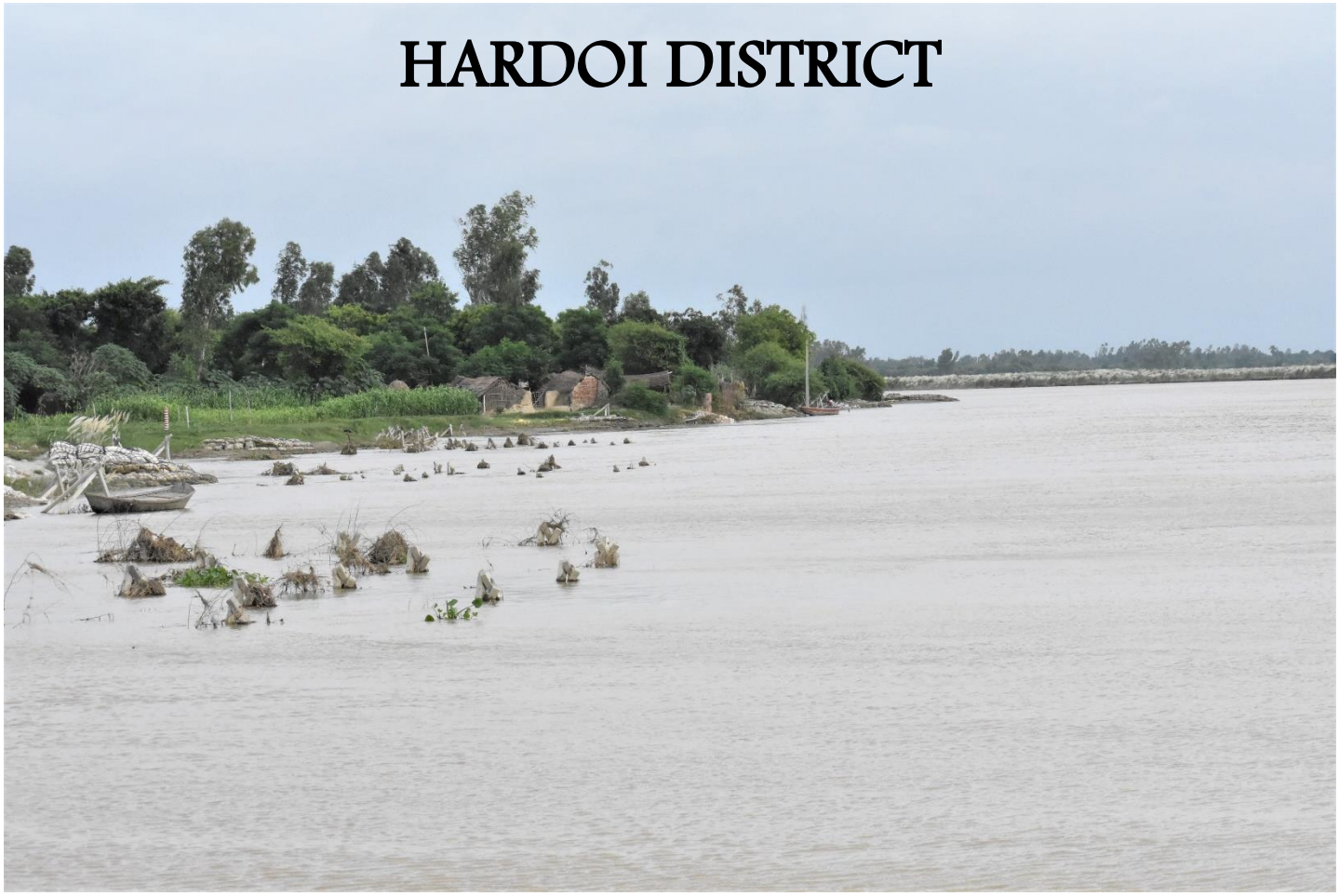
Ganga Cultural Documentation
September 2021

HARDOI DISTRICT



National Mission for Clean Ganga

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Front Cover : Ganga River as seen from Rajghat in Hardoi Distt.

Background : Birds flying over riparian grasses near Mehendipur Ghat bridge

Back Cover : Riparian vegetation along Ganga River near Jigni village

Formatting and Design by : Sumesh Dudani

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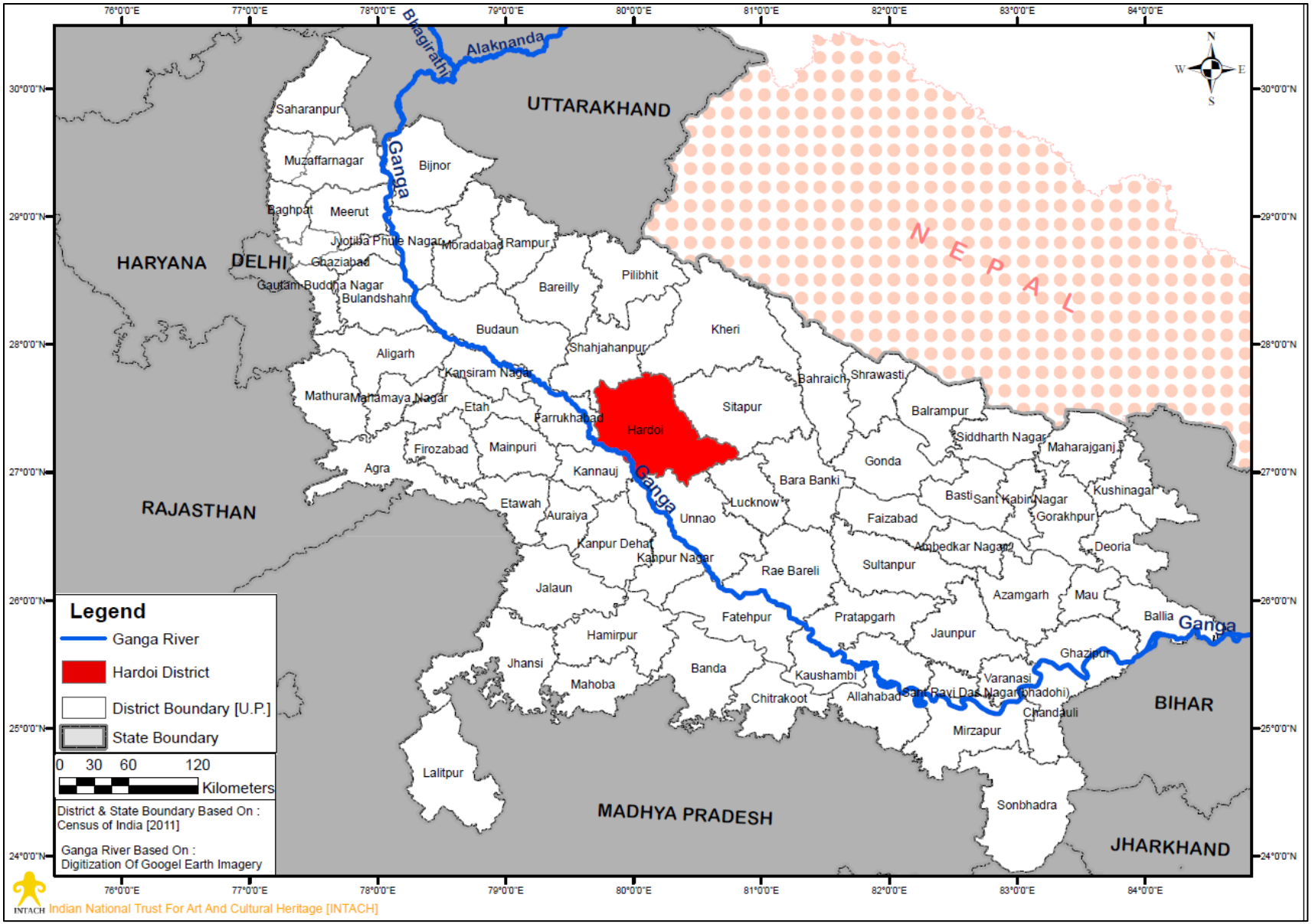
1.0 Introduction

1.1 Hardoi Distt. is one of the 75 distt.s of Uttar Pradesh state falling under the Lucknow Division. It is situated between 26˚53' to 27˚46' N latitude and 79˚41' to 80˚46' E longitude covering a total geographical area of 5989 sq.km. It is bordered by Shahjahanpur & Lakhimpur Kheri Distt.s. in the north, Lucknow & Unnao Distt.s. in the south, Farrukhabad, Kannauj & Kanpur Distt.s. on the west and Sitapur Distt. on the east separated by Gomti river. Hardoi Distt. comprises of 5 Tehsils namely Hardoi, Shahabad, Bilgram, Sandila and Sawayajpur which are divided into 19 blocks, 191 Nyay Panchayat, 1306 Gram Sabha & 1907 habited revenue villages. The Distt. experiences mild and generally warm and temperate climatic conditions. It receives significant rainfall throughout the year with average rainfall in an year being about 1100 mm. Having an average temperature of 33.5˚C, June is the hottest month for the Distt. while January is the coldest (https://hardoi.nic.in/about-district/). The soil type in the Distt. is mainly alluvial in nature with the texture varying from sandy loam, loam to clay loam soils.

1.2 The early history of the district is based on traditions and legendary allusions of Shiva Purana which relates Hardoi with to Thathera king of Hiranya Kashyap who called himself the God. It is believed from Puranas that Hirnakashyap ruled this distt. in olden times and he was an enemy of God Vishnu. Since Hirnakashyap hated the God, thus the place derived its name as Haridrohi which in course of time become Hardoi. According to some scholars, the term "Hardoi" originated from the term "Haridwaya" which means two gods. Since there were two gods, Vamana Bhagavan (in the regime of King Bali) and Narasimha Bhagavan (in the regime of King Hiranyakashyap) had been incarnated hence the place called Haridwaya and later called Hardoi. There is another legend who says that there was a chieftain named 'Harnakas' who too was an enemy of God which may be another reason for its name as Haridrohi. There is another version about this that Hardoi was founded by Hardev Baksa. This is also confirmed by the fact that there still exists a Mohalla (locality) in the name of Hardev Baksa. As per one more opinion there was a great saint Hardev Baba from which the district derived its name.

Mallawa, Bilgram, Pihani, Shahabad, Sandila & Ruiyaa are the places of historical significance. According to some historians Mallawa was colonized by Buddhists while some believed that Sayyed Salar Masood Gazi came here. Earlier this area Mallawa was district headquarter. The ancient name of Bilgram is "SRINAGAR" its present name Bilgram was given by some associates of Mahmood Gajnavi. Pihani is derived by persian word Pinhani (place of shelter), it is believed that king of Moughal dynasty Humayun took shelter in the forest of Pihani when he was defeated by Shershah Suri. Pihani is also related with the minister Sadarejahan of Emperor Akbar. His tomb and paintings are still here. According to the view of some people; Sandila was colonized by Rishi Sandilya. Sandila is also famous for old buildings, Mosque & Barakhamba. (Source: Census of India, 2011)

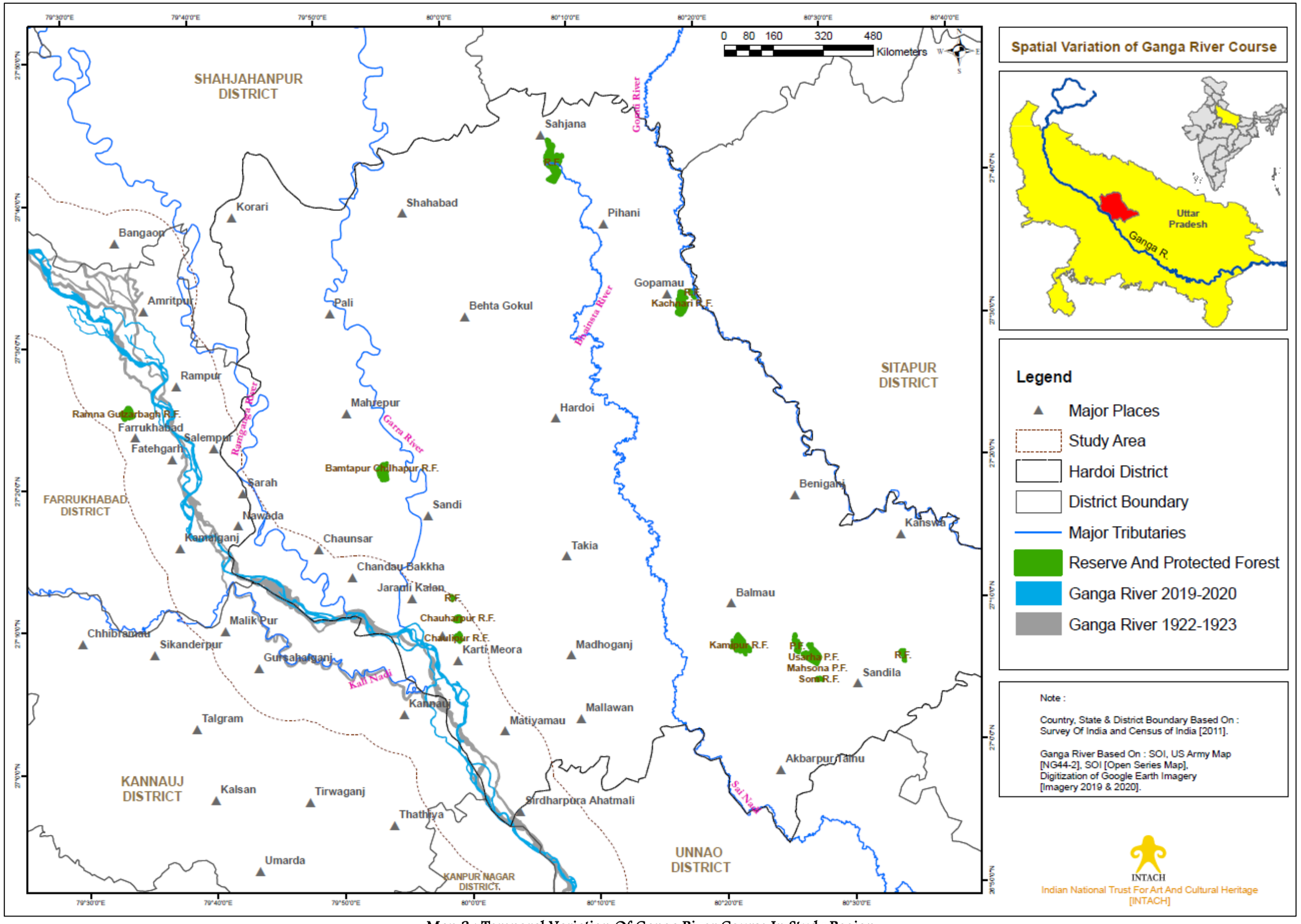


Map 1 : Location Of Hardoi Distt.

2.0 Ganga River In Hardoi Distt.

2.1 Ganga is the major river in this Distt. forming the south-western boundary and separating it from Farrukhabad, Kannauj & Kanpur Distt.s. It enters Hardoi Distt. near Gadanpur village and then flows southeastwards further where Ramganga river confluences with it near Katri Chandapur village. Flowing ahead in the same direction, Garra river confluences with it near Sarhiyapur Pansala village. Thereafter, Ganga River flows a little distance before bending southwards and exiting the Distt. near Shahpur Pawanr Pansala. Throughout its course of about 34.5 km in the study region, Ganga River is braided into different channels by the presence of numerous irregularly shaped riverine islands. During early 19th century, no bridges were present on Ganga River in this Distt. and ferries were the only means of transportation connecting opposite river banks (Nevill, 1904). However, currently two bridges were recorded over Ganga River in the study region – Mehendipur Ghat bridge & newly built bridge near Kusumkhor village in Kannauj Distt. which connect Hardoi and Kannauj Distt.s. Upon interacting with the local residents, it was noted that the course of Ganga River often shifted from side to side resulting in transferring of alluvial lands from one Distt. to another. Similar observations have also been recorded in the Hardoi Distt. Gazetteer (Nevill, 1904). Image 1 depicts Ganga River in Hardoi as seen during field survey while Map 2 depicts the spatio-temporal variation of Ganga River in Hardoi Distt.

Image 1 : Ganga River As Seen Near Sarhiyapur Pansala On 16th September, 2021

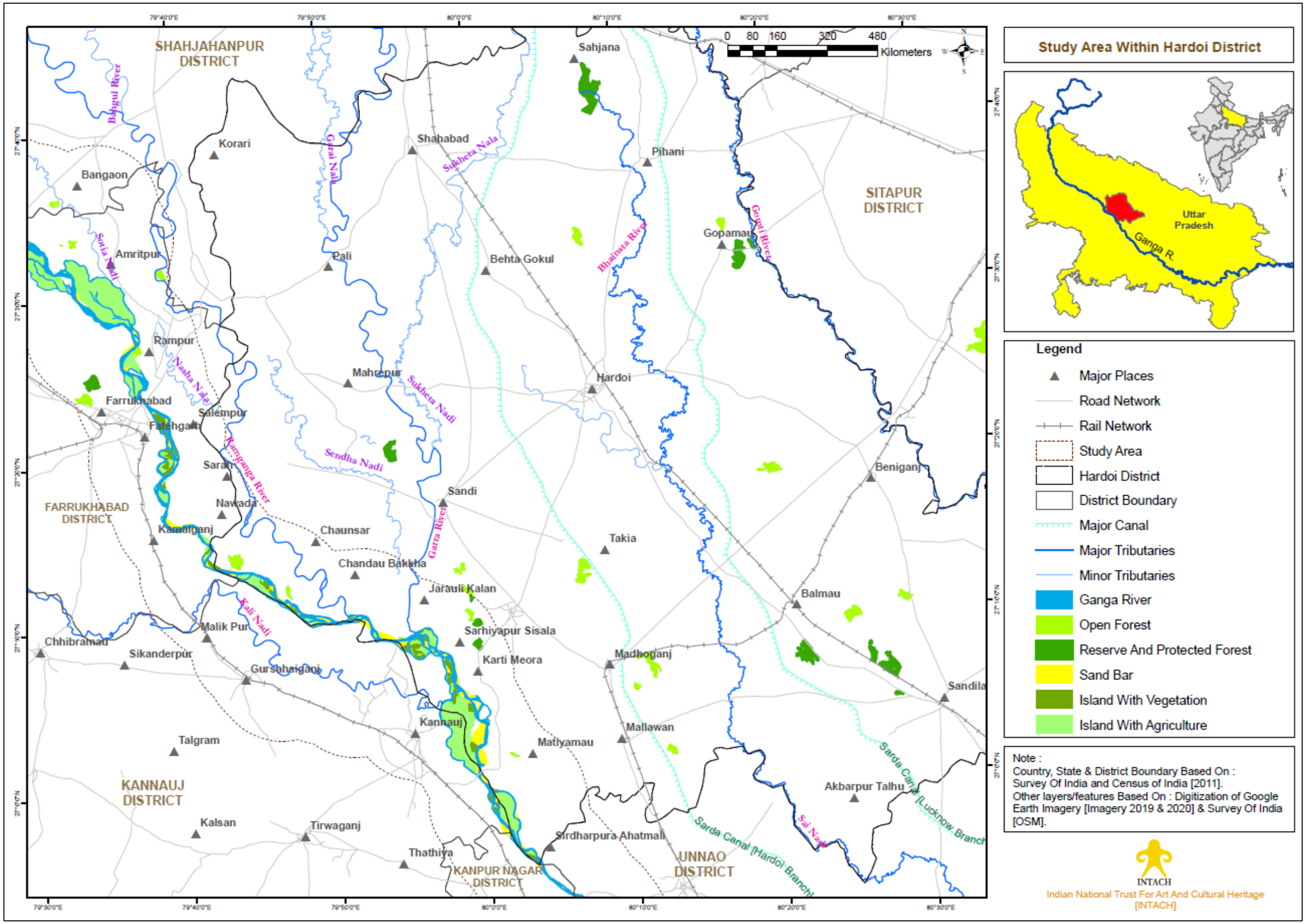


Map 2 : Temporal Variation Of Ganga River Course In Study Region

3.0 Methodology

3.1 Ganga River flows in Hardoi Distt. for approximately 34.5 kms adjoining it mainly on the left bank. Hence for carrying out the ground survey, a 7 km of buffer zone was selected on the left bank of Ganga River in the Distt. [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 Distt. for carrying out relevant interactions.

3.2 The field work in Hardoi Distt. was carried out from 15-18 September, 2021 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 during 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 Hardoi Distt.

4.0 Tributaries Of Ganga River

4.1 **Ramganga River:** Ramganga river is the first major tributary of Ganga joining on its left bank in Hardoi Distt. [Refer Map 4]. This river arises in lower Himalayas at an altitude of about 3110 m above the mean sea level near the village of Lohba in the Garhwal district of Uttarakhand. The total length of the river from the source to its outfall into the Ganga is 596 km and the entire length lies in the Uttarakhand and Uttar Pradesh. In the state of Uttar Pradesh, this river flows through the cities of Bijnor, Moradabad, Bareilly, Badaun, Shahjahanpur and Hardoi before its confluence with Ganga. All along its length, the river meets drinking water supply of large number of human habitations and meets irrigational demands of vast farming areas. According to the District Gazetteer (Nevill, 1904), Ramganga river made great changes in its course and brought rich alluvial deposit which didn't require any manuring for growing crops. It is also recorded that this river was navigable throughout its course during that time. However, currently negligible navigation is present in this river course in the study region. During the field survey, Ramganga river was observed from the newly constructed Ramganga bridge near Beerhijor village [Image 2]. A riverine island was present in this stretch which was mainly exploited by local residents for agriculture and also serves as an important source of fodder for cattle in the region.

4.2 A fading channel of Ramganga river [Refer Map 4] was also observed near Kiratpur in Hardoi Distt. This channel is under extensive pressure due to ever increasing agriculture in its surroundings along with expansion of villages. During the survey, it was found infused with water due to monsoon season [Image 3] but during remaining part of the year it generally dries up according to local residents. The growth of *Eichhornia crassipes* (water hyacinth) was observed owing to the inflow of sewage water from nearby villages. The interlocutors reiterated use of water from this channel chiefly for agriculture and bathing cattle. If the current situation persists, this channel might probably disappear from the region in coming years.

Image 2 : Ramganga River As Observed From Ramganga Bridge On 15th September, 2021

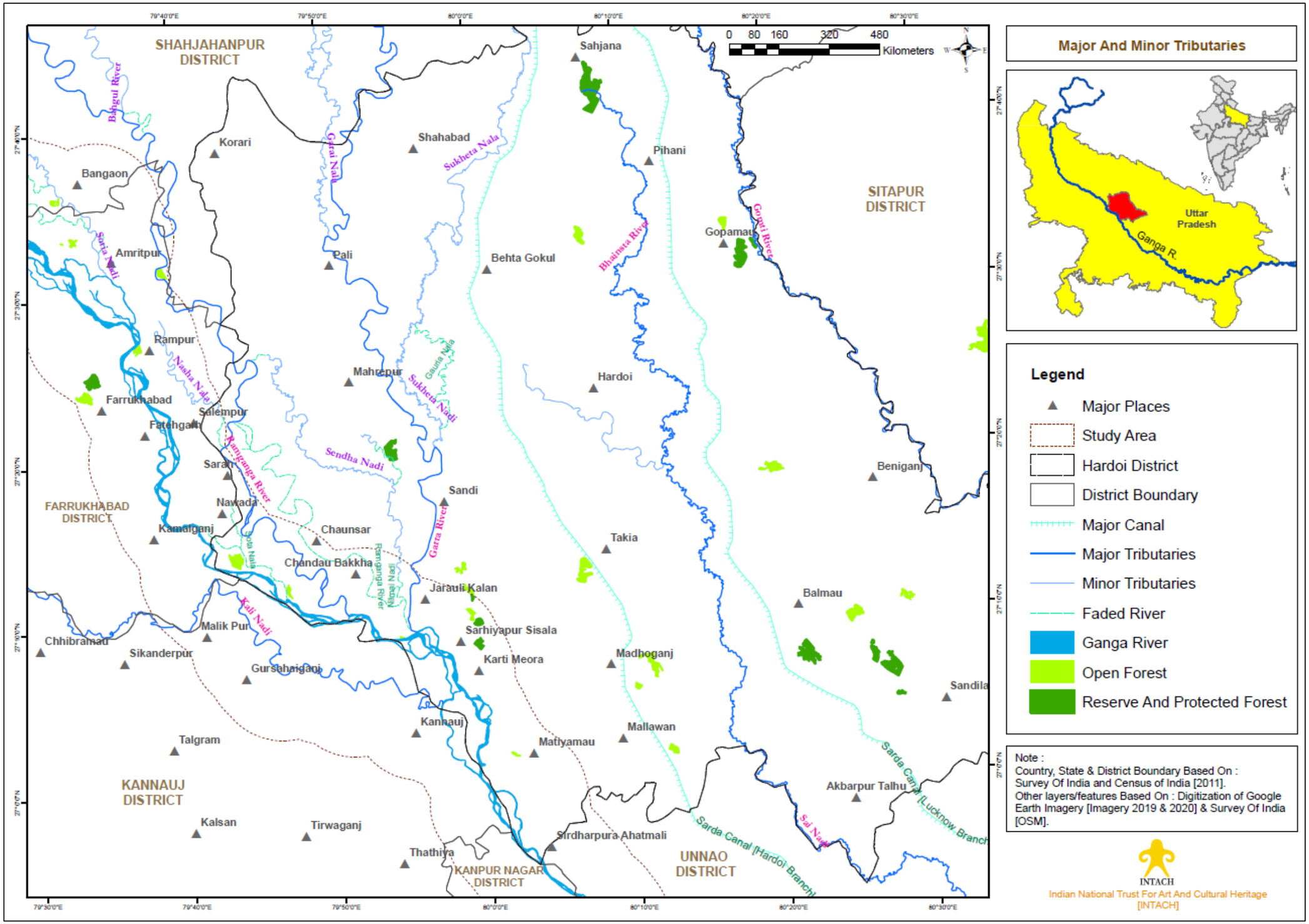
Image 3 : A Fading Channel Of Ramganga River As Observed Near Kiratpur In Hardoi On 15th September, 2021

4.3 **Garra River:** This river is another important left bank tributary of Ganga River which originates from the Nandhaur range in Nainital district of Uttarakhand, Kumaon Himalayas. According to the District Gazetteer (Nevill, 1904), this river passes downwards through the center of Hardoi Distt. between Barwan and Sandi before uniting with Sendha river and finally confluencing with Ganga River near Sahriyapur [Map 4]. During the field survey this river was observed from Garra River bridge near Sandi [Image 4] and at its confluence with Ganga River near Sarhiyapur Pansala village [Image 5]. Throughout its course in this Distt., Garra river is surrounded by extensive agricultural fields including at its confluence with Ganga [Image 6]. Crops such as potato, parwal, chana and arhar are grown in this region for which this river forms an important source of irrigation. Fish catch from Garra river is similar to that of Ganga River with the main fish species being China, Bachwa and Degara. Fine mesh-based dragnets and locally made fishing rods are the chief methods of fishing from Garra River.

Image 4 : Garra River As Seen From Garra Bridge On 16th September, 2021

Image 5 : Confluence Of Garra And Ganga Rivers Near Sahriyapur Pansala Village

Image 6 : Agricultural Fields Near Garra-Ganga Confluence



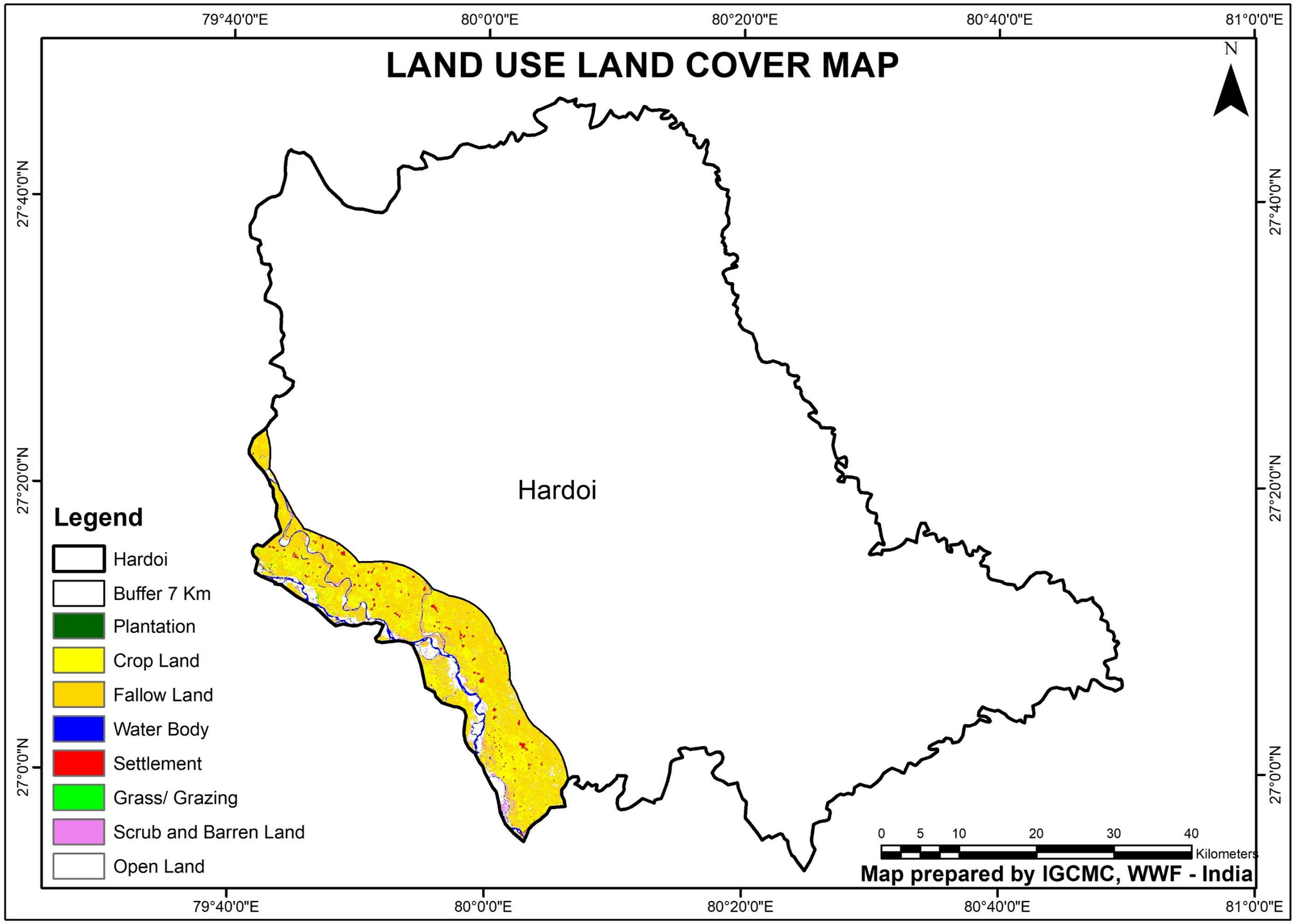
Map 4 : Major And Minor Tributaries Of Ganga River In The Study Area

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 – crop land, fallow land, plantation, water body, settlement, grass/grazing, scrub/barren land and open land. Agriculture being a principal source of income for residents of Hardoi Distt., the crop land & fallow land categories together dominated landscape of study region. The waterbody component covering 3.905% of the total geographical area of this Distt. chiefly includes Ganga River, parts of Ramganga and Garra rivers along with other wetlands. 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

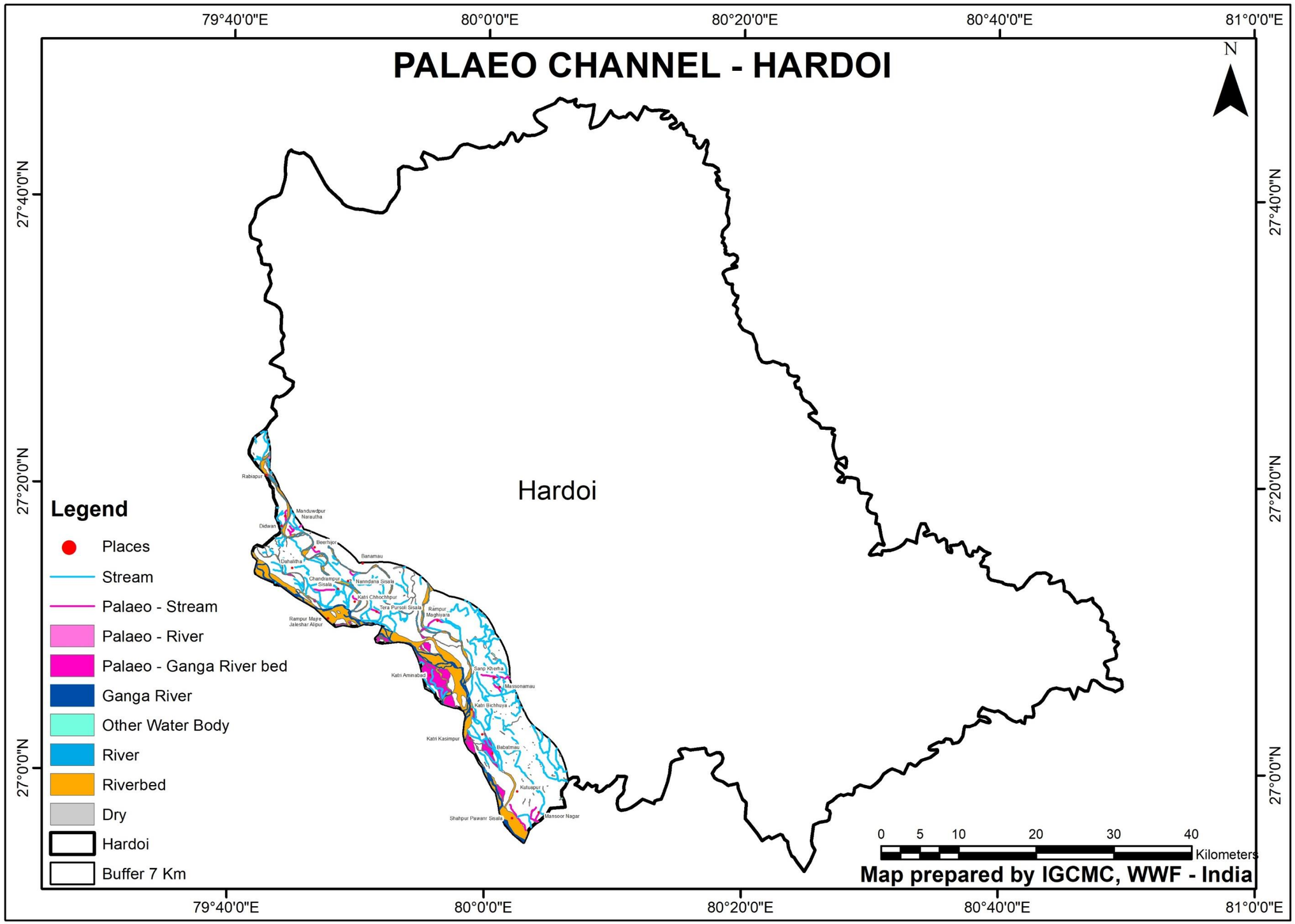
Hardoi Distt.		
Class Name	**Area (Ha)**	**Area (%)**
Crop land	15117.500	30.479
Fallow land	24263.000	48.917
Plantation	56.610	0.114
Water body	1937.070	3.905
Settlement	856.890	1.728
Grass/Grazing	273.600	0.552
Scrub/Barren land	1476.540	2.977
Open land	5618.880	11.328
Total	**49600.090**	**100**



Map 5 : Land Use/Land Cover Map Of Hardoi Distt.

6.0 Palaeochannels Of Ganga River

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



Map 6 : Paleochannels In Hardoi Distt.

7.0 Floodplain Of River Ganga In Hardoi

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 Hardoi Distt. falls in the Central Plain Zone of the Upper Gangetic Plain Region with the major soils being deep loamy sodic soil, silty sodic soil, deep silty soil and deep loamy waterlogging (NICRA-ICAR, 2014). Agriculture the chief source of income for majority of the residents of this Distt. and it is benefitted by the fertile alluvium brought by Ganga River and its tributaries. The floodplains in study region of Hardoi Distt. are under extensive agricultural practices as observed during the field survey. While wheat is the main Rabi crop, rice is the main Kharif crop grown in some parts of the Distt. Other major crops in the floodplain region are maize, sugarcane, bajra, arhar, mustard and chana. Along with this, the fertile floodplains were also utilized for cultivation of vegetables such as potato, raddish, cabbage, chillies and parwal. The extent of agriculture in the study region could be attributed to the fact that many agricultural fields were present up to the active river flow channel thereby impacting the native riparian vegetation. Table 2 provides details about floodplain outcrops as recorded in different villages of study region while Images 7-9 depict some floodplain agricultural plantations.

7.3 Most of the interlocutors during the survey reiterated heavy losses from agriculture due to crop destruction by stray cattle. According to them, herds containing hundreds of stray cows and buffaloes were present throughout the study region which foraged on the crops [Image 10] and destroyed young plants due to trampling. These animals found shelter in riparian vegetation along Ganga River bank and on the riverine islands. Despite using various fencing techniques and keeping vigil in the fields, the local residents could not prevent crop damage due to which the agricultural produce and overall economic conditions suffered greatly.

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

Sr. No.	Village Name	Agricultural Produce
1.	Arwal Paschim	Wheat, Bajra, Arhar, Chana, Mustard
2.	Sarhiyapur Pansala	Wheat, Potato, Mustard, Sesame, Parwal
3.	Katri Karehka	Wheat, Sugarcane, Mustard, Bajra, Arhar
4.	Katri Kar Talab Khanpur	Wheat, Potato, Arhar, Chillies, Sesame
5.	Murwa Shaha Buddinpur	Wheat, Chana, Potato, Bajra, Chillies
6.	Jasmai, Jigni	Wheat, Sugarcane, Sesame, Bajra, Bitter Gourd
7.	Kutuapur Pansala	Wheat, Mustard, Bitter Gourd, Potato

Image 7 : Bitter Gourd Plantation In Floodplain Agriculture Field Near Kutuapur Pansala

Image 8 : Sugarcane Plantation In Floodplain Agriculture Field Near Jasmai Village

Image 9 : Sesame Plantation In Floodplain Agriculture Field Near Sarhiyapur Pansala

Image 10 : Stray Cattle In Floodplain Agriculture Fields As Observed Near Arwal Paschim

7.4 **Floodplain Grasses:** The floodplain of Ganga River and its tributaries in the study region was dominated by different species of grasses. Among them, two species of Saccharum – *S. spontaneum* (commonly known as *Kans*) and *S. bengalense* (commonly known as *Munj/ Sarkanda*) were the most luxuriant [Images 11-12]. Both these species are tall and perennial grasses growing naturally in the alluvial plains, swamps and riparian areas of north India. Owing to the deep roots and rhizomes, these grasses successfully colonize the floodplains and grow rapidly spreading in huge areas with their height reaching 3-4 m in some places. The biomass of these grasses in dried form was an important natural resource in the study region which was used chiefly for thatching roofs of huts and old mud houses [Image 13]. Apart from this, the dried *Saccharum* grasses were also used for making brooms and in cots. Other floodplain grasses in the study region included – *Cynodon dactylon* (commonly known as *Doob* or *Durva* grass), *Dactyloctenium aegyptium* (Crawfoot grass) and *Bambusa bambos* (Indian thorny bamboo).

Image 11 : Luxuriant Growth Of *Saccharum spontaneum* (Kans) As Observed Near Arwal Paschim

Image 12 : Luxuriant Growth Of *Saccharum bengalense* (Munj) As Observed Near Kutuapur Pansala

Image 13 : Dried Saccharum Grass Used For Thatching Roof On A Mud House As Observed In Murwa Shaha Buddinpur Village

8.0 Wetlands In Hardoi Distt.

8.1 Wetlands are one of the most productive and unique ecosystems. They help in maintaining the food web and provide habitat for the aquatic biodiversity. They also help in controlling floods, recharging groundwater, nutrient recycling, climate stabilization and carbon sequestration. The list of wetlands present in the study region is provided in Table 3 while the spatial distribution of wetlands is depicted in Map 7. Some important wetlands as observed during the field survey are discussed in this section.

Table 3 : List Of Wetlands In The Study Region

Sr. No.	Wetland	Coordinates		Area [Hectares]
		Latitude	Longitude	
01	01	26°58'8.36"N	80° 4'19.97"E	0.64
02	02	27° 1'18.23"N	80° 5'38.69"E	3.64
03	03	27° 0'34.42"N	80° 4'21.31"E	1.23
04	04	26°59'56.76"N	80° 4'20.01"E	0.30
05	05	27° 1'10.53"N	80° 4'37.11"E	1.49
06	06	27° 1'46.97"N	27° 1'46.97"N	0.62
07	07	27° 1'42.89"N	80° 3'8.51"E	0.42
08	08	27° 1'35.38"N	80° 3'16.19"E	0.27
09	09	27° 1'54.84"N	80° 2'50.09"E	1.10
10	10	27° 1'55.89"N	80° 2'54.71"E	0.20
11	11	27° 1'53.74"N	80° 2'59.77"E	0.32
12	12	27° 0'54.34"N	80° 0'27.11"E	6.38
13	13	27° 1'0.58"N	80° 0'25.11"E	2.94
14	14	27° 0'48.70"N	80° 2'16.15"E	1.30
15	15	27° 2'46.28"N	80° 3'59.63"E	7.43

16	16	27° 2'42.05"N	80° 1'29.51"E	1.92
17	17	27° 3'44.59"N	80° 2'7.88"E	0.66
18	18	27° 4'41.10"N	80° 2'34.20"E	0.21
19	19	27° 5'37.07"N	79°59'27.04"E	1.58
20	20	27° 6'6.54"N	79°59'24.60"E	0.21
21	21	27° 7'57.22"N	80° 0'46.64"E	2.10
22	22	27° 7'58.76"N	80° 0'29.96"E	0.49
23	23	27° 8'14.54"N	80° 0'37.45"E	0.99
24	24	27° 8'33.86"N	80° 1'3.92"E	0.46
25	25	27° 7'36.99"N	79°58'56.39"E	1.95
26	26	27° 7'38.73"N	79°58'26.87"E	1.82
27	27	26°59'28.78"N	80° 5'16.51"E	0.16
28	28	27° 7'19.94"N	80° 1'27.51"E	0.71
29	29	27° 7'9.01"N	80° 1'22.93"E	2.87
30	30	27° 8'40.97"N	79°58'14.22"E	1.10
31	31	27° 9'7.92"N	79°58'10.88"E	2.96
32	32	27° 9'28.11"N	79°59'8.34"E	2.64
33	33	27° 9'32.15"N	79°58'58.53"E	0.43
34	34	27° 9'27.90"N	79°58'59.96"E	0.41
35	35	27°10'12.53"N	80° 0'10.91"E	1.28
36	36	27°10'7.54"N	79°58'36.21"E	1.23
37	37	27°12'46.81"N	79°53'57.18"E	0.53
38	38	27°12'17.90"N	79°53'36.54"E	0.85
39	39	27°14'13.36"N	79°53'34.69"E	4.26
40	40	27°13'7.57"N	79°51'37.89"E	3.26

41	41	27°12'58.12"N	79°51'28.27"E	0.55
42	42	27°13'2.33"N	79°51'33.83"E	0.15
43	43	27°12'56.61"N	79°51'38.34"E	0.84
44	44	27°12'49.00"N	79°47'13.62"E	19.0
45	45	27°14'0.47"N	79°47'15.85"E	1.32
46	46	27°14'8.37"N	79°47'5.49"E	0.32
47	47	27°14'22.90"N	79°47'7.61"E	2.49
48	48	27°14'51.83"N	79°46'53.05"E	3.67
49	49	27°11'33.99"N	79°55'55.17"E	1.98
50	50	27°11'49.37"N	79°54'31.23"E	1.29
51	51	27°13'13.35"N	79°53'12.60"E	0.24
52	52	27°13'14.96"N	79°53'7.64"E	0.24
53	53	27°14'6.93"N	79°52'17.77"E	0.22
54	54	27°09'52.78"N	79°54'29.52"E	1.00
55	55	27°14'43.67"N	79°45'45.28"E	17.0
56	56	27°16'37.79"N	79°46'16.79"E	0.60
57	57	27°16'6.30"N	79°45'29.77"E	0.94
58	58	27°15'47.77"N	79°45'51.08"E	4.45
59	59	27°21'23.37"N	79°42'8.74"E	19.9
60	60	27°22'31.87"N	79°42'28.70"E	0.14
61	61	27°22'32.85"N	79°42'35.44"E	0.10
62	62	26°56'22.57"N	80°02'50.02"E	5.10
Area [Hectares]				**144.90**

8.2 **Kacchua Talab:** Based on information from the interlocutors in study region, a freshwater pond was located in Kakrakheda village of Bilgram taluka in Hardoi Distt. having an area of about 1.2 ha [Image 14]. This pond is popularly known as 'Turtle Pond' or 'Kacchua Talab' [Image 15] owing to the large number of turtle population residing here. Upon further interactions and based on information available, this pond was found to be a conservation site for **Indian Softshell Turtle (*Nilssonia gangetica*)** [Image 16]. This turtle species is categorized as **'Endangered'** according to IUCN Red List. The interlocutors from this village reiterated the presence of these turtles since last 4-5 decades in this pond. According to their claims, hundreds of turtles inhabit this water body and are protected collectively by the villagers who also sometimes feed them with biscuits or various kinds of breads. It was also noted that numerous fish species used to inhabit this pond until three decades ago which were killed and collected by some miscreants and now only few small fish are present which are a food source for these turtles. The interlocutors also claimed that funds from government authorities were provided for maintenance of this important water body but were not used properly thereby leaving this pond vulnerable to deterioration. Urgent attention needs to be paid towards sustaining this important turtle habitat in the region.

Image 14 : Location Of Kacchua Talab [27° 09' 14.9" N 80° 01' 25.2" E]

Image 15 : Kacchua Talab As Seen On 17th September, 2021


Image 16 : An Indian Softshell Turtle Spotted Near Kacchua Talab

8.3 **Oxbow Lakes:** Due to the shift in course of Ramganga river, two oxbow lakes have been formed which were observed during the field survey. Locally known as 'Jheel' these oxbow lakes are present each near Murwa Shaha Buddinpur (17 ha) and Arwal Paschim (19 ha) villages of Hardoi Distt. [Refer Map 7; Images 17-20]. The interlocutors reiterated that both these oxbow lakes receive flood waters from Ramganga river during monsoon season and remain filled even during remaining part of the year. The water from these lakes is principally used for irrigating agricultural fields in the surroundings along with other purposes such as bathing cattle, washing clothes and performing religious activities. Fishing from these lakes was found to be an important activity as the fish resources formed a major diet for the local residents. Major fish caught from these lakes include – Padin (*Wallago attu*), Rohu (*Labeo rohita*), Degara/Degar (*Sperata* sp.), Baam (*Anguilla bengalensis*), China (*Cyprinus carpio*) and Sidhari. Fishing activity is prevalent throughout the year even during monsoons and involves the use of fine meshed fishing nets with or without boats.

Image 17 : Location Of Oxbow Lake Near Murwa Shaha Buddinpur Village [27°14' 43.67" N 79° 45' 45.28" E]

Image 18 : Oxbow Lake Near Murwa Shaha Buddinpur Village As Seen On 15th September, 2021

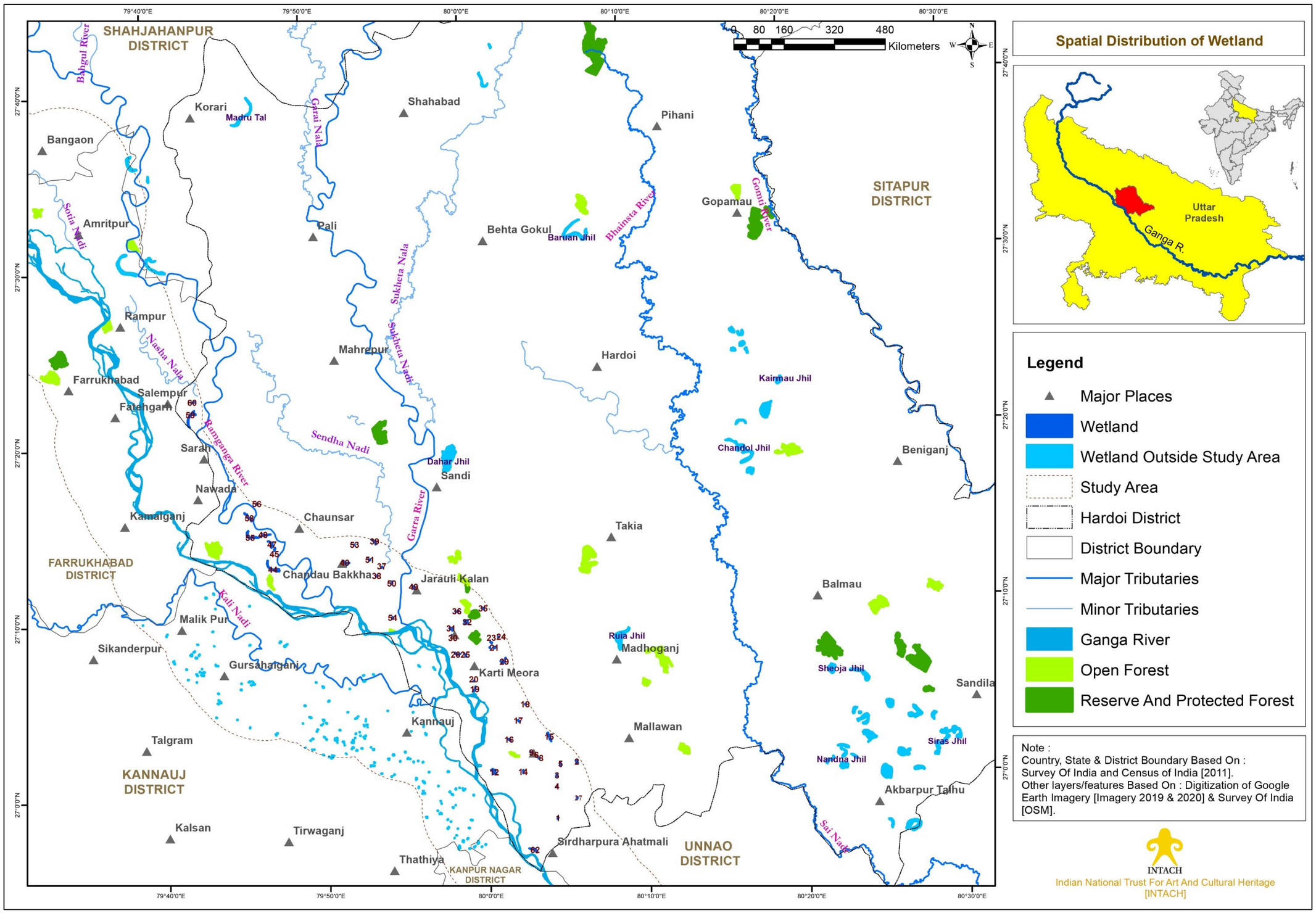
Image 19 : Location Of Oxbow Lake Near Arwal Paschim Village [27°12' 49.00" N 79° 47' 13.62" E]

Image 20 : Oxbow Lake Near Arwal Paschim Village As Seen On 16th September, 2021

8.4 Another oxbow lake (1.95 ha) was observed near Katri Karehka village [Refer Map 7; Image 21] in Hardoi Distt. during the field survey. The interlocutors in this region claimed this to be a channel of Ganga River which got cut off due to shifting of its main channel. Now this oxbow lake is locally known as *Jheel* and receives water during monsoon from Ganga [Image 22]. The residents in this region chiefly use water from this *jheel* for irrigating their agricultural fields where crops such as wheat, rice, chana and arhar are grown. Apart from this, some residents were also involved in fishing from the lake using dragnet. The common fish caught from this lake include – padhin (*Wallago attu*), rohu, sidhari and degara. These fish are caught for local consumption by the residents throughout the year.

Image 21 : Location Of Oxbow Lake Near Katri Karehka Village
[27° 07' 36.99"N 79° 58' 56.39"E]


Image 22 : Oxbow Lake As Seen On 16th September, 2021



Map 7 : Spatial Distribution Of Water Bodies Within Study Area

9.0 Riparian Flora Along Ganga River In Hardoi Distt.

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. Siddiqui (1991) gave an account of 40 riparian macrophytes from Narora-Kannauj region of which species of *Ammania*, *Eclipta*, *Polygonum*, *Ipomoea*, *Rumex*, *Saccharum*, *Scirpus* and *Tamarix* are amphibious in nature.

9.3 The riparian vegetation in the study region had patchy distribution and was mainly dominated by grasses – *Saccharum* sps. & *Cynodon dactylon* [Image 23]. Extensive agriculture in the floodplain of Ganga, Ramganga and Garra rivers was a major reason for decrease in native riparian vegetation as in some places the agriculture was being practiced right up to the active river flow. A total of 26 different plant species were recorded along Ganga River which included some commonly occurring trees such as *Ficus* sps., *Acacia nilotica* and ground vegetation such as *Lantana camara*, *Croton bonplandianus* and *Zizyphus* sp. The details of these plants are presented in Table 3 while Images 24-26 depict some major riparian plant species as recorded during the field survey.

Table 4 : Riparian Flora In The Study Region

Sr. No.	Botanical Name	Common Name	Family	Habit
1.	*Acacia nilotic*a (L.) Delile	Babool	Fabaceae	Tree
2.	*Azadirachta indica* A. Juss.	Neem	Meliaceae	Tree
3.	*Bombax ceiba* L.	Semal	Bombacaceae	Tree
4.	*Borassus flabellifer* L.	Taad	Arecaceae	Tree
5.	*Eucalyptus* sp.	Nilgiri		Tree
6.	*Ficus benghalensis* L.	Banyan tree	Moraceae	Tree
7.	*Ficus religiosa* L.	Peepal	Moraceae	Tree
8.	*Mangifera indica* L.	Aam	Anacardiaceae	Tree
9.	*Phoenix dactylifera* L.	Khajur	Arecaceae	Tree
10.	*Tectona grandis* L.f.	Teak/Saagwan	Lamiaceae	Tree
11.	*Calotropis procera* (L.) Dryand.	Aak	Apocynaceae	Shrub
12.	*Ipomoea aquatica* Forsk.	Water morning glory	Convolvulaceae	Shrub
13.	*Lantana camara* L.	Lantana	Verbenaceae	Shrub
14.	*Polygonum glabrum* Willd.		Polygonaceae	Shrub
15.	*Zizyphus* sp.	Wild ber	Rhamnaceae	Shrub
16.	*Cannabis sativa* L.	Bhaang/Ganja	Cannabaceae	Herb
17.	*Croton bonplandianus* Baill.	Ban Tulsi	Euphoriaceae	Herb
18.	*Euphorbia hirta* L.	Asthma weed	Euphorbiaceae	Herb
19.	*Parthenium hysterophorus* L.	Congress grass	Asteraceae	Herb
20.	*Persicaria* sp.	Smartweed	Polygonaceae	Herb
21.	*Xanthium strumarium* L.		Asteraceae	Herb
22.	*Cynodon dactylon* (L.) Pers.	Dhoob/Durva grass	Poaceae	Grass
23.	*Dactyloctenium aegyptium* (L.) Willd.	Crowfoot grass	Poaceae	Grass
24.	*Saccharum spontaneum* L.	Kans/Katha	Poaceae	Grass
25.	*Saccharum bengalense* Retz.	Munj	Poaceae	Grass
26.	*Bambusa bambos* (L.) Voss	Indian thorny bamboo	Poaceae	Bamboo Grass

Image 23 : Riparian Vegetation Along Ganga River In Hardoi Distt. As Seen From Kusumkhor Bridge

Image 24 : *Acacia nilotica* (Babool Tree)

Image 25 : *Zizyphus* sp. (Wild Ber)

Image 26 : *Dactyloctenium aegyptium* (Crowfoot Grass)

10.0 Faunal Diversity In Hardoi Distt.

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. During the field survey no direct sightings of dolphin could be recorded from the study region. However, the interlocutors reiterated its presence in the study region especially during non-monsoon months. They also emphasized on the decreasing number of dolphin sightings as compared to 2-3 decades ago.

10.2 **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. Very few sightings of nilgai could be recorded from some villages along Ganga in the study region. In most places, its population and threat to the agriculture was found be low as compared to that of wild boars.

10.3 **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). Throughout the study region farmers, especially from the floodplain agricultural fields, reiterated about the large-scale damages caused by wild boars. According to them, the wild boars inhabit the riparian forest patches on the riverine islands and among thick grassy vegetation along Ganga River in different areas. Throughout the night, these boars create menace in the fields especially to potato and other vegetable plantations thereby causing extensive crop damage. Though the native residents try to keep them away by using sharp barbed wires or electric fencing, the losses cannot be prevented. Some interlocutors also highlighted boar attacks on human beings trying to protect their farms in the study region.

10.4 **Turtles:** Freshwater turtles are distinctive animals of riverine and wetland ecosystems that require specific habitats for their life history strategies and propagation. India has one of the most diverse turtle fauna, with 24 species of freshwater turtle and four species of tortoise, and ranks among the top five countries in terms of importance for turtle conservation in Asia (Stuart & Thorbiarnarson, 2003) and the world (Rhodin, 2006). The Ganga River provides habitats for 14 testudines (13 turtle and 1 tortoise species) in the middle and lower stretches up to the deltaic region (ZSI, 1991). Turtles play a critical ecological role by controlling aquatic vegetation, serve as scavengers and help maintain rivers and lakes in a healthy condition (WII-GACMC, 2017). During the field survey two important turtle species were found to be present in the study region based on visual records and the information provided by interlocutors. They have been identified as – Indian Roofed Turtle (*Pangshura tecta*) [Image 27] and Indian Softshell Turtle (*Nilssonia gangetica*). While the former is categorized as 'Vulnerable' the latter is categorized as 'Endangered' according to IUCN Red List. Both the fishermen as well as other residents along Ganga claimed to not harm these turtles although they did emphasize on frequent turtle sightings on the Ganga River bank.

Image 27 : Indian Roofed Turtle (*Pangshura tecta*)

10.5 **Other fauna:** Based on visual observations during field survey and interactions with the interlocutors some major fauna species recorded from study region in Hardoi Distt. is presented in Table 5.

Table 5 : Other Important Fauna Recorded In Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	**Red Sand Boa**	***Eryx johnii***	**Near Threatened**
2.	Golden Jackal	*Canis aureus*	Least Concern
3.	Rhesus Monkey	*Macaca mulatta*	Least Concern
4.	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern
5.	Danaid Eggfly (Butterfly)	*Hypolimnas misippus*	Least Concern
6.	Grey Pansy (Butterfly)	*Junonia atlites*	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:** Ganga River, with its mosaic of habitats, supports a rich diversity of avifauna which include both resident and migratory species. some iconic and globally threatened birds such as the black-bellied tern (*Sterna acuticauda*), Indian skimmer (*Rynchops albicollis*), sarus crane (*Antigone antigone*) and river lapwing (*Vanellus duvaucelii*) also breed on the islands, sandbars and banks of the Ganga River. The literature suggests that the greatest species richness of the Ganga River is in Uttar Pradesh which has 135 bird species (WII-GACMC, 2017). During the field survey in study region of Hardoi Distt., a total of 63 different bird species have been recorded which include 23 wetland birds and 40 forest and grassland birds. Among these, 4 birds feature in the IUCN Red List – Eurasian Curlew & River Lapwing (Near Threatened), River Tern (Vulnerable) and Pallas's Fish Eagle (Endangered). The details of these bird species are presented in Table 6 while some important birds as seen during the survey are depicted in Images 28-31.

Table 6 : Avifauna Diversity In The Study Region

Sr. No	Common Name	Scientific Name	Conservation Status
1.	White throated Kingfisher	*Halcyon smyrnensis*	Least Concern
2.	Pied Kingfisher	*Ceryle rudis*	Least Concern
3.	Cattle Egret	*Bubulcus ibis*	Least Concern
4.	Little Egret	*Egretta garzetta*	Least Concern
5.	Intermediate Egret	*Ardea intermedia*	Least Concern
6.	Great Egret	*Ardea alba*	Least Concern
7.	Indian Pond Heron	*Ardeola grayii*	Least Concern
8.	Grey Heron	*Ardea cinerea*	Least Concern
9.	Black-crowned Night Heron	*Nycticorax nycticorax*	Least Concern
10.	**Eurasian Curlew**	***Numenius arquata***	**Near Threatened**
11.	Common Greenshank	*Tringa nebularia*	Least Concern
12.	Common Sandpiper	*Actitishypoleucos*	Least Concern
13.	Asian Openbill	*Anastomus oscitans*	Least Concern
14.	Little Cormorant	*Microcarbo niger*	Least Concern
15.	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
16.	Little Ringed Plover	*Charadrius dubius*	Least Concern
17.	White breasted - Waterhen	*Amaurornis phoenicurus*	Least Concern
18.	Common Moorhen	*Gallinula chloropus*	Least Concern
19.	Bronze Winged Jacana	*Metopidius indicus*	Least Concern
20.	**River Tern**	***Sterna aurantia***	**Vulnerable**
21.	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
22.	Black-winged Stilt	*Himantopus himantopus*	Least Concern

23.	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
24.	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
25.	Black Drongo	*Dicrurus macrocercus*	Least Concern
26.	Ashy Drongo	*Dicrurus leucophaeus*	Least Concern
27.	Common Myna	*Acridotheres tristis*	Least Concern
28.	Bank Myna	*Acridotheres ginginianus*	Least Concern
29.	Common Stonechat	*Saxicola torquatus*	Least Concern
30.	Jungle Babbler	*Turdoides striata*	Least Concern
31.	Common Babbler	*Argya caudata*	Least Concern
32.	White Wagtail	*Motacilla alba*	Least Concern
33.	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
34.	Asian Plain Martin	*Riparia chinensis*	Least Concern
35.	Streak-throated Swallow	*Petrochelidon fluvicola*	Least Concern
36.	Barn Swallow	*Hirundo rustica*	Least Concern
37.	Common Tailorbird	*Orthotomus sutorius*	Least Concern
38.	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
39.	House Sparrow	*Passer domesticus*	Least Concern
40.	Indian Jungle Crow	*Corvus culminatus*	Least Concern
41.	House Crow	*Corvus splendens*	Least Concern
42.	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
43.	Common Pigeon	*Columba livia*	Least Concern
44.	Ashy Prinia	*Prinia socialis*	Least Concern
45.	Asian Koel	*Eudynamys scolopaceus*	Least Concern
46.	Greater Coucal	*Centropus sinensis*	Least Concern
47.	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
48.	Red-vented Bulbul	*Pycnonotus cafer*	Least Concern
49.	Common Kaestral	*Falco tinnunculus*	Least Concern
50.	Black-winged kite	*Elanus caeruleus*	Least Concern
51.	Black Kite	*Milvus migrans*	Least Concern
52.	**Pallas's Fish Eagle**	***Haliaeetus leucoryphus***	**Endangered**
53.	Spotted Dove	*Spilopelia* chinesis	Least Concern
54.	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern
55.	Laughing Dove	*Spilopelia senegalensis*	Least concern
56.	Red Turtle Dove	*Streptopelia tranquebarica*	Least concern
57.	Baya Weaver	*Ploceus philippinus*	Least Concern
58.	Purple Sunbird	*Cinnyris asiaticus*	Least Concern
59.	Common Hoopoe	*Upupa epops*	Least Concern
60.	Black Redstart	*Phoenicurus ochruros*	Least Concern
61.	Eurasian Thick-knee	*Burhinus oedicnemus*	Least Concern
62.	Indian Peafowl	*Pavo cristatus*	Least Concern
63.	Indian Roller	*Coracias benghalensis*	Least Concern

Image 28 : Eurasian Curlew

Image 29 : Red-Wattled Lapwing

Image 30 : Red-Naped Ibis

Image 31 : Grey Heron

11.0 Ganga Riverine Islands In Hardoi 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 riverine islands in the Ganga River stretch of UP and Bihar which are locally referred to as 'Diara' or 'Taapu'. Numerous irregularly shaped riverine islands and sand bars are present in the Ganga River stretch between Hardoi and Kannauj due to which the main channel of the river is braided into different channels at various sites. Some of the important riverine islands surveyed in the study region are discussed in this section.

11.2 The biggest riverine island in the study region is roughly spear head shaped measuring about 12 kms long and 1-3.5 km wide [Refer Map 2; Image 32]. Parts of this island were observed during the survey from Rajghat in Hardoi Distt. and Mehendipur Ghat bridge [Images 33-34]. Some fringe parts of this island were covered with rich riparian vegetation dominated by *Saccharum* grasses, *Zizyphus* sp. and *Acacia nilotica*. Upon interactions, the interlocutors revealed that this riparian vegetation harbored animals such as wild boar, stray cattle and some deer species. The island was also used extensively for agriculture especially during non-monsoon part of the year with the main cultivation that being of watermelon (tarbuj) along with parwal and some other seasonal vegetables. The interlocutors highlighted that rich alluvial soil deposited by Ganga and its tributaries in this region made such islands extremely fertile and that the crops could be grown without any external input of nutrients. Cattle reared by residents along Ganga bank in this region were also taken to this island for grazing owing to the rich fodder resources available there.

Image 32 : Location Of The Biggest Riverine Island In Study Region

Image 33 : Riverine Island As Observed From Mehendipur Ghat Bridge On 17th September 2021

Image 34 : Riverine Island With *Saccharum* Grasses As Observed From Rajghat On 17th September 2021

11.3 Another irregularly shaped island was observed in the southern part of Hardoi Distt. which measured about 6 kms long and 0.5-2 kms wide [Refer Map 2; Image 35]. It was observed near Kutuapur Pansala village during the survey [Image 36]. The island was mainly covered with vegetation dominated by Saccharum grasses followed by *Acacia nilotica* and *Zizyphus* sp. The rich vegetation supported fauna such as deer species, wild boars and jackals as claimed by the interlocutors in the region. Scattered agricultural fields were also present which were mainly for growing watermelon here.

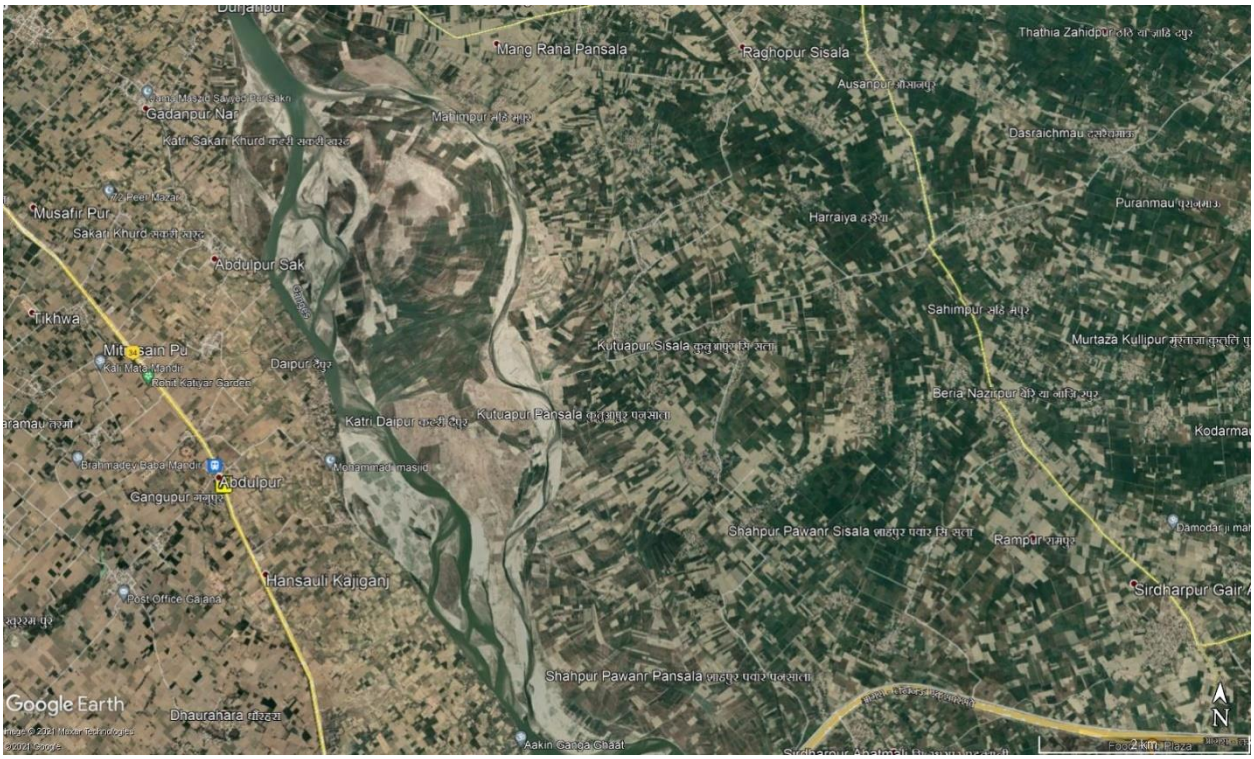


Image 35 : Location Of An Irregularly Shaped Riverine Island In The Study Region

Image 36 : Riverine Island As Observed Near Kutuapur Pansala On 17th September, 2021

11.4 A group of irregularly shaped riverine islands is present in the northern part of this Distt. [Refer Map 2; Image 37] which were observed near Arwal Paschim village. These islands are mainly covered with dense riparian vegetation [Image 38] dominated by *Saccharum* grasses and other plants such as *Acacia nilotica* (Babool tree), *Azadirachta indica* (Neem tree), *Ficus religiosa* (Peepal), *Zizyphus* sp. (Wild Ber) and *Borassus flabellifer* (Taad). This vegetation supports wild boars and stray cattle [Image 39] which roam around in the floodplain areas and river banks during night time causing extensive damage to agricultural plantations as reiterated by all the interlocutors. Agriculture on these islands was patchy with watermelon being the major produce during non-monsoon season.

Image 37 : Location Of A Group Of Irregular Riverine Islands In The Study Region

Image 38 : Riverine Island With Agriculture And Riparian Vegetation As Observed Near Arwal Paschim On 16th September, 2021

Image 39 : Stray Cattle As Observed On The Riverine Island Near Arwal Paschim Village

12.0 Fishing In Hardoi Distt.

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

12.2 Fishing from Ganga River and its tributaries (mainly Ramganga and Garra in this region) is an important source of livelihood and food for local residents. The chief fishing gears employed here include – fine meshed gill nets, drag nets and locally made fishing rods [Image 40]. Most of the nets employed in fishing were bought from the markets at rates varying from Rs. 500-1000. Use of small boats for fishing is generally observed in the Ganga River stretch and to some extent in Ramganga River. According to the claims of fisherfolk, **fishing contracts are given for specific stretches of Ganga River in the study region by the state government** which restricts the fishing activities as they are controlled by the contractor. If other residents wish to catch fish from this region, they either have to take permit from the contractor or carry out fishing activities during night time to avoid getting into trouble.

12.3 Most of the interlocutors reiterated a sharp decline in the fish catch and yield especially during the last couple of years. According to them, **Patar fish (*Setipinna phasa*) was earlier caught in good amount from Ganga River but has declined sharply to the extent that now it is almost negligible in the study region**. Some of the other major fish caught from Ganga River here included – Rohu, Padhin, China and Degara. The list of fish species recorded from Ganga River stretch in the study region is presented in Table 7. Majority of the fish was caught by the contractors who sold them in the town markets and to buyers from nearby cities. The fish caught by other local residents was mainly for their own consumption and did not form a major source of their income. Hence, many fisherfolk claimed to have shifted to other occupations in order to sustain their livelihoods. Image 41 depicts some fish caught by a fisherman using dragnet as observed during the field survey.

Image 40 : Dragnet Based Fishing In The Study Region

Image 41 : A Fisherman Displaying Fish Caught From Ganga River Using Dragnet

Table 7 : Riverine Fish Recorded In Study Region

Sr. No.	Scientific Name	Common Name
1.	*Labeo rohita*	Rohu
2.	*Labeo catla*	Katla
3.	*Wallago attu*	Padin
4.	*Cyprinus carpio*	China
5.	*Eutropiichthys vacha*	Bachwa
6.	*Sperata* sp.	Degara
7.	*Anguilla bengalensis*	Baam
8.	*Rita rita*	Kunkuna
9.	*Clupisoma garua*	Garrua
10.	*Setipinna phasa*	Patar
11.	*Mystus tengara*	Tengara/Tengar

13.0 Groundwater In Hardoi Distt.

13.1 The groundwater level in different villages along Ganga River varied from 20-40 ft and it kept increasing as the distance from river increased. The use of wells in the study region has declined as observed during the survey and the use of handpump is fairly common nowadays. The details of groundwater levels as recorded during the survey are presented in Table 8.

Table 8 : Goundwater Levels In Different Villages As Recorded During The Survey

Place	Coordinates		Ground Water Table in Feet
	Lat.	Long.	
Bar Karaka			40 ft.
Tikar	27°16'36.43"N	79°46'39.60"E	35 ft.
Parsola	27° 4'27.17"N	80° 1'32.42"E	40 ft.
Sandi	27°17'23.22"N	79°56'28.41"E	45 ft.
Pachrauli	27°17'20.21"N	79°44'51.59"E	25 ft.
Ganga Mandir	27° 4'56.97"N	79°59'58.37"E	40 ft.
Bilgram	27°10'17.80"N	80° 1'48.15"E	45 ft.
Terwa Kulli	27° 2'50.65"N	80° 0'36.63"E	30 ft.

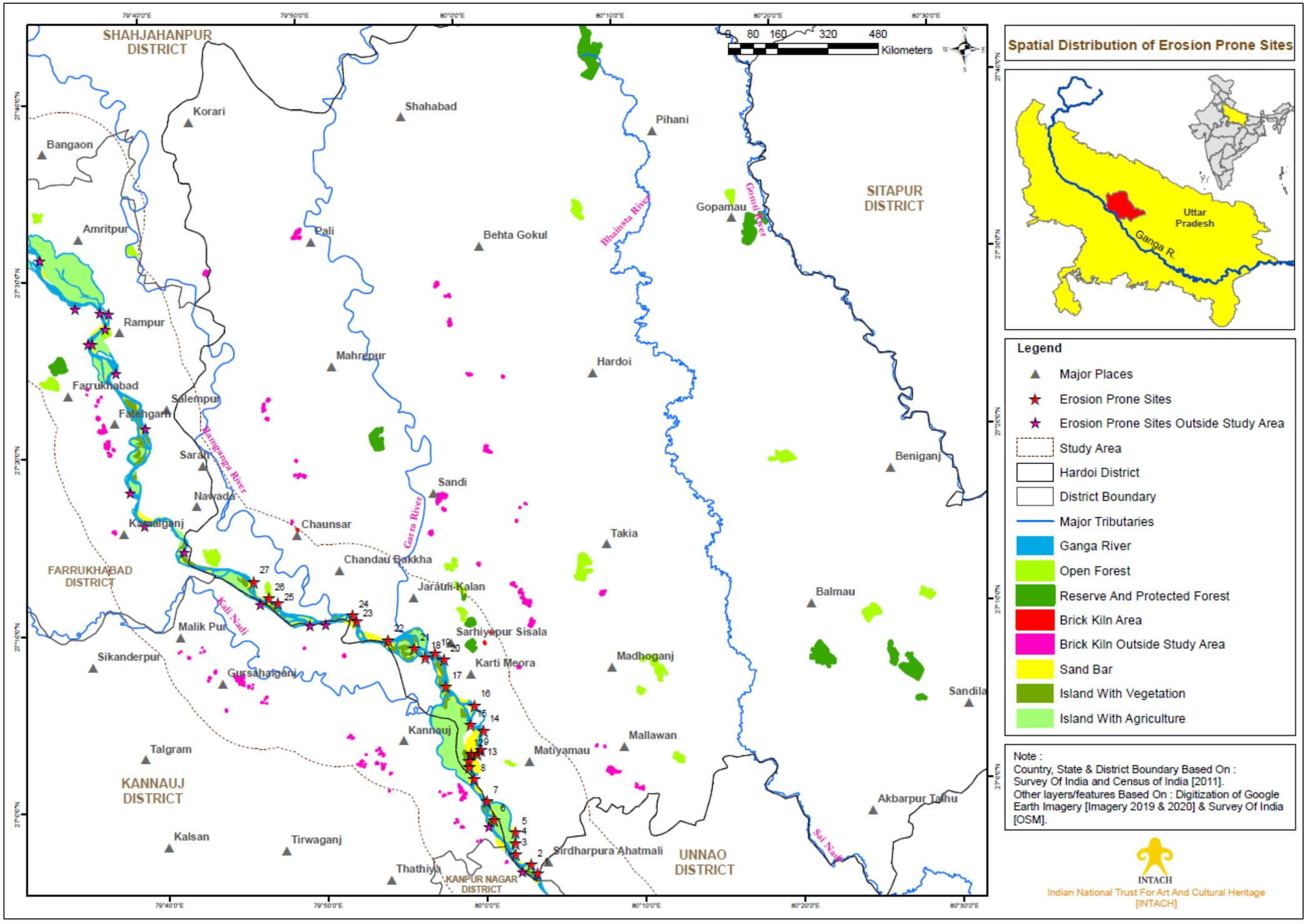
14.0 Ganga River Bank Erosion In Hardoi Distt.

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

14.2 The Ganga River bank in study region was found to be erosion prone in most of the sites surveyed. Map 8 depicts erosion prone sites recorded along Ganga River in Hardoi Distt. The course of Ganga River frequently meanders and shifts between Hardoi and Kannauj which is a main reason for lateral bank erosion. The interlocutors reiterated losses of agricultural fields and village lands due to severe erosion for which they didn't receive any kind of assistance from concerned authorities. Some interlocutors also highlighted those **rich riparian forests especially in areas such as Jigni & Jasmai villages were lost due to erosion along with wildlife such as fox which used to once reside here**. It was also observed during the survey that barring few places such as near Rajghat in study region, negligible steps were taken to control erosion thereby exposing the river bank to future damage. Some erosion prone sites as observed during the survey are depicted in Images 42-43.

Image 42 : Erosion Prone Bank As Observed Below Mehendipur Ghat Bridge

Image 43 : Erosion Prone Bank As Observed Near Jigni Village

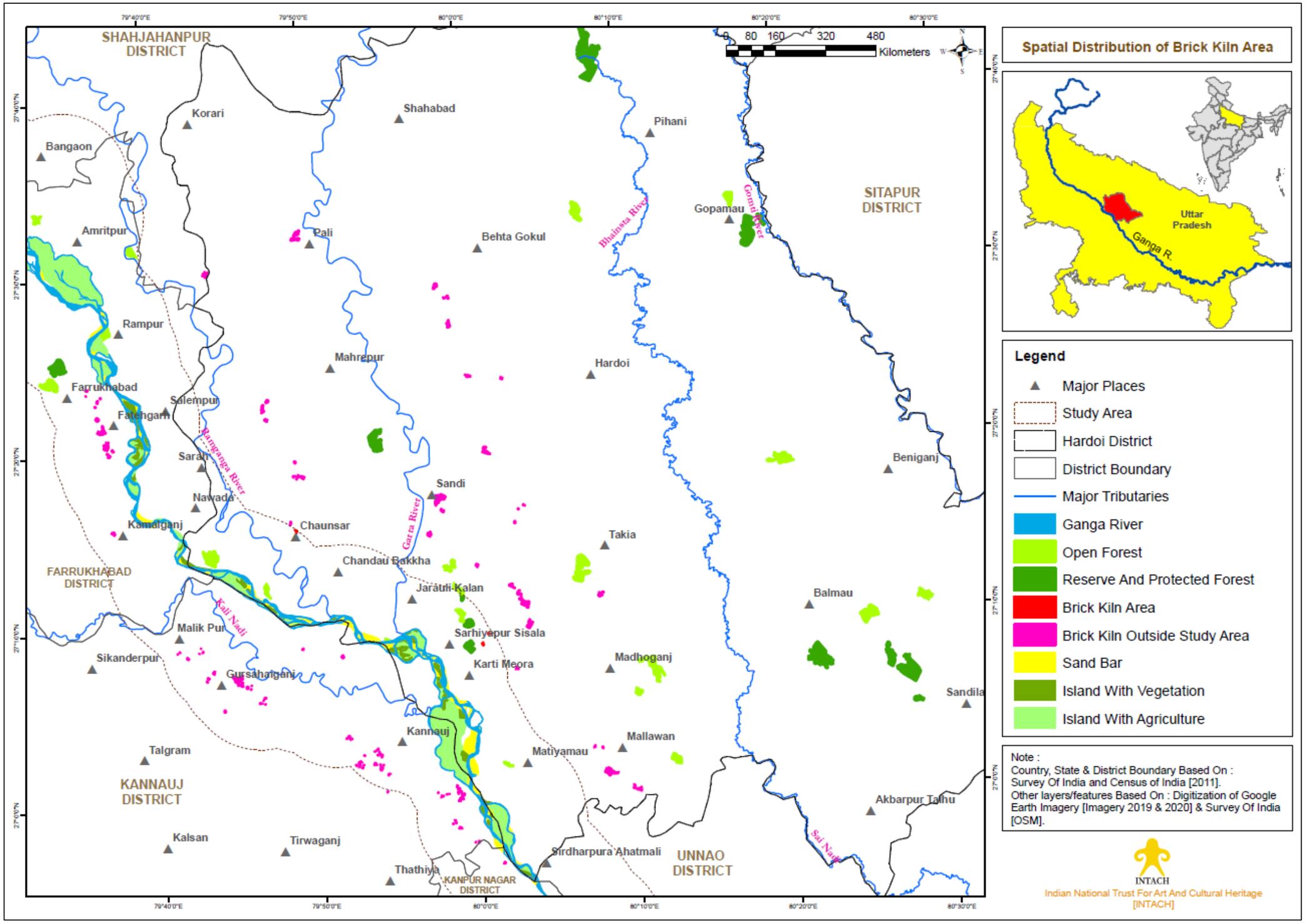


Map 8 : Spatial Distribution Of Erosion Prone Sites In Hardoi Distt.

15.0 Mining And Brick Kilns In Hardoi

15.1 Sand is the major mineral available in the Distt. which is mainly collected from Ganga & Gomti rivers for construction work (MSME-DI, 2012). However, due to the monsoon season sand mining activities couldn't be observed during the field survey from any part of study region.

15.2 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. Barring few brick kilns, most others were situated outside the study region selected for this survey. Map 9 presents the spatial distribution of brick kilns in the study region of Hardoi Distt.



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

16.0 Boatmaking and Inland Navigation in Hardoi

16.1 Most of the interlocutors during the survey highlighted that boatmaking by local residents was negligible in the study region. The small sized boats were mainly used for fishing while little bigger sized motorized boats [Image 44] were used by the residents for transporting people and other materials to the riverine islands and back as well as transportation to opposite banks in Kannauj Distt. Both these boats were made by specialized 'Mistry' (carpenters) in Kanpur and were brought here for use. The cost of constructing smaller boats ranged from Rs. 40000-80000 depending upon wood and other materials involved. While the cost of constructing bigger sized motorized boats went upto Rs. 1.5 lakhs. Sekhua/Shisham (*Dalbergia sisoo*) was generally the preferred wood in construction of boats but due to its cost and unavailability, other options such as Mango (*Mangifera indica*) and Babool (*Acacia nilotica*) which were readily available in the region had picked up. The use of motorized boats was generally for ferrying people from places such as Rajghat in Hardoi to Mehendipur Ghat in Kannauj as well as other river bank areas in these Distt.s. Rs.10-20 was charged per person for a short distance ferry while for larger distances the rates varied depending upon place to be traveled to, number of people and time taken.

Image 44 : Big Sized Motorized Boat For Transportation As Seen Near Rajghat

17.0 Sacred Trees In Hardoi Distt.

17.1 Various sacred trees were observed during the field survey. Among them, Peepal (*Ficus religiosa*) and Banyan (*Ficus benghalensis*) were the most common ones. They were generally associated with temples or ashrams in the study region and were protected owing to the sanctity associated with them. The sacred trees were generally worshipped by women residents by tying threads and offering water on auspicious occasions throughout the year. Some of the sacred trees as observed during the field survey are depicted in Images 45-47.

17.2 An old and sacred Peepal tree was found associated with Lord Hanuman Temple on the way to Rajghat in Katri Chhibramau village. Upon interaction, the Pandit of this temple highlighted that people visited here for seeking blessings and once their wishes fulfilled, they tied red colored *Langot* on this tree as offerings.

Image 45 : An Old And Sacred Tree Associated With A Hanuman Temple Near Rajghat

Image 46 : An Old And Sacred Peepal Tree Protected By The Residents Of Arwal Paschim Village

Image 47 : A Sacred Peepal Tree At Rajghat

When People Come To Take Bath In Ganga River During Auspicious Occasions, They Also Tie Threads, Offer Water And Worship This Sacred Tree

17.0 Key Issues And Recommendations

17.1 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 practice was also observed along Ganga River bank in the study region especially below Mehendipur Ghat bridge [Image 48]. Along with burning of bodies, Hindu burials were also observed alongside the same site [Image 49]. Upon interaction with some residents, they claimed that burning of bodies was for those who have married in their lifetime while burials were mainly for children and those adults who died without marrying. Hundreds of burials could be found in this area according to their claims. 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 48 : Burning Of Dead Bodies On Ganga River Bank Below Mehendipur Ghat Bridge In Hardoi Distt.

Image 49 : Hindu Burials On Ganga River Bank Below Mehendipur Ghat Bridge

17.2 The riparian ecosystems are of high conservation priority owing to the rich biodiversity they support and the large-scale ecosystem services they provide. However, the extensive agriculture in the floodplains of Ganga River in the study region [Image 50] has already impacted the riparian vegetation communities which is evident from low plant species diversity. 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 50 : Extensive Agriculture Along Ganga River In The Study Region

17.3 One of the most important issues reiterated by interlocutors throughout the survey was large scale crop destruction in the floodplain agricultural fields by wild boars and stray cattle. The wild boars even attacked small children and adults who tried to drive them away from their fields often resulting in man-animal conflicts in the region. Stray cattle too in hundreds of numbers trampled in the agriculture fields and foraged on crops grown by the farmers. They tried putting sharp barbed wires and electric fences but both didn't help to any good extent. The losses burdened residents in the study region who demanded some urgent solution to this matter. Hence, it is strongly recommended in this study to develop strategies for preventing man-animal conflicts in the study region, take up compensation related matters with the concerned authorities and create awareness among the people.

17.4 Another very important observation in the study region is severe bank erosion caused by the floods which lead to destruction of riparian settlements and even cause shifts in the villages from one side to the other. This issue has impacted floodplain farmers mainly as their agricultural fields are cut and washed away during floods. This has also led to shifting of agricultural pressure on riverine islands in the study region. The preventive measures for erosion have not been taken up in most part of the Distt.

Hence, it is recommended to identify erosion prone and impacted sites throughout the Distt. 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.

17.5 Many wetlands surveyed in the Distt. served as important sources for fish catch, irrigation of surrounding fields as well as excellent habitats for birds. Despite this, there is not much information or any efforts to know about these wetlands and maintain them. Hence, it is strongly recommended to take up initiatives for well-being of such water bodies in conjunction with various local stakeholders.

17.6 The fisherfolk dependent mainly on fish resources from Ganga River had raised their concerns about the sharp decline in fish catch and yield owing to various reasons such as changes in river flows, climatic alterations and increasing water pollution. Hence, it is imperative to carry out awareness cum training programs with these communities regarding fish availability, its importance and sustainable fishing. Along with that alternate livelihood need to be developed for fishermen communities such as promoting them for building different boats and involving in eco-tourism activities.

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