

## *Chapter – V*

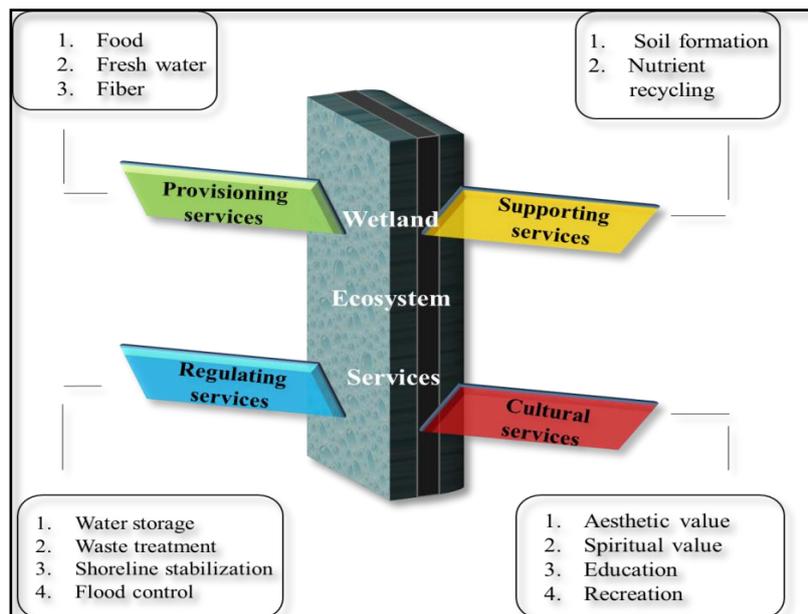
### *UTILIZATION OF WETLANDS*

## CHAPTER – V

### UTILIZATION OF WETLANDS

#### 5.1 Introduction:

The total wetland benefits involve an estimation of many intangible values, which are rather difficult to quantify. These are the values, which form the basis of wetland products and services (Rao & Datye, 2003). Wetlands support an exceptionally large biological diversity as well as provide a wide range of ecosystem services i.e. food, fiber, raw materials and medicines (Ramachandra & Aithal, 2015). Wetland ecosystem depends on constant, recurrent or shallow inundation at or near the surface of the substrate and characterizes the presence of physical, chemical and biological components. Water, modified substrate and distinct biota thus are the essential constituents of these ecosystems (Ramachandra et al., 2001). The wetlands and water bodies with sufficient food and weedy vegetation provide a good habitation for the residents and also supply a valuable number of plant species. The spectacular concentration of different species of animals and plants in the wetlands provide opportunities for tourism as well as recreational activities. In the recent past, non-consumptive benefits of wetlands such as recreation, archaeology, education and science were usually given lower priority in measurement plans than directly consumptive values because of having difficulty to quantify the aesthetic value. But in recent years these values are being given greater attention worldwide (Das et al. 2000). Now-a-days wetlands have been analysed as the 'biological supermarkets' because of the extensive food webs and rich biodiversity they promote. Wetlands perform numerous functions that are considered to have socio-economic importance and values. The functions and values of wetland ecosystem are determined by human perception, human population pressure and the extent of resources. Human benefits from the wetlands emerge either directly from the use of water plants, animals, soils, food, fibers, raw materials and other components of wetland ecosystem or indirectly from their ecosystem functions including breeding ground for many species, commercially valuable furbearers, water fowls. These benefits are now called as ecosystem services and summarized into *provisioning, regulating, supporting* and *cultural services* (Figure 5.1). In the present study, the provisioning services of wetlands in the form of providing fresh water, food, fiber, and other biotic components through cultivation, fishing and wetland product collecting activities are discussed, in the perspective of wetlands, under study in Malda district.



Source: Ramsar Convention, FAO & IWMI, 2014.

Figure 5.1 Wetland ecosystem services

## 5.2 General study on wetland utilization of Malda district:

Wetlands under study, provides intrinsic values (direct values) to the people, especially those, whose lives and customs are intimately linked with wetland functions. In Malda district, wetlands constitute a special ecosystem nurturing a large variety of flora and fauna and a rich genetic pool, and used as multiple systems. Almost all the wetlands are utilized by the peripheral households directly and indirectly through different occupations like cultivation, fishing, gathering different macrophytes and aquatic fauna. The habitats around and surrounding the wetlands are classified into two categories: (a) *Bed village* and (b) *Belt village*. *Bed villages* are located at the immediate vicinity around the wetlands whose whole lives and customs are intimately linked with the wetland functions. On the other, *Belt villages* are located a bit away, surrounding the wetlands who exploit wetlands especially for major commercial purpose (Seshavatharam, 1992). The wetlands have significant impact on the livelihood of the local people, irrespective of both the village types (Appendix-9,10).

### 5.2.1 Wetland utilization for cultivation:

The wetland water is used especially for cultivation which is considered a primary driver of economic growth as well as provides critical economic support to the rural households. Further, most of the wetlands experience a good portion of its area coverage to be contributed for cultivation. Some of them have been converted to intensive cultivation,

and others are continued to be cultivated in their natural form. Both the kharif crops such as; aman paddy, jute etc. and several rabi crops like wheat, pulses, mustard etc. are cultivated at the wetland edge, especially by the settlers, residing at the periphery. Several varieties of high yielding potential paddy crops are cultivated, in which aman paddy dominates as well as cultivated in the high land of *barind* region. The wetland associated low lands are contributed to a wide range of paddy species such as ‘*Digha*’, ‘*Kalabona*’, ‘*Kali Rai*’, ‘*Lalbona*’, ‘*Laxmi Digha*’, ‘*Mughi*’, ‘*Metegarol*’, ‘*Sada Bona*’ of aman varieties, ‘*Muktahar*’ of aush and ‘*Boali*’, ‘*Jagoli*’ of boro varieties (Sarkar & Roy, 2013). Apart from the mentioned crops, cash crop like makhana is cultivated in a vast area in the wetlands under *tal* and *diara* physiographic regions. Makhana is suitably cultivated within wetlands, which contains water-logged soil and water table at or near the surface.

#### **5.2.1.1 Wetland utilization for irrigation:**

Wetlands are chiefly used as a source of irrigation for the surrounding farm lands. As, it is observed that the canal irrigation in the entire Malda district is non-existing, the alternative source of irrigation is either in the form of extracting ground water or in the form of tapping from the river and wetlands through pump and marshal (Plate 5.1 & 6.6). The farm lands around the rivers mainly use its water for irrigation by paying a certain amount of cost. On the other hand, the level of ground water as is lower in several areas; the cost of irrigating the crop lands is high. As a consequence, the cultivators, around the wetlands always prefer to use small pumps to tap the water from wetlands as a source of irrigation legally or illegally. Pumping of wetland water by shallow bore wells, fitted with pump sets, having a capacity of 2 or 5 Horsepower is also common especially during the pre-monsoon (Mukherjee, 2008). But, for the upland farmers, the cost of pumping water gets relatively higher because of more diesel consumption due to distant location from the wetlands to the cultivated area. Furthermore, it has also been noticed in many cases that the farm lands, adjacent to the wetlands also utilize manual lifting devices for irrigation (Mukherjee, 2008). Thus, the benefits of the farmers around the wetlands is primarily due to the less cost of irrigation and save some money, which can therefore be diverted to the cost of other agricultural inputs.



*Plate 5.1: Wetland water extraction through Marshal*

### **5.2.2 Wetland utilization for fishing and product gathering:**

Along with the support to agricultural production, wetlands facilitate better opportunities for the inhabitants in the form of fishing practice, which has immense socio-economic values, attached to it. The wetlands, located in Malda district provide a nursery habitat for a wide range of fishes including commercial species like Ar, Mrigel, Singi, Koi, Rohu etc. The fishing practice is mainly done by the co-operative societies under Gram Panchayets on lease basis. Moreover, few households, belonging to the bed villages at the wetland periphery, collect several wetland products in the form of both aquatic flora and fauna. They gather macrophytes like kalmi, hingcha, kulekhara as food as well as medicinal ingredient along with local oysters/mollusks, tortoises and other available fishes for their own consumption and income. The combination of these functions and products together makes these wetland ecosystems invaluable to the households throughout the study area.

As per the hypothesis no. 2, wetlands under Malda district is utilized negligible for coir rotting, which has been found during the field study and observation (2016-17).

### **5.3 Utilization of selected wetlands:**

The wetlands under case study (Siali, Chakla, Naghoria and Chatra) are characterized by large number of villages containing households. Being one of the most under developed district of West Bengal, cultivation is the mainstay of the district's population as well as economy. The district contains certain places where the farmers are well to do with relatively affluent family structure while there are several place where, the rural poor in spite of their hard work, lives in an impoverished state. However, Malda district is characterized by environmental homogeneity but displays a unique feature of cultivation in association with diverse production and productivity of various crops, which vary in different regions.

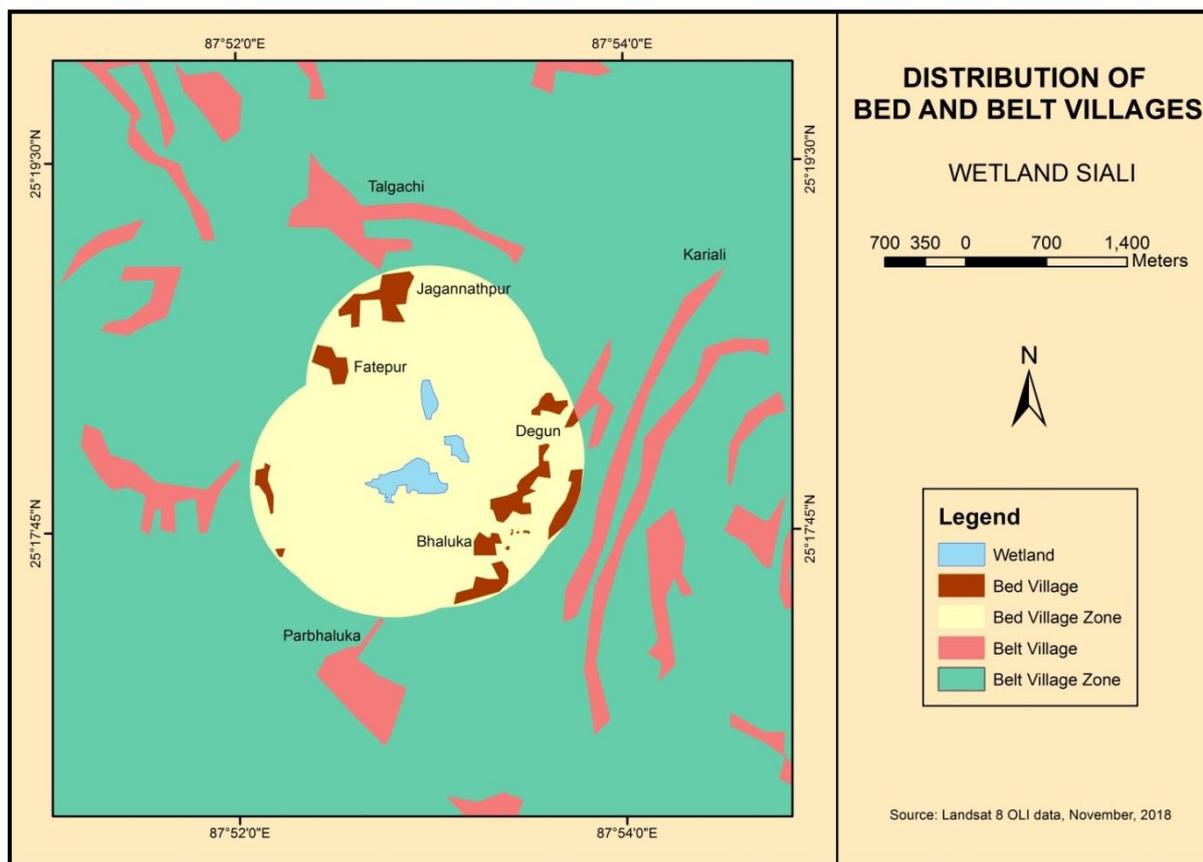
However, the soil type, climate and association of large quantum of wetlands are compatible for the agricultural crops; consist of rice, pulses, and oil seeds. Along with the crop cultivation, inhabitants depend on wetlands for several other purposes in the form of fish culture, jute retting, hydrophyte and fodder collection. As earlier mentioned, the villages surrounding the wetlands are categorized into bed and belt village. A household survey by random sampling of 5% from bed and belt villages has been conducted in order to determine the utilization of wetland for cultivation, aquaculture, gathering fruits and fiber etc. in the year 2016-17 (*Appendix-9,10*). Total numbers of households are 1242, have been surveyed from bed and belt villages, surrounding the cast studies. In the present study, it has been observed that all the studied wetlands are chiefly utilized by agricultural activity including cash crops, followed by aquaculture and gathering aquatic products. Further, an economic valuation of these wetland resources is essential in order to put a monetary value to this natural ecosystem.

### **5.3.1 Siali Wetland**

#### **5.3.1.1 Introduction:**

Siali wetland provides a wide range of physical benefits to a large section of the local community in the form of food, water and offers a unique habitat for many different species. Since Siali wetland has highly significant economic values, it is very essential to assess the wetland services and functions upon which the people around the wetland rely through their different livelihood activities. This wetland is surrounded by number of villages, wherein seven villages are taken into consideration for conducting household survey, which are placed adjacent to this water body. The villages namely; Jagannathpur, Fatepur, Bhaluka and Degun are considered as bed villages, where the households are entirely dependent on Siali wetland (located at wetland edge up to a distance of 1 km). Whereas, three villages namely Talgachi, Par bhaluka and Kariali have been considered as belt villages, which are relatively less dependent than the bed villagers (located beyond 1 km up to 2 km) (*Map 5.1*). In the present study, a pre-mentioned household survey (5% of universe) has been conducted in both bed and belt villages, wherein, out of the total 5,665 number of households in bed villages (*District Census Handbook, Census of India, 2011*), 283 no. of households have been surveyed. Out of total 2,508 no. of households in belt villages (*District Census Handbook, Census of India, 2011*), 125 households have been surveyed in order to know, the utilization of Siali wetland, by surrounding villagers as well as sustaining their socio-economy (*Table 5.1*) (*Figure 5.2*). Most of the communities around the wetland comprise of scheduled castes and

weaker sections. The major economic benefits that settlers living in the bed and belt villages of Siali wetland, obtain are cultivation, irrigation, jute retting, fisheries and makhana cultivation within wetland.



Map 5.1: Distribution of Bed and Belt Villages around wetland Siali

### 5.3.1.2 Wetland utilization for irrigation and cultivation:

Siali wetland has been recognized as valuable land area to facilitate the agricultural exercises for the food and fodder production because of having fertile soil as a result of regular sediment deposits and a reliable supply of water (Verhoeven & Setter, 2009). The majority of the peripheral households are marginal labourers and cultivating different food as well as cash crops, which are considered main source of income for the settlers around wetland.

Table 5.1 Utilization of Siali wetland by households

Village	Village type	Total household	Cultivator (AL+CL household)	Fishing household	Wetland product collecting household	Cultivator+ Fishing household	Other
<b>Jagannathpur</b>							
Fatepur	Bed village	283	182	75	4	17	5
Bhaluka							
Degun							
<b>Talgachi</b>							
Par Bhaluka	Belt village	125	45	52	0	5	23
Kariali							

Source: Field Survey, 2016-17

In the present study, above mentioned table reveals that, out of the total number of surveyed households, bed village accounts 182 number households (64.3%) and belt village accounts only 45 households (36%), who are engaged in cultivation, including both the agricultural labourers as well as cultivators. Out of these cultivator households in bed villages, 143 numbers of households (78.57%) utilize the wetland water for irrigating fields and 39 (21.45%) do not utilize this particular water body (Table 5.2) (Figure 5.3).

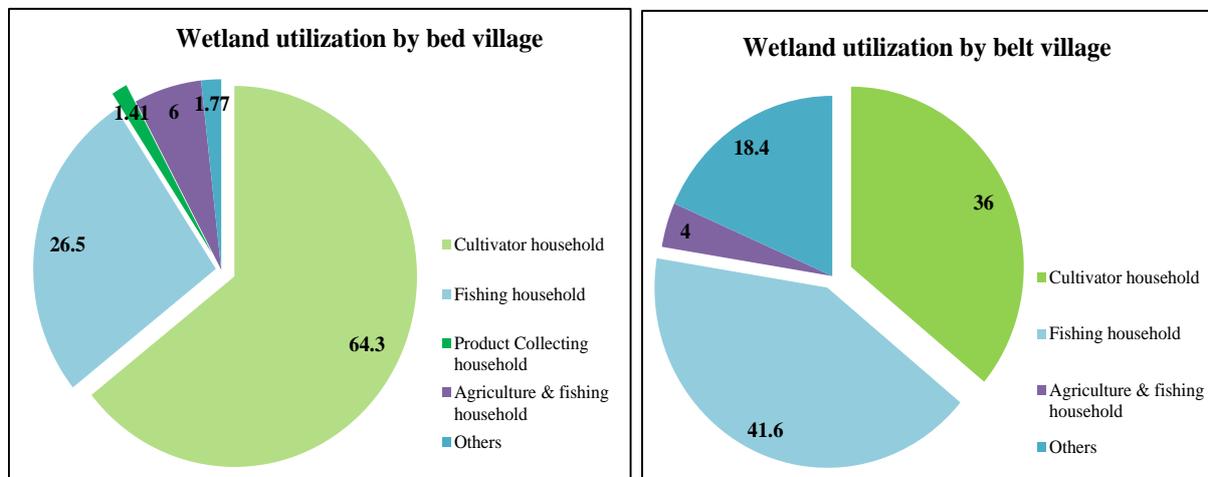


Figure 5.2: Utilization of Siali wetland by households

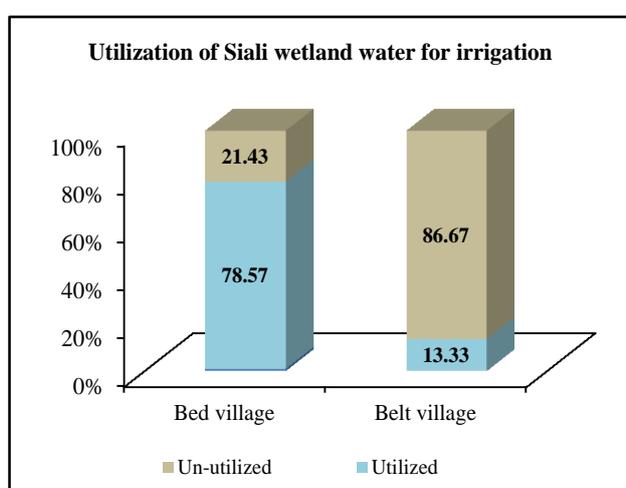
Many of the agricultural households use this wetland water for irrigating their fields as well as for growing varieties of greens in various seasons. The households especially of Degun and Fatehpur (bed villages) are solely dependent on Siali wetland water, either in the form of cultivation in wetland bed or utilizing its water for irrigation. On the contrary, in belt village, out of the total cultivators, only 6 households (13.33%) utilize this wetland, whereas 39 households (86.67%) do not utilize this particular water body for irrigating their agricultural field. The surrounding belt villages practically have less cohesion with this wetland regarding agricultural practices, which is attributed to distant location from Siali wetland.

**Table 5.2 Utilization of Siali wetland for irrigation and cultivation**

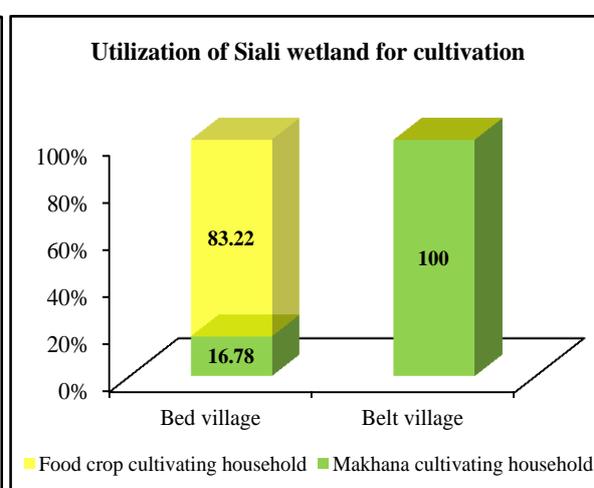
Village type	Cultivator (household)	Wetland utilized	(%)	Wetland un-utilized	(%)
Bed village	182	143	78.57	39	21.43
Belt village	45	6	13.33	39	86.67

*Source: Field survey, 2016-17.*

As per the household survey, out of the total 104.42 ha area under cultivation, irrespective of bed and belt villages, 10.12 ha (9.69%) is irrigated with the help of water from Siali wetland (*Appendix-10*), in which paddy in 6.88 ha, pulse in 2.43 ha and jute in 0.81 ha are cultivated.



**Figure 5.3: Utilization of Siali wetland water for irrigation**



**Figure 5.4: Utilization of Siali wetland for cultivation**

The major crops cultivated, with the help of wetland water are paddy (Aman, Boro), legumes, mustard and pulses (Kalai, Moong) etc. Aman paddy is considered mostly dominant kharif crop, cultivated during June to October and by most of the cultivators and agricultural labourers. Jute is the important commercial crop, cultivated during February to May in the uplands, surrounding this wetland (*Plate 5.2*). Jute is also cultivated in substantial area under wetland bed at the time of water logging period, as it can withstand the standing water, which is essentially required for jute retting purpose (*Mukherjee, 2008*). It is noticed at the time of field study that, the wetland edge is occupied with the unique assemblage of aman paddy and jute in their respective growing seasons (*Plate 5.3*). Boro paddy is another key crop, which is cultivated at the wetland edge during November to February and is mostly remunerative for the cultivators as they could save money in terms of irrigation, fertilizer and labour costs (*Mukherjee, 2008*). Sometimes, Boro is cultivated in the water spread area of Siali wetland, where the cultivators get the single crop (*Plate 5.7*). Another major crop, cultivated by the households adjacent to Siali wetland includes Wheat, Corn, and Mustard especially during the time period from October to February. Furthermore, the entire cultivation in these surrounding villages are characterized with a good association of cereals (Motor, Chola, Kalai) as well as several vegetables (Brinjal, Cauliflower, Radish) etc. Another important crop with high economic valuation is Betel leaf on which a good number of households especially of bed villages are dependent. From the field survey, it has been observed that near about 80 % of the cultivators are engaged traditionally from a long period, with betel leaf (dishi/ indigenous) cultivation in combination with other crops (*Plate 5.4*). These agricultural crops are cultivated with the help of wetland water. Irrigation facility has also been developed with the help of shallow machine at the depth of 45 to 60 feet. Among the mentioned cultivated crops Jute and Betel leaf are considered as important cash crops, which economically sustain the habitants' livelihood. These crops are marketed to Mathurapur, Samsi, Chanchal and Kumedpur markets and local hats.



*Plate 5.2: Jute cultivation during pre-monsoon*



*Plate 5.3: Aman paddy cultivation during monsoon*



*Plate 5.4: Betel leaf cultivation with the help of wetland water*



*Plate 5.5: Researcher during field study*

#### **5.3.1.2.1 Makhana cultivation in wetland:**

Along with the food crops, makhana, which is considered an important cash crop with high nutritional value, is cultivated on a mass scale on Siali wetland bed. A significant number of households, irrespective of bed and belt villages, intensively cultivate makhana on lease basis under the fisheries co-operative society. Out of the total wetland dependent cultivators (143 no. households) in bed village, 24 numbers (16.78%) are makhana cultivating household whereas; in belt villages the entire wetland dependent cultivators (6 no. households) are engaged in makhana cultivation (Table 5.3) (Figure 5.4) (Plate 5.6).

Table 5.3 Utilization of Siali wetland for makhana cultivation

Village type	Cultivator (household)	Wetland utilized	Makhana cultivating household	%	Food/Cash crop cultivating household	%
Bed village	182	143	24	16.78	119	83.22
Belt village	45	6	6	100	0	0

Source: Field survey, 2016-17

Makhana is cultivated as a seasonal annual crop and dies out after the fruits mature. The seeds are first broadcasted (sowing) in the surface water of wetland during the post-monsoon period (November-December). The germination process of makhana seeds starts in the month of March and the plant comes out above the surface water. After one and half months (30-45 days) from the flowering period, the fruits get fully matured and the ripen seeds start bursting during the month of July-August. The makhana seeds are harvested as well as collected in the last week of July or the first week of August, following three rounds of practices. First round of seeds collection is locally called ‘Sharkat’, which is associated with maximum collection. Second round is called ‘Markat’ and the last round, which is of longest duration, is called ‘Chharkat’ (Khatun, 2012). A large number of households are involved in collecting the seeds from the wetlands through local devices. The collection period starts from 9:00 a.m. and continues day long, up to 4:30 p.m. The labourers, who are involved in collecting the makhana seeds get good wage, which ranges from Rs. 30 per kg to Rs. 50 per kg i.e., Rs. 700/800 to Rs.1000/2000 per day. Initially, the wage is low with the abundance of makhana seeds within wetlands, but it reaches to maximum, while the seeds availability starts diminishing. The traditional involvement of localized settlers has made makhana cultivation pretty much rather than fish cultivation in the last few decades in both the bed and belt villages, surrounding Siali wetland. Moreover, this aquatic crop (makhana) has immense potentiality to provide considerable amount of cushion to counteract the impact of poverty in this district (Kumari et al., 2014).



Plate 5.6: Makhana cultivation in Siali wetland bed



Plate 5.7: Boro paddy cultivation at Siali wetland during post-monsoon

### 5.3.1.3 Wetland utilization for fishing:

Aquaculture in the form of fish culture is extensively carried out in Siali wetland, which provides better opportunity for the inhabitants, residing in both bed and belt villages. This wetland facilitates major benefits to the fisheries, with the high consumption of fishes in this district. Out of the total households, bed village contains 75 (26.5%) no. and belt village contains 52 (41.6%) no. of households (Table 5.1) (Figure 5.2) to be engaged in fishing practice. The mentioned table clearly depicts that the fishing practice is relatively less in comparison with agricultural activities especially among the inhabitants of bed villages. The entire fishing practice is controlled by the Bhaluka Fisheries Cooperate Society. The cooperative society has leased out different portions of the wetland for three to five years and fishing is done by the private ownership on leasing. Out of the total fishing households, 49 no. of households (65.33%) of bed villages utilize Siali wetland, whereas only 10 (19.23%) households utilize this particular wetland for fishing in the form of fish cultivation and catch (Table 5.4) (Figure 5.5) (Plate 5.8). Being distantly located, majority of the households are inclined for fishing to nearby water bodies rather than this particular wetland. The fishing practice is primarily dominated by Rohu, Ar, Shingi, Mangur, Bata, Mrigel and Catla cultivation. All varieties of carps are produced in this wetland. Different types of fishes (Koi, Mangur, Shingi,) cultivating in this wetland, are considered more profitable as well as utilized for commercial purpose. The fishes, caught from the wetland are sold at random in the markets located at Malda Town. Very little portion of the fish catch are sold in the local market of Fatehpur and Bhaluka hat (Plate 5.9).

**Table 5.4 Utilization of Siali wetland for fishing**

Village type	Fishing household	Wetland utilized	(%)	Wetland un-utilized	(%)
Bed village	75	49	65.33	26	34.67
Belt village	52	10	19.23	42	80.77

Source: Field survey, 2016-17

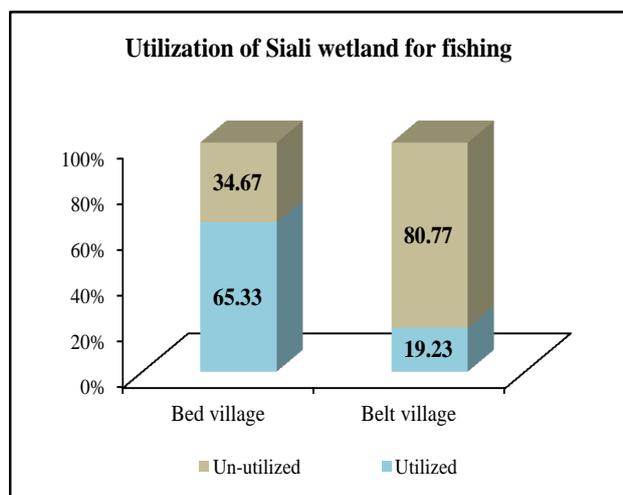


Figure 5.5: Utilization of Siali wetland for fishing

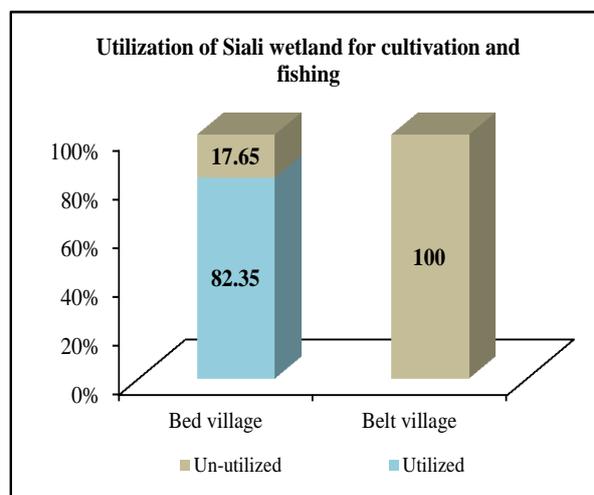


Figure 5.6: Utilization of Siali wetland for cultivation and fishing together



Plate 5.8: Fish catch in Siali wetland



Plate 5.9: Fish sold at Fatehpur and Bhaluka market, Malda District

**5.3.1.4 Wetland utilization for cultivation and fishing together:**

The field study and household survey reveals that most of the surrounding inhabitants cultivate diverse crops for their subsistence as well as commercial purpose or are engaged in the combination of both cultivation and fishing for their livelihoods. The inhabitants of peripheral villages used to practice cultivation from long back and later have adopted practicing fish culture into that crop land as a form of fish pond (*Irrinki & Irrinki, 2006-07*).

*Table 5.5 Utilization of Siali wetland for cultivation and fishing together*

Village type	Cultivator + Fishing household	Wetland utilized	(%)	Wetland un-utilized	(%)
Bed village	17	14	82.35	3	17.65
Belt village	5	0	0	5	100

*Source: Field survey, 2016-17*

Out of the total surveyed households in bed village (283), 17 households (6%) are engaged both in cultivation and fishing (*Table 5.1*) (*Figure 5.6*), in which 14 (82.35%) households utilize Siali wetland water both for irrigation or cultivation and for fishing (*Table 5.5*) (*Figure 5.6*). On the other hand, belt villages record only 5 (4%) households, out of total surveyed households (no. 125) to follow cultivation and fishing together but not utilize this particular wetland, which may be attributed to distant location of villages and in between existence of other scattered water bodies. During the field study, it has been observed that makhana cultivation and fishing practice together are found ecologically vulnerable. Before, sowing the makhana seeds, wetland water is completely sterilized through the application of insecticides of Endosulphun group, which is harmful for the fish fauna and found unhygienic for the human health. Moreover, the thorny appearance of makhana creates problem for the fish cultivation. That is why; the households engaged in fishing practice generally cultivate food crops with the help of this wetland, rather than makhana cultivation. But, few numbers of households are found to catch fish species like Koi, Bot koi, Shingi etc., which can tolerate less oxygen above water level and are available in the makhana cultivating wetland field.

#### **5.3.1.5 Wetland utilization for product gathering:**

Siali Wetland is considered an important sources of the availability of plentiful grass and livestock feed through grazing throughout the year for the households living in and around the wetlands (*Das et al., 2015*). The inhabitants of bed villages, surrounding Siali wetland, get the benefit directly from gathering wetland products, as it displays growth of several open water and water edge macrophytes such as Ghima, Kalmi, Hatisur, Hingcha, Kulekhara, Thankuni. These macrophytes constitute an inevitable component of the entire ecosystem, and are used by local habitants directly for the food, fiber and fuel. Some of these macrophytes possess known medicinal properties to the local people e.g. thankuni, kulekhara, hingcha etc. especially of bed villages. Along with macrophytes, this wetland exhibits variety of aquatic organisms (frogs, turtles, mollusks and shellfishes), which provide outputs of commercial value and economic sustenance to the people residing around this water body. The wetland products (aquatic flora and fauna) are collected and sold to the local market in order to supplement the household economy to some extent for the people living in the vicinity of Siali wetland. In comparison, with other occupations, related to wetland, product gathering households contain 4 numbers of households (1.41%) out of total households (283) in the bed villages (*Table 5.1*) (*Figure 5.2*). Furthermore, the wetland water is used for domestic work by a small number of households in the form of washing cloths and utensils. The rate of utilization of wetland water for the household purpose has presently been diminishing because number of shallow tube wells has been built up in the village premises. From, interviewing the inhabitants, especially of bed villages, it has been known that the wetland water is presently beyond human use and any other consumption due to drastic water quality deterioration because of polluted and toxic chemical fertilizers from adjacent agricultural field and domestic sewage inflow into this water body.

#### **5.3.1.6 Economic valuation of wetland:**

The economic evaluation encompasses the values and importance of diverse functions of wetlands, which are utilized by the stakeholders. These values can therefore be helpful in evaluating developmental projects, policies and frameworks for efficient allocation of wetland resources for their further sustainable development. Further, the purpose of economic valuation is to reveal the true costs of utilizing the wetland as well as environmental resources (*Ramachandra et al. 2005*). As per the benefits of Siali wetland, in terms of agricultural practice, the majority of households, residing in bed villages along with small number residing in belt villages utilize the wetland water in order to irrigate their agricultural

fields of around 10.12 ha as well as minimize the cost of irrigation. As per the household survey, Makhana is cultivated on 1.7 ha of the wetland bed on lease by Bhaluka fishing cooperative society by total 30 no. of households. The gross benefit of surveyed household is recorded Rs. 3,82,500.00 per annum, whereas the total cost in the form of labour cost (Rs. 12,750.00/annum) (for preparing makhana cultivating filed) and lease cost (Rs. 19,125.00/annum) is recorded Rs. 31,875.00. Therefore, the estimated net benefit from makhana cultivation within Siali wetland is recorded Rs. 3,50,625.00 per annum (Table 5.6).

**Table 5.6 Economic valuation of Siali wetland**

Sources of benefits and cost	Makhana cultivation
Gross benefit (Rs./annum)	3,82,500.00
Area under wetland cultivation (ha)	1.7
lease + labour cost (Rs./annum)	31,875.00
Estimated Net benefit (Rs./annum)	3,50,625.00
Sources of benefits and cost for wetland fishing	Wetland fishing (cultivation+catch)
Total production + Total catch (kg/annum)	8,700
Market price (Rs./kg)	175.00
Total benefit (Rs./annum)	15,22,500.00
Lease (Rs./annum)	75,000.00
Estimated net benefit from wetland fishing (Rs./annum)	14,47,500.00
Sources of benefits and cost for wetland product gathering	Wetland product gathering
Total income (Rs./annum/household)	8,000.00
No. of household gather wetland product	4
Total estimated benefit (Rs./annum) from product gathering	32,000.00
Total estimated benefit from wetland (Rs./annum)	18,30,125.00

*Source: Field survey, 2016-17*

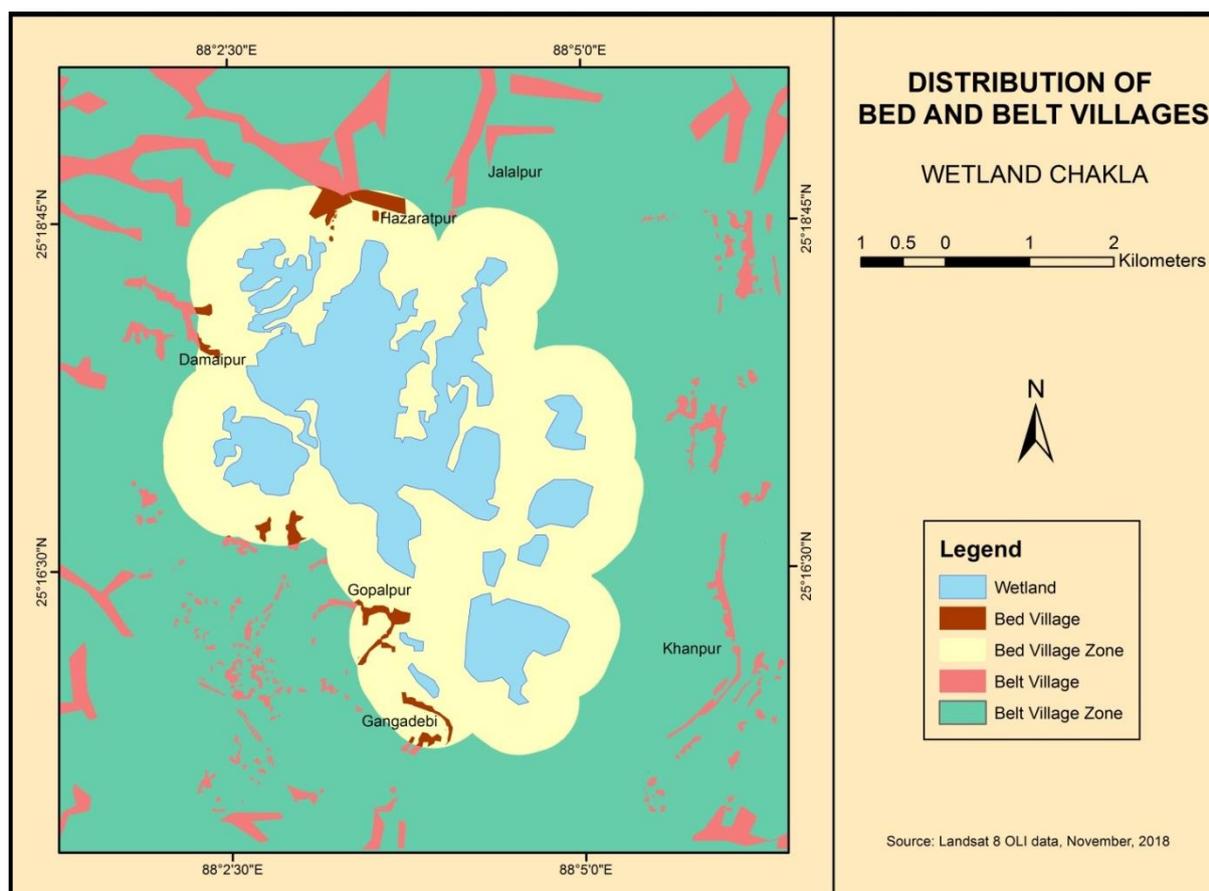
Apart from makhana cultivation, the beneficiaries (73 households) who are engaged in fish cultivation, irrespective of bed and belt villages get the estimated total benefit of Rs. 15,22,500.00 for the total production including total fish catch of 8,700 kg. per annum (market price Rs. 175.00/kg). The wetland is leased out to the fishermen for Rs. 75,000.00 per annum. Therefore, the net estimated benefit from the wetland fishing including fish catch

is recorded Rs. 14,47,500.00 per annum. The households, who gather various wetland products including aquatic flora and fauna, get an estimated benefit of Rs. 32,000.00 per annum. Therefore, the total estimated benefit from Siali wetland in the form of wetland cultivation, wetland fishing as well as wetland product collection is recorded Rs. 18,30,125.00 per annum (*Table 5.6*).

### ***5.3.2 Chakla Wetland***

#### **5.3.2.1 Introduction:**

Chakla wetland has immense potentiality as it facilitates cultivation, fishing and gathering several wetland products. The ecological set up in the form of existing landscape, soil and perennial water source in this wetland have made this region more farming oriented. The inhabitants, residing in the peripheral villages are closely associated with this wetland for their diverse economic purposes. The direct eco-functions from Chakla wetland include the usage of wetland water for cultivation as a leading source of irrigation, jute retting as a source of fodder, wetland fisheries for domestic as well as economic sustenance. This vast water body is surrounded by entirely dependent bed villages; namely Gangadebi, Gopalpur, Damaipur, Kaliganj, Shimultala and Hazaratpur, (located at wetland edge up to a distance of 600 meter). On the other, Jalapur and Khanpur are considered as belt villages, relatively less dependent on Chakla wetland (located beyond 600 m up to 1 km) (*Map 5.2*). Out of total 4,749 no. of households in bed villages (*Census of India, 2011*), 237 households have been surveyed and out of 2,357 no. of households in belt villages (*Census of India, 2011*), 117 households have been surveyed by following random sampling of 5% of universe in order to detail survey and analyse the utilization of Chakla wetland by the peripheral settlers.



*Map 5.2: Distribution of Bed and Belt Villages around wetland Chakla*

### 5.3.2.2 Wetland utilization for irrigation and cultivation:

Chakla wetland is an obvious source of water which is encompassed with extensive agricultural fields. The households, located in the bed village, solely depend on certain irrigation facilities and exploitation of available wetlands and water resources. In bed village, out of the total surveyed households (no. 237), 154 (64.98%) are engaged in cultivation, whereas in belt village, out of total households (no. 117), only 33 (28.2%) households are engaged in cultivation including cultivators and agricultural labourers (Table 5.7) (Figure 5.7).

Table 5.7 Utilization of Chakla wetland by households

Village	Village type	Total household	Cultivator (AL+CL household)	Fishing household	Wetland product collecting household	Cultivator+ Fishing household	Other
Gangadevi	Bed village	237	154	35	3	19	26
Gopalpur							
Damaipur							
Kaliganj							
Shimultala							
Hajratpur							
Jalapur	Belt village	117	33	19	0	8	57
Khanpur							

Source: Primary Census Abstract, Census of India, 2011 & Field study, 2016-17

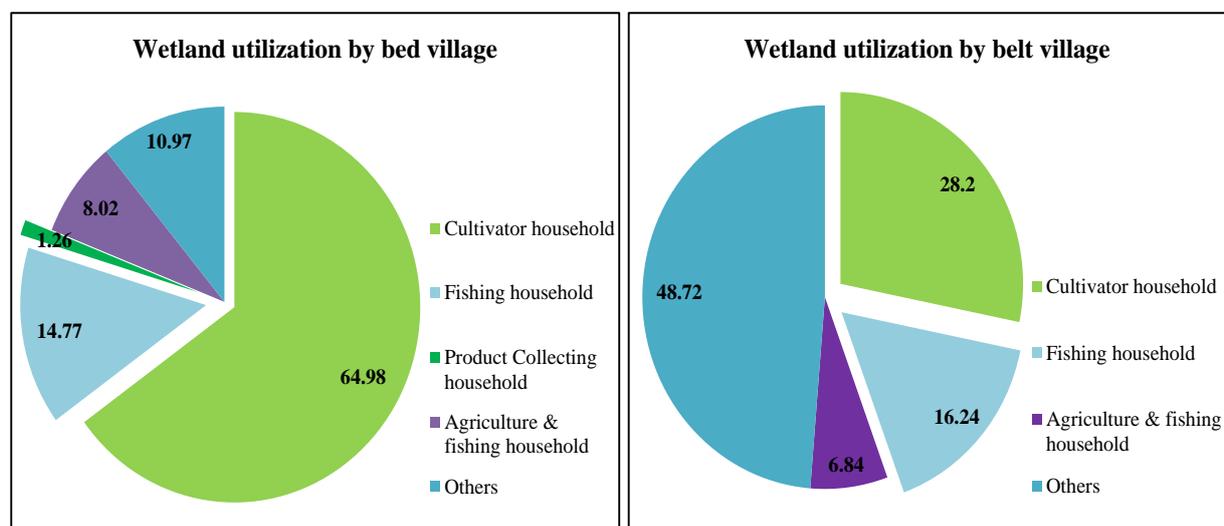


Figure 5.7: Utilization of Chakla wetland by households

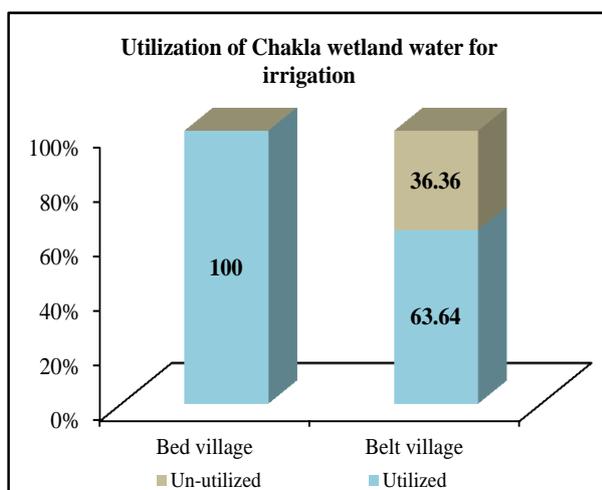
All the surveyed households in the bed village, who are engaged in cultivation (no. 154), utilize the wetland water (Chakla) for irrigating their farm lands, whereas in the belt village, out of the total cultivators (no. 33), 21 numbers of households (63.64%) utilize Chakla wetland and 12 (36.36%) no. of households do not utilize this particular wetland (Table 5.8) (Figure 5.8) which is attributed to distant location from this water body. As per the household survey, out of total 93.5 ha land under cultivation, 10.74 ha (11.49%) is irrigated with the help of Chakla wetland water (Appendix-10), in which paddy in 7.79 ha, pulse in 1.82

ha and jute in 1.13 ha are cultivated. The land holders use the pump set or indigenous system for irrigation. In the present study, the field observation reveals that number of pumps sets (shallow pump) are operated round the year, which are considered the main source of irrigation for vast cultivable fields, surrounding Chakla wetland.

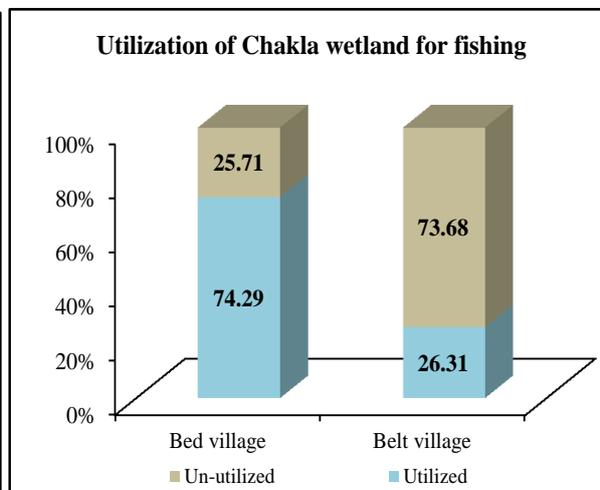
**Table 5.8 Utilization of Chakla wetland for irrigation and cultivation**

Village type	Cultivator (household)	Wetland utilized	(%)	Wetland un- utilized	(%)
Bed village	154	154	100	0	0
Belt village	33	21	63.64	12	36.36

Source: Field survey, 2016-17



**Figure 5.8: Utilization of Chakla wetland water for irrigation**



**Figure 5.9: Utilization of Chakla wetland for fishing**

Among the cultivated crops with the help of Chakla wetland water, paddy (Aman, Boro) and jute are the dominant crops in and around wetland bed especially by the bed villagers (Plate 5.10 & 5.11). During the pre-monsoon season, when the wetland bed dries up, cultivation becomes a most common practice by the farmers especially of bed villages. The agricultural labourers and cultivators, residing in bed villages, generally get two crops per year at the immediate vicinity of wetland whereas, the farmers having land in the water spread area, at some distant location from the wetland bed, get single crop (Mukherjee, 2008), because during the monsoon months, some portion of agricultural land in and around this wetland remain completely or partly under the water. Boro paddy, which is considered much

remunerative, is cultivated during November to February. A large section of the settlers utilize the wetland water as their main source of irrigation for the boro paddy cultivation and seasonal vegetables. A common variety of paddy named as 'Jaya' is being frequently cultivated by the households, but not that much commercially worth according to the cultivators. Along with food crops, Jute is the cash crop, which supplements the household economy. During the monsoon period, the field surrounding this wetland gets submerged and except jute, no other crops could withstand the standing water. Beside Paddy and Jute, rabi crops (Wheat, Mustard, Kalai, Potatoes) etc. are well grown crops with the appearance of this water body. Mustard is generally cultivated from October to December, whereas Kalai is cultivated during August to December at the agricultural field, adjacent to wetland. However, several difficulties are experienced by the cultivators in wheat cultivation which may be attributed to lack of proper water outlet and resulting water logging condition in agricultural field especially after the monsoon period. The deficit wheat cultivation is also attributed to persecuting rat dominance in the agricultural field as per interviewing the households. Apart from the mentioned crops, paniphal, one of the traditional water crops, is commercially cultivated as edible fruits in this wetland of Malda district.



*Plate 5.10: Aman paddy cultivation during monsoon*



*Plate 5.11: Jute cultivation during pre-monsoon*

### 5.3.2.3 Wetland utilization for fishing:

Fishing is a constituent source of food and additional source of income for local villagers and fishermen, who are repeatedly found in and around this wetland. The Chakla wetland is a typical example of middle Ganga wetlands, which was once one of the very momentous water bodies of Malda district for the fish cultivation. Presently Fishing practice has been decreased as well as altered into crop (food and cash crop) cultivation. But still it provides food and shelter to a large number of aquatic fauna and shelters many fresh water fish species. The diversity of fish species is citable, which performs a significant role in the trophic formation of this wetland. Out of the total surveyed household, bed village contains 35 numbers of households (14.77%), whereas belt village holds only 19 (16.24%) households, engaged in fishing practice including fish catch (Table 5.7) (Figure 5.7) (Plate 5.12).

**Table 5.9 Utilization of Chakla wetland for fishing**

Village type	Fishing household	Wetland utilized	(%)	Wetland un-utilized	(%)
Bed village	35	26	74.29	9	25.71
Belt village	19	5	26.32	14	73.68

*Source: Field survey, 2016-17.*

The table clearly depicts that, in the bed villages a large number of households are engaged in fish cultivation and fish catch in comparison with the belt villages. Out of the total fishing households (35) in bed village, 26 (74.29%) households utilize this vast natural wetland for fish cultivation and catch. Among the fishing households of belt villages (19), only 5 (26.32%) households utilize this particular water body (Table 5.9) (Figure 5.9), due to relatively distant location. Out of the total number of household a small section are fishermen and chiefly dominated by Muslim population. Their main occupation is to catch fishes and to sell it to the middleman, who ultimately takes it to the nearby markets, located at Gazole, Samsi and Malda town. At a time of about 20 years ago, Chakla wetland was a depot as one of the significant sources of variety of fishes, and pisciculture was the major occupation in this region. Presently, regular flood occurrences and the cheap supply of fish from Andhra Pradesh has discouraged the interest of the people, through which so many people, especially the Muslim community have started to shift their cottage from bed villages to different belt villages like, Khanpur, Gobindopur, Jalapur, since last few decades. Catla, Rohu, Boal,

Tengra, Mrigel, Mourala, Chanda, Puti are the ample species, which are cultivated in this wetland throughout the year. Silver carp and Grass carp are other variety of fishes cultivated and caught from Chakla wetland. Five cooperative societies are in operation in Chakla wetland namely, Rampur Fishing Cooperative, Ojitpur cooperative, Goalpara cooperative, Boalia cooperative and Dhanga cooperative society. Fishing practice is done on lease basis by these cooperative societies for three to five years. The fishes, caught from the wetland are sold at random in the markets located at Samsi, Alal and Chanchal (*Plate 5.13*).



*Plate 5.12: Fish catch at Chakla wetland*



*Plate 5.13: Fish sold at Samsi and Alal market*

#### **5.3.2.4 Wetland utilization for cultivation and fishing together:**

The settlers, especially from the bed villagers are the direct beneficiaries of Chakla wetland in the form of farming and fishing together. Generally, fish is cultivated after paddy harvest, when the fields are flooded (*Srinivasan, 2010*). The bed village, adjacent to Chakla wetland, accounts a small number of 19 (8.02%) households to be engaged in crop cultivation and fishing together (*Table 5.7*) (*Figure 5.7*), and all the households are dependent on wetland, either in the form of cultivation, or fishing or both, whereas the belt village records 8 (6.84%) households to practice both cultivation and fishing, in which 5 (62.5%) households are dependent on this particular wetland (*Table 5.10*) (*Figure No. 5.10*).

**Table 5.10 Utilization of Chakla wetland for cultivation and fishing together**

Village type	Cultivation + Fishing household	Wetland utilized	(%)	Wetland un-utilized	(%)
Bed village	19	19	100	0	0
Belt village	8	5	62.5	3	37.5

Source: Field survey, 2016-17

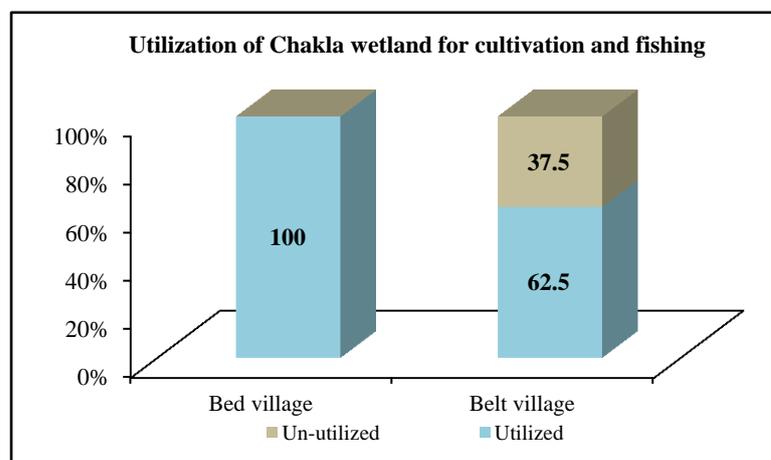


Figure 5.10: Utilization of Chakla wetland for cultivation and fishing together

### 5.3.2.5 Wetland utilization for product gathering:

Chakla wetland exhibits diverse plant composition on which number of people figure on. This wetland flourishes a number of valuable plants and animals, such as plant products, fish, forage etc. which can be harvested on a sustainable basis to provide an economic return. This wetland acts as the store house of kalmi, hingcha, sushni, thankuni etc. at the water edge, which are gathered by very small number of bed villagers for commercial purpose as well as for sustaining their economy. Out of the total households (no. 237) only 3 (1.26%) households residing in bed villages, at the closest proximity, gather different wetland products (Table 5.7) (Figure 5.7). Macrophytes such as hingcha, kulekhara, and thankuni are used and consumed most efficiently as supplementary vegetables for its medicinal values. These aquatic macrophytes are observed to play substantial role in the local socio-economy i.e., edible plants, medicinal values, feed for livestock, green manure, and thatch cordage. Diversified macrophytes, found in wetland bed and along the wetland edge such as Kalmi Sak, Sushni, Ghima sak, are considered very significant for the day to day human diet and of salubrious consumption. Chakla wetland provides habitat and food to other diverse life forms, which are of major economic consideration. The paddy cultivation at the water edge harbors

associated biodiversity i.e. nutritious food in the form of fish, mollusks etc. People belonging to the wetland periphery collect the most conspicuous wetland fauna like shell fishes (Plate 5.14), local mollusks, tortoises and sell in the local market and hat at remunerative price. The market price has made it easier for the sellers to reveal the amount they save in every month through gathering diverse aquatic flora and fauna from this wetland (Mukherjee, 2008). Apart from the mentioned usage, duck keeping is often practiced by the inhabitants, at the periphery of this wetland which is considered one of the sources of duck egg in malda market. Along with the other usage, cattle grazing are allowed on a small scale by the households, especially during the pre-monsoon, at water receding season. A small percentage of households use this wetland water for their daily usage in household works especially for washing purpose. Chakla wetland, being a vast natural water body, facilitates a large community from the adjacent bed and belt villages, belonging to the ailing sections of the society for their livelihood and nutriment.



*Plate 5.14: Shell fishes collected and sold at local market*



*Plate 5.15: Researcher with wetland utilized population*

### **5.3.2.6 Economic valuation of wetland:**

Being a vast natural water body, large number of households are the direct beneficiaries of Chakla wetland for utilizing the wetland water in order to irrigate an area of about 10.74 ha as well as reduce down the cost of irrigation. Moreover, as per the household survey, total 55 no. of households, who are involved in fish cultivation and fish catch within this particular wetland, get an estimated gross benefit of Rs. 15,35,275.00 per annum (total production = 8,773 kg/annum; market price Rs. 175.00/kg). The fish cultivation is practiced on lease by the fishing cooperative society for Rs. 87,000.00 per annum. Therefore, the net estimated benefit from wetland fishing including fish cultivation and fish catch is recorded Rs. 14,48,275.00

per annum (Table 5.11). According to the field survey, the fishing practice in Chakla wetland is found relatively less organized, which could otherwise; promote substantial economic sustenance to the local fishermen. Moreover, a few households especially from the bed villages gather several aquatic products for food, fodder, medicine round the year as well as sell in local market and get an estimated benefit of Rs. 21,600.00 per annum (Table 5.11). Therefore, the estimated total benefit from Chakla wetland is recorded Rs. 14,69,875.00 per annum.

**Table 5.11 Economic valuation of Chakla wetland**

Sources of benefits and cost	Wetland fishing (cultivation+catch)
Total production + Total catch (kg/annum)	8,773
Market price (Rs./kg)	175.00
Gross benefit (Rs./annum)	15,35,275.00
Lease (Rs./annum)	87,000.00
Estimated net benefit from wetland fishing (Rs./annum)	14,48,275.00
Sources of benefits and cost	Wetland product gathering
Total income (Rs./annum/household)	7,200.00
No. of household gather wetland product	3
Total estimated benefit (Rs./annum) from product gathering	21,600.00
Total estimated benefit from wetland (Rs. /annum)	14,69,875.00

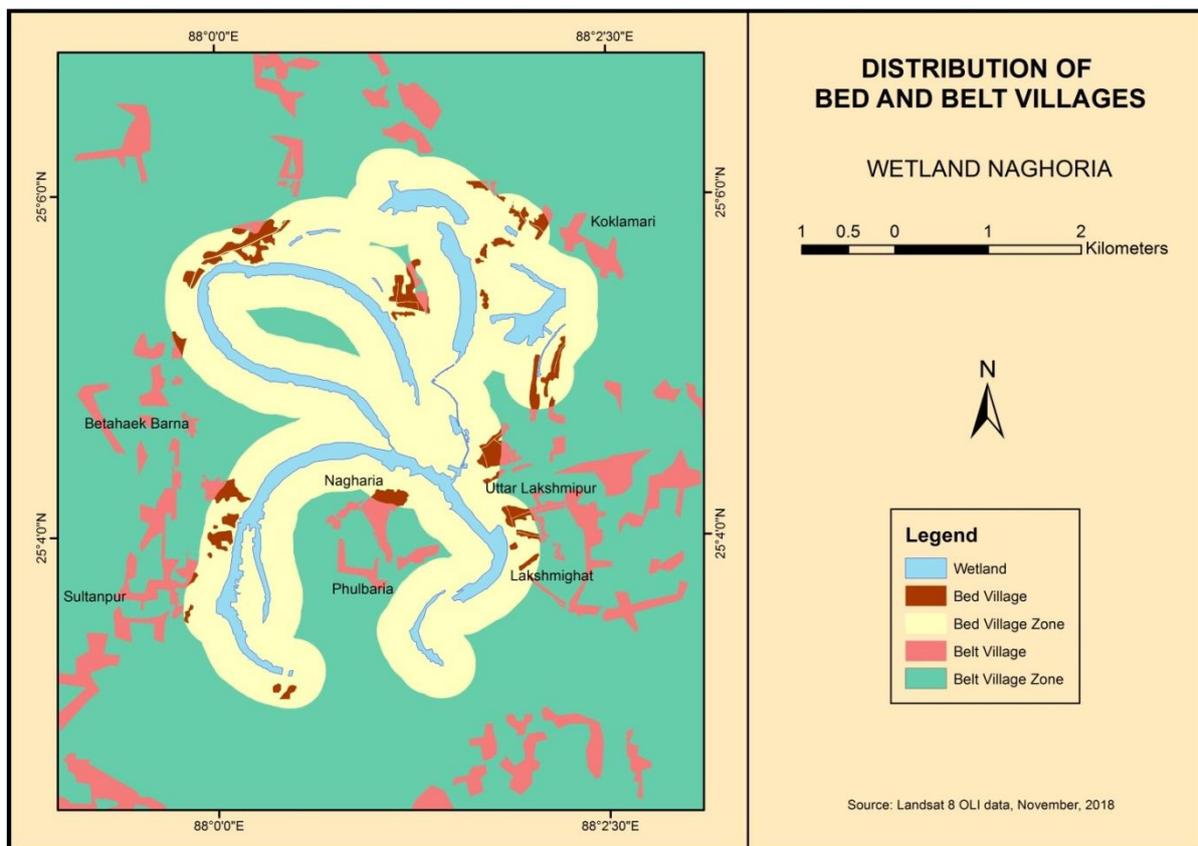
*Source: Field survey, 2016-17*

### **5.3.3 Naghoria wetland**

#### **5.3.3.1 Introduction:**

Naghoria wetland, a cut off meander from River Kalindri, in English Bazar block provides an ideal opportunity to highlight its gravity in backing cultivation, especially since many family farming operations, rely on the water, soil, plant and animals found in this wetland to provide food security and ennoble their livelihood. Naghoria wetland is enclosed with three bed villages namely; Nagharia, Lakshmightat and Uttar Lakshnipur, (located at wetland edge up to a distance of 350 meter), whereas, Phulbaria and Koklamari are selected as belt villages (with a distance beyond 350 meter up to 800 meter) (Map 5.3). Out of the total number of 3,309 household (Census of India, 2011) in bed villages, 5% of universe i.e. 165

households have been taken randomly and out of total 2,438 no. of households in belt villages, 122 households have been selected as well as surveyed in order to detail analysis on the utilization of Naghoria wetland, especially for the socio-economic livelihood of surrounding settlers. The socio-economic condition of these villages is moderately well. People residing in these villages are engaged mainly in cultivation and fishing, duck rearing, retailing and other economic activities. These characteristics are playing a positive role to the economy and society of the concerned village areas.



**Map 5.3:** Distribution of Bed and Belt Villages around wetland Naghoria

### 5.3.3.2 Wetland utilization for irrigation and cultivation:

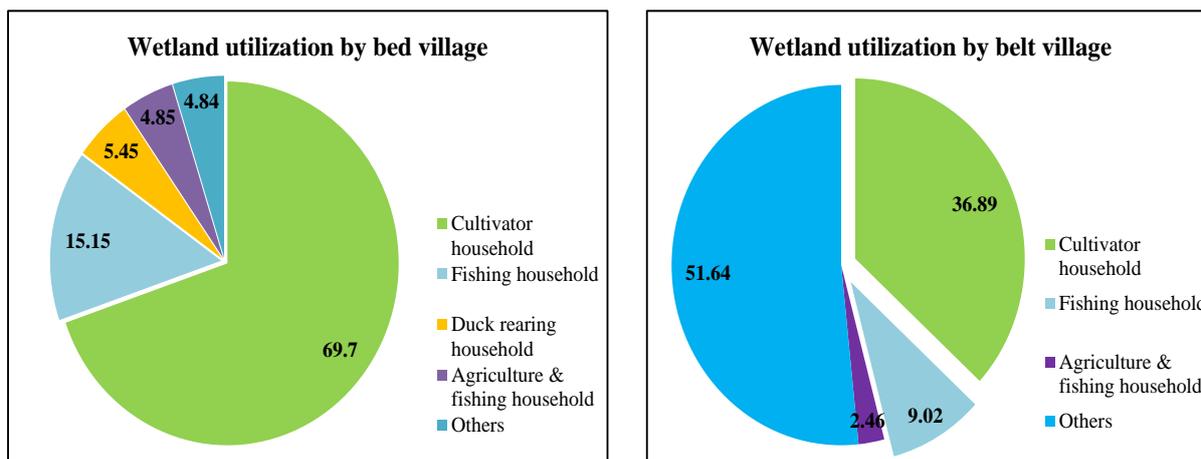
The necessity of cultivation for a flat, productive tract with a ceaseless supply of water from Naghoria wetland, are often a potentially valuable agricultural resource. The agricultural land is mostly double cropped, as the entire land is composed of thick and fertile silt along with the proper irrigation facility of the wetland water. Out of the total surveyed household (no. 165) in bed village at the closest contiguity, 115 households (69.7%) are engaged in cultivation, whereas out of 122 households in belt village, 45 numbers (36.89%)

are engaged in cultivation (Table 5.12) (Figure 5.11). In bed villages, out of the total cultivator households (115), majority of them i.e. 87 (75.65%) households utilize this wetland water in order to provide food security as well as improve their livelihood.

**Table 5.12 Utilization of Naghoria wetland by households**

Village	Village type	Total household	Cultivator (AL+CL household)	Fishing household	Cultivator+ Fishing household	Duck rearing household	Other
<b>Naghoria</b>							
Lakshmighat	Bed village	165	115	25	8	9	8
Uttar Lakshmipur							
Phulbaria	Belt village	122	45	11	3	0	63
Koklamari							

Source: Primary Census Abstract, Census of India, 2011 & Field survey, 2016-17



**Figure 5.11: Utilization of Naghoria wetland by households**

**Table 5.13 Utilization of Naghoria wetland for irrigation and cultivation**

Village type	Cultivator (household)	Wetland utilized	%	Wetland un-utilized	%
Bed village	115	87	75.65	28	24.35
Belt village	45	0	0	45	100

Source: Field survey, 2016-17

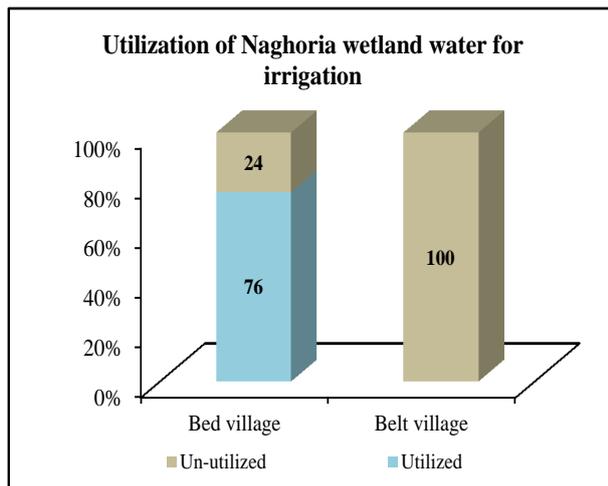


Figure 5.12: Utilization of Naghoria wetland water for irrigation

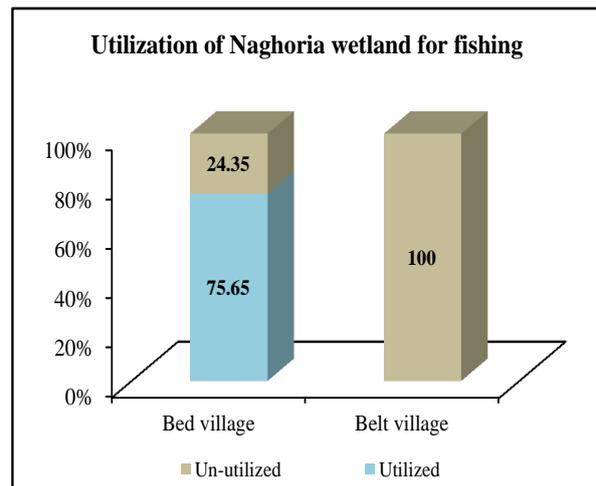


Figure 5.13: Utilization of Naghoria wetland for fishing

On the contrary, the cultivator households in the belt village do not utilize this particular wetland for irrigation purpose, which may be caused due to locating far off from the wetland bed (Table 5.13) (Figure 5.12). In the present study, out of the total 65.6 ha area under cultivation, a total of 6.23 ha (9.50%) area, at the closest proximity, is irrigated with the help of Naghoria wetland water (Appendix-10), in which paddy in 3.64 ha, pulse in 1.29 ha, maize in 0.81 ha and jute in 0.49 ha are cultivated. The major crops are paddy (Aush, Aman, and Boro), vegetables, pulses, mustard and mixed crops. Boro paddy is considered a key crop, which starts at the end of November, and is cultivated along the wetland edge of Naghoria. Beside boro; aush and aman paddy are also cultivated at wetland edge with the help of wetland water as zaid and kharif crop respectively. Jute is frequently cultivated cash crop and the availability of water is an additional advantage, which help the people in jute retting, especially those, residing at the close vicinity of this wetland (Plate 5.16). Additional crops are Maize (Plate 5.18), which is cultivated from March to July; Bajra, Kalai and Arhar (Plate 5.17) are cultivated during August to November and December. Although, there is fertile and productive cultivable land, most of it has gradually been converted into mango orchards during last few decades, through which per hectare monetary return is excessively high. Simultaneously, the practice of crop cultivation of pulses, vegetables and sometimes aman (Plate 5.19) and aush paddy through large land holdings, including mango orchards supplement the household economy of both bed and belt villagers. Commercialization of mango, including their familiarity has encouraged the settlers to shift from sole crop cultivation to the combination of mango orchards and other crops.



*Plate 5.16: Aush paddy and Jute cultivation during pre-monsoon*



*Plate 5.17: Arhar cultivation with wetland water during post-monsoon*



*Plate 5.18: Maize cultivation with wetland water*



*Plate 5.19: Aman paddy cultivation during monsoon*

### **5.3.3.3 Wetland utilization for fishing:**

Fishing is an additional source of income for the peripheral settlers and fishermen, who are frequently found in and around Naghoria wetland. In comparison with the agricultural activity, small numbers of households are engaged in fishing practices in Naghoria wetland. Fish is not cultivated in Naghoria wetland because of having no cooperative society. The households, residing in bed village, at a close vicinity to this wetland are engaged only in fish catch, along with crop cultivation throughout the year. Out of the total households in bed village (165), 25 number of households (15.15%) are engaged in fish catch, whereas in belt village (no. 122 households), only 11 (9.02%) no. are found as fish catching households (*Table 5.12*) (*Figure 5.11*) (*Plate 5.20*). In the present study, out of the total fishing households (25) in bed village 19 (76%) households are dependent on Naghoria wetland for fish catching. The mentioned table (*Table 5.14*) (*Figure 5.13*) reveals a reverse picture in case of belt village, where the total number of fishing households do not utilize this particular water body for fish catch.

Presently, dominant fish species which are usually caught in Naghoria wetland include, Bata, Kalbaush, Catla, Koi, Mangur, Prawn, Rohu, Tangra. As this cut off is well connected with River Kalindri, some of the fishes migrate between wetland and the river and a middling number of riverine fish species have amalgamated here. The commercially important fishes like, Catla, Khera, Kalbaush, Mangur and Prawn are also found as well as caught by the fishermen. The fishermen catch fishes round the year and sell them to Bichitra market, which is considered the main wholesale market of this region and Amriti hat in nearby Malda town.

**Table 5.14 Utilization of wetland for fishing**

Village type	Fishing household	Wetland utilized	%	Wetland un-utilized	%
Bed village	25	19	76	6	24
Belt village	11	0	0	11	100

*Source: Field survey, 2016-17*



**Plate 5.20:** Fish catch at Naghoria wetland



**Plate 5.21:** Duck rearing at Naghoria wetland

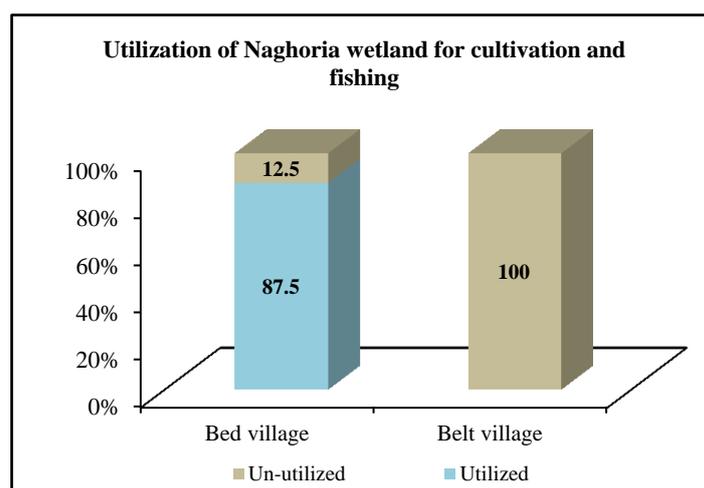
#### **5.3.3.4 Wetland utilization for cultivation and fishing together:**

The household survey at field visit reveals that, as fish cultivation is completely absent in Naghoria wetland, the households under bed village use this wetland mainly for crop cultivation (food and cash crop) along with fish catch. The table (no. 5.15) depicts that, out of the total surveyed households in the bed village, 8 (4.85%) households are engaged both in crop cultivation and fish catch together (Figure 5.14), in which most of the households (87.5%) are dependent on Naghoria wetland. Whereas, in belt villages only 3 (2.46%) households practice crop cultivation and fish catch together in order to sustain their economy, although they do not utilize this particular water body.

**Table 5.15 Utilization of wetland for cultivation and fishing together**

Village type	Cultivation + Fishing household	Wetland utilized	%	Wetland un-utilized	%
Bed village	8	7	87.5	1	12.5
Belt village	3	0	0	3	100

Source: Field survey, 2016-17



**Figure 5.14:** Utilization of Naghoria wetland for cultivation and fishing together

### 5.3.3.5 Wetland utilization for duck rearing:

As per the field study, 9 numbers (5.45%) of households are found to be involved in duck rearing within Naghoria wetland (Table 5.12) (Figure 5.11). Duck rearing (Plate 5.21) is also considered economically significant as well as one of the important source of duck eggs in nearby Bichitra market and Green park market of Malda town, which is just 12 km away from this wetland, and finally supplement the household economy to some extent for the people living at the vicinity of the wetland. Apart from the mentioned usages, this wetland is negligibly used for cattle grazing especially during the pre-monsoon by bed villagers when this cut-off partially dries off. The wetland bed and its fringe area harbor thick vegetation and support appreciable assemblage of both open water and water edge macrophytes like Kutipana, Paniphal, Water fern, Ghima, Kalmi, Kulekhara, Hatisur etc. These wetland products are not gathered by the villagers presently in an organized manner, which has been known from the field study. Moreover, jute, reeds and many grasses are used for fiber and

woody plants are used for the fuel consumption. The households, residing in the bed villages use this wetland water for domestic purpose in washing cloths and utensils.

### 5.3.3.6 Economic valuation of wetland:

Naghoria wetland, as observed during the field study, provides ample opportunity to the associated households in order to enhance their economic well-being both in terms of cultivation, irrigation and fish catch. Naghoria wetland is considered one of the very few wetlands of the Malda district, which facilitates the irrigation potential to paddy crops (aush, aman and boro) along with other food and cash crop round the year, covering a total area of 6.23 ha, with the help of wetland water.

*Table 5.16 Economic valuation of wetland*

Sources of benefits and cost	Wetland fishing (fish catch)
Total catch (kg/annum)	3500
Market price (Rs./kg)	250.00
Total benefit (Rs./annum)	8,75,000.00
Lease (Rs./annum)	0
Total benefit from wetland fishing (Rs./annum)	8,75,000.00

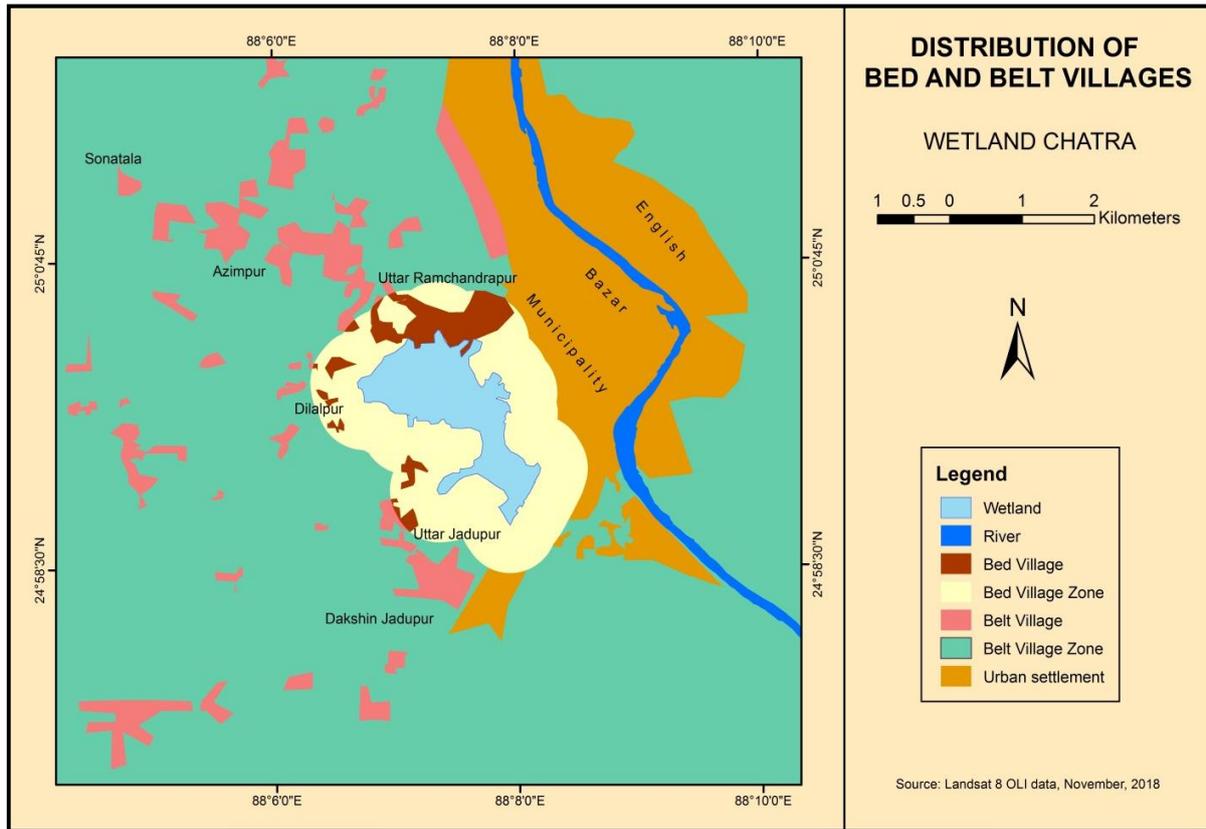
*Source: Field survey, 2016-17*

Apart from the irrigation and cultivation, the field study has recorded a good amount of benefit from the wetland fishing only in the form of fish catch. Although, the fish cultivation is not practiced in Naghoria wetland, the beneficiaries (26 no. of households) catch the available fish fauna, sell it to the local and main market as well as get an estimated total benefit of Rs. 8,75,000.00 per annum (Total catch = 3,500 kg/annum; market price = Rs. 250.00/kg). As, wetland product gathering is not practiced by the local villagers in an organized manner, an estimated total benefit from this cut off meander of River Kalindri is recorded Rs. 8,75,000.00 per annum (*Table 5.16*).

### **5.3.4 Chatra wetland**

#### **5.3.4.1 Introduction:**

Chatra wetland is a significant peri-urban wetland which forms an important component of the entire ecosystem and environment because of having ample biological, ecological, social and economic values. In accordance with other studied water bodies, this wetland is potential to retain substantial water resource to meet the requirement in the peripheral areas. Moreover, Chatra wetland provides a number of valuable plants and animals, such as plant products, fish, forage etc. which can be harvested on a sustainable basis to provide substantial economic return. The wetland has unique location as it is enclosed by villages in the north-west, west and south-west side whereas, the entire eastern portion including north and south-east are surrounded by municipal wards and at a very close proximity. The wetland is generally utilized by village populace in the form of cultivation, fishing, gathering several wetland products and makhana cultivation. The villages namely; Uttar Ramchandrapur, Uttar Jadupur, Dilalpur and Arazi Dilalpur have been considered as bed villages, to be wholly dependent on Chatra wetland (located at wetland edge up to a distance of 650 meter), whereas Sonatala, although an urban area (CT) as per census 2011, has been considered as the only belt village (located 3 km far off this water body) to utilize the wetland water only for commercial cultivation (Makhana), (*Map 5.4*). Apart from the mentioned belt village, no other belt villages utilize Chatra wetland, as are entirely dependent on tertiary sector of economy and on brick kiln industries. However, out of total 2,672 no. of households in bed villages (*Census of India, 2011*), 193 households are selected, whereas, in belt villages, out of 2,241 no. of households (*Census of India, 2011*), 134 households are selected randomly (5% of universe) and surveyed for further detail analysis regarding the utilization of this peri-urban water body. Among the bed villages, Arazi dilalpur does not account any household, as it is entirely under the wetland water coverage.



**Map 5.4:** Distribution of Bed and Belt Villages around wetland Chatra

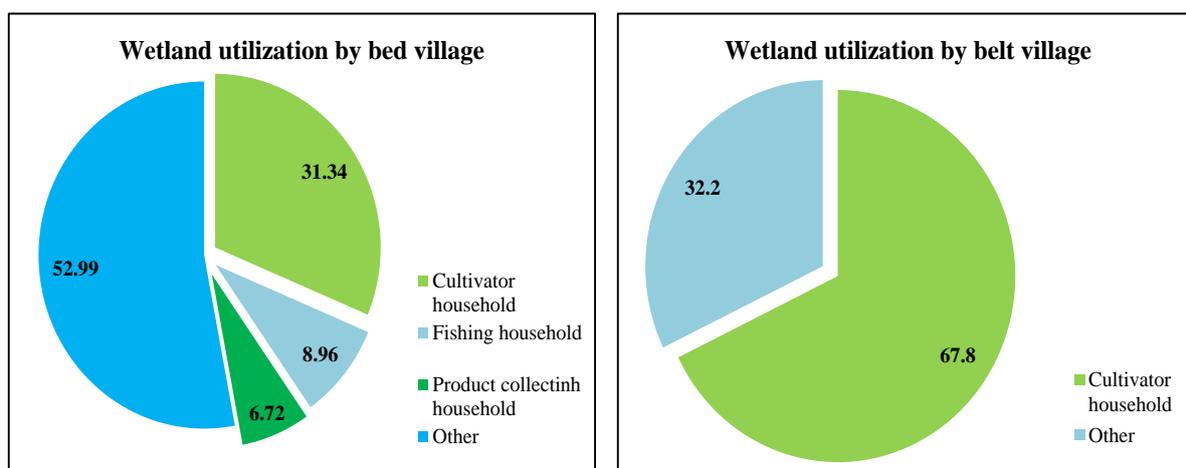
#### 5.3.4.2 Wetland utilization for irrigation and cultivation:

Chatra wetland is highly productive, and facilitates a wide range of ecosystem services such as food, fiber, fish, timber, housing materials e.g., reeds, medicinal plants, provision of fertile agricultural land, constant water supply by irrigation for the arable usages. The inhabitants, residing in and around this peri-urban water body, depend on wetlands for variety of economic activities such as farming, collection of fish, shellfish, leafy vegetables, grazing, domestic uses, etc. The field study reveals that, the utilization of wetland is considered highest for cultivation in the form of food crop and especially for makhana cultivation on wetland bed. Out of the total surveyed households in bed village (no. 134), 42 (26.12%) households are engaged in cultivation, whereas in belt village (surveyed 59 households) 40 households (25.42%) including cultivators and agricultural labourers are engaged in cultivation (Table 5.17) (Figure 5.15).

**Table 5.17 Utilization of Chatra wetland by households**

Village	Village type	Total household	Cultivator (AL+CL household)	Fishing household	Wetland product collecting household	Other
<b>Uttar</b>						
Ramchandrapur Uttar Jadupur	Bed village	134	42	12	9	71
<b>Dilalpur</b>						
Sonatala (CT)	Belt village	59	40	0	0	19

Source: Primary Census Abstract, Census of India, 2011 & Field survey, 2016-17



**Figure 5.15 Utilization of Chatra wetland by households**

Chatra wetland acts as an obvious source of water for the agricultural use, which is considered one of the major occupations of the surrounding inhabitants, especially of bed villages. Out of the total cultivated area of 35.26 ha, this wetland acts as water source in order to irrigate a total of 1.82 ha (5.16%) area (Appendix-10) for cultivating principal crops namely, aman and boro paddy (Plate 5.22). Paddy fields are kept under wetland water for a major part of the year.

**Table 5.18 Utilization of wetland for irrigation and cultivation**

Village type	Cultivator (household)	Wetland utilized	%	Wetland un-utilized	%
Bed village	42	27	64.29	15	35.71
Belt village	40	33	82.50	7	17.50

Source: Field survey, 2016-17

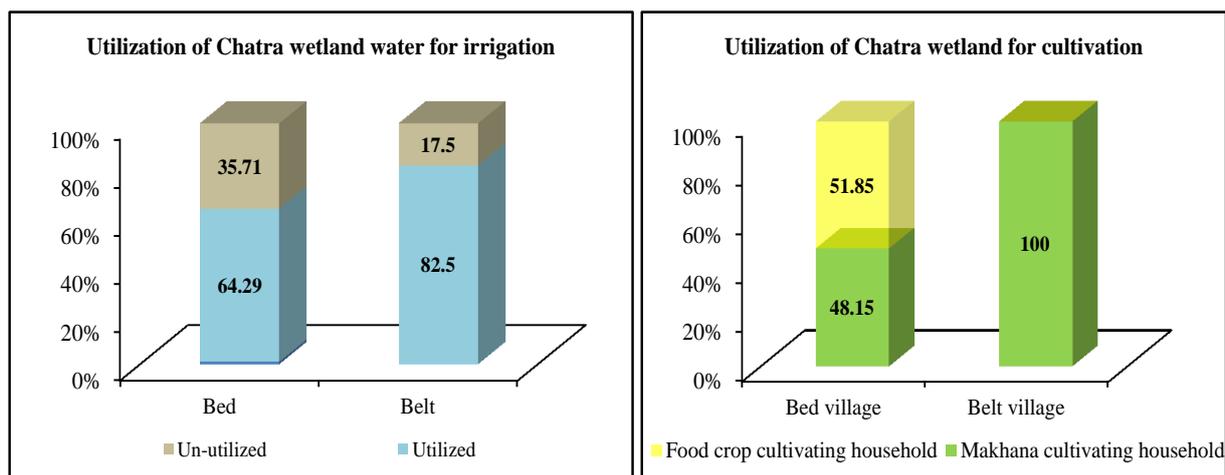


Figure 5.16 Utilization of Chatra wetland water for irrigation      Figure 5.17 Utilization of Chatra wetland for cultivation

Out of the total cultivator households (no. 42), 27 (64.29%) households utilize this wetland water whereas, 15 (35.71%) households do not utilize this particular water body for irrigation purpose. In belt village, 33 (82.5%) households directly rely on Chatra wetland for cultivation as well as use the wetland water in order to irrigate their crop lands (Table 5.18) (Figure 5.16). The field study reveals that in belt village, almost all the agricultural households are associated with makhana cultivation over a large area on Chatra wetland bed.

#### 5.3.4.2.1 Makhana cultivation in wetlands:

The greatest benefit that is likely to be achieved is makhana cultivation on Chatra wetland bed. In the early nineties, this geo-plant was observed in Harishchandrapur block. Slowly, it extended out in other blocks especially in English Bazar and got introduced in Chatra wetland from 2003. Among the agricultural household, a significant number are presently engaged in makhana cultivation rather than food crop cultivation. Makhana practice is being dominated in the belt rather than the bed villages. From the frequent observations and household survey, it has conspicuously been noticed that the villagers of Sonatola and Uttar Jadupur are massively engaged in makhana practice rather than fishing, and varied pockets of this wetland is progressively roofed with this hydrophyte at the monsoon months when the water is at its peak. Chatra wetland is leased out zone wise by Uttar Jadupur Gram Panchayat for 3 years to the cultivators for makhana practice within wetland water (Plate 5.23). In the bed villages, out of the total cultivator households (no. 27) to utilize Chatra wetland, 13 households (48.15%) are engaged in makhana cultivation, whereas 14 (51.85%) households

cultivate food crops in kharif and rabi seasons. In the belt village, the entire cultivator households are actively inclined to makhana cultivation within this particular water body (Table 5.19) (Figure 5.17). Moreover, most of the people’s livelihoods in both the bed and belt villages are solely dependent on makhana cultivation and processing. The present study exhibits that the number of households, engaged in fish catch is relatively less, compared to other case studies, which is attributed to major shifting of fishermen to more profitable crop cultivation in the form of makhana in Chatra wetland bed.

**Table 5.19 Utilization of wetland for makhana and food crop cultivation**

Village type	Cultivator (household)	Wetland utilized	Makhana cultivating household	%	Food crop cultivating household	%
Bed village	42	27	13	48.15	14	51.85
Belt village	40	33	33	100	0	0

*Source: Field survey, 2016-17*



**Plate 5.22:** Boro Paddy cultivation at Chatra wetland during post-monsoon



**Plate 5.23:** Makhana cultivation in wetland bed

#### **5.3.4.3 Wetland utilization for fishing:**

In Chatra wetland, fish is not cultivated due to absence of any fishing cooperative in English Bazar block, but still it promotes immense potential for fishing household in the form of employment generation and several other associated sources of income. Further, it is the place of intense biological activity including the breeding of many species of fishes and aquatic organisms. In the present study, table 5.17 reveals that out of the total household in bed village (no. 134), only 12 (8.96%) households are engaged in fish catching, which are directly dependent on this particular wetland. On contrary, no households of belt village are

found to be engaged in fish catch within this particular wetland, as those are entirely devoted to makhana cultivation during last few decades (Table 5.20) (Figure 5.18) (Plate 5.24).

**Table 5.20 Utilization of wetland for fishing**

Village type	Fishing household	Wetland utilized	%	Wetland un-utilized	%
Bed village	12	12	100	0	0
Belt village	0	0	0	0	0

*Source: Field survey, 2016-17*

The uniqueness of this peri-urban wetland is still characterized by fish faunal diversity, which constitutes the fresh water species such as Chanda, Tangra (big and small), Punti, Mangur, Bacha, Bata etc. A small amount of commercially important fish species like Kalbaush, Bot koi, Khalisa, Mangur etc. are also caught from this wetland. The diverse available fish species, caught by the fishermen are sold to the local hat and market at Malanchapalli, Krishnapalli, Mokdumpur and Bichitra markets of Malda town as well as sustain the livelihood and economy of peripheral settlers (Plate 5.25). According to the field survey, it has clearly been observed that the proportion of households engaged in cultivation and fishing together record negligible. The reason behind is the fishing practice, done in an unorganized manner and only in the form of fish catch in this wetland. Further, majority of the cultivator households irrespective of bed and belt villages are makhana cultivators. And along with makhana cultivation, fishing practice is generally not done because before sowing the seeds, the water needs to be completely sterilized by applying the organochlorine insecticide (Endosulphun group), which poses considerable threat to the oxygen demanding biodiversity and aquatic life. That is why, with the introduction of this aquatic gloating crop, the fishing practice has been hampered as well as restricted in several pockets of this water body. Moreover, the less oxygen demanding fishes (Shingi, Koi, Magur) float freely beneath the makhana covered wetland water. That is why, the households of peripheral villages records a major shifting of wetland based fishing occupation, which has been altered by makhana cultivation during last several years.

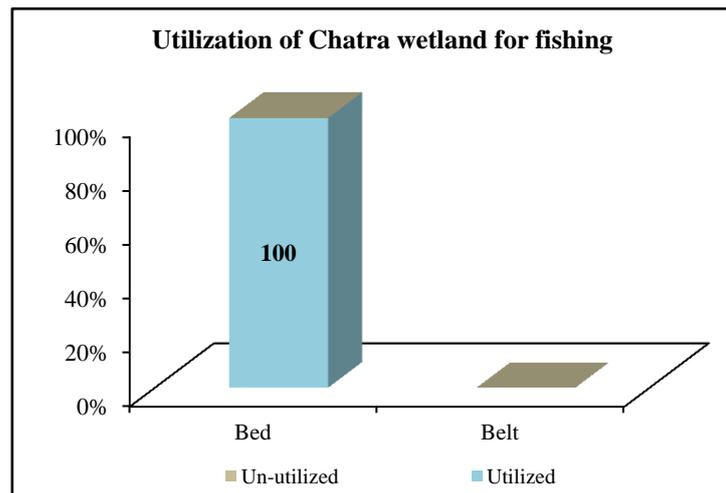


Figure 5.18 Utilization of Chatra wetland for fishing



Plate 5.24: Fish catch at Chatra wetland



Plate 5.25: Fish sold at Mokdumpur and Bichitra market



Plate 5.26: Teuthowenia pellucida (Gugli) collected and sold at Bichitra market. Malda



Plate 5.27: Duck rearing at Chatra wetland

#### **5.3.4.4 Wetland utilization for product gathering:**

Chatra wetland is mostly significant for the survival of diverse flora and fauna. Out of total surveyed households, 9 households (6.42%) (Table 5.17) (Figure 5.15) are engaged in gathering several wetland products throughout the year. The macrophytes, collected in the form of open water and water edge vegetation, include ghima, hatisur, hingcha, kalmi and kulekhara which constitute an indispensable component of wetland ecosystems as well as a principal source of food in the food chain of the aquatic animals and fish fauna. Among the available macrophytes the traditional uses of aquatic medicinal plants of thankuni, hingcha, kulekhara etc. are of immense potential. Chatra wetland is roofed with thick coverage of water hyacinth (Kachuripana), which is collected by the peripheral settlers as fodder. This fodder is considered a cheap source of food in order to reduce down the cost of feeding the cattle population, because the fodder available in the local market is quite expensive (Ramachandra et al., 2005). Apart from diverse fish composition, gugli (Plate 5.26), snakes and frogs are common, fed on shellfishes, leeches and other worms, insects etc. which are collected and sold in the local market, as well as supplement the household economy to some extent for the people living in the close proximity of this wetland. Furthermore, duck keeping and rearing is regularly practiced into Chatra wetland by adjacent households (Plate 5.27) and the duck eggs are sold to nearby Bichitra and Mokdumpur market. At the same time, this wetland also yields fuel wood for cooking and heating as well as provides food for the entire Malda town and has numerous socio-economic values attached to it.

#### **5.3.4.5 Economic valuation of wetland:**

Chatra wetland is considered an important source of economic sustenance especially for those households, who directly and indirectly utilize this water body. The wetland water is utilized substantially in order to irrigate 1.82 ha area, entirely under paddy cultivation. Apart from paddy, no other food crops are significantly found to be cultivated around this water body.

As per the household survey, Makhana is cultivated on 25.2 ha of the wetland bed on lease by Uttar Jadupur Gram Panchayat by a total 46 no. of households. The gross benefit of surveyed household is recorded Rs. 56,70,000.00 per annum, whereas the total cost in the form of labour cost (Rs. 1,89,000.00/annum) (for preparing makhana cultivating filed) and lease cost (Rs. 2,83,500.00/annum) is recorded Rs. 4,72,500. Therefore, the estimated net benefit from makhana cultivation within Chatra wetland is recorded Rs. 51,97,500.00 per annum (Table 5.21). As per the filed survey, apart from makhana cultivation, fish catching is

practiced in Chatra wetland by 12 no. of households, which accounts relatively less monetary value with an estimated benefit of Rs. 4,62,500.00 per annum (Total catch = 1850 kg/annum; market price Rs. 250.00/kg). Fish is not cultivated in Chatra wetland, primarily because; no fishing cooperative is in operation. Secondly, this water body is mostly dominated with makhana cultivation, which creates several complications and hindrances to simultaneous fish cultivation. That is why; the fish cultivation has drastically been declined during the last several years, which eventually leads to further economic loss. Moreover, this peri-urban water body holds good proportion of beneficiaries, to gather several aquatic products in the form of macrophytes and aquatic fauna, which accounts an estimated benefit of Rs. 76,500.00 per annum. Therefore, the total estimated benefit by utilizing Chatra wetland by the surveyed households is recorded Rs. 57,36,500.00 per annum (Table 5.21).

**Table 5.21 Economic valuation of Chatra wetland**

Sources of benefits and cost	Makhana cultivation
Gross benefit (Rs./annum)	56,70,000.00
Area under wetland cultivation (ha)	25.2
lease + labour cost (Rs./annum)	4,72,500.00
Estimated Net benefit (Rs./annum)	51,97,500.00
Sources of benefits and cost	Wetland fishing (fish catch)
Total catch (kg/annum)	1,850
Market price (Rs./kg)	250.00
Total benefit (Rs./annum)	4,62,500.00
Lease (Rs./annum)	0
Net estimated benefit from wetland fishing (Rs./annum)	4,62,500.00
Sources of benefits and cost	Wetland product gathering
Total income (Rs./annum/household)	8,500.00
No. of household gather wetland product	9
Total estimated benefit (Rs./annum) from product gathering	76,500.00
Total estimated benefit from wetland (Rs. /annum)	57,36,500.00

*Source: Field survey, 2016-17*

#### **5.4 Wetland potential as alternate economic support:**

The present study reveals that, the entire wetland resource of Malda district are of immense potential in order to provide alternate economic support to rural mass through generating gainful self-employment along with displaying a marvelous nutrient dynamics. These wetlands with their abundant biotic assemblage are potential to provide subsistence for a large number of inhabitants in the form of makhana (*Euryale ferox*), Paniphal (*Trapa natans*) and sola (*Aeschynomene aspera*) cultivation during monsoon and post-monsoon along with duck keeping and rearing. There is a scope in revenue generation by practicing makhana in a vast area of the wetlands under *Tal* and *Diara* region, which is associated with numerous economic benefits. Moreover, Makhana cultivation plays substantial role in the local socio-economy in the form of having nutritional value and medicinal importance, whose calorific value compares well with the staple food materials such as wheat, rice, etc. During field study, small distribution of sola, a little branched stout herb has been observed and identified in several wetlands under *Diara* region, which contains significant potentialities in providing nitrogen input in soil in order to enhance the agricultural productivity (especially rice). The green manure with sola is presently recognized as the most efficient way to transform the biologically fixed nitrogen into soil (Devi, 2013). Furthermore, sola is potential in order to provide indigenous handicrafts, which occupy a unique position in India's heritage of handicrafts (Mandal et al., 2014). Moreover, paniphal can commercially be cultivated within wetlands under study as edible fruits which are potential to provide alternate economic return on a sustainable basis to the rural mass of Malda district. Apart from cultivation and fishing, duck rearing within the wetlands, under study contributes to the rural livelihoods as an important part in the agricultural economy. The potentials of duck farming can be tapped to alleviate poverty among the rural communities in and around wetland. Furthermore, the potent duck rearing and farming also provide manure in order to improve the soil fertility of agricultural lands (Jha & Chakrabarty, 2017).

#### **5.5 Conclusion:**

The present chapter is focused on the socio-economic valuation and aesthetic importance of wetlands under study. Given their importance for ample water supply and food production, wetlands are considered a principal element for achieving the goals of poverty alleviation in this less developed district of West Bengal. Moreover, the wetlands under study have the potentiality in order to provide alternative economic support to the rural people through generating gainful self-employment. The use of wetlands are dynamic in nature,

which vary with space (e.g., across different physiographic zones) as well as time (e.g., across different seasons). The wetland utilization also changes across years depending upon the interest and capability of the stakeholders (*Das et al., 2015*). In the present study, it is clearly evident that in spite of having potential influence of all the economic activities on wetland's ecology, it seems to be very dangerous for the survival of this ecosystem (*Irrinki & Irrinki, 2006-07*). The economic and ecological functioning of these wetlands differs considerably, which may be attributed to economic, social as well as political pressure from dominant stakeholders. Wetlands in Malda district have already been affected by ever increasing human induced pressures, engineered by over exploitation of wetland resource, intensive agricultural and aquaculture, which eventually lead to increased loads of pollutants and disinfectants and several conflicting land-use practices. Despite the importance of the range of resources and services which wetland provides, inadvertence over the years and anthropogenic squeezes pose serious menace to the survival of this precious ecosystem. The most important threat arising from man induced willful pressures in the form of indiscriminate and unjust conversion of wetlands for cultivation, human habitation as well as over exploitation of wetland water and associated wetland products and other resources. But even as apathy and ignorance continue to permit conversion of wetlands, people are becoming increasingly aware of the loss of the services, which wetlands once provided free of charge (*Dugan, 1994*). Therefore, the wetlands under study area should immediately be conserved by ensuring their wise use where the sustainability of wetland is of prime importance. Therefore, addressing meaningful strategies, considering the present ecological condition of this aquatic ecosystem, people's participation and the role of non-governmental, educational and governmental organizations is required for the restoration, conservation and sustainable management of entire wetland resources of Malda district.

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