# Small-scale irrigation in Noakhali char area of Bangladesh

**Professor Zahir Ahmed. Department of Anthropology, Jahnagirnagar University, Dhaka, Bangladesh.**

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## Summary of Key Findings

- **Small-scale irrigation is innovative and a viable livelihood option for char dwellers**

New forms of irrigation involving plastic pipes, hand pumps and shallow tube wells (STW) have been developed by farmers. Some of these hand pumps are inside *baris* (homesteads); others have been sunk in the fields. The pipes are attached to the pumps by cut off plastic bottles. The pipes can run for many hundreds of feet across the fields.

Small-scale and marginal farmers are benefiting from this irrigation as watermelons are an important cash crop. They have been able to grow watermelons twice a year whilst previously they could only grow mono crop paddy.

- **Formal institutions have not played a significant role in the innovation**

Key formal institutions associated with this irrigation development include the Bangladesh Water Development Board (BWDB), which has been involved in constructing culverts and sluices. Participatory water management has also recently been established with the assistance from the Netherlands, ADB and the World Bank.

Two significant interventions were the Dutch-assisted Land Reclamation Project (LRP), which took place during the 1970s, and the Char Development and Settlement Projects (CDSP), during the 1990s. These were responsible for the construction of canals, which have however since largely fallen into disrepair and been blocked by individual homesteads or private landowners who have built paths and bridges across them.

Despite the presence of these externally-induced interventions, knowledge exchange still primarily takes place mainly between farmers both at individual and household levels. Interactions between the Department of Agriculture Extension and farmers are minimal and weak.

- **Unequal access to resources, particularly land, is key to differentiated farming in the char area.**

Land access is uneven and this both shapes and is shaped by existing wealth and access to social networks. There are many absentee landlords and sharecropping is common. The social relations of land ownership/access directly affect farmers' access to water and their ability to innovate.

Absentee land ownership is a specific constraint in getting sharecropping land for the majority of the small farmers. This is linked to issues of political influence.

- **Water sharing is a product of social context**

Social connections are important for securing access to water for irrigation. Richer farmers are in a better position to get access to land and water for irrigation. They are also able to use their connections to gain access credit. This is particularly important as growing irrigated crops requires considerable cash layout.

# PART ONE: RESEARCH RATIONALE AND CONTEXT

## *A VISUAL IMPRESSION*

*Subarnachar, rural Bangladesh. It is 11a.m. on a sunny day at the end of January and a busy time for working in the fields. Watermelons are grown alongside winter vegetables after the main aman rice crop. As far as the eye can see, fields (khet) are filled with different people: watermelon growers, labourers, hand pump installers and children. The fields are filled with plastic pipes and shallow sunk wells with hand pumps. Some of these hand pumps are inside baris (homesteads); others have been sunk in the fields. The pipes are attached to the pumps by cut-off plastic coke bottles, and run for many hundreds of feet across the fields.*

*Among those spraying pesticides and pumping the shallow tube wells are labourers, all dressed in white T-shirts and lungis (men's local dress) with masks. These labourers are seasonal migrants from adjacent upazilas (sub-districts) and are working for relatively wealthy farmers. Others water the fields by hand, carrying the water in pots from the ponds. A poor sharecropper is helping a mechanic to install a hand pump for irrigating his one-acre of land. His college-going boy dressed in lungi and shirt is also helping to bring water to pour into the newly installed well. Several times he carries water with a tiny pot from the neighbour's pond; they cannot bear the cost of hiring labour to assist. The skilled technician installing the tube well is arguing heatedly with the man and his son to bring water quickly. He is in hurry to install another one in the same area. Half a mile further on, the picture is even more crowded. Eight boys and girls are helping a farmer bringing water from an adjacent pond. The watering is being done by another group of labourers. They are not seasonal migrant workers; they are local and negotiate wages individually. At least ten hand pumps are waiting to be used.*

## 1.2 Introduction

This snapshot provides a picture of just a small number of the estimated 500 or so watermelon growers in Subarna *char*. Yet even this one-dimensional picture raises some questions about the manual irrigation system and about water sharing: why are so many new installations taking place in the fields? What are the social and political relationships that surround this use of water? How, and in what ways are the various individuals integrated into institutions that manage their irrigation? How does the watermelon production make a difference to these farmers' livelihoods? Why is the hand pump being used most instead of deep tube wells (DTW), which are visible in other *chars* and would allow farmers to reduce their manual labour?

This report aims to provide answers to these questions as part of an interrogation of the institutions and politics of small-scale irrigation. It is part of a wider research project that has examined the institutional arrangements governing access to and control over water for irrigation by smallholder farmers. The project, funded through the DFID-ESRC Growth Programme (DEGRP), aims to explore the relationship between resilience and vulnerability in rural livelihoods and how these are shaped by relations of power. It also seeks to determine if general principles of water allocation and equity can be identified, and how these are influenced by both externally-induced innovations and the effects of climate change. The project has involved comparative research in Bangladesh, Tanzania and Malawi. It asks four principle research questions:

- How do different groups get access and use of water resources?
- What are the moral economies, rules and principles that govern water use?
- What is the role of knowledge and information in the development of small-scale irrigation?
- How are the various processes and practices at play in the management and use of water in irrigation influencing wellbeing and livelihoods?

In Bangladesh, some 90-95% of irrigation is classified as small-scale; usually involving the abstraction of groundwater using manual pumps. In crop diversification, and manual pumps can play a vital role in irrigating non-rice upland crops. For the government, small-scale irrigation is therefore an important part of the agricultural development strategy (current reference).

But there is only a limited understanding of the ethnographic background to this irrigation: the rules, norms and moralities that are involved in it, how they intersect with local and national politics and whether lessons can be learned from elsewhere. This study therefore identifies the rules and principles that govern small –scale irrigation through an ethnographic case study of small-scale irrigation in Bangladesh. It seeks to understand how such irrigation contributes to livelihoods and the role of both formal and formal institutions within this.

*Figure 1: Children irrigating watermelons with jars*

The study was conducted in a site called *char* Rashid in Noakhali District in the southern coastal part of Bangladesh. This area has seen a recent growth of production of irrigated watermelons, which have an international market. Not all farmers have access to this irrigation or are growing watermelons. The study focuses, not so much on the impact of technical aspects of irrigation, but on the ways in which the social relations of land and water ownership and access directly affect farmers' ability to innovate.

In the remainder of this section we set out the methods adopted in the present study, and the national and local context within which the research was carried out.

## 1.3 Research Methods

A first phase of research involved an initial household questionnaire, which was translated into Bengali. This was implemented in two sites: Char Clerk (N=40) and Char Rashid (N=48), which are described in detail below. Data from this survey and discussions with key informants led to us to focus on Char Rashid for the more detailed ethnographic phase of the research.

In this second phase, lasting three months, participant observation was combined with formal interviews, life histories and the use of audio-visual methods. Questions focused on crop choice, constraints in accessing water or other inputs, cultural 'rules' involving access to water and relationships between and within households. Those interviewed were selected according to their socio economic well-being as determined by the survey, including both irrigators and non-irrigators. In total, these detailed interviews, some of which were repeated, were carried out with members of thirty households. We observed both irrigated and dry-season agricultural activity and, in this, carried out mapping exercises of both water resources and fields. Sometimes this involved meeting with individuals and sometimes with groups in tea stalls, yards and in the fields in order to see ongoing activities of watering. Concurrently, we were able to map the different water-melon growers near the fields in order to build up a picture of the correlation between connection to water supply and social connections.

Both male and female research assistants took part in the fieldwork to ensure as gender-balanced a perspective as possible.

## 1.4 Bangladesh: the national context for small-scale irrigation

Almost 80% of Bangladesh is considered to be floodplains and flooding is a recurrent problem for livelihoods, destroying crops and damaging land. Despite this regular surfeit of water, irrigation in the dry season is an important part of agricultural livelihoods and is essential for crop production.

In Bangladesh food production largely depends upon minor/small scale irrigation. Recent data estimate that about 90-95% of the total irrigated area is covered by minor irrigation (Dey et al., 2013).It has been estimated that on average, 0.035 million hectares is irrigated by manual irrigation pumps (Iqbal, 2009), mostly lifting water from underground sources. The main source of this irrigation is groundwater, which is equally recognized as the most essential input for increasing crop production as well as for the sustainable agricultural development in Bangladesh (ibid.). Studies argue that groundwater irrigation has probably been the most dramatic development in Bangladesh agriculture during the past 25 years (ibid.)

Currently, 35,322 deep tube wells, 1,523,322 shallow tube wells and 170,570 low lift pumps are working in Bangladesh to provide water for irrigation. About 79% of the total cultivated area in Bangladesh is irrigated by groundwater, whereas the remaining is irrigated by surface water (Qureshi et al. 2015).It is further documented that many rivers and canals dry up during the dry season and make the people completely dependent on groundwater (Shahid 2008; Shahid and Behrawan 2008; Dey*et al*. 2011). Recent declines of groundwater levels during the dry season in northwest Bangladesh has posed a major threat in irrigated agriculture system. Recurrent drought is a common problem in this regard (Shahid 2008; Shahid and Behrawan 2008).

*Figure 2: 300 metres of plastic pipe coming from a tube well*

The administration of flood control, irrigation, erosion control and other water projects is the responsibility of the Bangladesh Water Development Board within the Water Resources Ministry. Over the last three decades, the Government of Bangladesh (GoB) has attempted to introduce policies to monitor and regulate groundwater resources. In 1985, the GoB introduced an ordinance exclusively for the management of agricultural groundwater resources. In this ordinance, licensing was introduced to restrict installation of private tube wells in critical areas where groundwater was falling at rapid rates and/or where groundwater quality was deteriorating. The subsequent National Environmental Policy (1992), National Policy for Safe Water and Sanitation (1998), and National Water Policy (1999) stressed the need for the protection of surface water and groundwater resources. Very recently, the introduction of the Water Act of 2013 makes it mandatory for any

individual to obtain a license/permit for large-scale withdrawal of groundwater by individuals and organizations beyond domestic use (Querishi et al., 2015).

The National Agriculture Policy of 2010 has argued for sustainable growth of agriculture for reducing poverty and ensuring food security through increased crop production and employment opportunity as envisaged in National Strategy for Accelerated Poverty Reduction (NSAPR), Millennium Development Goals (MDG) and SAARC Development Goals (SDG). The Ministry of Agriculture (MoA) highlights irrigation in Section 8 and is considered as one of the most essential inputs for increasing crop production.

The Bangladesh Poverty Reduction Strategy identifies *char* areas as being pockets of extreme poverty and it specifically mentions the continuation of *char* development and settlement programmes – (Shakil Mahmud, 2011). The strategy also identifies the coastal zone as being of special risk from climate change. From the colonial period up to the present *char* has been recognized as a 'zone of anomaly' in terms of its isolation (Ahmed 1999). In contrast, in 'postcolonial' discourse, *char* has been represented as a periphery of settlement, a landscape, and an economic resource for the country and a food source for the landless who may work to bring the *char* under cultivation. It is in this context that the *char* land constitutes the principal source of resource (Ahmed, 1999). The challenge facing successive governments of Bangladesh has been to grow more crops in this area.

It is in this context of uncertain *char* land livelihoods and lack of resources that external intervention has taken place. In 1978, the then government of Bangladesh embarked on a Land Reclamation Project (LRP) with the cooperation of government of the Netherlands. The project was originally designed to address the problems of floods, erosion and accretion of the coastal areas and to find a suitable remedy to combat these problems in order to reclaim land and to develop the *chars*. Afterwards, emphasis was given more to intensify the development of the new land rather than to the accretion of land. In 1991, both the Government of Bangladesh and the Netherlands, in recognition of the two distinct approaches decided to continue the LRP project under two separate projects namely: *Char* Development and Settlement Project (CDSP, a land based project); and Estuary Development Project (EDP, a water based project).

The experience of this project was applied in the first *Char* Development and Settlement Project (CDSP-I) that ran from 1994 to 1999. This involved water management infrastructure, rural infrastructure, productive development, institutional development and community development (CDSP Design Completion Report--Appraisal, 2009.). CDSP-II was initiated in early 2000 aiming to support the unprotected lands and ran up to 2005. The objective of CDSP-II was to improve the socioeconomic condition of the poorest in the coastal areas. Following the Integrated Coastal Zone Management (ICZM) and Integrated Water Resources Management (IWRM) approaches, CDSP-III was launched in 2005 for poverty alleviation and integration. CDSP IV was to give emphasis to the issue of institutions. It was stated in the project report (CDSP, 2007; 2011) that the lead agency of CDSP IV would be the Bangladesh Water Development Board (BWDB). Several officials claimed that the funds for new investments dwindled and budget allocations have fallen far short of the requirement. Another claim has been made that BWDB has undergone a downsizing operation that saw its staff number reduced from around 19,000 to some 8,500 today (field notes, 2013)

The local Government Engineering Department (LGED) is key to the implementation of the project goals including setting up internal infrastructure. BWDB and LGED together account for over 80% of project expenditure. The other government implementing agencies include: Department of Public

Health Engineering (DPHE), Department of Agricultural Extension (DAE), Forest Department and Ministry of Land.

CDSP-IV targets the development of about 30,000 hectares of *char* land and the settlement of *khas* land to over 20,000 landless households over a period of six years Part of this involves registration of land holdings and the creation of formal deeds for both men and women.

The CDSP has also been involved in the creation of water management infrastructure such as embankments, sluices, drainages and internal infrastructure such as cyclone shelters, houses, clustered villages, and rural roads. Recent academic research shows that the scarcity of water dominates the lives of the settlers in char area. At the initial days of settlement people had no source of water except canal, creeks and ponds. For drinking purpose they used to collect water from the mainland, walking 3 to 4 kilometers. In response to a question as to whether the Char Development and Settlement Project intervention has brought any change to the livelihood of the people, the answer was positive. The research showed that 87 percent of the respondents had benefitted directly or indirectly from the project intervention, among them 82 percent benefitted from land allocation, but few from canal or pond excavation for irrigating their land (Mahmud, 2011).

Differentiated tenure rights result in complex issues of water accessing which informal water management is operated within communities in the absence of formal arrangements, and patron-client relations are also strong (Ahmed, 1999; Mahmud, 2011). In general though, the importance of social networks is not well studied in Bangladesh. This is despite the fact that they are increasingly recognised as central to farming livelihoods, including for small-scale irrigators. Such networks have strong moral dimensions, in which 'help' or support takes place in allowing free use of water from one's own tube well or pond, but this is modified as crops become increasingly commodified. In *char* areas, a lack of kinship ties or patron client relations to the land may disrupt agricultural production, causing the poorest to lose vital forms of support. To date, no studies have interrogated the qualitative study of the social relations and water sharing in Bangladesh. This research aims to develop an empirical case that will address this gap.

## 1.5 Noakhali District

Noakhali District is situated in the south-eastern part of the coastal belt of the country The district has an area of 3600.99km² and is bordered by Comilla district to the north, the Meghna estuary and the Bay of Bengal to the south, Feni and Chittagong districts to the east and Lakshmipur and Bhola district to the west (see map 1). In the 19th century, colonial records show that the landscape around the coastal area was often subjected to inundation, gales and storms. Such natural calamities not only brought loss of life and property but also the loss of land due to river erosion (Ahmed, 1999). The whole district was made up of alluvial soil that has been deposited by the Meghna. In 1950, the district headquarters were completely submerged. In 1961, a dam was built from the district headquarters to the south as protection from river erosion. As a result, the river changed its course and contributed to the emergence of a number of small islands or *chars*.

The Noakhali coastal *chars* are vulnerable to regular flooding and have saline soils (Ahmed, 1999). In most of the unprotected lands along the coast only one rice crop is possible in the *aman* season (the principal paddy cultivation which starts from late June and harvest in November-December), when heavy rains temporarily decrease the salinity of the higher layers of the soil. In the winter (*rabi*) season, at some places an additional crop is possible. The overall cropping intensity of the *char* area is poor. When protected, the salinity will, over the years, gradually decline, while the possibilities of controlling water levels substantially improve the agricultural potential of the land.


*Map 1 Noakhali District. Source: Banglapedia, 2014*

Noakhali district consists of six *upazilas* (sub-districts) namely Noakhali Sadar, (the study area) Begumganj, Sonaimuri, Chatkhil, Senbagh, Companiganj and Hatiya. The Noakhali Sadar*upazila* occupies an area of 1071.66km², including 220.34km² of rivers and 103.71km² of forested land. The *upazila* is bordered to the north by Begumgonj and Senbaghupazilas, to the east by Compnaiganj, to the southeast by Hatiyaupazila of Noakhali district and to the west by Ramgati and Laksmipurupazila of Laksmipur district. The southwestern part of the *upazila* faces the sea and forms part of the Meghna estuary. Noakhali Sadar*upazila* is now split into two *upazilas*, namely Noakhali Sadar (or Sudharam) *upazila* and Subarna *Char upazila*.

The area is an extensive flat, coastal and deltaic land, located on the tidal floodplain of the Meghna River delta, characterized by flat land and low relief. The area is influenced by diurnal tidal cycles and the tidal fluctuations vary depending on seasons, being pronounced during the monsoon season. The population of Noakhali Sadar and Subarna *Char upazila* in 2001 was 766,722 with the male and female population divided almost equally. The population growth rate is 1.65% and density is 715km². The urban population is 14.52%. The literacy rate for males is 51.43% and for females is 45.04% (Subarna Char Upazila Office, 2013).

## 1.6 The ethnographic locale: Subarna char and Char Rashid:

Subarna Char belongs to the administrative unit of Greater Noakhali district. Situated only twelve kilometers from Maijdee town, the district head-quarters of Noakhali, with its huge agricultural land,

Subarna char is a 'settled' village *par excellence*. Alongside the huts of those who have been living here since the formation of these chars, the village is filled with in-coming peasant farmers who have migrated from adjacent areas due to river bank erosion. The recent brick buildings are reminders of the town-centred way of life of this area. Satellite dishes with TVs are visible in the market place as well as in wealthy houses.

Oral histories narrate that the area has been settled since the 1930s, largely by people from the adjacent sub-district of Ramgoti due to river erosion. Some are still arriving, having had land washed away. Due to the complex process of settlement, in which some people were given small areas of *khas* (government land) for cultivation and others –who are more wealthy and are now absentee landlords - were able to take much more, land holdings are not equal.

There are other noteworthy features of the area. These include the village's vibrant bazaars which are filled with shops selling not only paddy, water melon and so on, but also offering mobile phone and internet services as well as 'modern' snacks. Unlike previous muddy roads, which restricted movement during rainy season, there are also a high number of metal roads connecting homesteads (*baris*) and their fields to the main road. These have all been financed by the Dutch government assisted Char Development Settlement Project (CDSP) with the help of government bodies. Subarna char is increasingly becoming a prosperous area with the recent upgrade of the sub-district (*upazila*), having many of the schools, health centres and community centres.

Most of the soil is moderately saline. Soils that are highly saline during the *rabi* (winter crops and vegetables) and *aus* (rice crop grown in the rainy season) seasons become desalinised by the huge quantities of fresh water supplied by monsoons rains. The mainstay in char areas is *amon* (the main crop, grown from July to December). During the dry season about eighty percent of the land remains fallow. Due to the scarcity of water, it is difficult to grow crops in saline prone area.

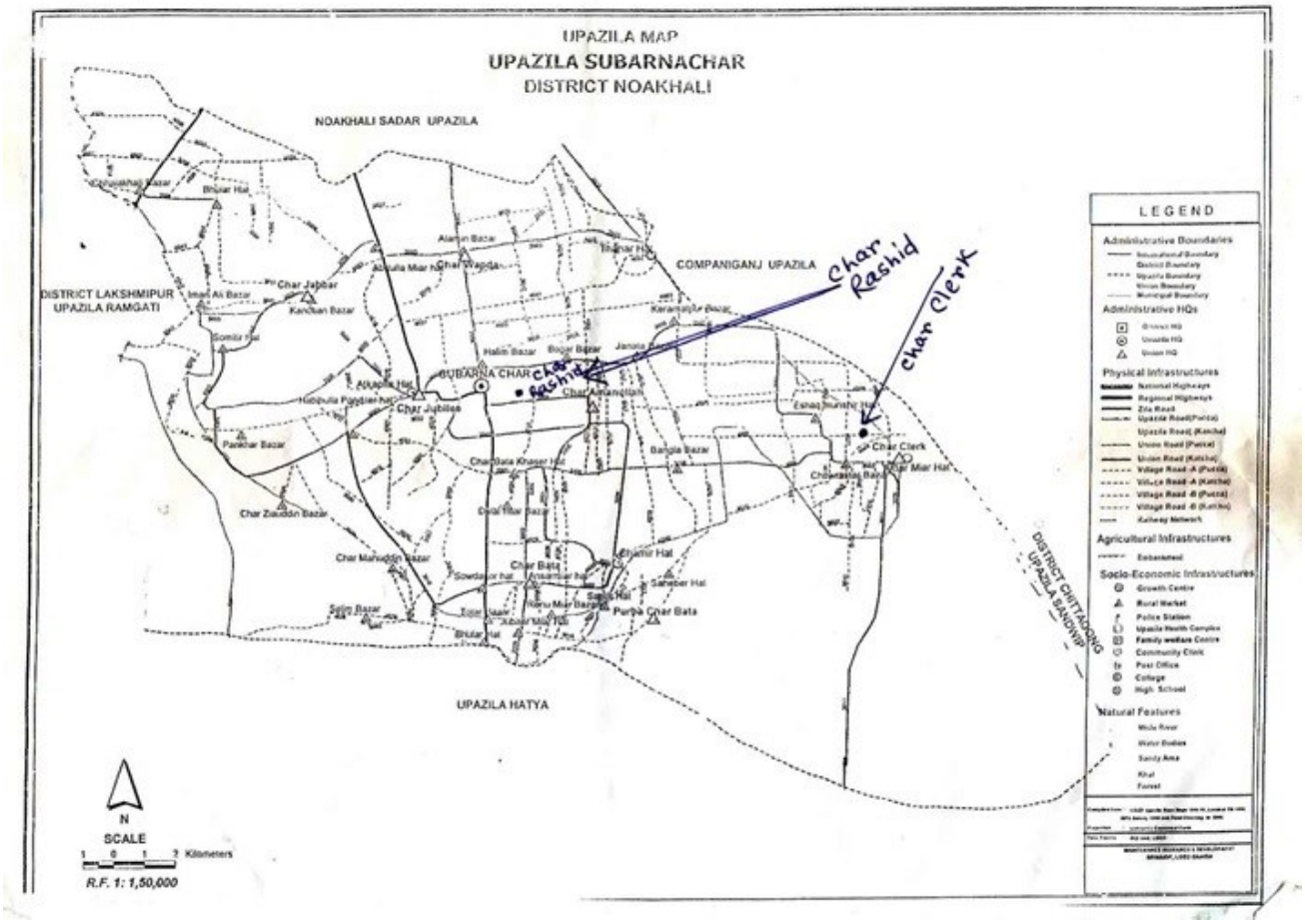
This is a striking contrast with the rest of Bangladesh, where (depending upon local ecology) the land is normally cultivated twice a year (during the *aman* and *boro*rice crops), often combined with a crop of winter vegetables (*rabi)*. Some fields are not farmed at all, but lie fallow, containing the salt at the surface level during dry season.

In Subarna Char, watermelons are being grown. Watermelons are a cash crop, which has been grown in this area for around ten years. They only need to be watered three times in a three-month growing cycle; they require some pesticide, but the inputs are seen as relatively low. The irrigation involves an innovative, adaptive technology involving plastic pipes and shallow sunk hand pumps. Some of these hand pumps are inside *baris*; others have been sunk in the fields. Winter vegetables such as cauliflower, tomato and chilli are also grown, after the *aman* crop.

*Table 1 Subarnachar Upazila Agriculture at a glance. Source: Subarnachar Upazila Agriculture Extension Office, 2014*

| **Description** | **Land Use** |
|---|---|
| Total Agricultural land | 37000 Hectare |
| Watermelon Cultivation in 2013 | 2200 Hectare |
| Watermelon Cultivation in 2014 | 3000 Hectare |
| Soybean | 7500 Hectare |
| Boro/Irri Paddy | 1200 Hectare |
| Nuts | 650 Hectare |
| Aman Paddy | 37000 Hectare |
| Chili | 450 Hectare |
| Khesari Pulse | 450 Hectare |
| Mung | 500 Hectare |
| Total Winter Vegetable Cultivation | 19427 Hectare |
| Total Paddy + Watermelon + Soybean Cultivation | 1455 Hectare |
| **Total Land** | **37000 Hectare** |
| **Cultivated Land** | **20882 Hectare** |

Under Subarna*char* upazila, *char* Rashid is located in the southern part of Noakhali district. It is located twenty km. south of Maijdee town. Char Rashid is one of the villages of Char Jabbar in Subarnachar*mouza*. It used to be located along the mud road connecting the one local market, Charjabbar bazar, which is the centre point of whole Subarna*char*. Due to CDSP's development projects, many roads have been built surrounding the village. All connecting roads which were once mud and slippery are now concrete. Previously, travel to the Char Jabbar and thus to the district towns of Sonapur and Maijdee was very difficult and after rain, movement on foot was almost impossible. Because of the road accessibility, one notices that trucks and carts can now come to the paddy and watermelon fields. The motorbikes of absentee landlords and paddy and watermelon traders also frequently move around the village. Char Rashid has a typical rural appearance. Solar electricity is common to every household. TV is also available.




*Map 2: SubarnacharUpazila. Source: Upazila Office, 2014*

# PART TWO: RESEARCH FINDINGS

In this section, we set out the key findings with regard to irrigation practices, focusing in particular on their contribution to livelihoods and the ways in which access to resources is shaped by wealth and political connections.

## 2.1 Summary of Key Findings

- **Small-scale irrigation is innovative and a viable livelihood option for char dwellers**

New forms of irrigation involving plastic pipes, hand pumps and shallow tube wells (STW) have been developed by farmers. Some of these hand pumps are inside *baris* (homesteads); others have been sunk in the fields. The pipes are attached to the pumps by cut off plastic bottles. The pipes can run for many hundreds of feet across the fields.

Small-scale and marginal farmers are benefiting from this irrigation as watermelons are an important cash crop. They have been able to grow watermelons twice a year whilst previously they could only grow mono crop paddy.

- **Formal institutions have not played a significant role in the innovation**

Key formal institutions associated with this irrigation development include the Bangladesh Water Development Board (BWDB), which has been involved in constructing culverts and sluices. Participatory water management has also recently been established with the assistance from the Netherlands, ADB and the World Bank.

Two significant interventions were the Dutch-assisted Land Reclamation Project (LRP), which took place during the 1970s, and the Char Development and Settlement Projects (CDSP), during the 1990s. These were responsible for the construction of canals, which have however since largely fallen into disrepair and been blocked by individual homesteads or private landowners who have built paths and bridges across them.

Despite the presence of these externally-induced interventions, knowledge exchange still primarily takes place mainly between farmers both at individual and household levels. Interactions between the Department of Agriculture Extension and farmers are minimal and weak.

- **Unequal access to resources, particularly land, is key to differentiated farming in the char area.**

Land access is uneven and this both shapes and is shaped by existing wealth and access to social networks. There are many absentee landlords and sharecropping is common. The social relations of land ownership/access directly affect farmers' access to water and their ability to innovate.

Absentee land ownership is a specific constraint in getting sharecropping land for the majority of the small farmers. This is linked to issues of political influence.

- **Water sharing is a product of social context**

Social connections are important for securing access to water for irrigation. Richer farmers are in a better position to get access to land and water for irrigation. They are also able to use their connections to gain access credit. This is particularly important as growing irrigated crops requires considerable cash layout.

## 2.2 The role of formal and informal institutions

In this section I examine the ways in which people gain access to formal and institutions to assist them to grow watermelons in the *char* areas. As I shall also discuss, reliance upon informal credit institutions rather than formal credit institutions, be it government run Bangladesh Agricultural Bank or NGOs credit programmes, is prevalent in the *char* area.

### 2.2.1 Formal institutions

There is no institutional or organisational agency that can claim to be promoting watermelon led small-scale irrigation in the study area. The Dutch government assisted CDSP has made a contribution by digging a number of canals but has not made particular provision for small-scale irrigation. Nor the Department of Agriculture Extension nor the WAPDA is directly responsible for providing this facility to the farmers.

In the early 1990s, CDSP dug some canals as reservoirs of water, which was envisaged as an important livelihood option for poor farmers. Through the CDSP and LRP project, both the government (via WAPDA) and NGOs (e.g. CDSP) assume that the poor farmers had limited resource for winter crop production. It was in this context that canal digging became a mainstream intervention. But the reality is different. The FGDs and informal interviews suggest that neither the government nor the CDSP has engaged in other activities, especially not in providing credit for installing deep tube wells or offering water access to the community. Rather, the farmers themselves have established relations with both kin and non-kin to use ponds, hand pumps and many other small-scale irrigation sources. It was also found that interaction between NGOs and the watermelon growers' is minimal.

For example, according to one person in a focus group discussion:

> 'It is good to work together through samitee but NGOs worker, UP chairman or member all are involved in corruption. All want percentage. The landlords are not actual farmers. So, you need to hear the voices of the actual farmers. In addition, those who are funding, they need to monitor as well. Our political leaders are not for us. They do not come to grassroots; they do not listen to local people. They just listen to their respective party's president-secretary and follow their advice. No representation from farming community. The farmers have Allah".

Shophy (70) is a local elected local council member. He has been serving in this job for the last 35 years. As a public representative he had a variety of experience in local infrastructural development projects. One of the projects he was involved with was the land reclamation project run by the Netherlands government. He was also involved in CDSP development activities including the planning and monitoring of a local canal digging project. According to Shopy,

> CDSP dug a canal from Bagdadona to Boyar Char. The length of this canal was 14 miles. Through this the CDSP connected this canal to the adjacent upazilla Ramgoti. Consequently local people have enormously been benefited. It would have been better if the branches of Bagdadona had been sluices. It is possible to reserve water through this sluice. Interestingly the water management authority of the government of Bangladesh called WAPDA did not do anything. They always think of making money.

Evidence from fieldwork more generally suggests that the patterns of interaction between farmers and other actors such as formal institutions necessary to create dynamic systems of innovation (e.g. local methods of irrigation for watermelons) are weak. The problem is not that institutions for this innovation are absent. In fact many of these institutions have been present. These include the Char Development and Settlement Programme (CDSP), Water and Power Development Authority (WAPDA), both government and non-government banks which provide credit. But they have not been well integrated, nor have they formed the relationships required to plan an integrated irrigation system in *char* area.

Watermelon growers tend to emphasise the importance of installing Deep Tube Wells or digging out the canals they already have. They see this as something that could be done by the Dutch government assisted CDSP project to improve the overall irrigation system and hopefully lead to a wider range of crops in the area. In particular they acknowledge that the canals have made an enormous contribution, through connecting them to the Meghna river, 30 kilometres away. In short, there is a common understanding of the water use and of the need for radical reform of canals, at least those that have already been dug by the CDSP or WAPDA that went across Char Rashid.

*Figure 3: Installing a new hand pump*

Landless farmers, who cannot afford to pay for sharecropped watermelon land and production costs, also tend to be left out from the 'miracle success' of micro credit. Watermelon growers told us that cash and credit are essential; there are a few formal credit institutions which seek higher interest, and which recover the interest at an exhorbitant rate with brutal ways, forcing them to repay installments. Many poor farmers in Char Rashid complained to us that the micro credit programmes are not friendly. In contrast to the increasingly precarious rural livelihoods in risky *char* areas where natural calamities are regular phenomenon, the formal credit institutions are not highly desirable; they are viewed by some as depressing.

The following FGD illustrates this:

> Water becomes scarce during dry seasons. We do *robi* (winter vegetable) crops but do not get water. If you want to install a deep-tube-well you need to dig 400-500 feet deep, otherwise you will not find good water level. It is also difficult to run deep-tube-well without

having electricity. We have tried our best to get connected power. In order to bear the expense we formed *samitee* (cooperative) and donated money; but we were cheated. Some NGOs had promised but not yet. They appropriated our money. The Dutch government assisted programme built some infrastructures such as setting up sluices, constructing culverts and bridges in this area. But they did not provide credit.

As a result the majority of the watermelon growers rely on their neighbours, relatives or other patrons for 'financial help' in the form of small loans that keep life ticking over. The pertinent point is that in Char Rashid the poorest farmers rely upon patrons. This support tends to revolve informally around social connections to neighbouring petty traders, input dealers and some powerful relatives as well as absentee landlords.

## 2.3 Accessing resources: networks and social differentiation

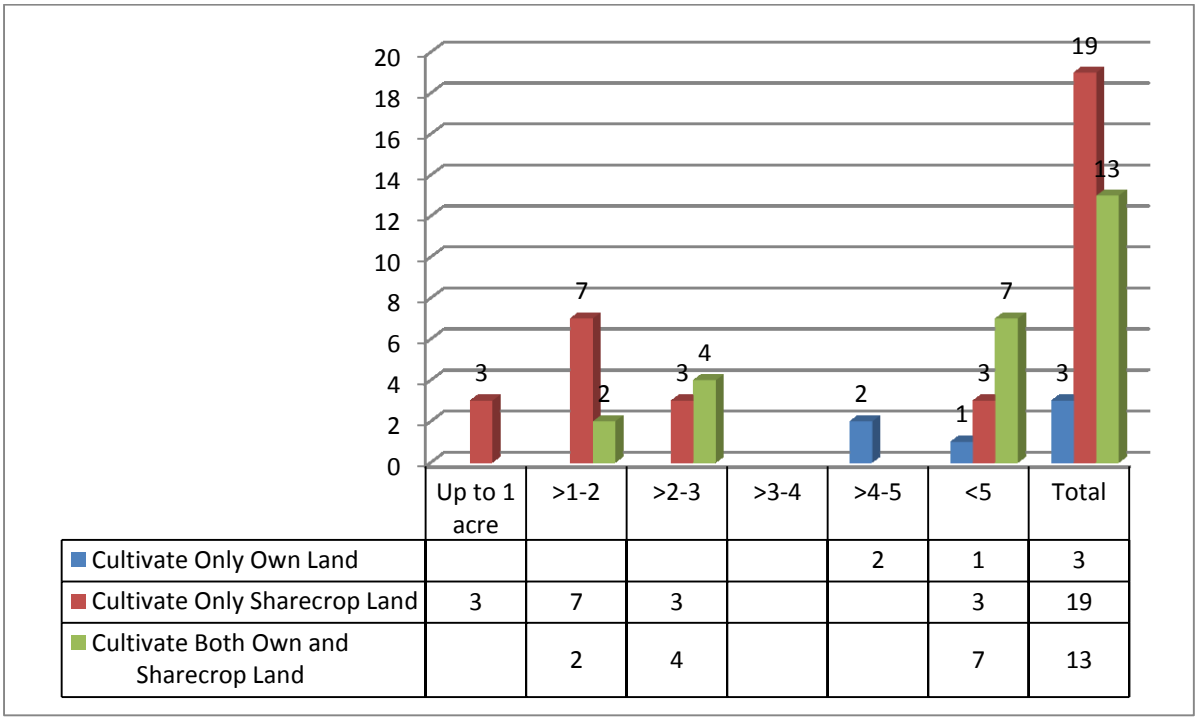
### 2.3.1 Access to land

Land ownership and access directly affects farmers' access to water and their ability to innovate. The majority of land is owned by absentee landlords who live in town - some 30 km away from the area. Land holdings are also not equal, which further influences production. Getting watermelon fields to sharecrop is competitive in the area. This is dependent on social connections such as networks and kinship or political relations such as patron-client relations. Tenure agreements are verbal and because there is no written tenancy agreement, the sharecroppers are vulnerable. This means that if social relations are good, tenure agreements can last for a long time. If the relations are not good for any reason, the tenancy agreement is dropped. A large number of *aman* paddy cultivators do not have the opportunity to grow watermelons due to a lack of these networks. This has reduced their livelihood options, preventing them from staying inside the village. On the other hand, local rich farmers rent their land out to those who are their close kin or dependents in the village. Farming practices are therefore issues of maintaining strong networks and social connections and acting for 'the interest of the fellows'.

The land holding and hierarchy in Char Rashid thus involves considerable sharecropping and absentee landlords. Of the total agricultural land in Char Rashid, around 30% is owned by local land owners, whilst 70% is owned by absentee landlords. When we examine the amounts, the figures are even more striking. Of the local landlords, only 16 households held 60 acres. Of them, five households own 40 acres of land whilst the remaining 11 held the remaining 20 acres. This suggests that much more land was concentrated in fewer hands in *char* villages than the rest of the country (Jannuzi and Peach, 1980; Ahmed, 1999).

In our survey, of the 35 households involved in winter crops including watermelon production in the village, 32 are 'sharecroppers' whilst the remaining 3 households have their own land and have been classified as owner-occupier or *malik*. Another 13 households are classified as 'Owner occupier and sharecropper'. Of these, 7 households own more than 5 acres whilst the remaining 6 owned 1-3 acres. This information is conveyed in the table below.

*Table 2: Ownership by cultivation. Source: Fieldwork Survey 2013*




| | Up to 1 acre | >1-2 | >2-3 | >3-4 | >4-5 | <5 | Total |
|---|---|---|---|---|---|---|---|
| Cultivate Only Own Land | | | | | 2 | 1 | 3 |
| Cultivate Only Sharecrop Land | 3 | 7 | 3 | | | 3 | 19 |
| Cultivate Both Own and Sharecrop Land | | 2 | 4 | | | 7 | 13 |

Out of 35 households, 16 are absolute sharecroppers who basically grow watermelons as a cash crop for their livelihoods. Such landless/ sharecroppers in Char Rashid are in dire need of getting land to sharecrop as a principal source of their livelihoods. Those farmers who can ensure both *aman* paddy land and winter crops such as chilli or watermelon are considered to be fortunate. Because watermelons are a high return cash crop, farmers are thus able to secure their year round livelihoods. Consequently, competition over sharecropped land between local farmers is intense.

Our survey data shows that the predominant form of tenancy is *barga* (pure sharecropping). In this arrangement the *malik* rents the land out to the *bargadar* for at least a year. The production costs such as inputs, seeds and hired labour are evenly shared by both the *malik* and the *bargadar.* This describes an ideal arrangement. The real situation is rather different, depending on how relationships between the *malik* and *bargadar* are formed. Usually the tenant bears the cost of seeds and labour and the value is deducted at the time of harvest. As the tenant carries out all post-harvesting operations, he gets the paddy straw. This tenancy arrangement takes place during the rainy season for *aman* paddy. Another type of tenancy contract is called *ekkhondo*, which is only for a single crop season, usually during the dry season.

### 2.3.2 Wealth and wellbeing: social differentiation

As the following case studies show, differences in resource access are crucial in getting access to land and then to irrigation. These are, in turn shaped by the ability to access social networks. The wealthier households have strong kinship ties and cultivate large amounts of land. With irrigation facilities they farm both *aman* paddy and winter (*rabi*) crop vegetables. They plant a greater proportion of their land with watermelons, soybean, chilli and a smaller proportion with cucumber. They then sharecrop a proportion of land to their kin groups (siblings) and have proportionately less land left as fallow.

Such households sharecrop out that land which is far away and less fertile. These households also maximize higher yields compared to the poor ones. If there is an environmental risk such as cyclone or monsoon rain, these households compensate for the loss by making profit from their *aman* paddy harvest. For example, last year, watermelon harvests were severely damaged by storms and many the farmers lost their investment, but this was not the case for the richer households.

**Abdus Shahid**

Abdus Shahid is aged 45. He cultivates 20 acres of land. Of this land, he owns 6 acres and share crops in another 14 acres. He grows watermelon, paddy, winter vegetables such as chili cucumber, brinjal, soya bean, tomato etc. He farms thrice in a year. In addition, he rears livestock and he is also involved in business. Shahid uses shallow tube wells, which he owns, for irrigation. During the dry season he recruits labourers to irrigate his fields, which are irrigated for about 5 months between November and March. The irrigation system he follows is that, by cutting the top of a bottle, he connects a pipe and then fixes it to the short tube well. After that, the labourer pushes the handle of tube well and the water flows through the plastic pipe, channeling it to the big hole. These holes are used as a reservoir in order to supply to the adjacent areas. According to Shahid, the char dwellers themselves innovated this particular form of irrigation. He says that it is easy to irrigate water through plastic pipe. As he says, "we don't need to buy water. We can carry pond water through silver jars. More importantly we don't buy water from others' pond'.

This example indicates that differential ability to farm is related to access to differential resources. One of the important aspects of this example is that wealthier households have a variety of different resources to combat production risks and ensure greater productivity. A similar case is that of Horon Mia, below.

**HoronMia**

HoronMia owns about five acres, along with four acres of sharecropped land. He employs two *aillas* (year round labourer). With his four other brothers, he shares farming activities. In general, these brothers are relatively wealthier, having both their own and sharecropped land. Their economic wellbeing enables them to undertake different strategies in growing crops during rabi seasons. They were able to achieve higher yields of watermelon by adopting certain strategies along with their access to land and irrigation such as having a number of hand pumps and own pond water, which most poor farmers were not able to afford. As a former local body elected member, Horon has good connections with bank officials who provide him with loans. Getting access to these resources enables Horon, like other rich farmers, to plant high return crops on a greater proportion of land.

Poorer households tend to share with close relatives in order to bear the total production cost. In most cases, they together work in their fields including watering from adjacent ponds and hand pumps rather than hiring labourers like the wealthier households. Indeed, during the preparation of the watermelon plants and the three times watering in the winter season, we found that these households were completely reliant on their family labour.

The majority of the poorer households informed us that if they had land to cultivate winter vegetables including watermelon, they would not migrate. According to sharecropping contracts in the *char* area, the landlord only shares the cost of *amon* and receives half of the income. But the *rabi* cost is completely borne by the tenant and the *malik* gets one third of the share. The majority of the poor farmers thus find it better to earn something from outside the village rather than getting involving in production.

Another important reason preventing the poorer farmers from growing watermelons is lack of access to land and thus irrigation. The case of Azor illustrates this.

**Azor**

Azor (55) is a *chotochasha* (small farmer). He sharecrops two acres of land. He planted all of his sharecropped land during *amon*. During the *rabi* season when most lands are left fallow, Azor could not manage to plant winter vegetables on even a tiny proportion of his land. He did not have close relatives in the area who could lend him money to offer to the landlords. A richer farmer offered the absentee landlord a handsome sum of money to cultivate watermelon. He has had relatives who helped him to use their tube wells. According to Azor, after harvesting *amon*, he migrates to Chittagong as a day labourer, leaving behind two daughters with his wife.

Watermelon production depends on the options and opportunities the poorer farmers have in Char Rashid. For example, Abdur Rahman's case shows that farming watermelons is a matter of maintaining kin ties in order to ensure production.

**Abdur Rahman**

Abdur Rahman is 30 years old. His father died. He is the eldest of his four brothers whilst two brothers are farmers, the other two are studying. Altogether he has cultivated one and half acres of land. The owner of the land lives in Noakhali town. His cousin's home is situated only 600 yards from his watermelon field and has one tube well and one pond. For this Rahman has bought six kg plastic pipes. He will bring water through these pipes from his cousin's tube well. He has to pay 1000 taka for a seasonto his cousin for using this water. If the tube well is broken during irrigation, Rahman must bear the cost of repairing it. As Rahman estimates, altogether he has to pay 15000 taka for irrigating water. He borrows money from relatives for buying fertilizer, seeds and pesticides. He has to pay 100 taka per thousand taka loan as interest. For irrigation, he buys a pipe every year and this pipe cannot be used for two consecutive years. Each year he buys 2400 taka -worth of pipe. He says that if the relationship is good with the landlord, paying back the loan can be delayed.

Kinship alone does not guarantee one's own production. There is a tension between general principles of sharing and mutuality and the fact that at certain times of year, water dries up so that each household is keen to establish its own supplies.

**Amanullah**

Amanullah, aged 28, is a small watermelon grower and wants to install a new tube well despite the existing provision to share water from his relatives. This year he has cultivated one acre of land and he has planted watermelon too. The owner is his neighbour. Amanullah has paid twenty thousand taka as an advance for bearing the cost of watermelon production from a local businessman. He has also received sixty five thousand taka as a loan for buying fertilizer, seeds and pesticides. The local Islamic Bank has provided him with fifty thousand taka of this. Another fifteen thousand taka has been lent by his wife's family. In return, Amanullah will have to pay back to his in -laws about 10 kg soybean or twenty kg paddy for each thousand taka loan. His field is close to his cousin's homestead. They have a pond and Amanullah used it as a source of water. But the well is going to dry up soon and he sees establishing his own tube well as an urgent priority.

These cases illustrate how watermelon production is a product of social context. Social networks and dependent relationships form the basis on which production is negotiated. This means that social relations are critical components of people's livelihood strategies; understanding how relationships are formed both within and beyond households. Farming watermelon in char areas is thus complex and constrained by resource options.

## 2.4 Water sharing

Turning to water sharing more generally, it is certainly the case that social relations are important. Those who have strong kin ties and are related with each other enjoy the use of hand pumps and free use of water from the adjacent tube wells. Paying some money for the use of hand pumps or pond water applies only to those who have good relations; the small-scale irrigators benefit from those sources. Many famers said that it is a rule (*neom)* that he should allow others to access his shallow tube well, and is happy to let others use it for a day or so, so long as he doesn't need it for the moment. On the other hand, the farmers also have a sense of consideration not to use the little amount of pond water as the owner may need to use it for household consumption. We think this probably only applies to those who already have a social connection.

Networks and relationships form the basis on which water sharing and exchange arrangements are negotiated. But these arrangements are not static; they change according to the circumstances and the intensity of relations in a particular time and space. These relationships are formed beyond the household and cut across social economy, kinship, region and even religion. For the sharecropping and poor farmers, the option to grow watermelons is dependent on sharing relationships with other farmers. These take place among the close kin such as siblings where the well-off brother(s) installs a number of hand pumps and lends them out to younger poorer brothers or other close kin. Beyond kin ties, informal relationships also work. Some believe that it is moral duty that enables them to let the other farmers to use water freely. These households are allowed to bring water from the ponds for a certain period and/or are allowed to irrigate from the hand pumps installed inside the field. In this case, the famers have to bear the costs of adding plastic pipes to their fields.

The ability to cultivate dry season vegetables is obviously dependent on access to water resources. The survey data shows that a large number of farmers grow watermelons as cash crop. But for the sharecropping and poor farmers, the option to grow watermelons is dependent on sharing relationships with other farmers. These can be classified into four types. The first type of relationship

is typified by close kin such as siblings, where the well-off brother(s) installs a number of hand pumps and he or they lend them out to younger poorer brothers or other close kin.

Horon's case, mentioned earlier, demonstrates exchange relations of sharing when water is needed.

> Horan Mia and his five brothers have two big ancestral ponds and two shallow tube wells. These households are able to sow watermelons on time compared to the other farmers who wait for a chance to manage irrigation facilities. These advantages provide them a very good yield, as everything goes on time.

The second type of relationship is typified by the case where two households (neighbours or close kin) come together and cultivate watermelons together. The third type of relationship is more informal, based on moral obligations at times of irrigation and thus more subject to change and renegotiation. Households are allowed to bring water from the pond for a certain period and/or are allowed to irrigate from the hand pumps installed inside the field.

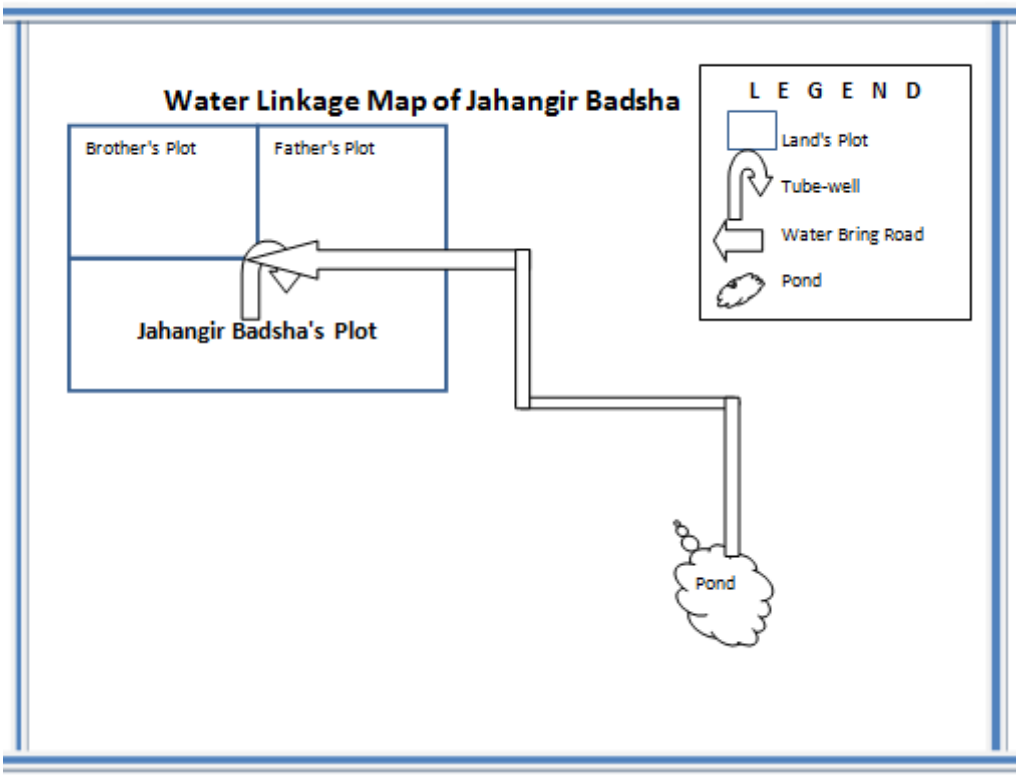
The following case represents a poor farmer's sharing arrangement. Here, with the help of an adult son, the farmer installs a tube well. With his help his father might also get help to irrigate his adjacent field. This case also demonstrates an exchange pattern of sharing. The close relatives with the new installed tube well could exploit the opportunity to form cooperation:

**Jahangir Badsha**

Jahangir Badsha has no close relatives with whom he can share a tube well, so he wants to install a new one and allow his father and brother to use it. Jahangir has started growing watermelons in half an acre of land, which is sharecropped. He has been growing for three years. This is the first time he grows watermelon on this tiny patch of land. His own house is 400m from the field. When we met him, he was sinking a tube well in his land. We also saw that his plants were only just growing, whilst the adjacent field watermelons had already matured. He had not had sufficient money to mitigate the cost, so, he was unable to plant in time. Now he is preparing to use chemical fertilizer and water. He has to use pesticide every week. For his tiny land, he needs five big bottles of pesticides. In this way, Jahangir will have to spray liquid pesticides at least 4-5 times.

He also told us that for installing a new tube well one needs much water. We saw that his son and the worker were carrying water with small jars from a pond that was 300m away in order to pour into the new tube well to pick up water. He is happy to give water to those who want to use it. But the pipes will have to be provided by the borrowers themselves.

The following diagram shows Jahangir's water sharing links in adjacent plots.




*Map 3: Water Linkage Map. Source: Fieldwork, 2013*

### 2.4.1 The significance of religious differences

Lastly, religion needs to be considered as a factor influencing access to resources, including water. If options and opportunities are limited for the Muslim poor farmers, the same applies to the Hindu poor farmers as well, as the following case demonstrates:

**Bikram Debanath**

Bikram Debanath, a Hindu, is 32 years old, does not have any land of his own and relies on sharecropping. He cultivates watermelons but finds this very challenging, as he struggles to access water and does not have money to hire labourers. In response to the question of how he irrigates his land, Bikram replied that "There is a pond located 500 metres away from my field. This is the only source of water. I myself carry jars and then pour into the field, along with my wife. I do not hire day labourers. I tell you watermelon cultivation is expensive compared to soybean and brown nuts. You see there is a canal close to my field. But it is useless, as it does not have a little drop of water. If there is water I would have used it".

So does religion play a role in shaping access to resources and land for irrigation? In 2014, the population of Bangladesh was estimated at 160 million. About 89% of Bangladeshis are Muslims, followed by Hindus (8%), Buddhists (1%) and Christians (0.5%) (https://en.wikipedia.org/wiki/Religion_in_Bangladesh). In Subarna char, the ethnic relations

between Hindus and the dominant Muslim communities have tended to be characterized by co-existence. Whilst many people originally settled via a process of land-grabbing, violence and patronage, in other instances they have migrated into the area from adjacent areas through receiving *khas* (government) land. In our field site, due to river erosion in adjacent area such as Ramgoti, along with predominant Muslims, some (about 50 households) Hindus have also taken shelter. In the initial survey we see that few Hindu households (9) own their land and most are sharecroppers.

*Figure 4: Innovation using a coke bottle to divert water*

Nonetheless, we should make it clear that religious-based differentiation does not affect social relationships in sharing water in the area. The classical distinctions and to some extent religious taboos which are prevalent in many parts of South Asia, do not work in *char* area and relationships are generally harmonious. So, a Hindu can have access to a Muslim's land to sharecrop in or out. This can equally applied to the uses of water from available resources such as tube wells and ponds. The notion of 'community' in char land social organization is not the same as in mainland Bangladesh (Ahmed, 1999). Boundaries are not closed or rigid and the members can easily overlap. The Hindu homesteads are concentrated in one particular area in Char Rashid, largely because lineage-based in-migration has occurred over the years. They have come from the adjacent area called Ramgoti due to river erosion. Though there is a Hindu *para* (neighbourhood) in Char Rashid, it is not self-contained. Local Hindu villagers' testimonies confirm this.

The following two cases illustrate the water sharing among and between Hindu communities. The sharing relations continue if the relations are good. Water use is free if it occurs in a small scale. But for irrigating through pumps, one has to pay. Within the Hindu community, the social relations

spillover into personal interests and can end up with conflict. This might jeopardize the relations, both within and beyond religion. The following cases exemplify this.

**Ramesh**

Ramesh Chandr Devnath, a Hindu, is 36 years old and has a young family. Due to river erosion he has migrated with his three brothers from Ramgoti into this area. He owns only 40 decimals of land, which is used as a homestead. He mortgaged half an acre of land for which he will have to pay nine thousand taka to get back this piece of land. Ramesh borrowed this money from a local NGO and moneylenders. After harvest he will repay this loan. He has just started to grow watermelons. He estimates that about 26 thousand taka has been spent for half an acre of land. If the harvest is good the saleable amount would be nearly seventy thousand taka. He says that it is difficult to irrigate as water scarcity is common during the dry season. Both canals and ponds become dry. However, he can rely on his neighbours: 'my Muslim neighbors have ponds and tube wells but I should maintain good social relations with them. I am loyal to the owner of those water resources. During the dry season I go to them in order to use water and to survive as well. So we have to maintain good relation with neighbours. We are created by the river. We are nomads, what to do naturally we must keep good relation with the neighbor. Otherwise we will die. This is reality'.

The case shows that water can be shared when necessary irrespective of class and religion. Ramesh lives in Hindu dominated homesteads but goes to the Muslim neighbours to obtain water.

**Himangshu**

Himangushu Debnath (42) migrated into this area ten years ago, leaving behind is four brothers in Ramgoti. When he first came into this area, Himangushu was involved in tailoring. Later he took agriculture as an occupation for his livelihood. He said that it was hard for him to survive just by tailoring. Five years ago Himangushu mortgaged twenty decimal of land at the cost of fifty thousand taka. This short time tenure is locally called 'kot' and the owner of this land will not be able to get it back as long as the payment is due. He cultivates watermelon on his twenty decimals mortgaged land.

He says: 'My land is situated between a canal and a tube well. A tube well has recently been installed adjacent to my field on the north, whilst the canal is situated on the south. So I am in an advantageous position. In my neighborhood there are six ponds. This means that in Hindu dominated homesteads; every ten households have access to one pond. All the households have to keep good relations to each other. If the relation is not good, it is hard to use owners' pond water. Sometimes our community owners build fences around the pond so that the neighbor cannot have access to water. The argument is that if I have not good relation with you, why I should allow you to use my pond freely? This is also true for domestic use of water as well. Some of the Hindu households pay money to the Muslim pond owners if they want to pump water. The ideology is that if you bring water by carrying jars or buckets, you don't have to pay. But if you use a pump machine to irrigate, you will have to pay".

## 2.5 Irrigation, innovation and livelihoods

*Figure 5: A day laborer irrigating using jars*

What does the economics of watermelon involve in the area? We conducted some individual interviews in Char Rashid and asked people to tell us how and why they made decision to follow small-scale irrigation. We visited their fields at different stages of watermelon production, allowing us to build up a picture of their livelihoods over the dry season.

Several issues cut across each of the case studies. The first is that affordability is vital for large scale Deep Tube Well installation, but that only some wealthier households can afford hand pumps. Some had to borrow money in order to bear the cost. As the case studies show, the farmers try to grow watermelons by borrowing, repaying and borrowing again. They are entangled with long term borrowing relationships with neighbours, the local shopkeeper or relatives, often having to pay interest on the loan after harvest.

Crucially, the case studies indicate that the need to pay in advance for sharecropping land is increasing. A major factor for the absentee landlords to rent out land is to get cash in which money is given upfront to the owners rather than a proportion of the crop paid back after the harvest. As several farmers told us, absentee landlords prefer this advance receiving system to sharecropping land, as they receive cash rather than taking the risk of harvesting watermelons.

### 2.5.1 Making a living with watermelons: case studies

The first two case studies are of sharecroppers who live in Char Rashid. Both cases show people who are continually struggling to balance their costs with the potential cash crop of watermelon. Drought, the lack of capital, and the absence of water resources, have also had an important impact on choosing watermelon in the area.

**Henju Mia**

Henju Mia is 50 years old. He has three sons. He cultivates watermelon on one and half acres of land. He has already spent 35000 taka for this cultivation. The anticipation is that he needs a further 10 thousand taka. His field is surrounded by the land of big farmers. He doesn't have any tube wells. Whenever he needs, to he goes to a neighbor to irrigate. Usually, they are reluctant to give water. Next year, he will set up on of his own. If there are any inconveniences in access, Henju will be responsible for repairing the neighbor's tube well. In order to meet the expenses of cultivation, he has borrowed 50000 taka from his father-in-law. He has to repay 20 kg paddy for each one thousand loan. As he narrates, " If everything is favorable, I would be able to sell one and half lac taka watermelon. This means that I would make more than double profit (1,50,000 - 45,000 BDT= 1,05,000 BDT ".

**Moin**

The next case study is of another poor farmer, Moin, who was unable to manage sharecropping land to grow watermelons. His case demonstrates that the innovation of developing small-scale irrigation emanated from a search of alternative livelihood sources for small-scale farmers in Char Rashid. He also mentioned the transition from tiny scale pond/jar based irrigation to hand pump based irrigation, telling us that poorer farmers can barely manage the costs of large scale irrigation.

According to Moin, there are also problems with water quality which influence the success of farming watermelons. He says: "If a STW is set deep down about 24-25 feet then the water will be salty and if the layer could be set deep down in 800-900 feet then one can get sweet water". Moin believes that water is not for rent but one can buy water from the pond. If a farmer intends to irrigate water in half acre of land, he has to pay 500 to 1000 BDT (£4-8 pound) and he must use a long pipe to collect water from STW for irrigating his land.

He had a loan from a petty trader in Maijdee town: 30,000 taka that was used for buying inputs, paying advance money to the landlord and installing a hand pumps. The loan will have to be repayed with 40,000 taka.

In calculating his profit, Moin takes into account the costs of labour and seed, concluding that it costs about 40,000-50,000 BDT per acre (about £350-400). But the potential income is 80,000-100,000BDT (about £700-£900). Thus profits are good in good year. However, the income is risky: "If there is rain or a cyclone or any other political unrest, I will be ruined for my life. So it's risky but profitable if the yields are good. There's no other profitable option to survive during the dry season. If I had much land, I'd have planted variety of crops to mediate risk. There are nine people in my household and I'm the only source of income. We need 8 kg rice per day. If I can harvest watermelons I will sell them out and would buy paddy to feed my family members".

What happens to those farmers who own tube wells but are unable to afford the maintenance cost to irrigate? The case of Abul Bashar demonstrates some of the problems that may be involved.

**Abul Bashar**

Abul Bashar is 60 years old and has five brothers. Compared to his other brothers his economic condition is not good. He cultivates watermelons on one and a half acres of land, which is sharecropped. His elder brother's pond is located on one edge of this land, which he has initially irrigated freely from; however as his plants grow, he has had to install a tube well in his own. However, having a tube well does not ensure irrigation. His watermelon field is adjacent to his homestead. If he wants to irrigate water from his tube well, it will require at least 480 feet of plastic pipe. For this he needs to pay 1500 taka, which he does not have. Abul used to grow soybean on this land but, as all farmers started growing watermelons, he has followed suit. If he alone grows soybean in a plot surrounded by watermelon fields, the soybean field will be affected by insects. His neighbour's crop selection pressures him into growing watermelons.

*Figure 6: Channeling water through a plastic pipe*

# PART THREE: DISCUSSION AND CONCLUSIONS

The above findings suggest that the land tenure system (usually sharecropped land, use of the dominant, urban, absentee landowners large-scale growers and poor, rural, small-scale irrigators) has hindered the creation of large scale irrigation facilities in *char* area. Building relations with neighbours, patrons and close kin are options to enable people engage in farming. These relations act as informal institutions against the dominant institutions for enabling an environment to grow watermelons in Char Rashid. As we have seen, there are those who have strong kin ties and are related with each other, who enjoy installing hand pumps and free use of water from the adjacent tube wells. This involves paying some money for the use of hand pumps or pond water only to those who have good relations; the small-scale irrigators also benefit from those sources. Many famers told that it's a rule (*neom)* that he should allow others to access his shallow tube well, and is happy to let others use it for a day or so, so long as he doesn't need it for the moment. On the other hand, the farmers also have that sense of consideration not to use the little amount of pond water as the owner needs to use it for household consumption. We think this probably only applies to those who have already had a social connection with the water owner.

What does every day economic life involve in the *char* village? The material we gathered shows that for those households which are sharecropping/cultivating their own land (a couple of acres), making a living is relatively better than the landless and small growers for whom the livelihoods were a highly precarious affair. Several further issues arose from the field data. The first is that cash availability is vital for watermelon production, but that only the richest families who usually have socio-political connections with credit institutions manage to stay in credit. Many poor farmers told us that they are constantly borrowing money and / or rice in order to keep themselves afloat. Social connectedness is key: those with links to petty traders in the town borrow hundred thousands of taka as an 'advance' rather than a loan. They become part of long term borrowing relationships, with neighbours, the local shopkeeper or relatives, often having to pay interest on the loan. If the yields are good, it is possible to repay the loan or interest and make the living in a more easy way.

Crucially, the case studies indicate that watermelon production is profitable and the need for this land is increasing. Other changes have also increased the need for this land: the low cost of hand pumps (which need only four thousand taka to install) for irrigation is an example, as is the increased use for watermelon fields which farmers told us used to be less expensive. This has been confirmed by the engineer who has been installing hand pumps in Char Rashid for last three years.

As watermelon is a cash crop and has high potential, the majority of the poor farmers also try to get involved in watermelon production, but face barriers to doing so. Many of the households we interviewed were engaged in other winter crop cultivation at some time of the year. Rich farmers, landless farmers, sharecroppers, all were involved in watermelon production in order to create an alternative livelihood option after *aman* paddy harvest. Rather than a decisive shift away from agriculture, what we therefore see is a shift towards a high potential cash crop that mediates risks on livelihoods. Having said this, many people told us that if the yields are poor or the marketing is interrupted by natural hazards or political strikes meant that it wasn't 'worth it'.

Finally, the data shows how making a living for poorer people in *char* area is intrinsically bound up with social and political relationships. This means that that these relationships are based on patronage, which resonates with old style obligations and exchanges being reproduced.

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