Ganga Cultural Documentation 2021

BUXAR DISTRICT

National Mission for Clean Ganga

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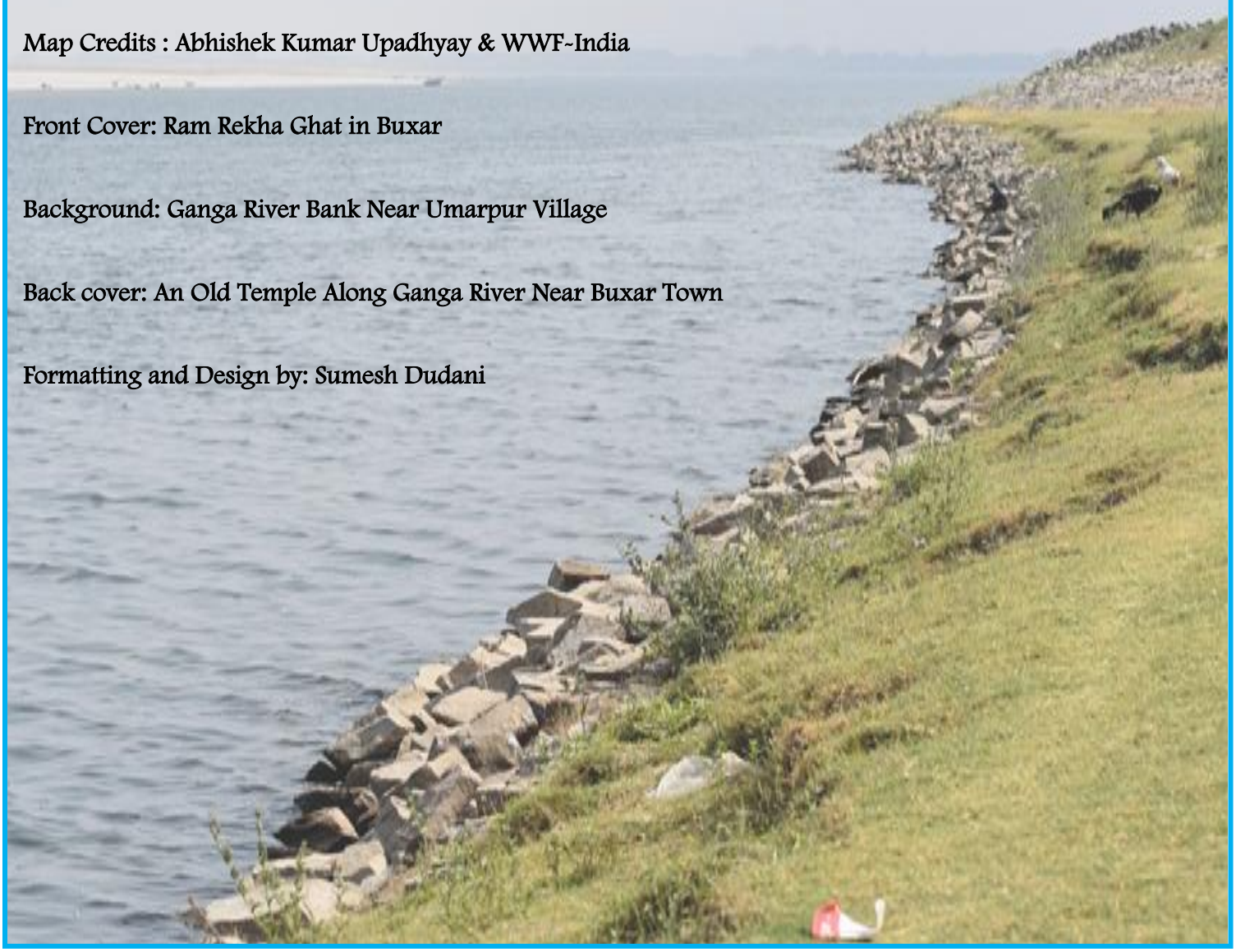
Front Cover: Ram Rekha Ghat in Buxar

Background: Ganga River Bank Near Umarpur Village

Back cover: An Old Temple Along Ganga River Near Buxar Town

Formatting and Design by: Sumesh Dudani



GANGA CULTURAL DOCUMENTATION

BUXAR DISTRICT

APRIL, 2021

Sponsored by :

National Mission for Clean Ganga

Authored By

INTACH

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1.0 Introduction

1.1 Buxar Distt. (situated between 25° 18' to 25° 45' latitudes north & 84° 20' to 84° 40' longitude east) is located on the Western border of Bihar with Uttar Pradesh [Map 1]. It is bounded on the north by Ballia distt. of U.P., on the south by Rohtas Distt., on the west by Ghazipur and Ballia Distt.s of U.P. and on the east by Bhojpur Distt. This Distt. was created on 17th March, 1991 by carving out from Bhojpur Distt. and currently occupies a geographical area of about 1624 sq.km. The Distt. is divided into 2 sub-divisions – Buxar and Dumraon having 4 and 7 community development blocks each respectively. It falls entirely on the right bank of Ganga River i.e. to the south of it. The Ganga flows for a length of 40 km on the northern edge of the Distt.

1.2 Buxar Distt. has close linkage with that of its parent Distt. Bhojpur with an interesting history. Buxar is famous since the ancient times for being the seat of eminent saints, battlefield of Gods and Demons as per Puranas and a battle ground between foreign invasion and countrymen in modern history. The remains from archaeological excavations have established the link of Buxar with ancient civilizations of Mohanjodaro and Harappa. This area was also known as "Siddhashram", "Vedgarbhapuri", "Karush", "Tapovan", "Chaitrath", "VyaghraSar", "Buxar" in ancient history. The history of Buxar dates back even prior to the period of Ramayana. The name Buxar is said to have been derived from VyaghraSar. During Mughal period, the historic battle between Humayun and Sher Shah was fought at Chousa in 1539 A.D. [Image 1]. On 23rd June, 1764 the British forces under Sir Hecter Munro defeated the combined forces of Mir Qasim, Shuja-ud-Daulah and Shah Alam-II on the grounds of Katkauli situated at about 6 kilometers from Buxar town (https://buxar.nic.in/history/).

1.3 The Distt. is part of the lower sub-basin of the Upper Ganga basin. The physiography of the Distt. reveals an alluvial plain having gentle slope towards north which can be divided into two physiographic sub-divisions :

(1) The low-lying northern plain - extending from the Ganga, the river has built a long natural levee along its course which covers the entire geographical area of the Simri and Chakki Blocks alongwith parts of Buxar and Brahampur Blocks.

(2) The flat region of the south – this unit covers major part of the Distt. Occupying the entire area of Chausa, Rajpur, Kesath, Nawanagar, Itarhi, Dumraon and parts of Buxar and Barhampur blocks. There are mainly three types of soils found in the Distt.:

(a) Recent Alluvium Soil (Levee Soil) found along the banks of the river Ganga;

(b) Tal Soil (Kewal soil) found in south of the levee soil;

(c) Old Alluvium Soil : it is a combination of Kewal soil and clayey soil which covers the central part of the Distt. (CGWB, 2013).

The **climate** of this Distt. is moderate with the summer months of April and May being very hot, monsoon being experienced during June-September and cold winters being experienced during the months of November-February.

According to mythology, sage Vishwamitra the family guru of Lord Rama and eighty thousand saints, had their sacred ashram on the banks of holy river Ganges inside the modern District Buxar. Vishwamitra was disturbed in the yagna (sacrificial offering) by the demons. The place where killing of the famous Rakshasi (demoness) Tadika by Lord Rama, is said to fall within the present Buxar town area. Besides, Lord Rama and his younger brother Laxman took their lessons from Vishwamitra at Buxar. It is also said that Ahilya, the wife of Gautam Rishi restored her human body from that of stone and got salvation by a mere touch of the feet of Lord Rama. This place is presently known as Ahirauli and is situated six kilometers away from the Buxar town. The Kanwaldah Pokhara also known as VyaghraSar is a tourist spot.

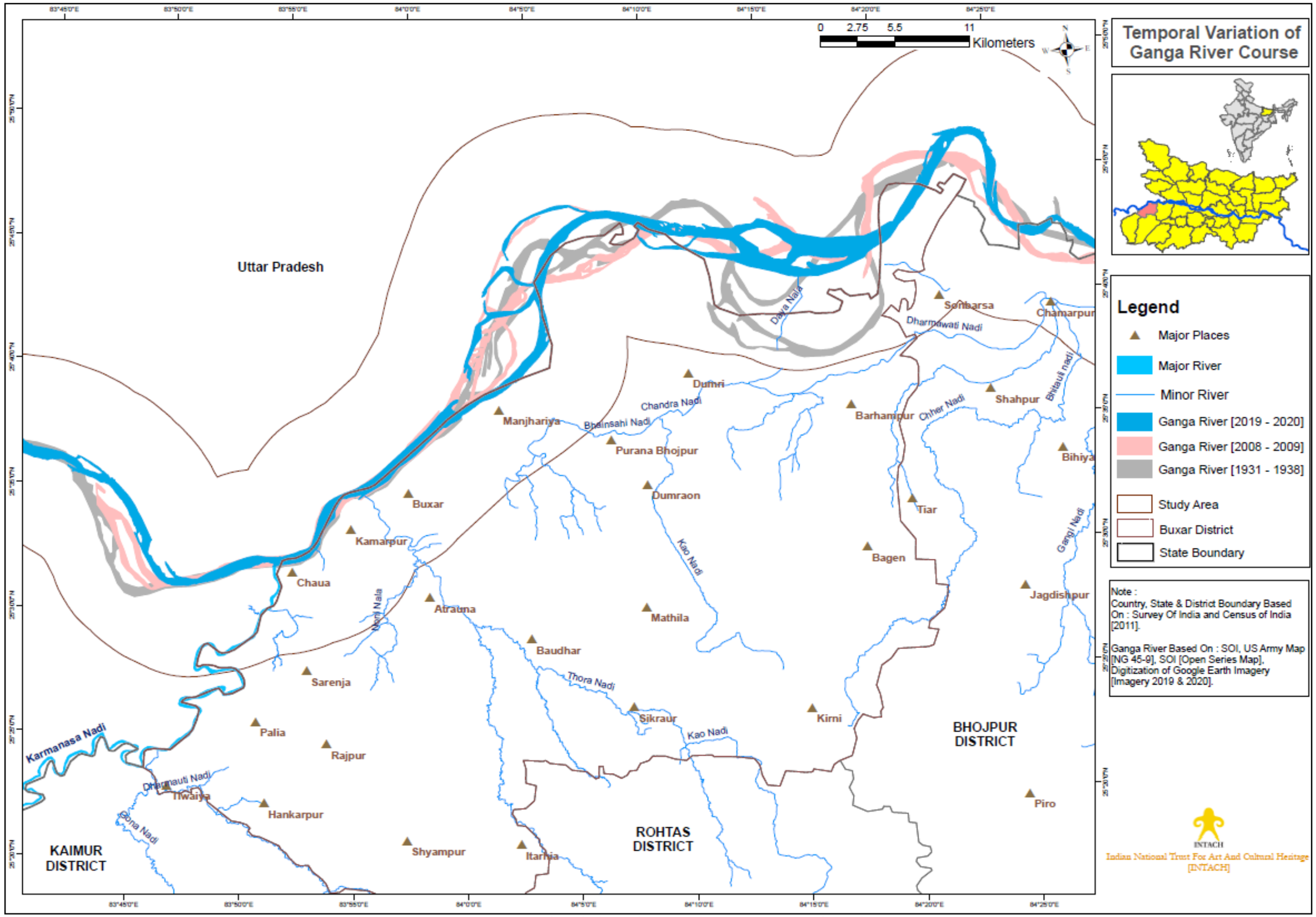
Image 1 : Stone Marker at The Site Of Battle Of Chousa In Buxar Distt.

Map 1 : Location Of Buxar Distt.

2.0 Ganga River In BuxarDistt.

2.1 Ganga River enters Buxar Distt. near Chausa where it is met by Karamnasa river [right bank tributary which flows along the boundary between Buxar and Ghazipur Ditt.s] [Refer Map No.2]. Thereafter it flows in north-eastern direction passing along Buxar town. A little after Umarpur, the river makes a curve where it is intersected by a group of a few irregularly shaped *diaras* [riverine sand bars transforming into islands]. The river curves through a small segment of Ballia District to its north and is then back again in Buxar Distt near Nainijor. A little further the river makes another curve southwards leaving Buxar and entering Bhojpur Distt. According to the District Gazetteer of Shahabad, the Ganga River banks in Buxar sub-division are of hard gravel and generally steep and abrupt mainly towards upstream of the river. During monsoons Ganga River swells up and expands greatly causing widespread bank erosion but by summer the river width shrinks to just 0.5-0.75 km wide. Image 2 depicts the Ganga river as seen during the field survey [April, 2021]. Map 2 also depicts the course migration of Ganga River over several decades 1931 onwards.

Image 2 : Ganga River As Seen Near Chausa In Buxar Distt. On 10th April, 2021

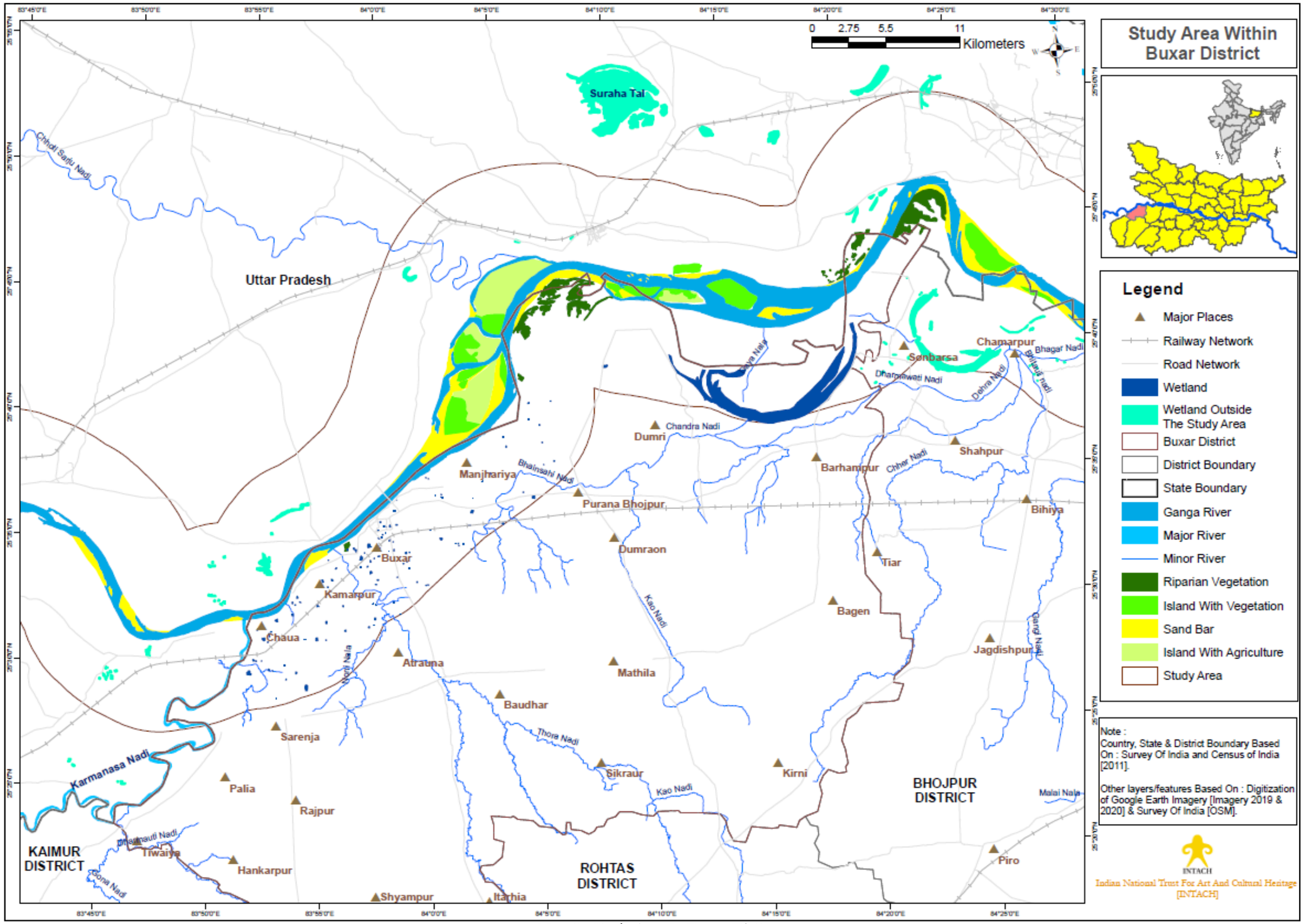


Map 2 : Temporal Variation Of Ganga River Course In Study Region

3.0 Methodology

3.1 Ganga River flows in Buxar Distt. for about 40.14 kms adjoining it mainly on the right bank. Hence for carrying out the ground survey, a 7 km of buffer zone was selected on the right bank of Ganga River in the Distt. [Map 3]. Based on the secondary information analyzed and the features noted from Google Earth satellite 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 and *Diara* communities in the Distt. for carrying out relevant interactions.

3.2 The field survey in Buxar Distt. was carried out from 9th to 13th April, 2021. The documentation and necessary permissions for the survey were taken from DM Office in Buxar town. During the survey, various sites such as Chausa, Buxar town, Umarpur, Keshopur and Nainijor were visited in the study region wherein high quality pictures related to the study were recorded using Nikon D3400 DSLR camera. The GPS locations were also recorded using Garmin hand-held GPS and videography at the study sites was carried out 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 agriculturists and dairy farmers, temple priests, village heads, fishermen, boatmen, general public.



Map 3 : Study Area In Buxar Distt.

4.0 Tributaries Of Ganga River

4.1 **Karamnasa River:** It is one of the important tributaries of Ganga River in the study region which originates in Kaimur Distt. of Bihar and flows through the states of Uttar Pradesh and Bihar [Refer Map 4]. Along the boundary between Uttar Pradesh and Bihar it has the Districts of Sonbhadra, Chandauli, Varanasi and Ghazipur on its left bank [west] (Uttar Pradesh side); and the Districts of Kaimur and Buxar on its right bank (Bihar side). The river was observed near Chausa in the Distt. [Image 3] where it forms the border between the states of Bihar and Uttar Pradesh and also confluences with Ganga River. Upon interaction, it was noted that agriculture was being practiced in the villages neighbouring this river using its water for irrigation purpose. The river swells up during monsoon whereas the water flow and extent decrease significantly during remaining part of the year. Fishing was also found to be practiced at its confluence with Ganga River though it was practiced only on a small scale mainly for local consumption. There was scanty riparian flora along the river as extensive agriculture dominated the land use in this region with crops being grown up to the active channel of the river in most places.

Image 3 : Karamnasa River As Observed Near Chausa On 10th April, 2021

4.2 Karamnasa is a legendary river with an interesting legend associated with it and which is mentioned in various literature including the Shahabad District Gazetteer. According to this legend, Raja Trisanku was anxious to ascend to heaven in his human form for which he approached his Guru Vashishta. When Vashishta refused by saying that he was forbidden to offer such an indignity to the gods, Raja Trisanku approached Rishi Vishwamitra with the same request. Rishi Vishwamitra accepted his petition and dispatched him to heaven with his powers. However, the Gods became angry and cast Raja Trisanku back towards the earth with his head upside down. When he cried for help Rishi Vishwamitra stopped him mid-air thereby preventing his fall on the ground. Thereafter, saliva began dropping from Raja Trisanku's mouth which is believed to have formed the source of this river. This river was used to be considered by Hindus in utmost abhorrence and thus this river came to be known as Karamnasa meaning 'destroyer of good deeds'. Today the residents of this region no longer hold these beliefs and make use of river water for many different purposes.

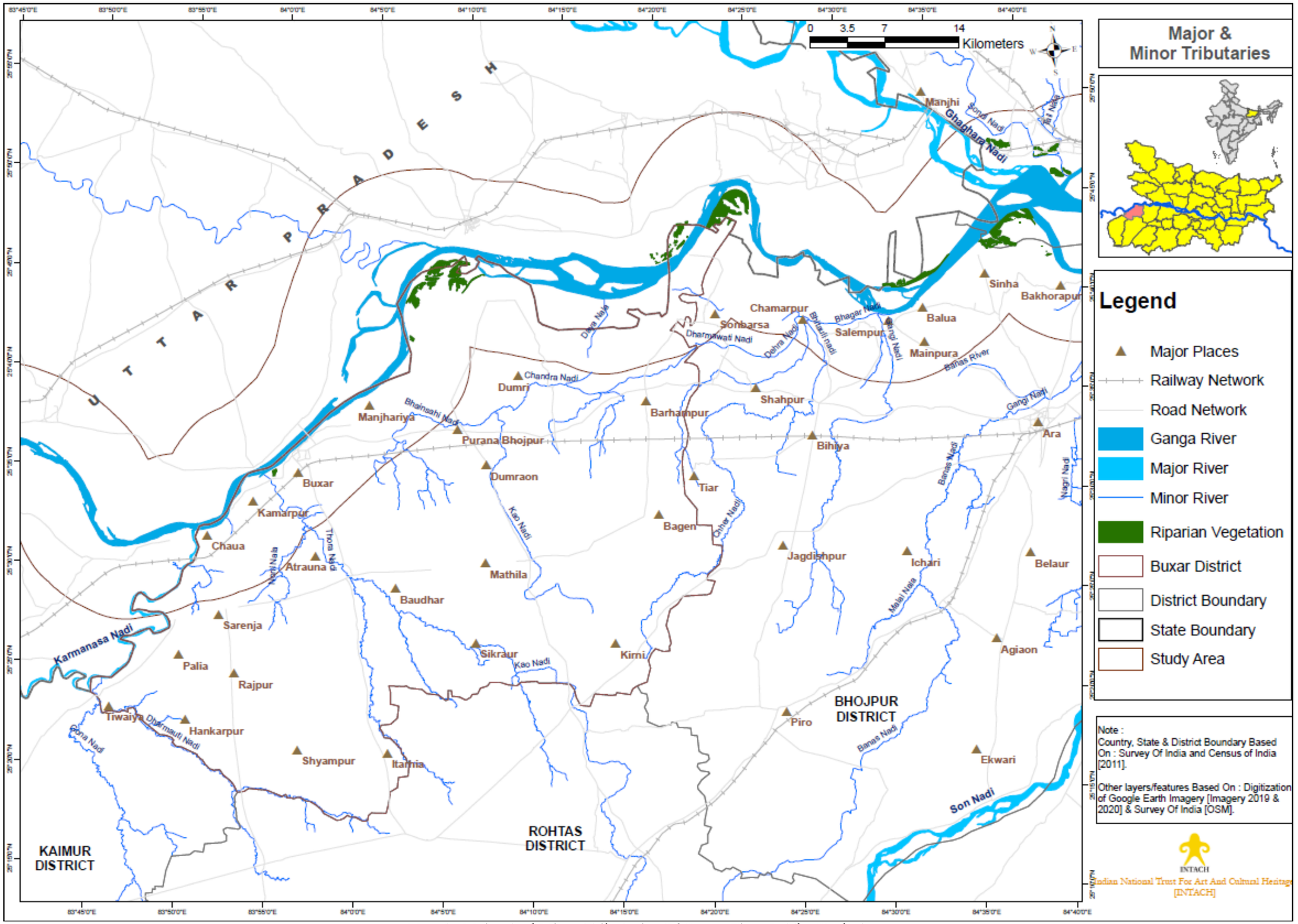
4.3 **Thora River:** Thora River (also known in some literature as 'Kao Nadi') originates from Dhuan Kund at Kaimur Plateau in Rohtas Distt. [Refer Map 4] and is known as Kao River at its origin. In Buxar Distt. specially downstream of Maliyabagh it is known as Thora river. Both the river and its confluence with Ganga River near Buxar Central Jail were observed during the field survey [Images 4 & 5]. The river has a narrow width with shallow water which dries up during summers and swells up during monsoon season. Fishing was found to be actively done in the river along with the use of water for irrigation of nearby agricultural fields.

Image 4 : Thora River As Seen On 10th April, 2021

Image 5 : Thora-Ganga Confluence Near Buxar Central Jail

4.4 **Dharmavati River:** This river (also known as 'Chandra Nadi' by some people) is another important tributary of Ganga which originates in Kaimur plateau [Refer Map 4]and passes through the Districts of Sasaram, Buxar and Bhojpur before merging with Ganga. The river was observed near Chakki village situated at about 35 kms east and upstream of Buxar town [Image 6]. Interaction with local residents revealed that this river was once quite wide and served as an important source of irrigation, fisheries and other household purposes for surrounding villages. However, with time this river has now reduced to only few meters wide with negligible water during post monsoon period and summers. Most of the sewage generated from surrounding villages is drained into this river which has reduced it to a polluted drain like condition at many places. Extensive growth of water hyacinth (*Eichhornia crassipes*) could be observed along with other floating and submerged aquatic vegetation. Though fishing nets were observed at some sites in the river, the fish caught were often few and undersized mainly due to extensive pollution and reduced water flow.

Image 6 : Dharmavati River As Observed Near Chakki Village On 11th April 2021



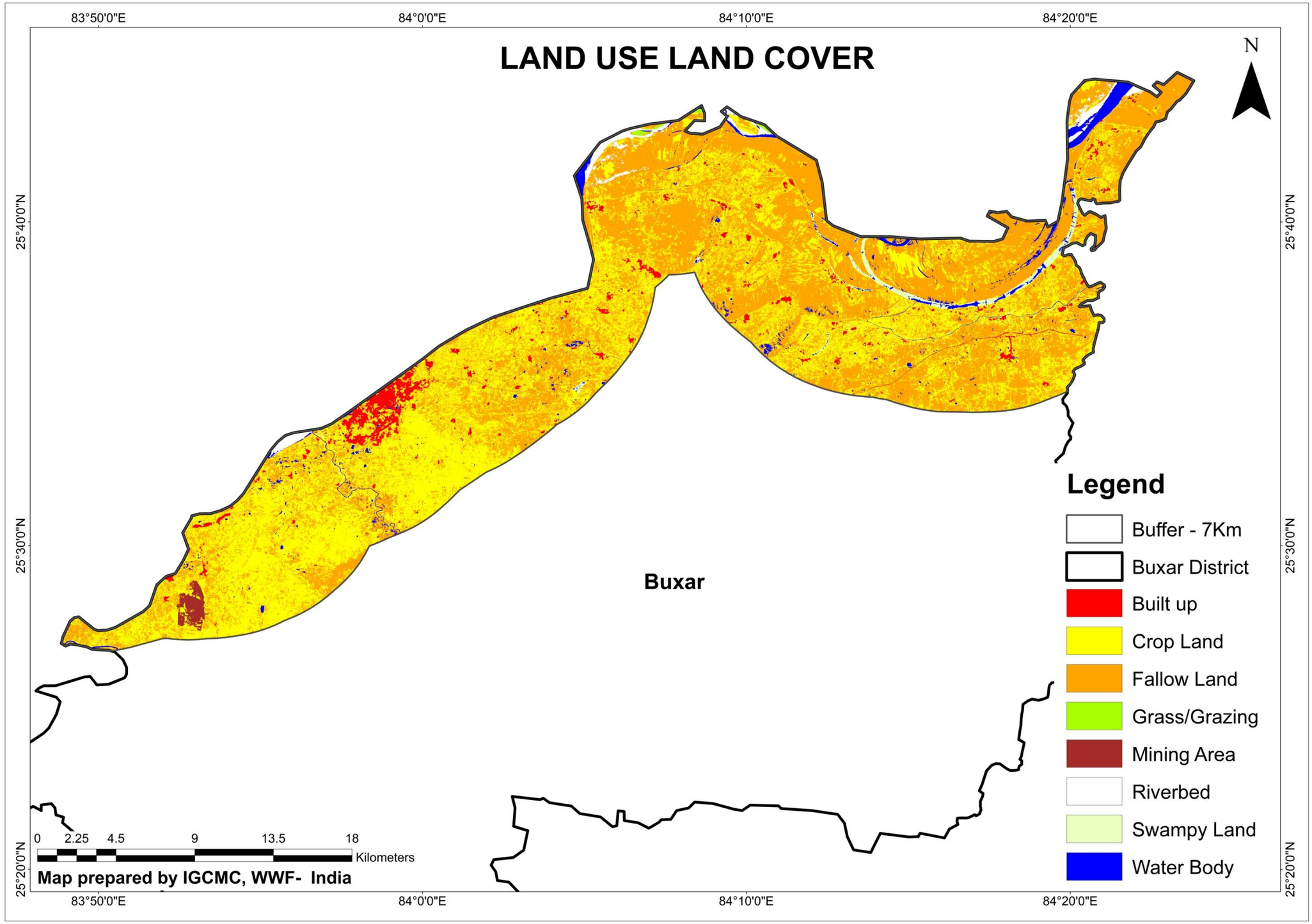
Map 4 : Major And Minor Tributaries Of Ganga River In The Study Area

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, 8 different classes were generated – water body, crop land, fallow land, built up, grass/grazing, swampy land, riverbed and mining area. Agriculture, being the principal source of income for local residents, crop land and fallow land dominated the land use with total of 46,300 hectares (occupying 92.13% of the total study region).The built-up area in study region was only 2.67% of the total area which mainly included Buxar town and Chausa town as major settlements along with scattered villages throughout. The details of these classes in terms of area are presented in Table 1 and the land use of the Distt. is depicted in Map 5.

Table 1 : Land Use And Land Cover Details Of Study Region

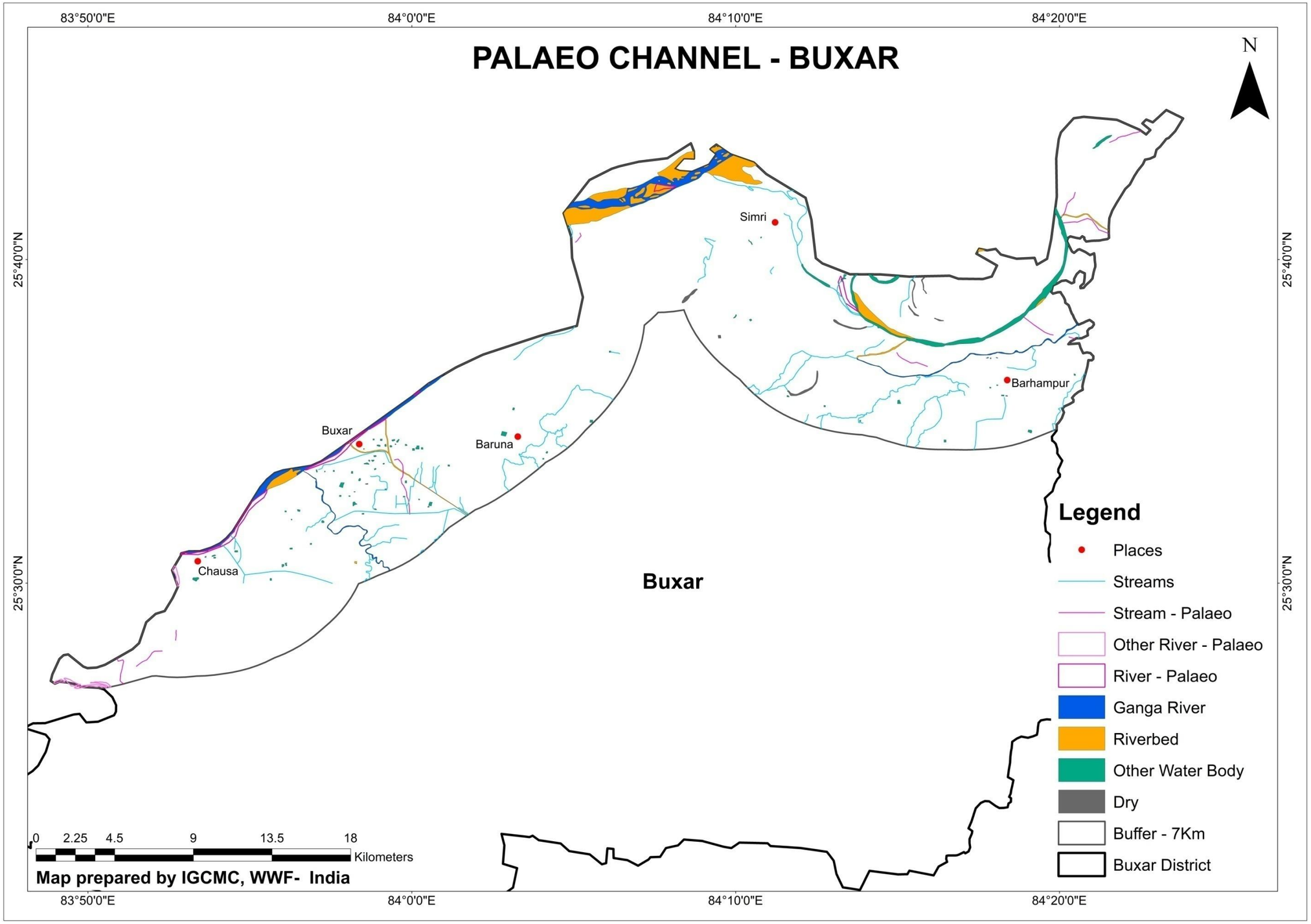
BUXAR (LULC) - 2021		
Class	Area (Ha)	Area (%)
Water Body	1200.51	2.39
Crop Land	21167	42.12
Fallow Land	25133.3	50.01
Built up	1342.08	2.67
Grass/Grazing	55.4907	0.11
Swampy land	415.391	0.83
Riverbed	703.303	1.40
Mining Area	240.15	0.48
Total	50257.22	100



Map 5 : Land Use/Land Cover Map Of Buxar 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 or earlier courses 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 located and mapped using 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 Buxar Distt.



Map 6 : Paleochannels In Buxar Distt.

7.0 Floodplain Of River Ganga In Buxar

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 ensuring 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 flows, for agricultural purposes.

7.2 Buxar Distt. falls in the South Bihar Alluvial Plain Zone with the major soils being sandy loam soil, loam soil, clay and clay loam soils (NICRA-ICAR, 2013). Agriculture is the main source of sustenance for residents of this Distt. as it has got almost plain area, fertile soils and river waters for irrigation. Vast floodplain lands were observed to be under extensive cultivation during the survey with the major Kharif crop being Rice and Rabi crop being Wheat. During the survey, vast areas of Ganga River floodplain were found to be under wheat cultivation [Images 7 & 8]. Other major crops in the region included Maize, Mustard, Chana, Bajra and Arhar. Along with these vegetables such as Onion, Tomato, Potato, Brinjal, Chillies, Cauliflower, Parwal, Kakdi and Cabbage are also grown. In some areas, the crop cultivation could be observed upto the edge of the active flow channel of Ganga River indicating that the villagers expanded their fields till the current river channel. The details of some villages surveyed along with their floodplain agriculture produce are provided in Table 2.

Image 7 : Wheat Grown On Floodplain Fields Near

Image 8 : Wheat Fields On Ganga River Bank Near Keshopur Village

Table 2 : Some Floodplain Villages And Their Agricultural Produce In Buxar Distt.

Sr. No.	Village Name	Agriculture Produce
1.	Keshopur	Wheat, Bajra, Chana, Tomato
2.	Umarpur	Wheat, Bajra, Tomato, Potato, Onion
3.	Chausa	Wheat, Arhar, Chana, Potato
4.	Rajpur Kalan	Wheat, Chillies, Onion, Brinjal
5.	Gaighat	Wheat, Maize, Chana, Onion

7.3 **Floodplain Grasses:** The two main floodplain grasses in the study region are – *Saccharum munja* Roxb. (commonly known as *Munj* grass) and *Cynodon dactylon* (L.) Pers. (commonly known as *Doob* or *Durva* grass). Among these, Munj grass is most dominant and luxuriant along the Ganga River banks and on the *diaras*. This species is a perennial wild grass growing upto 2m height and found luxuriantly along river banks in India. It forms extensive root network that binds the soil/pebbles and forms tall thick clumps with high biomass tufts. During the survey, huge patches of this grass were observed in areas such as Sabdalpur, Belarpur, Keshopur, Rajpur Kalan and Umarpur [Images 9 & 10]. Upon interaction, it was recorded that this grass is used throughout the Distt. for roof thatching in villages. Along with this some local residents also use this grass in construction of temporary huts to monitor their agricultural fields. Apart from this some villagers also made use of this grass in dried form for making ropes, brooms and mats. The abundance of this grass and availability throughout the year makes it an excellent resource for the residents in this region.

Image 9 : Luxuriant Growth Of Munj Grass Near Sabdalpur

Image 10 : Luxuriant Growth Of Munj Grass Near Keshopur

8.0 Wetlands In BuxarDistt.

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. According to the report prepared by Tare et al. (2012), about 158 different wetlands are reported from Buxar Distt. which include lakes/ponds, oxbow lakes/cut off meanders, waterlogged, rivers/streams, tanks/ponds and other wetlands with size <2.25 ha. However, during the current study about 118 different wetlands have been recorded from the study region covering a total area of 1861.61 Ha. The details of these wetlands are provided in Table 3. Map 7 depicts the spatial distribution of these water bodies in the study region of Buxar Distt. Some of the major wetlands observed during field survey are discussed in this section.

Table 3 : List Of Wetlands In The Study Region

Sr. No.	Wetland	Latitude	Longitude	Area (Ha)
1.	01	25°27'42.66"N	83°53'42.03"E	0.15
2.	02	25°28'47.48"N	83°52'34.82"E	6.77
3.	03	25°28'0.66"N	83°55'3.78"E	7.14
4.	04	25°29'0.05"N	83°54'8.96"E	0.12
5.	05	25°28'40.24"N	83°54'39.12"E	1.11
6.	06	25°28'25.72"N	83°54'11.05"E	0.28
7.	07	25°28'51.87"N	83°53'27.89"E	0.73
8.	08	25°28'48.33"N	83°53'37.24"E	0.71
9.	09	25°29'17.40"N	83°52'49.08"E	1.18
10.	10	25°29'14.59"N	83°52'55.26"E	0.27
11.	11	25°29'13.90"N	83°53'10.03"E	0.14
12.	12	25°30'5.59"N	83°53'18.90"E	3.11
13.	13	25°29'58.45"N	83°53'29.54"E	0.36
14.	14	25°30'16.14"N	83°53'34.52"E	1.74
15.	15	25°30'29.51"N	83°53'4.86"E	0.57
16.	16	25°30'22.30"N	83°53'40.00"E	0.31
17.	17	25°30'48.51"N	83°53'57.09"E	2.46

18.	18	25°30'59.49"N	83°54'39.52"E	1.45
19.	19	25°29'58.43"N	83°55'7.76"E	0.58
20.	20	25°29'55.82"N	83°55'38.49"E	2.92
21.	21	25°29'53.47"N	83°56'3.50"E	0.31
22.	22	25°29'14.67"N	83°57'0.29"E	0.68
23.	23	25°30'35.66"N	83°56'7.24"E	1.36
24.	24	25°31'40.40"N	83°54'54.79"E	0.89
25.	25	25°31'22.73"N	83°54'48.26"E	0.30
26.	26	25°31'27.81"N	83°55'2.08"E	0.30
27.	27	25°31'26.51"N	83°54'41.13"E	0.20
28.	28	25°31'28.62"N	83°54'42.84"E	0.18
29.	29	25°31'18.18"N	83°55'46.43"E	1.1
30.	30	25°31'15.23"N	83°55'49.93"E	0.22
31.	31	25°30'12.74"N	83°56'55.72"E	0.92
32.	32	25°30'17.21"N	83°57'58.74"E	0.84
33.	33	25°30'21.26"N	83°58'12.34"E	0.22
34.	34	25°30'36.53"N	83°58'16.56"E	1.59
35.	35	25°31'11.86"N	83°56'54.37"E	0.57
36.	36	25°32'14.66"N	83°56'4.86"E	1.49
37.	37	25°31'59.68"N	83°56'17.70"E	0.40
38.	38	25°33'4.33"N	83°56'23.81"E	0.23
39.	39	25°32'15.88"N	83°56'30.07"E	1.23
40.	40	25°32'42.91"N	83°56'42.14"E	0.51
41.	41	25°31'12.30"N	83°58'13.70"E	0.13
42.	42	25°31'9.31"N	83°58'20.55"E	0.11
43.	43	25°30'44.17"N	83°59'23.82"E	0.18
44.	44	25°31'12.14"N	83°59'8.77"E	0.42
45.	45	25°31'58.37"N	83°58'24.43"E	0.36
46.	46	25°32'8.92"N	83°58'30.77"E	0.79
47.	47	25°32'27.20"N	83°58'13.49"E	2.00
48.	48	25°32'41.63"N	83°57'46.86"E	0.64
49.	49	25°32'42.55"N	83°58'5.99"E	0.43

50.	50	25°32'55.68"N	83°58'14.43"E	0.26
51.	51	25°32'53.34"N	83°58'14.65"E	0.29
52.	Angani Lake	25°33'3.44"N	83°57'51.01"E	4.10
53.	53	25°33'25.63"N	83°57'16.19"E	0.58
54.	54	25°33'27.32"N	83°57'32.99"E	0.78
55.	55	25°33'23.30"N	83°57'37.96"E	1.21
56.	56	25°33'20.39"N	83°57'38.61"E	0.42
57.	57	25°31'48.71"N	84° 0'41.58"E	0.39
58.	58	25°31'48.11"N	84° 0'36.63"E	0.20
59.	59	25°31'57.68"N	84° 0'13.73"E	0.30
60.	60	25°32'12.28"N	83°59'21.83"E	0.24
61.	61	25°32'43.90"N	83°59'40.84"E	0.26
62.	62	25°32'31.48"N	83°59'55.08"E	0.14
63.	63	25°32'48.02"N	83°59'50.64"E	0.33
64.	64	25°33'16.28"N	83°59'17.91"E	0.33
65.	65	25°33'1.06"N	83°58'25.08"E	0.28
66.	66	25°33'19.38"N	83°59'18.45"E	0.10
67.	67	25°33'15.50"N	83°59'3.93"E	0.10
68.	68	25°33'24.63"N	83°58'40.66"E	0.85
69.	69	25°33'15.59"N	83°58'0.17"E	0.89
70.	70	25°33'31.55"N	83°58'13.27"E	0.50
71.	71	83°58'13.27"E	83°58'47.29"E	0.71
72.	72	25°34'6.76"N	83°58'39.96"E	0.91
73.	73	25°34'14.77"N	83°58'59.16"E	1.71
74.	74	25°34'15.55"N	83°59'12.01"E	1.48
75.	75	25°34'51.27"N	83°59'26.72"E	0.73
76.	76	25°34'17.56"N	83°59'29.82"E	0.82
77.	77	25°33'8.92"N	83°59'49.22"E	1.30
78.	78	25°33'9.72"N	83°59'58.28"E	0.27
79.	79	25°33'48.33"N	83°58'41.72"E	1.10
80.	80	25°33'50.28"N	83°58'48.35"E	0.24
81.	81	25°33'55.98"N	83°58'51.61"E	0.25

82.	82	25°33'59.47"N	83°58'59.19"E	0.30
83.	83	25°33'41.78"N	83°59'9.34"E	1.10
84.	84	25°33'37.38"N	83°59'17.85"E	0.16
85.	85	25°33'4.96"N	83°58'37.10"E	0.67
86.	86	25°33'36.58"N	84° 1'24.53"E	1.97
87.	87	25°33'59.75"N	84° 0'57.76"E	0.11
88.	88	25°35'16.75"N	83°59'33.77"E	0.29
89.	89	25°33'23.22"N	84° 2'2.17"E	0.28
90.	90	25°35'21.58"N	84° 1'17.53"E	0.10
91.	91	25°33'22.90"N	84° 2'9.31"E	0.32
92.	92	25°33'17.47"N	84° 2'9.92"E	1.15
93.	93	25°33'7.97"N	84° 2'42.11"E	0.14
94.	94	25°33'20.59"N	84° 2'22.14"E	0.18
95.	95	25°35'22.41"N	84° 1'32.93"E	0.25
96.	96	25°36'5.36"N	84° 0'55.08"E	0.15
97.	97	25°34'3.95"N	84° 2'40.01"E	0.52
98.	98	25°34'37.12"N	84° 2'50.46"E	3.41
99.	99	25°36'2.38"N	84° 1'1.48"E	0.19
100.	100	25°35'8.52"N	84° 2'55.29"E	0.13
101.	101	25°34'3.37"N	84° 4'10.10"E	1.16
102.	102	25°35'46.69"N	84° 3'23.51"E	0.32
103.	103	25°36'4.19"N	84° 3'45.14"E	1.42
104.	104	25°35'1.41"N	84° 5'35.44"E	3.40
105.	105	25°35'14.73"N	84° 5'9.12"E	0.28
106.	106	25°37'6.73"N	84° 4'32.32"E	0.71
107.	107	25°37'28.57"N	84° 4'26.35"E	0.26
108.	108	25°36'17.61"N	84° 6'8.10"E	0.10

109.	109	25°36'23.92"N	84° 6'36.30"E	0.45
110.	110	25°37'10.67"N	84° 6'7.82"E	0.38
111.	111	25°37'53.07"N	84° 6'4.12"E	0.37
112.	112	25°38'7.65"N	84° 5'36.48"E	0.27
113.	113	25°38'46.77"N	84° 5'39.40"E	0.58
114.	114	25°38'48.07"N	84° 6'37.38"E	0.13
115.	115	25°40'2.24"N	84° 9'7.92"E	4.22
116.	Bhagar	25°37'50.55"N	84°17'37.90"E	1458
117.	117	25°36'2.06"N	84° 8'1.93"E	260
118.	118	25°35'15.95"N	84° 1'34.14"E	0.67
Total				**1861.61 Ha**

8.2 **Bhagad/Bhagar Oxbow Lake:** Locally known as Bhagar or Bhagad, this oxbow lake is the largest wetland in study region situated approximately 35-36 kms eastwards from Buxar town. It lies between between 25°18N to 25°45N and 83°772E to 84°40E spreading from Chakki village to Nainijor [Image 11] and covers a total area of about 1458 Ha. The oxbow lake is about 20 kms long and about 0.25-0.35 km wide with the major villages alongside it being Chakki, Gaighat, Bairia, Pandeypur, Udhaura, Mahuar and Nainijor. The lake is fed by monsoon run off and ingress of flood waters from Dharmawati River (Prasad et al., 2020). According to the local residents, Ganga River used to flow here till about 40-45 years back. But due to the shift in its course, this oxbow lake came into existence.

Image 11 : Location Of Bhagad Oxbow Lake

8.3 A detailed study of this oxbow lake was recently undertaken by Prasad *et al.* (2020) which highlighted the ecological richness of this lake and its role in local livelihoods. According to this study, the water depth of this lake ranges from 1.5-3 meters during summers and 4-6 meters during monsoon months. Approximately 30% of this lake is infested with submerged vegetation and aquatic weeds mainly *Eichhornia crassipes* (water hyacinth) and *Hydrilla cillata*. The study also highlighted that this lake served as an important water source for fauna including birds and antelope species such as – blackbucks (*Antilope cervicapra*), swamp deer (*Rucervus duvaucelii*) and nilgai (*Boselaphus tragocamelus*). The study also reported presence of 44 different fish species from this lake.

8.4 During the survey, this lake was observed at two different sites – at its confluence with Dharmavati River near Chakki village and near Udhaura village [Images 12 & 13]. The lake water was found to be infested with water hyacinth and other aquatic flora at both these sites. The main reason for this was high sewage influx that comes into this lake along with Dharmavati river water. Upon interaction it was found that the lake water was used for different purposes such as bathing animals, irrigation of surrounding fields and fishing. According to the respondents, fish mainly come into this lake during monsoons when flood water of the river enters here. During lean seasons the fish size and quantity of fish catch decreases. Fishing is done by using different techniques such as drag nets, hook and line or by placing nets made of plastic in the lake water. The respondents also revealed that this lake attracts different birds which can be seen mainly in the winters.

Image 12 : Bhagar Oxbow Lake As Seen Near Chakki Village On 11th April, 2021

Image 13 : Bhagar Oxbow Lake As Seen Near Udhaura Village On 11th April 2021

8.5 **Mahipal Pokhara:** A roughly rectangular shaped pond was observed in Buxar town [Image 14] which was referred as Mahipal Pokhara by the local residents. Upon interaction it was noted that this water body is believed to be hundreds of years old. The respondents reiterated that till many years ago people believed that by taking bath in this pond water fever could be cured which was a chief reason for its popularity in the region. A 'Gauri Shankar' temple was also observed on its bank which is also believed to be old and associated with the water body. However, currently it is in a decrepit state mainly because of reasons such as – erosion of its banks and encroachments, deterioration of water quality due to sewage influx and dumping of solid waste into the water. Still some local residents were involved in fish rearing and catching from the water body. Some people also used this water for washing clothes and bathing their animals. The respondents strongly reiterated the need for conservation and proper management of this water body with the help of local authorities.

Image 14 : Location Of Mahipal Pokhara

Image 15 : Deteriorated State Of Mahipal Pokhara As Observed On 10th April, 2021

8.6 **Kamaldah Pokhara (VyaghraSar):** The name of Buxar is said to be derived from the word 'VyaghraSar'. The tiger face of Rishi Vedshira, an outcome of the curse of the sage Rishi Durvasha, was restored after bathing in a holy tank which was later named as VyaghraSar (https://buxar.nic.in/history/). This tank is now known as Kamaldah Pokhara and lies in the heart of Buxar town near Buxar Railway Station [Image 16]. The surroundings of this tank are converted into a park which is a popular attraction among locals especially during mornings and evenings.

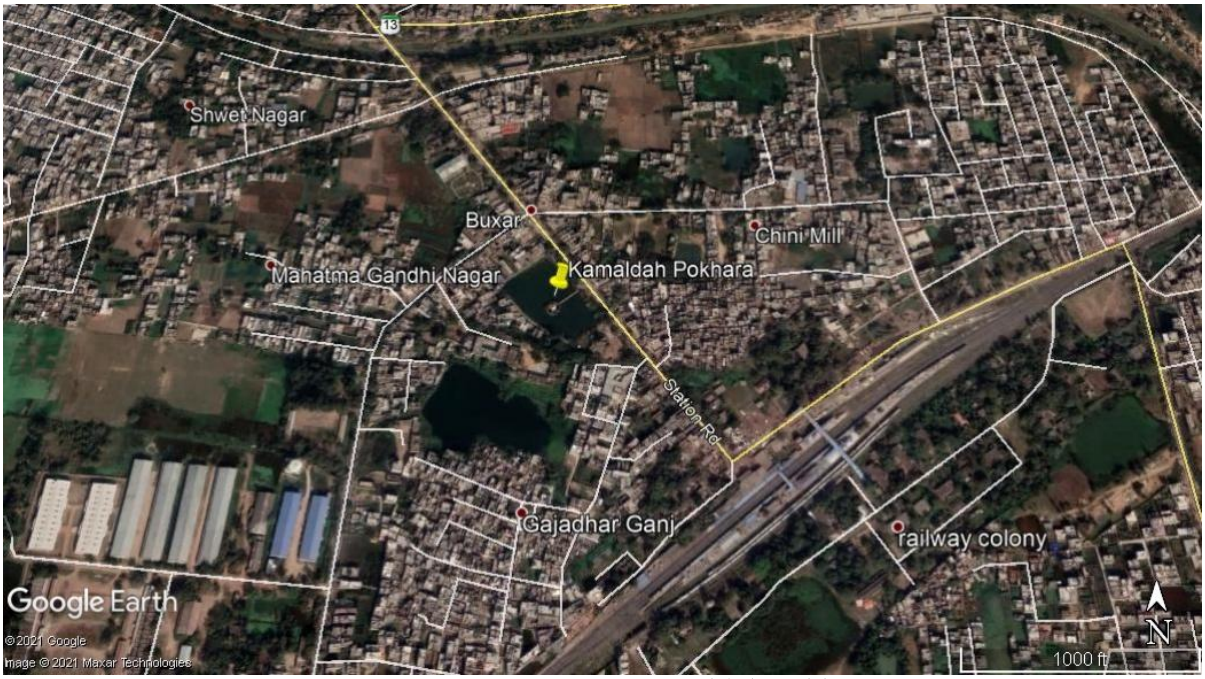


Image 16 : Location Of Kamaldah Pokhara

Image 17 : Kamaldah Pokhara As Seen On 10th April, 2021

8.7 **Angani/Anjani Pokhara:**This lake is located in the Nuawan area of Buxar [Image 18] and is an important source of water for various activities such as bathing, washing clothes and performing various religious practices by the local residents. According to folklore and mythology, this lake was the site where Maharishi Uddalak welcomed Lord Rama and Lakshaman on the fourth day of 'Panchkosi Parikrama' by offering Sattu and Radish. Hence, till date many devotees visit here on fourth day of this parikrama and eat sattu-radish as Prasad after taking bath in the lake water. According to another popular mythological belief, Mata Anjani along with her son Lord Hanuman used to reside on the banks of this lake close to the ashram of Maharishi Uddalak. Hence, this lake came to be popularly known as 'Angani/Anjani Lake' (Jagran, 2019). However, despite its mythological and social importance, this lake was found to be in neglected state [Image 19] with waste being dumped at some sites and encroachments at some. The local respondents claimed presence of large size fish in the lake water such as *Rohu* which are sometimes caught by them for local consumption.

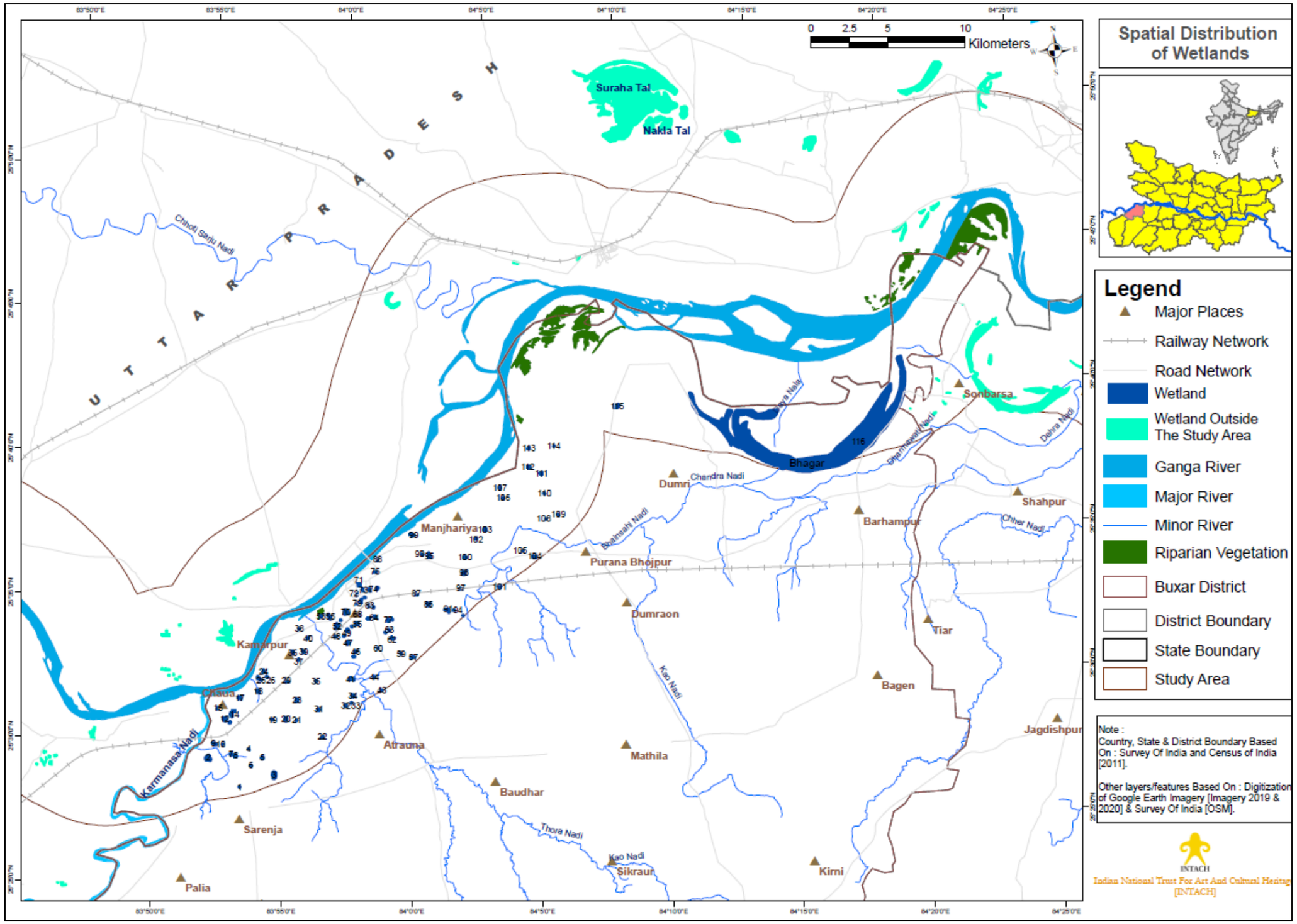
Image 18 : Location Of Angani Lake

Image 19 : Angani Lake As Seen On 12th April, 2021

8.8 **Unnamed Wetland:** A wetland which does not have any particular name was also observed on the Civil Lines road close to Vaishnavi Clarks Inn Hotel in Buxar town [Image 20]. According to the local residents, the pond received ample water during monsoons which was used during remaining part of the year for various household purposes. No kind of religious activities or beliefs were found to be associated with this pond and it seemed to be of recent origin unlike other wetlands as discussed above. The current condition of this wetland is depicted in Image 21 as observed during the field survey. If maintained properly this wetland can become an important source of water throughout the year for local residents.

Image 20 : Unnamed Wetland in Civil lines Buxar


Image 21 : Unnamed Wetland [Map Above] As Observed In Buxar On 12th April, 2021



Map 7 : Spatial Distribution Of Water Bodies Within Study Area

9.0 Riparian Flora Along Ganga River In BuxarDistt.

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 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 some time ago, no proper 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, there is a detailed study published in the form of a book titled – "The Ganga – A Scientific Study" edited by Krishnamurti [1991] which documents 475 riparian plant species from Rishikesh to Chinasura.Earlier workers have reported from Buxar to Barh, the presence of 7 shrubs, 41 herbs, 6 grasses and 2 sedges and, besides these, a number of tree species along the banks of river during 1987-88 (Kumar, 2001).

9.3 During the field survey the riparian vegetation was found to comprise more of shrubs and herbs while trees were sparse [Image 22]. The rapid expansion of villages and associated agricultural activities in the floodplain regions is one of the important reasons for the disappearance of natural vegetation. The common tree species in the region included – Mango, Peepal, Banyan, Neem and Semal among which Peepal and Banyan were also found associated with various religious sites. Among the shrubs, *Polygonum glabrum* was found to be growing luxuriantly along the river water on many bank sites [Image 23]. Other commonly found shrubs and herbs in the study region included – *Argemone Mexicana, Lippia alba, Croton bonplandianus* and *Solanum xanthocarpum*. The floodplain grass – *Saccharum munja* was also a major component of riparian vegetation throughout with its luxuriance dominating the other flora at some sites. The list of riparian plant species recorded during the survey is presented in Table 4 and some notable species are depicted in Images 24-27.

Image 22 : Riparian Vegetation As Observed Near Chausa Town

Image 23 : *Polygonum Glabrum* Found Growing Along Ganga River Near Keshopur

Table 4 : Riparian Plant Species Recorded In The Study Area

Sr. No.	Botanical Name	Family	Habit	Common Name
1.	*Acacia nilotic*a (L.) Delile	Fabaceae	Tree	Babool
2.	*Azadirachta indica* A.Juss.	Meliaceae	Tree	Neem
3.	*Bombax ceiba* L.	Bombacaceae	Tree	Semal
4.	*Dalbergia sissoo* DC.	Fabaceae	Tree	Shisham
5.	*Ficus benghalensis* L.	Moraceae	Tree	Banyan
6.	*Ficus religiosa* L.	Moraceae	Tree	Peepal
7.	*Mangifera indica* L.	Anacardiaceae	Tree	Mango
8.	*Phoenix dactylifera* L.	Arecaceae	Tree	
9.	*Borassus flabellifer* L.	Arecaceae	Tree	Taad
10.	*Argemone mexicana* L.	Papaveraceae	Shrub	Mexican poppy
11.	*Calotropis gigantea* (L.) Dryand.	Apocynaceae	Shrub	Safed Aak
12.	*Calotropis procera* (Aiton) Dryand.	Apocynaceae	Shrub	Aak
13.	*Lippia alba* (Mill.) N.E.Br. ex Britton & P.Wilson	Verbenaceae	Shrub	
14.	*Polygonum glabrum* Willd.	Polygonaceae	Shrub	Common marsh buckwheat
15.	*Justicia adhatoda* L.	Acanthaceae	Shrub	Arus/Arusa
16.	*Ricinus communis* L.	Euphorbiaceae	Shrub	Wild Castor
17.	*Achyranthes aspera* L.	Amaranthaceae	Herb	Chirchira
18.	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Prickly Amaranth
19.	*Blumea lacera* (Burm.f.) DC.	Asteraceae	Herb	Kakronda
20.	*Croton bonplandianus* Baill.	Euphorbiaceae	Herb	Ban Tulsi
21.	*Rumex dentatus* L.	Polygonaceae	Herb	
22.	*Parthenium hysterophorus* L.	Asteraceae	Herb	Congress Grass
23.	*Solanum xanthocarpum* Schrad. & H. Wendl.	Solanaceae	Herb	Kateli
24.	*Xanthium strumarium* L.	Asteraceae	Herb	Chhota dhatura
25.	*Saccharum munja* Roxb.	Poaceae	Grass	Munj
26.	*Cyperus* sp.	Cyperaceae	Grass	
27.	*Cynodon dactylon* (L.) Pers.	Poaceae	Grass	Doob/Durva

Image 24 : *Lippia alba*

Image 25 : *Argemone mexicana*

Image 26 : *Xanthium strumarium*

Image 27 : *Rumex dentatus*

10.0 Faunal Diversity In BuxarDistt.

10.1 **Gangetic Dolphins:** 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 Ganges–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 during 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 During the field survey dolphin sightings were observed near Mahadeva Ghat located close to Chausa town and near Nath Baba Ghat in Buxar town. Total ten sightings involving 2-3 different individuals were recorded at these sites. Upon interaction with local community it was found that the number of dolphins has significantly decreased in this stretch. This could be mainly attributed to changes in river flow, water depth and unchecked fishing activities in the region. Maximum dolphin sightings in this stretch could be observed only during monsoons as reiterated by all interlocutors throughout the study region.

10.3 **Blackbucks:** The blackbuck (*Antilope cervicapra*) is a medium-sized antelope species generally found in semi-arid plains and open forests throughout India (Mahato et al., 2010). They are considered to be the most beautiful of all antelopes because of the male's striking black and white pelage and his long spiral horns (Schaller, 1967).Blackbuck is included in the Schedule-I of Wildlife (Protection) Act, 1972 and is currently classified as 'Least Concern' by IUCN Red List. During the field survey in Buxar Distt., a herd of blackbucks including adult male and female individuals and young offspring were observed in a floodplain agriculture intermixed with scrub forest habitat near Majharia village [Images 28-29]. More than 10-15 individuals were seen foraging on the grasses along with crops grown in these fields close to Ganga River.

10.4 Upon interacting with the villagers, it was noted that these blackbucks were present in this region since many decades. Many villagers even claimed to have seen them since their childhood. A main reason for this can be that during earlier time this region had abundant riparian vegetation and grasslands which served as an important abode for this species. However, as population grew and villages expanded, these areas were largely cleared for agriculture due to which these antelopes have learnt to acclimatize

with human habitations. Their principal source of food includes some remnant floodplain grasses, herbs and agricultural crops grown here. Despite this, the respondents seemed to be aware of their protection status and refrained from killing them, though they tried fencing the agricultural fields to keep them away from the crops.

Image 28 : Adult Male And Female Blackbucks Observed Near Majharia On 13th April, 2021

Image 29 : A Young Offspring Blackbuck Observed Near Majharia On 13th April, 2021

10.5 **Turtles:** Turtles form an important component of Ganga riverine biodiversity and play a critical ecological role by controlling aquatic vegetation, serve as scavengers and help maintain rivers (WII-GACMC, 2017). **During the field survey, interactions with local fishermen revealed a significant decrease (almost 80-90%) in the turtle population during last couple of decades.** According to them, turtles would be seen earlier on the sandy river banks and exposed *diaras*. However, particularly since the last two decades there have been negligible sightings of turtles in the study region.

10.6 **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 field survey, nilgai was found to be present abundantly throughout Buxar Distt. especially in and around agricultural fields including Ganga River floodplain areas [Image 30]. 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 awaywith the help of sticks and stones.

Image 30 : Nilgai Observed Near Dalan Chhapra Village On 11th April, 2021

10.7 **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 farmers in villages such as Mahuar, Gaighat, Keshopur, Umarpur and Majharia complained about the menace caused by wild boars especially to crops such as potato and onion. **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.

10.8 **Avifaunal Diversity:** BuxarDistt. has a rich diversity of avian species which is relatively understudied. 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 55 different species of birds were sighted during the field visit in study region. The list of birds recorded is provided in Table 5 while some of the notable birds in study region are depicted in Images 31-32.

Table 5 : List Of Birds Recorded In Study Region Of Buxar Distt.

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	Glossy Ibis	*Plegadis falcinellus*	Least Concern
5	Indian Pond Heron	*Ardeola grayii*	Least Concern
6	Common Sandpiper	*Actitis hypoleucos*	Least Concern
7	Asian Openbill	*Anastomus oscitans*	Least Concern
8	Little Cormorant	*Microcarbo niger*	Least Concern
9	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
10	White breasted –Waterhen	*Amaurornis phoenicurus*	Least Concern
11	Common Moorhen	*Gallinula chloropus*	Least Concern
12	Eurasian Coot	*Fulica atra*	Least Concern
13	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
14	**River Tern**	***Sterna aurantia***	**Vulnerable**
15	Red-wattled Lapwing	*Vanellus indicus*	Least Concern

16	Black Drongo	*Dicrurus macrocercus*	Least Concern
17	Common Myna	*Acridotheres tristis*	Least Concern
18	Bank Myna	*Acridotheres ginginianus*	Least Concern
19	Asian Pied Starling	*Gracupica contra*	Least Concern
20	Paddyfield Pipit	*Anthus rufulus*	Least Concern
21	Green Bee-eater	*Merops orientalis*	Least Concern
22	Jungle Babbler	*Turdoides striata*	Least Concern
23	Indian Bushlark	*Mirafra erythroptera*	Least Concern
24	Chestnut-headed Bee-eater	*Meropos leschenaulti*	Least Concern
25	Common Babbler	*Argya caudata*	Least Concern
26	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
27	Grey Wagtail	*Motacilla cinerea*	Least Concern
28	Indian Silverbill	*Euodice malabarica*	Least Concern
29	Asian Plain Martin	*Riparia chinensis*	Least Concern
30	Common Tailorbird	*Orthotomus sutorius*	Least Concern
31	Crested Lark	*Galerida cristata*	Least Consern
32	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
33	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Least Concern
34	House Sparrow	*Passer domesticus*	Least Concern
35	Indian Jungle Crow	*Corvus culminatus*	Least Concern
36	House Crow	*Corvus splendens*	Least Concern
37	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
38	Common Pigeon	*Columba livia*	Least Concern
39	Barn Swallow	*Hirundo rustica*	Least Concern
40	Brown-headed Barbet	*Psilopogon zeylanicus*	Least Concern
41	Coppersmith Barbet	*Psilopogon haemacephalus*	Least Concern
42	Ashy Prina	*Prinia socialis*	Least Concern
43	Plain Prinia	*Prinia inornata*	Least Concern
44	Asian Koel	*Eudynamys scolopaceus*	Least Concern
45	Greater Coucal	*Centropus sinensis*	Least Concern
46	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
47	Red-vented Bulul	*Pycnonotus cafer*	Least Concern
48	Shikra	*Accipiter badius*	Least Concern
49	Common Kaestral	*Falco tinnunculus*	Least Concern
50	Black-winged kite	*Elanus caeruleus*	Least Concern
51	Scaly-breasted Munia	*Lonchura punctulata*	Least Concern

52	Golden Oriole	*Oriolus kundoo*	Least Concern
53	Spotted Dove	*Spilopelia chinesis*	Least Concern
54	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern
55	Laughing Dove	*Spilopelia senegalensis*	Least concern

Image 31 : River Tern

Image 32 : Grey Francolin

11.0 Ganga Riverine Islands/Diaras In Buxar Distt.

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.

11.2 Downstream of and close to Buxar town, the Ganga is divided into two different courses by a group of irregularly shaped *diaras* which extend all the way to the curve made by the river near Ballia town. These *diaras* are referred by the riparian villagers as 'Umarpur *diara*' [Image 33] and are accessed from Buxar banks by boats. These *diaras* were a storehouse of riparian grasses and vegetation till few decades ago which have been largely cleared now for agricultural purposes. The *diara* areas in this region are known mainly for their 'parwal' cultivation which is one of the popular vegetables throughout Bihar state. Besides this cucumber, onion and watermelon are the major crops grown on *diaras*. The respondents also highlighted that some parts of these *diaras* are covered with riparian grass – *Saccharum munja* [Image 34] which serves as an important habitat for wild boars that cause menace in floodplain areas.

Image 33 : Local Residents Using Boats To Travel to Umarpur Diara

Image 34 : Umarpur Diara With Luxuriant Growth Of Riparian Grasses Stabilizing the Banks

11.3 Another irregularly shaped *diara* can be observed near Beyasi village of Ballia Distt. which is referred by the local residents as Shivpur *diara* [Image 35]. The major part of this *diara* falls under Ballia Distt. of U.P while only a small portion of it falls under Buxar Distt. of Bihar. This *diara* is also under intense agriculture which mainly include crops such as mustard, potato, parwal, wheat and watermelon. Some fringe portions of this *diara* in Buxar Distt. are also covered by the growth of riparian vegetation dominated by *Saccharum* grass which is often collected for thatching roofs of houses in riparian villages.

Image 35 : Shivpur *Diara* As Observed From Beyasi-Ballia Bridge On 12th April, 2021

12.0 Fishing In BuxarDistt.

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 Fishing from Ganga River and its tributaries (mainly Karamnasa, Thora and Dharmavati) was found to be an important source of livelihood and food in the study region of Buxar Distt. Many local residents, specially belonging to the Mallah community were involved in fishing using small boats throughout the region. The main fishing techniques used by them include fine mesh sized nets spread across the stream which are mostly made of plastic and available from nearby markets and rope-based drag nets some of which are made locally [Image 36]. Along with this, some local residents also use fishing traps and hook & line technique for catching fish mainly in the tributaries [Image 37]. The fishing traps are also made locally by the residents and can be of different shapes and sizes according to their requirements. While the raw materials for drag nets are obtained from market and woven by the fishermen as per their requirements, the fine mesh plastic nets are available in the markets for about Rs. 600 Rs. Per Kg.

12.3 A study conducted by Manna et al. (2020) highlighted upon a unique fishing technique known locally as 'Tuka-feka' in the Buxar stretch of Ganga River. In local dialects, the term 'Tuka' means the 'Ball shaped bait' while 'feka' implies 'throwing the device by hand'. According to the study, this technique has gained popularity in the region owing to its simple and efficient methodology for capturing Indian Major Carps. The fishing gear consists of an 'H' shaped bamboo structure unit installed at the mid river channel when water level recedes during winter [Image 38]. Preparation of attractive bait from plant derived materials is the key in 'Tuka-feka' fishery. Locally available ingredients comprising of chickpea (*Cicer arietinum*), mustard (*Brassica juncea*) oil cake, jowar (*Sorghum bicolor*), mahua (*Madhuca longifolia*), fenugreek (*Trigonella foenum*) are blended with alluvial mud.

Image 36 : Fine Mesh Fishing Nets Set Up In Ganga River Near Buxar Central Jail

Image 37 : A Fish Trap Placed In Thora River As Seen From Thora River Bridge Between Chausa And Buxar

Image 38 : H-Shaped Bamboo Structure Of Tuka-Feka Fishery (source: Mannan et al., 2020)

12.4 The boats used for fishing are small sized and hand-rowed [Image 39] made usually from 'Sekua' wood (*Shorea robusta*) and sometimes from 'Jamun' wood (*Syzygium cumini*) as well. These boats were earlier mainly constructed using the raw materials available in the villages by local Mallah community members. However, currently only few members construct these boats by themselves while majority are dependent upon 'Mistry' (carpenters) from other villages for this. The cost of constructing these boats can range from Rs. 50,000 to Rs. 1 lakh depending upon various factors.

Image 39 : Small Hand-Rowed Boat Used For Fishing By Mallah Community In Buxar Distt.

12.4 Upon interactions, fishermen in the study region highlighted that the commonly caught fish in this stretch included - Rohu (*Labeo rohita*), Catla (*Labeo catla*), Tengara (M*ystus tengara*), Buari/Barari (*Wallago attu*) and Sidhari (*Puntius* sp.). These fish, especially Rohu and Catla, are found in plenty during monsoons while Tengara is found more during the summer months. Some of the important fish species caught from the region are represented in Table 6. The fish caught are generally sold in Buxar town or local markets of nearby villages. While Rohu and Catla are sold anywhere between Rs. 300-500 per kg in the market, Sidhari is least priced fish which is sold for Rs. 60-80 per kg. They also reiterated the increase of exotic fish – common carp/Chinese carp (*Cyprinus carpio*) in the region which is found in more quantity especially during pre-monsoon season. The fishermen also highlighted that more fish were caught from sites which are near river banks which was an important reason of many nets being placed in such areas throughout rather than in the centre of river. They also said that repeated changing of sites helped them in identifying the most ideal areas for fishing in the region.

12.5 The fishermen in this region unanimously raised their concerns over decreasing fish catch and yield (almost 70-80% decrease) during the last few decades. Various important factors such as overexploitation of fisheries, water pollution, and variations

in river flow and depth along with changes in climatic conditions such as uncertain monsoons and higher temperatures during summers were believed to be chief reasons for this decrease. Besides this, the increase in population of exotic carps also proved to be a tough competition for survival of Indian major carps in Ganga River. This had significantly impacted the livelihoods of fishermen in the region who are forced to look for alternate modes of earning income for family. **The respondents also reiterated that Hilsa fish, which was once available in the Ganga river stretch of Buxar Distt. was no longer seen since the last few decades.**

Table 6 : Major Fish Caught From Rivers In The Study Region

Sr. No.	Scientific Name	Common Name
1.	*Labeo rohita*	Rohu
2.	*Labeo catla*	Catla/Bhakur
3.	*Wallago attu*	Buari/Barari
4.	*Mystus tengara*	Tengara
5.	*Puntius sp.*	Sidhari/Kothia
6.	*Cyprinus carpio*	Common/Chinese carp
7.	*Channa punctata*	Garai
8.	*Oreochromis niloticus*	Tilapia
9.	*Cirrhinus mrigala*	Mrigal carp

13.0 Groundwater In BuxarDistt.

13.1 Ground water characteristics of a particular area are subject to several natural factors like precipitation, drainage, topography, lithology and hydrogeological conditions of the region. Geomorphologically, Buxar Distt. forms a part of southern Ganga plain. Physiography of this Distt. is an alluvial plain having gentle slope towards north which is marked by presence of several minor depressions. Broadly the Distt. is divided into two micro physiographic units – (1) The low-lying northern plain having rich fertile soil and covering the entire geographical area of Simri and Chakki; (2) The flat region of the south which is densely populated, covered by network of canals and covers the geographical areas of Chausa, Rajpur, Kesath, Nawanagar, Itarhi, Dumraon blocks and parts of Buxar & Barhampur blocks (CGWB, 2013).

13.2 According to the Central Ground Water Board (CGWB), the groundwater in this Distt. occurs under water table condition in aquifer disposed at shallow depth. This aquifer is commonly tapped by dug-wells with depths ranging from 5-10 m bgl (16-32 ft bgl) whereas the shallow tube-wells in the region tap unconfined aquifer at depths ranging from 20-60 m bgl (65-195 ft. bgl). During the field survey ground water levels in different villages was recorded based on interaction with local residents which is presented in Table 7. The groundwater availability was found to be shallowest in Majharia village with depth at 50ft. bgl while it was deepest in Narbatpur with depth at 200 ft. bgl.

13.3 The respondents in the study region reiterated the use of dug wells for using ground water which was once very prevalent but has now reduced giving way to bore pumps. A beautiful and historic well, known locally as 'Rani Kuan', is situated along Ganga river near Nath Baba Ghat which stands reminiscent of this practice in the region [Image 40]. Nonetheless, some residents still made use of wells for water some of which were very old. Such an old well was observed in a household situated on the Thana Road in Civil Lines area of Buxar town. According to the members of that house, the well was almost 60-70 years old and was an important source of water for them since last two generations.

Table 7 : Ground Water Level Of Different Sites In Study Region

Place	Coordinates		Ground Water Table (Ft.)
	Lat.	Long.	
Narbatpur	25°30'10"N	83°53'12"E	200
Chausa	25°30'33"N	83°53'32"E	40
Mahadev Ghat	25°34'42"N	83°58'30"E	80
Thora River Bank	25°33'36"N	83°56'39"E	65
Rani Ghat	25°34'19"N	83°57'58"E	150
Umar pur	25°36'02"N	84°00'45"E	100
Hanuman Ghat	25°34'14"N	83°59'17"E	110
Ram Rekha Ghat	25°34'34"N	83°58'17"E	150
Manjharia	25°36'37"N	84°02'46"E	50

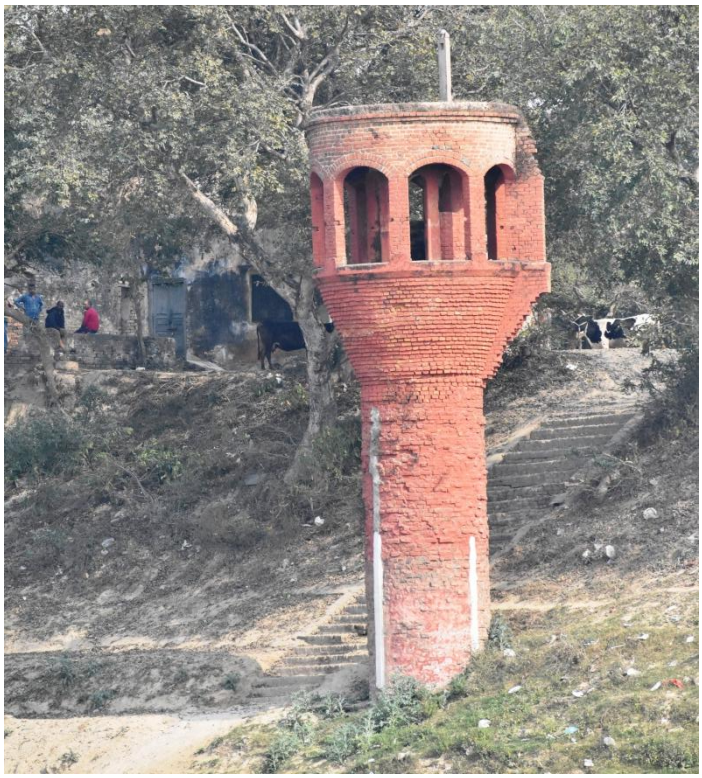


Image 40 : Rani Kuan Along Ganga River In Buxar

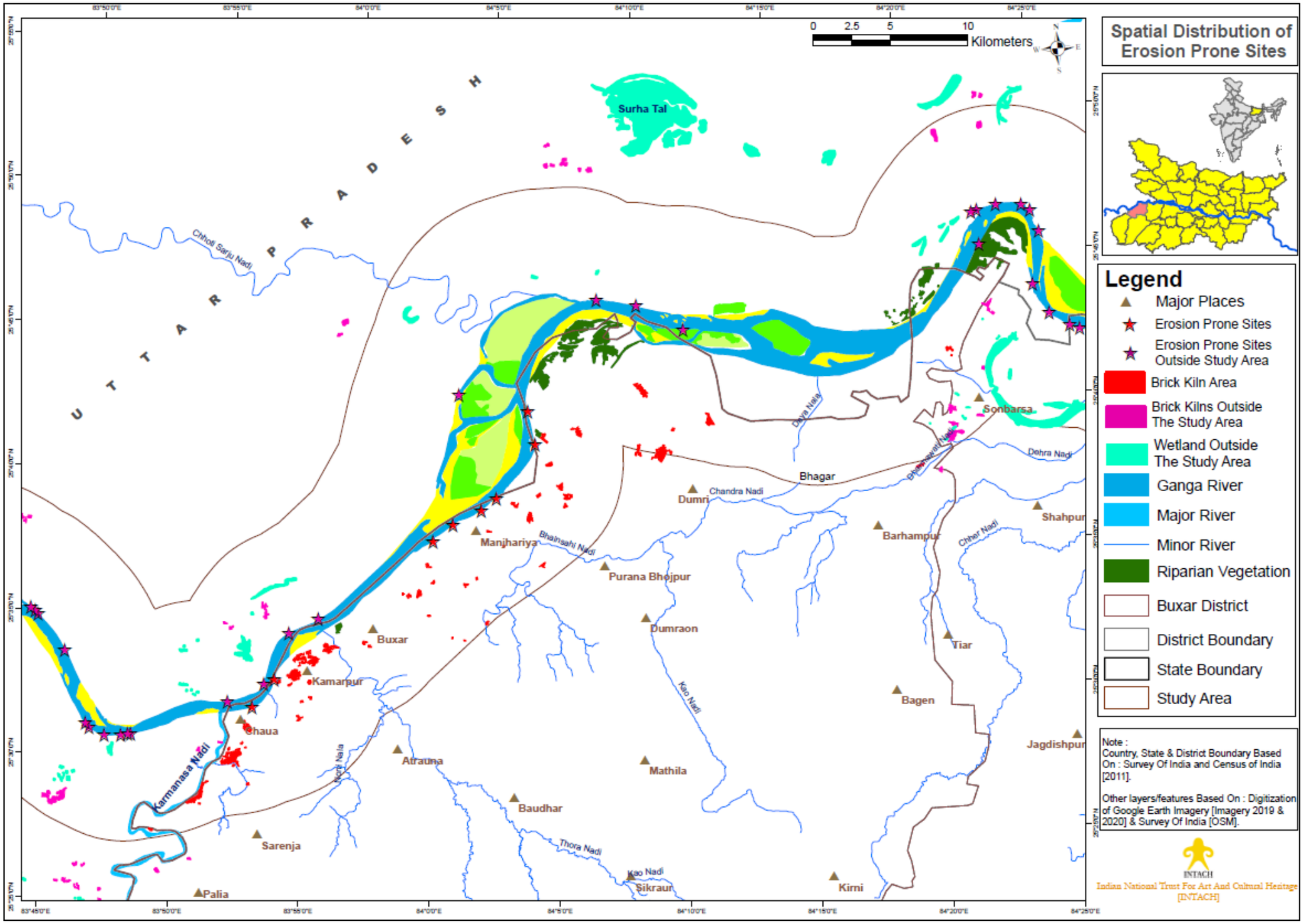
14.0 Ganga River Bank Erosion In BuxarDistt.

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.

14.2 During the field survey, severely eroded sites were observed along Ganga river bank from Chausa to Buxar town and upto Umarpur village. Some such sites are represented in Images 41-42 while all the erosion prone sites in the study region are marked on Map 8. In some sites, the intense rainfall accompanied by torrential flow of water in Ganga River resulted in lateral bank erosion. Various other factors such as decrease in riparian vegetation and largescale land-use changes have also contributed to this severe erosion. The local respondents reiterated about losses caused by floods and associated erosion to their villages and floodplain agriculture fields. They also claimed to have no kind of aid or assistance in this matter from anyone including authorities thereby bearing the brunt of these losses all by themselves. However, in few sites such as Umarpur village, the plantation of trees such as Peepal, Neem, Mango and Babool along with luxuriant growth of *Saccharum* grass helped in binding the bank soil and preventing disastrous effects of erosion during floods. Along with this, stone riprap was also placed along the river banks to control bank erosion in this region.

Image 41 : Severe Bank Erosion As Observed Near Ramrekha Ghat In Buxar Town [geobag protection of no use]

Image 42 : Bank Erosion As Observed Near Chausa Town



Map 8 : Spatial Distribution Of Erosion Prone Sites In Buxar Distt.

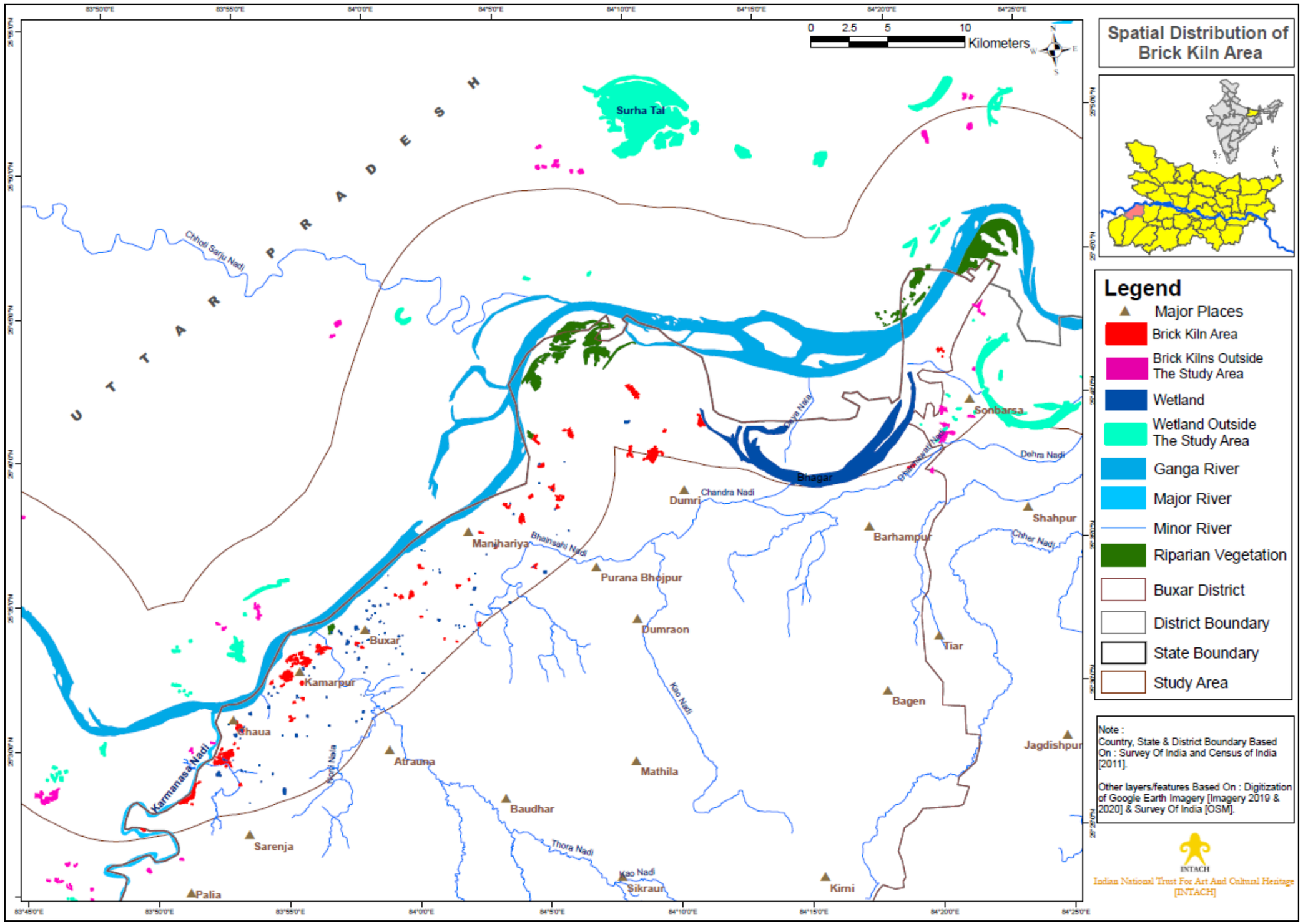
15.0 Mining And Brick Kilns In Buxar

15.1 The mineral resources of Buxar Distt. are negligible (https://buxar.nic.in/about-district/). However, sand is widely available mostly from the dried up river bed of Ganga in the study region [Image 43]. Though there were no direct sightings or record of sand collection during survey. However, according to secondary sources illegal sand mining is present sometimes as it has a good demand in nearby towns of both Bihar and U.P. states. Such unchecked and 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 43 : Dried Up Ganga River Bed As Observed Near Rajpur Kalan On 11th April, 2021

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. Except select few, most of the brick kilns observed in this survey were situated at a distance from Ganga River but mostly in the floodplain region. The spatial distribution of brick kilns in the study region is depicted in Map 9 and a brick kiln is depicted in Image 44.

Image 44 : A Brick Kiln Observed Near Nainijor Village



Map 9 : Spatial Distribution Of Stone Quarry And Brick Kilns In The Study Region

16.0 Boatmaking In Buxar Distt.

16.1 During the survey, boat making was observed on the Ganga River bank near Chausa town [Image 45]. Upon interaction it was noted that mostly the members of Mallah community were involved in these constructions. Mostly, the wood of *Sekua* tree (*Shorea robusta*) is used by them for construction of boats. However, in some cases the wood of Jamun and Mango trees are also used depending upon the need and availability. Two major types of boats are constructed in this region – small sized and hand rowed wooden boats mainly used for fishing purposes; big-sized hand rowed or motor based wooden boats mainly used for transportation of goods and ferrying people. While the cost of constructing small boats ranged anywhere between Rs. 60,000-1 Lakh, the cost for constructing big boats ranges anywhere between Rs. 2 lakh-4 Lakh depending upon size, available raw materials and whether services of a 'Mistry' used or not.

Image 45 : Boatmaking As Observed On Ganga River Bank Near Chausa Town

17.0 Sacred Sites And Old Trees In Buxar Distt.

17.1 **Ramrekha Ghat:** This is an old and a very religious spot both for visitors and local residents of Buxar situated close to Buxar Railway Station. According to mythology and folklore, this is the place where Lord Ram killed the demoness Tadaka who used to trouble the sages by disrupting their 'Yagnas'. Hence, Guru Vishwamitra sought help of Lord Ram to end this terror and bring peace in the region. After killing the demoness, Lord Ram took bath in the holy Ganga River at this site to wash the sins of killing a woman. This place swells up with pilgrims and worshippers from many nearby towns and villages during auspicious occasions such as Chhath Puja, Diwali and Khichdi festival. Image 46 depicts Ram Rekha Ghat as seen during the field survey.

Image 46 : Ram Rekha Ghat In Buxar

17.2 **Nath Baba temple/Nath Baba Ghat:** Sri Nath Baba Temple (also known as Sri Adinath Akhara) is located in Charitravan at the confluence of Sone River Canal with Ganga River. This temple is dedicated to Lord Shiva and houses the statues of different Gods and deities along with 'Jyotirlingas' in its campus. According to an article by Jagran (2018), this Akhada was established in 1964 and its construction was completed with the help of dedicated disciples in the association of Shri Adinath Peetadhishwar Sritrilokinathji Maharaj 'Srinath Baba'. Hence, this temple is now popularly known as Sri Nath Baba Mandir and is immensely popular for worshippers especially during auspicious occasions such as Shravan Somwar, Shivratri and Teej festival. Over the years, the temple has been constructed in a grand manner [Image 47] and stands as a symbol of Holy City – Buxar. There is also a Ghat constructed in front of the temple which is known as Nath Baba Ghat where worshippers come to take bath in Ganga River along with praying in the temple.

Image 47 : Nath Baba Temple In Buxar

17.3 **Sri Bisnu Brahma Baba Mandir:** This site is located close to Ganga river bank near Chausa town adjacent to the highway connecting it with Buxar. The local residents including priest/caretaker of this temple reiterated that this site is more than 200 years old. It houses an old Shiva temple around which many small Shivalingas were observed [Image 48]. According to respondents, people from nearby villages pray at this site with the hope that once their wishes are fulfilled, they will construct these shivalingas as per their beliefs and ability. Trees such as Neem and Peepal were also found associated with this temple which was protected owing to the sanctity of this site. A fair is also organized here during Navratri when people from nearby villages come to offer their prayers and enjoy with their families.

Image 48 : Sri Bisnu Brahm Baba Mandir In Buxar

17.4 **Mahadev Ghat:** This is another important sacred site near Chausa town where people from nearby villages and towns come for bathing in Ganga River. This Ghat has been developed recently [Image 49] and is especially thronged by worshippers during auspicious occasion such as Chhath Puja, Khichdi Mela and Shrawan Somwar. According to local respondents, the popularity of this Ghat is such that during such occasions it can take hours for visitors to reach the Ghat and take bath in Ganga river. Near this Ghat there is a temple which is dedicated to Maharishi Chawan Muni who is believed to be the originator of 'Chawanprash'. A group of old and sacred trees including Neem and Peepal are found associated with this temple [Image 50].

Image 49 : Mahadev Ghat In Buxar

Image 50 : Maharishi Chawan Muni Temple Associated With Sacred Trees

17.5 Apart from these sites, many sacred trees were also observed during the survey in study region. Peepal (*Ficus religiosa*) is the major species that is often found associated with temples and other religious sites throughout. The worship of this tree is usually done by the women residing in that region by tying threads around it and offering water along with singoor, coconuts or incense sticks. Other tree species that is also found commonly associated with sacred sites is *Ficus benghalensis* (Banyan tree). Owing to their protection these sacred trees often develop trunks with huge girths and a luxuriant canopy. Other common sacred trees observed in the study region include – Neem (*Azadirachta indica*) and Semal (*Bombax ceiba*). Some such examples of sacred trees as observed during field survey are depicted in Images 51-54.

Image 51 : An Old And Sacred Peepal Tree Associated With A Temple On Ganga River Bank Near Chausa Town

Image 52 : An Old And Sacred Peela Tree Associated With A Temple Near Chanda Village In Buxar Distt.

Image 53 : An Old And Sacred Peepal Tree In Umarpur Village Of Buxar Distt.

Image 54 : A Sacred Peepal Tree Associated With Temple Near Bangla Ghat In Buxar Town

18.0 Inland Navigation In Buxar Distt.

18.1 According to the Distt. Gazetteer (Roy Chaudhury, 1966), there used to be significant traffic on Ganga river especially between Buxar and Chausa as steamers of Indian Navigation and River Stream Navigation companies used to run their services in this stretch. However, this was limited more or less around Buxar town and upto the barrage on Ghaghra River. During the survey it was observed that steamers and various wooden boats were still employed for ferrying passengers. However, these services were more or less limited now for connecting Ramrekha Ghat/Nath Baba Ghat in Buxar with Ujjiar Ghat in Ballia Distt. of U.P on the opposite bank. The charges for this service usually ranged between Rs. 5-15 for on sharing basis and could be more for hiring entire boats. The wooden boats could usually transport 30-50 passengers in one round depending upon luggage whereas the steamers were large-sized [Image 55] with capacity of transporting more than 100 passengers in one round. During auspicious occasions and festivities, scores of people crossed this stretch of river resulting in a very fruitful business for boatmen. During remaining time, few people made use of this service mainly including daily workers, villagers, vendors and people who wish to catch train from Buxar Junction or reach their home in UP from Buxar.

Image 55 : Large-Sized Iron Steamers Ferrying Passengers From Ramrekha Ghat In Buxar To Ujjiar Ghat In Ballia

19.0 Key Observations and Recommendations

19.1 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 also present in the study region mainly confined to a designated site near Buxar town where people from across the distt. came to perform last rites for their deceased relatives. This site (locally known as 'Shamshan Ghat') was on the Ganga river bank where many bodies were observed to be burning simultaneously during the survey [Image 56]. It can be noted that all the remains of these rites along with other substances such as pots, flowers, clothes, threads and so on are dumped directly into the river thereby impacting the riparian and instream biodiversity. Hence, it is recommended to designate another site for cremation little away from Ganga River and develop appropriate facilities in order to prevent further pollution and ecosystem damage.

Image 56 : Cremation activities at Shamshan Ghat on Ganga river bank in Buxar

19.2 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 killing wild boars as they are 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.

19.3 Another important observation during field survey was the presence of a significant population of blackbucks. There has been a drastic decrease in the original habitat for these antelopes which have now come to acclimatize with agricultural landscapes and scrub like habitats along with human presence. However, their natural food scarcity has led them to invade the crops being cultivated in the region. Despite this, the locals never react violently to these animals owing to the awareness regarding its Schedule I protection under Wildlife Protection Act. However, there is a need to carry out detailed studies on the presence, distribution and ecological linkages of blackbucks in the study region in order to develop suitable habitats for them and also to develop tourism potential in the distt.

19.4 Evidences of severe bank erosion were observed during the field survey which not only impact the floodplain settlements but also pose imminent danger to historical sites such as Buxar fort. Hence, it is recommended to carry out detailed studies in the Distt. to identify erosion prone and impacted sites along with developing suitable remedies for its control such as extensive plantation of trees, shrubs and grasses having strong root system to bind the soil.

19.5 Barring Kamaldah pokhra, most other wetlands including Bhagad oxbow lake are in wane state due to issues such as influx of sewage, dumping of waste materials and infestation of invasive species. These wetlands if conserved properly have the potential to not only provide good fish resources, but also harbor other flora and fauna diversity, provide aesthetic benefits and clean water for various uses. Hence, it is strongly recommended to pay immediate attention for maintenance of these water bodies especially in conjunction with local stakeholders.

19.6 The fishermen in study region strongly reiterated their concerns regarding sharp decline in the fish availability, catch and yield which could be attributed to reasons such as changes in river flow and depth, climatic alterations and dominance of invasive

exotic species such as Chinese/Common carps. Along with this the influx of pollution in Ganga River from various sources was also to blame for the changes in fisheries. Hence, it is imperative to carry out awareness cum survey programs involving fishermen in the region to understand these changes and address the necessary issues. Along with that alternate livelihoods could to be developed for fishermen communities such as promoting them for building different boats and involving in eco-tourism activities.

19.7 Buxar has a huge historical and mythological significance with the presence of important heritage sites such as Ramrekha Ghat, Nath Baba temple, Mahadev Ghat and sites pertaining to Battles of Buxar & Chausa. Despite the huge popularity of these sites among residents of Buxar and nearby districts, their tourism potential and conservation status is still undervalued. Hence, it is recommended to take significant measures for bringing out the importance of these sites with a view of improving their tourism potential in conjunction with their proper maintenance to boost local livelihoods and safeguard our heritage.

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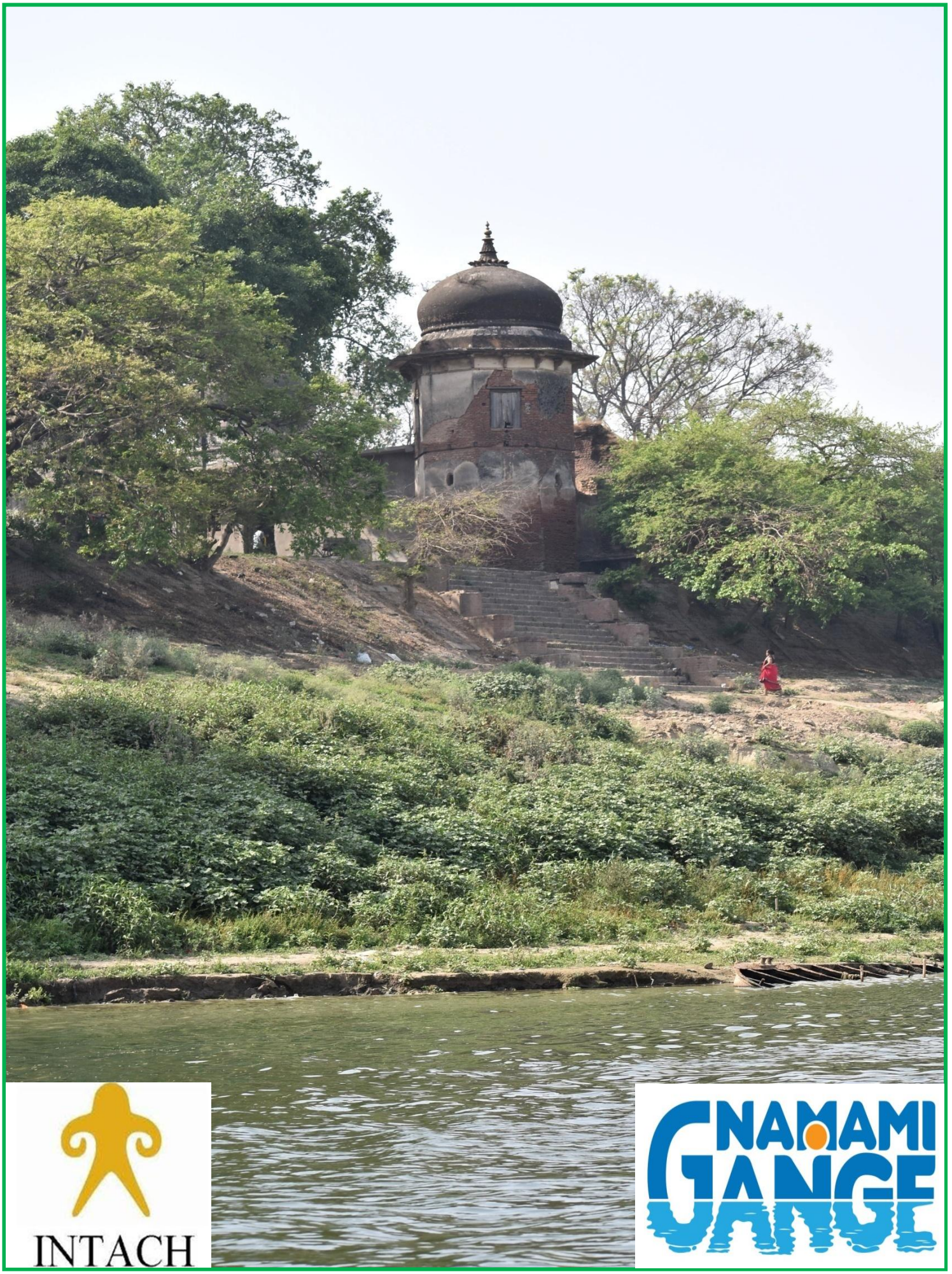

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NAMAMI GANGE