

Draft

**Mapping of Coastal Charland of Shyamnagar upazila having
Potential for Mangrove Restoration**

Summary Report

**Mangrove for Future (MFF)
IUCN Bangladesh**

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1. Introduction

Under the MFF-Bangladesh project, CNRS was awarded a small project to establish a community-based mangrove restoration in a riverine char land in the southwestern district of Satkhira. The site covers an area of over 3km along the bank of Kholpetua River on the opposite side of the Sundarbans reserved forest (SRF) in Sora village under Gabura union of Shyamnagar upazila (sub-district). The project started in August 2013 and would end in February 2014. The project aimed at:

- Mobilizing communities around mangrove restoration and protection for the benefits of ecosystems, livelihood while reducing the risks from the effects of disaster and climate change.
- Building local capacity to restore, manage and derive benefits from ecosystems services through restorations of mangroves.
- Promoting ecosystems based adaptation to climate change initiatives in mainstream development processes for the areas highly susceptible to the impacts of coastal hazards.

One of the activities of the project is to develop a mapping of all coastal charland along various river systems where mangroves can be restored or rehabilitated or can be afforested with the engagement of local communities and other relevant stakeholders. The output of this activity would be a GIS based map showing the charland and their current status and land cover based on satellite based mapping backed up by field verifications of attribute data.

The physical activity in terms of mapping and field verification is done along the entire river systems. We also collected attribute data from interviewing local communities on various aspects of these charland. It is noted that all these accreted charland along the river bank outside the coastal protective dykes are *khas* land (state owned lands) but are being encroached and used by local people for various private purposes such as shrimp *ghers* (shallow shrimp ponds), ponds, settlements, naturally grown mangroves (floating seeds from nearby SRF settled in char lands and then germinated plants grow bigger if get protection or somehow escaped from cattle grazing). All these charland wide data are mapped by mouza (lowest land boundary) and aggregated in to unions (lowest administrative unit in Bangladesh comprises more than one mouzas) and then a map is prepared for the entire sub-district. Since mangroves can only grow and survive in tidal lands in the coast our study was limited to the char lands that falls outside the coastal embankment which is exposed tidal regular tidal inundations.

This summary report is basically depicting the maps generated through GIS analyses with data sets on different land use or land cover of char lands at current situation. The final report incorporating all social and bio-physical data sets would be prepared by end of December 2014.

2. Methodology

2.1 Study Area

The Shyamnagar upazila area covers an area of 1968.24 sq km, located in between 21°36′ and 22°24′ north latitudes and in between 89°00′ and 89°19′ east longitudes. It is bounded by Kaliganj and Assasuni upazilas of Satkhira district on the north, Bay of Bengal on the south, Koyra and Assasuni upazilas on the east and West Bengal, India on the west. The southern part of the upaizla is covered by the Sundarbans Reserved Forest (SRF) which is the largest single unit of mangrove forest in the world and is declared as the world heritage site and the first Ramsar site in Bangladesh. The SRF is crisscrossed by a complex network of river systems and is subject to regular inundation during high tides on a diurnal basis.

Rivers along the southern edges and within the upazila are under tidal zone and thus there are regular high and low tides every day in six hourly intervals river water rises and falls. These rise and fall and water current cause erosion of lands in some areas while accretion in other areas. The entire southern edge along of the upazila is protected by coastal embankment which was built during mid to late 1960s to protect the area (crop land, settlements and assets) from tidal flooding associated with cyclones and storm surges. The other objective of coastal embankment was to protect salinity intrusion in land area and thereby facilitate agriculture, mainly rice.

As mentioned, the accreted land (called char land) is formed along the river systems located between coastal embankments and rivers. It means the char land lie outside the embankment (river side) and is subject to regular tidal flooding every day. These land gradually raised and settled over time with tidal depositions and at time become more stable and then people started use these land for various production purposes including making settlements, ponds and shrimp farms. These tidal char land is also suitable natural growth of mangrove species with seeds come ashore form the adjacent SRF and settle on char land and then grow. However, in most cases these naturally grown mangroves along the char land get damaged mainly due to cattle grazing and clearing for other productive of land by local people.

We collected data spatial and attribute data on char land to gather information in the area of char lands, land cover and current use and ownership patterns of such land through field verification using a checklist and a detailed map of the area. We also use GPS in some areas to locate some important land marks for the ease of the study and future use f such landmarks as reference points.

2.2 Data Collection

Google Earth is used for extracting and preparing the land use database of the study area (Figure 1). Google Earth is an open source raster image of the Earth. Land use database preparing by digitizing with the help of google earth for minimizing the error and time. After completing digitizing, with ArcGIS application complete the land use map to verify the real time.

2.3 Land use map preparation

We prepared the land use map for the area located between the coastal embankment and river systems over the entire area of the upazila. Based on our initial field data, we have found seven different types of land use in the char land under the study area. These land use types include:

1. Char (tidal),
2. Shrimp Ghers,
3. Natural Mangroves,
4. Human Settlements
5. Fish and drinking water ponds
6. Rivers, canals
7. Embankments



2.4 Ground Trothing

After preparing land use map from Google earth, the study area was divided into 86 blocks for field study and verification (see Figure 1). Every block is thoroughly field checked by visiting the sites to get real data on land use/ land cover. Later using those data, land use map was prepared based on desk study. Again, the attribute data by blocks were verified with local people through interview and field visits/ direct observation. During field verification we used a

checklist to get detailed information on current land cover viz. information on mangroves – whether these are naturally grown or planted, fish ponds & shrimp ghers – ownership and legal aspects, settlements – ownership, years of settlements and so forth.

Detailed methodological steps for accomplishing this land use mapping exercise in the coastal char land is presented in Figure 2.

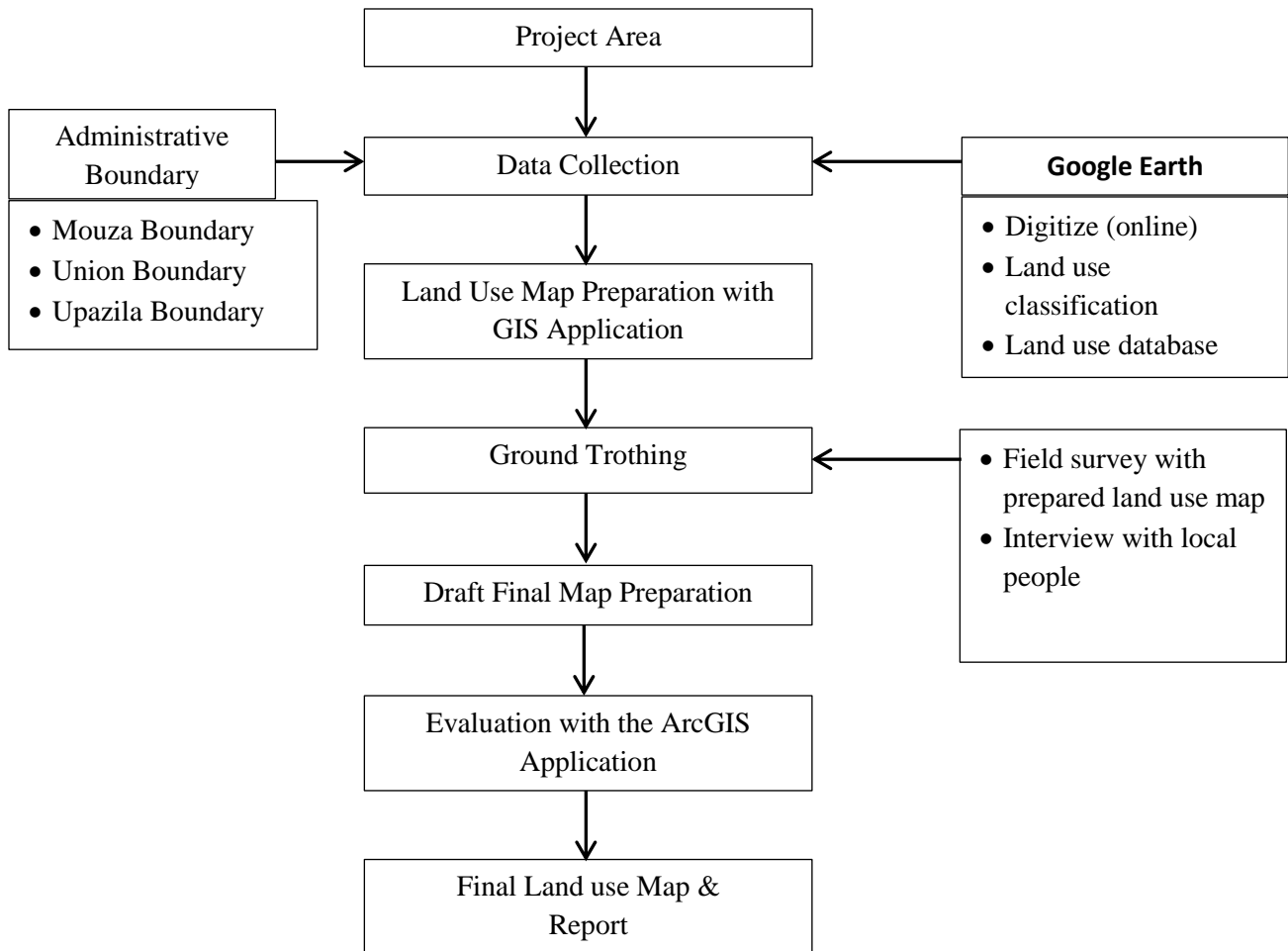


Figure 2: Various Steps of coastal land use mapping

3. Results and findings

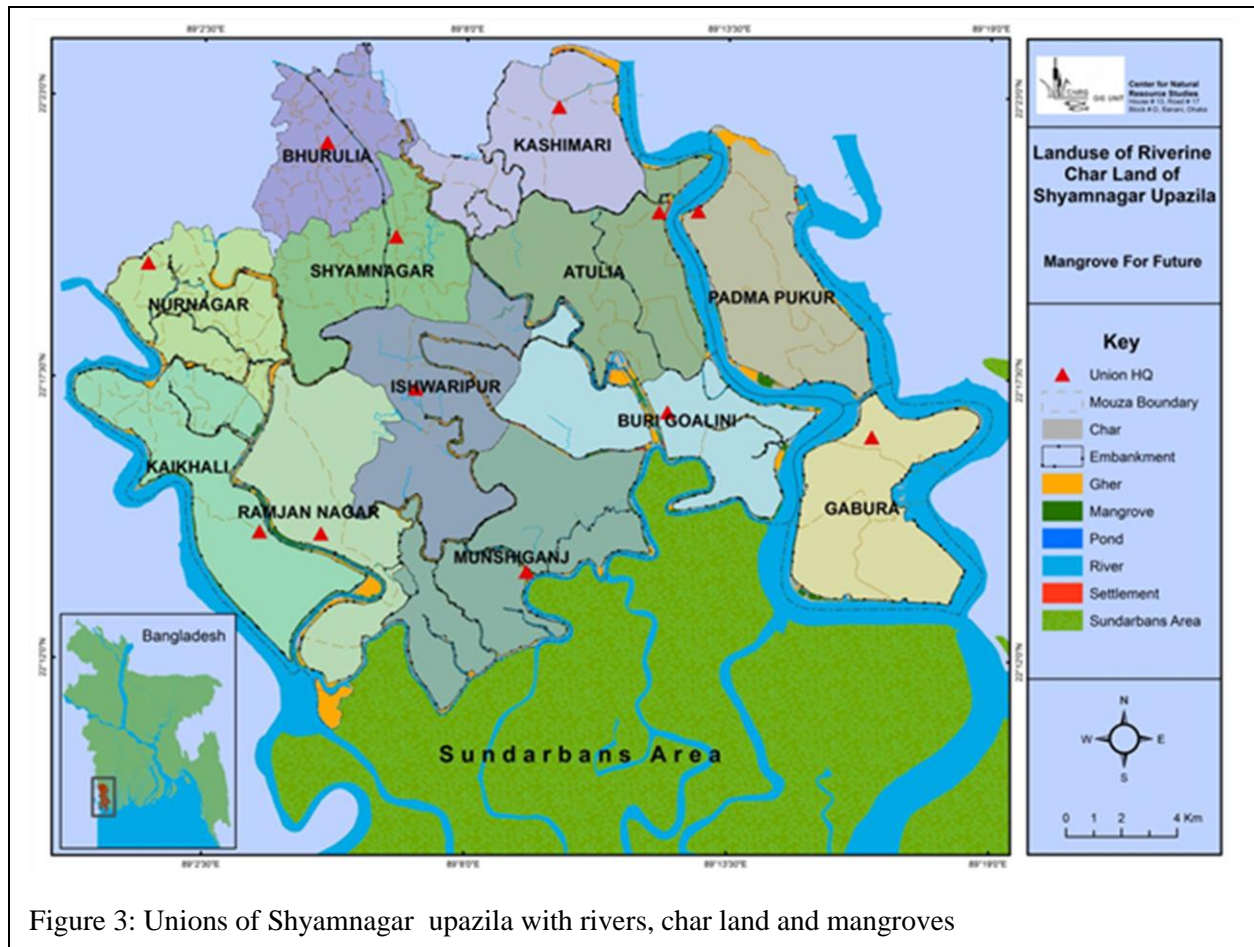
3.1 Char land cover

The study findings revealed that there are total of 1,664.18 ha of char land along various river systems (secondary and tertiary rivers) in the sub-district distributed among twelve unions (lowest administrative units). Of these 12 unions, four unions (namely Poddya Pukur, Buri Goalini, Munshigonj and Ramjan Nagar) collectively comprise more than half (an area of 904 ha covers over 54%) of the total char land in the sub-district while the rest distributed in eight unions. Highest area of char land falls under Ramjan Nagar union that covers an area of 281.39 ha comprises 16.91% of the total char lands in the sub-district (Table 1). The second ranked union is Buri Goalini which comprises 231.01 ha having a share of 13.88% of the total char land followed by Poddya Pukur with 12.86% (213.94 ha) and the fourth ranked union is Munshigonj that covers 177.35 ha of char land (10.66% of the total char area).

Key reason for such higher coverage in those unions was mainly due to their locational advantages as they all are located at the southern most areas interfacing the larger river systems where accretion of char land is higher compared to the unions comprise smaller rivers with less tidal hydrodynamics (Figure 3). However, there are some differences in this general rule as we observed in case of Gabura union which is surrounded by large river systems around have made this union like an island but it covers relatively moderate area of char land 102.36ha comprises only 6.15% of the total char land in the sub-district. In contrast, Ramjan Nagar union comprises the highest area of char land but it has a very small area bounded by large river system. However, the entire western side of the union is bounded by a small river and where substantial area is under accreted char land along that river.

The smallest char land coverage is recorded in two unions namely Shyamnagar and Bhurulia where char land area covers only 1.02% and 1.07% respectively. Main reasons for such less char land in these unions are due to the fact that they are small in size and located at the northern end of the upazila meaning far from the coastal large river systems. Areas of char land in other five unions are more or less similar in size that ranges from a minimum of 100.76 ha (6.05%) in Ishwaripur union to a maximum of 148.02 ha (8.89 %) in Kaikhali union.

It is noted that major parts of Kaikhali union is bounded by a medium tidal river on the entire southwestern borders but its accreted area is ranked 5th as was informed by the people that erosion rate is also higher than other unions which limits char land formation. Atulia is another union where char land area is also on the high side as recorded in Kaikhali that covers an area of 138ha (8.31%), owing to its eastern part is bounded by a large river (Kholpetua River). Unions of Kashimari (113.5 ha) and Nurnagar (122.86 ha) comprise moderate sizes of char land. These two unions though located at the northern side of the sub-district, have borders with moderate tidal river systems where erosion and accretion of river banks is exist.



3.2 Land use coverage of char land in the sub-district

According to the experience of local people, there has been a regular erosion and accretion of lands along the rivers in the dynamic coastal zone of the southwest. Accretion of land in one location contributes to form land while erosion in other places causes loss of lands. People also observe that an accreted char land area again face erosion usually after 40/50 years. When there is an accretion of char land in a location, the area comprises soft clay/ silt and devoid of any grass. Later when the clay becomes relatively harder or thicker, a kind of grass, locally called “*dhani*” starts to grow. Local people mentioned that it takes 1-2 years for *dhani* grasses to grow in a newly accreted char land. When *dhani* grasses grow bigger, they help settling floating seeds of various mangrove trees come from adjacent sundarbans in these char land. These seeds of mangrove species then germinate and grow in to seedlings. Both *dhani* grasses and mangrove seedlings are highly exposed to grazing (goats and sheep) and thus these naturally grown grasses and trees in most places cannot survive. Local people said, if there is no protection measure in place, it is likely that these naturally grown mangroves would not sustain in these char land.

Table 1: Distribution of char land by land use cover by unions of Shyamangar upazila in early 2014

Sl.No	Union Name	Fallow Char Land		Shrimp Gher			Mangroves		Ponds			Settlements		Total	
		Area (ha)	%	No	Area (ha)	%	Area (ha)	%	No	Area (ha)	%	Area (ha)	%	Area (ha.)	%
1	Atulia	69.06	14.21	233	32.30	4.58	28.84	6.91	1	0.04	0.51	8.10	17.45	138.34	8.31
2	Bhurulia	2.95	0.61	90	6.93	0.98	6.83	1.64	0	0.00	0.00	0.19	0.41	16.90	1.02
3	Buri Goalini	56.55	11.63	418	103.66	14.68	65.09	15.59	2	0.07	0.81	5.64	12.15	231.01	13.88
4	Gabura	61.76	12.71	56	8.85	1.25	28.80	6.90	6	1.48	17.79	1.46	3.15	102.36	6.15
5	Ishwaripur	14.33	2.95	832	46.70	6.62	37.22	8.92	5	0.12	1.48	2.39	5.15	100.76	6.05
6	Kaikhali	43.86	9.02	281	18.22	2.58	85.21	20.41	0	0.00	0.00	0.74	1.58	148.02	8.89
7	Kashimari	27.67	5.69	238	65.36	9.26	13.62	3.26	13	0.50	5.96	6.36	13.70	113.50	6.82
8	Munshigonj	59.65	12.27	588	58.69	8.31	44.17	10.58	90	4.63	55.56	10.20	21.98	177.35	10.66
9	Nurnagar	22.79	4.69	499	71.98	10.20	24.61	5.89	3	0.03	0.37	3.45	7.44	122.86	7.38
10	Podday Pukur	79.33	16.32	117	101.02	14.31	31.00	7.43	0	0.00	0.00	2.59	5.57	213.94	12.86
11	Ramjan Nagar	46.20	9.51	402	179.29	25.40	52.07	12.47	25	1.46	17.53	2.36	5.09	281.39	16.91
12	Shyamnagar	1.91	0.39	279	12.90	1.83	0.00	0.00	0	0.00	0.00	2.93	6.32	17.74	1.07
Total (sub-district)		486.07	100.00	4033	705.90	100.00	417.46	100.00	145.00	8.34	100.02	46.41	100.00	1664.18	100.00
	%	29.21			42.42		25.09			0.50		2.79		100.00	

In general, the char land is accreted along the river banks and owned by the state – hence *khas* land. Government has defined *khas* land management and distribution policies being operated by the local land department officials under the guidance of upazila (Assistant Commissioner-Land) and district (Assistant Deputy Commissioner-Land) administrations. However, the policy does not support any private use of *khas* land unless it is approved by the appropriate authorities of the government or as per the relevant policy guidelines such as cultivable *khas* land distribution policy, for wetlands, there is Jolmohal¹ management policy and so forth. The government also has a policy for this sort of char land particularly in place where there is embankment along river banks to protect crops and settlements from flooding, a part of these char land (up to 30feet or so on the river side) belongs to Bangladesh Water Development Board (BWDB) for embankment maintenance and realignment purposes. For such coastal chars facing the sea or bay, the tidal land beyond 30feet or chars in the bay (bounded by sea waters), goes to the Forest Department (FD) for afforestation (with mangroves) purposes aiming to stabilization of newly accreted land and the tenure is usually runs for around 20 years.

However, in most cases these policy guidelines are not properly followed and in case of riverine char land in Shyamnagar it is not at all followed. In most cases these char land are used by local people without any legal rights. The char land along the river banks in this sub-district has five different uses. These include shrimp *ghers*, mangroves, fish and crab ponds, settlements and fallow char land (have potential for beneficial uses). Our field survey data shows that shrimp farming is the major land use covering 42% of the total char land in the sub-district followed by fallow chars covers 29% of the total char and then naturally grown mangrove patches cover 25% of the chars (Figure 4). Settlements cover 3% while only 1% char area is under ponds.

3.2.1 Use of Char land as Shrimp ghers

It is seen that major areas of char land in this sub-district has already been gone under shrimp *ghers* which covers an area of 705.9 ha covering an area of over 42% of the total char land in the area (Table 1 and Figure 4). Rampant grabbing of char land is mostly done by the local influential people in collusion with field level government agencies deal with lands, water and forest management. Often these influential land grabbers have blessings from political stakeholders. All these powerful stakeholders shape up their actions to protect their interest while ignoring the value of mangroves and natural resources and biodiversity, landless poor who has rights to have access to *khas* land, and necessity of protecting common pool resource systems for wider social-ecological benefits.

As per the opinion of local people, char land grabbing and conversion by the influential people is quite common in many unions under this sub-district. After grabbing, they convert these char land in to shrimp *ghers* and operate privately. Construction of these illegal shrimp *ghers* in char

¹ Jolmohal means water state – usually the state owned wetlands (*khas*) and according to the relevant policy, the poor fishers' cooperatives should get the rights of access to fishing in jolmohals.

land leads to the loss of opportunity of further development of these land (such as mangroves, community freshwater ponds, grazing lands, aquaculture by the poor people and so forth) for the use and benefits of wider communities in the area. Next we discuss about mangrove coverage in the accreted char land.

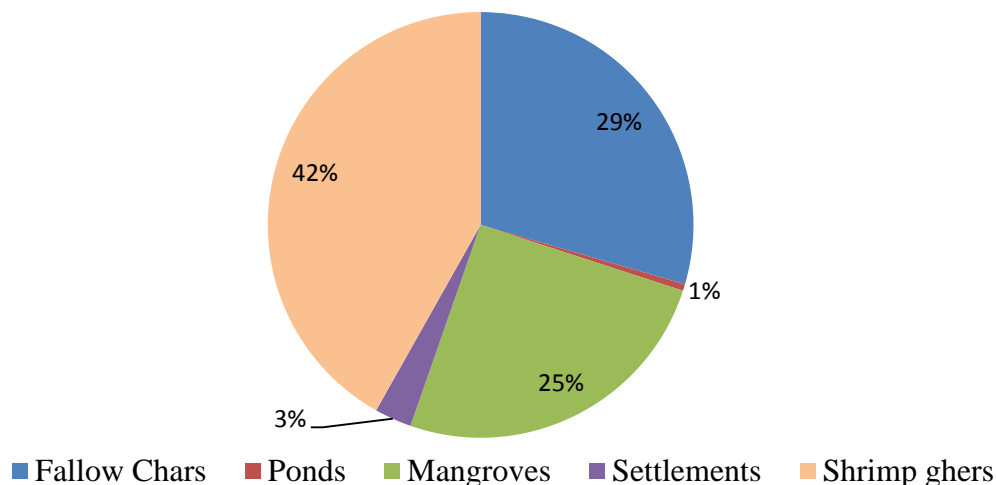
3.2.2 Use of Char land as Mangroves

The area located at the vicinity of the Sundarbans Reserved Forest (SRF) – the largest single unit of mangroves in the world. In many places these char land areas are located just opposite to SRF which is divided by secondary and tertiary rivers (see Figure 4). Therefore, seeds of various mangrove species carried in by tidal waters and deposited on the char land at the country side. As a natural process, over time, many of these seeds germinate and grow and gradually become patches of mangroves of variable sizes. However, it is learned from the local people that these plants in patches can better survive and grow if get protection from cattle grazing and fishing and boating disturbances. As such, in many places where we recorded good patches of mangrove forests in char land, local people reported that they undertook some protection measures through fencing the area and taking care of trees from cattle grazing. It is seen that local people excavated ponds in chars for multiple purposes.

3.2.3 Use of Char land as ponds

In some areas of char land, people construct ponds either for fish culture or freshwater for drinking and other household purposes and in a few cases there are some small ponds being used for crab fattening. Some small ditches /ponds are created at close to homesteads to raise land for making homesteads in char land. As recorded that altogether 145 ponds are found in char land of 12 unions covering an area of 8.34 hectares which cover only 0.5% of the total char land in the sub-district. However, practice of digging ponds in char land was seen only in few cases.

Figure 4: Current land use of reverine charlands in Shyamnagar upazila



Most abundance of ponds was seen in Munshigonj union where 90 ponds are found in char land that covers 4.63 hectares and shares about 56% of total ponds in the chars of the sub-district (Table 1). The next abundance of ponds was found in Ramjan Nagar union where we recorded 25 ponds covering an area of 1.46 hectares that comprises 17.53% of total pond area of the sub-district. Kashimari union stands at third position in terms of having ponds in char areas. There are 13 numbers of ponds in Kashimari union that covers an area of 0.5ha and comprises about 6% of the total pond area in the chars of the sub-district. No pond was recorded in chars of four unions of the sub-district namely Shyamnagar, Podday Pukur, Kaikhali and Bhurulia. Other unions have a few ponds that range from 1, 2, 3, 5 and 6 in Atulia, Buri Goalini, Nurnagar, Iswaripur and Gabura unions respectively. Although highly exposed to inundation, some people make houses in char areas.

3.2.4 Use of Char land as settlements

It is seen that local people make houses (settlements) in char land in all the twelve unions. As reported by the inhabitant, these houses are mainly made by the landless poor who finding no other option bound to make their houses on char land which registered as *khas* land. Most of these households have no legal document for the land they use or have de facto ownership (char land adjacent to their parental land. These households however, get blessings (concurrence) from local influential people or leaders even union chairmen of members so that they can overcome any eviction drive of the state agencies. Our study findings revealed that an area of 46.41 ha or some 2.79% of the char land is under settlements in this sub-district (Table 1 and Figure 4). It was found that in some union numbers of settlements are higher while there are a few in others. As observed, areas under settlement was found highest in Munshigonj union covers 10.2 hectares that comprises 22% of the total settlement areas in the char land of the sub-district followed by Atulia union where 8.1 hectares of chars was found under settlements comprising of 17.45% of the total settlements in the chars of the sub-district. Kashimari union ranked third (comprising of 14%) in this order followed by Buri Goalini union (comprising of 12%). It was seen that all char land areas are not under different uses or otherwise not suitable and thus remains fallow.

3.2.5 Char land remain fallow

A good area of char land as recorded remain fallow meaning there is no mangroves or shrimp *ghers* or ponds or settlements but are covered with scattered bunches of *dhani* grasses. As per the study findings, there is 486 ha of chars remain fallow which comprises over 29% of the existing char land area in the sub-district (Table 1 and Figure 4). Many of these char areas are newly formed and thus not suitable for other form of community use for income. Local people informed that these fallow char land are exposed to encroachment if legal measures are not undertaken by the relevant government agency viz. UNO and Deputy Commissioner jointly with the representatives of land department, Bangladesh Water Development Board (BWDB) and Forest Department (FD). The representatives of locally elected bodies' viz. chairmen and members of

union parishads (UPs) can also play a key role in protecting char land from illegal grabbing and abuses by the local influential if get proper supports and directives from upazila and district administrations.

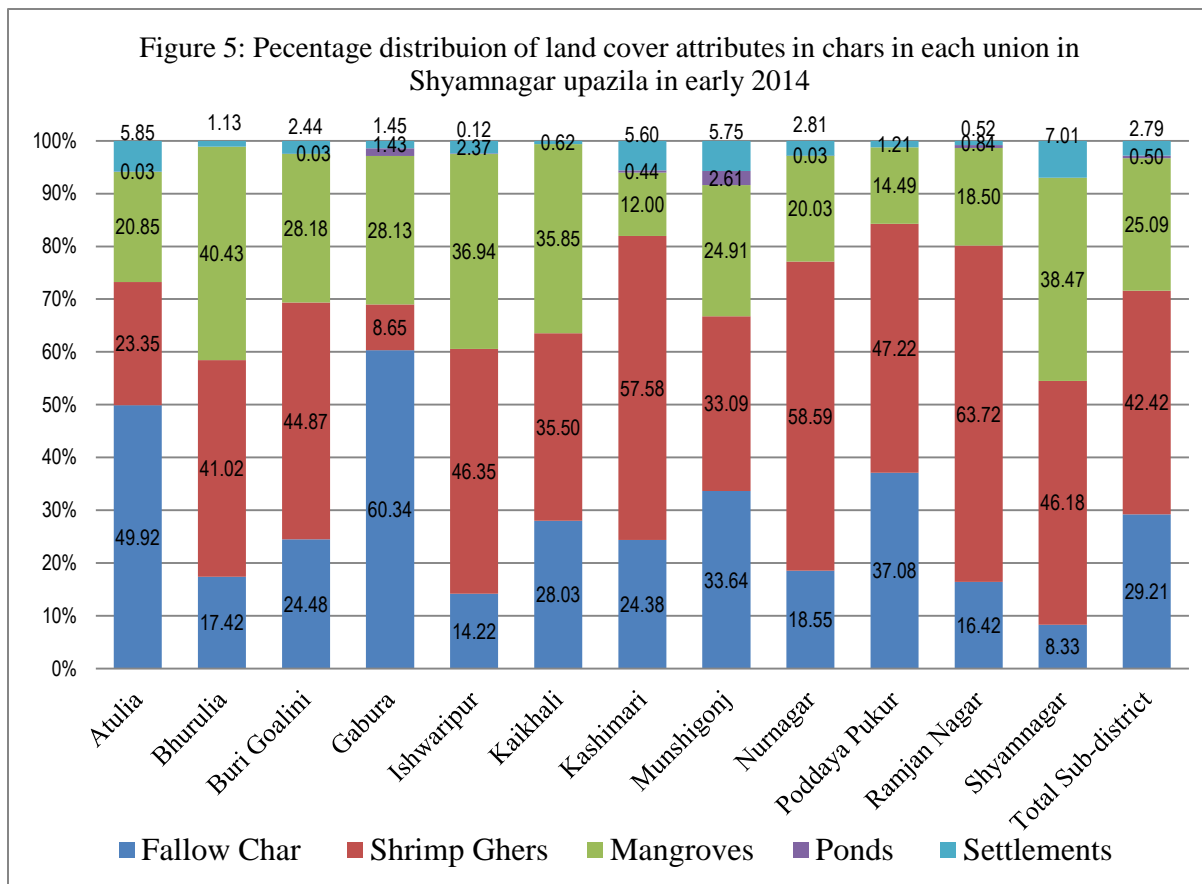
3.3 Land use patterns of char land within unions

Distribution of char land cover with attributes like fallow (barren) chars, shrimp ghers, mangroves, ponds and settlements, vary within and between unions (Figure 5). Detailed mouza wise land use cover of char land is presented in Appendix 1. Union level GIS map showing various land cover attributes are presented in Appendix 2. We made a percentage distribution of land cover by attribute types in each union against the total char land available in each union separately. We present the land type coverage by attributes by unions.

Fallow char land – Figure 5 shows that there are variable sizes of char land remaining fallow in each of the twelve unions of Shyamnagar that ranges from a minimum of 8% in Shymangar union to a maximum of 60% in Gabura union with an average of 29% in all unions combined in the char land in the upazila. Lowest area of char land in Shyamnagar was mainly due to its location at the northern tip of the upazila where river are narrow with least tidal effects and so the accretion and erosion rate is the least (Figure 3). In contrast, higher area of fallow char land in Gabura may be due to the fact that the union is located at the southernmost tip of the upazila and is surrounded by large tidal river systems around and thus erosion-accretion rates of char land seemed higher in there (see Figure 3). Besides Gabura union, second highest area of fallow char land (ranged between 30-50 hectares) was recorded in three unions viz. Atulia union (50%) followed by Poddapukur (37%) and then Munshigonj (nearly 34%). There are three unions namely Koikhali, Buri Gioalini and Kashimari that have fallow char land between 20-30 hectares. Other four unions such as Bhurulia, Iswaripur, Nurnagar and Ramjan Nagar have fallow char land less than 20 hectares (Figure 5). Like fallow char area, land cover by shrimp ghers in char land also vary within and between unions.

Shrimp ghers – as mentioned earlier, combining all twelve unions of the upazila, shrimp gher or shrimp farming alone occupies the highest amount of char land (42.42%). There are wide variations of land cover between unions if compare lands under shrimp farming in each union. As far as the land cover of char land with shrimp ghers, highest area coverage was recorded in Ramjan Nagar union where about 64% char land available within the union is occupied by the shrimp farmers, means under the private use of rich people. In contrast, only 8% area of char land in Gabura is under shrimp farming. The least amount char land under of shrimp ghers in Gabura union may be due to strong tidal effects and increased heights of tides which makes shrimp farming risky. Besides, Gabura is highly exposed to cyclones and storm surges as such making shrimp ghers outside embankment/char land is risky. Therefore, highest area remains under fallow chars (over 60%) in Gabura. Moreover, large numbers of landless poor in Gabura have negative attitude to expansion of shrimp farming in their union.

There are seven unions in Shyanagar upazila where land under shrimp ghers cover 40% to 60% of the total char land. In this group, highest land cover under shrimp gher (about 59%) was recorded in Nurnagar union followed by about 58% in Kashmirari union, 47% in Poddya Pukur, over 46% each in Ishwaripur and Shyamnagar, 45% in Buri Goalini and Bhurulia union comprises of 41% shrimp ghers. Based on field observation and opinion of local people, it can be said that the char land along tidal river systems in this upazila is highly exposed to conversions for shrimp farming and the trend is continuing with increased pace. Local people though not prefer to have these khas char land be converted to shrimp ghers but have less power to protect these land from powerful people. The other form of char land cover is mangrove patches and



most of which as reported are generated naturally from the seed coming with tidal water and settled in these char land.

Mangrove patches –Overall, char land cover by mangroves stands third (25%) in terms of area after shrimp ghers (42%) and fallow chars (29%). It was found that mangroves are present in all the twelve unions with variable areas. The highest char land under mangroves is recorded in Bhurulia union that covers over 40% followed by over 38% in Shyamnagar and then Ishawripur 37%. The least area under mangroves is found in Kashmirari union (12%), a bit higher than that in Poddya Pukur (15%) and then in Ramjan Nagar (18%). Other unions of the upazila have mangroves area ranged between 20 to 30% of char area. People also make ponds in char land.

Ponds – It was found in all unions that the number and area of ponds whether for fish or crab farming or for drinking water purposes is far less than other forms of land cover in char areas. Overall ponds cover only 0.5% of the total char areas in the upazila. In four unions of this upazila (viz. Bhurulia, Kaikhali, Podday Pukur and Shyamnagar) there is no pond at all. Highest area of ponds in char land is found in Munshigonj union where 2.6% land is covered by ponds followed by 1.43% in Gabura. Besides, in some chars people make their settlements.

Settlements - It was found that people have made settlements in exposed char land in every union of the upazila at varying extents. However, like ponds, the coverage of char land area by settlements is also far less compared to other forms of use like shrimp farming and mangroves. Usually the poor people either have lost their land due to erosion or have no land of their own have made their houses on char land in places where the char land is more raised and settled with low risk of being eroded or flooded by tidal flooding.

4. Concluding remarks

The key challenges in sustainable and environmental management of char land lies with policy and legal aspects of land ownership, institutional arrangements, and resource management strategies. First thing to be done on an urgent basis is to carry out a physical survey of all char land and delineate the areas by ownership status. Then consensus should be built among relevant stakeholders as what to do with current illegal occupation and their facilities (settlements, ponds, gher, etc.) under private use. Make plan with the local communities and relevant government agency officials and civil society members, local government functionaries as to what would be the best land use modality for char land other than environmentally negative land uses /schemes viz. shrimp farming. At the same time, steps to be taken so that no new shrimp gher is established in char land owned by the state.

There is still scope for increasing the mangrove coverage in char lands in this upazila in areas still remains as fallow chars. Urgent step is required to start giving protection to naturally growing mangroves in char land supplemented by afforestation with mangrove saplings. If no such measure is undertaken, it is most likely that these fallow char areas will be grabbed by rich people and then converted to shrimp gher. To this end, Gabura union is highly potential as 60% of the total char land in this union still remains as fallow which can be covered with mangroves in a planned manner under different development projects (such as MFF, CREL). However, for institutionalizing mangroves plantation and sustainability, the project or actors should develop strategies as to settle issues like what should be the ownership of the land to be brought under mangroves, who would be the management partners, how would local conflict be managed, how management costs of mangroves (fencing, planting saplings, guarding, etc.) be met, what should be benefit sharing mechanisms among stakeholders, etc.

Appendix 1: Mouza wise char land coverage by unions in Shyamnagar uapzila

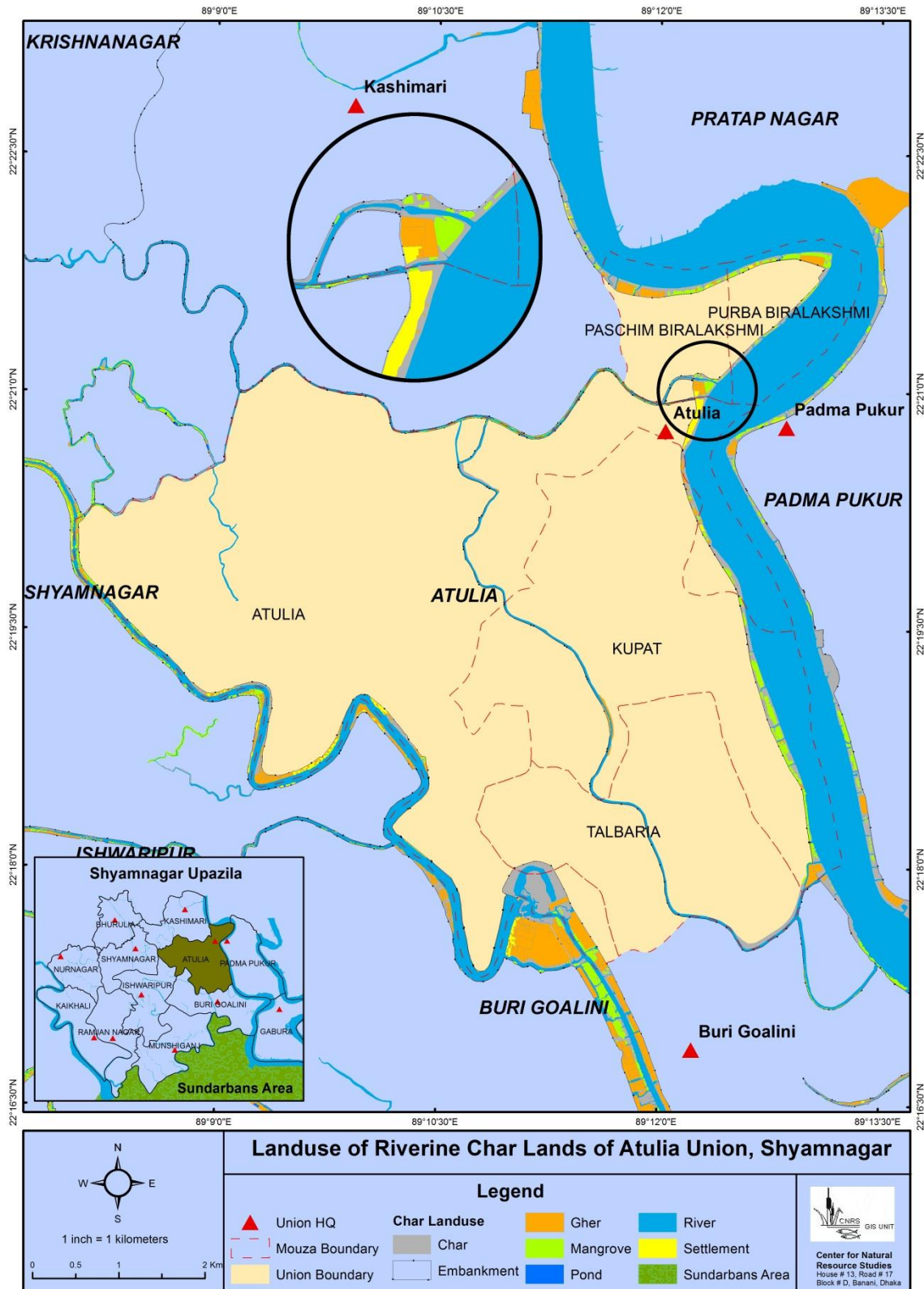
No	Union Name	Mauza Name	Char Land	Shrimp Gher		Mangrove	Pond		Settlement	Total	
			Area (ha)	No	Area (ha)	Area (ha)	No	Area (ha)	Area (ha)	Area (ha)	%
Atulia Union											
1	Atulia	Atulia	32.94	174	16.73	8.67	1	0.04	7.08	65.45	47.31
2	Atulia	Kupat	12.85	24	5.82	10.93	0	0.00	0.00	29.61	21.40
3	Atulia	Paschim Birallaxmi	9.12	30	7.13	3.81	0	0.00	0.77	20.83	15.06
4	Atulia	Purba Birallaxmi	6.94	5	2.62	5.43	0	0.00	0.25	15.24	11.02
5	Atulia	Talbaria	7.21	0	0.00	0.00	0	0.00	0.00	7.21	5.21
Atulia Union Total (area and numbers):			69.06	233	32.30	28.84	1	0.04	8.10	138.34	100.00
Atulia Union Total (%):			49.92		23.35	20.85		0.03	5.85	100.00	
Bhurulia Union											
1	Bhurulia	Anantapur	0.08	4	0.03	0.51	0	0.00	0.00	0.62	3.67
2	Bhurulia	Bhurulia	0.00	19	0.35	1.32	0	0.00	0.00	1.67	9.88
3	Bhurulia	Chak Kathi	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
4	Bhurulia	Chak Nittaynandapur	0.11	1	0.07	0.42	0	0.00	0.00	0.59	3.51
5	Bhurulia	Chalitaghata	0.01	3	0.10	0.33	0	0.00	0.00	0.44	2.57
6	Bhurulia	Gagrakhali	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
7	Bhurulia	Hatchhala	2.50	46	5.89	0.79	0	0.00	0.19	9.37	55.44
8	Bhurulia	Ichhakur (Khanpur)	0.03	2	0.24	0.07	0	0.00	0.00	0.34	1.99
9	Bhurulia	Jahajghata	0.04	3	0.04	0.16	0	0.00	0.00	0.24	1.40
10	Bhurulia	Kanchanhati Nandigram	0.00	8	0.17	2.03	0	0.00	0.00	2.20	13.02
11	Bhurulia	Katibarhal (Khanpur)	0.00	0	0.00	0.07	0	0.00	0.00	0.07	0.43
12	Bhurulia	Majat Anantapur	0.05	0	0.00	0.22	0	0.00	0.00	0.26	1.56
13	Bhurulia	Nagbati	0.14	4	0.04	0.87	0	0.00	0.00	1.04	6.17
14	Bhurulia	Seora	0.00	0	0.00	0.06	0	0.00	0.00	0.06	0.37
Bhurulia Union Total (area and numbers):			2.95	90	6.93	6.83		0.00	0.19	16.90	100.01
Bhurulia Union Total (%):			17.42		41.02	40.43			1.13	100.00	
Buri Goalini Union											
1	Buri Goalini	Abad Chandipur	16.60	228	60.81	14.37	0	0.00	2.23	94.00	40.69
2	Buri Goalini	Buri Goalini	23.00	105	20.84	18.10	0	0.00	1.71	63.65	27.55
3	Buri Goalini	Jabakhali	0.44	53	3.54	0.15	2	0.07	0.84	5.04	2.18
4	Buri Goalini	Pura Katla	16.51	32	18.47	32.48	0	0.00	0.86	68.32	29.57
Buri Goalini Union Total: (Area and numbers):			56.55	418	103.66	65.09	2	0.07	5.64	231.01	100.00
Buri Goalini Union Total: (%):			24.48		44.87	28.18		0.03	2.44	100.00	

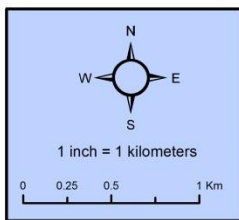
No	Union Name	Mauza Name	Char Land	Shrimp Gher		Mangrove	Pond		Settlement	Total	
			Area (ha)	No	Area (ha)	Area (ha)	No	Area (ha)	Area (ha)	Area (ha)	%
Gabura Union											
1	Gabura	Dumuria	24.19	45	4.44	21.29	6	1.48	1.17	52.58	51.37
2	Gabura	Gabura	22.87	7	4.26	3.27	0	0.00	0.29	30.68	29.98
3	Gabura	Khalisha Bunia	11.74	4	0.15	2.63	0	0.00	0.00	14.53	14.19
4	Gabura	Parshemari	2.95	0	0.00	1.61	0	0.00	0.00	4.56	4.46
Gabura Union Total (number and area):			61.76	56	8.85	28.80	6	1.48	1.46	102.36	100.00
Gabura Union Total (%):			60.34		8.65	28.13		1.45	1.43	100.00	
Iswaripur Union											
1	Iswaripur	Banshipur	0.11	11	1.58	1.16	0	0.00	0.00	2.84	2.82
2	Iswaripur	Dhumghat	1.56	366	18.34	15.17	0	0.00	0.13	35.20	34.94
3	Iswaripur	Gumantali	3.07	78	3.87	6.45	2	0.10	0.71	14.19	14.09
4	Iswaripur	Gutlikathi	1.96	0	0.00	0.00	0	0.00	0.00	1.96	1.94
5	Iswaripur	Iswaripur	1.32	56	2.44	0.86	0	0.00	0.11	4.73	4.70
6	Iswaripur	Khagraghati	4.28	85	4.18	2.03	0	0.00	0.56	11.05	10.96
7	Iswaripur	Sreefalkathi	2.03	236	16.29	11.56	3	0.02	0.88	30.78	30.55
Iswaripur Union Total (Area and Numbers):			14.33	832	46.70	37.22	5	0.12	2.39	100.76	100.00
Iswaripur Union Total (%):			14.22		46.35	36.94		0.12	2.37	100.00	
Kaikhali Union											
1	Kaikhali	Asthakhali	4.06	1	0.88	2.44	0	0.00	0.00	7.38	3.11
2	Kaikhali	Ghona	1.43	1	0.05	0.23	0	0.00	0.00	1.70	0.72
3	Kaikhali	Gorakhali	2.63	7	5.25	0.00	0	0.00	0.05	7.92	3.33
4	Kaikhali	Kaikhali	14.65	180	59.96	47.22	0	0.00	0.69	122.52	51.55
5	Kaikhali	Kankarghata	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
6	Kaikhali	Khosalpur	0.09	3	1.65	0.00	0	0.00	0.00	1.74	0.73
7	Kaikhali	Majherati	3.81	2	0.92	0.96	0	0.00	0.00	5.69	2.39
8	Kaikhali	Mendinagar	0.83	12	0.26	0.25	0	0.00	0.00	1.34	0.56
9	Kaikhali	Mirzapur	3.79	9	1.86	4.97	0	0.00	0.00	10.62	4.47
10	Kaikhali	Naikati	1.37	4	0.60	0.53	0	0.00	0.00	2.51	1.06
11	Kaikhali	Nidaya	6.80	10	3.39	2.98	0	0.00	0.00	13.17	5.54
12	Kaikhali	Paranpur	20.02	38	5.79	24.63	0	0.00	0.00	50.44	21.22
13	Kaikhali	Purakhali	3.30	3	0.79	0.84	0	0.00	0.37	5.30	2.23
14	Kaikhali	Shib Chandipur	3.85	11	2.96	0.16	0	0.00	0.37	7.34	3.09
Kaikhali Union Total: Area and Numbers):			66.63	281	84.36	85.21	0	0.00	1.47	237.67	100.00
Kaikhali Union Total (%):			28.03		35.50	35.85			0.62	100.00	

No	Union Name	Mauza Name	Char Land	Shrimp Gher		Mangrove	Pond		Settlement	Total	
			Area (ha)	No	Area (ha)	Area (ha)	No	Area (ha)	Area (ha)	Area (ha)	%
Kashimari Union											
1	Kashimari	Deol	1.56	50	6.91	0.69	0	0.00	0.00	9.16	8.07
2	Kashimari	Ghola	12.46	57	43.31	0.30	0	0.00	5.53	61.60	54.27
3	Kashimari	Gobindapur	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
4	Kashimari	Joynagar	0.49	5	0.27	0.66	0	0.00	0.00	1.42	1.25
5	Kashimari	Kanchi Harania	0.10	4	0.04	0.55	2	0.03	0.00	0.72	0.63
6	Kashimari	Kathal Baria	1.65	101	2.70	5.14	0	0.00	0.32	9.81	8.64
7	Kashimari	Kashimari	6.57	4	6.10	2.07	1	0.04	0.52	15.29	13.47
8	Kashimari	Khutikata	2.26	15	0.50	3.96	10	0.42	0.00	7.15	6.30
9	Kashimari	SankerkathiI	0.00	0	0.00	0.19	0	0.00	0.00	0.19	0.17
10	Kashimari	Tepakhali	2.59	2	5.52	0.06	0	0.00	0.00	8.18	7.21
Kashimari Union Total (Area and Numbers):			27.67	238	65.36	13.62	13	0.50	6.36	113.50	100.00
Kashimari Union Total (%):			24.38		57.58	12.00		0.44	5.60	100.00	
Shyamnagar Union											
1	Shyamnagar	Badghata	0.00	4	0.23	2.87	0	0.00	0.01	3.11	6.68
2	Shyamnagar	Chingrakhali	1.97	94	8.39	6.77	0	0.00	0.32	17.46	37.47
3	Shyamnagar	Fulbaria	0.00	0	0.00	0.08	0	0.00	0.00	0.08	0.16
4	Shyamnagar	Haibatpur	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
5	Shyamnagar	Jadabpur	0.00	0	0.00	0.01	0	0.00	0.00	0.01	0.03
6	Shyamnagar	Kallaynpur	0.13	22	1.88	0.36	0	0.00	0.50	2.87	6.16
7	Shyamnagar	Kashipur	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
8	Shyamnagar	Mahmudpur	0.0	1	0.02	1.62	0	0.00	0.00	1.64	3.51
9	Shyamnagar	Nakipur Majat	0.00	0	0.00	0.00	0	0.00	0.00	0.00	0.00
10	Shyamnagar	Patni Pakur	1.60	31	6.65	0.19	0	0.00	0.00	8.45	18.12
11	Shyamnagar	Shibpur	0.00	20	1.02	0.38	0	0.00	0.00	1.40	3.00
12	Shyamnagar	Shyamnagar	0.18	107	3.33	5.65	0	0.00	2.43	11.59	24.87
Shymanagar Union Total (Area and Numbers):			3.88	279	21.53	17.93	0	0.00	3.27	46.61	100.00
Shymanagar Union Total (%):			8.33		46.18	38.47			7.01	100.00	
Ramjan Nagar Union											
1	Ramjan Nagar	Bhairab Nagar	1.84	63	10.00	2.69	1	0.05	0.12	14.69	5.22
2	Ramjan Nagar	Bhetkhali	16.67	159	30.79	9.93	0	0.00	0.06	57.45	20.42
3	Ramjan Nagar	Kalinchi	16.16	58	119.42	8.99	24	1.42	1.54	147.52	52.43
4	Ramjan Nagar	Ramjan Nagar	11.53	122	19.09	30.47	0	0.00	0.64	61.73	21.94
Ramjan Nagar Union Total (Area and number):			46.20	402	179.29	52.07	25	1.46	2.36	281.39	100.00
Ramjan Nagar Union Total (%):			16.42		63.72	18.50		0.52	0.84	100.00	

No	Union Name	Mauza Name	Char Land	Shrimp Gher		Mangrove	Pond		Settlement	Total	
			Area (ha)	No	Area (ha)	Area (ha)	No	Area (ha)	Area (ha)	Area (ha)	%
Poddaya Pukur Union											
1	Poddaya pukur	Ghar Kumarpur	26.12	69.00	72.51	1.49	0.00	0.00	1.85	101.97	47.66
2	Poddaya pukur	Jhapa	27.22	29.00	24.02	23.68	0.00	0.00	0.00	74.92	35.02
3	Poddaya pukur	Poddaya pukur	21.73	2.00	1.33	4.06	0.00	0.00	0.58	27.70	12.95
4	Poddaya pukur	Patakhali	4.27	17.00	3.17	1.77	0.00	0.00	0.15	9.35	4.37
Poddaya pukur Union Total (Area and Number):			79.33	117.00	101.02	31.00	0.00	0.00	2.59	213.94	100.00
Poddaya pukur Union Total (%):			37.08		47.22	14.49			1.21	100.00	
Munshigonj Union											
1	Munshigonj	Harinagar	39.13	379	36.56	19.79	0	0.00	3.43	98.92	55.77
2	Munshigonj	Munshigonj	20.53	209	22.12	24.38	90	4.63	6.77	78.43	44.23
Munshigonj Union Total (Area and Number):			59.65	588	58.69	44.17	90	4.63	10.20	177.35	100.00
Munshigonj Union Total (%):			33.64		33.09	24.91		2.61	5.75	100.00	
Nurnagar Union											
1	Nurnagar	Chaulia	6.04	48	12.45	3.98	0	0.00	0.27	22.75	18.51
2	Nurnagar	Choto Katakhal	3.07	13	1.41	0.85	3	0.03	0.00	5.36	4.37
3	Nurnagar	Choto Rajapur	0.37	22	1.43	0.87	0	0.00	0.00	2.67	2.17
4	Nurnagar	Choto Shyamnagar	0.09	3	0.17	0.46	0	0.00	0.00	0.72	0.58
5	Nurnagar	Hajipur	0.00	0	0.00	0.34	0	0.00	0.00	0.34	0.28
6	Nurnagar	Harinagar	2.83	48	5.75	1.19	0	0.00	0.00	9.77	7.96
7	Nurnagar	Haripur	0.00	27	0.87	2.74	0	0.00	0.00	3.62	2.94
8	Nurnagar	Kultali Ramchandrapur	8.82	83	11.76	2.82	0	0.00	0.26	23.66	19.26
9	Nurnagar	Manikpur	0.02	84	11.83	1.07	0	0.00	0.00	12.92	10.51
10	Nurnagar	Murarikati	0.20	10	1.48	0.18	0	0.00	0.00	1.86	1.51
11	Nurnagar	Nurnagar	0.00	0	0.00	1.16	0	0.00	0.00	1.16	0.94
12	Nurnagar	Paikamari	0.00	51	3.31	3.54	0	0.00	1.55	8.40	6.84
13	Nurnagar	Ramchandrapur	0.00	6	0.93	0.75	0	0.00	0.00	1.67	1.36
14	Nurnagar	Ramjibanpur	0.00	62	17.48	3.10	0	0.00	0.70	21.27	17.32
15	Nurnagar	Saidalipur	0.49	29	1.65	1.32	0	0.00	0.00	3.46	2.82
16	Nurnagar	Sreekrishnapur	0.85	13	1.47	0.24	0	0.00	0.67	3.23	2.63
Nurnagar Union Total (Area and Number):			22.79	499	71.98	24.61	3	0.03	3.45	122.86	100.00
Nurnagar Union Total (%):			18.55		58.59	20.03		0.03	2.81	100.00	

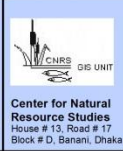
Appendix – 2: Union Level GIS map showing various attribute data on char land cover

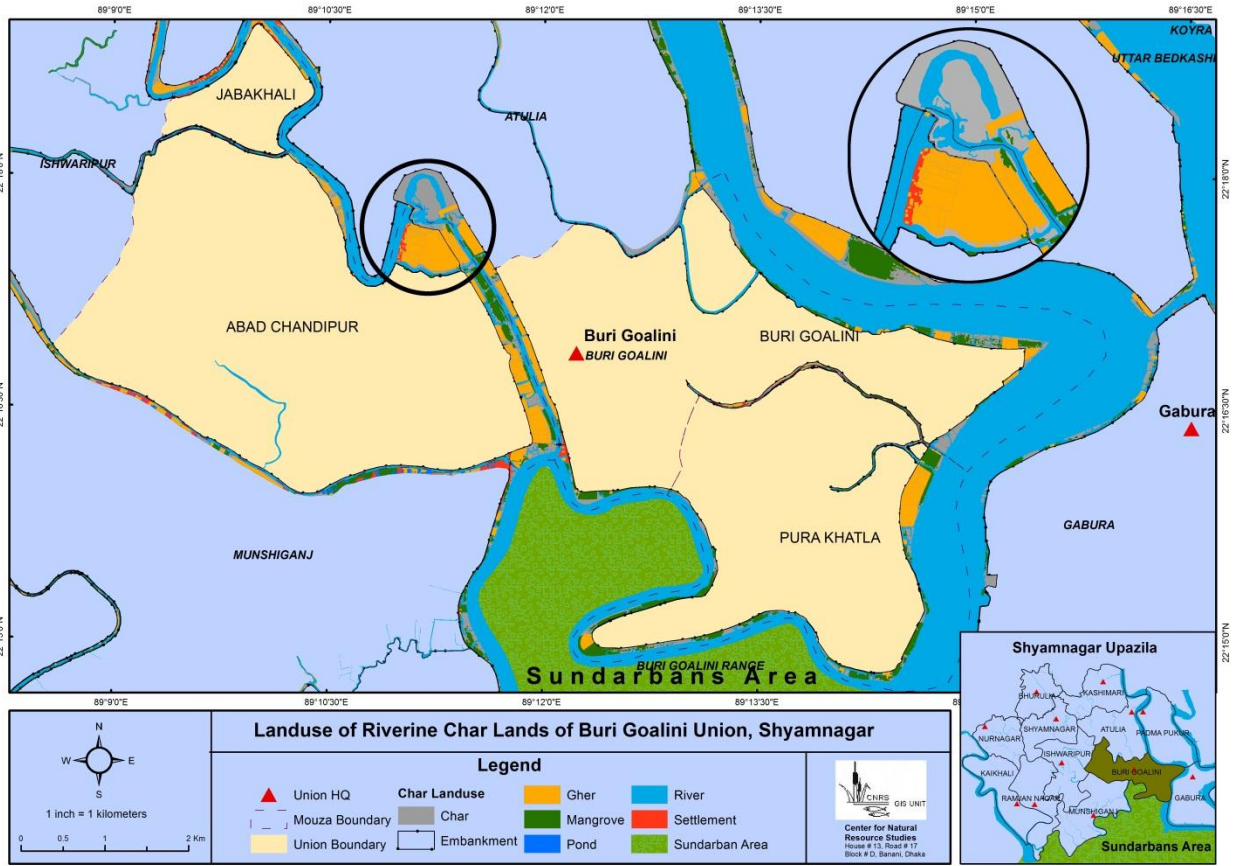




Landuse of Riverine Char Lands of Bhurulia Union, Shyamnagar

Legend			
Union HQ	Char Landuse	Gher	River
Mouza Boundary	Char	Mangrove	Settlement
Union Boundary	Embankment	Pond	Sundarbans Area







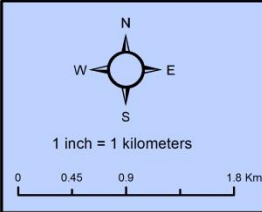
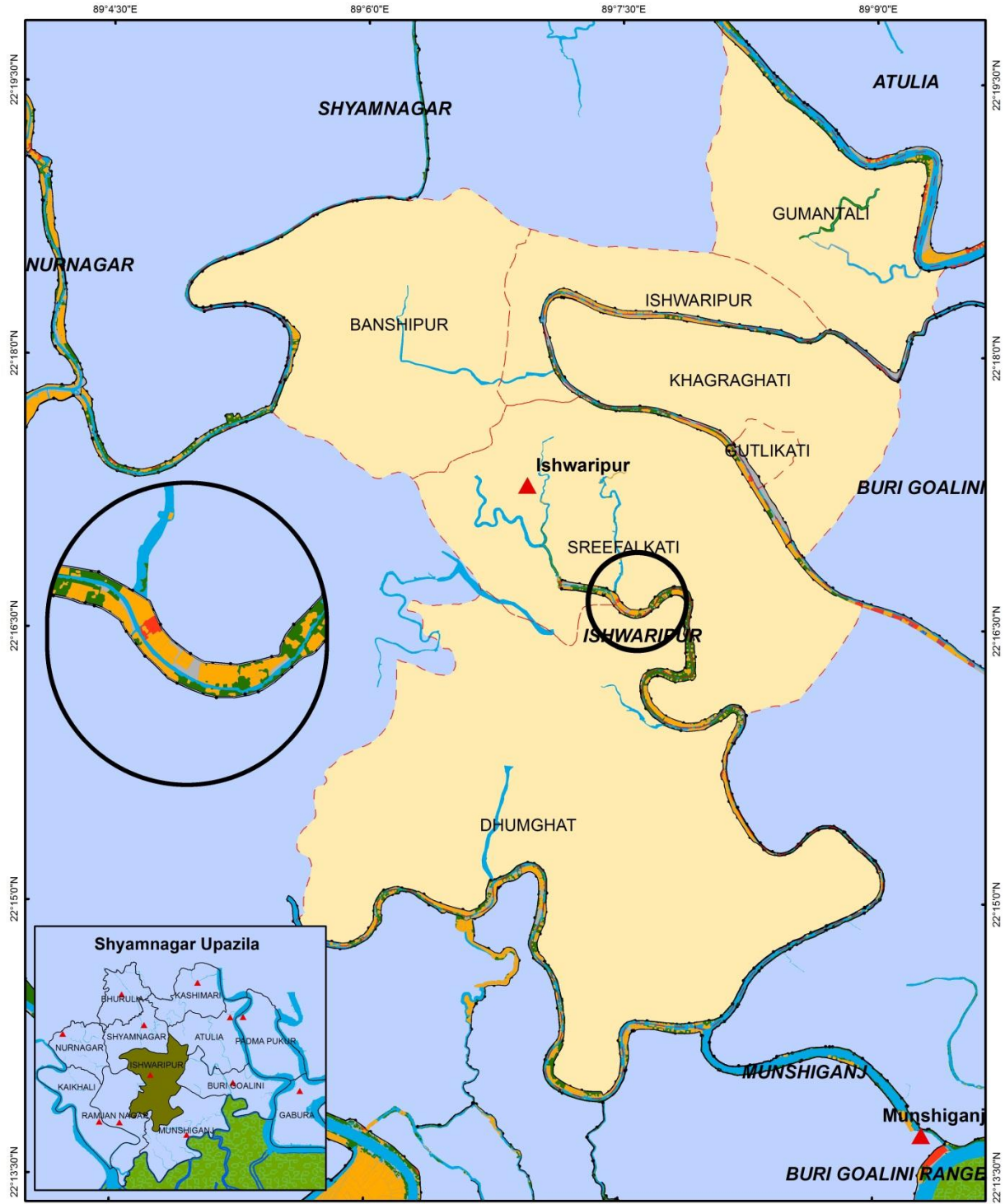
Landuse of Riverine Char Lands of Gaburai Union, Shyamnagar

Legend			
Union HQ	Char Landuse	Gher	River
Mouza Boundary	Char	Mangrove	Settlement
Union Boundary	Embankment	Pond	Sundarbans Area

1 inch = 1 kilometers

0 0.375 0.75 1.5 Km

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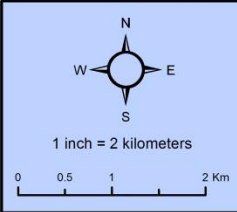
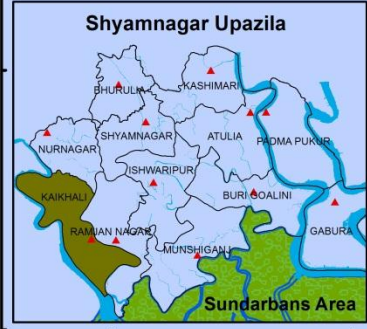
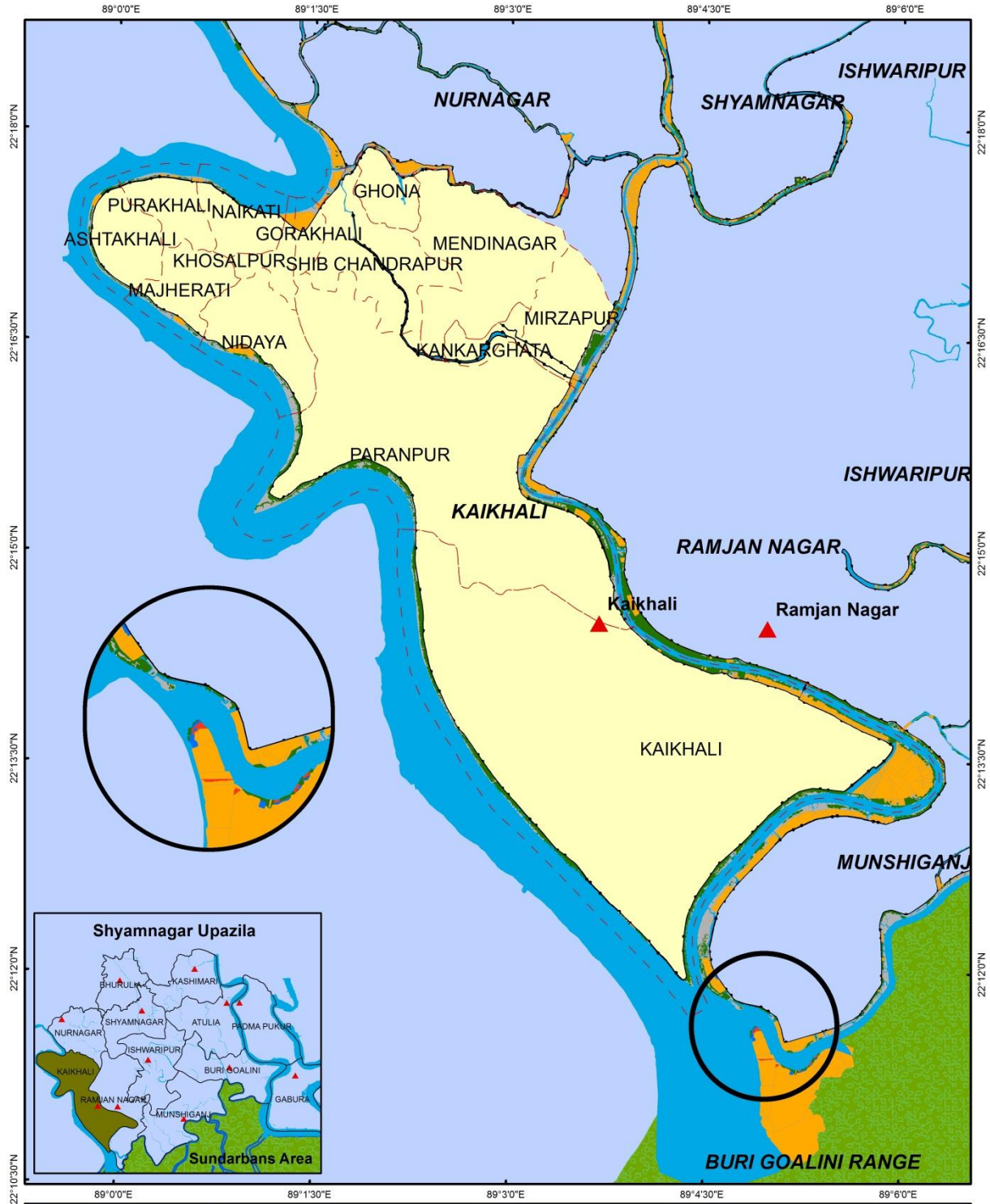


Landuse of Riverine Char Lands of Ishwaripur Union, Shyamnagar

Legend

Union HQ	Char Landuse	Gher	River
ISHWARIPUR	Embankment	Mangrove	Settlement
ISHWARIPUR		Pond	Sundarbans Area

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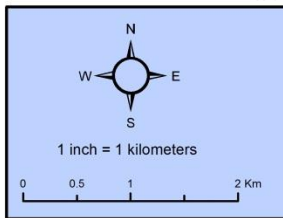
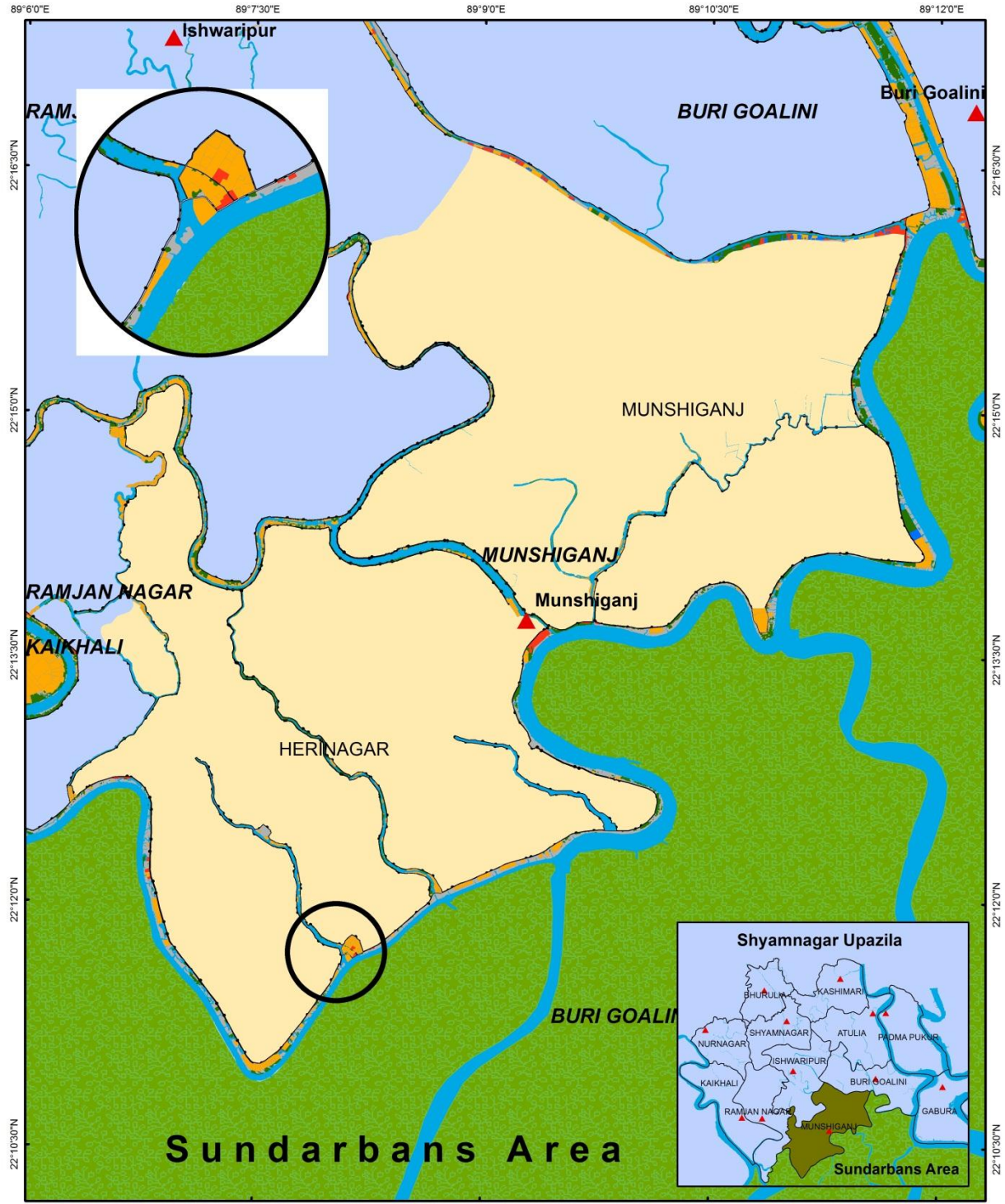


Landuse of Riverine Char Lands of Kaikhali Union, Shyamnagar

Legend			
	Union HQ		Gher
	Mouza Boundary		Mangrove
	Union Boundary		Pond
	Char		River
	Embankment		Settlement
			Sundarbans Area



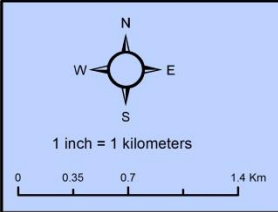
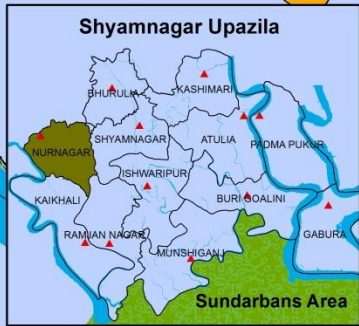
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Landuse of Riverine Char Lands of Munshiganj Union, Shyamnagar

Legend			
	Union HQ		Char Landuse
	Mouza Boundary		Gher
	Union Boundary		Mangrove
	Embankment		Pond
	River		Settlement
	Sundarban Area		

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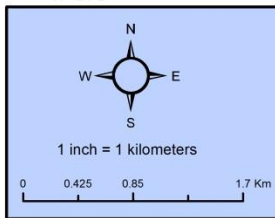
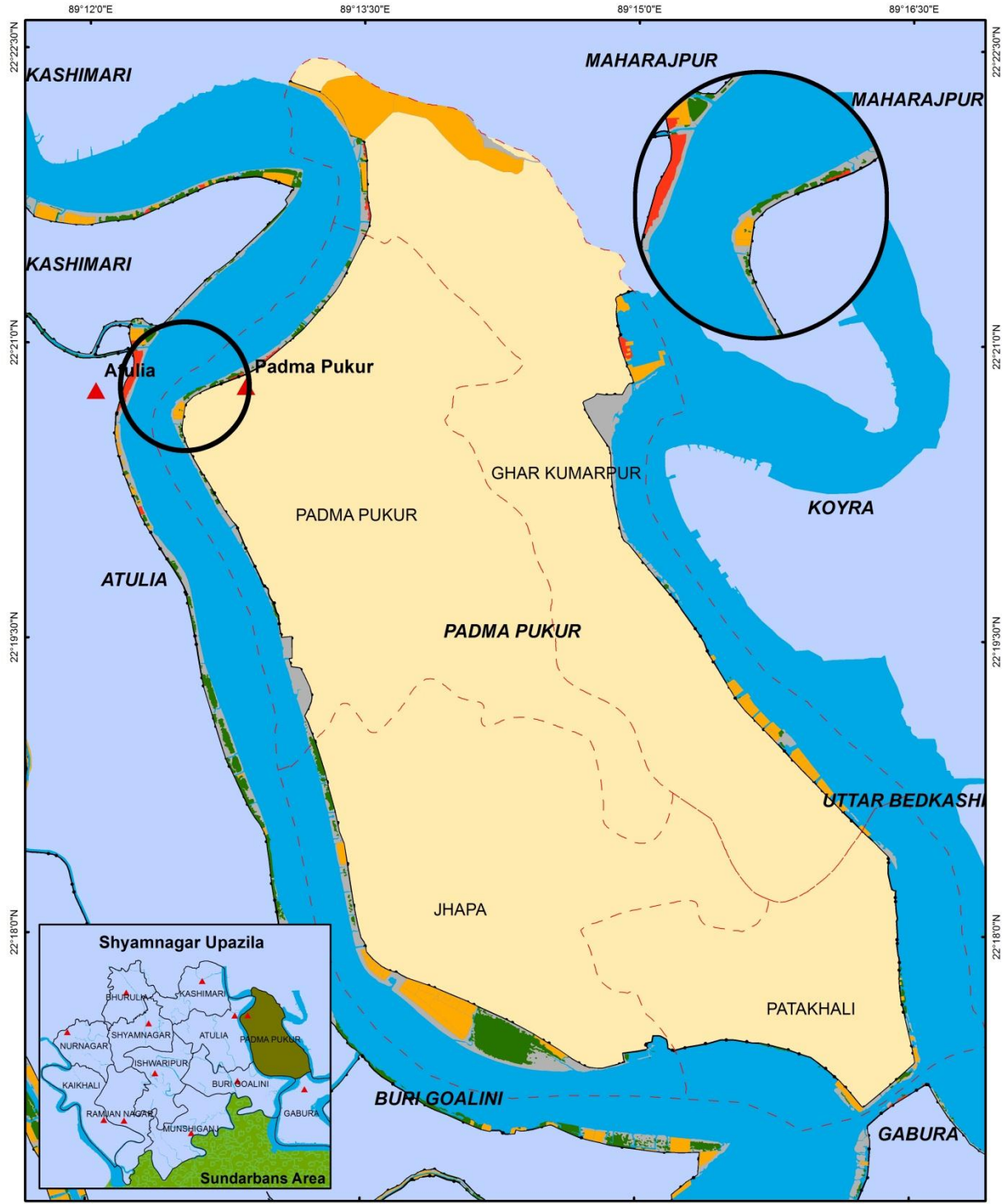


Landuse of Riverine Char Lands of Nurnagar Union, Shyamnagar

Legend			
Union HQ	Char Landuse	Gher	River
Mouza Boundary	Char	Mangrove	Settlement
Union Boundary	Embankment	Pond	Sundarban Area



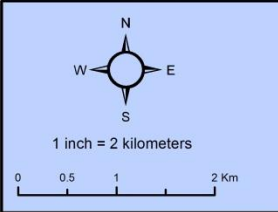
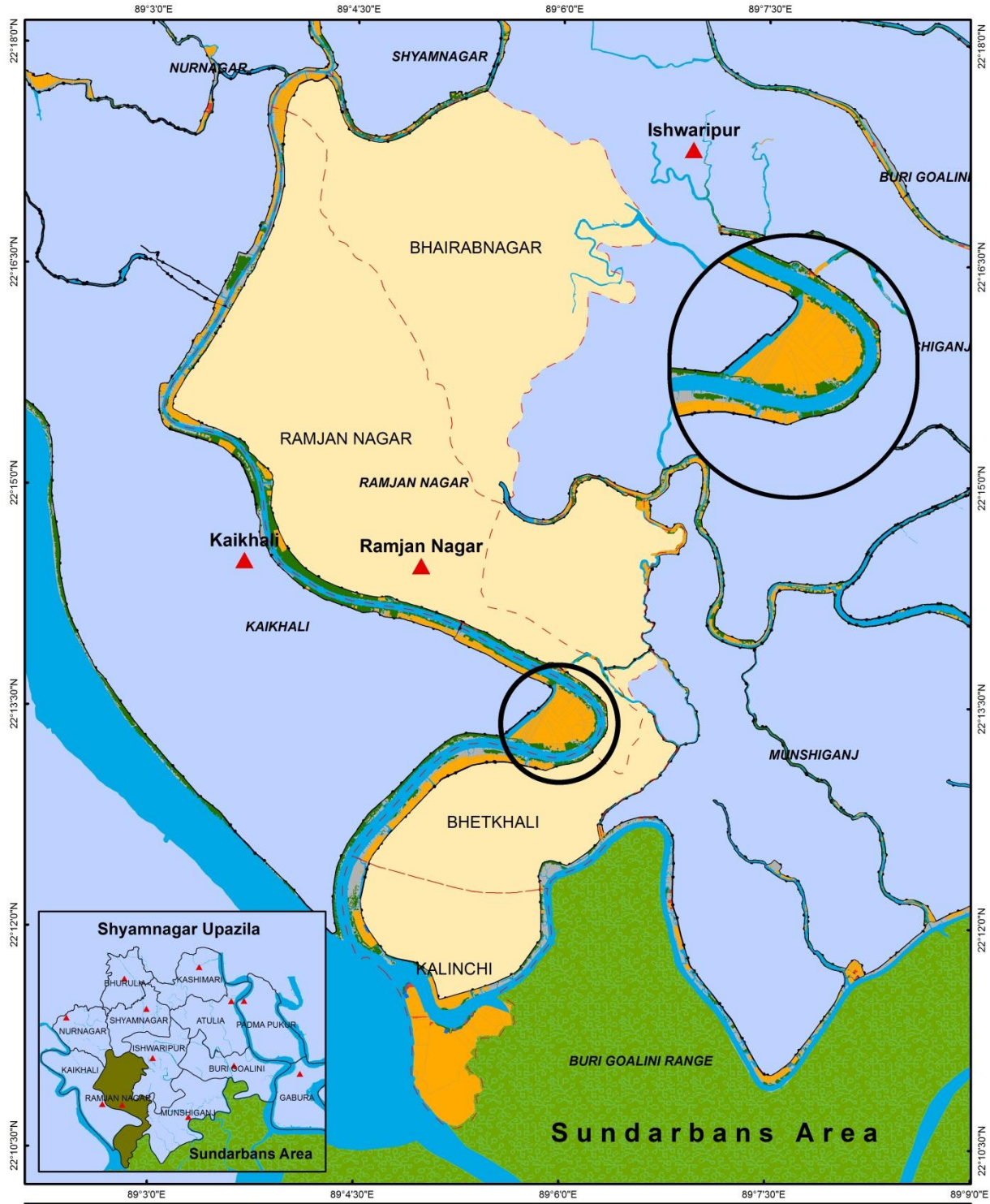
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Landuse of Riverine Char Lands of Padma Pukur Union, Shyamnagar

Legend			
	Union HQ		Gher
	Mouza Boundary		Mangrove
	Union Boundary		Pond
	Char		Settlement
	Embankment		Sundarban Area
	River		

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Landuse of Riverine Char Lands of Ramjan Nagar Union, Shyamnagar

Legend

Union HQ	Char Landuse	Gher	River
Mouza Boundary	Char	Mangrove	Settlement
Union Boundary	Embankment	Pond	Sundarban Area

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