Ganga Cultural Documentation
2022

KATIHAR DISTRICT

NAMAMI GANGE

National Mission for Clean Ganga

Indian National Trust for Art and Cultural Heritage
INTACH

INDIA@75
Azaadi Ke Rang Bharatiya Sanskriti Ke Sang

Indian National Trust for Art and Cultural Heritage

71, Lodhi Estate, New Delhi – 110003

Website: www.intach.org

Email: intach@intach.org

Surveyed & Authored by : Sumesh Dudani & Aditya Gopal

Team Headed By : Manu Bhatnagar [Principal Director [NHD] & Dr. Ritu Singh [Director, NHD]

Photo Credits : Sumesh Dudani & Aditya Gopal

Map Credits : Abhishek Kumar Upadhyay & WWF-India

Front Cover : Part of Ganga River as seen near Karhagola Ghat

Background : A diara near Karhagola Ghat

Back Cover : Mustard Cultivation Near Sisia Village

Formatting and Design by : Sumesh Dudani

GANGA CULTURAL DOCUMENTATION

KATIHAR DISTRICT

JANUARY, 2022

Sponsored by :

National Mission for Clean Ganga

Authored By

Indian National Trust for Art and Cultural Heritage

INTACH

INDIA@75

Azaadi Ke Rang Bharatiya Sanskriti Ke Sang

Contents

List of Images

List of Tables

List of Maps

1.0 Introduction

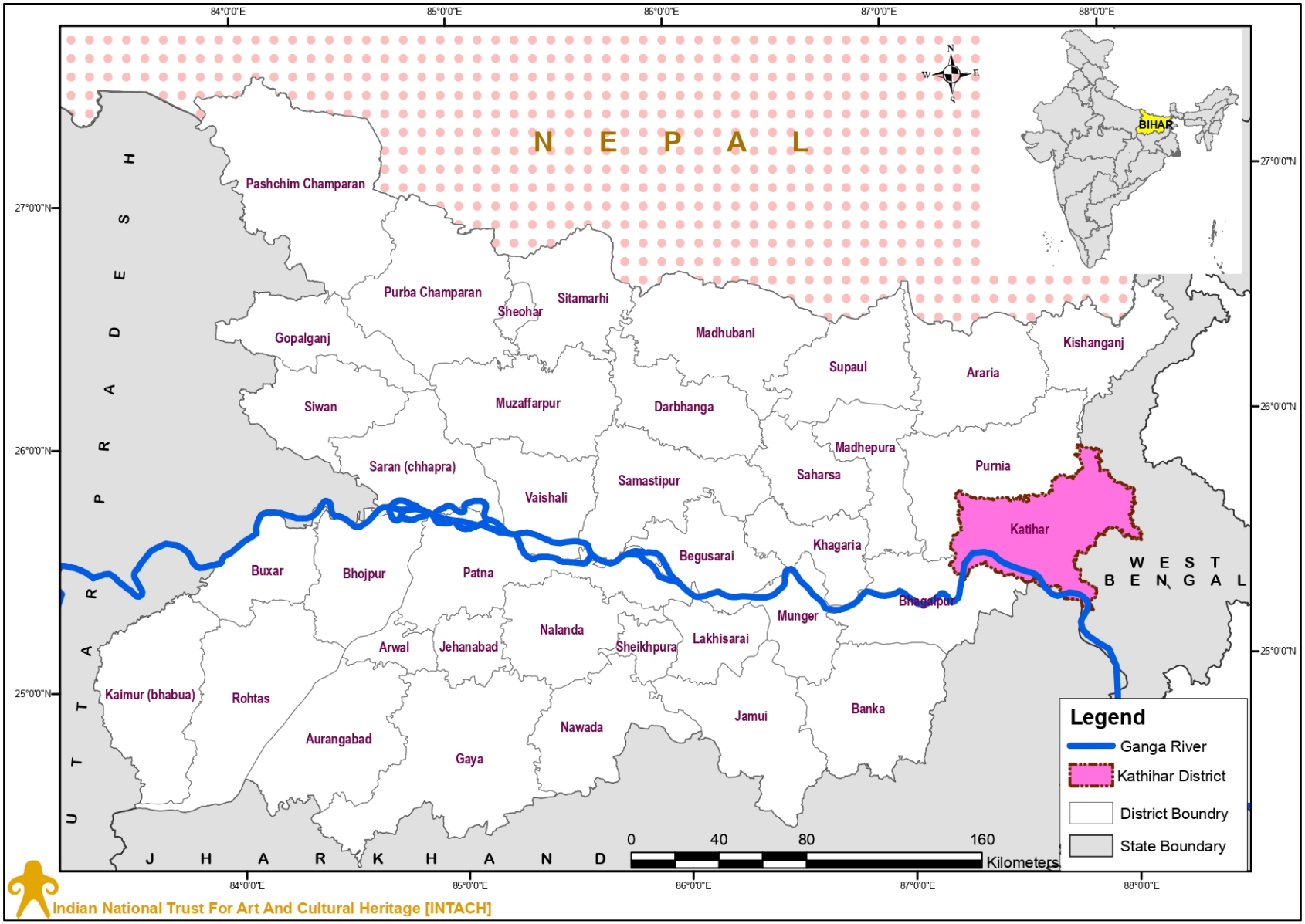
1.1 Katihar Distt. (25.3478° N, 86.9824° E) is situated in the north-eastern region of Bihar state occupying an area of about 3057 sq. km. It is one of the largest Distt.s. of Bihar which was earlier part of the Purnea Distt. as a sub-division. On 2nd October, 1973 the Katihar sub-division was upgraded to an independent Distt. Currently it is divided into 3 sub-divisions – Katihar, Barsoi and Manihari which altogether consists of 26 Community Development Blocks. The Distt. is bounded on the north by Purnia Distt. and part of West Bengal, on the south by Bhagalpur and part of Jharkhand state, on the east by the state of West Bengal and on the west again by the Distt. of Purnia. The District takes its name after the chief town of Katihar which probably derived its name from a small village on the north-east called Dighi-Katihar where there is a big tank (dighi) excavated for the troops, when the soldiers of the Nawab of Purnia fought with the troops of Nawab of Murshidabad (Census of India, 2011).

1.2 This Distt. is part of the lower Ganga basin falling in the Kosi and Mahananda sub-basin. The Kosi River and the Mahananda River with their numerous tributaries like Pamar, Dhar, Kamla, Saura Nadi, Morabrandi Nadi, Fariyani Nadi and Nagar drain the district. The river Ganga passes through the southern border of district in NW-SE direction. The other important rivers the Kosi and the Mahananda pass through the district in N-S direction. The Distt. experiences three seasons – summer from March to early June, rainy from mid-June to September end and winter from November to February. The area of this Distt. represents flat topography with regional slope towards south. The areas in northern part are at higher elevation and gradually reduce towards south. Overall, the soil in the Distt. is non-calcareous and non-saline in nature and is a mixture of clay, sand and silt in varying proportions (Singh, 2013).

1.3 Earlier Katihar Distt. was dominated by the Choudhary family who were the biggest landlords of Kosi zone. The founder of this family was Khan Bahadur Mohammad Baksh, and the family holds lands of about 15,000 acres in Katihar Distt. and 8,500 acres in Purnea Distt. Katihar is a historical place where it is believed that Lord Krishna visited and lost a 'mani' in Manihari (a religious place of Katihar Distt.) [Image 1]. Katihar was a part of Purnia Distt. and the latter was constituted in about 1813 along with Malda Distt. Under the Mughal rule, this Distt. consisted of Sarkar Tajpur, east of the Mahananda and Sarkar Purnia west of the river. The province of Bihar came under Muslim rule after Bakhtiyar Khilji conquered Bihar town, the then capital of Bihar towards the close of 12th century. His successor, Ghiasuddin Iwaz, extended the limits of

the territory to include virtually the whole of Bihar. Katihar came under Mohammedan rule in the beginning of the 13th century (https://katihar.nic.in/history/).

Image 1 : Manihari Ganga Ghat In Katihar Distt.

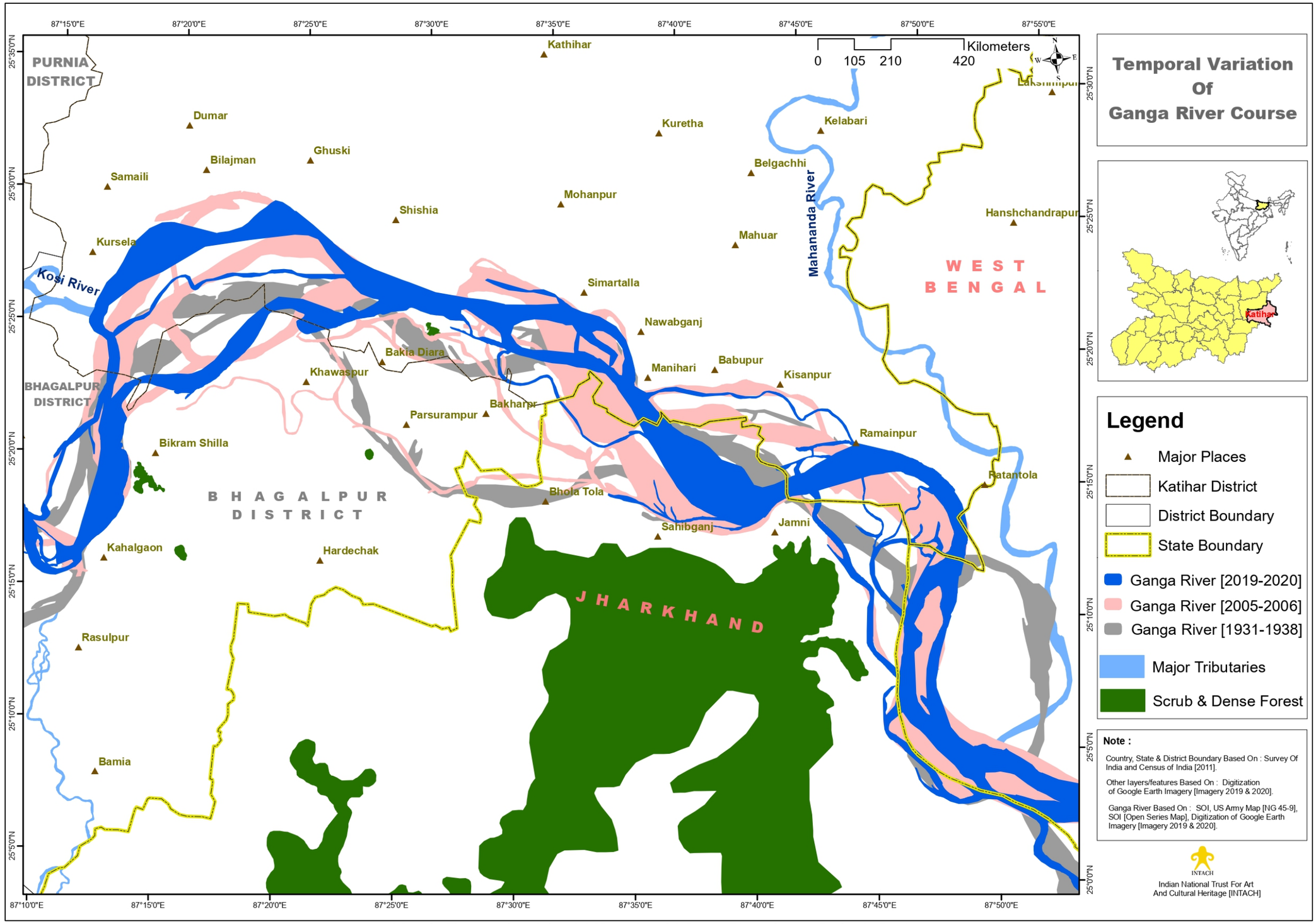


Map 1 : Location Of Katihar Distt.

2.0 Ganga River In Katihar

2.1 Soon after the Kosi-Ganga confluence, Ganga River enters Katihar Distt. from Bhagalpur in a north-easterly direction where it is braided by the presence of a group of irregularly shaped riverine islands. After crossing Karhagola Ghat, the river makes south-easterly turn and continues to flow in that direction more or less as a single channel until Manihari. Close to Manihari, the river is again braided due to interspersed riverine islands after which it takes turn in southern direction entering Jharkhand and West Bengal. According to Bhagalpur Distt. Gazetteer (Roy Chaudhury, 1962), the river stretch in this region was navigable by boats, steamers and even ships of larger sizes carrying tons of goods mainly during monsoon season when water depth was suitable in a large width of the expanded river. However, during summers the water level in river is recorded to have receded rendering the navigation possible only in a narrow width. Image 2 depicts the Ganga River as observed during field survey while Map 2 depicts temporal variation of Ganga River course in this region.

Image 2 : Ganga River As Observed Near Karhagola Ghat On 11th January, 2022

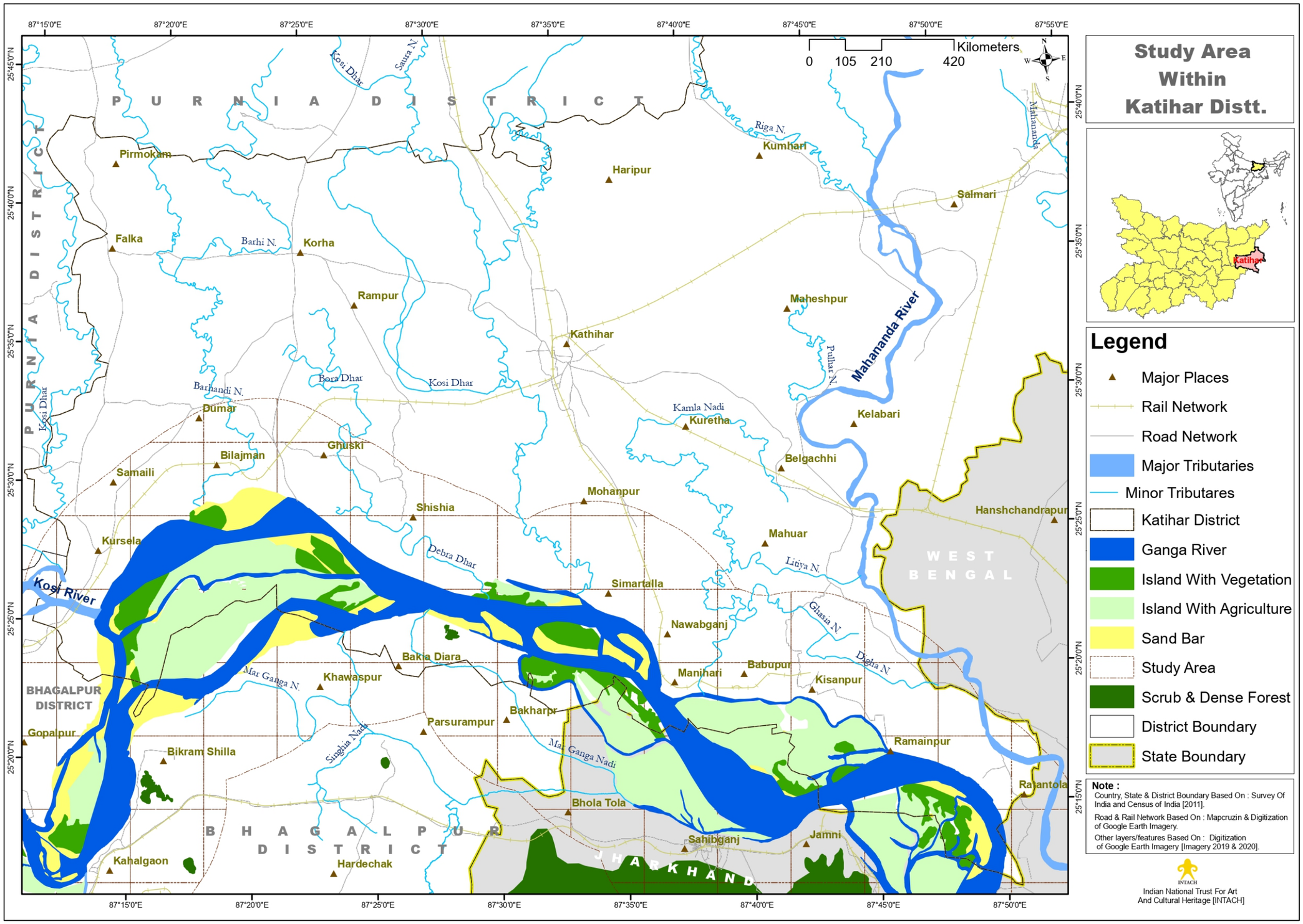


Map 2 : Temporal and Spatial Variation Of Ganga River Course In Study Region

3.0 Methodology

3.1 Ganga River flows in Katihar for approximately 77.5 km adjoining it mostly on the left bank and to some part on the right bank. Hence for carrying out the ground survey, a 7 km of buffer zone was selected on left bank of Ganga River [Refer 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 area for carrying out relevant interactions.

3.2 The field survey for Natural Heritage documentation in the study region of Katihar Distt. was carried out from 11-14 January, 2022. The 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 and general public.



Map 3 : Study Area In Katihar

4.0 Tributaries Of Ganga River

4.1 **Kosi River :** Kosi is a trans-boundary river which flows through the regions of Tibet, Nepal and India for about 720 km and draining an area of about 74, 500 sq.km. Many studies have highlighted major shifts in the course of this river which have been random and oscillating. The unstable nature of this river is owing to the huge amount of silt that it carries during monsoon and its flooding events have extreme impacts in some parts of the study region. Hence, this river is often described as 'Sorrow of Bihar' as it leads to enormous losses of fertile agricultural fields along its both banks parts of which also fall in this study region. It is one of the important left bank tributaries having its confluence with Ganga River between Katri and Kursela villages falling in Katihar Distt. [Refer Map 4].

4.2 During the survey, this river was observed from the Kosi bridge connecting Katria towards Bhagalpur and Kursela towards Katihar Distt. [Image 3]. The floodplains of Kosi River along with Ganga River in the study region are an important habitat for Greater Adjutant Storks which are the most endangered among 20 other stork species in the world (IUCN, 2003; Choudhary, 2007). During the field survey a good population of these storks (about 10-15) were sighted in the wetlands/oxbow lakes formed in the Ganga-Kosi floodplain region [Image 4].

4.3 Kosi and Ganga rivers are also an important source of fishing for local residents in their floodplain villages. Fishing activities were observed during the survey in Kosi River as seen from its bridge. However, the interlocutors reiterated that owing to various factors such as decline in fish availability, insufficient catch and drying up of Kosi river bed in some parts, it is difficult to sustain entirely on the fish resource from this river. Many residents depend upon the wetlands/oxbow lakes created in these floodplain regions for fish resources while many have migrated from this region or looking for alternate source of livelihoods.

Image 3 : Kosi River As Observed From Kosi River Bridge On 6th January, 2022

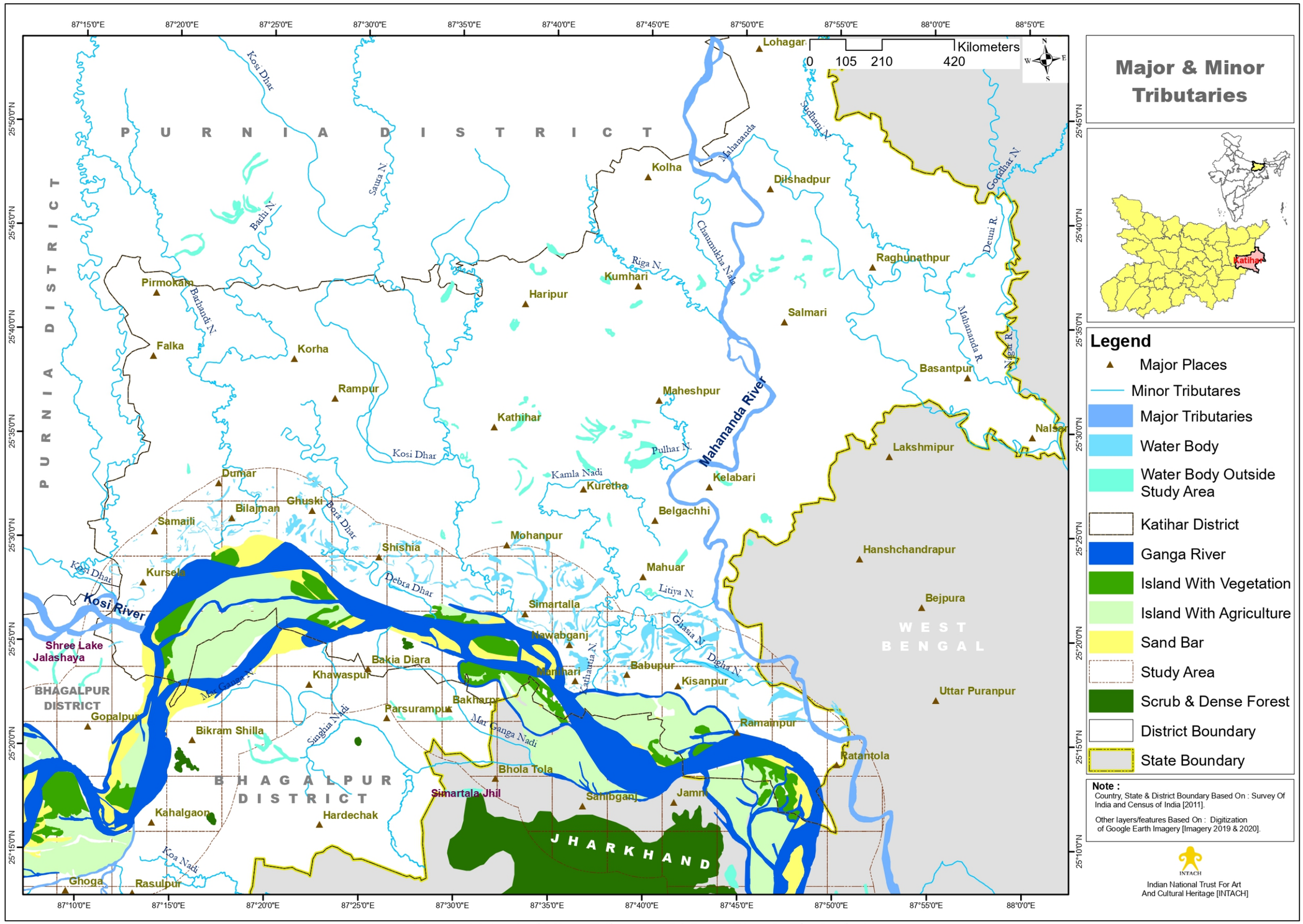
Image 4 : A Population Of Greater Adjutants In A Kosi River Floodplain Wetland As Observed During Field Survey

4.4 **Fulahar River :** The Mahananda river system consists of two streams- one is locally known as Fulahar River and the other Mahananda. Fulahar originates from mountainous region of Himalayas in Nepal and traverses through the Indian state of Bihar before entering West Bengal where it confluences with Ganga River. It forms almost a distinctive boundary between Katihar Distt. in Bihar and Malda Distt. in West Bengal state. With frequent shifts and floods, Fulahar River is one of the chief causative factors of dynamic bank erosion in this region affecting the lives of many people (Momin *et al.*, 2020). During the field survey, this river was observed near Fulhar bridge which serves as the border check post between Bihar and West Bengal states [Image 5]. Agriculture was found to be a prominent activity in this region mainly including crops such as wheat and mustard.

Image 5 : Fulhar River As Observed On 13th January, 2022

4.5 **Kosi Dhar:** An old channel of Kosi River was observed near Sahuria village which was referred locally as 'Kosi Dhar' [Image 6]. As the river shifted its course, this channel got separated and now receives water only during monsoon season. During remaining part of the year, accumulated water in this channel serves as an important source for irrigation and fishing by numerous residents who reside in the vicinity.

Image 6 : Part Of The Kosi Dhar As Observed Near Sahuria Village On 12th January, 2022



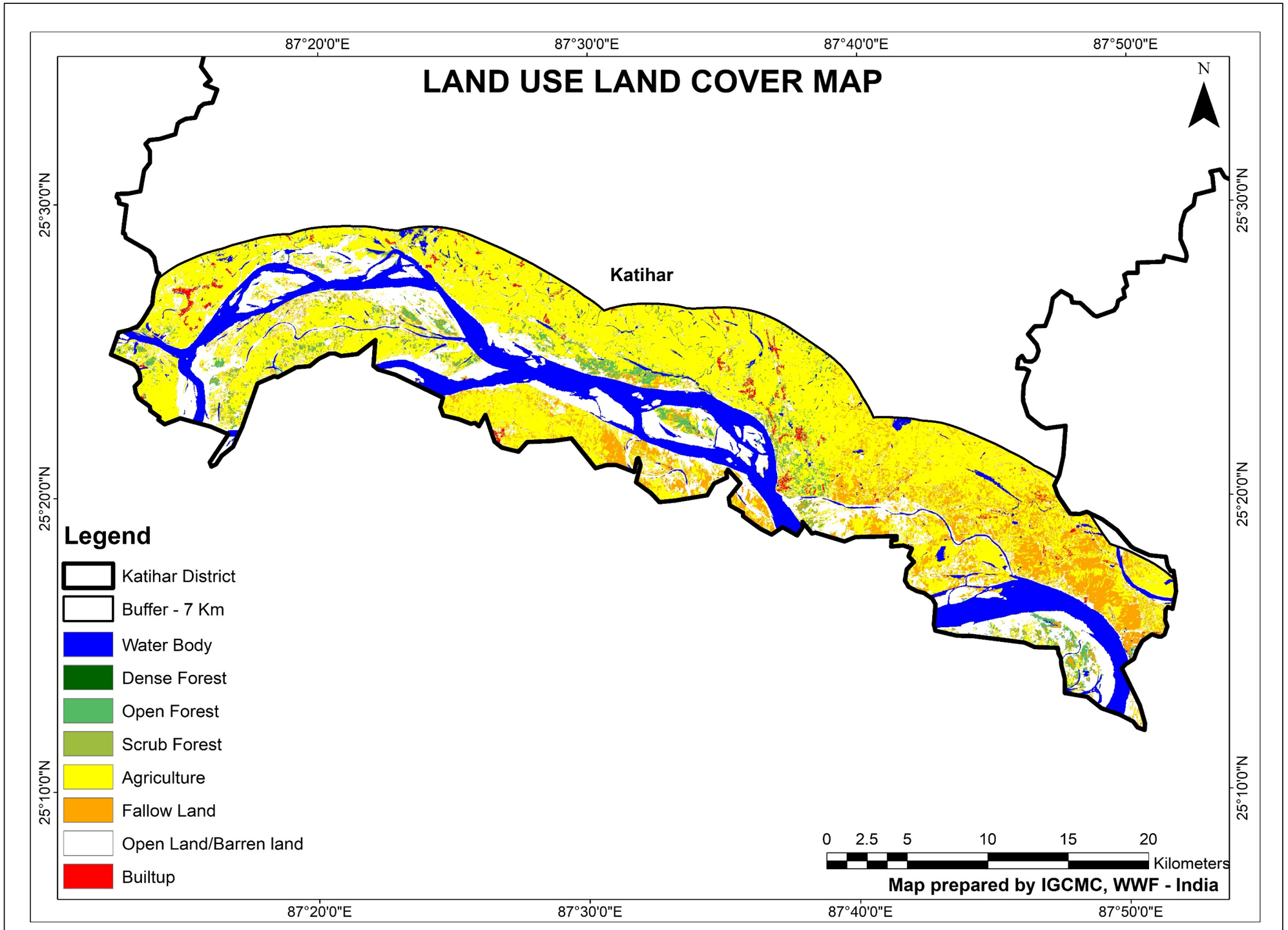
Map 4 : Major And Minor Tributaries Of Ganga River In The Study Area

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, dense forest, open forest, scrub forest, agriculture land, fallow land, open/barren land and built up. Agriculture being a dominant source of income, occupies major part of the land use system in this area. The water body component covering 15.728% of the total geographical area of this Distt. chiefly includes Ganga River, its tributaries such as Kosi & Fulahar, old river channels, oxbow lakes and other wetlands. The built up area represents only 0.831% of the total geographical area due to absence of developed towns or villages in the study region. Table 1 provides the statistics while Map 5 depicts the various land use/land cover classes as analysed for the study region.

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

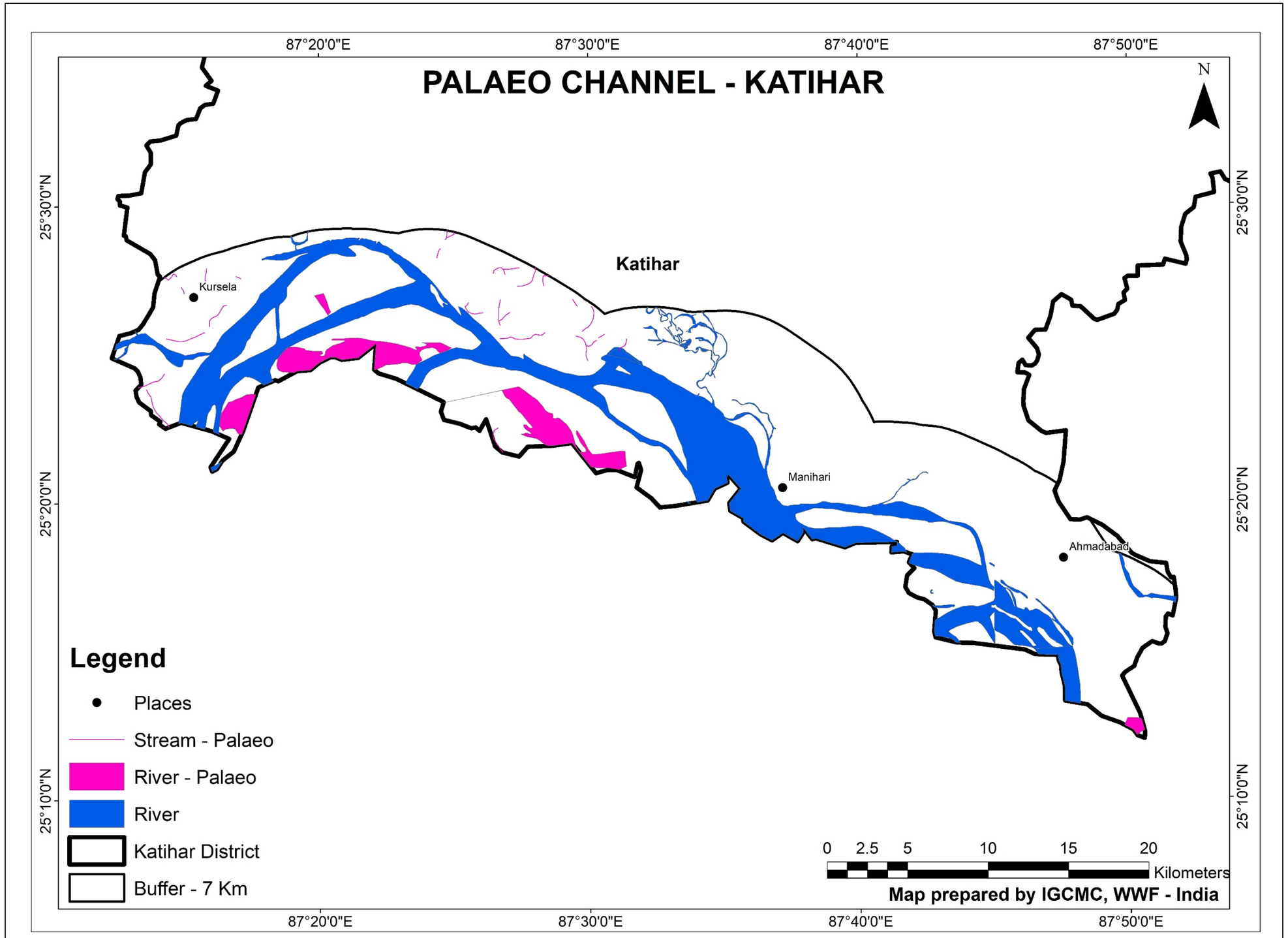
KATIHAR			
Class Name	**Area (Ha)**	**Area (Sq. Km)**	**Area (%)**
Water Body	10636.300	106.363	15.728
Dense Forest	9.180	0.092	0.014
Open Forest	2275.740	22.757	3.365
Scrub Forest	666.090	6.661	0.985
Agriculture Land	31533.600	345.336	46.628
Fallow Land	7536.420	75.364	11.144
Open Land/ Barren Land	14408.300	144.083	21.305
Built up	561.960	5.620	0.831
Total	**67627.590**	**676.276**	**100**



Map 5 : Land Use/Land Cover Map Of Study Region In Katihar

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 paleochannels do not carry water during most of the year but may flow during flood events. Such abandoned and silted paleochannels 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 Katihar Distt.



Map 6 : Paleochannels In The Study Region

7.0 Floodplain Of River Ganga In Katihar

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 Katihar falls in the Mid-Gangetic Plane Region having a humid eco-system with the major soils being sandy to sandy loam, clay soil in deep water logged area and Gangetic alluvial soil in the *Diara* area (NICRA-ICAR, 2013). Agriculture is one of the major sources of income for the residents in the area and is benefitted by the fertile alluvium brought by Ganga River and its tributaries. Vast floodplain lands along Ganga, Kosi and Fulahar Rivers along with old channels and oxbow wetlands were observed to be under extensive crop cultivation during the field survey in this region. Major crops grown in the study region included – wheat, rice, maize and mustard along with other crops such as various lentils, pigeon pea and vegetables (such as onion, cauliflower, radish, chillies and parwal). The details of some villages surveyed along with their floodplain agriculture produce are provided in Table 2 while Image 7 depicts a floodplain agriculture field as recorded during the survey.

Table 2 : Some Floodplain Villages And Their Agriculture Produce As Noted During Field Survey In Katihar

Sr. No.	Village Name	Agricultural Produce
1.	Manihari	Mustard, Wheat, Paddy, Potato, Brinjal, Green Chilli
2.	Near Gogabil Lake	Chana, Arhar, Mustard, Wheat.
3.	Kishum pur	Wheat, Paddy, Potato, Green Peas, Mustard
4.	Baghmara	Mustard, Wheat ,Green Chilli, Turnip.
5.	Karhagola Ghat	Mustard, Arhar, Chana, Paddy, Brnjal
6.	Barari	Paddy, Wheat, Potato, Tomato, Onion.

Image 7 : Mustard And Maize Cultivation In Ganga River Floodplain Fields Near Sisia Village In Study Region

7.3 **Floodplain Horticulture:** Besides agricultural crops, the Ganga river floodplain region is also known for its mango plantations, banana plantations and bamboo plantations [Images 8-10]. Bamboo is mainly planted due to its large scale utilization in construction of huts by native residents in the study region.

Image 8 : Mango Orchards As Observed Near Manihari In Katihar Distt.

Image 9 : Banana Plantation Near Mohanpur Village In Katihar Distt.

Image 10 : Bamboo Plantation Near Purbi Bari Nagar Village In Katihar Distt.

7.4 **Floodplain Grasses:** The chief floodplain grasses growing throughout study region are – *S. spontaneum* (commonly known as *Kans*), *S. bengalense* (commonly known as *Munj/ Sarkanda*) and *Cynodon dactylon* (L.) Pers. (commonly known as Doob or Durva grass). Among these, the *Saccharum* grasses are dominant and luxuriant along the Ganga River banks and on the *diaras*. They are tall, perennial wild grasses growing upto 2-3 m height. They form extensive root networks that bind the soil/pebbles and form tall thick clumps with high biomass tufts. The dried *Saccharum* grasses are widely used throughout the area for roof thatching in villages [Image 11]. Along with this some local residents also use these grasses in construction of temporary huts to monitor their agricultural fields. The abundance of this grass and availability throughout the year makes it an excellent resource for the residents in this region.

Image 11 : Dried Saccharum Grasses Collected For Roof Thatching As Seen Near Karhagola Ghat

8.0 Wetlands In Katihar

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. During the current study [limited to the study area] 160 different wetlands are recorded whose details are provided in Table 3. Map 7 shows the spatial distribution of these wetlands in the study region. Some notable wetlands as observed during the field survey are discussed in this section.

Table 3 : List Of Wetlands In The Study Region

Sr. No.	Wetland Name/ Number	Coordinates		Area [Hectares]
		Latitude	Longitude	
01	1	25°24'24.80"N	87°13'28.28"E	17.2
02	2	25°25'2.47"N	87°13'12.59"E	15.3
03	3	25°25'48.03"N	87°13'42.15"E	19.4
04	4	25°25'30.43"N	87°14'12.43"E	19.6
05	5	25°25'17.79"N	87°14'28.97"E	8.20
06	6	25°25'26.43"N	87°14'36.54"E	1.64
07	7	25°26'6.74"N	87°14'33.14"E	0.80
08	Oxbow Lake near Kursela	25°26'25.30"N	87°14'36.59"E	37.2
09	9	25°26'45.70"N	87°15'42.47"E	2.75
10	10	25°27'8.80"N	87°14'47.93"E	3.00
11	11	25°28'5.53"N	87°15'42.65"E	3.85
12	12	25°27'55.28"N	87°15'47.83"E	3.48
13	13	25°28'6.65"N	87°16'16.05"E	1.39
14	14	25°28'19.62"N	87°16'24.74"E	12.6
15	15	25°28'7.49"N	87°16'40.13"E	36.5
16	16	25°28'4.05"N	87°17'25.60"E	46.0
17	17	25°27'51.89"N	87°13'30.87"E	29.4
18	18	25°28'17.14"N	87°14'15.23"E	1.87

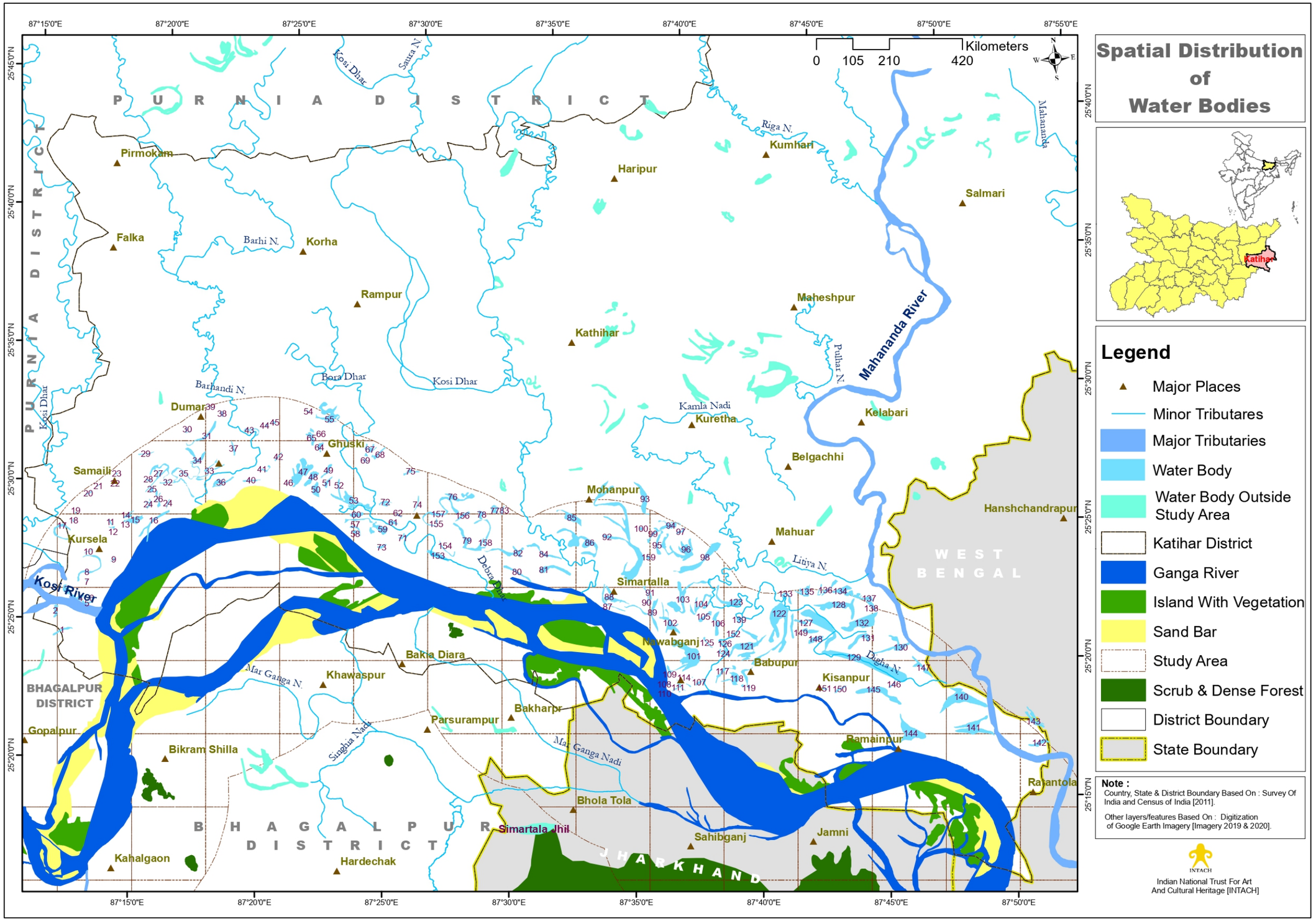
19	19	25°28'34.26"N	87°14'21.66"E	0.97
20	20	25°29'14.81"N	87°15'0.28"E	3.91
21	21	25°29'29.10"N	87°15'20.84"E	1.00
22	22	25°29'35.21"N	87°16'1.68"E	0.44
23	23	25°29'51.76"N	87°16'7.94"E	1.37
24	24	25°28'36.09"N	87°17'18.28"E	8.34
25	24A	25°28'36.04"N	87°18'1.96"E	4.22
26	25	25°29'7.14"N	87°17'27.51"E	7.10
27	26	25°28'38.02"N	87°17'41.44"E	16.0
28	27	25°29'41.33"N	87°17'51.85"E	43.1
29	28	25°29'30.26"N	87°17'23.03"E	4.11
30	29	25°30'28.29"N	87°17'28.98"E	6.00
31	30	25°31'8.57"N	87°19'0.08"E	4.10
32	31	25°30'54.89"N	87°19'48.63"E	34.3
33	32	25°29'21.46"N	87°18'24.28"E	26.9
34	33	25°29'37.32"N	87°19'41.69"E	37.5
35	34	25°30'3.85"N	87°19'25.73"E	36.5
36	35	25°29'30.29"N	87°18'56.27"E	30.9
37	36	25°29'13.99"N	87°20'7.16"E	29.4
38	37	25°30'17.79"N	87°20'50.39"E	10.1
39	38	25°31'37.78"N	87°20'30.10"E	4.79
40	39	25°31'56.17"N	87°20'5.99"E	2.33
41	40	25°29'9.61"N	87°21'30.18"E	9.79
42	41	25°29'27.33"N	87°22'3.21"E	7.29
43	42	25°29'55.88"N	87°22'33.90"E	6.79
44	43	25°31'0.88"N	87°21'44.03"E	13.5
45	44	25°31'5.55"N	87°22'12.64"E	2.22
46	45	25°31'9.01"N	87°22'31.95"E	3.10
47	46	25°28'57.53"N	87°22'50.58"E	0.68
48	47	25°29'11.68"N	87°23'20.06"E	120
49	48	25°29'1.98"N	87°23'44.58"E	38.1
50	49	25°29'15.14"N	87°24'27.97"E	17.3
51	50	25°28'33.05"N	87°23'54.59"E	32.7

52	51	25°28'48.48"N	87°24'21.55"E	12.6
53	52	25°28'12.86"N	87°24'51.11"E	26.0
54	53	25°28'4.36"N	87°25'14.07"E	70.7
55	54	25°31'28.52"N	87°23'54.24"E	2.10
56	55	25°31'4.61"N	87°24'46.42"E	88.7
57	56	25°30'34.95"N	87°23'59.82"E	1.79
58	57	25°27'22.23"N	87°25'22.29"E	17.8
59	58	25°26'55.93"N	87°25'19.26"E	17.0
60	59	25°26'56.83"N	87°26'20.26"E	46.8
61	60	25°27'32.75"N	87°25'24.30"E	22.5
62	61	25°27'7.72"N	87°26'48.98"E	10.5
63	62	25°27'24.02"N	87°27'2.91"E	5.1
64	63	25°29'58.07"N	87°24'13.82"E	0.99
65	64	25°30'9.47"N	87°24'14.02"E	11.6
66	65	25°30'28.97"N	87°23'56.88"E	24.0
67	66	25°30'37.58"N	87°24'10.89"E	0.69
68	67	25°29'50.95"N	87°26'13.00"E	17.5
69	68	25°29'36.23"N	87°26'24.47"E	15.5
70	69	25°29'28.66"N	87°25'57.34"E	3.88
71	70	25°29'41.19"N	87°26'2.76"E	3.25
72	71	25°26'34.94"N	87°27'7.74"E	6.73
73	72	25°27'53.09"N	87°26'31.50"E	15.4
74	73	25°26'19.49"N	87°26'16.99"E	7.94
75	74	25°27'41.57"N	87°27'50.18"E	6.85
76	75	25°28'57.45"N	87°27'43.22"E	12.5
77	76	25°27'48.95"N	87°29'55.13"E	48.9
78	77	25°27'12.34"N	87°30'53.12"E	17.2
79	78	25°27'9.15"N	87°30'17.15"E	13.9
80	79	25°26'0.65"N	87°29'34.96"E	66.8
81	80	25°24'51.30"N	87°31'35.47"E	26.3
82	81	25°25'0.99"N	87°33'0.79"E	49.0
83	82	25°25'37.12"N	87°31'18.25"E	49.5
84	83	25°27'11.49"N	87°31'9.76"E	5.11

85	84	25°25'24.93"N	87°32'44.00"E	34.0
86	85	25°26'42.57"N	87°33'57.80"E	54.4
87	86	25°25'43.66"N	87°33'58.61"E	132
88	87	25°23'36.31"N	87°34'48.39"E	22.7
89	88	25°23'37.91"N	87°35'11.81"E	44.7
90	89	25°22'53.60"N	87°36'39.29"E	50.6
91	90	25°23'34.68"N	87°36'34.05"E	10.5
92	91	25°23'34.68"N	87°36'40.71"E	7.27
93	92	25°24'38.63"N	87°36'11.88"E	315
94	93	25°26'48.91"N	87°36'45.85"E	63.7
95	94	25°26'3.57"N	87°37'42.86"E	34.8
96	95	25°25'18.92"N	87°37'6.39"E	23.0
97	96	25°25'4.85"N	87°38'15.34"E	119
98	97	25°25'49.56"N	87°38'4.54"E	8.60
99	98	25°24'50.64"N	87°38'59.73"E	107
100	99	25°25'48.57"N	87°36'58.09"E	20.2
101	100	25°26'4.48"N	87°36'33.84"E	3.55
102	101	25°21'12.63"N	87°38'8.75"E	183
103	102	25°22'31.07"N	87°37'23.56"E	58.1
104	103	25°23'9.45"N	87°37'39.48"E	110
105	104	25°23'1.87"N	87°38'24.58"E	59.2
106	105	25°22'39.70"N	87°38'38.14"E	18.3
107	106	25°22'9.27"N	87°39'7.59"E	36.8
108	107	25°20'21.28"N	87°38'14.81"E	6.99
109	108	25°20'22.10"N	87°37'1.54"E	2.98
110	109	25°20'40.10"N	87°37'6.76"E	0.61
111	110	25°20'10.48"N	87°37'4.29"E	0.17
112	111	25°20'10.61"N	87°37'18.34"E	7.35
113	112	25°20'4.56"N	87°37'26.77"E	0.87
114	113	25°20'20.67"N	87°37'28.50"E	2.49
115	114	25°20'30.57"N	87°37'24.22"E	0.52
116	115	25°20'15.54"N	87°37'52.42"E	2.48
117	116	25°20'33.48"N	87°38'0.16"E	0.37

118	117	25°20'37.63"N	87°39'10.00"E	23.1
119	118	25°20'15.94"N	87°39'40.71"E	39.2
120	119	25°20'19.60"N	87°40'6.70"E	39.2
121	120	25°20'3.86"N	87°39'56.19"E	2.99
122	Baghar Bil	25°21'27.77"N	87°40'23.03"E	135
123	Gogabil	25°22'29.51"N	87°41'37.42"E	231
124	123	25°23'4.22"N	87°39'56.90"E	51
125	124	25°21'15.46"N	87°39'17.48"E	12.7
126	125	25°21'43.18"N	87°38'45.39"E	7.28
127	126	25°21'37.15"N	87°39'24.12"E	9.57
128	127	25°22'8.30"N	87°42'6.58"E	39.0
129	128	25°22'37.34"N	87°44'14.88"E	107
130	129	25°21'54.02"N	87°43'27.04"E	433
131	130	25°20'51.22"N	87°46'9.60"E	66.5
132	131	25°21'22.06"N	87°44'37.73"E	47.4
133	132	25°21'55.96"N	87°45'4.96"E	129
134	133	25°23'1.23"N	87°42'6.44"E	19.8
135	134	25°23'9.68"N	87°44'17.55"E	51.0
136	135	25°23'10.62"N	87°42'49.37"E	32.0
137	136	25°23'11.60"N	87°43'34.41"E	27.4
138	137	25°22'52.64"N	87°44'43.60"E	27.8
139	138	25°22'30.46"N	87°45'17.96"E	17.4
140	139	25°22'28.15"N	87°40'2.55"E	7.93
141	140	25°18'49.08"N	87°48'15.13"E	172
142	141	25°17'53.02"N	87°48'52.54"E	124
143	142	25°16'59.24"N	87°51'26.34"E	27.4
144	143	25°17'41.93"N	87°51'19.46"E	50.2
145	144	25°17'46.15"N	87°46'25.88"E	126
146	145	25°19'22.43"N	87°45'29.64"E	99.4
147	146	25°19'36.57"N	87°45'51.46"E	7.23
148	147	25°20'0.02"N	87°47'13.82"E	36.6
149	148	25°21'29.38"N	87°42'59.68"E	27.2
150	149	25°21'47.37"N	87°42'50.93"E	22.0

151	150	25°19'37.02"N	87°43'46.20"E	10.0
152	151	25°19'40.24"N	87°43'9.99"E	4.61
153	152	25°21'55.58"N	87°39'45.76"E	4.15
154	153	25°25'43.75"N	87°28'38.53"E	37.0
155	154	25°26'0.19"N	87°28'45.24"E	11.0
156	155	25°27'2.98"N	87°28'32.62"E	3.56
157	156	25°27'9.48"N	87°29'33.87"E	14.3
158	157	25°27'16.59"N	87°28'44.67"E	67.9
159	158	25°26'22.16"N	87°30'29.53"E	23.9
160	159	25°25'1.76"N	87°36'46.14"E	6.1
Total Area				5522.23 Hectares



Map 6 : Spatial Distribution Of Water Bodies Within Study Area

8.2 **Gogabil Lake :** This is an important freshwater lake located in Amadabad block of Katihar Distt. [Image 12], about 6 km east of Manihari and 20 km southeast of Katihar town. It is one of the most beautiful birding sites of Bihar along with its surrounding wetlands namely Baghar bil [Image 13], Baldia Chaur which are connected with it and Kanchira wetland which is close to it. Gogabil Lake covers an area of approximately 88 ha of which about two-thirds belongs to Govt. of Bihar and rest is private land. The water spread area including Baghar bil and Baldia chaur in a stretch of nearly 5 km covers approximately 400 ha. The lake is linked to Mahananda (Fulhar) and Ganga Rivers in its vicinity and is recharged by their waters during monsoon season. This site is visited by numerous migratory birds especially during winters and also serves as an important habitat for other important flora and fauna. This site also enjoys the tag of being an Important Bird Area (IBA) since more than a decade. About 91 different species of birds belonging to 71 genera have been reported from Gogabil Lake (Sharma and Mishra, 2016).

8.3 During the field survey, Gogabil and Baghar bil Jheels were visited where it was noted that out of about 87 ha of Gogabil Lake, about 30 ha had been declared as Protected Reserve while the remaining area had been declared as Community Conservation Reserve vide Notification No. 30/19-1036 (E) on 02/08/2019. The field observation revealed presence of birds such as Asian Openbill Stork, Red Crested Pochard, Common Pochard, Little Grebe and Lesser Whistling Duck in this region. Interactions with some interlocutors here revealed expansive agriculture along with illegal bird hunting to be major threats for the avian diversity in this protected area. Net based fishing was also a major activity from these *jheels*. It is imperative to pay immediate attention to this pristine ecosystem in order for its ecological services to continue. Also immediate and strict action should be initiated to prevent hunting of avifaunal diversity in this reserve.

Image 12 : Location Of Gogabil Jheel [25° 22' 29.51" N; 87° 41' 37.42" E]

Image 13 : Location Of Baghar Bil Jheel [25° 21' 27.77" N; 87° 40' 23.03" E]

Image 14 : Part Of Gogabil Jheel As Observed On 13th January, 2022

Image 15 : Part Of Baghar Bil Jheel As Observed On 13th January, 2022

8.4 **Oxbow Lakes Near Kursela :** Two different oxbow lakes were observed in the Kursela region of Katihar Distt. [Images 16-17]. Both these oxbow lakes were located in the Kosi-Ganga floodplain region and received water during monsoons from these rivers. The larger oxbow lake among these two was known locally as 'Markosi' indicating that this oxbow lake was formed due to shift in the course of Kosi River while the smaller one, which was roughly horse shoe shaped, was not referred by any particular name. Both these oxbow lakes were utilized for fishing activities and irrigation purposes. Fish species such as Rohu, Tilapia, Tengara and Buari were found in plenty during monsoon and summer seasons as compared to winters.

Image 16 : Location Of Markosi Oxbow Lake [25° 26' 25.30" N; 87° 14' 36.59" E]

Image 17 : Location Of Unnamed Oxbow Lake [25° 27' 51.89" N; 87° 13' 30.87" E]

Image 18 : Part Of Markosi Oxbow Lake As Observed On 11th January, 2022

Image 19 : Part Of The Unnamed Horse Shoe Shaped Oxbow Lake As Observed On 11th January, 2022

9.0 Riparian Flora Along Ganga River In Katihar

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 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, 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. Earlier workers have reported from Buxar to Barh, the presence of 7 shrubs, 41 herbs, 6 grasses and 2 sedges, besides these a number of tree species along the banks of river during 1987-88 (Kumar, 2001).

9.3 Overall, the riparian flora in the region showed considerably lower proportion of trees and shrubs as compared to herbs during the field survey. This could be attributed to the expansive agriculture and frequent floods in the study region. The floodplain grass – *Saccharum* sps. was a major component of riparian vegetation throughout with its luxuriance dominating the other flora at some sites. Other commonly occurring species included – *Croton bonplandianus, Polygonum sp* and *Lantana sp.* Some notable riparian flora is presented in Table 3.

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.	*Aegle marmelos* (L.) Correa	Rutaceae	Tree	Bel Patra
3.	*Azadirachta indica* A.Juss.	Meliaceae	Tree	Neem
4.	*Borassus flabellifer* L.	Arecaceae	Tree	Taad
5.	*Dalbergia sissoo* Roxb. ex DC.	Fabaceae	Tree	Shisham
6.	*Ficus benghalensis* L.	Moraceae	Tree	Banyan
7.	*Ficus religiosa* L.	Moraceae	Tree	Peepal
8.	*Mangifera indica* L.	Anacardiaceae	Tree	Mango
9.	*Calotropis gigantea* (L.) Dryand.	Apocynaceae	Shrub	Safed Aak
10.	*Calotropis procera* (Aiton) Dryand.	Apocynaceae	Shrub	Aak
11.	*Lippia alba* (Mill.) N.E. Br. ex Britton & P. Wilson	Verbenaceae	Shrub	Bushy Lippia
12.	*Polygonum sp.*	Polygonaceae	Shrub	
13.	*Ricinus communis* L.	Euphorbiaceae	Shrub	Wild Castor
14.	*Zizyphus* sp.	Rhamnaceae	Shrub	Wild Ber
15.	*Achyranthes aspera* L.	Amaranthaceae	Herb	Chirchira
16.	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Prickly Amaranth
17.	*Croton bonplandianus* Baill.	Euphorbiaceae	Herb	Ban Tulsi
18.	*Rumex dentatus* L.	Polygonaceae	Herb	
19.	*Parthenium hysterophorus* L.	Asteraceae	Herb	Congress Grass
20.	*Xanthium strumarium* L.	Asteraceae	Herb	Chhotav dhatura
21.	*Saccharum munja* Roxb.	Poaceae	Grass	Munj
22.	*Cyperus* sp.	Cyperaceae	Grass	
23.	*Cynodon dactylon* (L.) Pers.	Poaceae	Grass	Doob/Durva
24.	*Saccharum spontaneum* L.	Poaceae	Grass	Kans/Katha
25.	*Saccharum bengalense* Retz.	Poaceae	Grass	Munj

10.0 Faunal Diversity In Katihar

10.1 **Gangetic Dolphins :** The Gangetic River Dolphin (*Platanista gangetica*) is exclusively aquatic and piscivorus, occasionally found in small groups. The Ganges River Dolphin 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 in the last 3-4 decades. During the survey, major dolphin sightings occurred in the Ganga River stretch adjoining Karhagola Ghat. A significant population (almost 6-7 different individuals) were observed flipping around the fishing nets and boats in this region. Other dolphin sightings occurred at Manihari Ghat, Baghmara Ghat and Baisa Ghat.

10.2 **Turtles :** Turtles play a major role in maintaining aquatic ecosystem by controlling aquatic vegetation and scavenging dead matter and thus considered as an important component of Ganga riverine biodiversity (WII-GACMC, 2017). During the survey, there were no direct sightings of Turtles occurred. However, according to the local fishermen community, presence of 3 species of turtles are there in the district, they are: Indian Roofed Turtle (*Pungshura tecta*), Indian Softshell Turtle (*Nilssonia gangetica*) and Indian Tent Turtle (*Pungshura tentoria*). Indian Roofed Turtle has **"vulnerable"** status, Indian Softshell Turtle is **"endangered"** whereas Indian Tent Turtle is Least Concern in IUCN's List of Threatened Species. Table 5 presents the turtle species as recorded during the survey.

Table 5 : List Of Turtles In The Study Region

Sr. No.	Common Name	Scientific Name	Conservational Status as per IUCN List.
1	Indian Softshell Turtle	*Nilssonia gangetica*	**Endangered**
3	Indian Roofed Turtle	*Pungshura tecta*	**Vulnerable**
4	Indian Tent Turtle	*Pungshura tentoria*	Least Concern

10.3 **Nilgai :** Nilgai (*Boselaphus tragocamelus*) is the largest antelope also known as Blue Bull is one of the most widespread species across the country prefers open grasslands, open scrublands, woodlands and agricultural fields as habitat. The population of Nilgai has increased drastically over the years due to prolonged breeding activity and lack of potential predators and has become overabundant in states of Gujarat, Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan, Madhya Pradesh and Delhi (Meena, 2017). The entire Gangetic plain is prone to crop raiding by the animal creating human-wildlife conflict across the region. During the survey, no direct sightings of Nilgai occurred in the study region. According to the locals the population of Nilgai is at the lower side in the district. There is a small population in Manihari, Teldanga, Kishunpur and near Gogabil Lake.

10.4 **Wild Boar :** Wild Boars (*Sus scrofa* L.) are one of the most widely distributed species in the world. Their highly adaptive behaviour and wide range of habitat have led the species' population to flourish. In recent years, wild boar has become a regular menace for farmers, causes crop damage right from planting till the maturity of the crop (Vasudeva Rao et al., 2015). During the survey, interlocutors reiterated that the boars are responsible for destroying the crops, potatoes and other vegetables. They tend to live on the *diaras* and come out at night to feed. Their population resides on riverine islands adjacent to Manhari Ghat, Karhagola Ghat, Amdabad and Dilarpur.

10.5 **Other important fauna :** The presence of wild fauna such as Golden Jackal, Indian Grey Mongoose, Bengal Monitor Lizard, , Jungle Cat and bat species have also been recorded in various riparian habitats based on visual observations and information from resident interlocutors. The list of such species recorded is presented in Table 6:

Table 6 : Other Important Fauna Recorded In The Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Golden Jackal	*Canis aureus*	Least Concern
2.	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern
3.	Bengal Monitor	*Varanus bengalensis*	Near Threatened
4.	Jungle Cat	*Felis chaus*	Least Concern
5.	Indian Flying Fox	*Pteropus giganteus*	Least Concern
6.	Danaid Eggfly (Butterfly)	*Hypolimnas misippus*	Least Concern

7.	Peacock Pansy (Butterfly)	*Junonia almana*	Least Concern
8.	Blue Jay (Butterfly)	*Graphium doson*	Least Concern
9.	Common Mime (Butterfly)	*Papilio clytia*	Least Concern
10.	Common Grass Yellow (Butterfly)	*Eurema brigitta*	Least Concern

10.6 **Avifauna Diversity:** Katihar Distt. supports highly rich and diverse avifauna. A good number of local and migratory birds were seen during the survey. Some of the larger lakes in the Distt. like Gogabil and Baghar Bil provide suitable habitats for winter visitors. During the field survey in study region, avian species were sighted using binoculars and identified using field guides (Salim Ali, 2012; Grimmett *et al.*, 2016). The species recorded are presented in Table 7 along with their conservation status based on IUCN Red List Data.

- Total **100** different avian species were sighted in study region of Katihar Distt. out of which **41** were wetland species and other **59** were of forest and grassland ecosystems including 5 species of raptors. Based on the identified species, following observations were made:
- Little Egret, Great Egret, Indian Pond Heron, White-breasted Waterhen, Common Moorhen, Little Cormorant, Asian Pied Starling, Indian Jungle Crow, House Crow, Common Pigeon, Common Myna, Red-wattled Lapwing and Eurasian Collared Dove were the most frequently sighted species.
- **Black-Headed Ibis**, **Ferruginous Duck**, **River Lapwing**, and **Alexandrine Parakeet** fall under "**Near Threatened**" category, **Lesser Adjutant, River Tern**, and **Common Pochard** have "**Vulnerable**" status whereas **Greater Adjutant** has been listed as "**Endangered"** in IUCN's Red List of Threatened Species.
- Some representative avian species as pictured during the survey are depicted in Images 20-22.

Table 7 : List Of Birds Recorded In The Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	White throated Kingfisher	*Halcyon smyrnensis*	Least Concern
2.	Common Kingfisher	*Alcedo atthis*	Least Concern
3.	Pied Kingfisher	*Ceryle rudis*	Least Concern
4.	Cattle Egret	*Bubulcus ibis*	Least Concern
5.	Little Egret	*Egretta garzetta*	Least Concern
6.	Intermediate Egret	*Ardea intermedia*	Least Concern
7.	Great Egret	*Ardea alba*	Least Concern
8.	Indian Pond Heron	*Ardeola grayii*	Least Concern
9.	Grey Heron	*Ardea cinerea*	Least Concern
10.	Purple Heron	*Ardea purpurea*	Least Concern
11.	Cinnamon Bittern	*Loxbrychus cinnamoeus*	Least Concern
12.	Common Sandpiper	*Actitishypoleucos*	Least Concern
13.	Green Sandpiper	*Tringa ochropus*	Least Concern
14.	Asian Openbill	*Anastomus oscitans*	Least Concern
15.	**Lesser Adjutant**	***Leptoptilos javanicus***	**Vulnerable**
16.	**Greater Adjutant**	***Leptoptilos dubius***	**Endangered**
17.	Little Stint	*Caldris minuta*	Least Concern
18.	Little Cormorant	*Microcarbo niger*	Least Concern
19.	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
20.	Great Cormorant	*Phalacrocorax carbo*	Least Concern
21.	**Oriental Darter**	***Anhinga melanogaster***	**Near Threatened**
22.	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
23.	**Black-headed Ibis**	***Threskiornis melancephalus***	**Near Threatened**
24.	White breasted -Waterhen	*Amaurornis phoenicurus*	Least Concern
25.	Common Moorhen	*Gallinula chloropus*	Least Concern
26.	Little Grebe	*Tachybaptus ruficollis*	Least Concern
27.	Common Teal	*Anas crecca*	Least Concern
28.	Gadwall	*Mareca strepera*	Least Concern
29.	Fulvous Whistling-duck	*Dendrocygna bicolor*	Least Concern
30.	Lesser Whistling-duck	*Dendrocygna javanica*	Least Concern
31.	Cotton Pygmy-goose	*Nettapus coromandelianus*	Least Concern
32.	**Ferruginous Duck**	***Aythya nyroca***	**Near Threatened**
33.	**Common Pochard**	***Aythya ferina***	**Vulnerable**
34.	Red-creasted Pochard	*Netta rufina*	Least Concern
35.	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
36.	Purple Swamphen	*Porphyrio porphyrio*	Least Concern
37.	**River Tern**	***Sterna aurantia***	**Vulnerable**
38.	Eurasian Coot	*Fulica atra*	Least Concern
39.	Common Greenshank	*Tringa nebularia*	Least Concern
40.	Black-winged Stilt	*Himantopus himantopus*	Least Concern
41.	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
42.	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
43.	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
44.	Black Drongo	*Dicrurus macrocercus*	Least Concern
45.	Common Myna	*Acridotheres tristis*	Least Concern

46.	Bank Myna	*Acridotheres ginginianus*	Least Concern
47.	Asian Pied Starling	*Gracupica contra*	Least Concern
48.	Brahminy Starling	*Sturnia Pagodarum*	Least Concern
49.	Common Stonechat	*Saxicola torquatus*	Least Concern
50.	Pied Bushchat	*Saxicola caprata*	Least Concern
51.	Indian Bushlark	*Mirafra erythroptera*	Least Concern
52.	Paddyfield Pipit	*Anthus rufulus*	Least Concern
53.	Common Babbler	*Argya caudata*	Least Concern
54.	Jungle Babbler	*Argya striata*	Least Concern
55.	Large Grey Babbler	*Argya malcolmi*	Least Concern
56.	White Wagtail	*Motacilla alba*	Least Concern
57.	Grey Wagtail	*Motacilla cinerea*	Least Concern
58.	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
59.	Indian Silverbill	*Euodice malabarica*	Least Concern
60.	Common Tailorbird	*Orthotomus sutorius*	Least Concern
61.	**Alexandrine Parakeet**	***Palaeornis eupatria***	**Near Threatened**
62.	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
63.	House Sparrow	*Passer domesticus*	Least Concern
64.	Indian Jungle Crow	*Corvus culminatus*	Least Concern
65.	House Crow	*Corvus splendens*	Least Concern
66.	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
67.	Streak throated Swallow	*Petrochelidon fluvicola*	Least Concern
68.	Barn Swallow	*Hurindo rustica*	Least Concern
69.	Brown-headed Barbet	*Psilopogon zeylanicus*	Least Concern
70.	Ashy Prina	*Prinia socialis*	Least Concern
71.	Plain Prinia	*Prinia innornata*	Least Concern
72.	Greater Coucal	*Centropus sinensis*	Least Concern
73.	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
74.	Red-vented Bulul	*Pycnonotus cafer*	Least Concern
75.	Common Kaestral	*Falco tinnunculus*	Least Concern
76.	Black-winged kite	*Elanus caeruleus*	Least Concern
77.	Shikra	*Accipiter badius*	Least Concern
78.	Osprey	*Pandion haliatus*	Least Concern
79.	White-eyed Buzzard	*Bustastur teesa*	Least Concern
80.	Green Bee-eater	*Merops orientalis*	Least Concern
81.	Scaly-breasted Munia	*Lonchura punctulata*	Least Concern
82.	Indian Peafowl	*Pavo cristatus*	Least Concern
83.	Spotted Owlet	*Athene brama*	Least Concern
84.	Jungle Owlet	*Glaucidium radiatum*	Least Concern
85.	Common Pigeon	*Columba livia*	Least Concern
86.	Spotted Dove	*Spilopelia* chinesis	Least Concern
87.	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern
88.	Laughing Dove	*Spilopelia senegalensis*	Least concern
89.	Yellow-footed Green-pigeon	*Treron phoenicopterus*	Least concern
90.	Rufous Treepie	*Dendrocitta vagabunda*	Least concern
91.	Purple Sunbird	*Cinnyris asiaticus*	Least concern
92.	Indian Roller	*Coracias benghalensis*	Least concern
93.	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern

94.	Common Chiffchaff	*Phylloscopus collybita*	Least Concern
95.	Greenish Warbler	*Phylloscopus trochiloides*	Least Concern
96.	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Least Concern
97.	Common Iora	*Aegithinia tiphia*	Least Concern
98.	Black Redstart	*Phoenicurus ochorus*	Least Concern
99.	Brown Rockchat	*Oenanthe fusca*	Least Concern
100.	White-throated Fantail	*Rhipidura albicollis*	Least Concern

Image 20 : Common Kingfisher

Image 21 : Common Stonechat

Image 22 : Greater Adjutant

10.7 **Migratory Birds :** A total of 16 Migratory and 6 Local Migratory species were identified among the recorded avian species. These migratory species (excluding LM) are winter visitors to Indian Subcontinent can be seen from October to march. The Migrants (M) and Local Migrant (LM) species are listed in Table 8:

Table 8 : Details Of Migratory Birds In The Study Region

Sr. No	Common Name	Scientific Name	Conservation Status	M (Migrant) / LM (Local Migrant)
1.	Common Sandpiper	*Actitishypoleucos*	Least Concern	M
2.	Green Sandpiper	*Tringa ochropus*	Least Concern	M
3.	Common Teal	*Anas crecca*	Least Concern	M
4.	Gadwall	*Mareca strepera*	Least Concern	M
5.	Ferruginous Duck	*Aythya nyroca*	Near Threatened	M
6.	Common Pochard	*Aythya farina*	Vulnerable	M
7.	Red-creasted Pochard	*Netta rufina*	Least Concern	M
8.	Common Greenshank	*Tringa nebularia*	Least Concern	M
9.	Common Stonechat	*Saxicola torquatus*	Least Concern	M
10.	White Wagtail	*Motacilla alba*	Least Concern	M
11.	Grey Wagtail	*Motacilla cinerea*	Least Concern	M
12.	Little Stint	*Caldris minuta*	Least Concern	M
13.	Osprey	*Pandion haliatus*	Least Concern	M
14.	Common Chiffchaff	*Phylloscopus collybita*	Least Concern	M
15.	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Least Concern	M
16.	Black Redstart	*Phoenicurus ochorus*	Least Concern	M
17.	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern	LM
18.	Great Cormorant	*Phalacrocorax carbo*	Least Concern	LM
19.	Black-winged Stilt	*Himantopus himantopus*	Least Concern	LM
20.	Common Kaestral	*Falco tinnunculus*	Least Concern	LM
21.	Barn Swallow	*Hurindo rustica*	Least Concern	LM
22.	Greenish Warbler	*Phylloscopus trochiloides*	Least Concern	LM

11.0 Ganga Riverine Islands/*Diaras* In Katihar

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 irregularly shaped riverine islands are present in the Ganga river stretch of study region.

11.2 Gobrahi *Diara* near Karhagola Ghat is the biggest and the most significant riverine island in the study region is roughly lens shaped. The *diara* also holds temporary settlements and is under extensive agriculture with crops such as mustard, water melon and wheat being grown there in different seasons. On some fringe parts of this *diara*, natural vegetation dominated by *Saccharum* sps. grasses were also present which was an important bio resource for construction of huts, thatching roofs of houses and making boundaries for agricultural fields on this *diara*. Fishing was also observed to be a prominent activity on and around this *diara*.

Image 23 : Location Of Gobrahi Diara

Image 24 : Agriculture And Fishing Observed On Gobrahi Diara

12.0 Fishing In Katihar

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 In the study region, members of the *mallah* community are chiefly involved in fishing activities from Ganga River and its tributaries (Koshi, Fulhar, Koshi Dhar etc.). Gogabil and Baghar bil lakes also harbor rich fish population. The common fishing techniques in the study region involve cast nets [Image 25], drag nets, fine meshed plastic nets and locally made fishing rods. The fine-meshed fishing nets are chiefly employed for catching smaller fish while nets having slightly bigger mesh sizes are employed for catching bigger fish species. Most of the fishing nets that were set up in the river systems of study region were done so with the help of bamboo sticks [Image 26].

12.3 The boats used for fishing are small sized and hand-rowed made chiefly from 'Sakhua/Sal' wood (*Shorea robusta*) which is available from the market. However, in many cases, the interlocutors reiterated use of other wood such as Jamun, Mango and Babool for constructing these boats due to unavailability of Sakhua. Mostly members of Mallah community residing in villages along Ganga River are involved in construction of these boats with the help of Mistry (carpenter). The cost of constructing these boats can range from Rs. 50,000/- to Rs.1,00,000/- depending upon various factors.

Image 25 : Cast Net Fishing At Karhagola Ghat

Image 26 : Fishing Using Nylon And Plastic Nets Along With Bamboo Sticks

12.4 As reiterated by local fishermen from the region, the fish population has decreased drastically in the last two-three decades approximately by 60%-70%. This significant decrease in fish population has adversely affected the livelihood of the *mallah* community forcing them to seek alternate source of income. During the survey total 13 species of fish were recorded which are listed below. Singhi (*Heteropneustes fossilis*), Common/Chinese carp (*Cyprinus carpio*) and Rohu (*Labeo rohita*) were the most commonly caught species. These fish are sold in Katihar town and in local markets of nearby villages. The demand for fish consumption in this region is very high thereby leading to prices ranging from Rs. 150/-to Rs. 200/- per kg for small fish and Rs. 300/- to Rs.400/- per kg for big fish in the market.

Table 9 : Major Fish Caught In The Study Region Based On Information From Fishermen During The Survey

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
6	*Cyprinus carpio*	Common/Chinese carp
7	*Channa punctata*	Garai
8	*Eutropiichthys vacha*	Bachwa
9	*Anguilla bengalensis*	Baam
10	*Cirrhinus mrigala*	Naini
11	*Cabdio morar*	Chepua
12	*Oreochromis* sp.	Tilapia
13	*Heteropneustes fossilis*	Singhi

13.0 Groundwater In Katihar

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. Katihar Distt. is the part of the Lower Ganga Plains and falls in the Koshi and Mahananda sub-basin. The geomorphological area in the Distt. represents a flat topography with regional slope towards the south. Overall the soil in this Distt. is non-calcareous and non-saline in nature and is a mixture of clay, sand and silt in varying proportions. The entire Distt. is underlain by thick unconsolidated sediment of Quaternary Period. These unconsolidated sediments consist of sand, gravel and pebbles which constitute potential groundwater aquifer. The thickness of granular zone is about 50-70 m within a depth of 80 m. The persistent clay layers are absent and ground water occurs under pheratic condition in major part of the district. Though lateral facies changes have been observed, the aquifer system may be considered as single continuous one down to a depth of 80 m. The aquifer is highly potential and a discharge of 100 m^3/hr may be obtained for nominal drawdown of 2 m (Singh, 2013).

13.2 The CGWB recorded the ground water level in the year 2011, in pre-monsoon (May) and post-monsoon (November) seasons to check the water level variations in the district. In the pre-monsoon season the water level varied from 2.88 to 8.66 mbgl. The water level of northern and central part varied from 2 to 5 mbgl, in the southern part water level was recorded below 5 mgbl. In the post-monsoon season the water level fluctuated from 2.26 to 6.47 mgbl. In most of the areas the water level was recorded from 2 to 5 mgbl. The average pH of ground water recorded in the district is 8, which is mildly alkaline. The Electrical Conductivity (EC) varies from 290 micro siemens/cm to 850 micro siemens/cm. The arsenic contamination has been recorded in the ground waters of Mansahi, Kursela, Sameli, Brari, Manihari and Amdabad blocks (Singh, 2013).

13.3 During the field survey, ground water levels in different parts of study region was recorded based on information provided by the interlocutors. This information is provided in Table 10. The groundwater in the study region ranged from 15 – 40 feet (approximately 4.5-12 m) with a general trend of increasing depth as the distance from Ganga River increased.

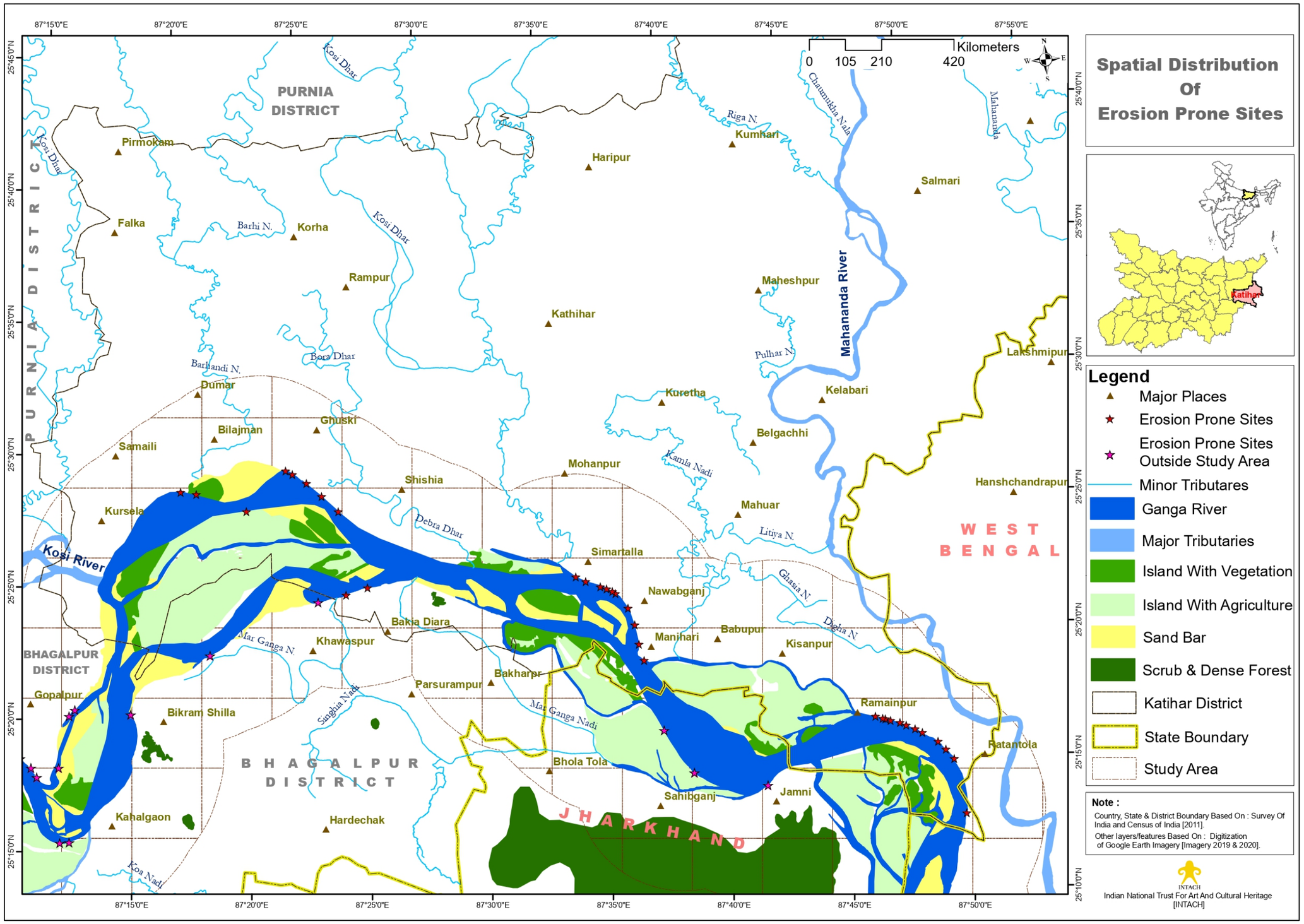
Table 10 : Groundwater Levels Recorded From Different Villages In Study Region

Place	Coordinates		Groundwater Table below ground level (In Feet)
	Lat.	Long.	
Manihari	25°20'45.90"N	87°37'17.04"E	25 ft.
Manihari Ghat	25°20'5.48"N	87°37'3.21"E	20 ft.
Pirpahar	25°20'9.24"N	87°37'18.45"E	35 ft.
Karhagola Ghat	25°28'56.56"N	87°21'49.81"E	15 ft.
Baghar Bil	25°21'24.98"N	87°39'52.06"E	20 ft.
Gogabil Lake	25°21'59.66"N	87°41'26.79"E	20 ft.
Dilarpur	25°23'25.73"N	87°34'47.15"E	30 ft.
Kishunpur Diara	25°15'9.30"N	87°47'36.02"E	20 ft.
Amdabad	25°17'58.87"N	87°47'50.61"E	25 ft.
Baghmara	25°21'22.20"N	87°37'0.77"E	40 ft.

14.0 Ganga River Bank Erosion In Katihar

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. During the field survey lateral erosion was observed along Ganga river bank at different sites such as Gobrahi *diara*, Manihari Ghat, Karhagola Ghat, and Baghmara Ghat. Image 27 depicts one such erosion prone site along Ganga River while Map 7 presents the erosion prone sites in the study region.

Image 27 : Erosion Prone Bank Near Karhagola Ghat



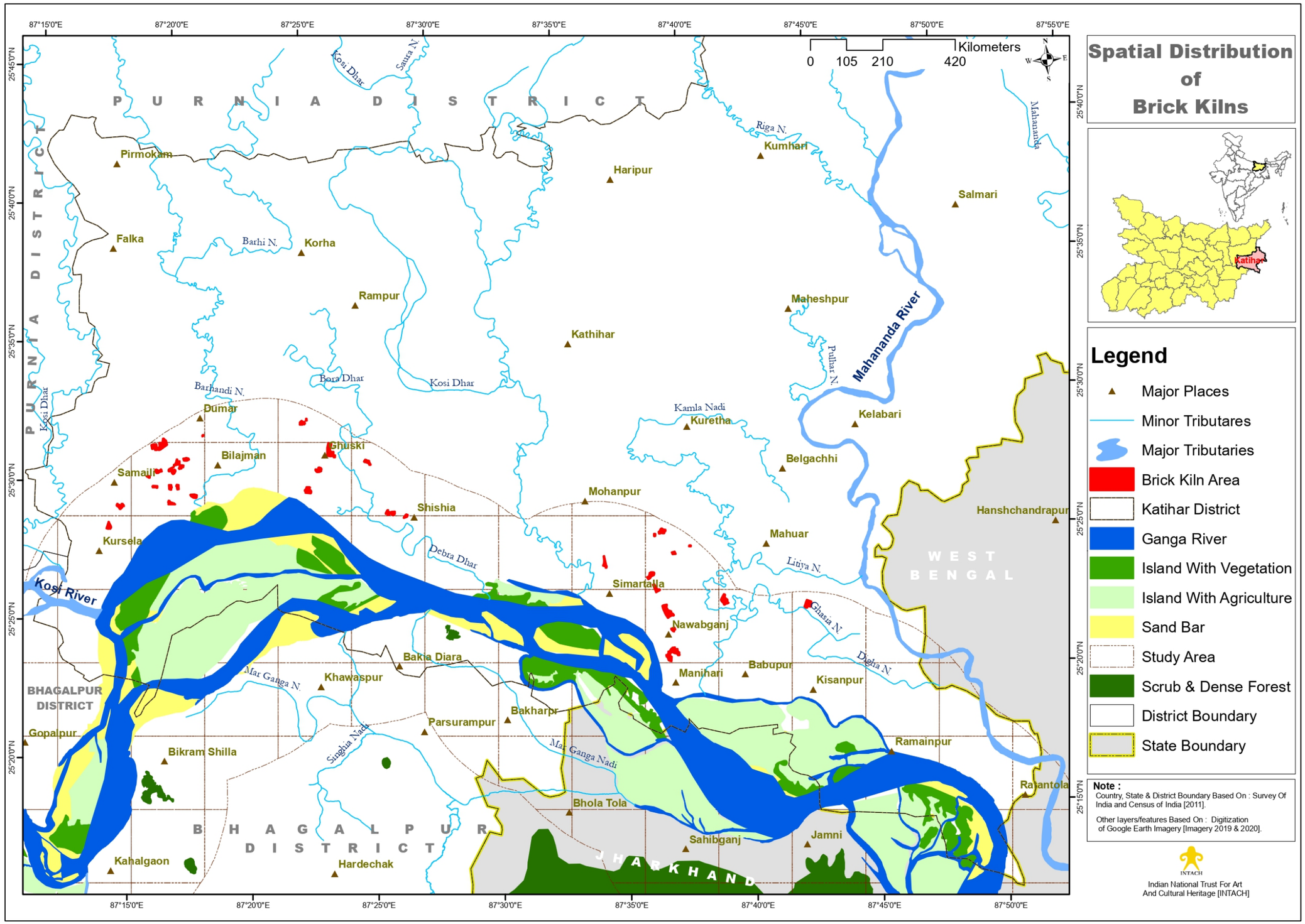
Map 7 : Spatial Distribution Of Erosion Prone Sites In Katihar

15.0 Mining And Brick Kilns In Katihar

15.1 Sand is one of the major minerals extracted from the Ganga River, especially in its middle and lower stretch. Its demand has increased manifolds especially in the recent time owing to rapid urbanization. Sand mining activity was not observed during the survey, but according to the interlocutors occasionally sand mining is done at Manihari Ghat, Dilar Pur, and at *diara* near Barari.

15.2 **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. Map 8 provides spatial distribution of brick kilns within the study region while Image 28 depicts a brick kiln as observed near Manihari.

Image 28 : Brick Kilns As Seen Near Manihari In The Study Region



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

16.0 Boatmaking And Inland Navigation In Katihar

16.1 Boats play a crucial role in the livelihood and day-to-day activities of riparian communities in the study region. Boats of varying sizes were found to be plying in Ganga River and its tributaries in the study region. Boatmaking by members of Mallah community was observed near Karhagola Ghat during the field survey [Image 29]. Majority of the boats in study region were small wooden boats which are hand rowed and principally used for fishing activities while some were larger motorized boats employed for transportation purposes. These boats were constructed by the local fishermen communities often with the help of a 'Mistry'. While Sakhua/Sal (*Shorea robusta*) was the main choice for this construction, other woods such as Babool, Mango and Jamun were also employed due to high prices and unavailability of sufficient Sakhua wood from the market. The interlocutors further reiterated that the cost of constructing these boats ranged from Rs. 50,000 to Rs. 1,00,000/- depending upon various factors.

16.2 Inland Navigation was recorded at Manihari Ghat. People use to commute from Manihari to Sahibganj District of Jharkhand using motorized boats [Image 30]. The fare from either side is Rs. 50. The boats are made using Shakhua, Shisam and other available woods with metals fitted at the joints. The constructional cost of these boats is around Rs.1.5 lakhs to Rs. 2 lakhs. **Ships were seen at Manihari Ghat carrying trucks full of stone chips and sand which were being transported to Sahibganj District** [Image 31].

Image 29 : Boat making at Karhagola ghat

Image 30: Inland Navigation At Manihari Ghat

Image 31 : Ships Carrying Trucks As Observed At Manihari Ghat

17.0 Sacred Trees In Katihar

17.1 **Sacred Trees:** Various sacred trees were also observed during the field survey in study region. Peepal (*Ficus religiosa*) is the major tree species often found associated with temples and other religious sites throughout. The worship of this tree is usually done by the female residents in that region by tying threads around it and offering water along with sindoor, coconuts or incense sticks. Another 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. One such example of sacred trees as observed during field survey is depicted in Image 32.

Image 32 : A Sacred Peepal Tree Near Nawabganj

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'. The remains of these rites along with other substances such as pots, flowers, clothes, threads and so on are often dumped directly into the river thereby impacting the riparian and in stream biodiversity. Some such cremation sites were observed during the survey along Ganga River in this study region [Image 33]. Hence, it is strongly suggested through this study to take cognizance of this matter and develop suitable cremation facilities while ensuring that water pollution and ecosystem damage is prevented in this region

Image 33 : Cremation Activities As Recorded Along Ganga River Near Karhagola Ghat

18.2 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.

18.3 Many settlements along Ganga River often lead to escalated solid and liquid waste dumping directly into the water which turns out extremely hazardous by degrading the water quality and negatively impacting the aquatic biodiversity. Such examples were observed in the study region [Image 34] during the field survey which need to be brought to immediate attention. Hence, it is suggested in this study to develop appropriate waste management strategies for the local communities directly linked to Ganga River.

Image 34 : Waste Strewn Along Ganga River Bank At Karhagola Ghat

18.4 Evidences of severe bank erosion can be observed on the map throughout the study region which usually results in losses of human settlements and agricultural fields. Hence, it is recommended to carry out detailed studies in the district 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.

18.5 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.

18.6 The riparian ecosystems are of high conservation priority owing to the rich biodiversity they support and the large-scale ecosystem services they provide. However, intensive agricultural practices including expansion of fields up to the current flow of Ganga River in many parts of this [Image 35] has already negatively impacted the riparian vegetation communities which is evident from the sparse growth and low species diversity of riparian plants recorded during this survey. This in turn impacts the associated faunal diversity as well as bank stability often leading to severe erosion during flood situation. Hence, it is recommended through this study to take up measures for checking the limit of agriculture in riparian areas of Ganga River in order to allow the natural biota to flourish.

Image 35 : Intensive Agriculture Along Ganga River In The Study Region Leaving Bald Banks Vulnerable to Erosion

19.0 References:

1. Ali S. (2002), The Book of Indian Birds (13th revised edition). Oxford University Press, New Delhi, 326 pp.
2. Auden J.B. (1941), An excursion to Gangotri. *Himalayan Journal*, 7: 96-102
3. Bhattacharyya U.C. and Goel A.K. (1982), Studies on the vegetation of Tehri dam and some rare plants in Garhwal Himalayas. Published by B.S.I. Howrah. pp. 1-38
4. Castelle A.J., Johnson A.W. and Conolly C. (1994). Wetland and stream buffer size requirements: A review. *Journal of Environmental Quality,* 23:878-882.
5. Choudhury, B.C., Singh L.A.K., Rao R.J. *et al.* (2007), *Gavialus gangeticus*. The IUCN Red List of Threatened Species. (http://dx.doi. org/10.2305/IUCN.UK.2007.RLTS.T8966A12939997.en)
6. Gangwar R.S. and Gangwar K.K. (2011). Taxonomic and economic classification of riparian floral diversity along river Ganga in Garhwal Himalayan region of India. *Researcher*, 3(4):5-14.
7. Gangwar R.S. and Joshi B.D. (2006). Some Medicinal flora in the riparian zone of river Ganga at Saptrishi, Haridwar, Uttaranchal. *Himalayan Journal of Environment and Zoology*, 20(2): 237-241.
8. Grimmett R., Inskipp C. and Inskipp T. (2016), Birds of the Indian Sub-continent: India, Pakistan, Sri Lanka, Nepal, Bhutan, Bangladesh and the Maldives. Bloomsburry Publishing, India.
9. Groffman P.M., Gold A.J., Husband T.P., Simmons R.C. and Eddleman W.R. (1990). *An investigation into multiple uses of vegetated buffer strips*. RI: University of Rhode Island, Kingston.
10. Gupta R.K. (1960), On a botanical trip to the source of the river Ganga in Tehri Garhwal Himalayas. *Indian Forester*, 86: 547-552.
11. Islam Md.S., Rahman M.M., Halder C.G. and Tanaka M. (2006), Fish assemblage of a traditional fishery and seasonal variation in diet of its most abundant species *Wallago attu* (Siluriformes: Siluridae) from a tropical floodplain. *Aquatic Ecology*, 40: 263-272.
12. Joshi K.D., Jha D.N., Alam A., Srivastava S.K., Kumar V. and Sharma A.P. (2014), Enironmental flow requirements of river Sone: impacts of low discharge on fisheries. Current Science, 107(3): 478-488.
13. Jha S. (2021), Online News Article. https://www.aajtak.in/india/news/story/bihar-story-of-kahalgaw-bateshwar-the-place-where-kashi-was-to-be-established-1281871-2021-06-29
14. Khan M.I. (2018), Dolphin population declines in India's only dolphin sanctuary. Online article published in Down to Earth Magazine. https://www.downtoearth.org.in/news/wildlife-biodiversity/dolphin-population-declines-in-india-s-only-dolphin-sanctuary-61192

15. Kumar M., Satyendra, Singh S.P., Kumar A., Smriti, Shashikant, Singh P.K. and Sohane R.K. (2018), Characterisation of Katarni rice for its Geographical Indication in Bihar, India. Journal of AgriSearch, 5(4): 223-229.
16. Kumar S. (2001), Plant diversity along river Ganga, BSI, Sai Publisher Dehradun.
17. Meena M. (2017), Agriculture crop damage by antelope (*Boselaphus tragocamelus*) and management strategies: Challenges in India. International Journal of Zoology Studies, 2(6): 157-160.
18. Montana C.G., Choudhary S.K., Dey S. and Winemiller K.O. (2011), Compositional trends of fisheries in the river Ganges, India. *Fisheries Management & Ecology*, 18: 282-296.
19. Nawab A., R.K. Sinha P.M. Thompson and S. Sharma (2016), Ecosystem services and conservation assessment of freshwater biodiversity. In: L. Bharati, B.R. Sharma, and V. Smakhtin (eds.), The Ganges River Basin: Status and Challenges in Water, Environment and Livelihoods. Routledge, Taylor and Francis Group, London, UK.
20. Nawab, A., R.K. Sinha, P.M. Thompson, and S. Sharma (2016), Ecosystem services and conservation assessment of freshwater biodiversity. In: L. Bharati, B.R. Sharma, and V. Smakhtin (eds.), The Ganges River Basin: Status and Challenges in Water, Environment and Livelihoods. Routledge, Taylor and Francis Group, London, UK.
21. NEERI (2018), Assessment of water quality and sediment to understand the special properties of River Ganga. Report submitted to NMCG.
22. NICRA-ICAR (2012), Agriculture Contingency Plan for District: Katihar. https://agricoop.nic.in/sites/default/files/BI6-Katihar%20-28.08.12.pdf
23. Osterkamp W.R. (1998), Processes of fluvial island formation with examples from Plum Creek, Colorado and Snake River, Idaho. *Wetlands*, 18(4): 530-545.
24. Pallis M. (1934), Gangotri und Leo Pangal. *Himalayan Journal*, 7(6): 106-126.
25. Prasad R., Pruthi V. and Saini R.K. (2012), Riparian floral diversity of Ganga River. Report prepared by Indian Institutes of Technology.
26. Roy Chaudhuri P.C. (1962), Bihar District Gazetteers – Bhagalpur. Printed by Secretariat Press, Bihar.
27. Sahai (1953), Trek to Gangotri (Source of the Ganga). *Indian Forester*, pp. 147-151.
28. Sarkar D., Ramesh C., Hussain S.A., Mondal R. and Talukdar G. (2018), A Field Observation of the Critically Endangered Indian Gharial, *Gavialis gangeticus* (Gemlin 1789), in the Lower Ganga Canal, Narora, Uttar Pradesh, India. *ICF Reptiles & Amphibians*, 25(3): 204-207.
29. Shyam R. (2008),A study on riparian floral biodiversity of river Ganga between Haridwar and Gangotri. Thesis submitted to Gurukul Kangri Unversity, Haridwar, India.
30. Singh R.K. (2013), Groundwater Information Booklet, Katihar District, Bihar State. Central Groundwater Board, Mid-Eastern Region, Patna.

31. Sinha M. and Khan M.A. (2001) Impact of environmental aberrations on fisheries of the Ganga (Ganges) River. *Aquatic Ecosystem Health and Management Society*, 4: 493-504.
32. Sinha R.K. and Kannan K. (2014), Ganges River Dolphin: An overview of Biology, Ecology and Conservation status in India. Ambio, DOI 10.1007/s13280-014-0534-7.
33. Tare et al. (2012), Wetland Report for Ganga River Basin Environment Management Plan. Report published by Indian Institutes of Technology.
34. Tripathi S., Gopesh A. and Swivedi A.C. (2017), Fish and fisheries in the Ganga river: Current assessment of the fish community, threats and restoration. Journal of Experimental Zoology India, 20(2): 907-912.
35. Udas P.B., Prakash A. and Goodrich C.G. (2018), Gendered vulnerabilities in *Diara*s: Struggling with floods in the Gandak River Basin. *Review of Women's Studies*, LIII(17): 46-54.
36. WII-GACMC (2017), Aquatic Fauna of Ganga River: Status and Conservation. Ganga Aqualife Conservation Monitoring Centre, Wildlife Institute of India, Dehradun.
37. Wyrick J.R. and Klingeman P.C. (2011), Proposed fluvial island classification scheme and its use for river restoration. *River Resources and Applications*, 27: 814-825.

INTACH
Indian
National Trust
for Art and
Cultural Heritage

INDIA@75
Azaadi Ke Rang Bharatiya Sanskriti Ke Sang

NAMAMI GANGE