

NGO Education Services at District-Level along the River Jamuna, Bangladesh: Using GIS and Remote Sensing Approaches

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Abstract

Poverty, lack of transportation and communication facilities, insufficient educational institutions, lack of awareness, huge distance from schools, and natural barriers are the main causes of educational backwardness in rural areas of Bangladesh. This study aims to evaluate the NGO education services at district-level along the river Jamuna, Bangladesh. Mainly this research purposes to investigate the deficiency in providing facilities by different NGOs and make recommendations for further improvement in the educational sector. GPS data overlapped onto satellite imagery of SPOT 5, GIS and remote sensing technology was used for identifying and predicting the service zone of pre-primary, primary and high schools. Modern technological tools have been used for mapping, buffering area measurement and data analysis using primary data and secondary information. Moreover, satellite navigation data has been developed and linked with remote sensing imagery that facilitates detailed and long term planning of educational institutions. There are 126 unions (the smallest a rural administration) within the 5 districts in the study area. According to the 1990 Primary Education Act, the government of Bangladesh intended to develop optimal distance for the educational institutions with respect to several parameters i.e. human settlements, size of service population, distance factors and road networks. This research intends to take up a case study at union level to examine the present status of NGO education in terms of services of the schools. Educational necessity in rural Bangladesh is functioned by a three-tier system. At the bottom is the pre-primary tier (usually one year) catering to the educational needs of children under six years. After that, there are primary schools serving children from six to eleven years. At the top, there are secondary high schools for children from 12 to 17. However, there are four types of schools in terms of ownership; the first is public, the second are registered non-government schools which receives government support in terms of salaries and other benefits, the third are NGO schools running with some community support and last are private institutions that are for profit. The key findings of this study are unequal spatial distribution of rural schools, insufficient and unplanned educational infrastructure, lack of utility facilities, i.e., water supply, electricity and lack of technology in educational institutions. Local NGOs along the river Jamuna provide facilities on education sectors such as increasing consciousness, development of a need-based curriculum, creation of graded learning materials, non-formal education and food for rural poor students. Unfortunately, donors' do not take any initiatives for clean water supply, playgrounds, the internet, computers, electricity and other facilities. It is estimated that along the river Jamuna the population density is 928 per km², whereas male and female literacy rates are 38.85% and 32.26% respectively. Evidently, the female literacy rate is less than the male literacy rate because of 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. For example, similar structure in plain land and char (island) that consist of sediments and are unsustainable due to the geographical setting. In char lands, erosional and depositional action are caused by wave action, whereas in plain land have no effect. The maximum stability of char land is 10 to 15 years while pakka (the term is applied to housing built of steady materials such as stone, brick, cement, concrete etc.) educational infrastructure construction is very unusual. NGOs activities continue for 3 to 4 years, which sometimes turned to the major causes for the instability of rural education. Therefore, local NGOs along the river should emphasize project duration, utilize local resources and services, i.e., clean water supply, playgrounds, the internet, computers and electricity facilities along with currently provided services.

Key words: NGOs, education services, optimal distance, buffering, GPS, GIS

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 a main reason. According to the report on "Bangladesh education sector overview" (Japan Bank for JBIC International Cooperation, 2002), the country faces serious problems

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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 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 was 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. 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 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 a 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 along the river Jamuna.

II. 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 described in the following sections.

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 (Rose, 2009; Char Development and Settlement Project Phase IV, 2015). 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).

III. Study area

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. Districts are Sirajganj, Bogra, Jamalpur, Gaibandha and Kurigram (Figure 1 and Table 1). Jamuna is the second largest of three main rivers in Bangladesh. It is the notable distributary channel of the Brahmaputra River which runs from India to Bangladesh.

The Jamuna River 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. Flood plains 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.

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).

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. It varies from 1,110 mm in the northwest to 5,690 mm in the northeast. Mean 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,

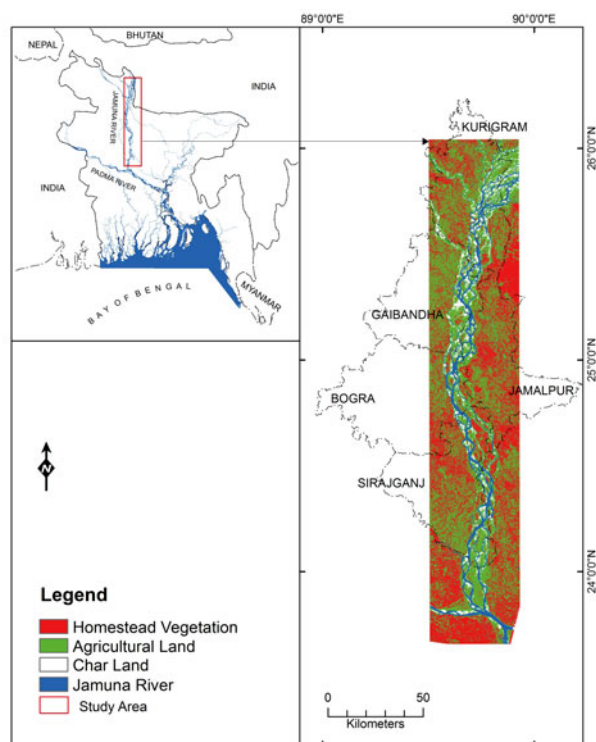


Fig. 1. Study area along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Table 1. List of NGO branches in the study area

No	Name of the NGOs	Branches	No	Name of the NGOs	Branches
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: Field survey and different organizations, 2015

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.

IV. 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:

- Local communities (interviews, i.e., facilities like food for school going students, infrastructure, clean water supply, computers, and the internet provided by local NGOs)
- NGO employees who are involved in education systems (focus group discussions, i.e., facing problems with educational services)
- Teachers in schools (interviews, i.e., number of teachers, number of male and female students, and problems faced by educational services)
- Employees of schools (interviews, i.e., facilities and problems with educational services)
- 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).

V. Major findings of the study

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

- 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.
- Development of need-based curriculum for poor rural students.
- 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.
- k. Educational institutions and infrastructural development in the rural areas of Bangladesh.

(2) 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 2, 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). 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.

(3) 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;

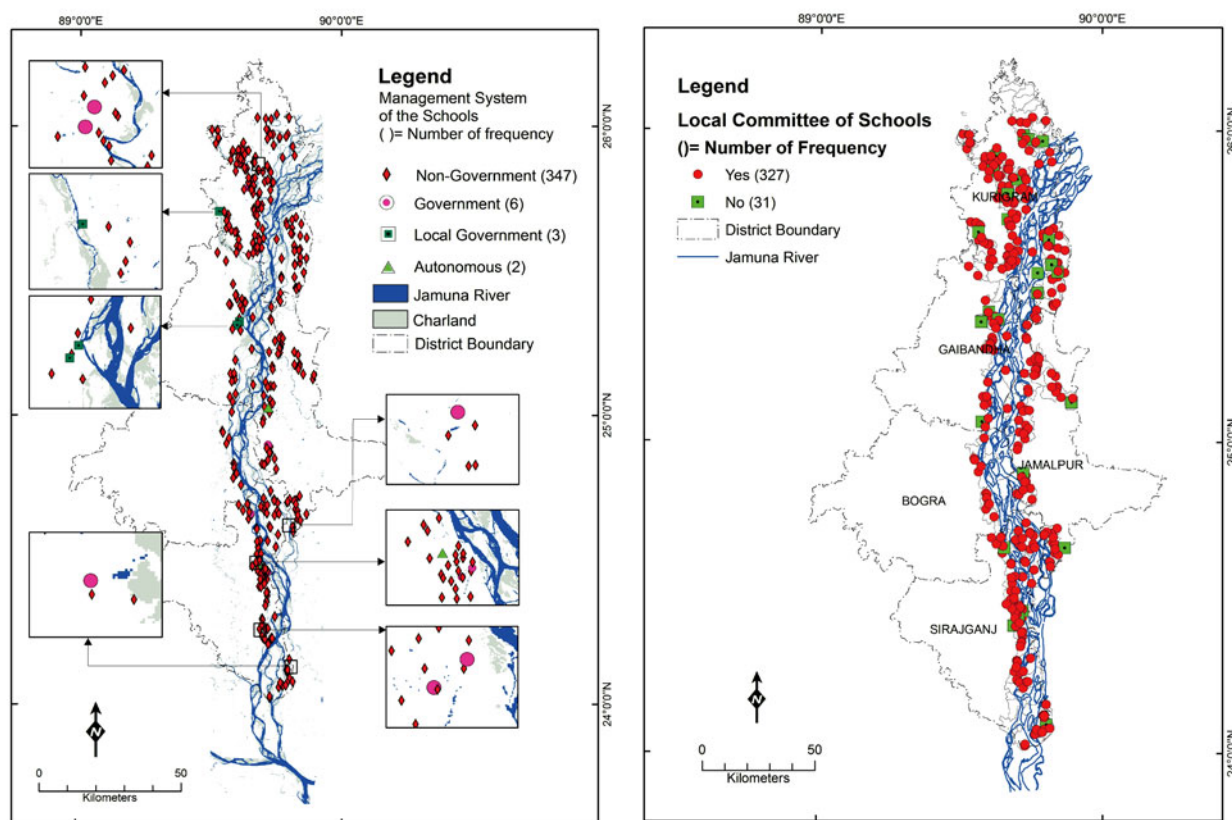


Fig. 2. Management system and local committee of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

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.

Observing Figure 3, 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.

(4) 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. Looking Figure 4 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.

(5) 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. By observing Figure 5, 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

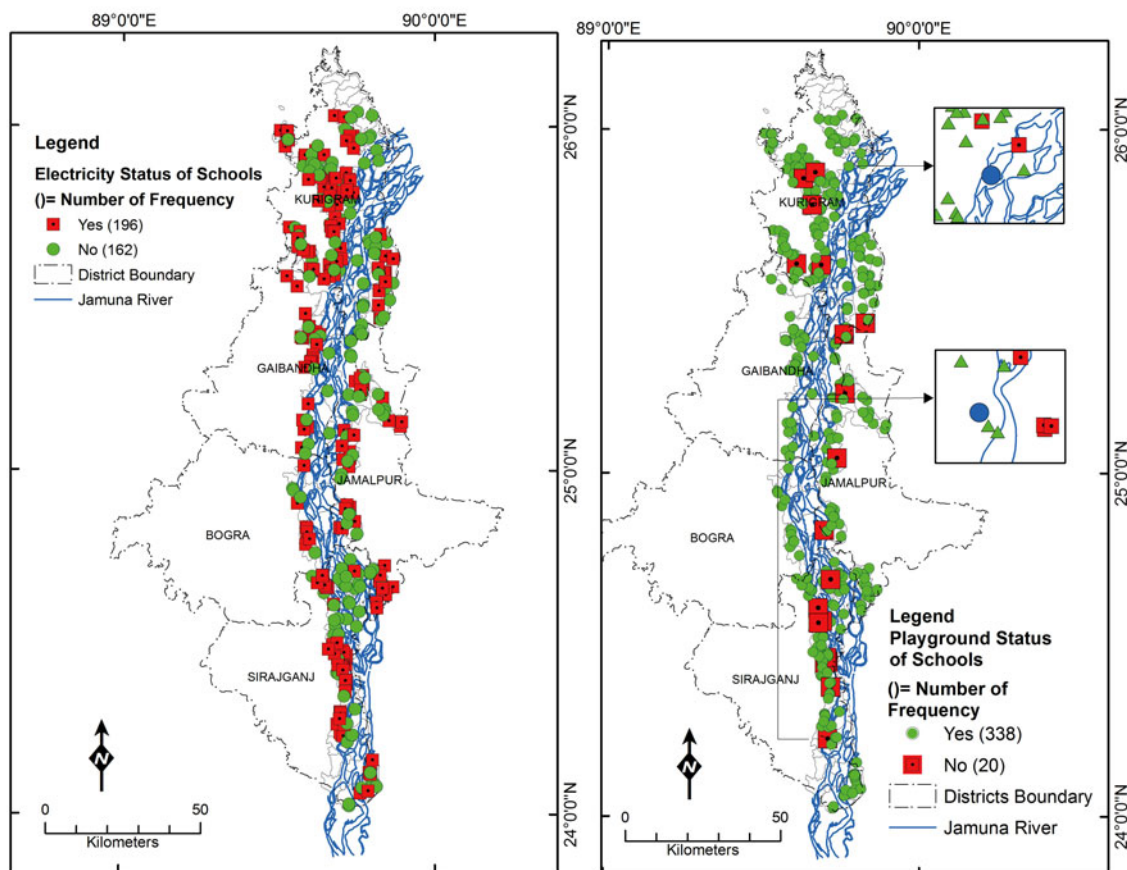


Fig. 3. Electricity and playground status of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

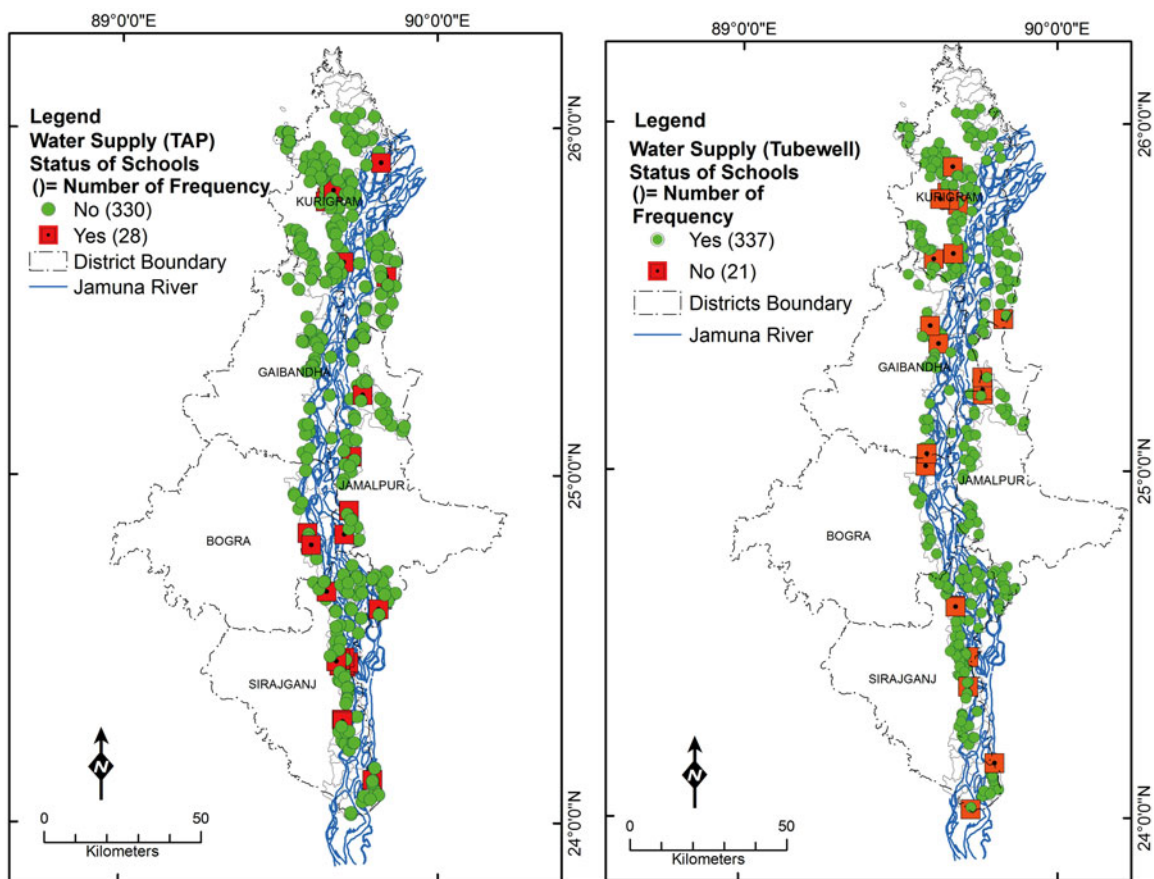


Fig. 4. Water supply status of the schools along the river Jamuna, Bangladesh
 Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

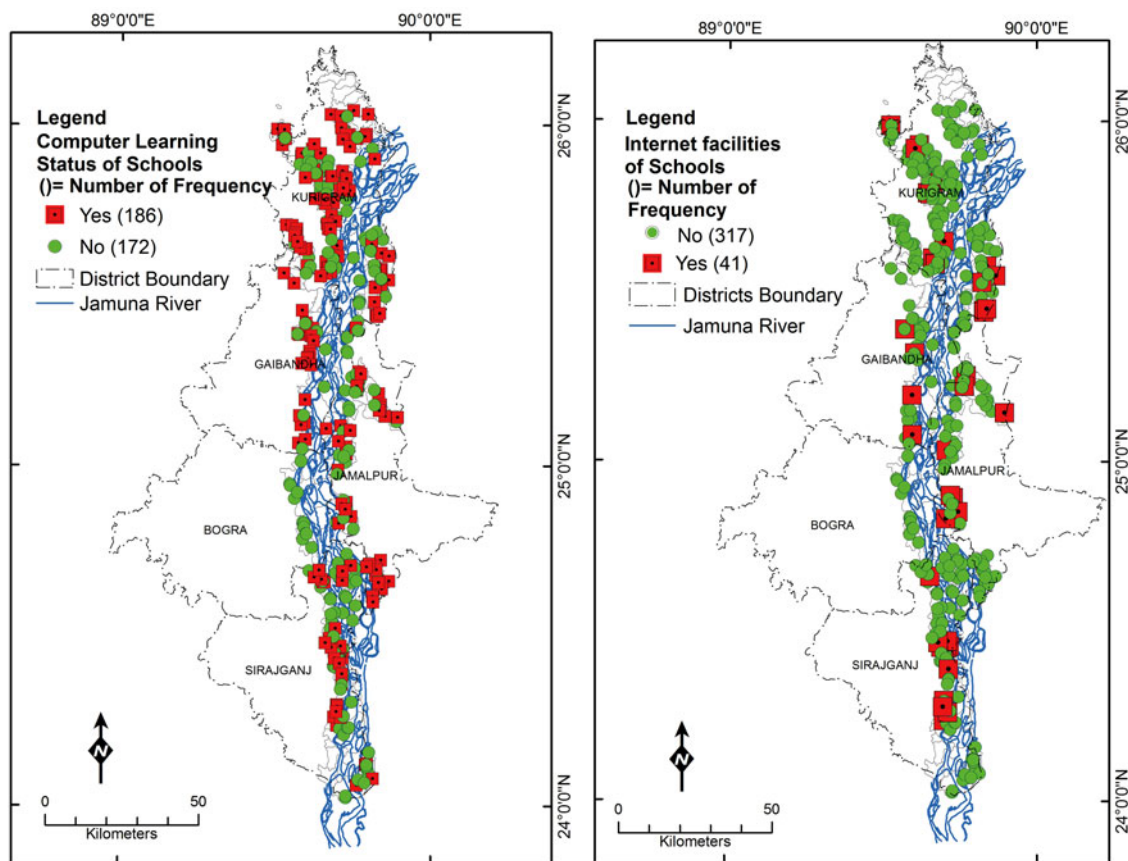


Fig. 5. Computer and internet facilities of the schools along the river Jamuna, Bangladesh
 Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

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

(1) 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.

Figure 6 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.

(2) 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.

Figure 7 links population data with the number of NGOs working in the study area, particularly in the education sector. Population density is high 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 km² respectively. Additionally, the population density in Bangladesh is 1,222 per km².

(3) 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 8, 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. 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

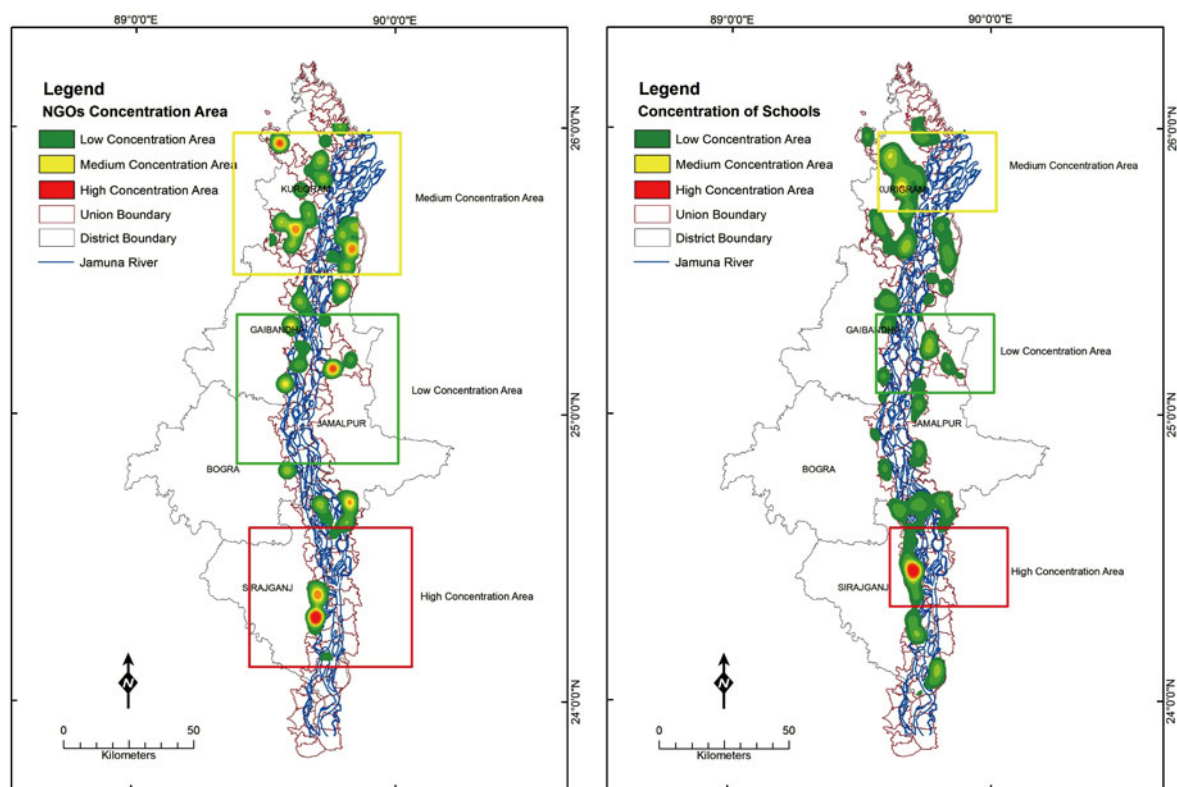


Fig. 6. Concentration area of schools and NGOs along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

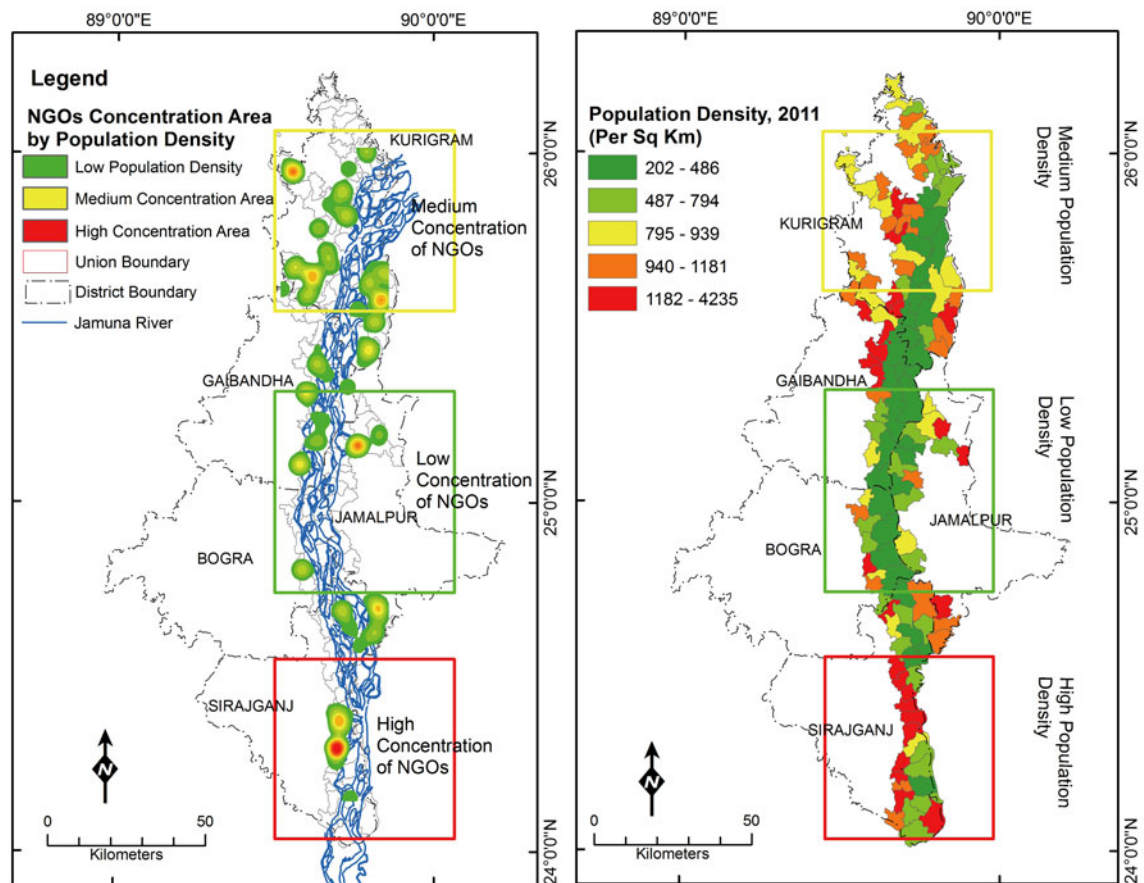


Fig. 7. Concentration of NGOs areas with the population density along the river Jamuna, Bangladesh
 Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

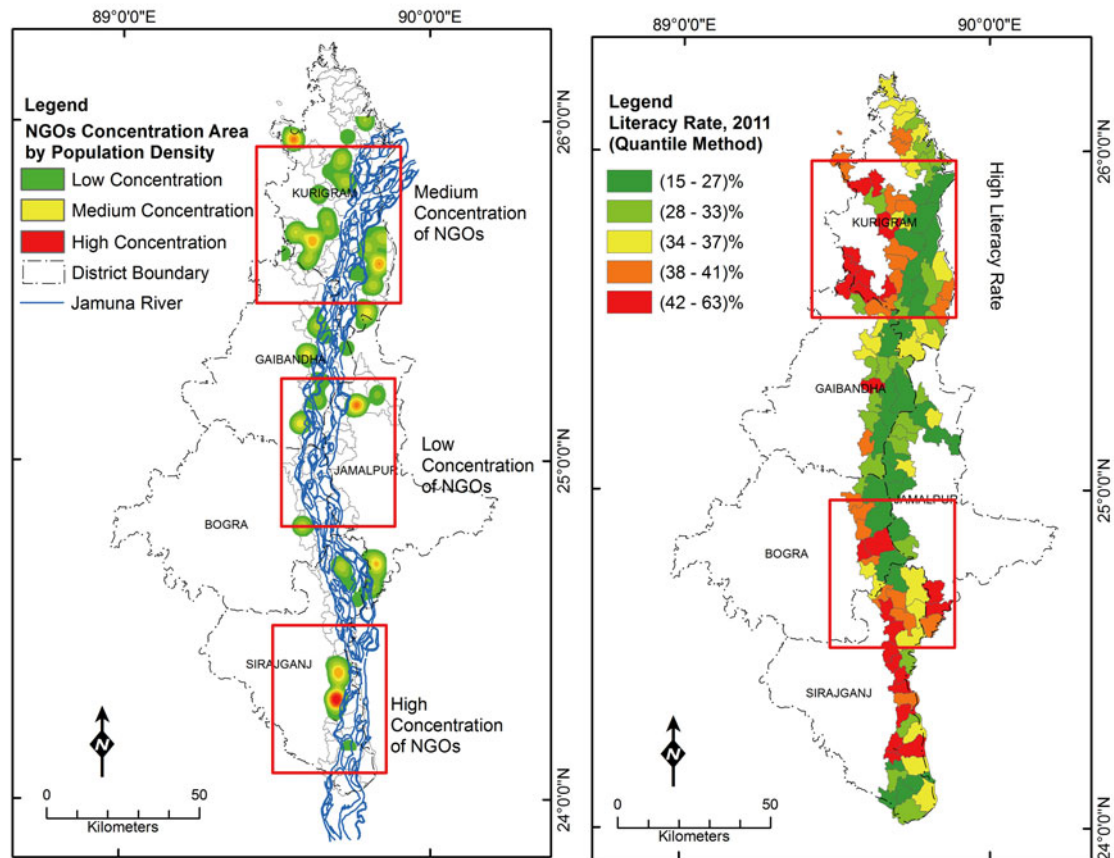


Fig. 8. Concentration of NGOs areas with the literacy rate along the river Jamuna, Bangladesh
 Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

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.

(4) 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 9, 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. 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. Looking at Figure 10, 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

(1) 2-km buffer zones of schools according to government rules

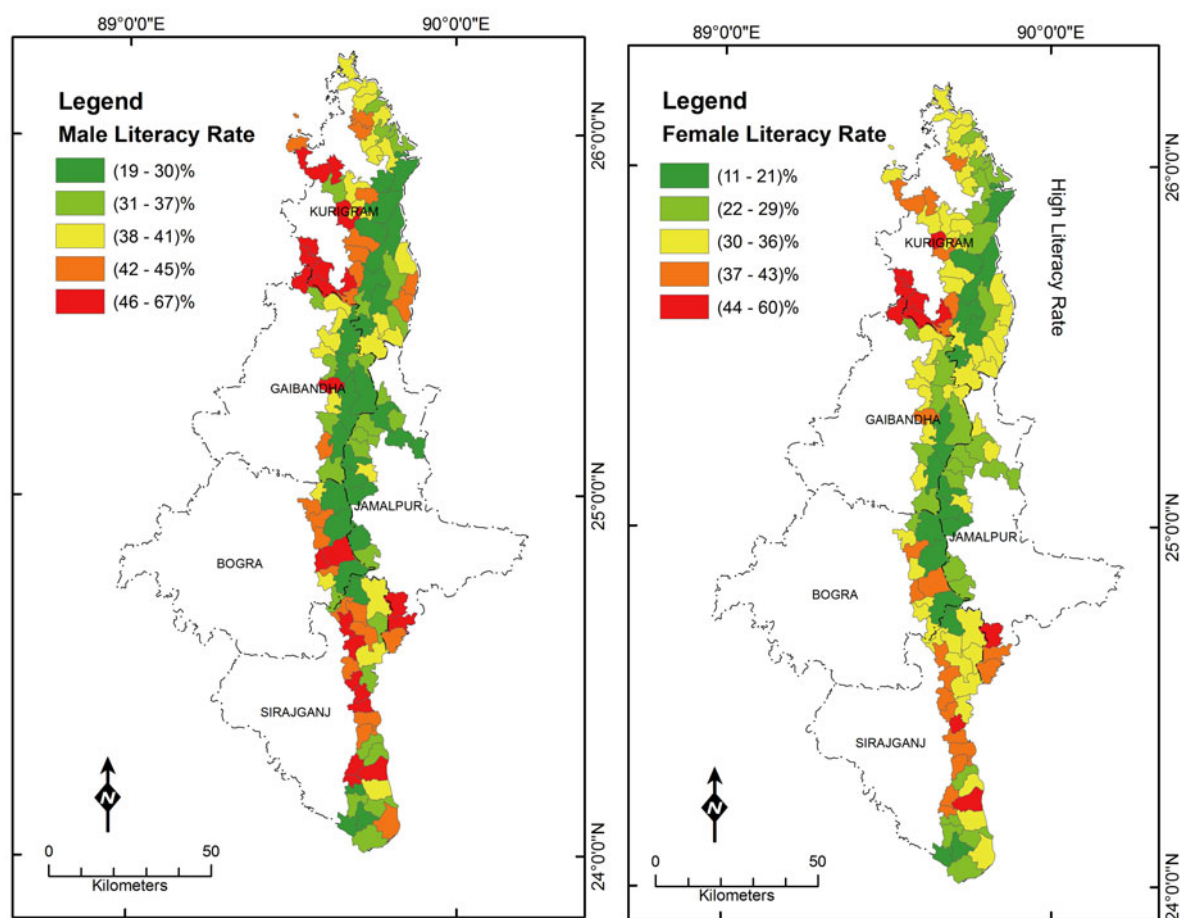


Fig. 9. Male and female literacy rate along the river Jamuna, Bangladesh
Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

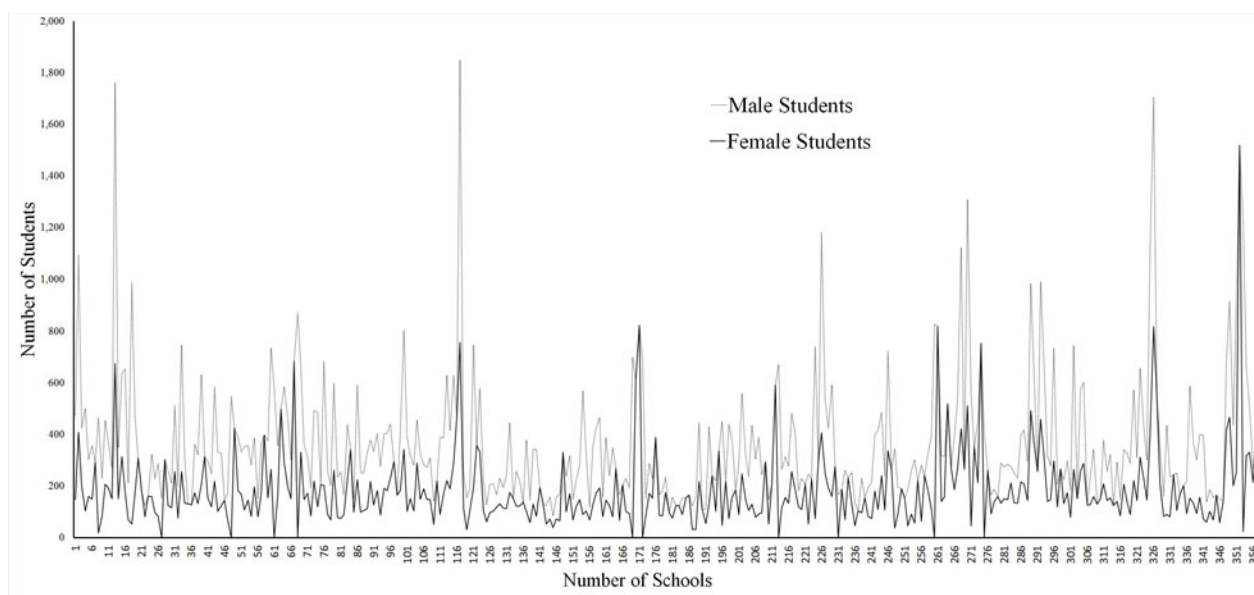


Fig. 10. Male and female students ratio of the schools along the river Jamuna, Bangladesh
Sources: BBS, Bangladesh Bureau of Educational Information and Statistics (BANBEIS), 2015

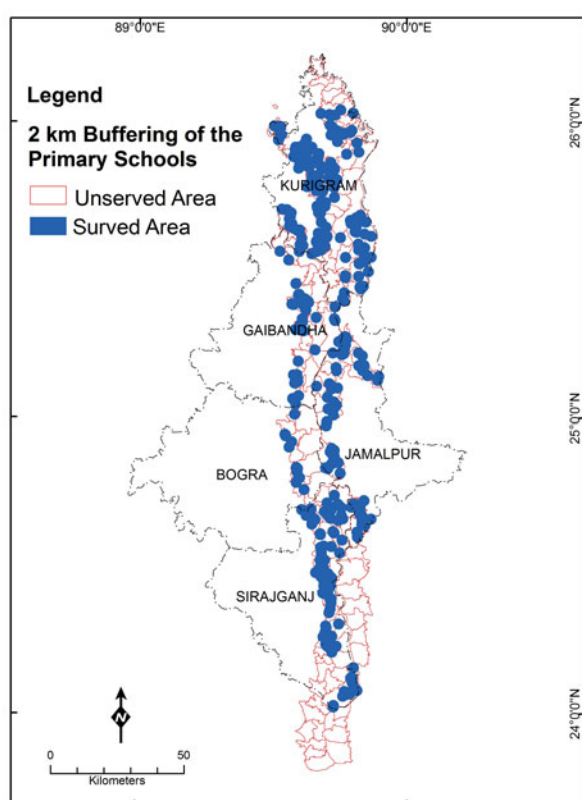


Fig. 11. Two-km buffering zones of the schools according the government rules along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

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 11 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.

(2) 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 river side 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 12). 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, river side or char land areas were 2, 284 and 72, respectively. So, most of the schools are found in the plain land and river side 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.

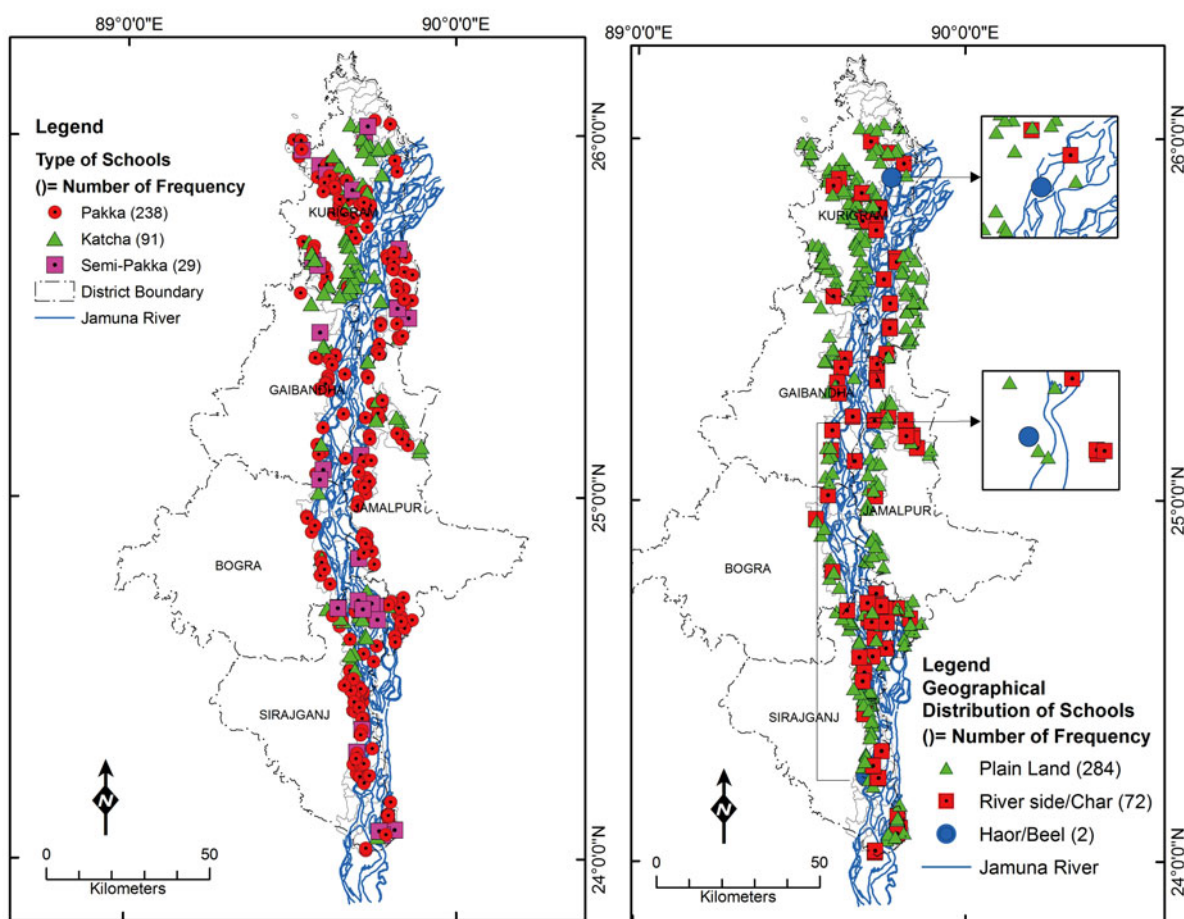


Fig. 12. Types of schools and geographical location of the schools along the river Jamuna, Bangladesh
Sources: Bangladesh Bureau of Educational Information and Statistics (BANBEIS) and field survey, 2015

Flooding normally occurs during the monsoon season from June to September. Table 2 shows there are 46 pakka and 6 semi-pakka schools located in the river side 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.

VI. 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 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 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

Table 2. Geographical condition of the schools

Categories	Frequency	Percent	Katcha	Pakka	Semi-Pakka
Plain Land (mainland)	284	79.3	70	191	23
River side/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

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. 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 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 river, most of them (46) were cement buildings (Pakka).

A common concern was seen among respondents that due to river bank erosion, these buildings are at high risk due to seasonal floods. Contrary to the national government rule (one primary school within 2-km buffer zone from the dwelling place), not every 2-km zone had a primary school.

NGOs must ensure 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 2-km buffer zone should be fulfilled to ensure every child gets the opportunity of access to education across the country.

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