

RESEARCH REPORT ON

Community Water Management from a micro level perspective

AQUATIC AGRICULTURAL SYSTEMS-KHULNA HUB

October 20, 2015

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1. Preamble and Background Information

Bangladesh is the most vulnerable countries in the world for the impacts of climate change. Southern Bangladesh faces HUB Development Challenge due to increasing salinity, changing hydrology, climate change, complex and dynamic markets and social change that impede achieving sustainable and continual improvements in agricultural activity, livelihoods and nutrition of poor communities. HUB Development Challenge and identification of water management on the basis of priorities are equally important issues for reaching the goals of the study. Present community water management initiatives which aimed to know the water management past and recent practices in the AAS (Aquatic Agricultural Systems) communities will contribute to the HUB Development Challenge through two complementary components. Implementing innovative approaches for land and water management is the first action aimed to micro-scale management of land and water by forming Land and Water Groups (LWD) within each community which include one female and one male member. These approaches stick to a Participatory Action Research (PAR) approach which lead to the definition and empowerment of LWGs, training and consultation about potential improved practices and definition of experimental plans (introduction of new crops, change in cropping calendar, innovative drainage and/or irrigation techniques, how farmers collectively managing these practices) by each group for water management, agriculture and aquaculture activities. These new practices support to increase productivity of agriculture and aquaculture, higher incomes, reduce water and land conflicts and improve coordination for the AAS community members. The second initiative is to assess the impact of the implementation of innovative land and water management practices on agriculture and aquaculture, water management, community empowerment and food security for those communities.

2. Methodology and Field Plan

2.1 Study Area and Sample Size

District	Polder	Upazila	Union	Villages	Surveyed Questionnaire	
Khulna	Polder 29	Dumuria	Sahas	6	168	
			Sarappur	1	28	
	Polder 30	Batiaghata	Batiaghata	2	56	
			Gangarampur	3	84	
Barguna	Polder 43/2f	Amtali	Gulisakhali	6	168	
Satkhira	Polder 3	Kaliganj	Debhata	Noapara	1	28
			Nalta	2	56	
			Tarali	3	84	

Total	4	5	8 Unions	24 Villages	672
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2.2 Team Composition

Team Leader	Field Management	Field Coordinator	Data Enumerators	Data Entry Operators
Mustafa Bakuluzzaman	Md. Saidul Islam and Sabekun Naher	Md. Atikul Islam Shah	1. Aman Ullah 2. Zakirul Islam 3. Aminur Rhaman 4. Habibur Rahman 5. Nasrin Akther 6. Abdul Based 7. Provash Kumar Mondol	1. Anup Kumar Debnath 2. Mohon Sardar 3. Ashish Kumer Sarker 4. Onadi Krisna Roy
		Sabekun Naher	1. Dipti Gain 2. Hasan Al Zahid 3. Lenin Sarker 4. Tanjim uddin 5. Shanta Kar 6. Mijanur Rahman 7. Apurbo Roy	

2.3 Sampling Technique

The imperative instrument of this study is household questionnaire for improving Community Water Management from a micro level perspective. This study exercised structured interview schedule using random and stratified sampling method to collect the number of total households and sample households of a village from the study area. The population list for identification sample size was collected from tax assessment lists of Union Parishad in control villages, World Fish in AAS villages and from Program Officers of AAS in IWMI-AAS villages. Then IWMI (International Water Management Institute) finalized the household list through random sampling using those sources.

2.4 Training and piloting

The training and piloting had conducted by International Water Management Institute (IWMI) resources personnel with the help of data collector team in Shushilan Head Office at Khulna. The training was consisting of one and half days in 27th to 28th August' 2015 and piloting (one and half days) held at 28th and 29th August' 2015. The first day piloting started at 2:00 pm and end at 5:00 pm; going to Batiaghata village for data collection. The second day piloting started in 8:00 am and ends 2:00 pm and went to Titukhali for identifying is the questionnaire matching the field or not? The problems regarding questionnaires and improving the efficiency of data enumerators about questionnaires also be evaluated.

The survey team also observes here that how many times will take to conduct a single interview. What response we can get about crop economics, aquaculture, and water management issues from farmers and we tries to find difficulties. How can we ask an easy way the questions through to respondent? After back from field we discussed among us on the basis of field piloting, we shared our difficulties and problem to IWMI. Our target was that all decisions and throwing pattern of questions as will be the same that we can achieve the study goals.

2.5 Questionnaire review and final Development

The household questionnaire was developed by IWMI in English and translated into Bangla by the staff of Shushilan. Most of the questions are structured format. There are a few of question corrected

by research investigator based on during training and piloting. During training, we arranged demy interview or MOCK test for interviewer as he/she could memorize all questionnaires. Which question is not appropriate or difficult to understand for interviewee or not able to give us suitable information for better result of data collection that had tried to revise. We were very conscious as every respondent can understand and give us good answer asking question by interviewer. It was also finalized to discuss with IWMI personnel.

2.6 Field Plan

Tasks	Deadline	Responsible Person
Confirmation of data enumerators and data entry operators	20 th August	Shushilan HR
Translate Household questionnaire from the English to Bangla	21 th August-24 th August	Mustafa Bakuluzzaman
Collection of household/voter list from respective UP/Upazila, World Fish	18 th August	Md. Saidul Islam
Movement of field team from Dhaka to Khulna (for orientation)	26 th August	Md. Saidul Islam
Training and Piloting	27 th to 29 th August	Mustafa Bakuluzzaman, Archisman, Md. Saidul Islam, Shourav and Sabekun Naher
Finalization of study instruments and detailed field plan	30 th August	Md. Atikul Islam Shah, Md. Saidul Islam and Sabekun Naher
First Field Work (Khulna)		
Fieldwork	31 th August-5 th September	Md. Atikul Islam Shah, Md. Saidul Islam and Sabekun Naher
Data entry	1 September-10 th September	Mustafa Bakuluzzaman, Md. Saidul Islam and Sabekun Naher
Revise Field plan and give rest to the enumerators	6 th September	Md. Atikul Islam Shah and Sabekun Naher
Movement from Khulna to Barguna	7 th September	Md. Atikul Islam Shah and Sabekun Naher
Second Field Work (Barguna)		
Fieldwork	8 th September-10 th September	Md. Atikul Islam Shah and Sabekun Naher
Data entry	11 th September-16 th September	Sabekun Naher
Movement from Barguna to Munshigonj, Satkhira	11 th September	Md. Atikul Islam Shah and Sabekun Naher
Third Field Work (Satkhira)		
Revise Field plan and give rest to the enumerators	12 th September	Md. Atikul Islam Shah and Sabekun Naher
Fieldwork	13 th September-15 th September	Md. Atikul Islam Shah and Sabekun Naher
Data entry	17 th September-21 th September	Sabekun Naher
Movement of field team from Satkhira to Dhaka	16 th September	Md. Saidul Islam and Sabekun Naher

2.7 Data Collection

Shushilan with its experienced research team had conducted household interview by face to face interview process. The sample size was 672 households located in 24 villages from 4 polders of

Khulna, Barguna and Satkhira. Households' data was collected through random sampling method. The field coordinator had provided to data enumerator a name list where was containing different name of respondents and marked 4 selected and 4 reserve respondents for data collection in case of control village and AAS village. In IWMI-AAS village there was no reserve list (In exceptional cases, sometimes enumerators got reserve by coordination with supervisors. So, total numbers of 8 respondents given to interviewer before starting their interview. They move through village every working day taking their name list. It was mandatory that he/she used to meet selected ID if any research assistant could not get selected respondent then he/she can take another name from reserve section. If due to different complication of respondent, could not reach 8 respondents during visit at home or data collection, then it was an opportunities to make conduct from outside of list. Every working day of data collections, all RA could done 4 questionnaires with pay attention. Global Positioning System (GPS) machine made use of keeping a record of the surveyed households and to authenticate the data.

2.8 Data Management

There were 20 team members of this study. Each day two team went to collect data from the field and total data enumerators of team members were 14 excluding 2 supervisors. Each team was composed by 7 Research assistants and 1 supervisor. Every working day, two teams conducted 56 questionnaires. It is mentioned that each team confirmed 28 questionnaires. All types of study related activity monitored by IWMI resources personnel.

After returning the field, all the data enumerators of each team cleaned the questionnaire and submitted to Supervisor in the evening meeting. Then, Supervisor verified the questionnaire, whether there any mistake or not. Data entry operators also join with us and shared their findings how we can make error free questionnaire. If there was any mistake, any understanding problem, Supervisor had given feedback to data enumerators to accurate over phone to the respondents. In this way data had been cleaned. After cleaning the data, we were provided all questionnaires at data management team.

2.9 Data Entry Procedure

There were 4 data entry operators of data management team with in mind that they were able to double entry each day collected data. Each day the data entry operators entered into CSpro software 56 questionnaire including double entry. After entering each the data, they were submitted the file with their supervisor. The supervisor was checked and compared the double entry to find out error data. Then the supervisor was provided the error list to the data entry operator. The data entry operators checked their file within each group through questionnaire. At this process, each day they were tried to provide error free data.

2.10 Ethical Approval

All participants provided verbal consent prior to being interviewed. If a participant was under 18 years old, her guardian was also asked to provide permission. Participants who could not give us information then abandoned him/her politely and select other members of the household.

2.11 Quality Control

Quality of the data tries to strictly maintain through some process. For maintaining the quality of the data, we tried to uphold 3 second rules, avoid outsider during asking to respondent, stop mobile phone or silent, first done questionnaire of data collectors checked by supervisor one by one. Supervisor of each team also aware of the data enumerators about how they handle respondents, rapport building, throwing questions, whether they skip some portion or not, they were jolly to collect data. Supervisors observe them time to time during interview and if there was any lacking, then supervisors let understand them. After one week, each team was revised and interchanged group members. This way we tried to maintained quality control during data collection.

3. Polder Situation of Salinity Zone

MEDIUM SALINITY ZONE (POLDER 29)

Polder	District	Upazila	Union	Mouza	Village	Sample Size
29	Khulna	Dumuria	Sahas	Sahas	KDC	28
29	Khulna	Dumuria	Sahas	Sahas	Kumarghata	28
29	Khulna	Dumuria	Sahas	Sahas	Sahas Madhyapara	28
29	Khulna	Dumuria	Sahas	Sahas	Rajapur	28
29	Khulna	Dumuria	Sahas	Gajendrapur	Gajendrapur	28
29	Khulna	Dumuria	Sahas	Baghdari	Baghdari	28
29	Khulna	Dumuria	Sarappur	Kalikapur	Uttar (North) Kalikapur	28
Total					7	196

The study has been conducted with 7 villages in medium salinity zone of polder 29. The villages are KDC (Kajirhula, Dudirhula, Charabandha), Kumarghata, Sahas Madhyapara, Rajapur, Gajendrapur, Baghdari and Uttar (North) Kalikapur. KDC village comprises of 3 paras named Kajirhula, Dudirhula, Charabandha.

KAZIRHULA - DUDHARHULA – CHARABANDA (KDC)



In KDC, Most of the villagers cultivate all year round. Cropping pattern of this village varies depending on different season. They cultivate aman and boro paddy. Most of the farmers of this village produce gourd, korola, cucumber, pumpkin, kusi in *aman* season and radish, cowpea and various beans in the bank of gher in *rabiseason*. They practice mixed cultivation technique in both agricultural and fish production part. Majority of the farmers cultivate fish and vegetables jointly. Farmers use bank of *gher* for vegetables cultivation. Vegetables cultivation is much more than sesame, dal and paddy cultivation. Many farmers' practice mixed fish cultivation. Both *galda* prawn (sweet water fish) and *bagda* prawn (saline water fish) cultivate in this area. But, shrimp is cultivated not only completely sweet water but also saline water basically there exist brackish water. Different varieties of fish like *parva*, *patari*, crab, prawn, *kucher boro*, *sader datne*, *chetre reha*, *taposi*, *faksacome* from river in the time of high tide and fall into nearest *gher* of the farmers through narrow *nala*. This area is abundant with fish both in river and pond. After harvesting paddy, fish cultivation starts to this same land. Fish farmers of this village cultivate *glasscup*, *mriner cup*, *silvercup*, *katla*, *rui*, *kal bous* and *telapia* fish in their *gher* and pond.

In this village, *aman* paddy generally cultivates in Bengali *vadro* and harvest in *poush* month. Boro paddy cultivates in *poush* and harvest in *chatra* month. But agricultural cultivation really depends on nature and rain. Some farmers of KDC do not cultivate *aman* last year due to starting fish cultivation of same land but who produce *aman* paddy, depend rain water for irrigation. In the middle time of *aman* cultivation needs again irrigation of *aman* land but production of *aman* paddy reduces per bigha as a consequence of scarcity of irrigation water because paddy grain containing no rice. In winter season, farmers cultivate *boro* paddy that need huge irrigation water in full season round. In KDC village, farmers use irrigation water from boring. Most of the villagers cannot use canal/river (Kakmari) water due to saline water. Boring is not available than demand for all farmers for high establishment cost. Some farmers jointly uses boring water for irrigation by paid. Field channel excavates 4 to 5 years back but water cannot flash out/in rapidly into this field channel because of congested way to move. Almost 50-60 farmers land water movement has occurred by this field channel that creates much water movement pressure that leads to delay water flashing out from agricultural land. For that case, in rainy season villagers faces water logging problem extremely. In winter season, farmers face scarcity of irrigation problem and soil salinity also increases in this season. The most important gates of polder 29 are katakhali, kanaidangha, bukultala, kanchannagar, telikhali (old), telikhali (new), agunkhali outlet, jaliakhali, ratonkhali, asannagar, chatchatia, golaimari, joykhali and ruhitmara.

Golaimari and chatchatia are the two important gates for the villagers of KDC. Golaimari gate is one door gate that uses for water flashing in and chatchatia gate is 3 doors that uses for water flashing out. But the condition of golaimari gate is not good due to block with accumulated soil in front of the gate door and chatchatia gate cannot flashing out water rapidly for the difference between high canal/river bed and low elevation of agricultural land. Canal (Kakmari) becomes silted and narrower. Gate operation is controlled by powerful that is why proper management is hampered. Farmers of the KDC village said that if it is possible to establish deep boring with collaboration with others farmers together than cost will be minimized and water scarcity problem will be reduced. Some farmers of this village try to produce *renu puna* of *bagda* prawn in hatchery bringing out saline water from nearest river/canal with pitcher.

In 2104, cultivation of *bagda* prawn damaged due to late digging of *gher*. At a time soil and water salinity was a vital problem that spoiled many trees and crops. *One farmer named Mr Sunil said that 3 poun (1 poun=80) date trees and 40 coconut trees had damaged totally due to soil salinity.* In last cropping year, probability of *aman* and *boro* production was good but a large amount of crops has been damaged due to attack of current insects. Prevention of this insect was not possible. It attacked suddenly and damaged crops rapidly that leads to reduce production of paddy quantity and many farmers cannot sell their crops.

In rainy season a big part of agricultural land flooded with rain water that causes *aman* cultivation is hampered. There is a scarcity of deep tube well. One tube well uses about 25-30 family. It is monitored that many household practice homestead gardening. They uses both pond and tube well water for different household and agricultural purposes.

A large part of respondent desire to improve their method of managing land, water and practice new method of production technique, use HYV seed for increasing productivity. Framers of KDC want to change their agricultural calendar for lessening crops damaged due to natural vulnerability. They think that if it is possible to sowing seed earlier then crops will be harvested in advance that reduces the crops damaged. Nearly allrespondents want to better water management groups and bodies. It is observed that women also can participate in both agricultural and household activities. A major part of the respondents live in a mud made house with tin and straw roof. There is a lack of proper sanitary latrine.

KUMARGHATA VILLAGE



Vegetable Cultivation



Agriculture Field

In Kumarghata village, different vegetables like cowpea, bean, gourd, lalshak, palongshak produces in *rabi* season and *Galda* prawn and other fresh water fishes are also available in this area. Majority of the farmers cultivate *aman* paddy, jute, bean in *aman* season and in the *aman* land they also cultivate fishes. In the gher area farmer usually cultivate *aman* paddy at monsoon season at higher position (generally middle of the gher) and round the *aman* area (generally lower side) they cultivate fishes. But last year, a lot of paddy was damaged by majra and current insects and fish cultivation basically shrimp cultivation hampered due to attack of virus. In order to increasing fish cultivation, tendency of *aman* paddy cultivation decreases. Villagers of Kumarghata think that at present salinity intrusion of soil and water decreases than before.

Vegetables production is much profitable than *aman* and *boro* rice crops. Farmers of Kumarghata village said that green dust (chadla) cover the paddy land and accumulate in the root of the paddy crops after getting down water from the paddy land that causes fertilizer, insecticides do not make benefit to the paddy crops. Water logging problem is one of the vital problems of this village mainly Bengali *Srabon* to *Vadro* months.

Water logging problem also a major problem which creates congestion of Ramakhali canal and also for low elevation of land area. Vadrakhali and gengrail rivers are the important river for the villagers and kurimari, amtoli and chatchatia gates are the essential gate for the farmers. But, villagers think that sluice gate do not operate properly. Ramakhalicanal becomes silted and water movement becomes slower due to frequently creation of embankment for fish cultivation or leasing out the canal. Water management basically water flashing out/in problem rises day by day because of difference views about water flashing out/in from canal/gate. Farmers think that if it is doable to uniform farmers about this issue then problems will be minimized.

RAJAPUR VILLAGE



Vadra River Situation



Cucumber Cultivation



Jute Fiber Preparation

Rajapur village is situated in near moikhali bazar. Narrow road (Iter salling) exists inside the village and Vadra River also across the village. Villagers think that now it is one of the cluster villages. In *aman* season, farmers cultivate *aman* paddy, gourd, cucumber, turmeric, jute and *kachu*. In *rabi* season, farmers cultivate *boro* rice, cauliflower, cabbage, potato, tomato. Besides, shrimp cultivation basically *galda* prawn cultivates all year round. But, volume of *galda* prawn is reduced by attacking virus (*dari vangha* disease) that is controlled by spreading broken coconut to the shrimp gher. In the time of tillage, farmers face scarcity of power tiller because demand of power tiller is much more than supply. Most of the farmers collect water from near Vadra River for irrigation. Farmers' faces extreme irrigation problem mainly in *rabi* season because Vadra River becomes dry in winter season and water becomes motionless. This time, water hyacinth start to rotten and spreads badly smell that is unbearable to the villagers.

Farmers also use underground water for irrigation although collecting water from boring require huge cost for diesel. If it is possible to use electricity instead of diesel then tillage cost will be minimized. Farmers face extreme irrigation scarcity in the middle time of paddy cultivation. In case of vegetables cultivation, they employ underground water that is costly. Some farmers said with grief that last year tomato was totally damaged by reason of attacking unknown insect.

Sahas, joykhali and vanderpara are the important gates for the villagers. Sahas gate is blocked due to soil accumulation in front of the gate. Joykhali River becomes narrow caused by siltation. In *aman* season, there is no opportunity of proper water drain out system that leads to increase water logging problem in the agricultural land which is far from the *borobill* and river vadra.

UTTAR KALIKAPUR VILLAGE



Turmeric field



Paddy Seedling

Uttar Kalikapur is one of the important villages of Dumuria Upazila. The village is scattered and divided into different paras (Sarder para, sen para, morol para). There is a good road transportation system and most of the household live in a semi pacca and pacca house. The people of this village are conservative minded.

In *aman* season, farmers produces *aman* paddy, korola, jute and in rabi season, they cultivate *boro* paddy. *Aman* paddy sow in vadro and harvest in poush, boro sow poush/magh and harvest in chaitra, jute plants baishak and yields in vadro, korola seed spreads in chaitra and collect in baishak from the field. Farmers depend on rain water for *aman* irrigation but if sometimes there is low rain then irrigation water have to collect from distant canal (Patcha khal) by pumping that was costly and some farmers could not afford this cost. Last year, some farmers' paddy was totally damaged due to lack of irrigation water and they heatedly said that want to stop cultivation. Farmers of this village said that *aman* paddy became half as per bigha due to scarcity of irrigation water in the middle of the cultivation. In *boro* season, farmers of this village who cultivate leasing out the land from others have to divide their production into 3 parts such as farmers get half (50 percent) of the total production, land owners obtain siki part (25 percent) and who giving irrigation water take others siki part (25 percent).

In *boro* season, Farmers of kalikapur village got korola seed from Counselor (Government) and farmers did not bear any cost. In the time of korola seed sowing, collect irrigation water from canal by pumping due to shortage of rain but some farmers' korola was totally damaged in consequence of excessive rain only the price of the land was come back. Farmers use mainly urea, sulphur fertilizer and gypsum fertilizer for lessening iron or salinity from the soil.

The condition of the canal named patch khal is extremely bad. Water of this canal is full of dust and spreads bad smell. Water movement of this canal was hampered by the reason of canal settlement for landless rehabilitation that leads to broaden water logging problem. Telikhali gate is another important gate for the villagers but water reaches to the agricultural field at least 15 days late after opening the gate. Farmers of this village think that when they tillage their land with plough got 28-30 Mon paddy per bigha now they get only 18-20 Mon paddy per bigha due to decrease soil fertility. They also think that it is happened because power tiller spade cannot reach to the deep land causes soil becomes infertile. It is observed that powerful/ musclemen of this village use agricultural instruments (Grant from WMO/Blue Gold) to their own agricultural and business purposes. The poor farmers of this village cannot use their own grant.

SAHAS MADHYAPARA VILLAGE



Prawn Cultivation

The research team observed that about 28 household at Sahas Madhyapara which located at Gangarampur Union in Dumuria Upazila under Khulna district. Almost all the people are Hindu and left people are Muslims. Most of the people are involved in agriculture, others people are related with service holder based on local people speech of this village. The present condition of this village is the outcome of changes since 7 to 8 years. Most household are made of tin, wood and bricks. The people of this area were conservative.

The Land of Sahas Madhyapara is horizontal. The people of this village cultivate two copes; *aman* and Rabi. At west side of the village, very beginning of the year (*April to May*) they cultivate in prawn (*Bagdha & Galdha prawn*). Most of the farmers has own Gher. East side of the village they cultivate in Rabi (*June to December*) crops like *korla*, Ghinga, gourd and lady's finger. Much gourd cultivation has seen in this locality. Some of farmers are cultivating *boro* paddy (*November to May*) they grow it's instead of *aman* paddy and each bigha contains 10 to 12 Mon. During Rabi season, each gourd sold by 20 to 25 tk.

Geographically this area is low land and in low land water logging always absorbs in. Farmers of this village cannot grow crops in well because of water logging. In dry season, they face in irrigation water problem due to change of environments. In that case they set up boring on land and give irrigation to crops. In canal water they have no power to take decision because it drives by the local leaders. Before 7 or 8 years ago all canals are full of mud. Now the condition is still same. In prawn cultivation, most of the farmers do all tasks and in Rabi season, sometimes they hire day labor for planting, weeding and medicine spreading. Also the family members of the household help to the agricultural activities. Each labor will be paid 200 or 300 BDT with 1 meals in a day. They use in chemical fertilizer for better cultivation in land. Also they complain that productivity of land day by day decreases due to use of chemical fertilizer. They rear domestic animals. Every year in prawn cultivation, a lot of prawn has gone lost due to virus due to loss of soil and water quality. They were very anxious about it and try to solve it but not getting expected result.

There were very few people of this village grow Lady's finger, *lal shakin* their yard. Getting better crops from yard gardening used stocks seeds and someone bought from local market. Taking all cost of seed or fertilizer will be averages 3000 BDT in a year though it depends on land size and type of labor. In case of homestead gardening, those who are landowner, most of them marketing the crops commercially and who are proprietor of small land, markets crops non-commercially. They also reserve for own consumption and for relatives or neighbors. As they cultivate *gher* so they need not to cultivate in extra fish in ponds. In *gher*, they cultivate *galda* and *bagdhaprawn* with mixed fish likes panghas, rui. Fertilizer is used for producing natural food in almost all the *gher* of the area. Besides this supplementary feed are used for both monoculture and polyculture. Generally farmers feed twice daily, one in morning and other in before evening. Farmers feed the prawn and carp at 2-3 times daily. Fish feed are collected from local market. Majority of the farmers did not get any training on homestead vegetables gardening but on prawn cultivation they achieved training which was arranged by World

Fish. Water logging, salinity, unsafe drinking water are main problems in this locality. Water logging has created due to not withdraw excessive water from land. Saline water entered easily into land from canal. Safe drinking water crises in every where due to a little amount of tube well. Villagers are affected by diseases like diarrheal for lacking of pure drinking water.

Ponds condition is not well because people and domestic animal bath in together. Whole water of those ponds full of dirty like water-hyacinth. To make cows feed, irrigation on yard gardening and for bathing, ponds water used this area. Cannel and gate condition of this locality are not suitable for water supply in land. They use water from cannel mainly to cultivate in paddy or prawn. The real scenery is that west side of the canal is full of soil and rest water contains salinity. Now they do not participate in gate conduction and on decision making of water management. They never shared money to appoint a gateman or maintained to canal with the help of bamboo and soil. Those who proprietor beside land, they cannot allow through water from her land to others. So, before 4 or 5 years ago some farmers melt among each other on water supplying.

The people of these villages are interested to take new technology on crops, water flow system, seeds, side cannel, organizing in women group. They appreciate to cultivate hybrid crops. They told that if we manage lot of water in dry season that we can cultivate wheat and maize. Within 12 months, they face 3 months food insecurity as Ashin Magh and Falgun. Crises in food security, they take a loan as coping system. Some spectator of village complains that they are vexatious in different NGOs activities on loan. No one can eat bread now a day. Tube well water is the prime source of this locality. All household have larine and they follow rules of health and sanitation. Electricity is available in this village. Agriculture and prawn cultivation are the main occupation of this area. All are contains mobile by hand for using daily communication each other. A few people have bank account. They are rearing domestic animal like hen, pigeon and duck. We observed that women are working to establish equality and equity in every sector of their life. Especially most women were passing their allocated time on household activities. Within 24 hours most women go by 8 to 12 hours on sleep. During data collection, we observed both husband and wife's assist to give us information. They do not interfering during data collection.

BAGHDARI VILLAGE



Only one Tebe-Well for Drinking Water

Baghdari village situated in near main road of Sahas Union at Dumuria Upazilla under Khulna district. The village of Baghdari is very small. Here almost 200 or 205 people live in this village. Nearly all are Muslims and abide Islamic rule in daily life. They were very cooperative to giving us information. Leaving land of Baghdari village is higher from cultivation land. Most of lands are low and flat. All habitants were not have own cultivable land. Most of the farmers cultivated leased out from others land. They have no uncultivated land. They use in land calculation as Bigha, khata and decimal. They cultivate *aman*, *boro* and other Rabi crops. *Aman* paddy grows very well. They are planting *aman* paddy on land 3rd or 4th week of the month of July and harvesting crops on 2nd or 3rd week of the month of December. *Aman* paddy grows each bigha 15 to 17 Mon. In Rabiseason they produce korla, lady's finger and *lal shak*. Rabi crops plant on land 1st or 2nd week of January and harvest to household last week of the month of June. Farmers of this village complain that they are not getting real cost of crops. We did not see fish cultivation gher in this area. Presence of water salinity has seen in land. In *aman* season they are not facing irrigation water problem because it goes on natural water, but in *boro* season they face a lot of problem due to unavailability of water. They solved their problem by set up a boarding or shallow machine. Framers of this village have own right to use irrigation water from shallow machine.

In dry season almost half of the crops have damaged due to shortage of water. In rainy season, due to excessive water one-third of the crops go lost. Mixed fertilizer (DAP and NPKS) have been used since 2 years for better cultivation. Before seeds planting, they prepare land by the help of tractor cost have to pay BDT 1000 per bigha. After end of each working day, each labor will be paid 150 to 200 at BDT. A very few numbers of people involve yard gardening. In cultivation on homestead, they grow in lady's finger, chal kumra and brinjal. Seeds are collected by local market. They use chemical fertilizer like TSP and Urea. Especially they cultivate for self consumption not for commercially. No one achieve training on agriculture of this village. Fish cultivation is not mentionable here.

Safe drinking water management is very difficult in this locality. In prior, two tube well were establish by the help of HYWSHA to supply on all habitants of this village. Now, one is lost and other is active. The whole people of his village collect from only one tube well. Tube well water only use for drinking, bathing and ponds water used for washing. They reserve water by jar and pitcher. In Bengali Chatra month, they faced in great danger about water. Bad road construction and unsafe drinking water are the main problems of this village. The village only one road, in rainy season it is not for moving due to becoming muddy. Villages have two gates: one is Ghutumara and another is Chatchatia. Ghutumara gate is well and good for water supply to land. Water entered into land and flash out easily. People of Baghdari cannot participate on canal and gate operation. Near the habitants of gate, they conduct all activities of water management. Last five years they did not melt each other any types of quarreling on land of water.

They are firm to change their attitudes, production calendar and system of cultivation. They are ready to create field channels beside land. Also they are expected to draw new crops like sunflower and wheat. Most of the respondents think that women participation in group is totally prohibited because it is male work. So they have no need to encourage joining with male. Most of them in village, they are ready to give free services on purifying of canal water-dirty. Habitants of this village feel food crises during Magh and Falgun month. They take a loan from NGOs and work as day labor outside of the village. The household conditions were not sound and most of the houses are made of mud and tin. There is no electricity in this locality. All they have latrine but the condition of latrine is not good. Most of the household head are rearing domestic animal.

GOJENDRAPUR VILLAGE



Drinking Water Collection Point



Unhygienic Latrine

Gajendrapur village are divided into two parts as north and south part. West part is located beside left side of the main road. East part is situated right side of the main road. Sizes of the two parts of this area are same. Villagers think that land of this village is flat and very fertile due to use of cow dung for cultivation. Farmers of Gajendrapur produce mainly *boro* instead of *aman* paddy and other Rabi crops in a year. They produce cucumber, potato, lady's finger, sweet pumpkin, sesame and chili. Very few fish cultivation occurs in this village only for self consumption like tilapia and rui fish.

Most of the villagers of Gajendrapur live by doing agriculture. Size of big plot in Gajendrapur village is not less than 1 bigha. They grow crops one after another crops. They do not keep land as unplanted. Their crops cultivation types were boro and other Rabi crops. Boro paddy cultivates started on 2nd or 3th week of November and harvest the crops at 3th or 4th week of the month of May. Rabi crops grow first or second week of the January and harvest from 3rd or 4th week of the month of June. Boro rice (*hira, rasemoti, basumoti*) preserve at household for self consumption. But in Rabi crops sell mostly of all as kg. Outsider business holders come to village and buy the goods as high rate. In Rabi season they face water complexity. Villagers face water scarcity due to decrease water layer in soil. Canal cannot supply sufficient water due to drier of water. Deep water (*shallow machine*) used for as irrigation on crops field. They prepared cultivation land for crops by tractor. For cultivation in each bigha pay 1000 to 1200 BDT and oil cost is bearded by owner of tractor. Crops are reduced due to attacking of insects and they do not get result to use insecticides.

Some farmers use plough before planting seeds on soil after completing or tilling land by tractor for better depth. Activities of Rabi crops planting are done by farmers himself or other member of family. In *boro* paddy (*Local people called it sheter dhan*) they depend on pumping water. Canal have water but they cannot use it due to salinity and they do not carries water from the canal. They have right to conduction the water of canal but have nothing to do it such types of water condition.

Most of the people (*west or east side*) relate with yard gardening. Their yard garden is situated very near to the household as manage all the activities of crops. For irrigation, in yard gardening they use ponds and deep tube well water. In yard gardening, they use own seeds. They use chemical fertilizer as TSP and potash. Some time they fallen in great problem due to quality of fertilizer resulting they do not get sufficient production from crops. They are very interested to get training on agriculture as could grow a lot of crops. But they did not get any training to day still. Fish cultivation was not noticeable here.

Lacking of pure drinking water and salinity are the problems of this village. The quantity of salinity is much on water layer. It is not suitable for drinking. Safe water is available in deep layer of soil. To get safe water costing (*50 to 60 thousand tk.*) is very high causes it is not possible to set up a single tube well solely. Tube well water only use for drinking and ponds water use for bathing and washing. Some of them use ponds water to making cows feed. From a distance mile they collect water from government

tube well by pitcher or pot and faces lot of pain. Some NGOs came to solve the problem but did not see the light of result. Canal condition was not so good. From the old Telikhali canal water does not move and new Gangabandha canal cannot bring sufficient water to land. They suggest that should repair this canal immediately. Gate condition of this village was not satisfactory due to broken. So water cannot pass easily. Water management committee, gate men are often inactive. During the time of irrigation on field, farmers discussed with them for getting the real solution from removing this curse.

People of Gajendrapur appreciate to take new technology regarding agriculture cultivation, change in agricultural calendar. They are also very interested to make new deep tube well for cultivation different Rabi crops like wheat, maize and sunflower. If it is possible that villagers will be benefitted and happy to cultivate. Most of the people are poor in this locality. Food insecurity exists here and they faced food insecurity during three months as Magh, Falgun and Chaitra. Unemployment increases day by day and in crises of food security, they involve as day labor or zone. Nearly all households are made of muddy and other brick, wood and tin. All of them have latrine but condition of latrine is not so good for spreading various dust like defecation. Most often they addicted in severe disease like gastric. Some of them have electricity opportunity those are owner of lot of money.

In this polder, among the visiting villages KDC is prosperous village both in fishes and vegetables than other villages. Nearly all villages, percent of homestead aquaculture cultivation is higher than that of homestead vegetables cultivation. It is observed that in KDC village, conflict among farmers about water distribution happened in *aman* and Rabi season when had to collect irrigation water from nearest canal, boring through other farmers land. Almost all villages' face water logging, water scarcity, canal siltation, weak sluice gate problems. Most of the farmers of visiting areas want to adopt better cultivation method, HYV seed, and organized water management group for increasing both aquaculture and agricultural production. Women of these villages also participate both in agricultural and households activities in parallel.

COMMENTS FROM RESPONDENTS OF POLDER 29

1. Water drain out problem leads to increase water logging that hampers *aman* paddy cultivation (Kalikapur, Kumarghata, KDC)
2. Farmers of Kalikapur village think that tillage with plough is much better than power tiller, tractor. It reaches deep to the land and helps to increase soil fertility than power tiller and tractor. If it is possible to make long spade of power tiller like plough spade (langoler fali) then soil fertility will increase as before.
3. Need re-excavation of wider and deeper field channel (KDC, Gajendrapur, Baghdari)
4. Need re-excavation of canal (Kakmari, Ramakhali, Patcha khal, Vadra River) and have to repair SAHAS, Golaimari and Chatchatia gate
5. Require monitoring of farmers getting or not agricultural instruments which are granted by WMO/Blue Gold
6. If it is doable to ensure available deep boring and power tiller timely then farmers suffering will be minimized
7. Arrange agricultural related training for all farmers
8. Ensure safe drinking water by setting up tube well in locality (Sahas Madyapara, Baghdari, Gajendrapur)
9. To make a road for moving all people in this locality (Baghdari)
10. Support logistic equipments to real farmers and establishing joint storehouse for preserving crops (Gajendrapur)

MEDIUM SALINITY ZONE (POLDER 30)

Polder	District	Upazila	Union	Mouza	Village	Sample Size
30	Khulna	Batiaghata	Batiaghata	Hatbati	Hatbati	28
30	Khulna	Batiaghata	Batiaghata	Phultala	Phultala	28
30	Khulna	Batiaghata	Gangarampur	Andharia	Andharia	28
30	Khulna	Batiaghata	Gangarampur	Gangarampur	Gangarampur	28
30	Khulna	Batiaghata	Gangarampur	CharkhaliMachalia	CharkhaliMachalia	28
Total					5	140

Under polder 30, this study surveyed 5 villages named Hatbati, Phultala, Andharia, Gangarampur and Charkhali Machalia. This polder is under medium salinity zone.

PHULTALA VILLAGE

In Phultala, most of the villages practices agricultural activities for their livelihoods. At present, farmers of this village try to grow IRRI (Block) paddy production. Paddy only cultivates in rainy season and basically sesame, lentils can produce in *Rabi* season. After *aman* cultivation, soil water cannot decrease as required for sesame cultivation as a result sesame seed sowing was being late in *Rabi* season.

Due to this late sowing, sesame crop was totally damaged for excessive rain. This is one of the common pictures of this village. So, for late sowing and early rain in harvesting period, sesame crop was spoiled in this village. Water logging and scarcity of irrigation water are other vital problem for this village. According to villagers, water flashing out problem is the main problem now.

Canal bank is higher than agricultural land causes water cannot drain out properly. Some days before initiatives for a new canal excavation have been stopped because land owners cannot want to excavate canal over their land. If it is possible to dig up this canal then water logging and insufficiency of irrigation water can be reduced. There is a shortage of pure drinking water in this village.

GANGARAMPUR VILLAGE



Agriculture Field



BRAC Agri-field



Farmer mixed fertilizer for spreading paddy

Gangarampur village is divided by two paras named Gangarampur pourbo para and Gangarampur paschim para. The north side of the village is high land and south side of this village is low. In Gangarampur pourbo para, rice, vegetables, sesame and lentil grows more and farmers of Gangarampur paschim para produce rice, lentil more than sesame. After 7 to 8 years back, farmers of this village start to cultivate IRRI rice of their land in *Rabi* season. In high land, sesame cannot be cultivated because soil becomes drier and sesame cannot be produced in wet soil also. Farmers think that the soil of this village is *bele* and this type of soil is not suitable for BRRI-II rice cultivation. They irrigate their land with pumping water from Amtoli River. Scarcity of irrigation water in *Rabi* season causes farmers of this village cannot be interested to cultivate rice in that season. Farmers think that if there is an opportunity to better water management system in *Rabi* season then IRRI rice becomes double in each year. Salinity intrusion becomes high in case of both irrigation water and drinking water. Villagers bring supply water for drinking from water plant of Katianagla bazar through pipe by paid. Every household pays 80 BDT each month for collecting drinking water from this plant. Farmers think that this village goes to under high salinity zone because water of deep tube well become saline even water of deep boring (1000 feet) also saline as a result deep tube well cannot be established here. Shallow tube well water becomes saline day by day.

Nearly all villagers use rain water for different household purposes. A non-government organization establishes one water plant for rain water collecting in Gangarampur primary school. Most of the farmers cannot want to cultivate sunflower because they think that this cultivation is more critical and costly. Many farmers think that rice cultivation is better than sunflower cultivation because it helps to meet our food demand. Amtoli gate and *labon golar* gate are the important gates for the villagers. Amtoli canal turns into silt. High and low land difference creates conflict to collect irrigation water. Some farmers nearest of the canal cultivate fish causes arises water flashing out/in problems. Some fishermen blocked the canal for fish cultivation causes hamper natural water movement that leads to create cultivation problem. Rat damages huge crops in this village last year. In this village women also participate in agricultural activities with men. Most of the women have sound knowledge about agricultural activities like men farmers that helps to improve their economic condition. Farmers of this village face water drain out problem and bad condition of gate and canal hamper crops cultivation each year. Farmers of this village try to overcome water drain out problem but some powerful men causes' water drain out/in problem cannot be solved.

HATBATI VILLAGE



Agriculture Field

The research team surveyed Hatbati village for the purpose of Data collection. Hatbati village situated at Batiaghata Upazila under Khulna District. Most of the villagers are Hindu and rest people are Muslims (*based on local people words*). All of them are living by agriculture. A very few numbers of people are doing business, services and day labor. Nearly all have own land. They are using Bigha, decimal and Khata for land measurement. There were no fallow lands in this village. Data was collected by two sides (north and south) of the Hatbati village. There were about 6 km. distances between of the two working areas. Majority of the household of this area are involved in agriculture and rest of the people are doing fish cultivation. They cultivate in two season as *Aman*(June to December) and *Rabi*(July to January) season. In *Aman* season they grow only *aman*Paddy. They are getting only 13/14 Mon paddy from each Bigha. In *Rabi* season they cultivate Dal, sesame, lady's finger, korla (*Usta*). Most of them are selling paddy as Mon and others *Rabi* crops are selling as Kg. They can't get actual value of these crops. Sometimes they sell their crops at cheap rate. Most often business holder come to village and buys the goods as low rate.

Farmers of this village try to stock paddy and use as *household rice* all the year. The land of Hatbati is high and moderate. In north part of this village is low and in rainy season lot of water come and most part of crops goes down to water in *aman* season. Generally, *aman* crops grows at first or second week of the June and harvest from the month of December last. *Rabi* crops grow first or second week of the January and harvest from 3rd or 4th week of the month of June. In *aman* season, they have no problem about irrigation but in dry season have very much problem.

In that time they have no useable water in canal due to salinity. This is totally unused for irrigation, eating and cultivation. In dry season they are depend on natural water and artificial boring. Insect infection is increasing day by day. Last year above one third of the *aman* paddy has damaged. Local leader of this villages think insect increases due to excessive use of chemical fertilizer. South part of Hatbati village, some farmer has no ability to use chemical fertilizer but they use in compost fertilizer. For cultivation in *aman* and *rabi* crops, almost of them are use in home seeds and they try to reserve it at home for next year cultivation. Plants did not grow well due to attacking of insect. They use fertilizer as phosphate and potash. They are tilling land by tractor or power tiller because it is run fast and less time consuming. Each Bigha land tillage cost takes at least 1000 to 1200 BDT. Some farmers of this villages told that Plough is the best for cultivating because it goes into the deep of land. Front side of the plough of needle helps to do it. It is very narrow, incisive and sharp. Now the real situation is that very few people are using plough. In seeding and harvesting they hired day labor from outside of the door. Also they work with them for management of work. Weeding and spreading fertilizer in land they work in solely. Eating management of labor works done by household wife. Villagers think Labor wage is very high and one day labor is getting 300 BDT for each working day.

Farmers can't use of canal and river water for irrigation properly because of full of soil. They only use in rainy water mostly. In rainy season, they no need to irrigate to field but in dry season they need more irrigation to field. Farmers crops of this village did not damaged in last year due to lack of irrigation but due to excessive rain water they lost a lot of crops in last year. Regarding irrigation they have no rights or power to take decision in rainy season because it is a natural phenomenon. In dry season they can take right decision about irrigation because they are proprietor of boring.

Both north and south part of this village very few peoples cultivate yard gardening. For irrigation in yard gardening they use ponds water. Generally they do not face irrigation on yard gardening. In yard gardening they use own seeds. They use chemical fertilizer as TSP and potash. Bangladesh water development board and agriculture extension project arranged workshop for farmers on agriculture. Almost half of the people of this village have ponds. Most of the ponds are cultivated by jointly. Who have own small ponds they are mainly cultivate fish for self consumption and those who have big pond they cultivate fish economically. But in dry season water dried out from pond. They cannot cultivate fish in ponds due to scarcity of water.

In *rabi* season, water contains green color due to change of quality of water; as a result a lot of fish die. Irrigation water scarcity and lack of pure drinking water are the main problems of this village because water layer goes down in pond. It is possible to set up a tube-well within 400 or 500 feet but water from this layer is not fit for drinking. If it is possible to set up deep tube well about 1000 feet then getting pure drinking water possible but it incurs huge cost about 70 to 80 thousand BDT. For that case, it is not possible to set up a single tube well for every man. Most of the people use tube well water for drinking. Almost all people are using pond water for bathing and washing. They also use pond water to make cow foods and yard gardening cultivation.

Since 4 to 5 years, they are involved in conflict each other about water passing through high land to low at north side in Hatbati village and the problems cannot be solved yet. Local people told that about 7 to 8 years ago people faced in extreme poverty now they are free from of poverty. The people of this village are living with nuclear family. Most of houses are made of bricks and tin. They use drinking tube well water from own or collect from nearest neighbor or government tube well. Most of the household have hygienic latrine, after defecation, all of are maintained in sanitation and hygienic rules.

ANDHARIA VILLAGE

The research team surveyed 28 household at Andharia village. It is situated near high way road at Gangarampur Union in Batiaghata Upazila under Khulna District. Here nearly all people are Hindu only a very few people are Muslims (*Based on local people speech*). All Hindus were very cooperative and devoted to give us information during data collection.

The land of Andharia village is *bele doash*. Here half of the villagers have no own cultivable land without homestead. They cultivate other land by leased in. Besides cultivation, they work as a day labour, van puller and votvoti or auto driver. A very few people are involving with business or service holder. They use Bigha, decimal and khata for calculating of land. One bigha=52 decimal.

In Andharia village, people cultivate crops and fishes. They mainly cultivate paddy of aman. Very few numbers of people cultivate mixed fish (*panghas and rui*) in pond. They cultivate two crops in a year, kharip and *rabi*. In kharip season, they cultivate paddy of aman and rabi season, they cultivate sesame, lady's finger, sunflower and pulses. The land of Andharia village is high in case of homestead but the cultivable land is little stumpy. Amount of salinity were not same everywhere on that villages. East side of the village land, amount of salinity is less due to high place. Low land of this village is very suitable for cultivation in *aman* paddy because water carries poly soil. It is very interesting that they do not use fertilizer in land. They just have sown seeds and each bigha contains 20 to 25 Mon rice. They have no costing for cultivation in *aman* paddy without planting. Aman grows 2nd or 3rd week of July and harvesting at 3rd or 4th week of December. Harvesting crops, they sell as mon. last year in *aman* season, a very few amount of *aman* crops goes down in water. But in rabi season they lost their lot of crops. *Rabi* crops are planting on the land 3rd or 4th week of January and harvest 4th week of the month of May or 1st week of June. Last year in rabi season, most of the sesame and sunflower has lost due to excessive water. Both *aman* and *rabi* season, they use own seeds for cultivation. For better cultivation they use chemical fertilizer from market especially in rabi season. Generally in rabi crops, they are using urea and potash. Many times the work of weeding, planting and harvesting are done by labor. Labor wage is high and each labor is getting 300 to 350 BDT per day.

The gate and canal condition are now better because it is repaired by higher authority very recently. So water can move very easily. They have no problem in irrigation. But in some places of the village have water logging problem (Tengrabazar have seen). But in *rabi* season they faced problem of excessive water and insect affecting. The people of this village think that productivity of land is decreasing day by day due to use of chemical fertilizer. Homestead cultivation is very rare at Andharia village but almost half of the people have own ponds where they cultivate mixed fish as rui and pangash. Basically they produce it for own self. Now they are not getting any training on fish or agricultural activities. In prior Andharia villages faced different problem regarding water management but now it is solved. They use the canal water of Khuriya and gate condition is well. But the leadership people of this village are very active regarding gate management and water distribution. In some places of Andharia village has scarcity of safe drinking water. They collect safe drinking water from far away. For the purposes of cows feeding and homestead cultivation they use ponds water. Those who are living very near to main canal they are doing all activities by canal water.

The main canal is situated far from away. So it will be very effective to set up new deep tube boring in central point of field. If it is done then every farmer would be very pleased. The amount of fish eating is very high due availability of fish. They are eating rice three times with fish. The power of women has totally changed present than past. Now they are participating in different meeting, seminar and group discussion. They are working beside male with shoulder to shoulder. They can play an important role to decision making at household. Most of the women are all time busy with household and agricultural activities.

CHARKHALI MACHALIA VILLAGE



Damaged Tube-well



Cow Dung Preservation

In Charkhali Machalia village, we surveyed 28 household. The village of Charkhali Machalia is situated very far away from the main road at Gangarampur Union in Batiaghata Upazila under Khulna District. It is a small village and mostly all of them are related with agricultural activities. The land of this village is very low. Each farmer has land average 5 bigha and not less than 1.5 bigha. In *rabi* season (January to June) farmers of Charkhali Machalia grows lot of crops like sesame, dal, sweet pumpkin, water melon and they get real value of the crops. Last two years of this village crops has damaged due to water logging. In *Kharip* season, farmers of this village cultivate various paddy named kaches, bemola, ramshail shaha, koche, rangamoli. Each bigha contains 13 Mon paddy. Charkhali Machalia village land is horizontal but suitable for cultivation any type of crops. Last year, many lands were inundated and water kept in land more than 14 days. Above 30 days, they have to prepare land for next cultivation. Generally, *aman* paddy planting start on 3rd or 4th week of the month of July and harvesting end of the month of December. During planting in *aman* paddy they use labor for cultivation. Each labor will be paid 300 BDT with 3 meals in a day. They are tilling land by tractor paid 1000 BDT for each bigha. In harvesting, they mainly rent machine where labor have to pay 300 BDT with 1.5 Mon paddy. For cultivation, they use cow dung mostly, a few number of people use chemical fertilizer.

All farmers depend on rain water in *aman* season and *rabi* season depends on shallow machine (*Deep tube-well*). Once there was strong committee on water management but now full of empty. Sometimes they faced water problem but result did not bear in good impact to discuss with local leaders. Most of the household involve in homestead gardening. For cultivation in yard gardening they use in ponds water, own seed and local marketed fertilizer as TSP, urea and phosphate. Few days ago Bangladesh water development board arranged on agricultural training for the farmers of this village. Few numbers of people are proprietor of ponds. They cultivate fish in pond for self consumption not for selling to the market. In dry season they dig a small cavity into the ponds where fish can gather in together. Fish feed buy from market. Some days ago *Shushilan* has arranged training how to cultivate fish.

Water logging, water circulation and lack of pure drinking water are the main problems of this area. In rainy season and keep horizontal land lots of water enter into land but due to low depth of canal water cannot move easily. Also water carries salinity in some areas especially south part of the village. Around of the village have four (*Khuriya, Amtoli, Mailmara and Kolatola*) gates and but only one gate (*Khuriya*) is working among three gates due to decreasing navigability. Fishermen catch fish ahead of gates and canal and also they create barricade central point of canals. So water cannot move. Also it is known that few numbers of people open the door widely as they can catch a lot of fish. As a result door of the gate cannot sustain for long time. It is goes exhausted in before (for 3 gates). Local leadership people of *Khuriya* have taken the decision about water supply.

The people of Charkhali Machalia can use tube well water for drinking but they faced safe water scarcity in locality. They have to collect water from 1 km distance. To set up a single tube well require 50 to 60 thousand BDT. Water layer goes down in 500 feet. In this regards HYWASHA is working

how to remove this curse. Also they use ponds water for bathing, cows feeding and cloths washing. Almost all farmers of this village are interested to take new technology about water system, cultivation, field channels and hybrid seeds. They wish to solve their water related problem jointly but how it will be possible because many time they discussed with higher authority but they didn't see the light of result. Some household faces food shortage mainly in Kartik month. They are tending domestic animal like cows, hen, duck and goats in household. We observed that gender balanced maintained equally in household especially in Hindu family. They respect each other in every sector of conjugal life about buying some foods, selling agricultural crops and as decision maker; women keep a good sign at household now a day.

Some families of this village use cow dung as fertilizer and they reserve it by nets for protecting from flood out by rain. The pillar of cow dung nets consists of 3 layers. 1st layer they can use as combustible 2nd and 3rd layer used to be as fertilizer when they have wish. It is seen that many villagers cultivate chakraborty on the bank of pond.

So, it is observed that the people of this Polder 30 are interested to take new technology on crops, water flow system, seeds, field channels, organizing in women group. They appreciate to cultivate hybrid crops. They told that if we manage irrigation water in dry season then we can cultivate wheat and maize. They are ready to work voluntarily. The real situation is that perception part was very difficult to understanding for respondents. Sometimes they gave their information emotionally without understanding. Their answer was that *'if all people do it, so I can'* or *'As I do not cultivate it, so I couldn't tell it'*. It is a hope full words that woman empowerment has increased day by day. Most of the women are involved in both household and agricultural activities. Now they can work beside male and participate in different meeting, seminar and group discussion. Decision on different working, women can play important role in household sector like buying land, irrigation, weeding and knowledge dissemination

Comments from Respondents of Polder 30

1. Farmers of this polder desire to cultivate crops in scientific way (Gangarampur)
2. Require available deep boring that helps to improve crops cultivation by minimizing water scarcity (Andharia, Gangarampur)
3. Need more water plant for reserving rain water in Gangarampur village
4. Need safe drinking water on community level (Andharia, Charkhali Machalia)
5. Have to distribute donor aided fund Properly among poor people
6. Should be careful before preparing the village people listing
7. Require a good road transportation system (Charkhali Machalia)
8. Amtoli, mailmara gate have to repair and amtoli canal need re-excavate

Low Salinity Zone (Polder 43/2f)

Polder	District	Upazila	Union	Mouza	Village	Sample Size
43/2f	Barguna	Amtali	Gulisakhali	Gojkhali	Gojkhali	28
43/2f	Barguna	Amtali	Gulisakhali	Gojkhali	Dalachara	28
43/2f	Barguna	Amtali	Gulisakhali	Gojkhali	Bazarkhali	28
43/2f	Barguna	Amtali	Gulisakhali	Gojkhali	Bainbunia	28
43/2f	Barguna	Amtali	Gulisakhali	Khekuani	Khekuani	28
43/2f	Barguna	Amtali	Gulisakhali	Fakirkhali	Fakirkhali	28
Total					6	168

BAINBUNIA VILLAGE



Damaged door of Bainbunia gate

Bainbunia is one of the important villages of Amtali Upazila in Barguna District. Various types of crops are cultivated in this area. In Kharif season, farmers of this village cultivate *aman* paddy, *aus* paddy, gourd, potato, sweet potato, betel leaves, sugarcane, peanuts and cucurbitaceous. In boro season, most of the farmers produce boro rice, pumpkin, (kalai) pulse, chili, *mug dal*, *kesari dal*, garlic and mustard much in this village. Cropping pattern of this area is slight difference from Khulna region. Most of the farmers cultivate in primitive way. Generally, farmers of this village cultivate different crops in all year round. In *aman* season basically they produce *aman* paddy, in *boro* season pulses and others time they grow *aus* paddy in their field. Farmers of this area firstly sow *aus* (*boro*) paddy in Bengali *Boishakh* month and harvest in Bengali *Vadrol/Srabon*, *aman* paddy produces in Bengali *Srabon* and yields in Poush month, different vegetables implant in Bengali *Poush* month and harvests in *Falgum* month. They think *aus* paddy is one kind of *boro* crops. It is observed that most of the farmers think that various pulse, betel leaves, peanuts cultivation are much profitable than paddy production, it is less costly and less water intensive crops. Sometimes villagers face scarcity of various kinds of vegetables for consumption purposes. Due to attacking of *amri* insect one-fifth of the paddy production was reduced in last production year. The price of both *aman* and *aus* paddy decreases than 2-3 years past. At present *aman* paddy sell at BDT 600-700 per Mon and *aus* sales at 400-500 BDT per Mon but *aman* sold at 800-1000 BDT per Mon and *aus* was sold 600-700 BDT per Mon 2-3 years ago in that village.

In Bainbunia village, there is an extreme scarcity of irrigation water mainly in *boro* season in the time of seed sowing even farmers cannot use high tides' water in that time. Again water logging problem arises due to excessive rain, flood and storm in the time of harvesting crops that leads to damage *rabi* crops also. Generally irrigation water collects through opening the Debpur gate in *aman* and *boro* seasons. In *boro* and *aman* paddy production, when water cannot come easily from opening the gate then irrigation water brings from Debpur canal by pumping and cost occurred 100 BDT per hour. In the middle time of *aman* paddy production, farmers face extreme shortage of irrigation water. Farmers think that due to shortage of irrigation water, one fourth of the *aman* paddy was damaged and *boro* paddy also becomes

dried due to excessive rain causes water logging before harvesting this crops. As a result of extreme scarcity of irrigation water, farmers shift to less water intensive *rubi* crops. In this village, farmers cultivate *aman* and *kesari dal* jointly. When *aman* seed forms into grains and soil is wet then seed of *kesari* sows in that same field. After harvesting *aman* paddy, fertilizer and insecticides sprays in the plant of *kesari* that leads to raise the plant rapidly. Farmers of this village employ only men labour and they have to pay breakfast, lunch and BDT 350 per day. Mug pulse production needs irrigation but *kesari* pulse cannot require irrigation.

Majority of the farmers of Bainbunia village use urea, TSP and phosphate fertilizer in their agricultural field. Farmers of this village apply various insecticides like Tryfun, Rajdan, Equijinan for protecting their crops from harm basically pulse cultivation. Insecticides use gradually increases because it cannot protect crops as required even farmers apply insecticides 15 times in one month that leads to increase production cost. Last year, *aman* paddy was sold by 700 BDT per Mon, *bom* paddy 400 BDT and pulses 1200 BDT.

In case of homestead gardening in Bainbunia village, most of the household produce cucumber, cucurbitaceous, gourd shak, *kumra* shak, sweet potato and beans in their homestead. They use TCP and organic fertilizer (cow-dung) for homestead gardening. The majority of the household sell their part of homestead vegetables after keeping for self consumption. They also cultivate fish in their homestead pond but in winter season pond water becomes drier. Debpur canal becomes drier, narrower and siltation increases. Debpur canal is full of water hyacinth causes water cannot move as required, fish died, cow, goat, buffalo cannot get water from this canal. The condition of Debpur gate is extremely bad.

Villagers of Bainbunia use pond water for different household activities even they use pond water for cooking and drinking by using fitkiri. Iron exists in tube well water and if tube well water uses for cooking then it turns into red colour that cannot be taken for consumption. It is observed that many farmers face water related conflict with neighboring plot cultivator for getting adequate irrigation water on time by pumping from Debpur canal through nearest *nala*. Sometimes conflict arises among farmers for excavating *nala* (field channel) through farmers land.

In Bainbunia, farmers' perception regarding rain water preservation is that they think drought causes pond water, canal water become drier in winter season as a result it do not come to work allocating part of farmers land to harvest rain water. Debpur, bainbunia, aungulkater and motbaria canal are the important canals of this village. Debpur canal was re-excavated by water development board last year but it does not excavate as per required depth causes problems remains still. Whole of the canal cannot re-excavate, canal becomes silted and leased out for housing settlement. Bainbunia canal linkage with *Chauna* River that is also linked with *Payra* river but both Debpur and bainbunia gate has one door causes less water flashing in/out. Villagers of this village face food insecurity much in Bengali *Asharh* and *Srabon* month.

KHEKUANI VILLAGE



Dried Paddy over Mat



Cow-dung for making Organic Fertilizer



Aquaculture Pond

Khekuani village is another important village of Amtali Upazila in Barguna district. Farmers of this village grow *aman* paddy, *aus* paddy, lady's finger, chili, *lakhak*, cauliflower, cabbage, tomato, bean, *kalmi* shak, *palong* shak, potato, pulses (*mug*, *musur*, *kesari*), sweet potato, sunflower, peanuts in different seasons in their agricultural field. They produce shak basically *kalmi* shak by making bed to their land. There is an extreme scarcity of irrigation water and also has scarcity of drinking water. Some farmers collect irrigation water from Khekuani canal and nearest pond through pipe.

Farmers, who cannot have opportunity to bring water through this process for money problem, collect water from pond or canal by pitcher but most of the cases it is far from their paddy land causes farmers face huge difficulty and trouble. There is no boring system for collecting irrigation water and farmers of this village only depend on rain water, canal and pond water for irrigation. After sowing *aman* paddy, in the middle time needs irrigation but there is no opportunity to irrigate in this village. In that case, farmers use dew which is fallen at night to their grains. Dew beats up by using stick causes dew falls to the soil and again using long stick spreading this dew to their paddy grains that helps to meet up some sorts of irrigation demand.

Khekuani canal becomes silted and gate is blocked due to accumulated soil in front of the gate. Ponds become drier mainly in *Ogrohaeon* month and various insects grow this less water resulting water cannot be used. Khekuani sluice gate is operated by water development board but one door causes this gate cannot capture water pressure of whole of the village consequently door recedes and water flashing out/in occurs automatically.

Farmers think that labour, fertilizer and insecticides cost increases much than before. It is observed that nearly all farmers wish a new and effective sluice gate, *gazi barir darja* or culvert needs repair that will support to water drain in/out for this village.

DALACHARA VILLAGE

Dalachara is one of the longest villages of Amtali Upazila in Barguna District. It is divided by middle, south and north Dalachara. Farmers of this village basically produce aman paddy, IRRI rice, betel leaves, sweet potato and *mug* pulse. Most of the farmers face shortage of irrigation water and water logging problem. There exists water drain out/in problem in the time of requirements. Most of the agricultural activities are done by farmer himself. It is observed that farmers do not want to employ women labour for their agricultural activities even participation of women of their home in agricultural activities is fewer than Khulna region. Most of the farmers wish to cultivate boro rice and much interested in sunflower cultivation.

There is a very bad road transportation system. Villagers face extreme communication problem even there is no rapid opportunity to taken to hospital in case of any sickness. Villagers move Gogkhali bazar for their various needs by foot or boat through *Ronachanda* canal covers 4 to 5 kilometers.

Dalachara, Gogkhali, Ronachanda are the important gates of the villagers. Villagers jointly removed water hyacinths from the *Ronachanda* canal last year causes it is better now but *Atheraddir* gate is blocked due to water hyacinths. Nearly all household use pond and canal water for cooking. There is a lack of pure drinking water and sanitary latrine. There is no electricity in this village. In rainy season muddy road completely becomes unusable for the villagers.

GOJKHALI VILLAGE



Goikhali Gate



Inlet Condition



Safe Drinking Water Point

Goikhali village situated in near the main road of Gulisakhali Union at Amtali Upazila under Barguna District. The land of homestead is high than cultivable land. Land type is *bele doash*. Of all habitants were not have land. A number of people cultivation land hired or leased from others. There were no uncultivated lands. They try to use all land for cultivation which have. They used land calculation as kani, kura katha and decimal. I Kura=66 decimal (*East side of the village*) and I Kura=72 decimal (*west side of the village*). They cultivate *ausb*, *aman* and *rabi* crops. *Aman* paddy grows very well. They are planting *aman* paddy on land 3rd or 4th week of the month of July and harvesting to household 2nd or 3rd week of the month of December. *Aman* paddy grows each bigha 12 to 13 Mon. Some of them were cultivate *ausb* paddy. West side is the best for cultivation in all types of crops comparatively east side. Because East side of the village is close to the river *Payra* and people are not interested to cultivate in this area due to calamity.

In *rabi* season they produce cucumber, chili, sesame, sweet pumpkin, mug dal, peanuts and betel leaves. Most of all are related with paddy (*bouraj-May to June*) cultivation. *Rabi* crops planting on land 1st or 2nd week of January and harvest to household last week of the month of June. Farmers of this village complained that they are not getting actual price of crops. We did not see fish cultivation gher in this area.

Salinity intrusion is very few here. In somewhere of this village at east part is low where in rainy season a lot of water entered into land. Last year, most of the crops go down to water in *aman* season. Generally, *aman* crops grows at first or second week of the June and harvest from the field of the month of December last. *Rabi* crops grow first or second week of the January and harvest from 3rd or 4th week of the month of June.

In IRRI/*ausb* season, they have very much problem about irrigation. In that time they have no useable water in canal. Canal is caring water with salinity. This is totally unused for irrigation, eating and cultivating. In dry season they are depend on natural water and underground water. Attack of insect is increasing day by day. Farmers of this village think insects are increasing due to excessive use of chemical fertilizer. For cultivation in *aman* and *rabi* crops, almost of them use in home seeds and they try to reserve it at home. For cultivating each kura land with tractor takes at least 1000 to 1200 BDT. In seedling and harvesting they hired day labor from outside of the door. Also they work with them for management of work of labors. Weeding and spreading fertilizer in land they work in lonely. Eating management of labor works done by household wife. A day labor is getting 380 to 400 BDT per working day with 3 meals.

Irrigation on the field, they can't proper use of canal and river water. Now it is full of soil and they use basically rain water in *aman* season. At the time of irrigation (*rabi season*), they are going to face different collusion and they use boring water for irrigation. Crops costing increasing day by day because they

have to collect water from long distance by machine or narrow pipe. A very few number of people cultivate in yard garden. In cultivation on homestead, they grow in lady's finger, shak and brinjal. Seeds are collected by local market or use self. Now they are always cheated by seed dealer because quality seeds are not providing to farmers. Almost all the people of this area use DAP (*Local name kala sar*) at flatland and cow dung use in high land. Especially they cultivate for self interest not for commercially. No one achieve training on agriculture of this village. Shortage of irrigation water and lack of pure drinking water are the vital problems of this area. Also water carries salinity in some areas especially east part of the village. Around the villages have three canals (*khal*) as east side khekuani, west side napit and south side has debpur khal. Gojkhali gate is the most important to this village. Gate condition is not well. The door of the gate is broken. Water can easily enter from canal but cannot flash out. Local people proposed that it should be repair immediately.

Mohesdham is a name of place. It is located at north side of Gojkhali gate. 4 years ago a little culvert were made to link between east and west side as water can supply properly. Villagers said that a few months ago LGED has broken the culvert due to political causes and make a road on that place. As a result people (*east and west side*) are not getting water for cultivation and water also cannot pass thoroughly, and west side of these villages' areas above 1000 acre land has gone to water crises. Local people of this area consult with up chairman, members and different NGOs but they did not see the light of good impact.

The people of Gojkhali use tube well water for drinking and cooking but they face safe water scarcity in locality. They have to collect water from 1 km distance. To set up a single tube well in this area, amount to be paid 70 to 80 thousand BDT because water layer goes down 9000 to 1100 feet. In this regards HYWASHA and RELIGIENT WASH (*in cooperation with Oxfam*) are working remove this curse. Maintenance cost regarding tube well is very few. All over 10 or 20 BDT take to repairing it. In some places few tube-well has established Maxwell foundation implemented by *Shushilan* but it is not sufficient for density of population. Also they use ponds water only for bathing, cows feeding and cloths washing. WMA (*Water Management Association*) exists here but activities of WMA are totally inactive.

Though they are well come to take new challenge of cultivation. But, most of the farmers of this village do not know how to cultivate land in standard way. They are worried about on it because they are not getting real result from cultivation. They are firm to change their attitudes, production calendar and system of cultivation. They are ready to create field channels beside land. Also they are expected to draw new crops like sunflower and wheat. Women participation in a group is totally prohibited (Leadership people speech) because they think it is male work. So they have no need to encourage joining with male. Most of all them in village, they are ready to give free services on purifying of canal water-dirty. Habitants of this village feel food crises during July to November. Sometimes, they take a loan from NGOs and work as zone or day labor outside of the village. The household conditions were not well. Most of the houses are made of wood and tin. All they have latrine but the condition of latrine is nohygienic.

BAZARKHALI VILLAGE



Fish Net Blocked by Bazarkhali Canal

Bazarkhali village is one of the small villages of Gulisakhali Union. Almost all the villagers are Muslims. Agriculture is the source of main income. Energetic and youth person in this area are earning by motor cycle driving. Most of the household head rearing domestic animal. Many farmers have no own cultivable land and most of the cases they leased in other lands for cultivation. They cultivate *ausb*, *aman* and many types of *rabi* crops. *Aman* paddy grows each bigha 12 to 13 Mon and they are planting *aman* paddy on land 3rd or 4th week of the month of July and harvesting to household 2nd or 3rd week of the month of December. Some of them were cultivate *ausb* paddy. In *rabi* season they produce peanuts, chili, sesame, chal kumra, mug dal, battle nut and betel leaves. Most of all are related with *bouraj* (May to June) cultivation. *Rabi* crops planting on land 1st or 2nd week of January and harvest to household last week of the month of June. Farmers of this village told that they are getting actual value of crops. In somewhere of this village at central part are low where in rainy season lot of water entered into land but due to canal siltation and lack of required gate door water can't flash out properly. Most often *aman* paddy goes down to water. In case of IRRI/*ausb* cultivation, farmers face shortage of irrigation water. They cultivate their land by tractor or power tiller. For cultivating each kura land will take at least 1000 to 1200 Tk. Some of farmers of villages participated training on agriculture. Here approximately half of the people are involved in fish cultivation. They cultivate fishes in ponds like tilapia, panggash and rui. Fish feed collected from local market. Most of the time household do not face water problem in pond but sometimes they have to fill the ponds by boring water. Also many villagers have taken fish cultivation related training few months ago.

Bazarkhali canals so narrow that water cannot pass easily. More over a lot of trees leaves and fish nets blocked the water movement. Here is no bill or gate committee. Group leader of the farmers would like to request that made a door beside canal to pass water widely. Sluice gate condition of Bazarkhali is not well and people do not participate in decision making to conduction the gate, water management and canal cleaning as voluntarily. Bazarkhali gate is the most important gate for this village. Gate condition is not well. The door of the gate is broken. Local people proposed that it should be repair immediately.

The people of Bazarkhali use tube well water for drinking but all they face safe water scarcity in locality. Sometimes, they have to collect water from 1 km distance. One tube well is allocated for 40 to 50 families. Most of the farmers of this village are interested to take high cultivation method for more production, less water intensive crops like sunflower, wheat and maize. In most cases female members of household cannot take proper decision on agricultural activities. Habitants of this village feel food crises during Ashin, Kartik and Falgun. Most of the houses are made of wood and tin and also seen two storied houses in this area. Electricity is not available at Bazarkhali. Every end of the day all places made of Ghost house. The light of oil lamp is the prime source through pass the whole dark night. Mainly, women involved at personal and family hygiene, child feeding, crops cutting and preparing or cooking for all members. We have seen that a very small number of women are relating with meeting, seminar and workshop.

FAKIRKHALI VILLAGE



Betel leaves cultivation

Fakirkhali village is located in low land and north corner of Gulisakhali Union. They cultivate *aman* and *rabi* crops. In *rabi* season they produce chili, peanuts, sesame, mug dal, betel leaves. Land of this village is flat and low. Salinity intrusion also has seen. In *rabi* season they faced irrigation scarcity problem. In that time, canal becomes drier and water salinity increases. The farmers of this village got better crops in 2014 but in 2015 have lost lot of crops due to excessive rain causes water logging. In *aman* season, farmers rely on rain water and *boro* season they use groundwater for irrigation. Few numbers of people are proprietor of ponds. They cultivate mixed fish in pond for consumption not sell to the market. In dry season they dug a small hole in corner side of the ponds where fish can gather in together.

Fakirkhali canal is so narrow that water cannot pass easily. Leaves of trees are scattered over the canal water and some fishermen creates slow water movement for keeping nets into the canal. Sluice gate condition of Fakirkhali is not well and people do not participate in decision making process. The door of the gate is small that could not supply water as required. Water logging problem rises due to catching fish from the canal for Local influential people in rainy season. The people of Fakirkhali use tube well water for drinking but most of all have safe water scarcity. They collect water from neighbors or government tube well. In most cases female members of households cannot take proper decision on agricultural activities. Most of them in village, they are ready to work for removing water hyacinth from the canal.

Household related all tasks are done by female and male also help to completing the work. Electricity is not available at Fakirkhali. At night, the village is dark and dangerous.

In Polder 43/2f, it is observed that from the surveyed villages, there is a scarcity of irrigation water and water logging both are the vital issues for the farmers. Water and soil salinity do not be alarming position. Villagers face electricity problem, sanitary latrine and lack of pure drinking water problem. There is a very bad road transportation and communication system inside the villages.

Comments from Respondents of Polder 43/2f

1. Need re-excavate of Debpur, motbaria, bazarkhali canal and bainbunia gate. If it is possible to repair Bainbunia and Debpur gates with two doors instead of one door then the lengthy time of water flashing out/in decreases
2. Khekuani village faces extreme irrigation water scarcity. Need re-excavate of Khekuani canal and badly need a new and effective gate for Khekunai village
3. Require good road transportation and improve communication system in Dalachara, Bazarkhali, Fakirkhali
4. Need electric facility, sanitary latrine and deep tube well for the villagers (Dalachara, Bazarkhali, Khekuani)
5. There is a scarcity of proper field for drying paddy crops (Bainbunia, Khekuani)
6. WMA should be active (Gojkhali)
7. Women participation should be increased (Bazarkhali)

High Salinity Zone (Polder 3)

Polder	District	Upazila	Union	Mouza	Village	Sample Size
3	Satkhira	Debhata	Noapara	Ghonapara	Ghonapara	28
3	Satkhira	Kaliganj	Nalta	Kazla	Kazla	28
3	Satkhira	Kaliganj	Nalta	Kashibati	Kashibati	28
3	Satkhira	Kaliganj	Tarali	Barea	Barea	28
3	Satkhira	Kaliganj	Tarali	Tarali	Tarali	28
3	Satkhira	Kaliganj	Tarali	Gopalpur	Gopalpur	28
Total					6	168

Satkhira district seems as a high salinity zone area. In this study surveyed six villages as Ghonapara, Kazla, Kashibati, Barea, Tarali and Gopalpur in Polder 3 (Satkhira).

KAZLA VILLAGE



Homestead Gardening



Crab Businessman

In Kazla village, for most of the households, both agriculture and aquaculture are the main sources of livelihoods. In Kharip season, most of the farmers of this village produce *aman* paddy, brinjal, banana, keura, jute and pumpkin and IRRI rice, lady's finger, cauliflower, *palong* shak, *lal* shak, potato and colocasia in *boro* season. Shrimp and crab grow almost whole year.

At present crab plays vital role for income generation like shrimp in village. Different grades of crab incur different price. There are at least 10 types of grade for crab cultivation. Sometimes 10 grade crab sells at 500 BDT each and average 1000 to 1200 BDT per kilogram depending on grade. It is monitored that crab farmers provide *Kuce* and tilapia fish for feeding the crabs resulting crab becomes bigger rapidly within 15 days. Crab farmers bring their crabs to *Nalta* bazar from that bazar wholesaler buy crab and sell to Dhaka. Buyers of Dhaka export this crab to America, Taiwan, Malaysia and Hong Kong by categorizing different parts on the basis of grades and gender.

Aman paddy depends on rain water whereas *boro* paddy requires irrigation from groundwater through boring pumping and farmers who have no boring collect water from other boring by paying average 1000 to 1250 BDT per season. Some of the farmers said that per bigha irrigation cost was 6000 BDT in a year from the nearest farmers boring and who does not have own boring, no opportunity to buy water, collect irrigation water from pond by using pitcher. They use underground water and pond water much than canal water for irrigation.

In this village, total 15-16 personal boring have for the farmers from collecting underground water. Farmers of this village said that IRRI/block cultivation required at least 45 times of irrigation in 3 months of cultivation period. Farmers of this village apply urea, DAP, potash, teobit fertilizer for

their land. Crops cultivation is much costlier than its production price and it increases day by day. Farmers of this village said that they had to buy seed, fertilizer, insecticides much. In rainy season, some of the agricultural land was flooded by rain water and created water logging problem. Land submerged and crops decreased due to excessive rain causes water accumulation. Last year seed bed mainly potato seed bed damaged totally for excessive rain.

Moreover, water for fish cultivation brings from canal Baliadhanga through pipe by pumping but canal becomes narrower due to siltation. Some of the farmers cultivate *keura* on the bank of *gher* and earn money by selling it to the local bazar.

There is an extreme scarcity of drinking water. Iron, arsenic and salinity exist in most of the tube well causes cannot have to drink. Nearly all villagers buy water from Delta (supply water) which is situated in Nalta bazar and pay 15-20 BDT per can and villagers said as a grief that since 25 years they bought water for drinking. Jiler gate, vangermari gate, sannasir char are the important gates for the villagers. If it is possible to establish more deep motor/boring then irrigation water scarcity decreases. It is monitored that women also participate in agricultural activities and the majority have no idea about gate operation and water management. But, nearly all farmers are interested to take new methods of crops cultivation, new method of managing water, change agricultural calendar, and adopt training for improvement of their agricultural cultivation that leads to improve their standard of living.

GHONAPARA VILLAGE



Sand filter water tank for drinking water



Pond Condition

Ghonapara village is situated in Debhata, Satkhira. It is divided by 2 communities Masterpara/sarderpara (south community) and Mobarakpara/hindu para (north community). The crops cultivated are *aman*, IRRI paddy, *galda* prawn, *bagdha* prawn, potato, colocasia, turnip, pumpkin, kuchurmukhi, cucurbitaceous and cabbage in this village.

Farmers of this village face extreme shortage of irrigation water due to the salinity of underground water and canal water also becomes saline gradually. Paddy production basically depends on rain water but due to excessive rain causes water logging problem. It is observed that, paddy only produce in *aman* season but in *boro* there is small amount of paddy production due to increasing salinity much in that season. Most of the villagers think that water logging is the vital problem for the crops cultivation now.

Paddy grains sometimes totally flooded by rain water then water can be drained out by pumping machine it leads a lot of costing. It is observed that many farmers decrease *aman* paddy production for this water logging problem. IRRI/block produces mainly in Bengali *Chaitro/Baishak* month using pond and tube well water for irrigation. On the other hand, lack of saline water *bagdha* cultivation hampers because most of the cases canal is far from the gher and water brings from canal by pumping machine through pipe, cost incurred 90 BDT per hour. Again due to sandy soil *galda* prawn production cannot be productive. In this area, aquaculture cultivation (*gher* cultivation) increases than agriculture (paddy cultivation) rapidly.

It is observed that, land bed of this village is higher than canal bed causes water entering into land/gher through field channel hampers. Due to increasing gher, water cannot drain out properly through field channel (*nayan jola*) mainly in *aman* season. Sometimes field channel is far from the farmers land and it becomes narrow that also hinders in case of water drain out. Sometimes water of shallow tube well pumps and drop into pond then it is again providing to the land through pumping for irrigation because some pond water exist salinity. If it is doable to excavate big pond and tube well attach the pond then it is possible to collect irrigation water by pumping from pond through this tube well.

In Ghonapara, almost half of the women can actively participate in various agricultural activities. Debhata and kandia sluice gate are the important gates for this village. *Gher* owner of this village operate the gate and only they jointly provide to wage of the gate man. Accessibility of pure drinking water is also a vital issue for the villagers because intense salinity of groundwater and arsenic intrusion of some of the tube well increases. Most of the household carry drinking water from other villages 3 to 5 kilometers far from the village and some other has access to collect water from sand filter water tank. Many farmers wish to attend shrimp/ fish/crab cultivation training for the betterment of their production.

KASHIBATI VILLAGE



Irrigation Pump



Pond sand filter (PSF)

In Kashibati village, aquaculture cultivation is also higher than agricultural production. The crops cultivated are *aman*, jute in kharip season and boro, brinjal, lady's finger, tomato and *pui shak* in *boro* season. They also cultivate various fishes are *bagdha* prawn, *galda* prawn, glasscup, tilapia, mrighel, rui, vetki, japane puti in different season.

In case of *aman* paddy cultivation, farmers rely on rain water and for IRRI/block cultivation requires underground water. But most of the farmers have no boring accessibility. In this case, farmers collect irrigation water from nearest farmers boring by paying BDT 4000 for electric machine and BDT 6000 for diesel pump machine in whole year and per bigha cost incurs average 500-600 BDT. A large fish farmer (Mr. Khalek) dig out field channel from canal to his land by own cost BDT 30000 and bring water through this process for cultivation. Many farmers collect water for irrigation and fish cultivation from him providing BDT 500 per bigha excluding pumping cost.

High salinity intrusion exists both in land (soil) and water in this village. *Bagdha* shrimp is the saline water fish but it is bending due to high saline water while it becomes small for low salinity that happens in rainy reason. It is observed that in that season rain water pp/salinity reduces causes *bagdha* shrimp requires at least 3 months maturing whereas in dry season this prawn is rapidly bigger and fish cultivator collect this prawn within 30-45 days. But, last year many *bagdha* prawns died due to attacking of virus.

Guler biler canal and baliadangha canal are the important canals for the villagers. Baliadangha canal becomes narrow, depth reduces, and water flows slower because fish farmers bind the canal for fish collection. Kaligonj narayan gate, jiler gate, kashibati hatkoler gate and satpur gate play vital for the villagers. In this village, many farmers want to cooperate willingly in gate operation only when they think that from canal/gate they will be benefited. Some respondent think that women cannot contribute in canal/gate operation. Villagers face extreme scarcity of drinking water due to iron, arsenic intrusion in deep tube well and many household keep rain water for drinking. Some other collects drinking water from supply. A number of villagers face food insecurity mainly in Bengali *Vadro*, *Ashin*, *Kartik* and *Falgun* months.

BAREA VILLAGE



Cultivation of Panifall at pond



Women collecting fish from current net

In Barea village, almost all people are involved in prawn cultivation (*Bagdha*), other people are service holder and day labor (Based on local speech of this village). Household are made of tin, wood and muddy. The people of this village cultivate two crops *aman* and *rabi*. Very beginning of the year (*April to May*) they cultivate in prawn (*Bagdha & white fish*). Most of the farmers has own *Gher*. In high land of the village, they cultivate *rabi* (*July to January*) crops like korla, Ghinga, gourd and lady's finger. Cultivation of gourd grows well in this locality. Here cultivable lands are very few. Some of them are cultivating *aman* paddy (*June to December*). After harvesting *aman* paddy, farmers sold as Mon and each bigha contains 12 to 15 Mon. During *rabi* season, each gourd sold by 20 to 25 BDT.

Before 15 -16 years ago, they grows a lot of paddy. Now they are cultivating prawn take aside saline water from canal due to high value of prawn. In low land water logging always absorbs and they cannot grow crops due to water logging and salinity. In dry season they face water scarcity problem and in that time they use boring water (Shallow machine) and provide irrigation to crops. In canal water they have no power to take decision. In prawn cultivation, all task done by farmers and *aman* and *rabi* season, planting, weeding and medicine spreading done by day labor. Also the family member of the household helps to do it. Each labor is to be paid 175 or 200 BDT With one meal in a day. They are use in chemical fertilizer for better cultivation. Also they complain that productivity of land day by day deceased due to use of chemical fertilizer.

Every year a lot of prawn has gone lost due to virus. They think that it happens due to loss of soil and water quality. World Fish is going to work how to mitigate the situation. There were very few farmers of this village cultivate lady's finger, *lal shak* and *kachu* in yard garden. Getting better crops from yard garden, many farmers use storage seeds and someone bought from local market. Those who have huge land, most of them selling their crops commercially. As they cultivate *gher* so they need not to cultivate in extra fish to pond. In *gher* they cultivate *galda* and *bagdha* prawn with white fish likes *panggash*, *ru*. Fertilizer is used for producing floating food in almost all *gher*. Generally farmers feed twice daily, one in morning and other in before evening. Farmers feed the prawn and carp at 2-3 times daily. Fish feed are collected from local market.

Some farmers of this village have been cultivating *panifall* in ponds commercially since few years. Idea of local people is that *panifall* has great demand in the market which is increasing day by day. Salinity, shortage of irrigation water and lack of safe drinking water are the main problems in this locality. Water logging absorbed in due to excessive water cannot get down from the land whereas canal navigability decreases day by day. Saline water easily entered into land from canal because canal and land bed almost parallel.

Villagers cannot drink own tube well water due to presence of salinity. They collect tube well water far from the village (*Rajapur and Tentulia*). Some of them collect water from ponds sand filter or buying from others. It is very painful works for women. Ponds conditions are not well. People cultivate *panifall* and fish in pond. They used ponds water for bathing, washing and cooking.

Gate condition of Narayanpur and root canal of Barea are good but side canal of lands not suitable for water supply. They use water from canal mainly to cultivate in prawn. Due to accumulation of soil in side canal water cannot entered into gher or crops land. Most of the farmers do not have power to access his land for water supplying. At the time of irrigation they participate in gate conduction and decision making of water management. Every year they donate 50 BDT for each bigha to gate committee. Farmers of this village were very much eager to change their primitive system of cultivation. They were very worried about prawn cultivation.

This regards they are ready to transform agricultural calendar, making field channels, group organizing, and coping strategies. Within 12 month, they face 3 months food insecurity as Ashin, Magh and Falgun. Health and sanitation condition not well because many villagers peoples are open defecation on the road yet. They are rearing domestic animal like hen, pigeon and duck.

TARALI VILLAGE



Shallow machine beside aman Field



Cultivation of pumpkin at gher Bank

The people of Tarali village cultivate *aman*, *boro* and *rabi*. In high land of the village, they cultivate *rabi* (*July to January*) crops like jute, dal, mustard, ghinga and lady's finger. Here cultivable lands are very few. Some of them are cultivating *aman* paddy (*June to December*). In dry season, they cultivate *boro* paddy depend on natural rain. Farmers think land of Tarali is very fertile for fish cultivation. Almost all people involved at prawn cultivation and starting of the year (*April to May*) they cultivate in prawn (*Bagdha & white fish*). They are cultivating prawn by collecting saline water from groundwater and canal water. In *gher* they cultivate *galda* and *bagdashrimp* with white fish like *panggash* and *ru*. In dry season, farmers use boring water for irrigation. No one get any training of this village but they are attaching different institution like World Fish, BRAC, ASA and AHASANIYA MISSION.

In Tarali people goes to collect water at least 18 km. water business man sell per drum 20 -30 BDT. People buy from their and reserve in jar or pot. One drum water uses only for 10-12 days. Within 300 or 400feet, water is available but it has salinity. People use it for irrigation, bathing, cows feed and washing. Safe water is available within 1200-1500 feet. To set up tube well to paid 50 -60 thousand BDT. HYWASHA is working now to improve this situation. Narayanpur (*Local name satpur*) gate and canal are good. Local people use canal water for jute rotation, fisher men catch fish and create artificial barricade. So water cannot pass properly in irrigation time. Due to afraid of salinity they do not entered water into land. They use water from canal mainly to cultivate in prawn. They think that due excessive use of fertilizer and aluminum pots for keeping water, people addicted gastric and diabetics.

Regarding perception of this village, people were always curios. They told that what activities carries good result on our agricultural system, develop our sustainability, and change our life pattern. So why not take it? We are ready to achieve it. They go to Nalta Hospital during pregnancy complication.

GOPALPUR VILLAGE

Gopalpur village located at Tarali Union in Kaliganj Upazila under Satkhira District. This village is small and divided into two parts by road which has gone straight of this village. This is the only way to reach in village. Two parts is east and west. Type of lands is *beledoash*. The people of this village cultivate two crops *aman* and prawn. At early of the year (*April to May*) they cultivate in prawn (*Bagdha & white fish*). Most of the farmers has own *gher*. Gher is more than crops land. Once time *rabi* crops grew here but people do not cultivate now due to incurring loss. Some of them are cultivating *aman* paddy (*June to December*).

The presence of salinity is available on water. In gher they cultivate galda and *bagdha* prawn with white fish likes rui and tilapia. At the time of collecting *bagdha* prawn, every day early in the morning outsider business men come in village and buy prawn from the farmers. Farmers think that it is profitable cultivation.

Aman land prepared by tractor and prawn gher prepared by spread and 1000-1200 BDT to be paid for each bigha land. In rainy season they do not face water problem but in dry season they face water collusion for shortage of irrigation. They cannot grow crops well causes of water logging and salinity. Most of the tasks are done by farmers themselves and also the family member of the household helps to do it. They use in chemical fertilizer like potash, urea and TSP. Also they complain that productivity of land day by day decreased due to use of artificial fertilizer. Every year a lot of prawn has gone lost due to virus. Although most of the farmers do not involve in cultivation yard gardening but they are interested to cultivate. If any organization can initiatives for them that how can more vegetables and fish cultivate in standard way that would be very good. As they cultivate in *gher* so they need not to cultivate in extra fish to pond (*Local words of village people*).

Road conditions are not well and people are moving by pain. In this area, the people face very difficulties for collecting safe drinking water. They cannot drink own tube well water due to presence of salinity. They collect tube well water from few distances of km. (*Rajapur*). Narayanpur (*Local name satpur*) gate is significant gate for Gopalpur people. Within 12 months, they face 1 month food security as *Chaitra* month. In Polder 3 is the high salinity zone area. Salinity intrusion causes paddy production, and other *rabi* and Kharip crops production are really difficult. Water logging is another vital problem due to narrow and low depth of field channels for water movement. There is an extreme drinking water shortage for all the surveyed villages.

Comments from Respondents of Polder 3

1. Require boring for lessening the extreme water scarcity in irrigation (Kazla,)
2. Water logging is the significant problem of Ghonapara village causes paddy production decreases rapidly
3. Paddy cultivation decreases due to salinity intrusion and fish cultivation (Ghonapara, Kashibati)
4. Need good road for communication (Gopalpur)
5. Require deep tube well for pure drinking water (Kazla, Barea, Tarali, Gopalpur, Ghonapara and Kashibati)

4. Best Practices

This study surveyed Polder 29, Polder 30, Polder 43/2f and Polder 3 in three districts. Due to differences areas, farmers cropping patten is slight bit different. Farmers of all the polders try to produce paddy as IRRI, *aman*, *aus* even managing various difficulties. Farmers of Phultala and Gangarampur try to cultivate paddy, in KDC many farmers form small hatchery for the production of *bagdha renu puna* bringing saline water from canal by pitcher. Villagers jointly removed water hyacinth from *Ronachandha* canal in Dalachara last year for using this water for various household and agricultural activities and transportation. In Kashibati, most of the farmers are tillage their land using power tiller then again tillage using ploughs for increasing productivity. In Satkhira, farmers of Ghonapara and Barea try to cultivate *panifall* in the pond that is much profitable business with low cost of production and some other farmers of Kazla start to cultivate keura at the bank of *gher*.

5. Challenges Faced during Data Collection

The mentionable problems which we faced during survey time are presented below.

1. When we went to survey, it was both the harvesting time and new crops sowing time causes both the men and women were so busy resulting taken time from them was so difficult
2. In the sample list, there had participants name but in questionnaire required Head of the Household against respondents causes it seems to be mismatch between these two with sample list when enter this name into data set
3. In some areas road transportation and communication system is really bad and reaching to the respondents was so hazardous. Sometimes enumerators had to go about 3-5 kilometers by foot (Dalachara, Bainbunia) for data collection
4. Enumerators faced extreme difficulties because of surname problems and many cases sample HH was not a farmer
5. Problems faced regarding understanding perception section properly
6. When actual farmers were discarded from the list then enumerators were faced rudeness behavior from them

6. Concluding Remarks

Bangladesh is one of the densely populated countries with number of difficulties where climate change creates more vulnerable situation for the livelihoods of the coastal community. This study tries to achieve sustainable development in agricultural productivity, improve livelihoods and nutrition of poor communities through changing community water management from a micro level perspective. This task attempts to know the cropping pattern, crop economics, water management issues, gender situation, food security and women participation for various tasks for reaching the study goals. Among the surveyed villages, it is monitored that many farmers produce *aman*, *aus*, IRRIpaddy, vegetables, galda, bagdha prawn and other fishes. In Barguna, different types of vegetables cultivation are higher than that of Khulna and Satkhira. In Satkhira, most of the farmers among the surveyed village cultivate shrimp and crab. It is observed that, villagers face irrigation water scarcity, water logging, canal siltation and canal leased out problems, water drain out, money problem and damaged gate problems. In the surveyed villages, many women actively participate in agricultural activities but some cases found that men did not want to women working outside their home. Most of the farmers wish to adopt new method of cultivation, water management, want to change agricultural calendar for lessening the loss of crops production. Some of the villagers face food shortage and take cheap, less expensive and less preferable food. Therefore we have tried to do our task carefully and we did not compromise with quality during field survey and data entry.