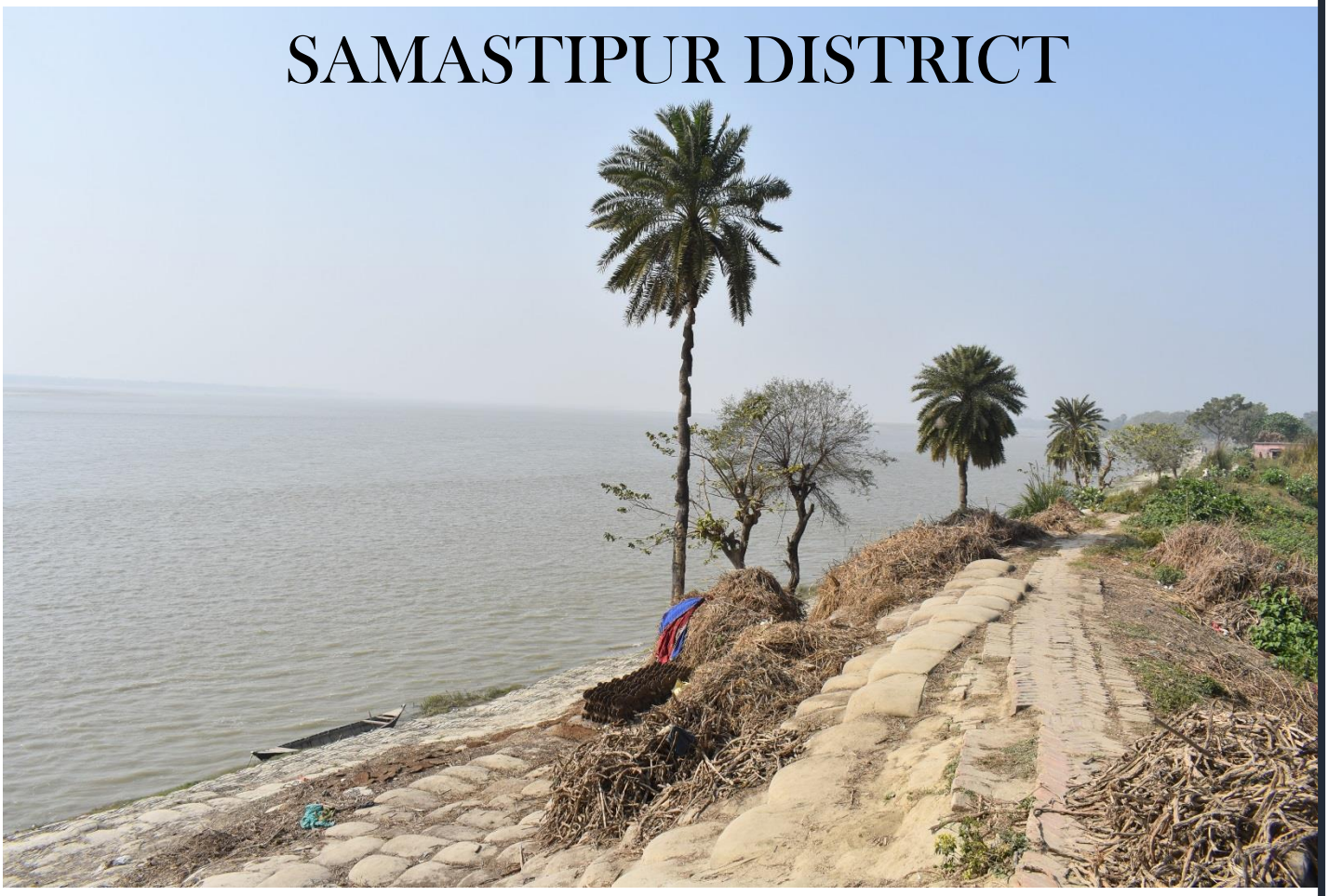
Ganga Cultural Documentation
2020

SAMASTIPUR DISTRICT



NAMAMI GANGE

National Mission for Clean Ganga

INTACH

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Front Cover:	Ganga river bank near Patthar Ghat
Background:	Ganga river as seen near Dharni Patti East Village
Back cover:	Mustard fields near Raspur Patasia village
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GANGA CULTURAL DOCUMENTATION

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December, 2020

Sponsored by :

National Mission for Clean Ganga

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Contents

List of Images

List of Tables

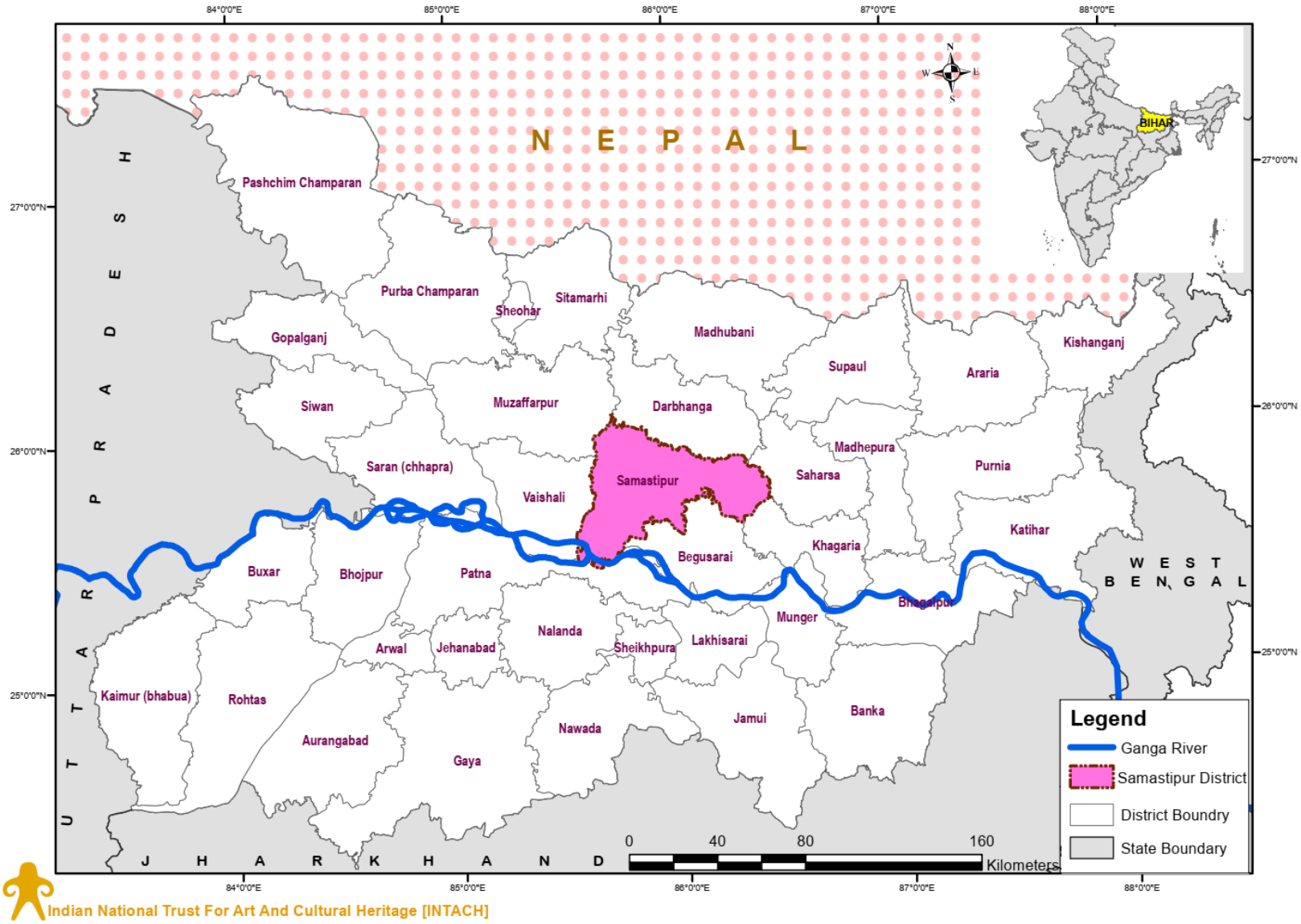
List of Maps

1.0 Introduction

1.1 Samastipur Distt. is one of the thirty-eight districts of Bihar state with its headquarters being at Samastipur town. It was earlier a sub-division of Darbhanga Distt. but was carved out as a separate Distt. on 14 November, 1972. Spread over an area of approximately 2624.82 sq. kms., the Distt. is bound on the north by the Bagmati river which separates it from Darbhanga district, on the west by Vaishali and some part of Muzaffarpur districts, on the south by the Ganges, and on the east by Begusarai and some part of Khagaria Districts [Map 1]. Currently, the Distt. comprises of 4 sub-divisions and 14 community development blocks.

1.2 The Distt. is part of the great Ganga basin with the Burhi Gandak and Ganga constituting the principal drainage of this region. The climate of this Distt. is characterized by semi-arid to sub-tropical climate with the maximum temperature varying from 21.2˚C to 36.5˚C. Physiographically, the Distt. has almost a flat topography with the general elevation varying from 40-42 mamsl. Samastipur comes under the agro-ecological zone-I of the Bihar state i.e. North-West Alluvial plains and is noted for its fertile alluvial soil which supports good cultivation of different crops (CGWB, 2013).

"After a temporary period of instability, Darbhanga came under the control of the Oinwaras (1325-1525 AD), also known as the Kameshwara Thakur or Sugauna Dynasty. These Hindu Chiefs were left undisturbed by the Muslim conquerors, who has by now conquered the whole of Mithila and whose exploits are indicated. The Oinwara Dynasty is noted for their encouragement of leaning and fine arts and their court served as the centre of Sanskrit belle's letters and philosophy. Among the prominent scholars of age were Gadadhara, Sankara, Vachaspati Mishra, Vidyapati, Amartakara and Amiykara. Kameshwara, the founder of dynasty, was resident of village Oini, near Pusa Road, in the District of Darbhanga. When Hazi Ilyas of Bengal divided Tirhut into two parts, the Oinwara Raja shifted his Capital to Sugauna near Madhubani. The southern part of the district was under Hazi Ilyas and the northern part under the Oinwaras. The modern subdivision of Samastipur (originally Shamsuddinpur) was founded by Hazi Shamsuddin Ilyas of West Bengal." (https://samastipur.nic.in/about-district/history/)



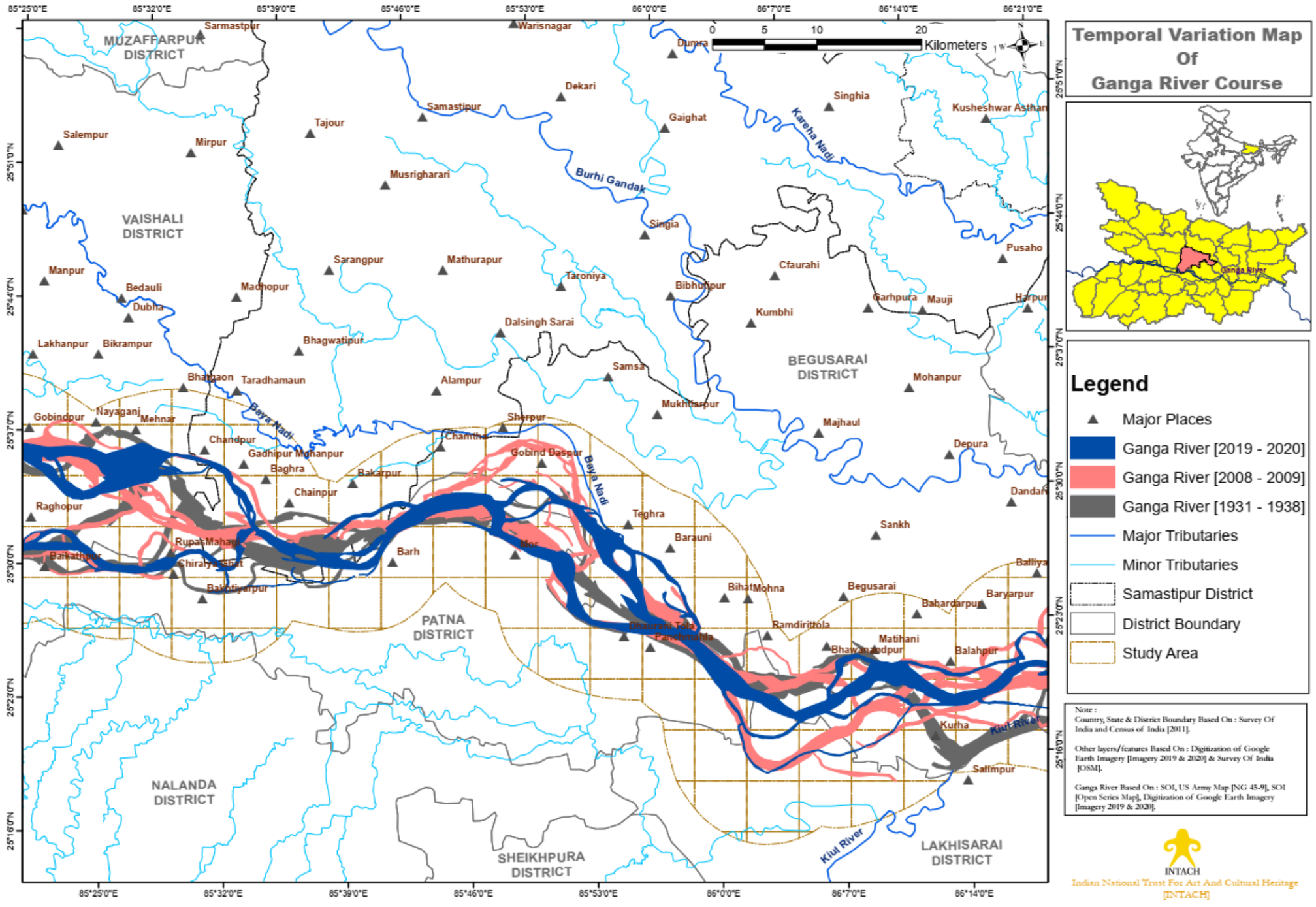
Indian National Trust For Art And Cultural Heritage [INTACH]

Map 1 : Location Of Samastipur Distt.

2.0 Ganga River In Samastipur

2.1 Ganga River enters Samastipur Distt. just after it passes Baba Ganninath temple in Hasanpur village of Vaishali Distt. For a short distance at this place, it flows as one of the two Ganga river braids bifurcated by Raghopur *diara*. Thereafter, a little further downstream of Kutubpur village, both these separated braids merge together and flow as a single river stem through the rest of this Distt. The river flows for approximately 19.5 kms in this Distt. It encompasses a small *diara* in the stretch along Sultanpur and Raspur Patasia before exiting Samastipur and entering Begusarai Distt. Image 1 depicts the Ganga river flow as observed from Patthar Ghat while Map 2 depicts the temporal changes in Ganga river flow in Samastipur Distt.

Image 1 : Ganga River As Observed From Patthar Ghat On 18th December 2020

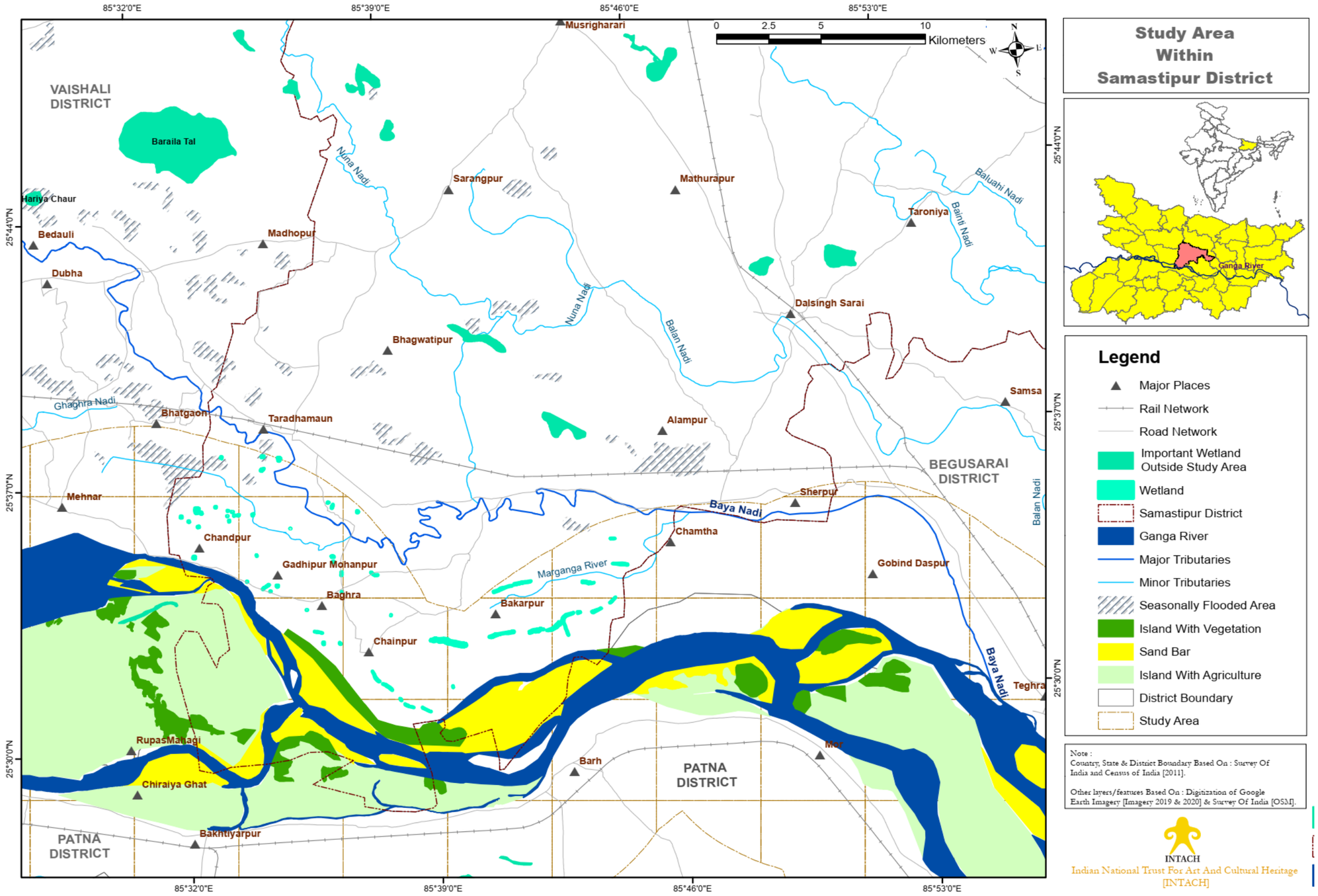


Map 2 : Temporal Variation Of Ganga River Course In Samastipur Distt.

3.0 Methodology

3.1 Ganga River flows in Samastipur Distt. for about 19 kms adjoining it mostly on the left bank. Hence, for carrying out the ground survey a 7 km of buffer zone on the left bank of Ganga River was selected encompassing a total area of 234.69 sq.km. The selected study area was further divided into grids of 5 × 5 km for field survey [Map 02]. Based on the secondary information analyzed and the features noted on Google Earth imagery, plan for the fieldwork was constituted to cover different elements of natural heritage in these grids. Special focus was laid on denoting the sites important for riparian biodiversity, riverine fishing, boat making communities, river and stream confluences, important water bodies and oxbow lakes. Furthermore, contacts were developed with various stakeholders including riparian & *Diara* communities in the Distt. for carrying out relevant interactions.

3.2 The field survey in Samastipur Distt. was undertaken from 18-21 December, 2020. During the survey, areas such as Chandpur, Mohanpur, Hetanpur, Kutubpur, Raspur Patasia, Bishanpur and Mohiuddinagar were visited where good quality pictures related to the study were collected using Nikon D3400 DSLR camera. The GPS locations were also collected using Garmin hand-held GPS and videography at the study sites was done using Sony Handycam. The plants observed in the survey were identified based on available handbooks and online databases while the birds observed in the survey were identified using Grimmett et al. (2011). The information on current status of Ganga river and changes from the past was obtained from detailed interactions with different stakeholders such as agriculture and cattle farmers, temple priests, village heads, fishermen, boatmen, etc.



Map 3 : Study Area In Samastipur Distt.

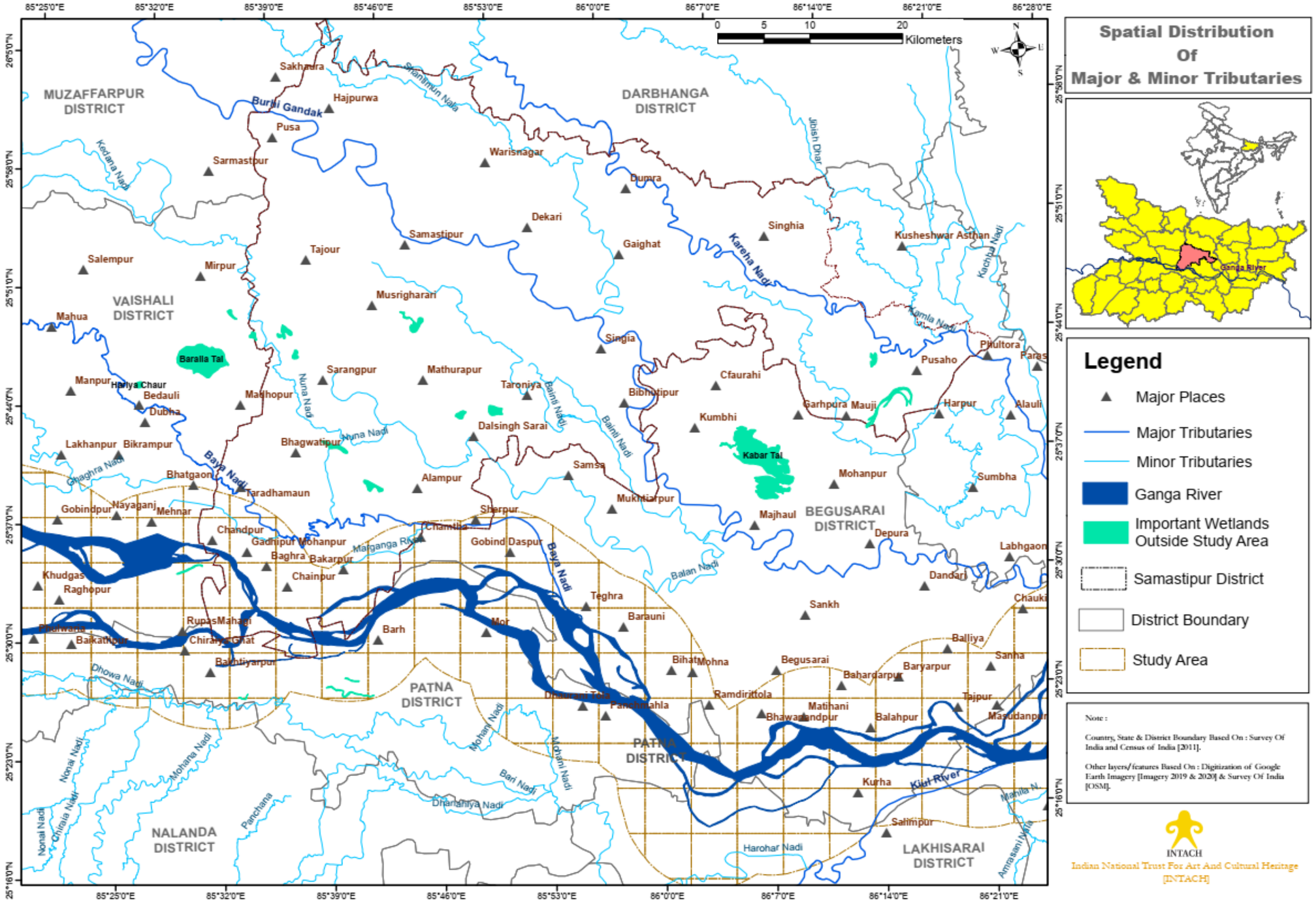
4.0 Tributaries Of Ganga River

4.1 **Baya River :** The river Raghua off takes from the Sarotar *chaur* in East Champaran district meets the Mekhwa river near village Murmala, just before entering Muzaffarpur district beyond which it is known as the **Upper Baya River**. It flows further in a south-east direction. After flowing about 25 km it is joined by the **Jhajha River** near Fatehabad in Muzaffarpur district on its left bank. It travels further in south east direction and enters Vaishali district near Saraiya village. Flowing further in same direction, it enters into Samastipur District near Sahpur Patori and crosses the Hazipur-Bachwara-Barauni NE Railway. Before entering Begusarai district near Bachhwara, it is joined by the river Ghaghra on its right bank after which it turns to south and joins the left bank of the river Ganga near Semaria Ghat. The river Baya flows between the Gandak river basin on the right side and the Burhi Gandak basin on the left side with its northern boundary as Burhi Gandak basin and southern boundary as the main Ganga river (NWDA, 2004).

4.2 Until few decades ago, the river was filled with water almost throughout the year which was extensively used by the local communities for fishing and irrigation purposes. However, with the passage of time, increasing anthropogenic factors and neglect have impacted the water flow and depth of this important river (Dainik Bhaskar, 2018). However, during monsoons this river along with Gandak and Ganga swell with water often causing floods in Vaishali, Samastipur and Begusarai distts. Due to this, the Govt. of Bihar along with National Water Development Agency prepared a DPR for interlinking the Gandak, Noon, Baya and Ganga rivers in order to protect the flood prone districts in this part of the state (PTI, 2014). During the survey in Samastipur Distt. Baya river flow was seen near Nawada town where some local residents were involved in fishing using fine-sized nets spread across the river [Images 2-3]. The course of Baya river through the study region can be observed from Map 03.

Image 2 : Baya River Flow With Wild Vegetation On Its Banks As Observed Near Nawada Town In Samastipur Distt. On 19th December, 2020

Image 3 : Fishing Activity Observed In Baya River Near Nawada Town In Samastipur Distt.



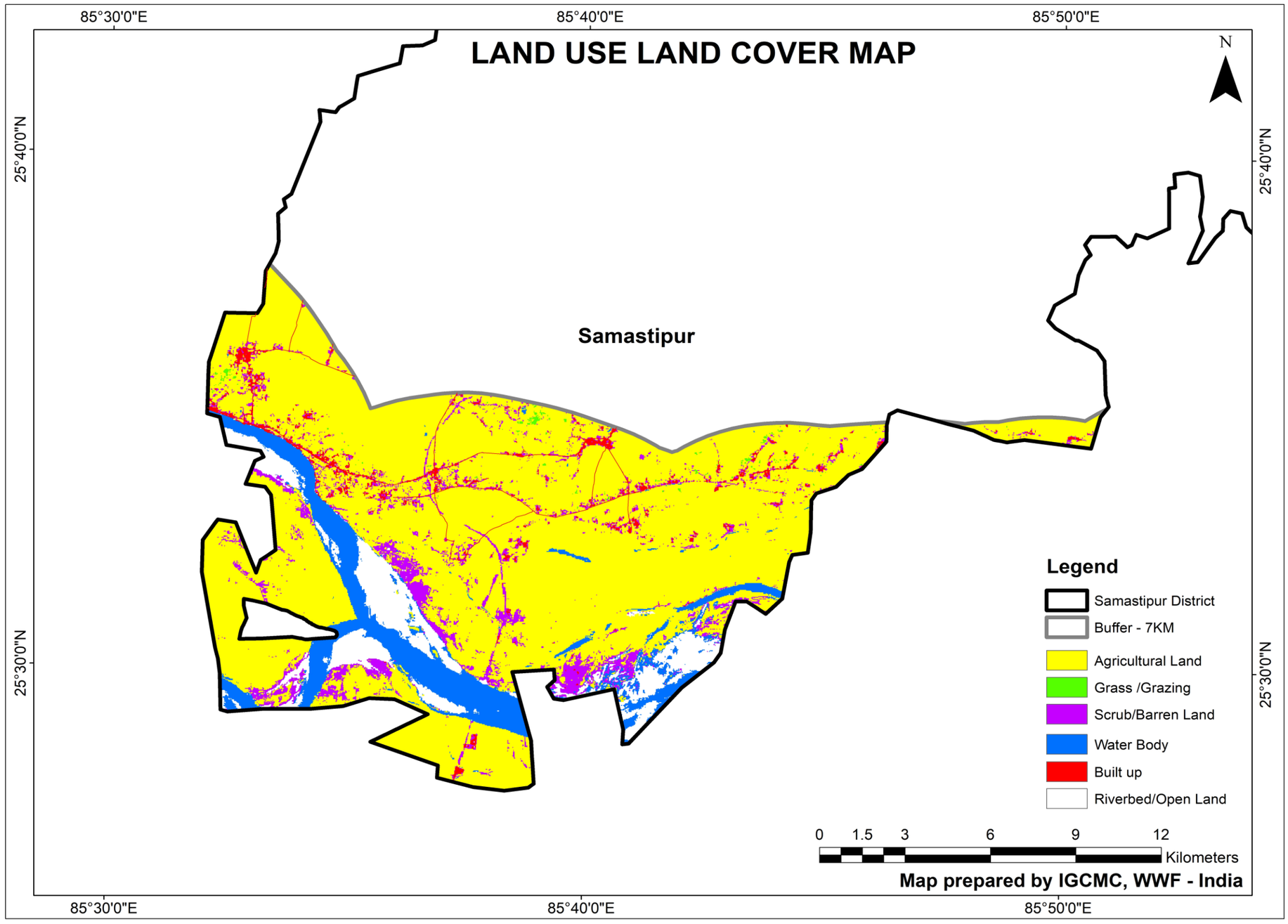
Map 4 : Spatial distribution of major and minor tributaries of Ganga river in the study region

5.0 Land use/Land cover

5.1 Land Use Land Cover (LULC) Map of the study corridor has been prepared from Landsat imagery. Using supervised classification system, 6 different classes were generated – agricultural land, grass/grazing, scrub/barren land, water bodies, built up area and river bed/open land. Agriculture is principal source of income for the local residents in Samastipur Distt. owing to which the agricultural land was found to be dominating the land use with total coverage area of 176.711 sq.km. (forming just more than 75% of the total area of study region). In contrast, the built-up area covered only 4.136 sq.km. (forming about 1.763% of the total study region) which comprised of places such as – villages alongside the main road connecting Hasanpur in Vaishali with Mohiuddinagar in Samastipur, Sultanpur, Jaunapur and Bishanpur. The scrub/barren lands covering an area of 15.380 sq.km. in the study region mainly comprised of dried and exposed Ganga river banks along with parts of Raghopur *diara* which are under water during monsoons and remain exposed during rest of the year. The details of these classes in terms of area covered are presented in Table 1 and the land use of the Distt. is depicted in Map 4.

Table 1 : Land Use/Land Cover Details Of the study region in Samastipur Distt.

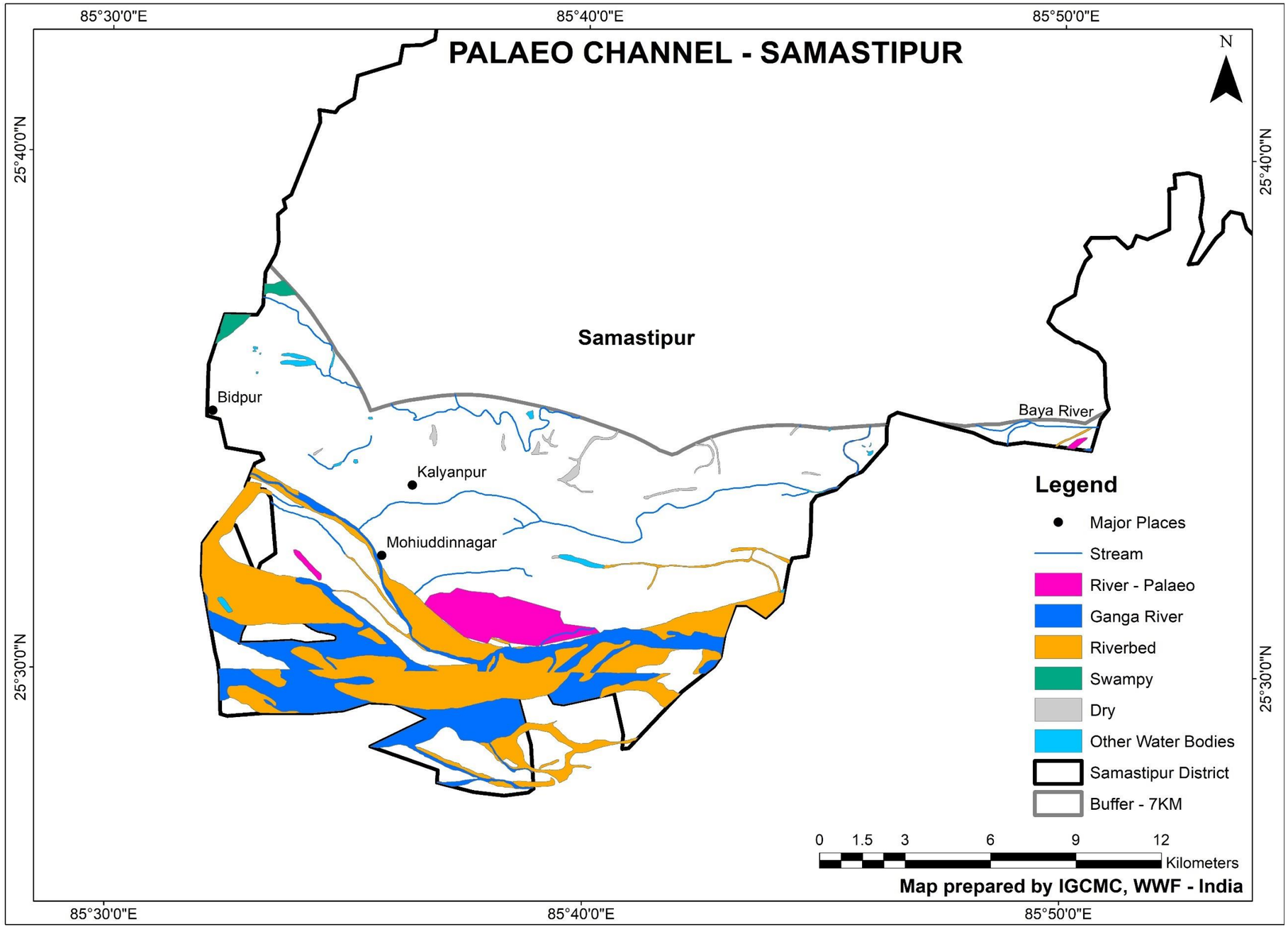
7 Km Buffer - Ganga River (Samastipur)			
Class	**Area (Ha)**	**Area (Sq.Km.)**	**Area (%)**
Agricultural Land	17671.100	176.711	75.295
Grass/Grazing	51.509	0.515	0.219
Scrub/Barren Land	1537.990	15.380	6.553
Water Body	2137.531	21.375	9.108
Built up	413.646	4.136	1.763
River Bed/Open Land	1657.440	16.574	7.062
Total	**23469.216**	**234.692**	**100.000**



Map 5 : Land Use/Land Cover Map Of Study Region In Samastipur Distt.

6.0 Palaeochannels of Ganga river

6.1 Decline in natural flow of a River or stream decreases the sediment flushing ability of the Rivers. It may be a reason behind the disappearing of River channels in the Ganga River basin. Apart from that various other factors such as change in land use pattern, sand mining, agricultural practices and brick kilns may also lead to disappearance of streams and river channels in the region. These palaeochannels do not carry water during most of the year but may flow during flood events. Such abandoned and silted palaeochannels of the past can be mapped using the remote sensing techniques. Hence, based on the available satellite data and subsequent remote sensing analysis, Map 6 was prepared which depicts the various paleochannels in the study region of Samastipur Distt.



Map 6 : Palaeochannels In The Study Region

7.0 Floodplain of Ganga River in Samastipur Distt.

7.1 The active flood plain of a river is defined as an area on either side of the river channel with regular flooding on a periodic basis. Maintaining active flood plain of a river is critical for assuring equilibrium in ecosystem. The floodplains harbour rich biodiversity including riparian vegetation as well as many other groups of organisms which help in maintaining fertility of this region. Along with this, the floodplains have been of great cultural and economic importance with many early civilizations having risen in these fertile lands. As the rivers naturally meander through the landscape over a period of time, they deposit sand, silt and other soil forming materials in the floodplain region which make them ideal for agricultural production. Throughout history, people have learned to cultivate in the fertile floodplains and use their rich resources for sustaining livelihoods. Even today, in most of the riverine regions especially in India, the floodplains have been occupied by local farmers for carrying out their agricultural activities especially in the non-monsoon season. Ganga River floodplain is one such important floodplain in India which has been extensively utilized in almost all the districts, where it passes through, for agricultural purposes.

7.2 Samastipur Distt. falls under the North West Alluvial Plain Zone according to NARP (National Agricultural Research Project) with the major soils being calcareous fine loamy, calcareous fine silty, coarse loamy and very fine cracking soil. Agriculture is one of the major sources of income for the residents of the Distt. and it is benefitted by the fertile alluvium brought by Ganga river and its tributaries. Similar to Vaishali Distt., large areas of Ganga floodplain in Samastipur Distt. were under cultivation round the year as is also evident from Map 5. During the survey, mustard was recorded as the major crop grown [Image 4] owing to the high demand for mustard seed oil which is an important component of every household diet in this region. Along with this, wheat cultivation was also practised more here while rice was grown occasionally. This floodplain fields in Samastipur are also an important stretch for vegetable and fruit crops such as onions, gourd, parwal, cucumber, cauliflower, potato and watermelon [Image 5]. The details of some villages surveyed along with their floodplain agricultural produce is provided in Table 2.

Image 4: Mustard Cultivation on Floodplain Near Bishanpur Village

Image 5 : Potato Cultivation on Floodplains near Sultanpur Village in Samastipur

Table 2 : Some Floodplain Villages Along With Their Agricultural Produce In Samastipur Distt.

Sr. No.	Village Name	Agricultural Produce
1.	Raspur Patasia	Mustard, Wheat, Potato, Onion, Parwal
2.	Sultanpur	Mustard, Wheat, Potato, Cauliflower, Watermelon
3.	Bishanpur	Mustard, Wheat, Tur Dal, Cabbage, Parwal
4.	Kutubpur	Mustard, Gourd, Cucumber
5.	Hetanpur	Mustard, Wheat, Potato, Cauliflower

7.3 **Floodplain Horticulture :** Banana is an important horticulture produce of the Ganga river floodplain region in Samastipur Distt. with the major varieties found here being Chinia, Alpan, Battisa and Kothiya. While Chinia and Alpan are well-known in the region for their small, sweet and tasty fruits, Kothiya variety is believed to be rich in Iron and other minerals due to which it is especially given to pregnant ladies and patients recovering from various ailments. The Battisa variety of banana is mainly used in its raw form as a vegetable as its ripened fruits are not found to be as tasty as the other varieties [Image 6]. However, the extent of fields under banana cultivation and the crop productivity is lower in the study region when compared to that of Vaishali Distt.

Image 6 : Battisa Banana Variety Seen Near Bishanpur Village

7.4 **Floodplain Grasses :** The two most common floodplain grass species found distributed throughout the study region are – *Saccharum spontaneum* L. and *Saccharum bengalense Retz.* (commonly known as *Kattha* or *Kaans*) [Image 7]. Both these grasses are tall, perennial grasses growing widespread in river bank and floodplain areas of Ganga in the study region. Upon interaction with the locals, it was found that these grasses in the dried form were commonly used for thatching roofs of huts and other temporary settlements throughout.

Image 7 : *Saccharum Spontaneum* Observed Near Patthar Ghat

8.0 Wetlands in Samastipur Distt.

8.1 Wetlands are one of the most productive and unique ecosystems. They help in maintaining the food web and provide habitat for the aquatic biodiversity. They also help in controlling floods, recharging groundwater, nutrient recycling, climate stabilization and carbon sequestration. In this study a total of 57 different wetlands were identified in the study region with the help of Google imagery and satellite data out of which some selected wetlands are discussed in this section. The list of identified wetlands is presented in Table 3 and their spatial distribution is depicted in Map 7.

Table 3 : List of wetlands recorded in the study region

Sr. No.	Wetland Name	Coordinates		Area [in hectares]
		Latitude	Longitude	
1.	01	25°37'31.92"N	85°33'43.76"E	0.39
2.	02	25°36'12.63"N	85°32'55.34"E	2.38
3.	03	25°36'7.04"N	85°32'55.04"E	1.40
4.	04	25°36'5.43"N	85°33'2.06"E	0.48
5.	05	25°36'2.25"N	85°32'27.90"E	0.80
6.	06	25°35'54.01"N	85°32'39.73"E	0.40
7.	07	25°34'56.74"N	85°32'43.95"E	1.38
8.	08	25°36'13.68"N	85°33'27.06"E	0.46
9.	09	25°37'27.66"N	85°34'53.74"E	1.12
10.	10	25°35'57.08"N	85°34'29.17"E	0.60
11.	11	25°34'1.66"N	85°34'41.23"E	1.25
12.	12	25°33'53.85"N	85°34'48.24"E	0.23
13.	13	25°34'1.47"N	85°35'0.17"E	0.77
14.	14	25°35'44.62"N	85°32'55.34"E	0.60
15.	15	25°36'4.07"N	85°33'54.91"E	0.35
16.	16	25°35'57.66"N	85°33'57.53"E	0.31
17.	17	25°35'57.78"N	85°33'45.78"E	0.27
18.	18	25°35'57.49"N	85°34'4.17"E	0.55
19.	19	25°37'6.81"N	85°34'51.19"E	1.25
20.	20	25°34'52.05"N	85°34'29.96"E	0.21
21.	21	25°37'21.42"N	85°35'20.59"E	1.88
22.	22	25°35'30.80"N	85°35'30.57"E	0.15
23.	23	25°33'20.24"N	85°35'47.05"E	0.16
24.	24	25°32'43.71"N	85°36'3.37"E	1.13

25.	25	25°32'25.07"N	85°36'10.24"E	0.68
26.	26	25°34'32.89"N	85°36'38.38"E	0.35
27.	27	25°34'40.88"N	85°36'37.83"E	0.91
28.	28	25°35'58.94"N	85°36'43.77"E	0.90
29.	29	25°36'6.99"N	85°36'37.79"E	0.30
30.	30	25°33'44.60"N	85°36'47.73"E	0.10
31.	31	25°32'23.02"N	85°36'38.52"E	052
32.	32	25°34'12.61"N	85°36'50.08"E	0.99
33.	33	25°35'48.81"N	85°37'25.77"E	0.70
34.	34	25°34'6.83"N	85°37'45.61"E	1.18
35.	35	25°31'23.38"N	85°37'33.93"E	2.95
36.	36	25°33'1.45"N	85°38'8.06"E	0.14
37.	37	25°31'9.28"N	85°37'52.47"E	2.87
38.	38	25°30'47.12"N	85°38'12.82"E	0.53
39.	39	25°30'36.76"N	85°38'23.19"E	1.17
40.	Chapar Jheel	25°32'12.17"N	85°39'44.34"E	29.6
41.	41	25°30'28.40"N	85°38'55.17"E	1.16
42.	42	25°31'1.96"N	85°39'42.38"E	0.20
43.	43	25°33'29.42"N	85°41'18.03"E	5.40
44.	44	25°33'36.52"N	85°41'53.18"E	4.63
45.	45	25°32'17.71"N	85°41'11.93"E	8.52
46.	46	25°32'19.38"N	85°42'8.93"E	5.92
47.	47	25°32'21.59"N	85°42'43.29"E	6.92
48.	48	25°32'42.01"N	85°43'24.08"E	0.82
49.	49	25°32'32.00"N	85°42'57.00"E	7.77
50.	50	25°33'29.22"N	85°43'42.35"E	3.00
51.	51	25°32'57.96"N	85°44'23.96"E	1.36
52.	52	25°33'52.96"N	85°44'42.99"E	4.47
53.	53	25°32'42.37"N	85°43'53.20"E	2.43
54.	54	25°34'34.96"N	85°44'31.43"E	0.84
55.	55	25°35'50.03"N	85°33'48.20"E	0.42
56.	56	25°36'6.25"N	85°33'47.55"E	0.24
57.	57	25°34'12.16"N	85°34'9.88"E	0.17

8.2 **Bhabbakkar Khan Pokhara:** This pond is situated in the Hetanpur village of Samastipur Distt. closer to Mahnar-Mohiuddinagar road [Image 8]. Upon interaction, it was recorded that this govt. owned water body was leased out to a local resident belonging to Mallah community for rearing fish such as rohu, katla and buari. The pond was surrounded by trees such as Acacia sp., *Borassus flabellifer* (Tad) and Bamboo which was maintained by the local residents for its aesthetic value [Image 9]. The local residents reiterated that if proper garbage disposal facility and a small Ghat was provided by the local authorities, it would add to further beautification of this pond along with ensuring its better conservation.

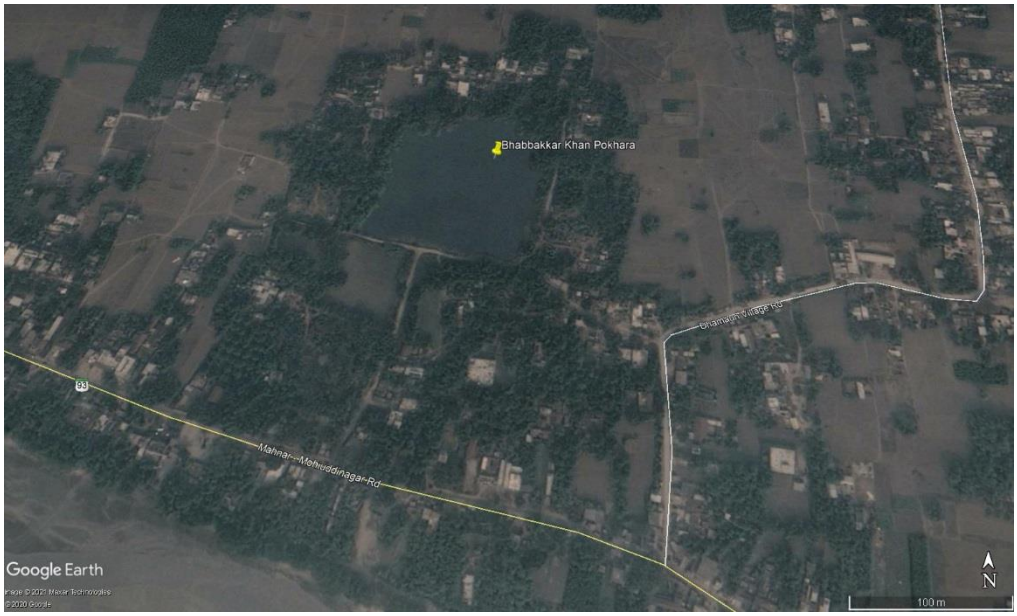


Image 8 : Location Of Bhabbakkar Khan Pokhara [25°34'57.29"N, 85°32'45.11"E]

Image 9 : Bhabbakkar Khan Pokhara Surrounded By Lush Vegetation

8.3 **Mohiuddinagar Oxbow Lake:** This oxbow shaped lake is situated in Mohiuddinagar town close to the Barauni road [Image 10]. According to the local residents, this lake receives water from a tributary of Baya river flowing close by and remains filled during monsoon and post monsoon season while dries up during summer months. Parts of this lake were covered extensively by the growth of water hyacinth (*Eichhornia crassipes*) indicating pollution caused by various factors including dumping of garbage and sewage inflow from nearby settlements [Image 11]. The water from this lake was mainly used by the residents nearby for washing their clothes/utensils and bathing. Apart from this, some local residents were also involved in fishing from this lake with the major fish caught being Singhi (*Heteropneustes fossilis*), Buari (*Wallago attu*) and Channa (*Channa* sp.). The seedlings of buari fish were usually obtained from Ganga river and introduced into this water body. Most of the fish collected here was sold in the town market for consumption by local residents.

Image 10 : Location Of Mohiuddinagar Oxbow Lake

Image 11 : Mohiuddinagar Oxbow Lake With A Part Of It Covered By Water Hyacinth

8.4 **Chapar Jheel:** Spread in an area of about 29.6 hectares with a 4,480m perimeter, Chapar Jheel is an important wetland situated in the Ganga river floodplain region near Bishanpur village of Samastipur Distt. [Image 12]. Not only does this Jheel provides water resource for household activities but is also an important source of irrigation for the farmers residing and practising agriculture in its vicinity. Mustard was found to be a major crop cultivated in the fields surrounding this Jheel [Image 13]. Apart from this, Chapar Jheel is also an important site for Chhath puja rituals which is a major festival of Bihar state. On this occasion, residents from Bishanpur along with couple of other villages in nearby areas gather here to bathe and offer prayers to the Sun God. They also immerse statues and other religious materials during occasions such as Durga puja [Image 14]. This Jheel is also leased out to a local resident for fish rearing with the major fish caught here being rohu (*Labeo rohita*), bachwa (*Eutropiichthys vacha*) and naini (*Cirrhinus mrigala*) which are all introduced into this wetland from Ganga river. One important observation at Chapar Jheel was the rich abundance of water birds such as Red crested pochard, Common pochard, Tufted duck, Little cormorant and White-throated Kingfisher [Image 15]. However, when interacted further with the local residents, some of them reiterated that the water birds are hunted for their meat by few people mainly including those involved in fish rearing and fish catching in this region.

Image 12 : Location Of Chapar Jheel

Image 13 : Chapar Jheel Surrounded By Mustard Cultivation

Image 14 : Immersion Of Statues In Chapar Jheel

Image 15 : Abundance Of Water Birds In Chapar Jheel [December, 2020]

9.0 Riparian flora

9.1 The riparian areas, lying between the aquatic and the terrestrial habitats, serve as functional interfaces within the landscapes, mediating energy and matter between these two ecosystems. With dynamic environmental conditions and ecological processes, these areas tend to harbor rich biodiversity. A major component of this biodiversity is the plant communities growing along the river bank which are interacting with both terrestrial and aquatic ecosystems. The riparian vegetation is significant in the overall ecology and environmental aspects of the region owing to its important roles in soil conservation, harboring faunal diversity and providing livelihood resources (Groffman *et al.*, 1990; Castelle *et al.,* 1994).

9.2 Till recently, no systematic sampling had been undertaken or record had been maintained for the riparian plant diversity all along Ganga river. There are however, some scattered but significant works of Pallis (1934), Auden (1941), Sahai (1953), Gupta (1960), Bhattacharyya and Goel (1982), Groffman *et al.* (1990), Krishanmurti (1991), Castelle *et al.* (1994), Shyam (2008), Gangwar and Joshi (2006) and Gangwar and Gangwar (2011) which have explored the biodiversity of Ganga river basin. Also, a detailed study published in the form of a book titled – "The Ganga – A Scientific Study" edited by Krishnamurti (1991) documents 475 riparian plant species from Rishikesh to Chinasura. Some earlier researchers have reported the presence of 7 shrubs, 41 herbs, 6 grasses and 2 sedges along with a number of tree species from Buxar to Barh stretch of Ganga river during 1987-88 (Kumar, 2001).

9.3 Barring few areas, the riparian vegetation along Ganga river stretch in Samastipur Distt. was more or less sparse comprising of only few species of trees, herbs, shrubs and grasses many of which were similar to that of Vaishali Distt. Only in some areas such as the river stretch along Patthar Ghat, significant growth of trees was observed, most of which had been planted there mainly to control severe bank erosion [Image 16]. The tree diversity in the study region mainly included – Peepal (*Ficus religiosa*), Teak (*Tectona grandis*), Tad (*Borassus flabellifer*) and Semal (*Bombax ceiba*). The list of riparian flora species recorded in the survey is presented in Table 4 and some of the notable species are depicted in Images 17-18.

Image 16 : Riparian Vegetation along Patthar Ghat in Samastipur

Table 4 : Riparian species recorded in the study region

Sr. No.	Botanical Name	Common Name	Family	Habit
1.	*Acacia nilotica* (L.) Delile	Babool	Fabaceae	Tree
2.	*Azadirachta indica* A. Juss.	Neem	Meliaceae	Tree
3.	*Bombax ceiba* L.	Semal	Bombacaceae	Tree
4.	*Borassus flabellifer* L.	Taad	Arecaceae	Tree
5.	*Dalbergia sissoo* DC.	Shisham	Fabaceae	Tree
6.	*Ficus benghalensis* L.	Banyan tree	Moraceae	Tree
7.	*Ficus religiosa* L.	Peepal	Moraceae	Tree
8.	*Mangifera indica* L.	Aam	Anacardiaceae	Tree
9.	*Phoenix dactylifera* L.	Khajur	Arecaceae	Tree
10.	*Tectona grandis* L.f.	Teak/Saagwan	Lamiaceae	Tree
11.	*Calotropis gigantea* (L.) Dryand.	Safed Aak	Apocynaceae	Shrub
12.	*Datura metel* L.		Solanaceae	Shrub
13.	*Lantana camara* L.		Verbenaceae	Shrub
14.	*Polygonum glabrum* Willd.		Polygonaceae	Shrub
15.	*Ricinus communis* L.	Arandi	Euphorbiaceae	Shrub
16.	*Ageratum conyzoides* L.	Jungli Pudina	Asteraceae	Herb
17.	*Croton bonplandianus* Baill.	Ban Tulsi	Euphoriaceae	Herb

18.	*Parthenium hysterophorus* L.	Congress grass	Asteraceae	Herb
19.	*Saccharum spontaneum* L.	Kans/Katha	Poaceae	Grass
20.	*Saccharum bengalense* Retz.	Kans/Katha	Poaceae	Grass
21.	*Bambusa bambos* (L.) Voss	Indian thorny bamboo	Poaceae	Bamboo Grass

Image 17 : *Croton bonplandianus* (Ban Tulsi)

Image 18 : *Ageratum conyzoides* (Jungli Pudina)

10.0 Faunal Diversity In Samastipur Distt.

10.1 **Gangetic Dolphin :** The Gangetic River Dolphin is exclusively aquatic and piscivorus, occasionally found in small groups. It is one of the three freshwater dolphin species in the world and is distributed in the Ganga–Brahmaputra–Meghna and Sangu–Karnaphuli River systems in India, Nepal, and Bangladesh (Sinha & Kannan, 2014). It has been declared as the National Aquatic Animal by Govt. of India (Sinha & Kannan, 2014) and is classified as 'Endangered' in the IUCN Red List owing to the decrease in its population in the last 3-4 decades. A detailed census of this endangered species was conducted by a multi-institutional team in 2018 which revealed the occurrence of 300 dolphins in Ganga river stretch from Buxar to Mokama and 700 dolphins in Ganga river stretch from Mokama to Maniari in Bihar state (Ranjan, 2019).

10.2 The sightings of Gangetic dolphins were observed almost throughout the Ganga river stretch in Samastipur Distt. Among the various sites, special mention is to be made about the river stretch between Hetanpur and Kutubpur villages where maximum dolphin sightings were recorded. During an hour-long observation at a river bank site [25°33'29.96"N, 85°34'20.39"E] near Patthar Ghat in this stretch, about 50-60 Nos. of sightings with 8-10 different individuals including full grown adults and baby dolphins were recorded. **This was the most preferred site for dolphins in the entire stretch and can be successfully termed as a 'Dolphin Hotspot' in the region.** One of the dolphins photographed in this region is depicted in Image 19.

Image 19 : A Gangetic Dolphin Photographed Near Patthar Ghat In Samastipur Distt.

10.3 Upon interacting with some local fisherfolk, they too reiterated similar observations and attributed this to factors such as appropriate depth of river, availability of water during most of the year and availability of food resources for the dolphins. They also claimed that the number of dolphins that used to be sighted by them in nearby stretches have decreased considerably in the last 3-4 decades mainly owing to disturbance caused by big-sized boats plying day and night along with unchecked fishing activities by some local goons. The fisherfolk also acknowledged that dolphins would sometimes unknowingly get captured in the fishing nets but were always released back into the river without any harm.

10.4 **Turtles :** India is one of the world's hotspots for turtle diversity hosting 29 species of tortoises and freshwater turtles among which 13 different species find their abode in the Ganga river system. These turtles play a significant role in the river by scavenging dead organic material and diseased fish, controlling fish population as predators and controlling aquatic plants and weeds (WII, 2017). Though there were no direct sightings of turtles in the survey, the interactions with local fisherfolk gave some valuable information on the status of turtles in the study region. In general, they reiterated a significant decrease in turtle sightings during the last few decades with species such as Crowned River Turtle (*Hardella thurjii*, IUCN-Vulnerable species) and Indian Roofed Turtle (*Pangshura tecta*) being extinct from the region. The commonly sighted turtle species in the study region included – Indian Softshell Turtle (*Nilssonia gangetica*) and Indian Flapshell Turtle (*Lissemys punctata*) while Brown Roofed Turtle (*Pangshura smithii*, IUCN-Near Threatened species) was rarely sighted.

10.5 **Nilgai :** The Nilgai antelope – *Boselaphus tragocamelus* is widely distributed throughout the country. However, due to prolonged breeding activity and lack of potential predators, the numbers of Nilgai have increased considerably and become locally overabundant in states of Gujarat, Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan, Madhya Pradesh and Delhi (Meena, 2017). In the due course of time, this species has been successful in adjusting to the human-altered landscapes and in many places have become serious pests of agricultural crops. During the survey nilgai was spotted foraging on agricultural fields in the floodplain region near Bishanpur village [Image 20]. The farmers in this region often complained about the large-scale damage to agricultural produce caused by nilgai but despite this they claimed to never kill this animal. The villagers often enclosed their fields with mesh nets or wires or thorny plants to keep nilgai away and drive them away with the help of sticks and stones.

Image 20 : Nilgai (Male Individuals) Foraging On Agricultural Fields Near Bishanpur Village In Samastipur

10.6 **Wild Boar :** The Indian wild boar (*Sus scrofa L.*) also known as the wild pig is one of the widespread animals throughout the world. In recent times, wild boar has become a regular menace for farmers as it generally causes damage right from planting till the maturity of the crop (Vasudeva Rao et al., 2015). The floodplain agriculture farmers in villages such as Raspur Patasia, Sultanpur and Bishanpur complained about the menace caused by wild boars specially to crops such as potato. They claimed that the boars destroyed entire fields sometimes resulting in huge losses and even attacked small children or some local residents who tried to drive them away. Hence, in some cases the local villagers had to resort to killing these boars in order to safeguard themselves and their agriculture produce.

10.7 **Golden Jackal :** The golden jackal (*Canis aureus*) is a wolf-like canid that is native to Southeast Europe, Southwest Asia, South Asia, and regions of Southeast Asia. It is listed as of Least Concern in the IUCN Red List with their population trend increasing in the last couple of years owing to their widespread distribution, availability of shelter and food in good quantity and they being generalist foragers. Its presence in the study region was recorded based on information of local residents along with a direct sighting on Ganga river bank near Patthar Ghat [Image 21].

Image 21 : Golden Jackal Spotted On Ganga River Bank Near Patthar Ghat In Samastipur

10.8 **Jungle Cat :** The Jungle cat (*Felis chaus*) is a medium-sized cat native to the Middle-East, South and Southeast Asia and southern China. It inhabits swamps, littoral and riparian areas with dense vegetation. It was sighted in an agricultural field in Raspur Patasia village of Samastipur Distt. [Image 22].

Image 22 : A Jungle Cat Hiding Among Grasses In An Agricultural Field In Raspur Patasia Village Of Samastipur Distt.

10.9 **Avian Diversity :** A fair number of bird species were sighted in the study region based on the field survey conducted in December, 2020. During our field survey, the diversity of avian species was recorded using binoculars and identified using field guides (Salim Ali, 2012; Grimmett et al., 2016). The conservation status of the species was listed by using IUCN Red Data List. A total of 51 different species of birds were sighted during the survey in Samastipur Distt. among which 17 were wetland birds. The remaining 34 were species of grassland and forest community including 2 species of raptors. The list of bird species recorded in the survey is presented in Table 5 while some notable birds from the study region are depicted in Images 23-25. Based on the data collected, following observations were made:

- Little Egret, Cattle Egret, Indian Pond Heron, White throated Kingfisher, House Sparrow, Jungle Crow, Common Myna, Bank Myna, Common Pigeon, Common Babbler, Eurasian Collared Dove, White Wagtail and White-browed Wagtail were the most common bird species sighted. The "Near Threatened" River Lapwing (as listed in IUCN's Red Data List) was also frequently sighted across the river banks.
- A healthy population of Tufted Duck, Red-crested Pochard and "Vulnerable" Common Pochard (as listed in IUCN's Red Data List) were seen in Chapar Jheel.

Table 5 : Avian diversity in the study region

Sr. No.	Common Name	Scientific Name	Conservation Status
1	White throated Kingfisher	*Halcyon smyrnensis*	Least Concern
2	Cattle Egret	*Bubulcus ibis*	Least Concern
3	Little Egret	*Egretta garzetta*	Least Concern
4	Indian Pond Heron	*Ardeola grayii*	Least Concern
5	Common Sandpiper	*Actitishypoleucos*	Least Concern
6	Red-crested Pochard	*Netta rufina*	Least Concern
7	**Common Pochard**	***Aythya ferina***	**Vulnerable**
8	Tufted Duck	*Aythya fuligula*	Least Concern
9	Asian Openbill	*Anastomus oscitans*	Least Concern
10	Little Cormorant	*Microcarbo niger*	Least Concern
11	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
12	White breasted - Waterhen	*Amaurornis phoenicurus*	Least Concern

13	Common Moorhen	*Gallinula chloropus*	Least Concern
14	Eurasian Coot	*Fulica atra*	Least Concern
15	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
16	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
17	Little Ringed Plover	*Charadrius dubius*	Least Concern
18	Black Drongo	*Dicrurus macrocercus*	Least Concern
19	Common Myna	*Acridotheres tristis*	Least Concern
20	Bank Myna	*Acridotheres ginginianus*	Least Concern
21	Asian Pied Starling	*Gracupica contra*	Least Concern
22	Common Stonechat	*Saxicola torquatus*	Least Concern
23	Jungle Babbler	*Turdoides striata*	Least Concern
24	Indian Bushlark	*Mirafra erythroptera*	Least Concern
25	Common Babbler	*Argya caudata*	Least Concern
26	White Wagtail	*Motacilla alba*	Least Concern
27	Grey Wagtail	*Motacilla cinerea*	Least Concern
28	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
29	Yellow Wagtail	*Motacilla flava*	Least Concern
30	Asian Plain Martin	*Riparia chinensis*	Least Concern
31	Common Tailorbird	*Orthotomus sutorius*	Least Concern
32	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
33	House Sparrow	*Passer domesticus*	Least Concern
34	Indian Jungle Crow	*Corvus culminatus*	Least Concern
35	House Crow	*Corvus splendens*	Least Concern
36	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
37	Common Pigeon	*Columba livia*	Least Concern
38	Barn Swallow	*Hirundo rustica*	Least Concern
39	Coppersmith Barbet	*Psilopogon haemacephalus*	Least Concern

40	Ashy Prina	*Prinia socialis*	Least Concern
41	Plain Prinia	*Prinia inornata*	Least Concern
42	Greater Coucal	*Centropus sinensis*	Least Concern
43	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
44	Red-vented Bulul	*Pycnonotus cafer*	Least Concern
45	Shikra	*Accipiter badius*	Least Concern
46	Common Kaestral	*Falco tinnunculus*	Least Concern
47	Red Avadavat	*Amandava amandava*	Least Cocern
48	Scaly-breasted Munia	*Lonchura punctulata*	Least Concern
49	Black-hooded Oriole	*Oriolus xanthornus*	Least Concern
50	Spotted Dove	*Spilopelia chinesis*	Least Concern
51	Laughing Dove	*Spilopelia senegalensis*	Least concern

Image 23 : Open Billed Stork

Image 24 : River Lapwing

Image 25 : White-Throated Kingfisher

11.0 Ganga Riverine Islands

11.1 The riverine fluvial islands are present in many major rivers and are defined as 'land masses within a river channel that are separated from the floodplain by water on all sides and exhibiting some kind of stability' [Osterkamp, 1998]. Such islands may not be permanent on the geologic time scale owing to the river meandering, climate change, etc. but can remain in place over decadal or century time scales and hence exhibit stability [Wyrick & Klingeman, 2011]. Many such islands are existent in the Ganga River stretch of throughout Bihar state which are locally referred to as *Diaras*. This term is derived from the word *Diya* (which means an earthen oil lamp) and has been coined for a land where a *Diya* is never lit [Udas *et al.*, 2018]. In local parlance in different parts of Bihar state, it symbolizes a village which is located outside the embankments of Ganga River floodplain. Some of the major *Diaras* surveyed in the study are described in this section.

11.2 A small part of Raghopur *diara* falls in the study region near Hasanpur south town where the Ganga river enters Samastipur from Vaishali Distt. This *diara*, spreading in Vaishali and Samastipur Distts. is the largest *diara* in this region measuring about 30 kms long and 8-10 kms wide. This *diara* mainly consists of alluvial soil and every year it gets submerged during the floods in Ganga River. It is connected with Samastipur Distt. only through boats which are an important source of transportation for local residents on both sides [Image 26]. **The *Diara* is officially recognized as a Community Development Block.** Agriculture and fishing are the main sources of income for residents of this *diara*. The agriculture produce mainly includes wheat and mustard along with vegetables such as cauliflower, potato, gourd and parwal. However, during monsoon many agriculture fields are inundated by the flood waters due to which people alternatively shift to fishing for fulfilling their food requirements and earning some income. Mostly dragnets and gillnets are used for catching fish with the help of small boats.

11.3 Another irregularly shaped *diara* was found to be present near Raspur Patasia village in Samastipur Distt. This *diara* was mainly covered with wild vegetation specially *Saccharum* sp. Grasses [Image 27] which were collected by the local residents for roof thatching. Some residents also used small boats to reach the *diara* and practice agriculture with mustard being the major crop grown there.

Image 26 : Part Of Raghopur *Diara* Falling In The Study Region

Image 27 : A *Diara* Covered With Saccharum Grasses Near Raspur Patasia Village In Samastipur Distt.

12.0 Fishing in Samastipur Distt.

12.1 Fish resources of Ganga river have been an important source of livelihood and food security for millions of people residing along its banks. Ganga river supports a diverse fish fauna with about 260 species reported for Indian waters (Sinha and Khan, 2001) among which about 35 species have been identified as having highest commercial value including carps (*Cyprinidae*), snakeheads (*Channidae*) and catfish (*Siluriformes*) (Islam et al., 2006). However, today these rich fish resources are threatened by various anthropogenic activities and resulting water pollution, accumulation of heavy metals, eutrophication, damming, alteration of hydrology and introduction of exotic species (Tripathi et al., 2017).

12.2 During the survey, fishing from Ganga river was found to be a major source of food and income for local residents after agriculture. Many people, specially belonging to the Mallah community were involved in riverine fishing using small wooden boats [Image 28]. The most common technique of fishing in this region was the use of fine-sized plastic nets available from the markets and spread across in Ganga river [Image 29]. Apart from this, some fisherfolk also made use of rope-based drag nets for catching fish from the river [Image 30]. Most of the fish caught by these people was sold in nearby villages or town markets such as in Mohiuddinagar. At some places such as in Raspur Patasia village, it was also observed that merchants used to come on the river banks for directly purchasing fish in bulk which in turn was sold by them in the local markets.

Image 28 : Wooden Boats Used By Mallah Community For Fishing In Ganga River Stretch Of Samastipur

Image 29 : Fine-Sized Plastic Nets Spread In Ganga River For Catching Fish Near Patthar Ghat

Image 30 : Dragnet-Based Fishing Observed In Ganga River Near Raspur Patasia Village

12.3 Upon interaction, the fisherfolk expressed their concerns over the significant decrease in the fish catch and yield over the last few decades. According to them the most commonly caught fish in the study region included – Bachwa (*Eutropiichthys vacha*), Tengara (*Mystus tengara*), Buari (*Wallago attu*), Chepua (*Cabdio morar*) and Garai (*Channa punctata*). Some fish like Rohu (Labeo rohita) and Catla (Labeo catla) were caught more during the monsoon season from Ganga river while they were obtained from nearby waterbodies during rest of the year. **The fisherfolk also reiterated that Hilsa and Sakuchi fish, which were once available in the Ganga river stretch of Samastipur Distt. were no longer seen since the last few decades.** The details of riverine fish recorded during the survey is provided in Table 6 while Image 31 shows Buari fish which is commonly caught from Ganga river stretch in the study region.

12.4 Many fishermen during their interactions brought upon some major issues pertaining to fishing from Ganga river. **The main concern reiterated throughout was the use of poison for killing and catching fish from the river and use of electric current by some local goons.** It was recorded that during night time mostly, the local goons dip electric wires with current flow in the central part of river due to which the fish run towards the banks, thereby getting caught in the nets planted there. **According to these fishermen, the use of electric currents was also a major reason for the death of dolphins and turtles in the region.**

Table 6 : List Of Fish Caught From Ganga River In Samastipur

Sr. No.	Scientific Name	Common Name
1.	*Eutropiichthys vacha*	Bachwa
2.	*Wallago attu*	Buari
3.	*Cabdio morar*	Chepua
4.	*Labeo catla*	Catla
5.	*Labeo rohita*	Rohu
6.	*Channa punctata*	Garai
7.	*Mystus teng*ara	Tengara
8.	*Heteropneustes fossilis*	Singhi/Singha

Image 31 : Buari Fish (*Wallago attu*)

13.0 Groundwater in Samastipur Distt.

13.1 The Distt. is part of Ganga basin with Burhi Gandak and Ganga rivers constituting the principal drainage in the area. Physiographically, the Distt. represents a monotonous flat land with the general elevation of land surface being 40-42 mamsl. The plain of the area is characterized by thick pile of alluvial deposits with varying depth and formed by aggregation of alluvial fans of river Burhi Gandak and Bagmati. Groundwater in the Distt. occurs under water table, semi-confined to confined condition and is mostly recharged by rainfall (CGWB, 2013). During the survey in this Distt., ground water levels of different villages were recorded based on the interactions with local residents. The details of these villages and the ground water availability is provided in Table 7. Most of the villages surveyed made use of dug wells for drawing the groundwater while only few employed handpumps.

Table 7 : Groundwater Levels Of Different Villages In Samastipur Distt.

Place	Coordinates		Ground Water Table in Feet
	Lat.	Long.	
Patthar Ghat	25°33'34.69"N	85°34'21.28"E	50 ft.
Chandpura	25°35'8.57"N	25°35'8.57"N	35 ft.
Hasanpur	25°35'15.64"N	85°30'56.08"E	25 ft.
Dhamoun	25°36'2.77"N	85°32'51.57"E	40 ft.
Mohiuddin Nagar	25°34'41.45"N	25°34'41.45"N	60 ft.
Panapur Lange	25°43'22.81"N	85°17'15.96"E	20 ft.

14.0 Ganga River Bank Erosion In Samastipur Distt.

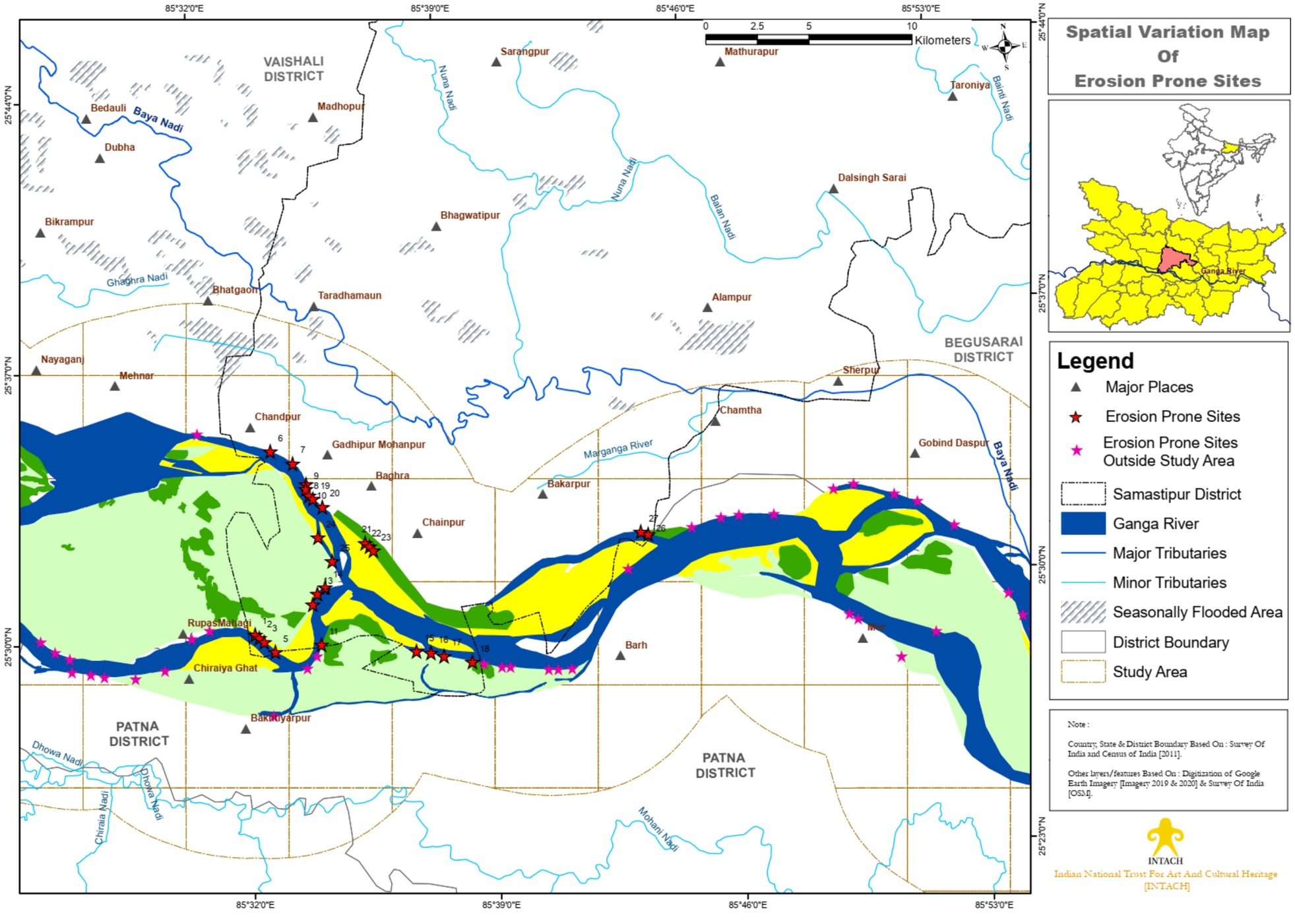
14.1 Weathering of soils by natural forces is both constructive and destructive. Erosion is the chief agent responsible for the natural topographic cycles as it wears down higher elevations, banks (lateral erosion) and deposits sediments in the plains. However, erosion gets aggravated due to human interventions through change in land use, excessive grazing, extensive farming, cultivation without taking proper conservation measures, destruction of forest and riparian vegetation. It is well known that exposed soil may erode rapidly (Singh et al., 2004).

14.2 During the survey, major erosion prone areas were observed on the Ganga river bank near villages such as Chandpur, Hetanpur, Kutubpur, Mohanpur upto Patthar Ghat and till a little distance further. Erosion was also high on the concurrent part of Raghopur *diara* falling in this part of the Distt. Map 7 highlights these high erosion prone areas along with other eroded sites in the Distt. Plantation of trees such as peepal (*Ficus religiosa*), teak (*Tectona grandis*), semal (Bombax ceiba) and Tad (*Borassus flabellifer*) was observed along this river bank stretch in the Distt. for checking soil erosion [Image 32]. Along with this, the use of sandbags covering the exposed bank slopes was also employed by the Government for reducing the impacts of lateral erosion in above mentioned areas [Image 33].

14.3 Upon interacting with local residents it was also recorded that severe erosion had resulted in destruction of numerous settlements and villages along Ganga river bank in the study region during last few decades. This had led to displacement of many local residents from this region to interior parts of the Distt. They also claimed that no kind of help or assistance was available from the government in this matter and hence, the erosion of houses in these villages resulted in huge personal losses for them. Various factors such as unchecked sand mining along Ganga river, decrease in riparian vegetation and land use changes are believed to be the major factors in contribution to this severe erosion in the study region.

Image 32 : Tree Plantation On Ganga River Bank Near Chandpur in Samastipur Distt.

Image 33 : Use of Sandbags for controlling bank erosion near Patthar Ghat in Samastipur Distt.



Map 7 : Erosion prone sites in the study region

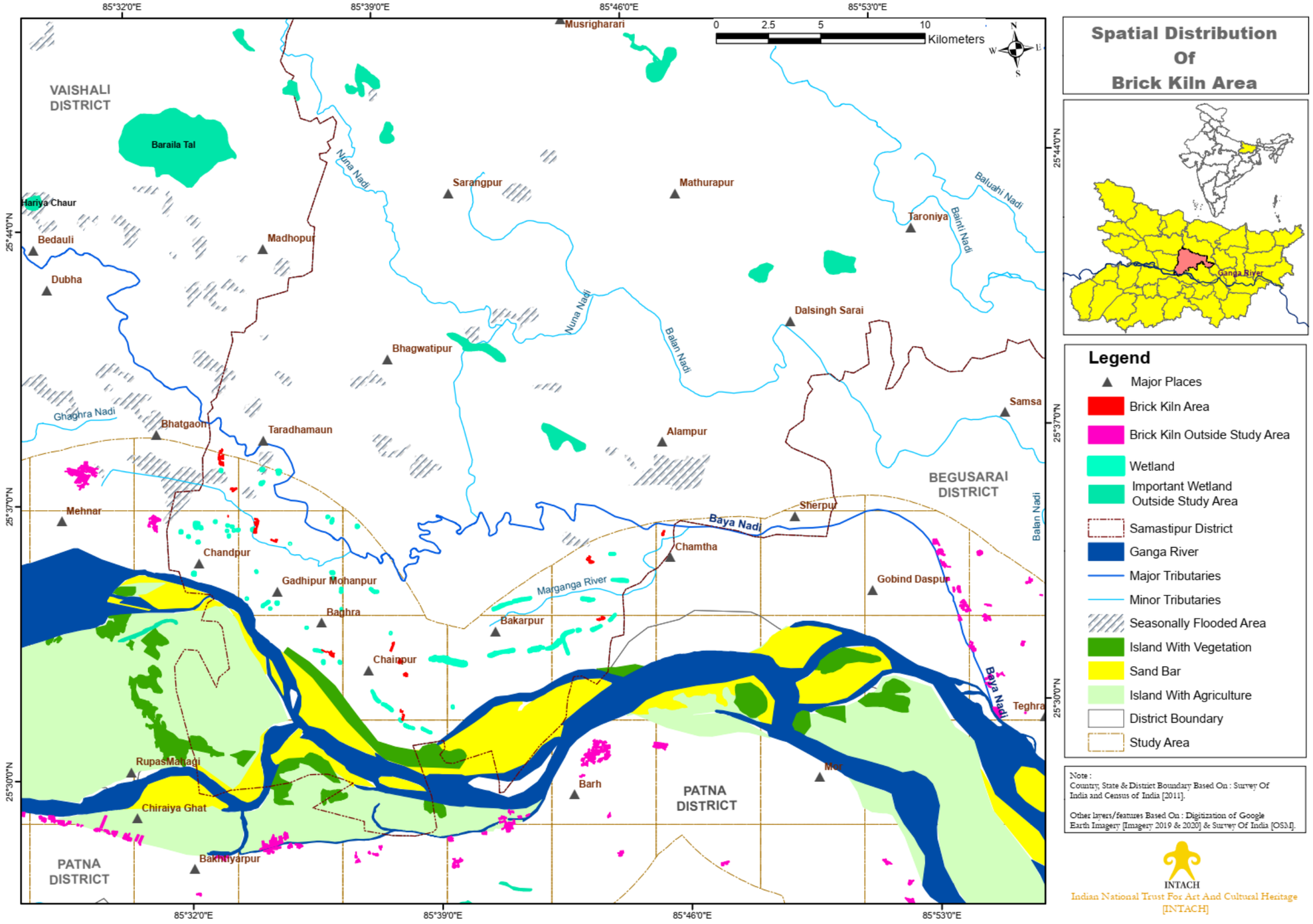
15.0 Sand Mining And Brick Kilns In Samastipur Distt.

15.1 **Sand Mining :** Sand is a major mineral resource [although classified as a minor mineral] available in plenty throughout Ganga river stretch in Vaishali Distt. The demand for sand has grown multifold in the last couple of years with rapid expansion of settlements in this Distt. Hence, sand mining was found to be an important activity almost all along the Ganga river course in this survey. Bid-sized boats were mainly employed for sand collection from the dried up river bed, sand bars and parts of *diaras* [Image 34]. Upon interaction, the locals reiterated the presence of illegal and unchecked sand collection activities in this region, much of which also involved some local goons. Such reckless sand mining operations are often considered to be detrimental to the river ecosystem and hence, the **'Enforcement and Monitoring Guidelines for Sand Mining 2020'** need to be implemented seriously in the study region.

Image 34 : Sand Collection From Dried Up Parts Of Raghopur *Diara* Near Samastipur Distt.

15.2 **Brick Kilns :** An important economic activity in the Distt. is production of bricks in the brick kilns. With rapid urbanization, bricks have become an important building material for construction activities. Brick kilns in the study area provide livelihood opportunity to the local community. However, this industry has posed current and potential future threats to the soil, air, biota and water system of the region. The spatial distribution of brick kilns in Samastipur Distt. [Map 8] shows that they are few in numbers with scattered distribution. Some of these brick kilns are present in the Ganga river floodplain of this Distt. but none of them are located on the river banks. One brick kiln observed near Sultanpur village in the study region is depicted in Image 35.

Image 35 : A Brick Kiln Near Sultanpur Village In Samastipur



Map 8 : Spatial Distribution Of Brick Kilns In The Study Region

16.0 Sacred Trees In Samastipur Distt.

16.1 Unlike its neighboring Vaishali Distt., the study region of Samastipur Distt. does not contain archaeologically or spiritually important sites. Most of the local temples here belong to Hindu God – Lord Shiva and are often associated with *Ficus religiosa* (Peepal) as the sacred tree. This tree is mainly worshipped by the female residents in this region by tying sacred threads around it and offering flowers, coconuts and sindoor. One such sacred tree associated with a Shiva temple on the Ganga river bank was observed near Patthar Ghat and is depicted in Image 36.

Image 36 : An old and sacred Peepal tree associated with Shiva temple near Patthar Ghat

17.0 Inland Navigation

17.1 During the interactions with riparian communities, it was recorded that till few decades ago, big-sized boats were employed in ferrying people from this region up to Kolkata towards east. Some of these boats were also an important source of crossing Ganga for reaching Patna mainly for trade purposes. The Ganga river stretch in Samastipur contained water almost throughout the year in contrast to Vaishali Distt. where the water used to dry up during winters and summers. However, in the current time, only few big-sized boats involved in ferrying people from this Distt. to Raghopur *diara* and Patna Distt. were observed to be operational [Image 37]. The local residents make use of these boats mainly for reaching across the river along with their luggage and in some cases with their cycles/two-wheelers by paying a nominal fare to the boatman. This mode of transportation is extremely important for the residents in this region especially during monsoons when the pontoon bridges are not operational.

Image 37 : A Boat Ferrying Passengers From Raghopur *Diara* To Samastipur Distt.

Image 38 : A Boat Ferrying Passengers From Samastipur Distt. To Patna

18.0 Key Observations and Recommendations

18.1 One important Hindu ritual associated with Ganga river throughout India is cremation of dead bodies as it is widely believed that by immersing your burnt remains in the holy Ganga water, the person will attain 'Moksha'. This activity was found to be prevalent throughout the Ganga river bank in Samastipur Distt. with the highest occurrence being around Patthar Ghat. Upon interaction, it was observed that though Patthar Ghat was a designated site for burning dead bodies, local residents often carried out this activity on other parts of Ganga river bank near the Ghat mainly due to crowding and unavailability of space there. This led to the dumping of leftover items from the rituals on an entire stretch from Hasanpur to Patthar Ghat and little further [Images 38-39]. Some respondents also revealed that often half burnt dead bodies or incomplete cremated remains are directly dumped into the river thereby impacting the riparian and instream biodiversity. Hence, it is strongly recommended in this report to urgently take this matter into consideration and develop appropriate cremation facilities for the local residents either at Patthar Ghat or in some nearby village little away from the main stem of river to prevent further ecosystem damage.

Image 38: Cremation Of Dead Bodies On Ganga River Bank Near Dharni Patti East Village

Image 39 : Remains From Cremation Dumped At Ganga River Bank Near Hasanpur village

18.2 The freshwater wetlands in the study region serve as important habitat for biodiversity including fish, turtles, birds and floral species along with providing numerous ecological services such as water source for drinking, irrigation, washing, maintaining hydrology of the region, use for cultural and aesthetic purposes. Despite this, these wetlands are under tremendous pressure from sewage influx, garbage dumping, encroachments and unsustainable resource utilization. Most of the wetlands in the study region are leased out to local residents for fish rearing who also indulge in killing of birds such as pochards as recorded near Chapar Jheel. Hence, it is strongly recommended through this study to take up initiatives for maintaining such water bodies in conjunction with various local stakeholders in order to safeguard biodiversity and ensuring sustainable resource utilization.

18.3 One important concern often raised during the survey was crop destruction caused by nilgai and wild boar especially in the floodplain agricultural fields. Though the farmers never retaliated violently towards the nilgai, they did admit to kill wild boar as it is equally dangerous to local residents in this region. Nonetheless, both these animals are known to cause huge losses to the farmers who claimed to receive no compensation or help of any kind from the authorities. Hence, this important issue in the study region needs to be mitigated by creating awareness among the local people, ensuring sufficient compensation for their losses and incorporating non-violent techniques to keep these animals away from the fields.

18.4 Another very important observation in the study region is severe bank erosion specially in areas along Patthar Ghat caused by the floods which lead to destruction of riparian settlements and even cause shifts in the villages from one side to the other. This issue has already caused displacement of local residents in some areas and also impacted livelihoods. In some erosion prone areas, the plantation of trees and use of sandbags was observed as techniques for controlling erosion. These techniques should be properly planned and implemented with the help of local stakeholders for all the impacted sites in the study region.

18.5 **One serious concern reiterated by the fisherfolk during this survey was the use of poisonous substances and electric current by some local goons in areas such as Dharni Patti, Kutubpur and Chapra villages along Ganga river.** This issue not only severely impacts the fish resources of this river, but is also a major threat to already endangered dolphin and turtle species. The fisherfolk also highlighted a sharp decline in fish catch and yield from Ganga river owing to the activities mentioned above along with other factors such as extensive use of chemical fertilizers and pesticides in floodplain agriculture fields causing water pollution, dumping of garbage in the river, changes in river flows and climatic alterations. Hence, it is imperative to carry out awareness cum training programs with these communities regarding fish availability, its importance and sustainable fishing along with keeping a check on those disturbing the ecosystem. Along with that alternate livelihoods need to be developed for fishermen communities such as promoting them for building different boats and involving in eco-tourism activities.

18.6 The Ganga river stretch in Samastipur Distt. is also an important habitat for IUCN Red Listed and Schedule-I (Wildlife Protection Act, 1972) species – Gangetic dolphin and some turtle species, many of which have either declines or have disappeared from this stretch currently. Hence, there is an urgent need for carrying out more surveys to identify their tentative population and presence status in this region. **It is also recommended to pay special attention to the river stretch between Hetanpur and Kutubpur villages where maximum dolphin sightings were recorded as this area can be termed as 'Dolphin Hotspot' of the region.** The local Forest department should also carry out awareness activities for sensitizing people directly associated with Ganga River.

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