty in getting a large amount of loan, and poor management of loan system. Still, there are many rural poor who were not interested to get involved in the process of NGOs credit, while many local NGOs are operating credit services at their doorsteps. The geospatial analysis results showed that the distribution of local NGOs is not equal in the study sites. The NGOs attributes like savers, borrowers, saving deposits and their total loan outstanding's indicate the strengths and weaknesses of the NGOs. From the point of view of NGOs' strength, the middle part of Jamuna River is the most unprivileged area in the study sites. Furthermore, NGOs working area is linked with growth/commercial centers and population density. It indicates that, where the number of growth center or commercial centers and population density are higher, NGOs activities are also higher those areas. Besides that, correlation results of income and selected eight dependent variables (solar panel electricity, cemented toilet, tube-well water, television, radio, bicycle, electric fan and wooden boat) have positive relations. In conclusion, this paper suggests that the equal distribution of local NGOs and upsurge in income through proper utilization of micro-credit as well as appropriate monitoring system needs to be established among the microfinance institute in the study sites.

6.1 Introduction

There are many prominent NGOs working in several sectors such as education, agriculture, poverty reduction, women empowerment, health, and sanitation by providing NGOs credit along the riverside of Jamuna, Bangladesh. While, the Jamuna River lies within a gigantic delta complex that has been growing for millions of years and comprises the greater part of Bangladesh, where bars are important topographical features in all orders of river channels (Williams and Rust, 1969). On the huge flat floodplain at the confluence of the three main rivers like Jamuna, Padma, and Meghna, the livelihoods of the rural poor are primarily affected by water-related disasters, including floods, drought, riverbank erosion, cyclones, and tidal surges due to the geographical setting of the country (Chowdhury, 2010). Besides that, riverbank erosion is one of the most noticeable disasters in Bangladesh, produced a dynamic channel shifting of the rivers. It annually affects about 100,000 people, including the poor, who face substantial social poverties, such as loss of homestead, lands, and agricultural crops, and being displaced to the riverine fringe land, *char* lands (ADB, 2013).

Furthermore, the *char* people and their settlements in the Jamuna River channel are under threat due to floods (Islam, et al., 2010) whereas the flooded area has progressively increased in the recent year (Islam, 1995). For example, the area affected by floods was 25.6%, 71%, and 36.6% in the year of 1954, 1974 and 1998 respectively, whereas the 1988 flood fixed a new record for the inundated area and it is one of the worst floods in recent decades. (IUCN, 1993; Ahmed and Falk, 2008; Hoper, 1998). However, the displacement of *char* settlement takes place in almost 3 to 5 times in their lifetime, and widespread flooding which damages crops, infrastructure, *char*-land settlements and communication networks (Mafizuddin, 1992). The *char* people always have to fight against natural calamities and poverty as well as food insecurity as of the unstable land (Haq, 1981; Elahi, 1991; Kabir, 2006).

The geographic characteristics of *char* landscapes, in terms of fluvial morphology and monsoon climate, have made the *char*-lands highly vulnerable to flood disasters (Coleman, 1969; Baqee, 1986; Baqee, 1993b). The Jamuna river can discharge a great amount of water> 100000 m3/s in the monsoon season (June to September) (Ministry of Irrigation Water Development and Flood Control, 1993). The surplus water makes widespread flooding which damages the *char*-land settlements, agricultural crops, infrastructure, communication networks, and lives. There are over 12 million poor people living in *char*-lands and struggle against the floods and river bank erosion (Haque and Zaman, 1989; Hooper, 2001).

For the consequences, there are around 80% of the villagers in Bangladesh are now

sheltered under NGOs activities. About 13000 NGOs are engaged in micro-credit operations. The majority of these NGOs are small: the few large NGOs are Grameen Bank, BRAC, Proshika, and ASA. Micro-credit is provided to the poor for self-employment, income-generating activities and afforestation and other poverty reduction program (Holloway and Richard, 1995).

The broad aim of the research is to make a plan for NGO's at district level along the riverside of Jamuna, Bangladesh. This research also tries to discuss the connection between the geo-spatial database of non-government organizations and satellite images that can be of assistance for further planning. Strategic planning delivers an outstanding opportunity to collect the opinions and demands of the local NGO's beneficiaries, managers, staff, donors and other stakeholders of the organization. Accordingly, a participatory approach to strategy development can also have significant to team constructing, enhanced organizational communication. However, to fulfill the aim, specific objectives are being set for this study includes; (1) to explore the spatial distribution of local NGOs in the study area; (2) study the relationship between NGOs' activities and population density; (3) investigate the chronological changes of *char* lands from 1985 to 2015 of Jamuna, Bangladesh; and (4) finally, to make a plan for the local NGOs distribution to minimize the distance from the centers of commerce and social services areas along the riverside of Jamuna, Bangladesh.

6.2 Data sources and methods

Primary data was collected from a different group of respondents in the study sites. A total of 533 respondents were interviewed questionnaire method and 50 focus group discussions (FGD) were also conducted at union council (combination of few villages) along the riverside of Jamuna, Bangladesh. The information on educational facilities, agricultural provision, health, and sanitation were collected from the local peoples in the study sites. The absolute information regarding on the physical locations of 30 NGOs with 175 sub-branches were collected using GPS (Global Positioning System). The study interviewed these following groups:

(a) Local community (total 50 FGDs); and

(b) Local people who are involved in NGOs credit program of 126 unions (Information's of NGOs facilities on education, agriculture, health, and sanitation were collected using 533 questionnaires)

Secondary data were collected from some selected NGOs (30 NGOs with 175 sub-branches) along the river Jamuna, Bangladesh. Furthermore, secondary data were also acquired from the Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS) and from Center for Environmental and Geographic Information Services (CEGIS).

(1) Data analysis and collection

ArcGIS 10.2 has been used for detailed mapping and analysis of the NGOs working area of the sample sites. Based on the physical location of MFI branches (175 branches), this paper tried to find out working gap areas in the study sites using ArcGIS 10.2. Besides that, grid method is used for NGOs equal distribution planning for ensuring optimal distances from the NGOs centers along the river Jamuna, Bangladesh. There are 30 NGOs with 175 sub-branches that had identified with the help of GPS within 126 unions (Unions are the smallest rural administrative organogram and local government units in Bangladesh) of 5 districts along the riverside of Jamuna, Bangladesh. Furthermore, this paper used GCPs (Ground Control Points) accurately for properly geo-referencing of the images. A participatory mapping method was used to understand the changes of the river shifting of Jamuna over 30 years along with the local people's knowledge.

Resolution is a factor in this research. The Landsat TM images gave a unique opportunity to compare the years and the ability to show the detail classification of landmass along the riverside of Jamuna, Bangladesh.

The main focus of this chapter is to provide an in-depth understanding of chronological changes of Jamuna river shifting and make the proper planning of NGOs distribution to minimize the distance of service zones. Landsat TM (The year of 1985, 1995 and 2005) and WorldView (The year of 2015) images were used for detail understanding of the Jamuna River shifting.
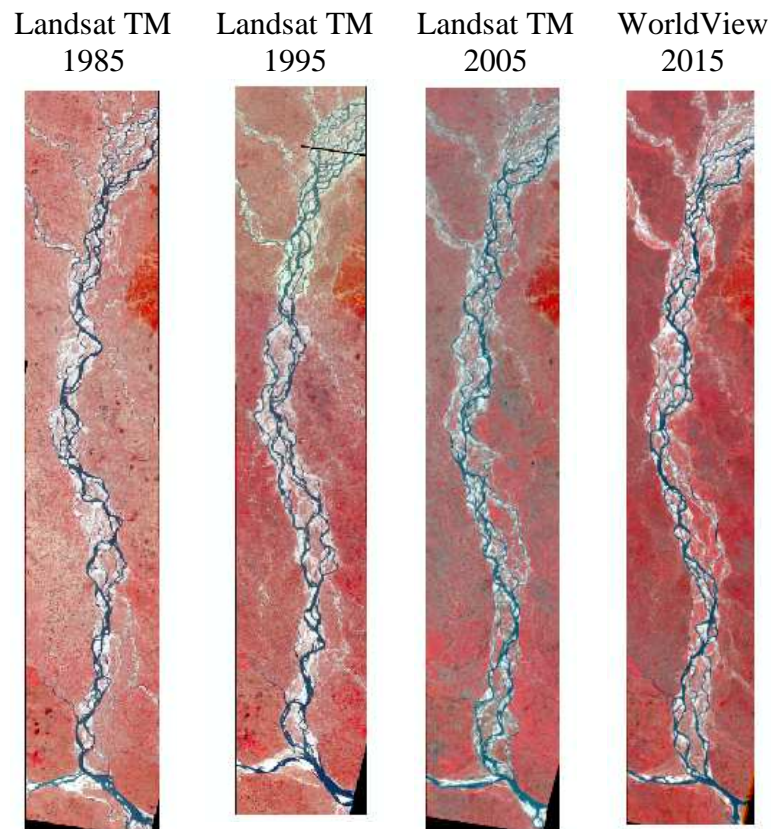
Figure 6-1: Images show the chronological changes of Jamuna river shifting from 1985 to 2015, Bangladesh
Sources: Made by the author, 2017; data collected from the Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

(2) Unsupervised classification

This paper used unsupervised classification for separating the land and water to detail understanding chronological riverbank shifting from 1985 to 2015. Using ArcGIS 10.2, unsupervised classification had done in major four categories such as water bodies, vegetation cover, homestead vegetation and finally identify *char* lands from Landsat TM (The year of 1985, 1995 and 2005) and WorldView (The year of 2015) images. Besides that, field calculator using ArcGIS 10.2 software measured each feature. The age of vegetation cover is highly linked with the age of the *char* lands in the study sites. Therefore, to know the ages of the *char* lands and its stability along the river Jamuna, this paper tried to classify vegetation cover changes from 1985 to 2015 in the study sites.
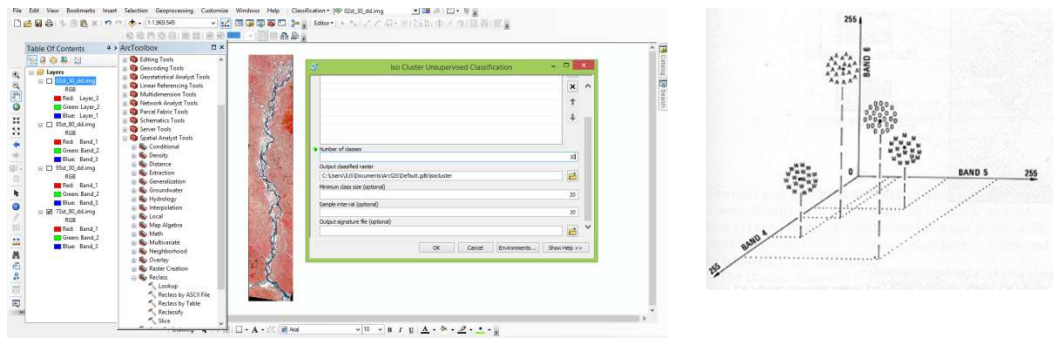
Figure 6-2: Unsupervised classification of the Landsat TM (Year of 1985, 1995 and 2005) and WorldView (Year of 2015) images using ArcGIS 10.1 software

By the following equations (1 to 4), this paper tried to measure waterbodies, vegetation cover, homestead vegetation and finally, *char* lands from Landsat TM (Year of 1985, 1995 and 2005) and WorldView (Year of 2015) images.

1. % Waterbodies= $\{(\Sigma Wp/n)*100\}$

    Whereas ΣWp= Total number of waterbodies pixels, n= total number of pixel.

2. % Vegetation cover= $\{(\Sigma Vp/n)*100\}$

    Whereas ΣVp= Total number of vegetation cover pixels, n= total number of pixel.

3. % Homestead vegetation= $\{(\Sigma Hp/n)*100\}$

    Whereas ΣHp= Total number of homestead vegetation pixels, n= total number of pixel.

4. % *Char* lands= $\{(\Sigma Cp/n)*100\}$

    Whereas ΣCp= Total number of *char* lands pixels, n= total number of pixel.

The below figure 6-3 shows how to calculate waterbodies, vegetation cover, homestead vegetation and *char* lands from Landsat TM and WorldView images using ArcGIS 10.2.
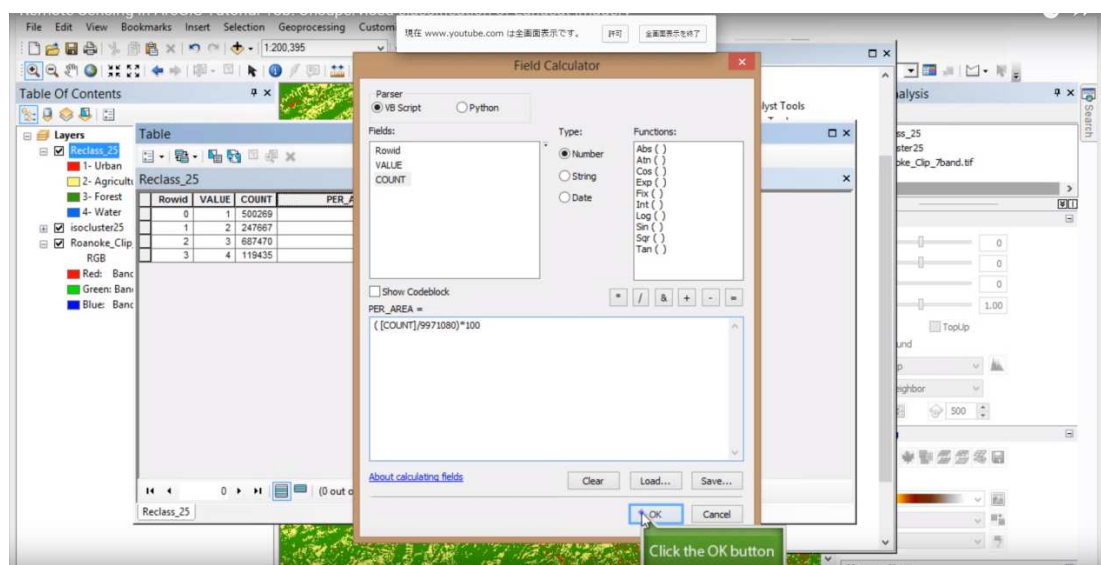
Figure 6-3: The percentages calculation of the different features using mentioned equations

6.3 Major findings of the study

NGOs in Bangladesh constitute a dynamic entity which continues to stand as a new challenge for the intellect as well as for the policy in Bangladesh. As a body of institutional arrangement, it is being raised as a result of failures in government delivery of certain social services to the poor people. However, the institutional dynamics and compulsions are arising out of a participatory approach to grassroots development (especially economic and social developments). Therefore, this paper tries to focus on the NGOs activates in development sectors of Bangladesh. Besides that, this paper also tries to make a plan to ensure the equal facilities of the rural poor along the river Jamuna. However, the major findings are discussed in the below sections.

(1) NGOs strength and spatial distributions

Numerous NGOs were found in the study area working in almost all sectors. The purpose and scope of their work change along with the type of project, for which they receive funding. NGOs like ASA, BRAC, Grameen Bank, RDRS Bangladesh are national level NGOs and work exclusively all around the country. There are in total 30 NGOs with 175 sub-branches have been working in different sectors such as education, agriculture, poverty reduction, health and sanitation in the study sites. In the study sites, NGOs had made enormous contributions to the development of the social and economic structure of the rural poor. Figure 6-4 shows the physical location of the local NGOs in the study sites. It indicates that the distribution pattern of NGOs along the Jamuna are not equal. In the upper and lower part of the Jamuna especially Kurigram and Sirajganj district, the concentration of local NGOs are higher than the middle part of Jamuna, which consists Bogra and Jamalpur district. This might happen because of the population density and economic opportunities are higher in the upper and lower part of Jamuna. Among 175 local NGOs, there were 102 NGOs (sub-branches) in the upper part, 24 NGOs in the middle part and finally, rest of 49 local NGOs in the lower part that was identified in the study sites.
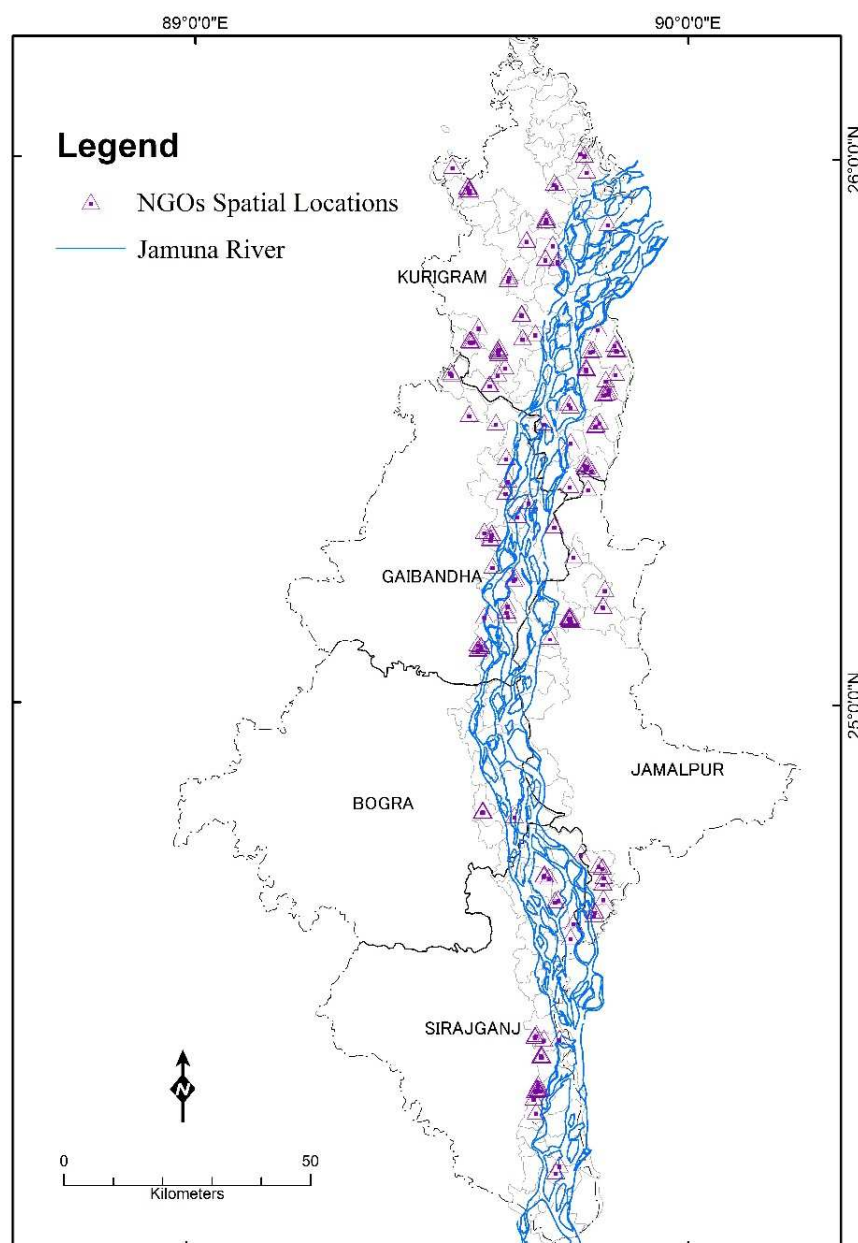
Figure 6-4: The spatial distribution of local NGOs along the riverside of Jamuna, Bangladesh

Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

Besides that, among 30 NGOs, there are only four prominent NGOs, which are working with huge savers and borrowers. Association for Social Advancement (ASA, total 35 branches) is covering 15.07% savers and 17.53% and borrowers where BRAC (total 31 branches) covers 27.38% savers and 27.61% borrowers respectively. Besides that, Grameen Bank (total 31 branches) covers 25.49% savers and 26.24% borrowers

in the study sites. Among 175 branches, there are 22 branches of RDRS are working along the river Jamuna. It covers 12.18% and 11.51% savers and borrowers respectively and the rest of 26 NGOs of 56 branches are covering 19.86% savers and 17.10% borrowers in the study sites. The rural poor people suffer a lot because limited numbers of NGOs are working in the middle part of Jamuna River.

On the contrary, the distribution of local NGOs among *char* lands/ island, embankment and the mainland are not equally distributed. In the embankment, the number of local NGOs are higher than *char* land and the mainland. In the *char* land, the number of local NGOs are very limited. This had happened because of the dynamics of erosion and accretion of the Jamuna River. Besides that, poor transportation and lack of accommodation facilities made an unsecured rural people's economic condition in the middle part of Jamuna, River.

Table 6-1: Distribution of NGOs in different areas

Sl	Categories	NGOs Branches	Comments
1	*Char* lands/ Island	21	Surrounded by water in the dry season
2	Embankment	87	Within 3km aerial distance from an island *char*
2	Mainland	67	More than 3km aerial distance from an island *char*
Total		175	

Source: Made by the author, 2017; data collected through field survey, 2016

Table 6-1 illustrates that the spatial distribution of local NGOs in different areas such as in *char* lands/ island, beside embankment and in the mainland. Among the 175 local NGOs, there were 87 NGOs located in the embankment areas, whereas only 21 NGOs are in *char* land and 67 NGOs in the mainland areas. The number of NGOs distribution indicates the unequal pattern along Jamuna, Bangladesh. Therefore, the unequal distribution of NGOs makes some major problems for the rural development as below:

(a) Problems in health sectors, especially maternal and child health care services because of huge distance and no transportation system especially in summer seasons;

(b) Childhood illness in the rural areas;

(c) No credit facilities for business, agricultural activities, and farming;

(d) No relief facilities during flooding period;

(e) Least of NGOs' clinics provide the service under the banner of Smiling Sun; and

(f) Rural poor did not get proper facilities in education sector due to the financial crisis and distance matter.

Table 6-2 demonstrates the distribution of local NGOs in union level along the

Jamuna River, Bangladesh. There are 175 local NGOs working within 126 unions of 5 districts along the riverside of Jamuna while 57 unions have NGOs and 69 unions have no NGOs activities (Table 6-2). As a result, *char* people among 69 unions are facing several problems like lack of health, transportation, agricultural and credit facilities as well as deprived of educational services. This might happen as a result of the dynamic of erosion and accretion of the Jamuna River in the study sites.

Table 6-2: Distribution of local NGOs in union wise

Categories	Number of Unions
Have NGOs	57
No NGOs	69
Total Number of NGOs are175	

Source: Made by the author, 2017; data collected through field survey, 2016

On the contrary, the overall trend of Jamuna River is shifting in the period of 1985-2015 has been eroded in the right (western) bank. The erosion along the right bank seems to have stopped recently. It is partly triggered by bank protection works, which have been constructed since the mid-1990s. In the downstream of Jamuna Bridge, extensive accretion has occurred along with more erosional activities. Therefore, local NGOs activities on 69 unions along the river Jamuna could not be located.

(2) Relationship between NGOs activities and population density

Population accumulates the concentration of the NGO. However, the establishment of NGO's center according to the category is mainly based on population density. Where the density of population is more, the concentration of NGOs is higher in those areas. The population density in the upper part (middle portion of Kurigram district, which counts as a mainland) is 1,182 to 4,235 per square kilometers whereas the total number of NGOs is higher. In the upper stream of Jamuna, there is 58.29% of the total NGOs are working for social and economic development by providing credit facilities. Besides that, in the western part of Kurigram district, the population density is 202 to 794 per square kilometers, whereas the number of NGOs is very least (Figure 6-5). Among 102 NGOs, there are only five local branches of NGOs had been located. On the other hand, in the middle part of Gaibandha district, the population density is 1,182 to 4,235 per square kilometers, whereas the number of NGOs concentration is higher. Besides that, in the upper and middle part of Jamalpur district, the number of NGOs is lower with low population density which is 202 to 939 per square kilometers. In the middle part of Jamuna (Bogra and part of Jamalpur district), the population density is 202 to 794 per square kilometers whereas only 13.71% NGOs of the total are being located. There is a very low concentration of local NGOs in the middle part rather than other areas along the river Jamuna, Bangladesh.
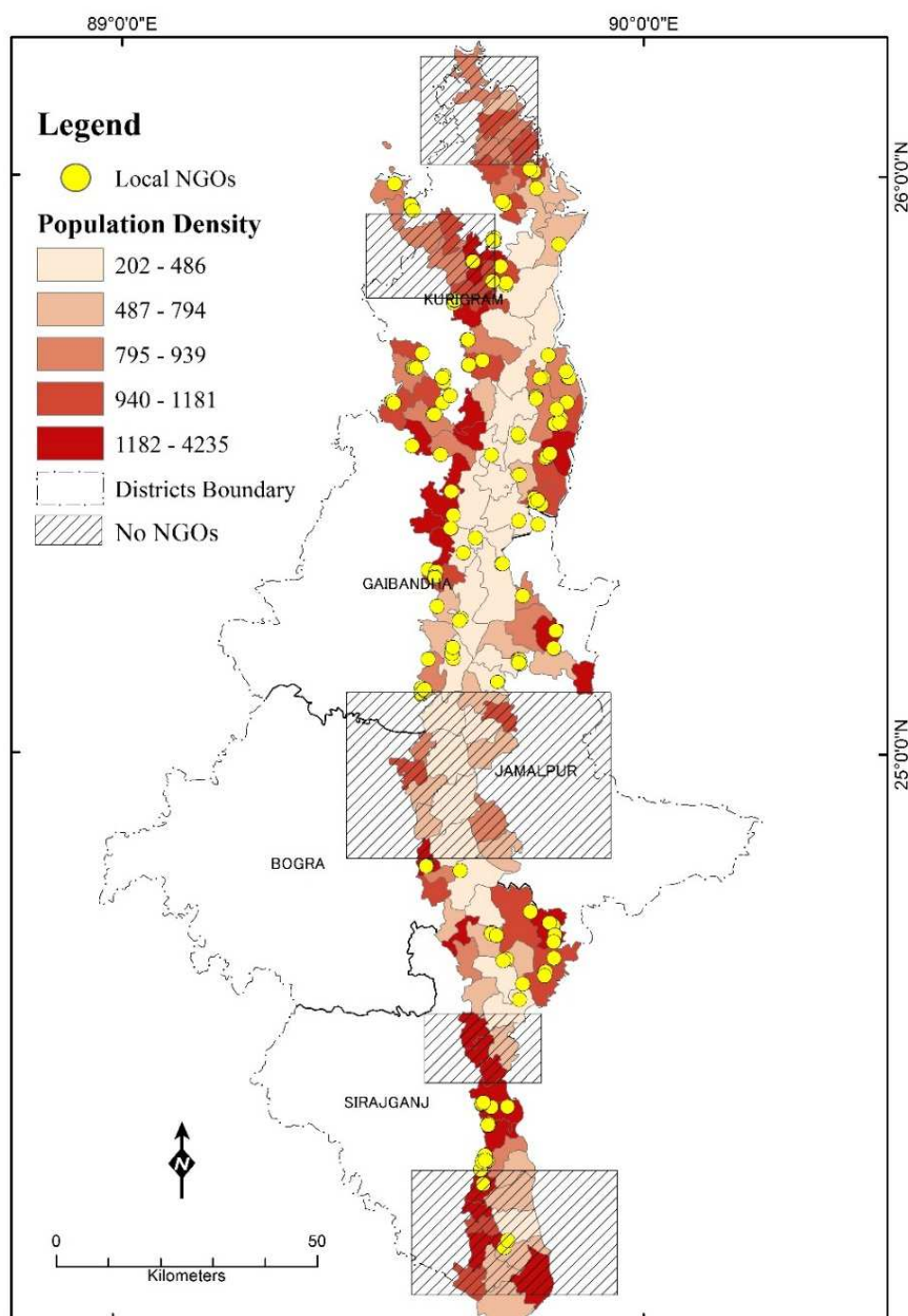
Figure 6-5: Relationship between NGOs activities and population density along the Jamuna River, Bangladesh

Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

In the lower part of Jamuna (upper and lower part of Sirajganj district), there are 28% NGOs working in different sectors by providing NGOs credit to the rural poor.

The population density in the upper and lower part of Sirajganj district is higher which consists 1,182 to 4,235 per square kilometers. Figure 6-5 shows the NGOs working areas gaps by grid box. Finally, it indicates that the number of NGOs are strongly linked with population density in the study sites. This had happened because all NGOs are profit oriented.

(3) NGOs centers, growth center and population density

Population density, growth center and NGOs activities are inextricably linked. The high concentration of people in rural area has created many economic benefits, including improved transportation links, educational, industrial and agricultural development as well as food production. The growth centers that places on the high population density areas with high concentration of NGOs activities have meant that increased of growth center is associated with rural development (Figure 6-6). The economic growth centers must be integrated with population density that promoting agro-processing industries in rural regions.

In the upper part of Kurigram district, the population density is 1,182 to 4,235 per square kilometers whereas the total number of NGOs and growth/commercial centers is higher. The population density is 202 to 486 in the north-eastern part of Kurigram district, whereas the number of NGOs and growth/commercial centers is limited. It indicates that NGOs centers, growth center, and population density are interlinked. On the other hand, the population density, the number of NGOs and growth/commercial centers are very lower in the middle part of Jamuna which includes Bogra and Jamalpur districts. In the lower and upper part of Sirajganj district, the population density is 1,182 to 4,235 per square kilometers whereas the total number of NGOs and growth/commercial centers is higher. This might because population density and number of commercial centers in a particular area attract to local NGOs for their investment in credit sectors. Local NGOs are working to facilitate the active participation of vulnerable groups, including women, youth and indigenous peoples and rural communities in the study sites.

Finally, conclude that NGOs working area are mainly depending on population density and number of growth/commercial centers in the study sites which is shown in figure 6-5.
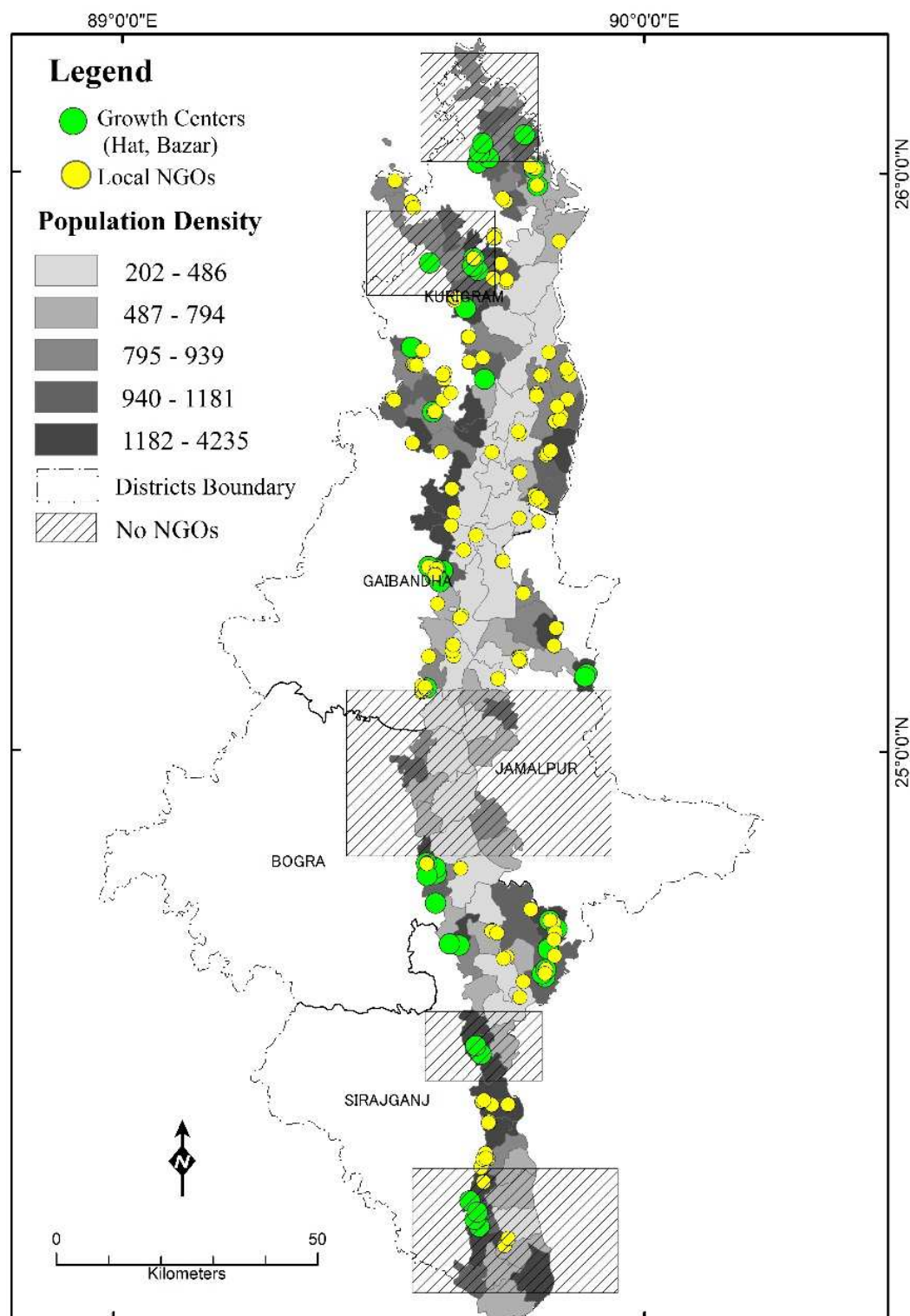
Figure 6-6: Relation between NGOs centers, growth center and population density
Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

(4) Chronological changes of *char* lands of Jamuna from 1985 to 2015
(a) Upper-stream of Jamuna River (Zone- A)

The flowing direction of the river, growing *char* land depends on the flow velocity, sediment intrusion, influences of the other tributary of a river. The main stream of Jamuna River is flowing with some other tributary river, i.e. Tista, Dudhkumar etc. This tributary rivers influence the main river to increase the flow velocity as well as the direction of flow, sediment intrusion and so on. For these reasons a river always does not go throw the same direction and sometimes it changes. Along with the changes of river direction *char* land is created in front of the river or alongside the river. Mainly *char* land is created because of the heavy sediment intrusion to the river flow. According to the above said causes Jamuna is not a different one. The change of river flow direction in Jamuna is very rapid. The main reason for this changing of flowing way is high water velocity and wave action.
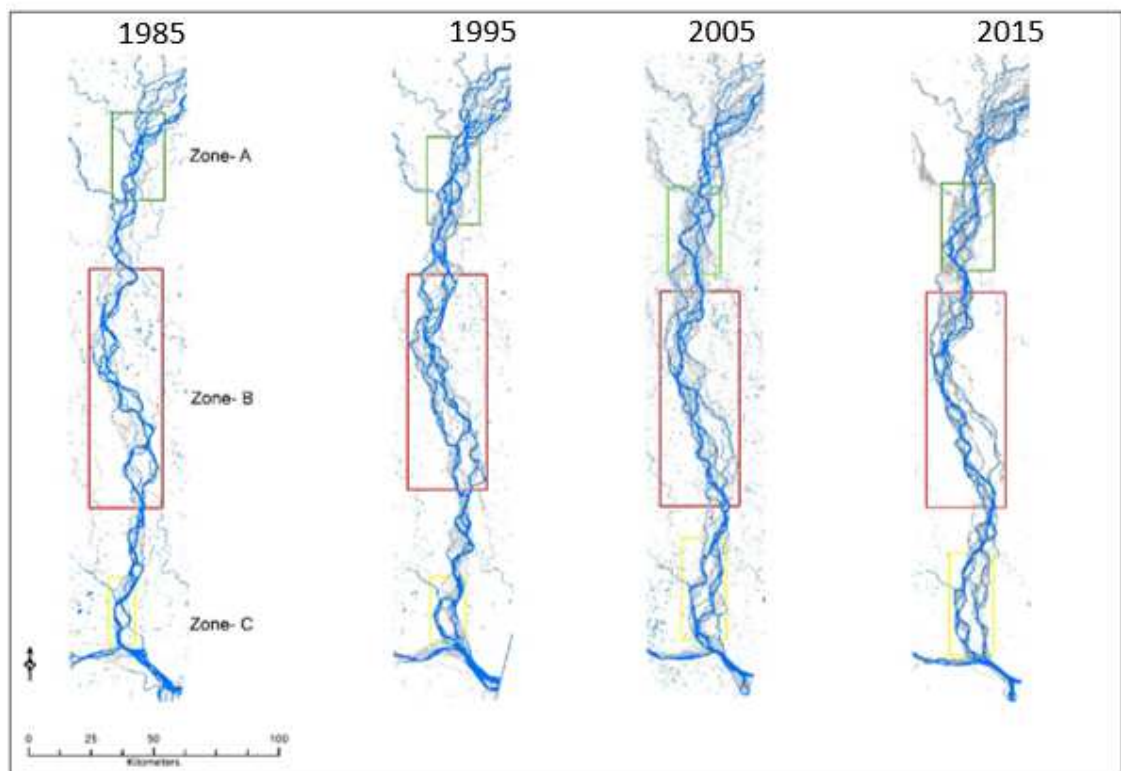
Figure 6-7: Chronological changes of *char* lands from 1985 to 2015 years of Jamuna, Bangladesh
Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

Figure 6-7 illustrates that there is a more or less change in flow direction of Jamuna River very frequently from the year of 1985 to 2015. The major changes path

has been marked as three zones: zone-A, zone-B, and zone-C. In zone-A, changing nature is not so rapid from 1985 to 1995 between the connecting point of river Dudhkumar and Tista. But between the years of 1995 to 2005, the changing way has been changed at the down upper stream of Jamuna. In 2015, as the image is representing its *char* land area is more structured than the previous year.

(b) Middle-stream of Jamuna River (Zone- B)

Zone-B is the middle stream of the Jamuna River, which is the major channel shifting zone in this study site. From the year 1985 to 1995 at the upper part of zone-B, a new stream order has found its way to flow with the mainstream on the western side of the river. Sometimes this new branch is going on within the river and sometimes in its own direction and at one stage it has been connected with the mainstream of Jamuna. This process is going on till 2005 with a little change in flow direction. But in the year of 2015, the changes of river flow appeared differently on the eastern side of Jamuna, where some branches have been almost filled up with sand and turning into *char* land.

(c) Down-stream of Jamuna River (Zone- C)

The downstream of Jamuna River has been marked as zone-C and it has been connected with the river Padma in Goalonda. Here, the river channel has been shifted gradually from 1985 to 2015. From a general point of view, it is almost clear that the many new branches have been created in this phase and the total width of the river area has been increased. At the upper part of zone-A, there is a little similarity between 1985 to 1995 and 2005 to 2015. Mainly changes start after 1995 which goes to 2005 until 2015. In consideration of lower part, there is a presence of many tributaries comparing with earlier stage, which connects with the main river Padma. It is also significant that the appearance of new *char* land is frequent in the downstream of Jamuna.
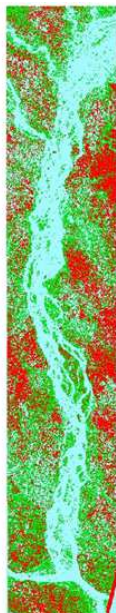
(5) Land use and land cover along the riverside of Jamuna

By using equations (1 to 4), the percentages of different features like river, homestead vegetation, vegetation cover and *char* lands had been identified. However, above table shows the chronological uses of landform along the riverside of Jamuna, Bangladesh. After the flooding of 1988, the number of *char* people has been significantly increased because of fertile land and raising the *char* areas the then period.

The percentages of homestead vegetation significantly growing from 1985 to 2015 which is 22.22% and 39.61% respectively, whereas the vegetation cover pointedly declined, which is 58.99% and 46.76% within the 30 years (Table 6-3). The growth of vegetation and their relation to the formation process of the *chars*, *char* age and location have been analyzed by the understanding of the vegetation process on the *char*s. The accumulation of silt and clay at *char*-top has been measured from cross

profiling and studied the age of vegetation. The influence of the different exogenous and endogenous factors such as large floods, bank erosion processes, and propagation of sediment wave are the main causes for *char* instability.

Table 6-3: Chronological land use and land cover change along the riverside of Jamuna from 1985 to 2015

Image	Year	Features	Pixels	Percentages	Examples
Landsat TM	1985	River	166,509	10.89%	
		Homestead vegetation	438,552	22.22%	
		Vegetation cover	1,164,044	58.99%	
		Char lands	155,562	7.88%	
Landsat TM	1995	River	216,520	10.96%	
		Homestead vegetation	707,567	35.85%	
		Vegetation cover	874,326	40.30%	
		Char lands	174,987	8.87%	
Landsat TM	2005	River	1,684,234	12.03%	
		Homestead vegetation	4,550,336	32.50%	
		Vegetation cover	5,841,906	41.72%	
		Char lands	1,925,915	13.75%	
WorldView	2015	River	1,219,815	8.71%	
		Homestead vegetation	5,545,885	39.61%	
		Vegetation cover	6,547,992	46.76%	
		Char lands	688,699	4.92%	

Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

(6) Distance from *char* land to the mainland

The rural/*char* people and their settlements in the Jamuna River are under threat due to floods and associated river bank erosion. The overflow of water happens during the monsoon season because of widespread flooding that damages settlements, agricultural crops, and infrastructure and communication networks.
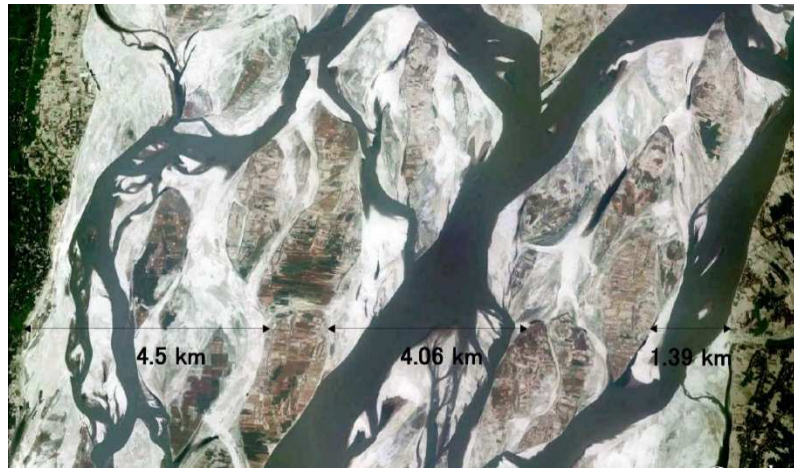
Figure 6-8: Distance form *char* land to mainland

Sources: Made by the author, 2017; data used from Google Earth images, 2016 and field survey, 2015

Figure 6-8 shows the distance from *char* land to the mainland while *char* land is largely affected by annual floods; as a result, the *char* people are being displaced frequently from one place to another and return to the native *char* when new land emerges in the river channel after floods. In the dry season, *char* land people sometimes fall into trouble like health problem for having not enough opportunities to move out to another place because of the transportation system. The figure 6-8 shows the minimum and maximum distance between *char* land and mainland which is 4.5 km and 1.39 km respectively. Therefore, rural poor people suffer a lot in health, education and other natural vulnerabilities along the river Jamuna, Bangladesh. This study is to examine the NGOs activities and spatial distribution along the riverside of Jamuna and formulate a long-term strategy and planning for the *char*-land people in Bangladesh.

(7) Planning for NGOs using grid methods

By overlapping population data and GPS data on the grids identify the more concentrated areas of NGO's in the study sites. This paper analyzed the concentration of NGO's within the areas and find out the unprivileged or unserved areas using overlapping methods. Health, sanitation, and education would be a Category 01 NGO's, agriculture is in category 02 and category 03 NGO's are less important than category 01 and 02 NGO's. Categories and importance of NGO's depend on the demand of the rural poor people's perceptions and demands.
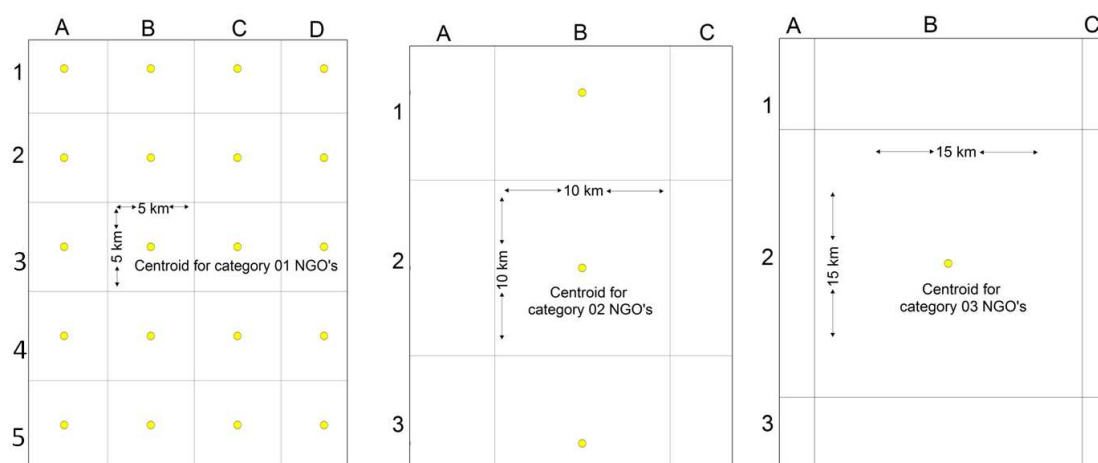
Figure 6-9: Figure shows the 5km*5km, 10km*10km and 15km*15km grids for the planning of local NGO's

Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

The existence and impact of Non-governmental Organizations (NGOs) in the rural areas of Bangladesh have radically increased over the last several decades. The distribution of local NGOs activity and the ways in which contextual factors influence the distribution of NGOs' activity should emphasis on geographical location and population density. This paper explores the distribution of local NGOs' activity using the grid method and identifies local factors that are linked to the distribution of NGO activity. Contradictorily, natural barrier splits up the NGO's concentration by ignoring the services. Due to natural obstacles, (i.e. the existence of river, river bank erosion, highly eroded area etc.) population concentration is less here. Therefore, NGO's concentration also gives less priority.
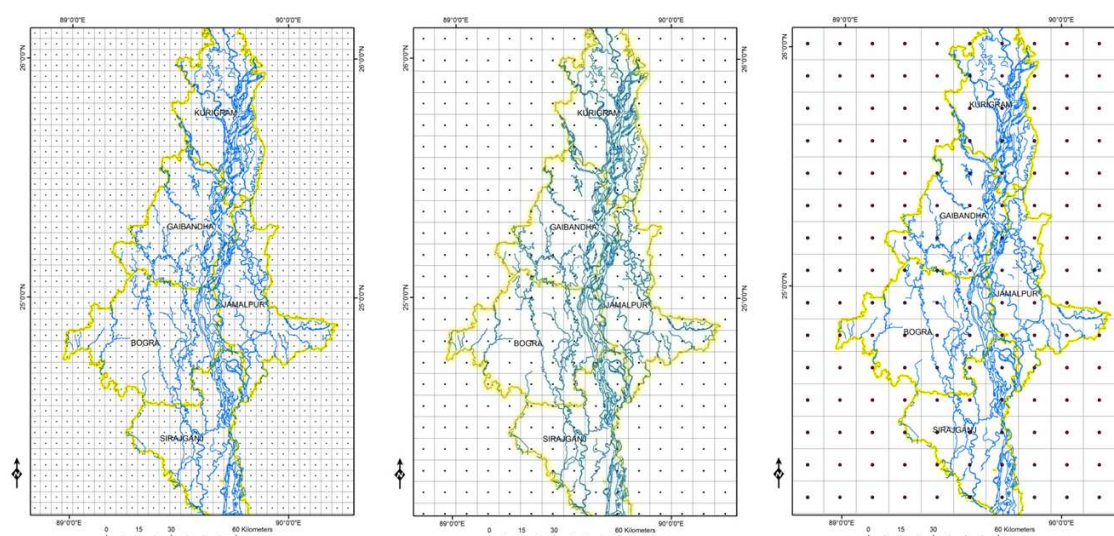
Figure 6-10: Figures show the category wise distribution in a broader view of different NGO's. According to the population density NGO's are distributed, if there any physical barriers within the grids that would be avoided

Sources: Made by the author, 2017; data collected from Chars Livelihoods Program (CLP), Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services (*CEGIS*) and field survey, 2015

In case of category 01, the services and facilities are demanded as first priority by the local people. In this sector, services are mainly related to basic human needs, i.e. health and sanitation, education facility etc. The transportation system in this rural area is not that good. The only vehicle for moving one place to another is walking or sometimes rickshaw and van which are not available all time. Because of fewer transportation facilities going to health care center immediately becomes tough. For example, when a pregnant woman needs to go to the health center during her severe situation, it becomes really challenging when there is no vehicle available. On the other side, education is one of the basic human needs. Usually, NGO provides education facility at an early stage. The little kids who go to school to learn are 3-10 years old; normally 5 km distance is much higher for a 3 years old school going kids. At this circumstances, distance more than 5 km is very difficult for them to go to the school where they and their family are not well known enough about the value of education. Considering the above facts, health and education facilities have been given first priority and concentration of NGO for this specific purpose has been set as 5 km distance. One important matter about education facility is that the service should maintain continuity and they should manage a linkage with other NGO about in this condition that, after completion period of one NGO they will take all of the students to another NGO's school. As for example, the durability of one non-government organization is usually not more than 5 years. In this context, when a 3-year-old children start to go to school, then after 5 years he/she become 8 years old while he/she stood for class three or four. At the same time, if that NGO wants to complete its running phase from that particular place, students who read in class three or four falls in awkward situations and some of them drop out from education.

For category 02, priority has been given to agricultural facilities and the distance of the NGO's center is 10 km. As the livelihood of this rural area depends on agriculture, the main focus of this sector is the removal of the economic crisis through functional agricultural systems. Developing new seeds, fertilizers, new cropping methods; training for the skilled farmer; multiplication of plant, plant breeding; irrigation facilities and providing agricultural tools to the farmer are primarily the main concentrations of NGO in this second phase. Therefore, agricultural facilities have been given second priority and concentration of NGO for this specific purpose has

been set within 10 km distance according to local poor peoples' perceptions and demands.

In category 03, the distance is 15 km from one NGO center to the next NGO. The concentration of this zone has been given less priority than the category 01 and category 02. The main focus of this sector is microcredit which refers giving the loan to the local poor people. Sometimes the local poor does not get any financial support for their agricultural purpose or any other difficulties. The loan, which rural people receive from the NGO, includes interest and sometimes it becomes hard for them to pay the whole loan with interest. NGO's authority collects the interest with the due loan in a vicious way. In spite of having difficulty, poor people get loans for their unavoidable cause and this loan giving organization is useful for them by all means. As the land type of this riverside area is *char* land, the frequent flood occurs there and there is a possibility of going down below the river water at any time. In this perspective, the structure of all infrastructure should be temporary to minimize the financial loss. Therefore, loan facilities provided by local NGOs have been given third priority and concentration of NGO for this specific purpose has been set within 15 km distance according to local poor people's perceptions and their demands.

6.4 Conclusion and recommendations

From the discussion and data analysis, we conclude that proper strategy and steps make the rural development in different sectors along the riverside of Jamuna, Bangladesh. Finally, coping with the erosional actions, proper uses of local resources, equal distribution of NGOs and integrated services of local NGOs can make sure the better lifestyle of rural poor people of Bangladesh.

This paper having all sorts of graphical evidence, local people interviews and perceptions, focus group discussions in different categories, and documentary reviews for ensuring the proper facilities provided by the local NGOs to the poor people along the riverside of Jamuna. If any further work to be initiated, these imageries and coordinates will help a clear picture of the in-situ and ex-situ survey work. Considering the above-mentioned analysis of NGOs spatial distribution, current situations and other observations following recommendations can be made.

(1) Local NGOs should be equally allocated by using grid methods and should make integrated services for the rural poor people;

(2) For the infrastructural development, the projects in particular NGOs should emphasis on the local resource utilization as for example school should make by the bamboo or using other local resources because erosional actions are presented whereas the maximum duration or the consistency of *char* lands are 10 to 15 years according to local people's perceptions and image analysis;

(3) To ensure the optimal distance, especially in summer time NGOs should provide the mobile services in everywhere;

(4) NGOs should not make the permanent structure in the *char* land areas influencing by the projects;

(5) Making the link program after concluding the project duration to another project especially for the education program and ensuring it to continue;

(6) For the development of the rural poor, NGOs activities should establish many growth centers to serve microcredit facilities within the rural villages along the riverside of Jamuna;

(7) Make a ministry only for the *char* land areas which should directly look after by the government;

(8) All *char* lands should have one boundary and ensure the same facilities for all rural people according to their needs and;

(9) Should increase the growth center like hat, bazar because rural development depends on proper infrastructure.

7.1 Summary

Local NGOs are addressing basic needs and increasing provision and access to services as a rescuer to improve livelihoods of the rural poor people along with the community near Jamuna River, Bangladesh. Besides that, they are also providing different social protection programmes to the vulnerable households, building social capital and resilience in rural communities, educational facilities, empower women and small-scale farmers, access to credit farm-based activities, support training of rural communities to cope with and recover from natural disasters in the study sites. Among the NGOs' activities, this research mainly focuses three significant arenas such as education, agriculture, and micro-credit sectors, where NGOs have made various contributions to support rural poor people of Bangladesh. However, in the study sites, there are 30 NGOs (175 sub-branches) were found in 126 unions (unions are the smallest rural administrative organogram and local government units in Bangladesh) of 5 districts.

The primary data was collected from a distinctive group of respondents. Total 533 respondents were interviewed by using a household survey method (questionnaire survey which is semi-structured) and 50 focus group discussions randomly (each group consist 5 to 6 persons) conducted at union council (combination of few villages) level along the riverside of Jamuna, Bangladesh. The household survey and focus group discussions were conducted in three segments such as (1) collecting local NGOs provision in education sectors and student's daily behavioural activities and others knowledge before and after joining NGOs education program; (2) local NGOs provision in agricultural sectors and collecting socio-economic information's before and after joining NGOs credit program; and (3) local NGOs provision in poverty reduction and accumulating socio-economic information's in the study sites. Besides that, primary data such as year of establishment, number of savers, the total value of savings deposits, number of borrowers, total value of loans outstanding, name and telephone number of the branch manager were collected from 30 NGOs (total 175 sub-branches). Furthermore, data was also acquired from the Bangladesh Bureau of Statistics (BBS), Chars Livelihoods Program (CLP), Bangladesh Institute of Development Studies (BIDS), Centre for Environmental and Geographic Information Services (CEGIS). ArcGIS 10.2 used for detail mapping and analysing of the NGOs working area, the concentration of educational institutions, identifying potential areas for farming, mapping NGOs strength and weakness in terms of savers and borrowers, saving deposits and loan outstanding's, population density and growth/commercial

centers of the study sites. A Garmin GPS device has been used to locate all MFIs (175 branches of 30 NGOs), educational institutions (358 schools) and growth/commercial centers (42 commercial centers) accurately and converted the collected waypoints in GIS and KML format. Furthermore, Statistical Package for the Social Sciences (SPSS 16.0) software was used for socio-economic characteristic analysis of the study sites. Besides that, the correlation was also analyzed using SPSS in two separate topics such as (1) correlation between profit from agriculture and six dependent variables; and (2) between monthly income and selected eight dependent variables (luxurious assets).

This study provides insights into the educational facilities provided by NGOs alongside the river Jamuna. There were 358 schools located along the river Jamuna whereas 6 were government schools, 3 were local government schools, 347 were non-government schools, and 2 were autonomous schools. Among 358 schools, 162 schools have no electricity, 330 schools have no tap water supply system, 317 schools have no internet connections and 172 schools have no computer education. Besides that, this study also analyzed the NGO's and schools' concentrated area. It indicates that schools concentrated area was highly linked with NGOs working area. Furthermore, this section showed that NGOs working area was highly linked to the density of population. The population density of the study sites is 928 per square km. In addition, it is estimated that the literacy rate of the study site is 35.48%, whereas the minimum and maximum literacy rates are 15.1% and 63.2% respectively. On the other hand, the literacy rate of the female in the study site is 32.26%, whereas the minimum and maximum values are 11.2% and 60.1% respectively. Besides that, the literacy rate of the male in the study site is 38.86%, whereas the minimum and maximum literacy rates are 19.1% and 67.1% separately. This section also draws a map of 2-km buffering zones of the schools, according to the government rules which was not reflected. This study found *pakka* schools are greater in number than others. It is analyzed that the number of schools in the *haor or beel*, plain land, riverside or *char* land areas were 2, 284 and 72 respectively. Among 72 schools, there are 46 *pakka* and 6 semi-*pakka* schools located in the riverside or *char* areas that are very unrealistic and unplanned as far as the geographical location is concerned. Finally, this section had analyzed the student's daily behavioral activities and others knowledge before and after joining the NGOs education program. Among 533 respondents, most of the students (20.1%) were below or equal to 12 years old followed by 80.9%, in the age group of 13 to 15 years old. There are 30.4% of the respondents were female, whereas the male respondents were 69.6%; both participating in the NGOs education program in the study sites. Student's daily behavioral activities after joining NGOs education program are not significantly enhanced, but there has a positive impact of NGOs

education on all learners' daily behavioral activities. The student behavioral activities were changed which was average 37.43% of the total respondents after joining NGOs education program (before it was 29.78% of the total). Besides that, maximum students are aware of the environment, natural disasters, early marriage and child labour which is average 68.74% of the total respondents after joining local NGOs education program (before it was 33.19% of the total respondents). Furthermore, this paper had also measured the student's life skill improvement which was average 45.53% of the total respondents after joining NGOs education program (before it was 3.9% of the total). On the contrary, students were involved to income generating activities after joining NGOs education which was average 15.43% of the total respondents where before it was average 0.9% of the total.

The NGOs are playing a significant role in the agricultural development in the study sites. The study has discovered that the local NGOs in the study area have supported farmers by giving agricultural aids such as; agricultural inputs (seed, fertilizer, pesticide), agricultural tools, cash loans, agricultural training, irrigation facility and kitchen gardening. Farmers are selected for aids based on their socio-economic condition, i.e., the poorest people are given priority. This paper has also made a database of current agricultural land use along the river Jamuna, Bangladesh. There are seven types of different landforms were identified, such as (1) *char* land attached to mainland; (2) new *char* land; (3) new *char* land with low population; (4) new *char* land with moderate population; (5) old *char* land with high population; (6) old *char* land with low population; and (7) finally, old *char* land with moderate population. The number of *char* lands were identified with area and agricultural crops. On the contrary, crop suitability and potential areas for farming were analyzed on the basis of household surveys (533 respondents) and 50 focus group discussions (5 to 6 participants in each discussion) and secondary data and reports on agricultural land suitability were collected from the Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Census and CEGIS. Total area included in the analysis was 340,659.49 hectares. Results are analyzed using a five-point Likert scale, i.e., very high, high, medium, low and very low. Crops being included in the analysis are; rice, wheat, Jute, potato, chili, ginger and turmeric, onion and garlic, mustard and sugarcane. Results show that three varieties of rice namely; *T. Aman, Boro* and *T. Aus* are grown in the study area, whereas *Boro* rice (87.25%) is the best suites for farmers of the study sites. Besides that, wheat (84.85%) and mustard (97.48%) are also the best suites for farmers. The land for jute and potato cultivation is moderately suitable. Furthermore, the production of chili, ginger, and turmeric is perceived as very low among sampled respondents due to unavailability of suitable land. This section had

provided gender-based (male/female) union council wise results on population engaged in three different sectors (agriculture, industry, and services) to support to their livelihood. There were around 5,180 to 8,630 farmers (male) participating in agricultural activities in some unions. Besides that, approximately 296 to 488 female participate in agricultural activities ranked very high in some unions among all the unions. Furthermore, 4,000 people from some unions are involved in industrial work for a livelihood while the rest of the areas have a very minimum number of industrial workers. Both male and female were almost equally involved in the industry sector. This paper makes a crop calendar with planting period, high labor demand, and proper harvesting period for the rural farmers to choose the plants and seeds in proper time to cultivate and harvest according to the perceptions of local people and the information provided by local NGOs. Besides that, this paper also identified the political, cultural and natural barrier to the agricultural development in the rural area of the Bangladesh. On the other hand, growth/commercial centers are one of the major indicators of economic development in the study sites. Therefore, this paper tried to link commercial centers with rural development and described agricultural machinery that has been used in the study sites. Socio-economic attributes of the households were interviewed during the household survey are presented in this section. The data presented here is collected through 533 Household Survey (HHS) questionnaire and 50 Focused Group Discussion (FGD) in 2016. Socio-economic attributes include; age, sex, number of family members, occupation, monthly income, distance from the NGOs office to the respondent's home, distance from the growth centers/ hat, bazaar to the respondents and facilities provided by the local NGOs in agricultural sectors along the riverside of Jamuna, Bangladesh. Results reveal that most of the respondents (56.1%) were below or equal to 25 years old followed by 42.8%, in the age group of 26 to 35 years old. 36.4% of the respondents were female, whereas the male respondents were 63.6%; both are participating in farming activities. Most of the rural poor people in the study area (90.3%) have 7 to 9 persons while the rest of the 7.7% people have more than 9 members in the household. Among the respondents, most of them (36.8%) are a housewife who is also involved with kitchen gardening. 37.1% respondents are involved in agricultural activities and the rest 12.4%, 7.5%, and 6.2% are involved in business, daily labor, and industrial services respectively. Before joining micro-credit program initiated by NGOs, the majority of the respondents (89.9%) were in the low-income group (less or equal to 63 USD), 7.7% in medium income (126 USD) and the rest of 2.4% in high-income groups (above 126 USD). Thereafter, joining the micro-credit program, low-income group decreased intensely from 89.9% to 41.3%, the medium income group increased significantly to 55.0% by benefiting from the

micro-credit program. People living near NGO offices receive more benefits and vice versa. Our results show that 46.5% of the sampled respondents were living within 5 kilometers distance from the NGO office. Approximately, 74% of the respondents live near the growth center where most of the facilities offered by NGOs can be accessed easily. Local NGOs along the riverside of Jamuna provided various agricultural facilities to the poor people. These facilities include; agricultural inputs (seed, fertilizer, pesticide), agricultural tools, cash loans, agricultural training, irrigation facility, providing help to women in kitchen gardening etc. All these facilities are given to people selected by NGO based on their socioeconomic situation, i.e., poorest people get it first. The aid included in the analysis of this paper was given in 2016. Among the 533 respondents, the majority of the local respondents receive agricultural loan (63.60%), agricultural tools (64%), fertilizer (69%), seeds (77.70%), agricultural training (74.30%), livestock (74.30%) and pesticides (68.30%). Among sampled respondents', the majority (71.30%) did not have access to receive handicraft training. In addition, this paper presents a correlation analysis performed for six dependent variables, i.e., agricultural training, fertilizer, domestic animals, seeds and agricultural loan; to show how they correlate with profit farmers receive annually. Results reveal that the correlation of coefficient for training (r) equals to 0.952 which indicates a significant relationship between trained farmers and their profit per Bigha (r = 0.952, p <0.001). Besides that, other four variables such as fertilizer, domestic animals, seeds and agricultural loan have a significant relation to profit except traditional agricultural tools. A negative correlation (r = -.046) was found between profit from farming and availability of traditional agricultural tools.

NGOs alongside the river Jamuna are providing innovative training, credit and other support to non-primary production activities. The services of micro-credit include primary and secondary economic activities such as crop production, rice husking and frying, cattle fattening, domestic animal husbandry, fish farming, vegetable cultivation, convenience store, bamboo and cane work, vegetables and raw materials business, cloth fabric, cottage industry, ready-made garments business, clothing business and finally, rickshaw or van buying. This study presents a geo-spatial distribution of local NGOs (30 NGOs having 175 branches) with respect to its (1) borrowers; (2) savers; (3) saving deposits; and (4) total loan disbursed among NGOs members. Results illustrate that local NGOs are not equally distributed in the study sites. The concentration of local NGOs is higher in the upper and lower Jamuna whereas, the number of local NGOs is fewer in the middle part of Jamuna. Furthermore, this paper was analyzed enrollment of rural poor to NGOs credit program in terms of savers, borrowers, total savings and loan outstanding. Besides that, NGOs

micro-credit was analyzed with the number of the population, the total number of households, the total number of savers and borrowers within 126 unions of the 5 districts. Results reveal that there are 4.58% savers and 4.26% borrowers of the total population in 12 unions of Bogra district. Gaibandha district is covering 12.23% saver and 9.88% borrowers of the total population in 18 unions respectively. Besides that, there are 8.73% savers and 7.93% borrowers were under micro-credit facilities in 17 unions of Jamalpur district. In Kurigram district (includes 50 unions), 28% people involved in NGOs credit program where the percentages of savers and borrowers are 15.13% and 12.91% respectively. Finally, Sirajganj district is covering 6.70% savers and 5.57% borrowers of the total population of 29 unions. Another study illustrates the member coverage (borrowers) using bubble maps. Here, the MFIs are classified into three major categories (i.e. 3 sizes of Bubbles) based on their total outstanding loans. The large bubble illustrates the value outstanding loans more than 10 million TK while middle and small MFIs represent groups between 5 to 10 and less than 5 million TK respectively. Therefore, each bubble also indicates the strength or weakness of the respective MFIs in terms of borrowed money. There are 35 branches of ASA are working in the study sites is covering 15.07% savers and 17.53% borrowers respectively. Besides that, 31 branches of BRAC are covering 27.38% savers and 27.61% borrowers respectively in the study sites. On the contrary, Grameen Bank (31 branches) covers 25.49% savers and 26.24% borrowers within 126 unions of 5 districts. There are 22 branches of RDRS are working alongside the river Jamuna and covers 12.18% savers and 11.51% borrowers respectively, among the 30 NGOs in the study sites. Finally, rest of 26 NGOs (56 branches) cover 19.86% savers and 17.10% borrowers in the study sites. In addition, this paper also tried to link among NGOs working area, growth/commercial centers, and population density. Results reveal that distribution of commercial centers, NGOs working area, and population density are strongly related to each other in the study sites. In this section, socio-economic attributes of the households interviewed during the household survey are presented. Socioeconomic attributes include; age, sex, number of family members, educational status, housing condition, the purpose of getting the loan, occupational status before and after receiving credit, monthly income before and after receiving credit, current economic status and facing problems in payment of installment. Results reveal that slightly more than half of the sampled respondents (56.1%) were below or equal to 25 and 36.4% of the respondents were female, whereas the male respondents were 63.6%; both participating in farming activities. Household size was relatively large i.e. 7 to 9 persons per household. Most of the survey respondents (58.9%) had 5 years of schooling, which might happen due to the relatively difficult access to schools in the

rural areas and poverty. Around 78% of them had non-cemented houses (made up of dry leaves, straw, wood, and sometimes using mud) with the bad condition and less facilities are available such as latrine, tube-well, bathroom, and other necessary facilities. Most of the respondents (38.8%) were getting the loan for buying agricultural tools. There are 18.0% respondents having access to the loan for buying cattle and the rest of 15.8%, 17.6%, 3.6%, 1.5% and 4.7% respondents were getting the loan for business, kitchen gardening, house loan, gardening and poultry farm business respectively. Among the respondents, most of them (40.2%) were involved in agricultural activities before receiving credit, but after involvement to NGOs credit program, the number of agri-workers had decreased to 38.8%. The percentages of housewife had decreased from 36.4% to 31.3% after getting the loan from NGOs credit program. Among the respondents, 11.4% to 18.0% became business persons after getting loans from the NGOs. Before joining micro-credit program initiated by NGOs, the majority of the respondents (89.9%) were in the low-income group (less or equal to 63 USD/month), but after joining the micro-credit, this group decreased intensely to 41.3% because of getting benefitted by micro-credit program. Besides that, luxurious household assets in the perspective of rural Bangladesh include electricity, *pakka* toilet, sources of drinking water like tube well, television, radio, bicycle, fan, boat and agricultural tools. After involvement with local NGOs credit program, they have capitalized money in different income generating activities like doing business, working in agricultural sectors, kitchen gardening and poultry farming which improve their economic condition. Before involving with local NGOs credit program, there were 98.9% respondents unable to connect with electricity facilities. But after involvement with NGOs credit program, electricity non-consumers' percentage decreased to 72.2%. Different types of toilet users are found before and after joining the NGOs credit program. Figure 4 shows that after involvement with credit program, the percentage of *pakka* toilet (metaled toilet) users increased from before. It shows that before involvement with local NGOs credit program, there were only 6.2% respondents who had *pakka* toilet before involving with local NGOs credit program and thereafter joining the NGOs credit program, it increased to 33.8% of the total respondents. Similarly, after involvement with credit program, the percentage of tube-well users significantly increased from 2.3% to 41.3%. There were 98.7% respondents who had no television. But after involving with NGOs credit program, people having television increased from 1.3% to 15.9%. Similarly increasing trends were observed in the case of owning radio, bicycle, and personal boat after joining NGOs credit programs. This clearly shows that the socio-economic condition of rural inhabitants in our study area has significantly improved after joining such credit

programs. Furthermore, this section also presents a correlation analysis performed to show how the selected dependent variables correlate with farmer's annual income (independent variable). Eight dependent variables were selected for this analysis including; solar panel electricity, cemented toilet, tube-well water, television, radio, bicycle, electric fan and wooden boat. Results demonstrate that the eight dependent variables are strongly related to the income of a person.

NGOs distribution along the river Jamuna is categories into three major classes such as (1) *char* lands/ Island; (2) embankment; and (3) mainland. 21 NGOs are located in *char* lands/ Island whereas 87 and 67 in the embankment and mainland respectively. It indicates that very few number of NGOs are working in the credit sectors at *char* land while the number NGO is higher in mainland and embankment. Besides that, this paper also identifies the number of NGOs are working at the union level. There are 57 unions have NGOs activities on credit services, educational and agricultural facilities while 69 unions have no NGOs in the study sites. Besides that, this paper evaluates a relationship between NGOs activities and population density. Results illustrate that where population density is higher, NGOs concentration also becomes higher there. Furthermore, this paper also tried to link NGOs centers with growth/commercial centers and population density. Results reveal that NGOs working/concentration area is significantly linked to growth/commercial centers and population density. In the upper and lower part of Jamuna, the number of growth/commercial centers and population density are higher where NGOs have more concentration in development sectors. For making better planning, this paper also identified the chronological changes of *char* lands from 1985 to 2015 of Jamuna using Landsat TM and WorldView Images. Results reveal that middle part of Jamuna River is more vulnerable than upper and lower part of Jamuna River. Besides that, percentages of land usage and land covers such as the river, homestead vegetation, vegetation cover and *char* lands were identified in the year of 1985, 1995, 2005 and 2015 accordingly. Results reveal that the area of *char* land and vegetation cover were reduced from the year of 1985 to 2015. On the contrary, this section also tried to measure distances from the mainland to *char* land. The minimum and maximum distance between *char* land to the mainland is 4.5 km and 1.39 km respectively. This section makes a proper planning of local NGOs distribution to minimize the distances using grid method with the perceptions of local people and their demand. As a consequence, there were 5km×5km, 10km×10km and 15km×15km grids made for NGOs spatial distribution along the river Jamuna. The local NGOs who worked on (1) education and maternal/health facilities should be on 5km×5km grids; (2) agricultural sectors should be on 10km×10km grids; and (3) microcredit sectors should be on

15km×15km grids. These grids were developed on the basis of the perceptions of local people and their demand to NGOs provisions along the river Jamuna, Bangladesh.

7.2 Conclusions

This paper has highlighted the role of NGOs provision in three sectors, such as (1) education; (2) agriculture; and (3) micro-credit sectors alongside the river Jamuna, Bangladesh. Recently, NGOs had made an enormous contribution to social development sectors. Therefore, local NGOs provision along the river Jamuna to be counted as a second-best alternative choice of the rural poor people.

Rural Children should attain a satisfactory level of basic education, whether they involve to NGOs education program. Alongside the river Jamuna, local NGOs are working to provide educational curriculum, raise educational awareness, generate income through the education program, ensure provision of learning material, food and nutrition programs and make community learning centers to all in the remote areas. Along with provided facilities, NGOs should give emphasis on clean water supply, make more playgrounds, the internet and computer facilities, make cemented toilets and supply electricity. To ensure primary schooling, more efforts like (1) reforming more educational infrastructure; (2) organizing training, seminars, workshops, meetings with religious perspective; (3) improving the quality of life of local people; (4) improving transportation and accommodation facilities; and (5) giving focus to unprivileged or unserved areas needed to develop literacy rate along the river Jamuna, Bangladesh. Besides that, local NGOs should ensure to reach their provision among the rural poor children. Furthermore, schools should make more in the *char* lands using local resources. In addition, this section was analyzed the student's daily behavioral activities before and after joining NGOs education program, making students aware of the environment, student's life skill improvement and finally, income generating activities through NGOs education program in the study sites. After involvement with NGOs education program, there were not significantly changed their daily behavioral activities, awareness to the environment and life skill improvement through income generating activities. Therefore, local NGOs should give more concentration on rural children's schooling providing an attractive curriculum with friendly motivation along the river Jamuna, Bangladesh.

On the contrary, local NGOs contributed the significant role in the agricultural sectors by providing agricultural loan, training and tools, fertilizer, pesticides, seeds, providing livestock, handicraft training, community based fisheries management, agricultural employment generation, make social capital for agriculture and food processing and storage along the river Jamuna, Bangladesh. To ensure better facilities

in the agricultural sectors, local NGOs should be provided agricultural loans in advance at the beginning of crops farming and repayment should be made after receiving returns from the investment. There are seven types of *char* land were identified in terms of population density and crop suits whereas new *char* lands are more prominent. Besides that, this paper identified potentialities of different agricultural yield where Boro rice, wheat, onion, garlic, and mustard are suitable for farming. Along the river Jamuna, the number of agri farmers are more than other secondary activities like services in the governmental and non-governmental organizations or industries. But in the recent year, people along the Jamuna tried to involve with business or services oriented job to earn more money for an economic solvent. Therefore, local NGOs should make attractive offers in the agricultural sectors to encourage local farmers for farming instead of business or services. In addition, this section makes the linkage between growth/commercial centers and agricultural development. Results illustrate that commercial centers are strongly related to agricultural development along the river Jamuna, Bangladesh. Finally, socio-economic results demonstrate that after involving to NGOs agri-credit program, their income was increased than before and income was highly related to NGOs provided services.

Microcredit has been a most important backing for rural livelihoods in Bangladesh. Geo-spatial attributes of local NGOs were analyzed and found that borrowers, savers, saving deposits, and loans were higher in the upper and lower Jamuna whereas in the middle part is very lower in terms of the number of borrowers and savers and amount of savings and loan outstanding. To ensure better and equal credit facilities, local NGOs should give more attention in the middle part of Jamuna. Among 30 NGOs, there are only four NGOs are providing more facilities to the rural poor, whereas rest of 26 NGOs were served a very little portion of the total population. So, rest of 26 NGOs should increase their working area with a huge investment in the credit sectors to serve rural poor people and make them economically solvent. Local NGOs working area are highly linked to the number of commercial centers and population density. Therefore, the remote areas should make commercial centers and create employment opportunities to support rural poor people. Finally, the socio-economic analysis illustrates that NGOs' credit makes economically solvent of the rural poor and significant assets of the respondents are significantly related to their income. At the end, this paper makes a plan to minimize distances and for equal distribution of local NGOs to ensure better facilities on education, agriculture and micro-credit sectors using the grid method. To make the sustainable economic development of the rural poor, local NGOs should take an attempt in order to increase awareness and motivate

to NGOs credit benefits as well as provide them an attractive offer to use credit in farming or business purposes.

I suggested some of the further issues which have been found as vital for the academic arena:

(1) Detailed studies are necessary to understand the local infrastructure and NGOs provided services to education sectors;

(2) The future study should analyze the regional differences among upper, middle and lower Jamuna River;

(3) In depth studies are required to detail understand the correlation between profit from agriculture and six dependent variables at union level;

(4) The present study should carry on for the next several years to understand the NGOs contribution to rural development; and finally

(5) Need to improve grids methods more according to the rural people perceptions and demand.

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Annex-I
Household Questionnaire Survey and Key Informant Interviews (KII)

1. Name of the respondent   Male/Female Age: Land ownership: Own/Land lord
   Address: Village: Union: Upazila:
   District:
2. Marital status   Married/unmarried/divorced
3. Family status

Name	Relation	Age	Sex	Education /NGOs	NGOs educational facilities	Occupation	Income

4. Schools information's (If respondents have children and involve to NGOs education program):

a.	The management system and local committee of the schools	Yes/No
b.	Electricity and playground facilities	Yes/No
c.	Water supply status of the schools	Tube-well/Tape
d.	Computer and internet facilities	Yes/No
e.	Types and geographical location of schools	Katcha/Pakka/Semi-pakka
f.	Geographical condition of the schools	Plain land/ River side/ Haor/Beel
Please write the total number of male and female students of the schools. Answer:		

5. Student's daily behavioral activities before and after joining NGOs education

	Option	Before Education	After Education
a.	Using sanitary latrine		
b.	Using sandals at latrine		
c.	Wash hands properly after using latrine		
d.	Wash hands properly before meal		
e.	Use safe water for drinking		
f.	Use safe water for daily use		
g.	Students cut their nail regularly		
h.	Students cut their hair regularly		
i.	Wearing clean dresses		
j.	No walking on bare foot		

6. Making students aware about environment, natural disasters, early marriage and child labour

	Option	Before Education	After Education
a.	Environment protection knowledge		
b.	Importance of tree plantation		
c.	knowledge on environmental pollution		
d.	knowledge on natural disasters		
e.	knowledge on mitigation strategy		
f.	Know about flood shelter		
g.	Knowledge on early marriage		
h.	Knowledge on child labour		

7. Activities which show students' life skill improvement

	Option	Before Education	After Education
a.	Can write and read		
b.	Can keep daily accounts		
c.	Can make saline		
d.	Can use computer		
e.	Can use internet		
f.	Aware about own right		

8. Income generating activities of the students through NGOs education

	Option	Before Education	After Education
a.	Vocational training		
b.	Computer training		
c.	Training on fisheries		
d.	Training on agricultural practice		
e.	Training on kitchen gardening		
f.	Training on handicrafts		

9. NGOs provision in agricultural sectors:

Member of NGOs	Yes/No
	If yes, then name of the NGOs:
	Distance from your house:
List of the facilities	(1)
	(2)
	(3)
	Any other comments:

10. Do you use agricultural tools?

List of agricultural tools	(1)
	(2)
	(3)
	Any other comments:

11. Have there any commercial centers? Please mention the name of commercial centers and collect its latitude and longitude.

List of commercial centers	(1)
	(2)
	Distance from your house:
	Latitude and longitude:

12. Monthly income (Before and after joining to local NGOs)

Before joining to local NGOs	After joining to local NGOs
Occupation	

13. Housing condition of the respondents

Categories			
1	2	3	4
Katcha	Pakka	Semi-pakka	Tin shed

14. Do you involve to NGOs micro-credit program?

Name of NGOs	Yes/No
List of the facilities	If yes, then facilities from the NGOs: (1) (2) (3) Demerits: 1) (2) (3) Any other comments:

15. Purpose of getting Loan of the respondents

Categories						
1	**2**	**3**	**4**	**5**	**6**	**7**
Business purpose	Buy cattle	Agriculture tools	Kitchen gardening	House loan	Making garden	Paltry farm

16. Occupational status (Before and after receiving credit)

Before joining to local NGOs	After joining to local NGOs
Monthly income	
If occupational status changed then reasons of changes- (1) (2) (3) Any other comments:	

17. Current economic status

Current economic status of the respondents: Bad/good, If bad then the reasons- (1) (2) Any other comments: Facing problem in installment? Yes/No, If yes then the reasons- (1) (2) Any other comments:

18. What types of assets do you have?

Assets name	Number of assets
(1) (2) (3) (4) (5) Any other comments:	

19. What type of NGOs facilities will you give priority first?

Categories			
1	**2**	**3**	**4**
Micro-credit facilities	Health facilities	Agricultural facilities	Educational facilities

20. Credit information's from the local NGOs:

Branch name	Latitude	Longitude
Geographical location of local NGOs		
Plain land	River side	Haor/Beel
Population density of the converges area		
Year of establishment		
Number of savers		
Number of borrowers		
Saving deposits		
Loan outstanding's		
Merits and demerits of NGOs credit		
(1)		
(2)		
(3)		
(4)		
(5)		
Any other comments:		
What types of health facilities they are provided for the employ?		
(1)		
(2)		
(3)		
Any other comments:		
Branch manager name:		
Phone number:		
Facing problem to disburse loan-Yes/ No, if yes then the reasons-		
(1)		
(2)		
(3)		
Any other comments:		

21. Take photograph- Yes/No

Name of the surveyor

Signature

Educational institutions

District Name	Institute	Longitude	Latitude
Bogra	Mathura Para B.K. High School	89.587700	24.837020
Bogra	Nizam Uddin High School Karnibari	89.591840	24.833270
Bogra	Kutubpur High School	89.590410	24.821970
Bogra	Naokhila P N High School	89.596200	24.802690
Bogra	Karitala S H Dimukhi High School	89.587470	24.786300
Bogra	Aowlakandi E M High School	89.616430	24.762100
Bogra	Ayesa Osman Girals Higth School	89.599550	24.802570
Bogra	Shahid Muktijoddaa Montu Bidyalaya	89.560850	24.905760
Bogra	Ahucar Para Junior High School	89.580930	25.015110
Bogra	Hat Sherpur High School	89.545160	24.949030
Bogra	Nizbolail High School	89.547490	24.943990
Bogra	Khorda Balail High School	89.569980	24.924040
Gaibandha	Sundargaj D.W Degree College	89.524310	25.566380
Gaibandha	Belka Degree College	89.557110	25.537070
Gaibandha	Dharmapur Abdul Jabbar Degree College	89.584150	25.457280
Gaibandha	Jumarbar High School	89.573310	25.067640
Gaibandha	Munshirhat High School	89.590230	25.139260
Gaibandha	Shaghatta Pilot High School	89.592480	25.126870
Gaibandha	Jhara Barsha High School	89.580720	25.120700
Gaibandha	Kachua Hat Shahid Hrm Girls High School	89.576090	25.148150
Gaibandha	Holdiabera Adarsha Junior Girl's School	89.595240	25.077880
Gaibandha	Nalchia Junior School	89.584390	25.050600
Gaibandha	Itakuri Junior Girl's High School	89.588840	25.148690
Gaibandha	Khidir Sharif Al Wahedi High School	89.596810	25.420550
Gaibandha	Kachuar Khamar High School	89.599200	25.406710
Gaibandha	Barabaldia High School	89.618190	25.405380
Gaibandha	Kamarjani Merchants High School	89.630170	25.396680
Gaibandha	Kamarjani Banik Girls High School	89.631120	25.392960
Gaibandha	Uttar Gidri Dee Mukhi High Shcool	89.612750	25.383120
Gaibandha	Gidarai B.L High School	89.620890	25.368020
Gaibandha	Baguria High School	89.608100	25.337970
Gaibandha	Mollar Char High School	89.729960	25.378490

Gaibandha	Dariapur Aman Ullah. High School	89.575360	25.386100
Gaibandha	Kholahati High School	89.570540	25.389280
Gaibandha	Murshider Bazar Junior Girls School	89.593760	25.419330
Gaibandha	Kholahati Junior Girls High School	89.569470	25.387900
Gaibandha	Kundarpar Gana Unnayan Academy	89.659740	25.342470
Gaibandha	Saidpur Bl-Lateral High School	89.608970	25.327030
Gaibandha	Kanchipara M A U Academy	89.602090	25.319130
Gaibandha	Kanchipara N H A Girls High School	89.600330	25.315900
Gaibandha	Golakati High School	89.582500	25.301850
Gaibandha	Manikkor High School	89.612960	25.297110
Gaibandha	Fulchari Pilot High School	89.593700	25.194760
Gaibandha	Jiga Bari High School	89.727730	25.338060
Gaibandha	Horichandi High School	89.744100	25.260610
Gaibandha	Algar Char Junior Girl's School	89.730250	25.332340
Gaibandha	Chandan Shar Jr. School	89.655670	25.232750
Jamalpur	Balijuri F. M. High School	89.727880	24.895030
Jamalpur	Balijuri Roushan Ara Govt. Girls High School	89.718300	24.901630
Jamalpur	Madargonj A.M. Pilot High School	89.713220	24.889900
Jamalpur	Tartapara High School	89.728250	24.875040
Jamalpur	No. 5 Union Jahanara High School	89.743130	24.853430
Jamalpur	Fuljore Rahim Zafor High School	89.695890	24.835750
Jamalpur	Koladah Mirza Golam Mostofa High School	89.749960	24.817520
Jamalpur	Khalequannessa Academy	89.703780	24.832880
Jamalpur	Khilkati Ideal Junior School	89.718420	24.848710
Jamalpur	Shukhnagari Bofatuddin Talukder Jr. School	89.724390	24.874490
Jamalpur	Rudra Boira Girl's High School	89.822930	24.709440
Jamalpur	Bogar Par High School	89.838430	24.724820
Jamalpur	Boira Israil Ahmmad High Schoool	89.817760	24.707190
Jamalpur	Pogal Digha High School	89.822460	24.678970
Jamalpur	Jamuna High School	89.831000	24.673420
Jamalpur	Pogaldigah Girls High School	89.824630	24.696330
Jamalpur	Batikamari High School	89.830650	24.645550
Jamalpur	Ponchashi High School	89.864620	24.662590
Jamalpur	Kabaria Bari High School	89.841900	24.640130
Jamalpur	Pingna Girls High School	89.814150	24.616230
Jamalpur	Pingna Hig School	89.812340	24.618120
Jamalpur	Shamsunnahar High School	89.814300	24.601700

Jamalpur	Malipara High School	89.801260	24.713340
Jamalpur	Doulatpur High School	89.831370	24.658910
Jamalpur	Shaheed Smrity A.B.S High School	89.709320	25.118380
Jamalpur	Kulkandi Shamsunnahar High School	89.728060	25.105440
Jamalpur	Mannia High School	89.661940	25.109680
Jamalpur	Belgacha Girls High School	89.717260	25.100570
Jamalpur	Belgacha High School	89.739570	25.104210
Jamalpur	Chinaduly S.N. High School	89.726800	25.056660
Jamalpur	Sapdhori High School	89.704890	25.033470
Jamalpur	Ulia A.M. High School	89.727880	25.036960
Jamalpur	Hargila High School	89.724330	25.012410
Jamalpur	Kajla Khalilur Rahman High School	89.700360	24.990310
Jamalpur	Katma Junior School	89.698150	24.977640
Jamalpur	Baliadaha High School	89.702390	25.072400
Jamalpur	Chinaduly Jonior Girl's School	89.735680	25.046320
Jamalpur	Noarpara Nilufar Mahmud Junior High School	89.719360	25.028920
Jamalpur	Hati Vanga A.B. High School	89.768080	25.277770
Jamalpur	Chaker Char New Modern High School	89.767250	25.276740
Jamalpur	Khola Barir Char Junior High School	89.722380	25.222520
Jamalpur	Delwar Hossain High School	89.734240	25.173060
Jamalpur	Bir Halka High School	89.735970	25.162720
Jamalpur	Bangladesh Railway High School	89.769260	25.250510
Jamalpur	Shahjadpur High School	89.765570	25.238290
Jamalpur	Pullakandi High School	89.764230	25.233720
Jamalpur	Bahadurabad High School	89.761160	25.222030
Jamalpur	Basetpur Bl Lateral High School	89.763290	25.220810
Jamalpur	Digrir Char Hefaz Uddin High School	89.760920	25.234430
Jamalpur	Akanda Para Jamiron Nessa Girl's High School	89.759980	25.271020
Jamalpur	Zhalur Char M.R.M Junior Girls School	89.755900	25.216680
Jamalpur	Char Hati Vanga Model High School	89.774100	25.270280
Jamalpur	Nilakhia R.J. Pilot High School	89.888360	25.129960
Jamalpur	Merur Char Hasen Ali High School	89.851670	25.146100
Jamalpur	Shadhur Para Nazrul Islam High School	89.831450	25.212890
Jamalpur	Khewarchar High School	89.837950	25.180830
Jamalpur	Bhaty Khewarchar Girls High School	89.836860	25.172170
Jamalpur	Jagirpara High School	89.833230	25.162830
Jamalpur	Farazi Para Junior School	89.818460	25.179440

Jamalpur	Janokipur Adarsha Girls High School	89.892600	25.143120
Jamalpur	K.B Model High School	89.817320	25.223000
Kurigram	Tapur Chhr B G Junior School	89.843960	25.665740
Kurigram	Char Shoulmari Girls High School	89.786670	25.671200
Kurigram	Sonapur Junior High School	89.789020	25.661190
Kurigram	Pakhiura High School	89.808800	25.651730
Kurigram	Char Shoulmari M,L High School	89.809420	25.631180
Kurigram	Tapur Char High School	89.839940	25.624900
Kurigram	Shoul Mari M.R. Hogh School	89.864360	25.617540
Kurigram	Rowmari Girls High School	89.839800	25.578560
Kurigram	Rowmari C G Zaman High School	89.835190	25.574290
Kurigram	Fulbari High School	89.863840	25.546630
Kurigram	Chaktabari High School	89.838990	25.531900
Kurigram	Kalababi B.Bc High School	89.853700	25.497700
Kurigram	Jadur Char High School	89.819600	25.526720
Kurigram	Jadur Char Girls High School	89.819770	25.524180
Kurigram	Komar Vangi High School	89.817740	25.481880
Kurigram	Kutir Char High School	89.818330	25.585010
Kurigram	Fulkar Char Junior High School	89.824000	25.688560
Kurigram	Batkamary Junior High School	89.816660	25.591030
Kurigram	Sonavori Model Junior School	89.817650	25.571870
Kurigram	Khodai Mari Junior High School	89.804290	25.633500
Kurigram	Rowmari Junior High School	89.839220	25.549080
Kurigram	Char Kazaikata Adarsha Junior School	89.840300	25.550750
Kurigram	Pashchim Fulmoti High School	89.502350	25.990570
Kurigram	Balarhat Adarsha Ml High School	89.522340	25.989200
Kurigram	Balarhat Girls High School	89.524850	25.988730
Kurigram	Shimulbari Miapara Nazimuddin High School	89.517100	25.943510
Kurigram	Uttar Shimulbari High School	89.528530	25.961240
Kurigram	Miahpara Adarsa Junior Girls School	89.526010	25.963860
Kurigram	Rabaitary S.B.Ml High School	89.615800	25.931850
Kurigram	Rangamati Sarder Para Adarsha High School	89.619910	25.885230
Kurigram	Baralai High School	89.602130	25.907060
Kurigram	Bara Bhita High School	89.579770	25.911060
Kurigram	Baravita Girls High School	89.581720	25.918960
Kurigram	Ram Ram Sen Junior Girls School	89.634380	25.917320
Kurigram	Najar Mamud Junio School	89.618860	25.921050

Kurigram	Uttar Bhangamore Junior School	89.627250	25.905380
Kurigram	Char Mkhliy Junior High School	89.574260	25.887130
Kurigram	Nowdabash Adarshah Juniour School	89.602170	25.921310
Kurigram	Char Baralai Juniour High School	89.602760	25.894750
Kurigram	Roygonj Girls High School	89.675750	26.033130
Kurigram	Ratanpur M. U. High School	89.707530	26.029490
Kurigram	Bamandanga N M Bl High School	89.718760	25.982400
Kurigram	Baromani Junior High School	89.718610	25.987070
Kurigram	Muria Hat High School	89.709860	25.993980
Kurigram	Subalpar High School	89.749710	26.045110
Kurigram	Kachakata M/L High School	89.796460	26.034310
Kurigram	Indrogore B.L.High School	89.791660	25.975950
Kurigram	Chaddoguri Adarsha Junior High School	89.810780	25.933050
Kurigram	Narayanpur B.L High School	89.817840	25.902570
Kurigram	Hasnabad Adarsha Janata Yidyabitan High School	89.641950	25.918980
Kurigram	Joymongal Agaromatha High School	89.621900	25.946190
Kurigram	Char Ballarampur Prantanibas High School	89.759680	25.962510
Kurigram	Madargonj M.L High School	89.785590	25.968530
Kurigram	Shalmara Islamia Ml. High School	89.735180	25.975020
Kurigram	Berubari B L High School	89.724990	25.974880
Kurigram	Berubari Bl Girls Highschool	89.713780	25.960510
Kurigram	Khalar Bhita High School	89.737510	25.938320
Kurigram	Noonkhawa Junior Girls School	89.772280	25.895480
Kurigram	Char Losni Junior Sehool	89.727890	26.027590
Kurigram	Momingonj Junior High School	89.760690	25.966220
Kurigram	Kurigram Govt. High School	89.648100	25.802490
Kurigram	Kurigram Govt. Girls High School	89.642240	25.791030
Kurigram	Kurigram Girl's High School	89.654810	25.816660
Kurigram	Kurigram River View High School	89.659710	25.820720
Kurigram	Harikesh J R High School	89.641330	25.809050
Kurigram	M.A. Sattar Adarsah High School	89.642140	25.825670
Kurigram	Kurigram Adarsha High School	89.666860	25.823870
Kurigram	Begum Nurunnahar Girls High School	89.651000	25.787640
Kurigram	Karimer Khamar High School	89.663160	25.797300
Kurigram	Hazi Ismail Hossan Junior School	89.661530	25.799070
Kurigram	Gobindapur Junior High School	89.725710	25.783440

Kurigram	Mogol Basa Junior Girls School	89.657620	25.779970
Kurigram	Majagram Adarsah Junior High School	89.682150	25.768230
Kurigram	Uttar Holokhana Junior Adarsah Girls School	89.609750	25.873790
Kurigram	Nornnabi Holokhana Junior Girls School	89.636150	25.857840
Kurigram	Kanchi Char B A G Junior High School	89.697090	25.846190
Kurigram	Char Baraibari Junior Girls School	89.660310	25.879430
Kurigram	Uttar Kumar Pur Junior Girls High School	89.668200	25.897250
Kurigram	Kagzipara Adrasah High School	89.611950	25.890650
Kurigram	Sarodob Adarsha High School	89.595620	25.871420
Kurigram	Holokhana Bl High School	89.629730	25.853200
Kurigram	Holokhana Junior Girls School	89.626400	25.860290
Kurigram	Khamar Barai Bari High School	89.664760	25.877870
Kurigram	Bhogdanga A K (Ml) High School	89.677350	25.851560
Kurigram	Bhogdanga Girls High School	89.681220	25.851860
Kurigram	Razar Hat Bl. High School	89.713290	25.867400
Kurigram	Ghogadaha Maleka Khatun Girls High School	89.724300	25.848890
Kurigram	Ghogadaha High School	89.726890	25.844510
Kurigram	Jatrapur Girls High School	89.731570	25.811160
Kurigram	Chanda Khan Para High School	89.736600	25.809100
Kurigram	Panch Gachhi High School	89.704180	25.811550
Kurigram	Panch Gachhi Girl's High School	89.715960	25.817560
Kurigram	Nayarhat High School	89.684620	25.774710
Kurigram	Mogal Basha B L High School	89.658870	25.771620
Kurigram	Sener Khamar R. B.L High School	89.653920	25.783010
Kurigram	Belagacha Barkatia B.L. High Shcool	89.624810	25.785430
Kurigram	Kanthal Bari High School	89.592930	25.847830
Kurigram	Fakirer Hat High School	89.696040	25.647840
Kurigram	Kanchkol Hat M.N. High School	89.680550	25.619470
Kurigram	Ranigonj Bazar High School	89.699680	25.616520
Kurigram	Balabari Hat Girls High School	89.660550	25.601250
Kurigram	Balabari Hat B.L High School	89.659900	25.598740
Kurigram	Chilmari Jr Girls School	89.692510	25.583270
Kurigram	Thannat Pilot Girl's High School	89.667460	25.583330
Kurigram	Thanahat A.U. Pilot High School	89.667990	25.580700
Kurigram	Bazra Tabakpur High School	89.683740	25.608600
Kurigram	Chilmari High School	89.675670	25.569960
Kurigram	Mudafot Thana Sc High School	89.660650	25.565500

Kurigram	Sharifer Hat M.U. High School	89.642880	25.558400
Kurigram	Natar Kandi High School	89.768660	25.545860
Kurigram	Radha Bollav Junoor School	89.666740	25.627630
Kurigram	Dakhin Khauria High School	89.749500	25.612530
Kurigram	Adhikari Para Girls Junior High School	89.676310	25.585040
Kurigram	Sadakat Hossain High School	89.767970	25.484220
Kurigram	Kodal Kati Girls High School	89.768380	25.481490
Kurigram	Shankar Madhabpur High School	89.767840	25.477400
Kurigram	Rajibpur Girls High School	89.822520	25.444750
Kurigram	Rajibpur Pilot High School	89.825250	25.444510
Kurigram	Jauniar Char High School	89.826080	25.439180
Kurigram	Shiber Dangi High School	89.835070	25.448610
Kurigram	Char Newaji B.L High School	89.764260	25.426200
Kurigram	Nayacar Bazer Girls High School	89.758160	25.406480
Kurigram	Naya Char Junior Boys School	89.764070	25.398760
Kurigram	Fakir Para Adarsha Girls High School	89.561060	25.656380
Kurigram	Hokadandga High School	89.559390	25.651010
Kurigram	Hatia Girls High School	89.693620	25.731890
Kurigram	Janata Hat Adosho Junior High School	89.679810	25.719790
Kurigram	Ramdhan Boikuntha Asram Junior High School	89.605230	25.611590
Kurigram	Mondoal Hat Junior Girls School	89.662040	25.718750
Kurigram	Kadamtala B.L High School	89.531420	25.708820
Kurigram	Daldalia Girls High School	89.550030	25.707200
Kurigram	Daldalia Adarsha High School	89.565510	25.696970
Kurigram	Khamar Magura Muhammadia High School	89.562390	25.684400
Kurigram	Buraburi High School	89.677720	25.736960
Kurigram	Bakshigonj Rajibia High School	89.691620	25.719170
Kurigram	Mandal Hat High Shcool	89.664320	25.712180
Kurigram	Khudir Kuti Abdul Hamid High School	89.726670	25.749140
Kurigram	Gandar Alga High School	89.808770	25.680040
Kurigram	Nutan Anantapur Girls High School	89.667660	25.697600
Kurigram	Nuton Anantapur High School	89.674790	25.695700
Kurigram	Hatia Bhosboesh Adarsha Jr. School	89.678570	25.665100
Kurigram	Bozra Sabuj Girl's High School	89.599010	25.588490
Kurigram	Bozra Purba Para Girl's High School	89.609690	25.586370
Kurigram	Chir Bozra High School	89.596180	25.566010

Kurigram	Kaludanga High School	89.596990	25.638950
Kurigram	Kanthal Bari Bilatterel High School	89.590570	25.636550
Kurigram	Nandu Nera Adarsha Junior Girls School	89.576750	25.643400
Kurigram	Thetrai B L High School	89.558870	25.676670
Kurigram	Thetrai Girls High School	89.568520	25.659590
Sirajganj	Mirpur High Schol	89.715760	24.436940
Sirajganj	Sirajganj Bahumukhi High School	89.716300	24.457740
Sirajganj	B.L. Govt. High School,Sirajganj	89.717160	24.460130
Sirajganj	Saleha Ishaque Govt.Girls High School	89.707810	24.452810
Sirajganj	Hazi Ahmed Ali High School	89.708860	24.452330
Sirajganj	Jahan Ara High School	89.705200	24.457720
Sirajganj	Guri Urban Girls High School,Sirajganj	89.717670	24.465050
Sirajganj	Rahmat Gonj Girls High School	89.695820	24.462310
Sirajganj	Darul Islam Academy High School	89.689770	24.454830
Sirajganj	Qaumi Jute Mills High School	89.702640	24.443270
Sirajganj	S.B. Railway Colony High School	89.703700	24.435180
Sirajganj	Dr. Nawsher Ali Memorial Girl's High School	89.698630	24.449450
Sirajganj	Sabuj Kanan High School	89.703450	24.465500
Sirajganj	Victoria High School	89.709160	24.468370
Sirajganj	Ranigram Adarsha Girls High School	89.705150	24.478200
Sirajganj	Power House Adarsho High School	89.690940	24.472140
Sirajganj	Haimabala Girls High School	89.702570	24.470890
Sirajganj	Jnanadiyani High School,Shirajganj	89.709320	24.471930
Sirajganj	Songasa Junior Girls School	89.691460	24.451900
Sirajganj	Tatulia Chunia Haty Junior High School	89.686680	24.412240
Sirajganj	S M Junior High School	89.693270	24.409660
Sirajganj	Shaluavita Junior Girls School	89.677610	24.490430
Sirajganj	Hilful Fuzul Modern High School	89.679620	24.467970
Sirajganj	Rupsha High School	89.757580	24.591340
Sirajganj	Mesra High School,Shirajganj	89.717930	24.569180
Sirajganj	Gotia Shamser Ali High School	89.748850	24.547910
Sirajganj	Shahid Ahsan Ul Habib High School	89.681000	24.547440
Sirajganj	Charsongacha Alhaz Samsher Ali High School	89.676610	24.522940
Sirajganj	Bhatpeary J. R. S High School	89.693140	24.524180
Sirajganj	Char Khokshabari High School	89.674160	24.495230
Sirajganj	Hat Boyra High School	89.687790	24.500550
Sirajganj	Kalia Kandapara High School	89.690540	24.436180

Sirajganj	Paik Para Model High School	89.706070	24.420720
Sirajganj	Al-Haj Mahiuddin Nasir Girls High School	89.717110	24.379410
Sirajganj	Sayadabad High School	89.717810	24.392940
Sirajganj	Porabari High School	89.713870	24.389850
Sirajganj	Preety Lata High School	89.660120	24.481380
Sirajganj	Paran Pur High School	89.607930	24.694140
Sirajganj	Kantanagar B.L. High School	89.723930	24.619780
Sirajganj	Shubgacha High School	89.689940	24.570960
Sirajganj	Banglabazar Girls High School	89.676590	24.612710
Sirajganj	Subgacha Tenglahata R.U. High School	89.677260	24.609690
Sirajganj	Alampur N.M. High School	89.645610	24.645310
Sirajganj	Beara Nurnabi Ml. High School	89.653150	24.661120
Sirajganj	Kazipur Rani Din Moni Ml. High School	89.657730	24.660560
Sirajganj	Kazipur A. M .U. Govt. Girls High School	89.653000	24.662620
Sirajganj	Meghai E.U.I. High School	89.648030	24.668250
Sirajganj	Khassuriber High School	89.705200	24.674570
Sirajganj	Kantanagar Junior Girls School	89.728010	24.615500
Sirajganj	Goal Bathan Junior School	89.743870	24.657780
Sirajganj	Dicree Dorita High School	89.754620	24.674470
Sirajganj	Rehai Suriber Girls School	89.706270	24.688780
Sirajganj	Purb Rahishureber Junior Girls School	89.691970	24.687990
Sirajganj	Beltoil Alah Baksa Riaj Uddin Junior High School	89.642370	24.697350
Sirajganj	Girish Junior High School	89.728750	24.742820
Sirajganj	Shalgram Junior High School	89.742100	24.712720
Sirajganj	Rajnath Pur Junior Girls School	89.791480	24.702570
Sirajganj	Ghoragaca Junior Secondray School	89.715040	24.664930
Sirajganj	Chand Nagor Junior School	89.678120	24.566480
Sirajganj	Shimuldair High School	89.624640	24.674700
Sirajganj	Raghunathpur High School	89.792930	24.704460
Sirajganj	Majna Bari High School	89.755190	24.701070
Sirajganj	Char Girish Union M.Munsur Ali Jatio High School	89.742080	24.708500
Sirajganj	Khashrajbari High School	89.701870	24.716940
Sirajganj	Nischintapur Union High School	89.760320	24.663250
Sirajganj	Natuar Para K. B. Ml High School	89.716460	24.692780
Sirajganj	Maiz Bari High School	89.640730	24.695760

Sirajganj	Enayet Pur Islamia High School	89.702690	24.232710
Sirajganj	Betil High School	89.697860	24.239010
Sirajganj	Meher Un Nessa Girls High School	89.707740	24.229570
Sirajganj	Sodia Dewan Tala Shankarhati Hich School	89.732700	24.230880
Sirajganj	Basantapur Junior School	89.720380	24.211750
Sirajganj	Khash Kawlia K.R. Pilot High School	89.789720	24.123530
Sirajganj	Janata High School	89.793580	24.126410
Sirajganj	Khash Kawalia Girls High School	89.794790	24.123760
Sirajganj	Khash Pukhuria B.M. High School	89.795780	24.108710
Sirajganj	Kodalia Jr Girls High School	89.801110	24.094100
Sirajganj	Mituani B C Sadarsha Girls High School	89.792940	24.078600
Sirajganj	R P N Shaid Shahjahan Kabir High School	89.813180	24.082170
Sirajganj	Shambhudia Ml High School	89.775720	24.068570
Sirajganj	Poyla High School	89.760840	24.062850
Sirajganj	Dattakandi K. M. M. L High School]	89.725990	24.026150
Sirajganj	Char Pachuria High School	89.726600	24.031270
Sirajganj	Chowhali Adarsha High School	89.793470	24.117310
Sirajganj	Pathrail Junior School	89.732290	24.232800
Sirajganj	Bridashuria Junior School	89.736280	24.232310
Sirajganj	Paschim Kodalia National Junior School	89.793850	24.122180
Sirajganj	Chowbaria Junior Girls School	89.766360	24.078690
Sirajganj	Hatail Junior School	89.787050	24.069730
Sirajganj	Char Jajuria Junior Girls School	89.800140	24.159150
Sirajganj	Amin Uddin Osmangani High School	89.714050	24.360530
Sirajganj	Rajapur High School	89.713770	24.358050
Sirajganj	Sholoshato Jangalia High School	89.745420	24.307470
Sirajganj	Shohagpur Nutan Para A.S. High School	89.697540	24.300450
Sirajganj	Shohagpur Pilot Girl's High School	89.698700	24.297290
Sirajganj	Shohagpur S.K. Pilot High School	89.699450	24.294810
Sirajganj	Tengasia High School	89.688280	24.264210
Sirajganj	Ajgara High School	89.711090	24.261960
Sirajganj	Alhaj Mojirul Hoque Junior School	89.719930	24.265870
Sirajganj	Kamarpara Alhaj Shajahan Girls High School	89.695680	24.279160
Sirajganj	D S A Junior School	89.709760	24.345230

NGOs information's and field survey: 2015

(Along the Jamuna River, Bangladesh)

District	Branch Name	Latitude	Longitude
Jamalpur	ASA	24.70605011	89.82574426
Jamalpur	ASA	24.70619998	89.82529038
Jamalpur	Grameen Bank	24.71031063	89.81841269
Jamalpur	ARBAN	24.71029856	89.81850212
Jamalpur	BRAC	24.68884952	89.82867239
Jamalpur	ASA	24.62518369	89.81010027
Jamalpur	BRAC	24.62537413	89.81080368
Jamalpur	Grameen Bank	24.61851387	89.80906947
Jamalpur	Grameen Bank	24.64902920	89.82732022
Jamalpur	SSS	24.67738291	89.82671941
Jamalpur	PDBF	24.67722190	89.82641405
Jamalpur	US	25.12721694	89.71926550
Jamalpur	PRODIPON	25.27714270	89.76674153
Jamalpur	Sajida Foundation	25.16696585	89.75809392
Jamalpur	Grameen Bank	25.16470299	89.75892213
Jamalpur	SSS	25.16481849	89.75749495
Jamalpur	BRAC	25.16315527	89.75998370
Jamalpur	PROGRESS	25.16634559	89.76088408
Jamalpur	ASA	25.15982363	89.76198572
Kurigram	Atto Mohila Unnaion Somity	25.94618135	89.55312453
Kurigram	Thangara Mara Mohila Sabuj Songo	25.94556344	89.55362803
Kurigram	Bhomukhi Mohila Unnaion Somity	25.98901011	89.52010897
Kurigram	Grameen Bank	25.94730679	89.55562804
Kurigram	ASA	25.95192153	89.55086779
Kurigram	BRAC	25.95252989	89.55145301
Kurigram	ASA	25.95213854	89.55120943
Kurigram	RDRS Bangladesh	25.94247580	89.55577942
Kurigram	RDRS Bangladesh	25.88510972	89.83484692
Kurigram	Grameen Bank	25.89063926	89.71047792
Kurigram	BRAC	25.89078954	89.71116037
Kurigram	TMSS(Thakurgan Mohila Sobuj Sango)	25.89596059	89.71030894
Kurigram	RDRS Bangladesh	25.89048511	89.70883070

Kurigram	RDRS Bangladesh	25.98157134	89.79190626
Kurigram	Grameen Bank	26.01037332	89.78688785
Kurigram	ASA	26.01103155	89.78697787
Kurigram	BRAC	26.01465622	89.77896485
Kurigram	Grameen Bank	25.95447122	89.73136805
Kurigram	BRAC	25.95886770	89.72625735
Kurigram	BRAC	25.81431834	89.73359864
Kurigram	RDRS Bangladesh	25.81794209	89.73368095
Kurigram	ASA	25.84662387	89.72335998
Kurigram	TMSS(Thakurgan Mohila Sobuj Sango)	25.85407530	89.67027965
Kurigram	Grameen Bank	25.85508884	89.67083680
Kurigram	ASA	25.82180589	89.70872099
Kurigram	Grameen Bank	25.82099830	89.70853893
Kurigram	RDRS Bangladesh	25.78253634	89.63400219
Kurigram	Grameen Bank	25.78713960	89.63492202
Kurigram	ASA	25.78825892	89.63565149
Kurigram	RDRS Bangladesh	25.55207575	89.76018721
Kurigram	RDRS Bangladesh	25.48578193	89.76027237
Kurigram	Grameen Bank	25.62218425	89.79106606
Kurigram	UDDIPAN	25.62028809	89.79139698
Kurigram	RDRS Bangladesh	25.61770052	89.79183250
Kurigram	Grameen Bank	25.65404906	89.80509904
Kurigram	RDRS Bangladesh	25.69305659	89.81505306
Kurigram	ASA	25.65330634	89.79921729
Kurigram	RDRS Bangladesh	25.57415150	89.82628539
Kurigram	RDRS Bangladesh	25.61185028	89.85070724
Kurigram	Grameen Bank	25.65477133	89.85187258
Kurigram	BRAC	25.65580146	89.85183494
Kurigram	ASA	25.65407236	89.85449511
Kurigram	SSS	25.66507470	89.84877597
Kurigram	Grameen Bank	25.57530016	89.83253100
Kurigram	BRAC	25.58336196	89.83813279
Kurigram	ASA	25.57385126	89.82710992
Kurigram	ASA	25.57385076	89.82712492
Kurigram	SSS	25.57658711	89.83664048
Kurigram	RDRS Bangladesh	25.44584929	89.78895114

Kurigram	RDRS Bangladesh	25.40649366	89.75878458
Kurigram	RDRS Bangladesh	25.40052909	89.79561509
Kurigram	BRAC	25.43489750	89.80153447
Kurigram	SSS	25.44060381	89.79219125
Kurigram	ASA	25.43932180	89.79009594
	Grameen Bank	25.44277481	89.79488871
Kurigram	RDRS Bangladesh	25.51653782	89.81188411
Kurigram	ASA	25.51540995	89.80978025
Kurigram	Grameen Bank	25.51799107	89.81176584
Kurigram	BRAC	25.52304293	89.81817489
Kurigram	RSDA	25.59966057	89.83095126
Kurigram	SSS	25.65095882	89.61438870
Kurigram	RDRS Bangladesh	25.65084801	89.61377682
Kurigram	BRAC	25.64684490	89.61495683
Kurigram	TMSS(Thakurgan Mohila Sobuj Sango)	25.65743686	89.61583508
Kurigram	ASA	25.65395862	89.61264594
Kurigram	ASA	25.65406498	89.61275280
Kurigram	ASA	25.61022889	89.61332671
Kurigram	ASA	25.59042069	89.59633408
Kurigram	Grameen Bank	25.59019446	89.59567568
Kurigram	BRAC	25.59053695	89.59768164
Kurigram	RDRS Bangladesh	25.62297240	89.62759841
Kurigram	ASA	25.67081496	89.55548571
Kurigram	Grameen Bank	25.67117580	89.55661853
Kurigram	BRAC	25.66998733	89.55908180
Kurigram	BRAC	25.69583436	89.57420963
Kurigram	RDRS Bangladesh	25.67012798	89.56283128
Kurigram	BRAC	25.67577252	89.66273158
Kurigram	Grameen Bank	25.68383541	89.68889594
Kurigram	RDRS Bangladesh	25.67606186	89.66323240
Kurigram	RDRS Bangladesh	25.71991070	89.66050602
Kurigram	ASA	25.71946445	89.66020519
Kurigram	BRAC	25.71948767	89.66163330
Kurigram	Grameen Bank	25.52036466	89.70675987
Bogra	GUK	24.79988837	89.64918215
Bogra	GUK	24.80882876	89.58625568

Bogra	BRAC	24.80919991	89.58531381
Bogra	Grameen Bank	24.80858065	89.58458676
Bogra	ASA	24.80768731	89.58481676
Gaibandha	AKOTA	25.41637500	89.63426479
Gaibandha	AKOTA	25.52065669	89.60958453
Gaibandha	BRAC	25.53578267	89.55560667
Gaibandha	ASA	25.61309407	89.51759364
Sirajganj	NDP	24.39178448	89.70892542
Sirajganj	UDPS	24.39621482	89.69111077
Sirajganj	BRAC	24.39720833	89.69107289
Sirajganj	MMS	24.39947865	89.69410806
Sirajganj	ASA	24.39218187	89.73980293
Sirajganj	SAP	24.36088610	89.70473128
Sirajganj	Grameen Bank	24.36075317	89.70520570
Sirajganj	BRAC	24.36238110	89.70436399
Sirajganj	Porosh	24.36283247	89.70360744
Sirajganj	BRAC	24.36075166	89.70257781
Sirajganj	MMS	24.14827947	89.73377265
Sirajganj	DORP	24.16078309	89.74052218
Sirajganj	NDP	24.30023113	89.69432926
Sirajganj	SATU	24.30027623	89.69489445
Sirajganj	GUK	24.30020423	89.69500400
Sirajganj	UDPS	24.30031923	89.69560138
Sirajganj	ASA	24.29815971	89.70211437
Sirajganj	ASA	24.29827748	89.69905741
Sirajganj	BRAC	24.30785037	89.69753156
Sirajganj	Grameen Bank	24.25792012	89.69400044
Sirajganj	BRAC	24.25821885	89.69386767
Sirajganj	ASA	24.28325661	89.68911923
Sirajganj	TMSS(Thakurgan Mohila Sobuj Sango)	24.29735019	89.69268029
Sirajganj	GKS	24.29937224	89.69793960
Sirajganj	NDP	24.57742369	89.76199779
Sirajganj	ASA	24.60461685	89.76807148
Sirajganj	ARCHES	24.69187958	89.70947737
Sirajganj	ASA	24.69325891	89.70939908
Sirajganj	BRAC	24.69150801	89.70807390

Sirajganj	Grameen Bank	24.68804838	89.71812313
Sirajganj	ARCHES	24.64699022	89.73717788
Sirajganj	ARCHES	24.64442552	89.73094409
Sirajganj	Grameen Bank	24.72942850	89.78253764
Gaibandha	Uddog	25.45739746	89.63070927
Gaibandha	BRAC	25.60987568	89.52040636
Gaibandha	ASA	25.32215327	89.58682163
Gaibandha	BRAC	25.31759125	89.60127974
Gaibandha	Grameen Bank	25.31871283	89.60191408
Gaibandha	SKS	25.31010655	89.59913070
Gaibandha	GUK	25.30791879	89.59974602
Gaibandha	GUK	25.25830815	89.60385223
Gaibandha	GUK	25.33230694	89.72686420
Gaibandha	SKS	25.33218582	89.72801378
Gaibandha	GUK	25.23744735	89.64991230
Gaibandha	SKS	25.23426533	89.64652777
Gaibandha	GUK	25.35126094	89.65371307
Gaibandha	Grameen Bank	25.39331362	89.62983688
Gaibandha	ASA	25.39372148	89.62924051
Gaibandha	BRAC	25.39372534	89.62929793
Gaibandha	GUK	25.37664101	89.67651495
Gaibandha	SKS	25.16854953	89.63498178
Gaibandha	ASA	25.17697242	89.63220720
Gaibandha	Grameen Bank	25.18748366	89.63402968
Gaibandha	SKS	25.11526066	89.57470341
Gaibandha	SKS	25.10438967	89.57444633
Gaibandha	ASA	25.10632035	89.57527447
Gaibandha	BRAC	25.11008232	89.58143600
Gaibandha	Grameen Bank	25.11292194	89.58078364
Gaibandha	SKS	25.16706518	89.58721088
Jamalpur	Grameen Bank	25.18580577	89.82631456
Jamalpur	BRAC	25.18668621	89.82554636
Jamalpur	ASA	25.21666509	89.82969976
Jamalpur	US	25.16141921	89.75916864
Kurigram	RDRS Bangladesh	25.55651941	89.75689547

Population, literacy rate and household data

(Districts along the riverside of Jamuna, Bangladesh)

Source: Census, 2011

District	Population	Households	Literacy	Lite Male	Literacy Female	Area Acres	Population Density
Kurigram	22191	5364	36.0	39.1	33.0	6821	804
Kurigram	16111	3960	37.4	40.7	34.3	4695	848
Kurigram	14720	3708	35.4	39.0	32.0	4607	790
Kurigram	20257	5171	30.2	33.2	27.4	5331	939
Kurigram	24802	6310	36.7	39.3	34.2	6360	964
Kurigram	24965	6340	35.7	39.8	32.1	6126	1007
Kurigram	23318	5930	38.9	42.8	35.2	6547	880
Kurigram	22547	5816	39.1	44.1	34.5	6413	869
Kurigram	29804	7095	29.7	33.8	25.6	6235	1181
Kurigram	23123	5723	41.9	45.3	38.8	5560	1032
Kurigram	18258	4654	36.2	38.6	34.0	5230	863
Kurigram	20618	5632	27.9	34.2	22.7	6525	781
Kurigram	22547	5816	39.1	44.1	34.5	6413	869
Kurigram	26443	5912	32.2	37.3	27.7	8258	791
Kurigram	22547	5816	39.1	44.1	34.5	6413	869
Kurigram	21851	5235	35.4	38.5	32.6	5120	1055
Kurigram	17074	4475	41.4	46.0	37.1	4798	879
Kurigram	27437	5151	23.0	26.3	19.7	13774	492
Kurigram	29129	6881	47.6	54.1	41.3	6652	1082
Kurigram	28409	7024	47.0	51.9	42.4	8137	863
Kurigram	14260	2991	26.1	30.3	22.3	8866	397
Kurigram	47196	10917	37.7	41.3	34.3	8432	1383
Kurigram	32412	7690	31.8	34.2	29.5	8894	901
Kurigram	28548	6605	37.9	42.8	33.3	6153	1146
Kurigram	20994	4744	27.0	30.6	23.5	17562	295
Kurigram	28456	6277	34.8	39.8	30.3	6120	1149
Kurigram	77252	17159	63.2	67.1	59.1	0	1130
Kurigram	20427	4564	24.3	27.7	20.9	24946	202
Kurigram	20995	5317	45.7	49.5	42.5	4030	1287
Kurigram	17309	3720	22.2	25.2	19.0	11355	377
Kurigram	33090	8458	39.6	43.3	36.0	9833	832

Kurigram	23084	6380	56.9	61.4	53.1	5573	1024
Kurigram	37911	9527	35.6	40.6	31.0	10625	882
Kurigram	28933	7610	37.7	42.5	33.5	7571	944
Kurigram	23884	6587	51.2	55.5	47.5	6782	870
Kurigram	52413	11994	29.2	32.6	25.9	14680	882
Kurigram	28239	7409	50.3	53.9	47.0	6233	1120
Kurigram	20513	5405	40.3	44.5	36.7	6381	794
Kurigram	10519	2574	24.2	27.7	20.9	12845	202
Gaibandha	29810	7456	55.3	60.2	50.7	6948	1060
Kurigram	38477	9698	52.7	54.7	50.7	6020	1579
Kurigram	26162	6270	39.4	42.6	36.3	5721	1130
Kurigram	31634	8549	49.2	52.3	46.3	8768	892
Kurigram	17701	4077	23.5	25.8	21.4	18528	236
Gaibandha	27065	7608	30.4	32.8	28.0	5200	1286
Kurigram	28729	7188	41.2	44.5	38.3	5161	1376
Kurigram	6902	2024	32.7	34.9	30.5	6654	256
Kurigram	46537	10969	38.0	42.2	34.0	8992	1279
Gaibandha	21846	5894	37.7	40.3	35.2	6219	868
Kurigram	33394	8111	33.3	36.1	30.8	8671	952
Gaibandha	14011	3660	23.6	24.6	22.5	7135	485
Gaibandha	32126	8551	37.3	41.1	33.6	4350	1825
Kurigram	14703	3438	36.7	39.2	34.4	6199	586
Kurigram	34523	8356	36.8	40.4	33.5	7739	1102
Gaibandha	40357	10676	35.6	39.2	32.3	7442	1340
Kurigram	24147	5516	36.0	38.1	34.2	13499	442
Gaibandha	27615	7356	37.5	40.7	34.5	5118	1333
Gaibandha	13196	3482	28.2	30.1	26.4	8037	406
Gaibandha	7931	1811	31.4	32.8	30.2	7617	257
Gaibandha	29043	7867	33.4	36.9	30.4	5880	1221
Gaibandha	29076	7012	27.0	29.5	24.5	21525	334
Gaibandha	22578	5430	22.9	27.0	18.7	18104	308
Gaibandha	27067	6946	42.1	46.0	38.5	6608	1012
Jamalpur	21509	5435	33.1	35.5	30.9	6051	878
Gaibandha	17057	4294	33.5	37.4	29.7	5836	722
Jamalpur	37520	8857	26.4	28.0	24.9	10816	857
Jamalpur	23265	5718	35.8	37.2	34.4	4625	1243
Gaibandha	19322	4886	32.4	35.9	28.9	7118	671

Jamalpur	19728	4724	30.9	33.2	28.7	6155	792
Gaibandha	24930	5544	17.7	20.9	14.3	13238	465
Jamalpur	7193	1921	29.0	30.8	27.4	5253	338
Jamalpur	32508	7462	27.2	30.5	24.0	10281	781
Gaibandha	22539	5846	39.3	43.9	35.0	6019	925
Jamalpur	25937	6210	26.1	28.3	24.0	5227	1226
Jamalpur	10825	2765	31.0	34.2	28.2	7024	381
Jamalpur	20799	5171	23.2	27.5	19.2	8312	618
Gaibandha	21862	5775	29.3	34.0	24.6	11557	467
Jamalpur	25744	6894	34.9	38.5	31.6	5933	1072
Jamalpur	9130	2132	18.4	20.8	15.9	8352	270
Jamalpur	25599	6455	24.0	27.5	20.5	8217	770
Bogra	17382	4468	19.5	25.0	13.7	14456	297
Bogra	13245	3451	32.5	37.7	27.3	3916	836
Bogra	24957	6295	37.9	41.6	34.4	5959	1035
Bogra	26191	6671	20.7	24.2	17.0	16509	392
Bogra	16175	4719	41.0	45.2	37.0	6817	586
Jamalpur	24560	5578	25.6	28.0	23.2	7493	810
Bogra	15779	4366	38.6	42.1	35.1	5443	716
Bogra	24479	6950	43.1	47.5	38.5	12919	468
Jamalpur	32701	7370	28.2	31.2	25.2	10516	768
Bogra	25720	7987	42.4	46.9	38.3	4837	1314
Bogra	23339	5728	22.0	25.6	18.3	17156	336
Bogra	10537	3468	37.7	41.4	34.3	3180	819
Bogra	23478	6722	35.7	39.5	32.2	5337	1087
Sirajganj	21289	5553	35.0	37.4	32.6	5464	963
Sirajganj	9821	2730	23.2	25.8	20.7	8072	301
Bogra	17973	4810	34.4	37.2	31.9	5671	783
Jamalpur	53002	12745	48.8	50.9	46.8	9883	1325
Sirajganj	25504	6681	37.9	41.5	34.3	4353	1448
Sirajganj	18292	4457	37.7	41.4	33.9	6821	663
Sirajganj	20728	5339	45.8	50.9	40.9	6058	845
Sirajganj	18591	4327	34.0	36.5	31.5	8020	573
Jamalpur	29756	7347	45.1	47.6	42.8	7552	974
Sirajganj	13952	3488	38.6	42.2	35.2	7700	448
Jamalpur	28935	6837	40.3	42.6	38.1	7205	992
Sirajganj	14412	3880	47.1	50.5	43.9	6325	563

Sirajganj	24766	5677	35.4	37.7	33.1	12589	486
Sirajganj	38179	9011	43.9	45.4	42.4	6710	1406
Sirajganj	17713	3957	31.1	32.0	30.1	8084	541
Sirajganj	30275	7038	44.8	46.4	43.2	4829	1549
Sirajganj	158913	35556	63.2	66.3	60.1	0	1820
Sirajganj	50400	10945	44.0	46.7	41.0	6972	1786
Sirajganj	47610	10485	40.7	42.5	38.9	8856	1328
Sirajganj	48331	10271	42.3	44.5	40.1	6178	1933
Sirajganj	10089	2065	28.8	31.1	26.5	3095	806
Sirajganj	19396	4807	36.2	37.1	35.2	7269	659
Sirajganj	88236	18069	45.2	48.1	42.1	5149	4235
Sirajganj	28495	6515	50.4	52.5	48.2	10294	684
Sirajganj	60438	12218	43.9	46.3	41.3	3559	4196
Sirajganj	17714	4188	34.9	37.9	31.6	9358	468
Sirajganj	18831	3924	27.6	30.1	25.1	4010	1160
Sirajganj	47404	11818	32.9	36.6	29.2	7114	1647
Sirajganj	18748	4763	27.7	31.4	24.1	6993	662
Sirajganj	24231	5662	15.1	19.1	11.2	7847	763
Sirajganj	25064	6279	37.5	42.1	33.1	3225	1920
Sirajganj	33286	7824	22.2	27.2	17.5	7381	1114
Sirajganj	34672	9169	30.8	36.0	25.9	12918	663

Annex-III
(Pictures of Field Survey)

Figure: Collecting GPS data from commercial centers, local NGOs and schools along the river Jamuna, Bangladesh. Spatial information's are more significant to analyze and evaluate the concentration of local NGOs, commercial centers along with distributional pattern of the schools.
Source: Photo taken by Ahmed Riyed
Date: May, 2016

Figure: Transportation system in the remote areas. There are 126 unions under my study area. Most of the area is *char* land (surrounded by water over the year round). Therefore, boat is only way to travel one place to another place along the river Jamuna, Bangladesh.
Source: Photo taken by Ahmed Riyed
Date: May, 2016

Figure: Availability of the river water sources, people along the Jamuna River usually wants to use river water in their daily life activities like cattle bathing, cloth washing and people bathing as well as irrigation purposes.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Transportation system along the Jamuna River, Bangladesh. Rural poor people usually used boat in the rainy season for their transport purpose. Boats are usually used for commercial purpose like agricultural crops transport to the commercial areas.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: This research carried out a detailed survey of 126 unions of 5 districts using questionnaire survey (in total 533 respondents), 50 Focus Group Discussion (FGD), Key Informant Interviews (KII) and Household Survey (HHS).
Source: Photo taken by Ahmed Riyed
Date: May, 2016

Figure: Using Household Survey (HHS), this research tried to find out the local NGOs provision in the education, agriculture and micro-credit sectors. As of late, NGOs have made enormous contribution to the women empowerment by providing credit facilities.
Source: Photo taken by Ahmed Riyed
Date: May, 2016

Figure: Repairing Boat for their transportation and business purpose. Along the Jamuna, people usually use boat in the flooding time. But in the summer time, walking is only way to communicate one place to another.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Domestic animals are usually for farming along the river Jamuna, Bangladesh. On the contrary, rural poor people used cow dung as manure and as fuel, as well as a substrate for methane production.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Once, jute was known as the golden fibre of Bangladesh. At that time, it was the most important cash crop for Bangladesh. Jute fibre is produced mainly from two commercially important species. The first one is white jute and second one is tossa jute. It is used for making ropes, hand-made clothes, wall hangings, etc.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Maize is cultivated along the river Jamuna, Bangladesh. It is cultivated to a limited territory in *Kharif* and *Rabi* seasons. Maize is not very popular to the rural poor people of Bangladesh. Although, it is used in the same way as rice and wheat.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Major *Rabi* crops grown along the river Jamuna which include oilseeds namely, mustard, sesame, groundnut, niger, sunflower, linseed, and safflower. Mustard cultivation along the Jamuna River is much higher than any other districts of Bangladesh. Mustard leaf is used as a vegetable and mustard herbs that give oil from its seeds.
Source: Photo taken by Ahmed Riyed
Date: December, 2016

Figure: Rice is cultivated along the river Jamuna throughout the year as *Boro. Boro* is generally cultivated in March-May. The harvesting time of *Boro* rice in different seasons are: local *Boro* (April-May), and high yielding *Boro* (May-June).
Source: Photo taken by Ahmed Riyed
Date: December, 2016

Figure: Chilli is cultivated in the both seasons namely, summer and winter seasons. The average production of green chilli is 5 to 6 m tons/ha. This crop is extensively cultivated along the river Jamuna, Bangladesh. As a winter crop, there are diverse local varieties found along the Jamuna namely, *Balijuri, Bona, Bain, Saita, Suryamukhi, Paba, Halda, Dhani, Shikarpuri and Patnai*.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Brinjal cultivation plays an important role to the rural economy along the Jamuna, Bangladesh. Brinjal is mostly grown as kitchen gardens. It is also one of the most popular vegetables among rural poor people.
Source: Photo taken by Tanjinul Hoque Mollah
Date: June, 2016

Figure: Onion is grown on all types of soils. The most favorable time of transplanting onion is December or the first week of January. Onion leaves are typically long and tubular. Its leaf are very much popular as a vegetable. The average production of onion is approximately 4-5 m tons/hectares along the river Jamuna, Bangladesh.
Source: Photo taken by Ahmed Riyed
Date: December, 2016

Figure: There are major two varieties of *Aman* rice were found along the river Jamuna namely, transplanted *Aman* and broadcast *Aman*. Transplanted *Aman* is grown almost all places whereas, broadcast *Aman* is mostly grown in the low-lying areas of Bangladesh. The harvesting time of broadcast *Aman* is November-December and for transplanted *Aman* is November-January.
Source: Photo taken by Ahmed Riyed
Date: December, 2016

Figure: *Aus* is generally cultivated in July-August cropping seasons. *Aus* is a common practice in the medium lowlands where mixed cropping of *Aus* and broadcast *Aman* were also found. Single cropping of broadcast *Aman* is known as deep water rice in *Kharif* season while, *Boro* practice in the winter (*Robi*) season.
Source: Photo taken by Tanjinul Hoque Mollah
Date: May, 2016

Figure: Seasonal vegetation (Kitchen gardening) is located along the river Jamuna, Bangladesh. Local NGOs have made enormous contribution to encourage rural poor women for making kitchen gardening by providing training and agricultural aids such as seeds, fertilizer and small credit.
Source: Photo taken by Tanjinul Hoque Mollah
Date: May, 2016

Figure: Collecting information's on NGOs educational facilities to the rural poor children through questionnaire and Household Survey (HHS). There are 358 schools were found in the study sites. Local NGOs are providing many facilities to improve the educational status of rural children.
Source: Photo taken by Shamim Kabir
Date: May, 2016

Figure: Focus Group Discussion (FGD) with the rural women who are involved to local NGOs credit program. Local NGOs are working on women empowerment by providing credit facilities, handicraft training and kitchen gardening training among the rural poor women along the Jamuna River, Bangladesh.
Source: Photo taken by Tanjinul Hoque Mollah
Date: May, 2016

Figure*:* Vegetables cultivation along the river side of Jamuna Bangladesh. This type of vegetables are mainly cultivated by the rural women. Besides that, local NGOs also help them how to cultivate by providing training and seeds.
Source: Photo taken by Tanjinul Hoque Mollah
Date: May, 2016

Figure: Talking with school going children's who are benefited by the local NGOs provision in education sector. This figure also shows the local poor children's dress up and their life style. Rural children's are especially deprived from their basic needs such as education, cloths, medical facilities, foods and so on.
Source: Photo taken by Ariful Islam
Date: May, 2016

Figure: Rural industry (cloths) is depending on the local NGOs credit. The poor people who are involved to NGOs credit program, only those people are getting NGOs credit benefits. Therefore, NGOs borrower is much higher in the rural areas in Bangladesh.
Source: Photo taken by Habibur Rahman
Date: May, 2016

Figure: Focus Group Discussion (FGD) with the rural community along the river Jamuna, Bangladesh. This figure shows the conversation with rural poor people and infrastructure in the rural village. In this conversation, this research tried to find out the NGOs provision in different sectors.
Source: Photo taken by Habibur Rahman
Date: May, 2016