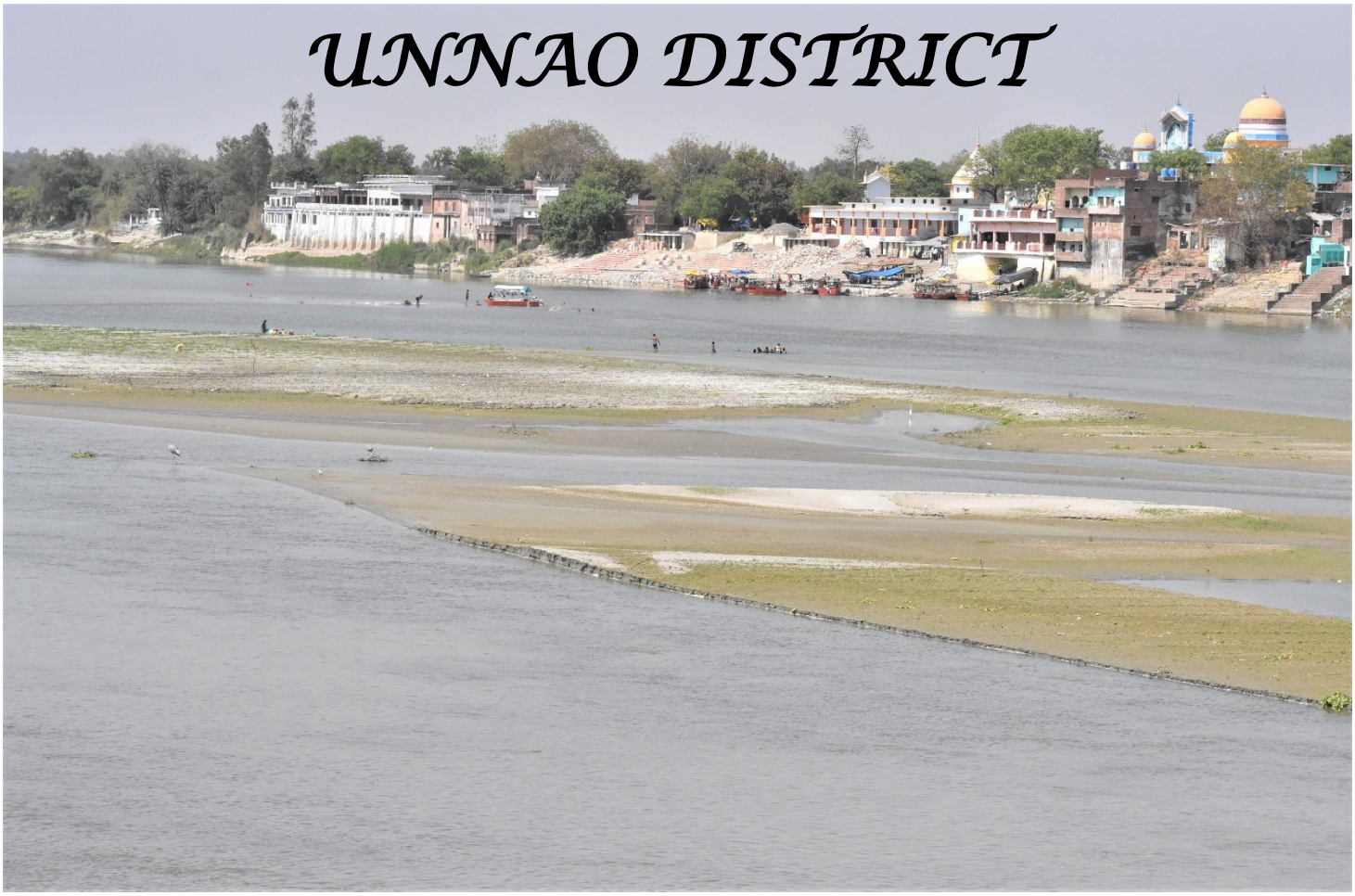
Ganga Cultural Documentation
April, 2022

UNNAO DISTRICT



National Mission for Clean Ganga

INTACH Indian National Trust for Art and Cultural Heritage

INDIA@75

Azaadi Ke Rang Bharatiya Sanskriti Ke Sang

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Front Cover : Ganga River near Baksar Ghat

Background : Part of a riverine island near Katri Pariyar Village

Back Cover : Riparian vegetation along Ganga River

Formatting and Design by : Sumesh Dudani

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1.0 Introduction

1.1 Unnao Distt. is named after its chief town and Distt. headquarters – Unnao. According to the Distt. website, the site of this town was covered with extensive forests about 1200 years ago. Godo Singh, a Chauhan Rajput, cleared these forests probably in the 3rd quarter of the 12th Century and founded a town called Sawai Godo, which shortly afterwards passed into the hands of the rulers of Kannauj who appointed Khande Singh as the Governor of this place. Little later, Unwant Singh – a Bisen Rajput and a lieutenant of the Governor, killed him and built a fort here, renaming the place as Unnao after himself. The Distt. has also been popular from the view point of history, literature, religious and cultural heritage. Local traditions connect a number of well-known personages mentioned in the Ramayana, Mahabharat and Purana viz, Parashuram, Dasharatha, Sharvana, Valmiki, Sita, Luv-Kush, Rama and many with different places in the Distt. providing a sanctity to them. (https://unnao.nic.in/about-district/).

1.2 The present Distt. Of Unnao falls under Lucknow Division and is divided into six different tehsils – Unnao, Hasanganj, Safipur, Purwa, Bighapur and Bangarmau which are further subdivided into 16 developmental blocks. The Distt. is roughly parallelogram shaped lying between Latitude 26°8' N & 27°2' N and Longitude 80°3' E & 81°3' E covering an area of about 4558 sq. km. It is bounded by Hardoi Distt. on the northern side, Lucknow Distt. on the eastern side and Rae Bareily Distt. on the southern side [Refer Map 1]. Ganga river forms the western boundary of this Distt. separating it from Kanpur and Fatehpur Distt.s.

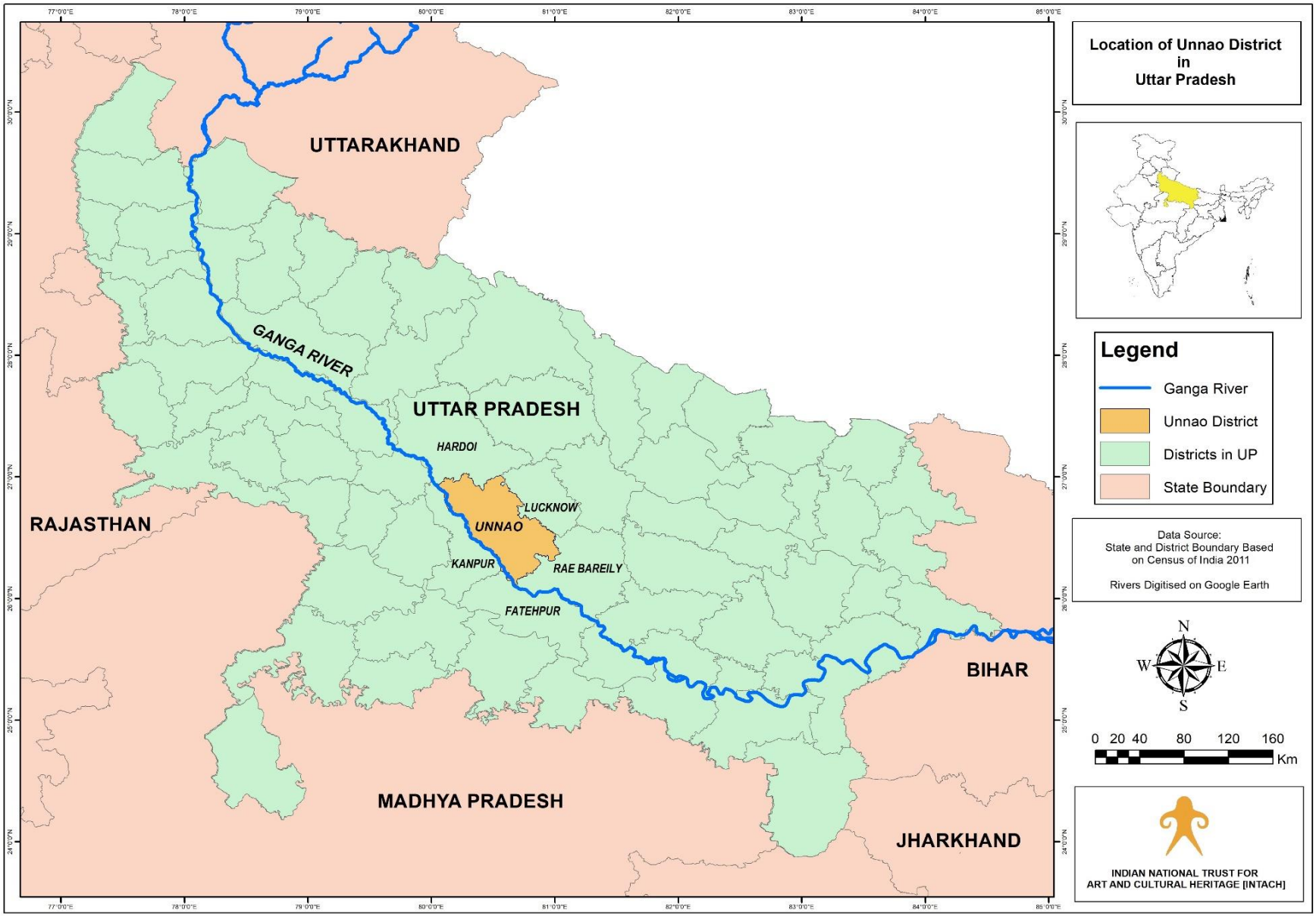
1.3 The Ganga, Kalyani and Sai are the chief rivers of the Distt., the former making its western and southern boundaries and the latter, for the greater part of its course, forming its northern & eastern boundaries. Other tributaries of Ganga River in the Distt. are Kalyani, Tanai, Loni and Morahi most of which dry up during summer season but hold water during monsoons and are utilized for irrigation in this region. The Distt. is also dotted with presence of large number of swamps and lakes, some of which hold water throughout the year. The Distt. being part of the Gangetic plain is dominated by alluvial soil which is highly fertile (D.S.R., 2016).

1.4 According to MSME-DI (2011), the topology of the Distt. can be divided into two main parts – the lowland and the upland. Lowland tracts (also known as *tarai* or *khaddar*) comprise about 23.7 % of the total area of this Distt. and lie along Ganga in the west

and along Sai in the extreme north and east. Upland tracts extend from the old high bank of Ganga to the Sai valley comprising about 76% of the area of this Distt. Unnao Distt. experiences four distinct climatic seasons – winter, summer, monsoon and receding monsoon. The average annual rainfall of this Distt. comes to around 837.125 mm with the months of June-September receiving maximum rainfall (Singh, 2013).

- In ancient times the area covered by the present district of Unnao formed part of the region known as Kosala and was later included in the Subha of Awadh or simply Awadh. This tract appears to have seen civilized and settled life since very early times. Finds from and traces of ancient remains at several places in the district are however, fairly interesting and testify to the antiquity of those sites.

- Hiuen Tsang, the famous chinese pilgrim to India, stayed at Kannauj for 3 months in 636 AD. From here he journeyed a distance of about 26 kms and reached the city of Na-fo-ti-po-ku-lo (Navadevakula) which stood on the eastern bank of Ganga. The city was about 5 km in circumference and had in or about it, a magnificent Deva Temple, several Buddhist Monasteries and Stupas. This place, which is about 3 kms north-west of Bangarmau in Tehsil Safipur, has been identified by some scholars with Nawal and is supposed to represent the site of an important ancient city, believed to have been upturned in the 13th century by the curse of a saint, and still called Aundha Khera or Lauta Shahr both meaning an upturned city. The dargah of the Muslim saint, whose curse is said to have befallen the city, is not only the oldest Muslim monument at Bangarmau but perhaps, in the entire district. (https://unnao.nic.in/history/)



Map 1 : Location Of Unnao Distt.

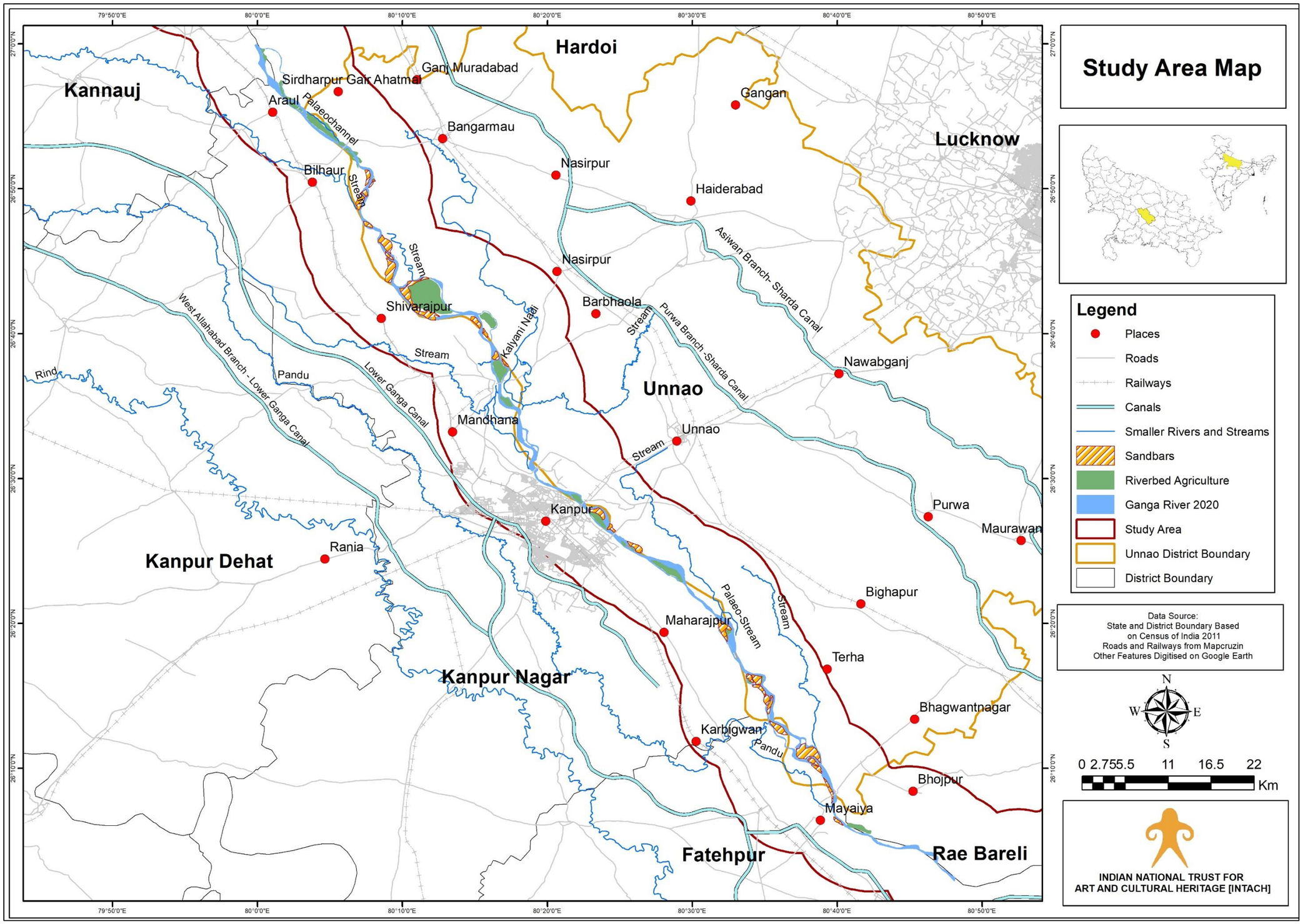
2.0 Ganga River In Unnao Distt.

2.1 Ganga River exits Hardoi Distt. near Shahpur Pawanr Pansala village to enter Unnao Distt. near Sirdharpur Ahatmali village below the bridge of Agra-Lucknow expressway. It then flows mostly south-eastwards for about 96 km in the Distt. separating it from Kanpur and Fatehpur Distt.s. The river generally flows from north-west to south-east but makes several sharp bends Umriya Bhagwantpur, and Rustampur in tehsil Safipur, Rautapur in tehsil Unnao and Ratua Khera and Duli Khera in tehsil Purwa (D.S.R., 2016). The river exits Unnao Distt. near Baksar where it flows close to its old high bank to enter Rae Bareily Distt. Throughout its course in this region, the river is braided due to the presence of several riverine islands and sandbars.

2.2 According to the Distt. Gazetteer (Nevill, 1903), Ganga river was bridged here even during that time for the movement of cargo and railways, while ferries, for the purpose of long-distance travel and trade, were more or less absent. Boat services available in this region were mostly serving pilgrims and tourists for a short distance at some designated sites which was observed even during current field survey at Nanamau Ghat and Baksar Ghat. The Gazetteer also mentions that cultivation was at a distance from the main Ganga river channel and sotas/small channels served the purpose of irrigation in the floodplain region. However, during the current survey, most of these sotas/channels were found to have been reduced due to aggressive agricultural expansion which has touched the current active channel of Ganga River in several places. Based on the available data, spatio-temporal variation of Ganga River course in the study region has been analyzed and depicted in Map 2 while Images 1-2 depict parts of the river as observed during field survey.

Image 1 : Ganga River As Seen Near Nanamau Ghat On 10th April, 2022

Image 2 : Ganga River As Observed Near Baksar Ghat On 11th April, 2022

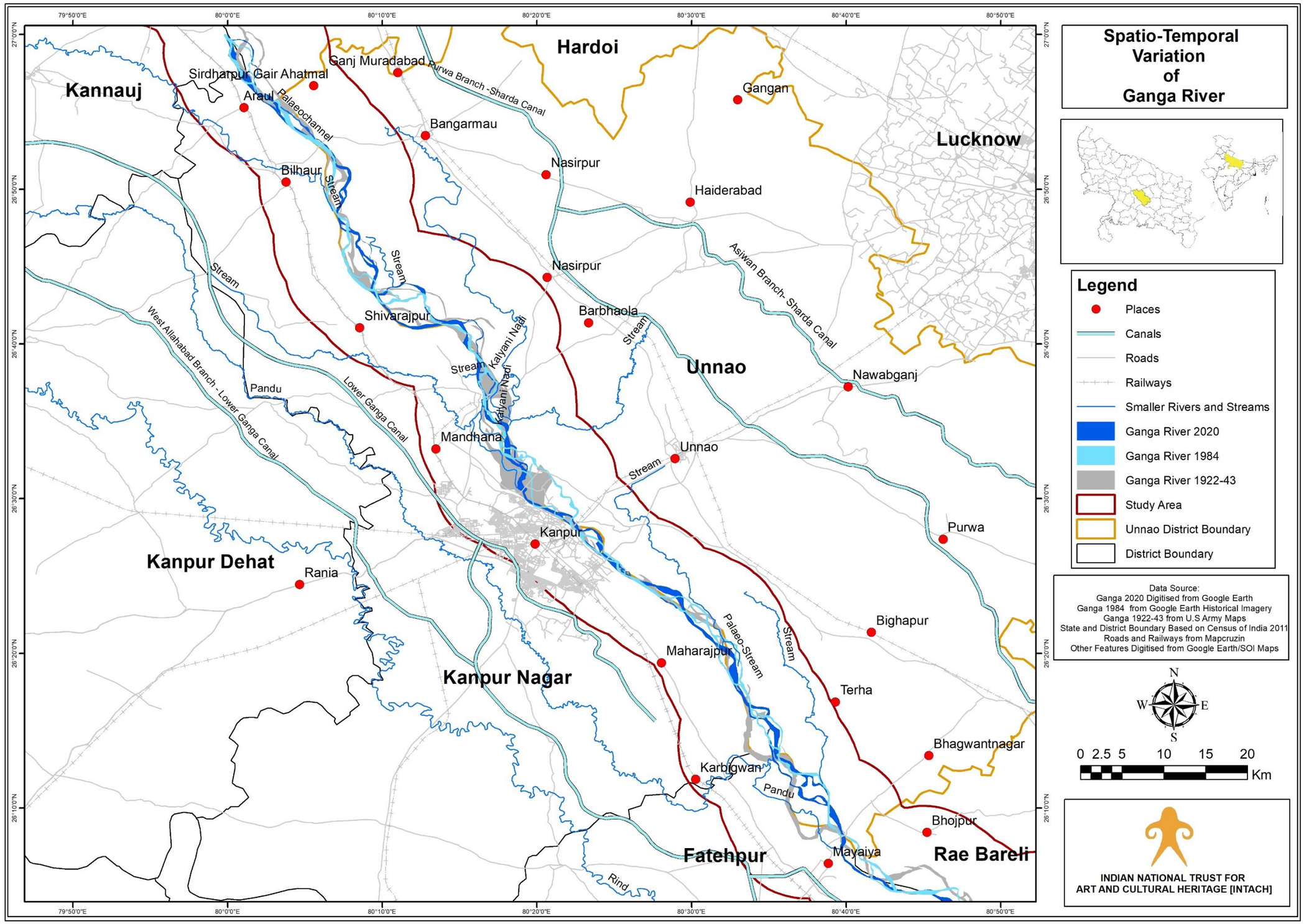


Map 2 : Temporal Variation Of Ganga River Course In Study Region

3.0 Methodology

3.1 Ganga River flows in Unnao Distt. for approximately 96 kms adjoining it mainly on the left bank and a small part on the right bank. Hence for carrying out the ground survey, a 7 km of buffer zone was selected on the both the banks 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 survey for Natural Heritage documentation in the study region of Unnao Distt. was carried out from 9-12 April, 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. 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 Unnao Distt.

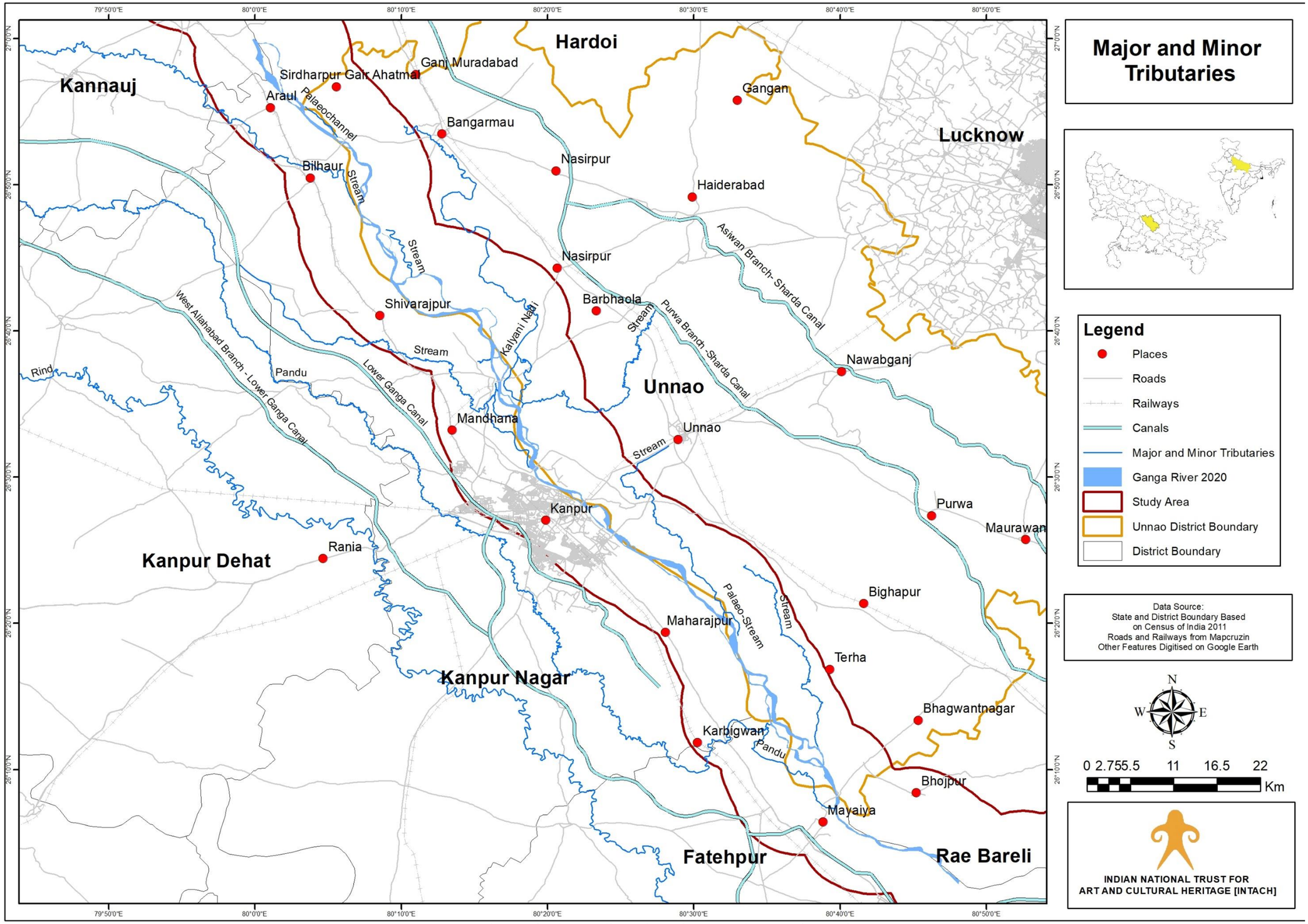
4.0 Tributaries Of Ganga River

4.1 **Kalyani River** : According to the Distt. Gazetteer (Nevill, 1903), Kalyani river rises in Hardoi and enters Unnao Distt. towards northern part of Bangarmau. Afterwards, it flows in an ill-defined, irregular course in the study region crossing through Saidapur, Pariyar, Bahraula and Rampur before its confluence with Ganga River near Hajipur village in this Distt. [Refer Map 4]. A part of this river was observed near Pariyar town [Image 3] which highlighted its sad plight. Due to influx of sewage and other waste into this river, algae and other vegetation growth had taken over the water. At some sites, the interlocutors claimed to use its water for irrigation purposes especially just after monsoon season.

Image 3 : Kalyani Nadi As Observed On 9th April, 2022

4.2 **Unnamed Stream :** An unnamed stream was also observed near Sultanpur Grunt town [Image 4] which received water during monsoon season and subsequently dried up as summer approached. This stream confluences with Kalyani Nadi just before its confluence with Ganga River. Agriculture and orchard plantations were found to be prominent alongside this stream and some interlocutors even claimed to practice fishing here during monsoon season. This serves as an important water source in this region but is subjected to increasing agricultural pressures which might threaten its sustenance in coming time if proper conservation measures are not undertaken.

Image 4 : Unnamed Stream As Observed During Field Survey On 10th April, 2022



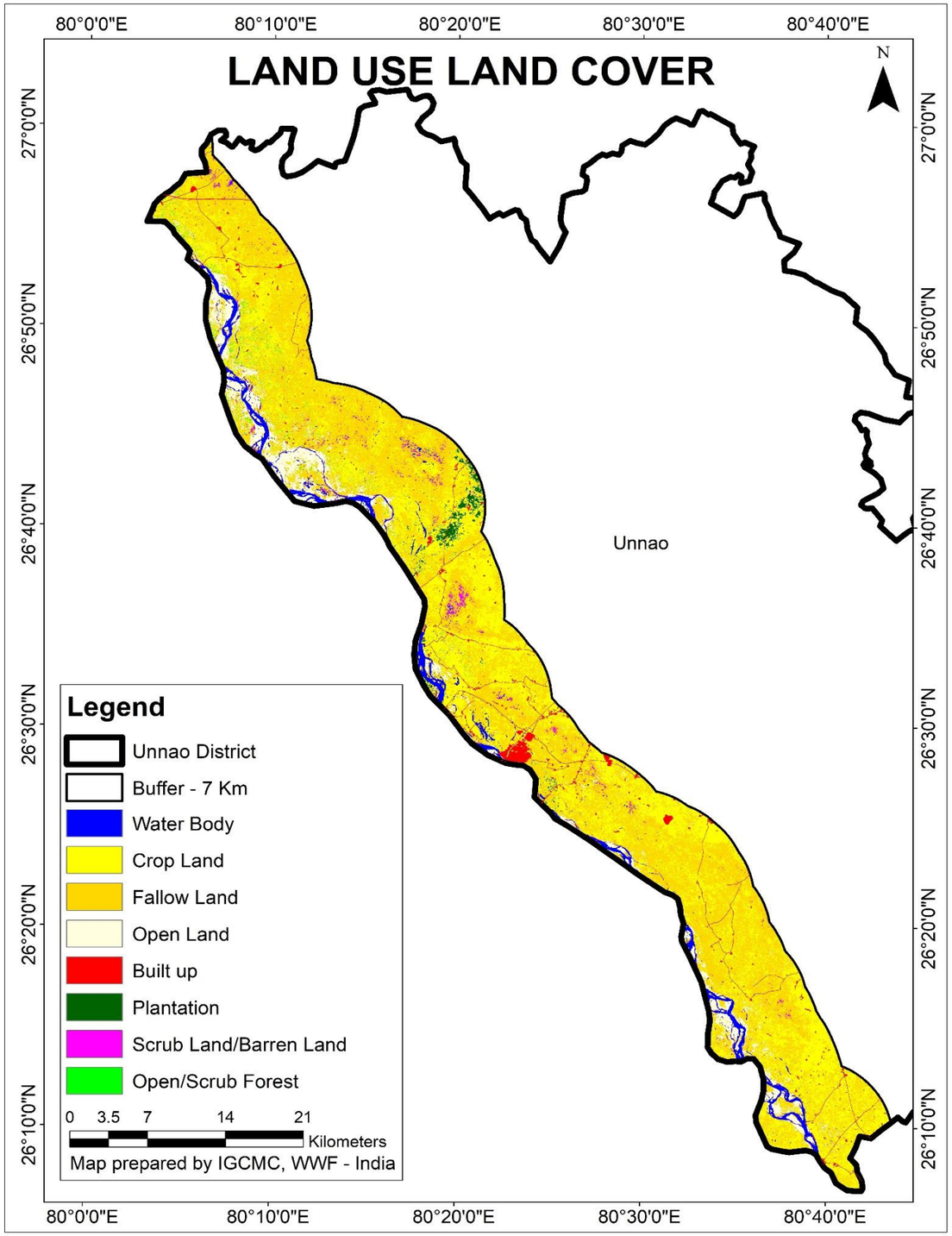
Map 4 : Major And Minor Tributaries Of Ganga River In The Study Area

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, crop land, fallow land, open land, built up, plantation, barren land and open/scrub forest. Agriculture being a dominant source of income, crop land and fallow land components occupy major part of the land use system in this Distt., together covering 84.57% of the total geographical area. The water body component covering 4.405% of the total geographical area of this Distt. chiefly includes Ganga river, its tributaries and other wetlands. The built-up area includes Shuklaganj as the major town along with other towns and 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

Unnao (LULC)		
Class	**Area (Ha)**	**Area (%)**
Water Body	4267.350	4.405
Crop Land	35777.800	36.931
Fallow Land	46151.500	47.639
Open Land	6953.040	7.177
Built Up	1403.100	1.448
Plantation	855.450	0.883
Barren Land	970.190	1.001
Open/Scrub Forest	499.050	0.515
Total	**96877.480**	**100**



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

6.0 Palaeochannels Of Ganga River

6.1 Decline in natural flow of a River or stream decreases the sediment flushing ability of the Rivers. It may be a reason behind the disappearing of River channels in the Ganga River basin. Apart from that various other factors such as change in land use pattern, sand mining, agricultural practices and brick kilns may also lead to disappearance of streams and river channels in the region. These palaeo-channels do not carry water during most of the year but may flow during flood events. Such abandoned and silted palaeo-channels 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 Unnao Distt.

6.2 An old channel of Ganga River, parts of which are also considered to be palaeo-channels in the analysis, was observed near Jamalnagar Ahatmal village in study region of Unnao Distt. [Image 5]. Some portions of these stream have been disrupted due to urbanization and rapid agricultural expansion in this region. According to the interlocutors, this channel receives water from Ganga River during monsoon which is used by the local residents for irrigation purposes chiefly whereas during summer months, it dries up completely. Image 6 depicts this channel as observed during the field survey.

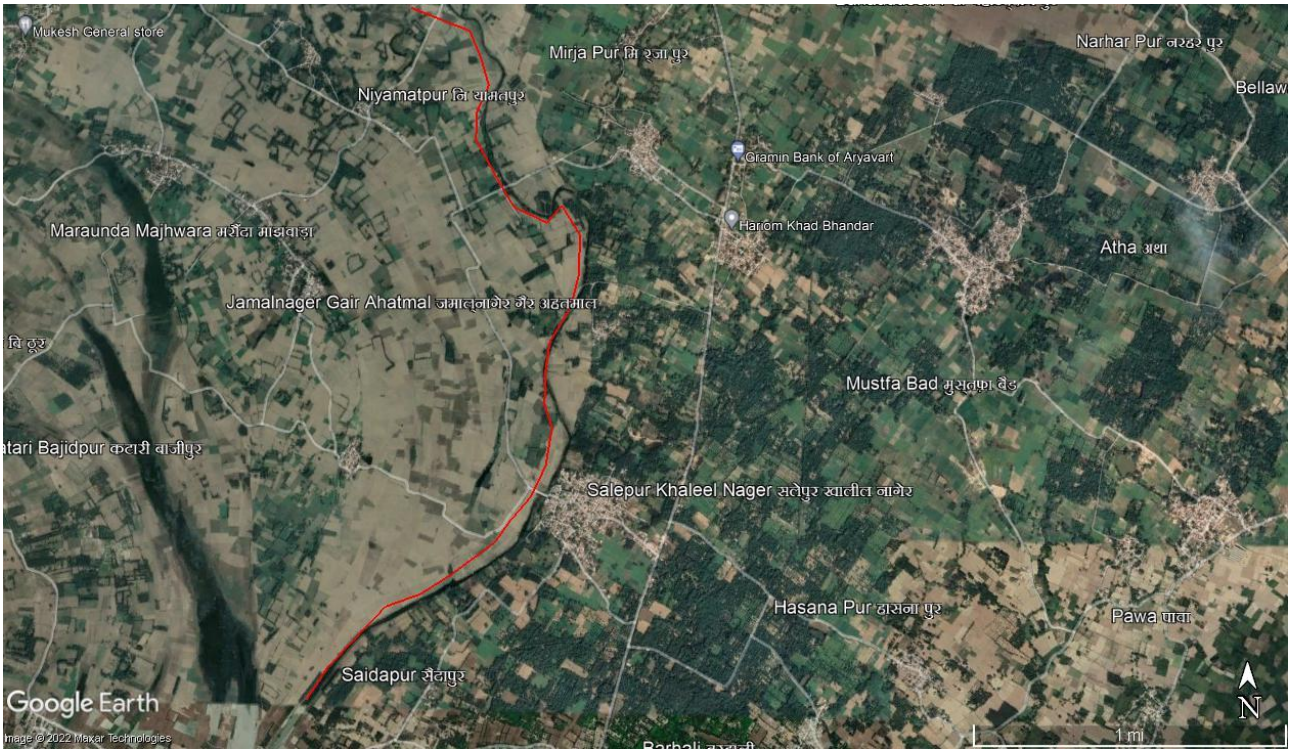
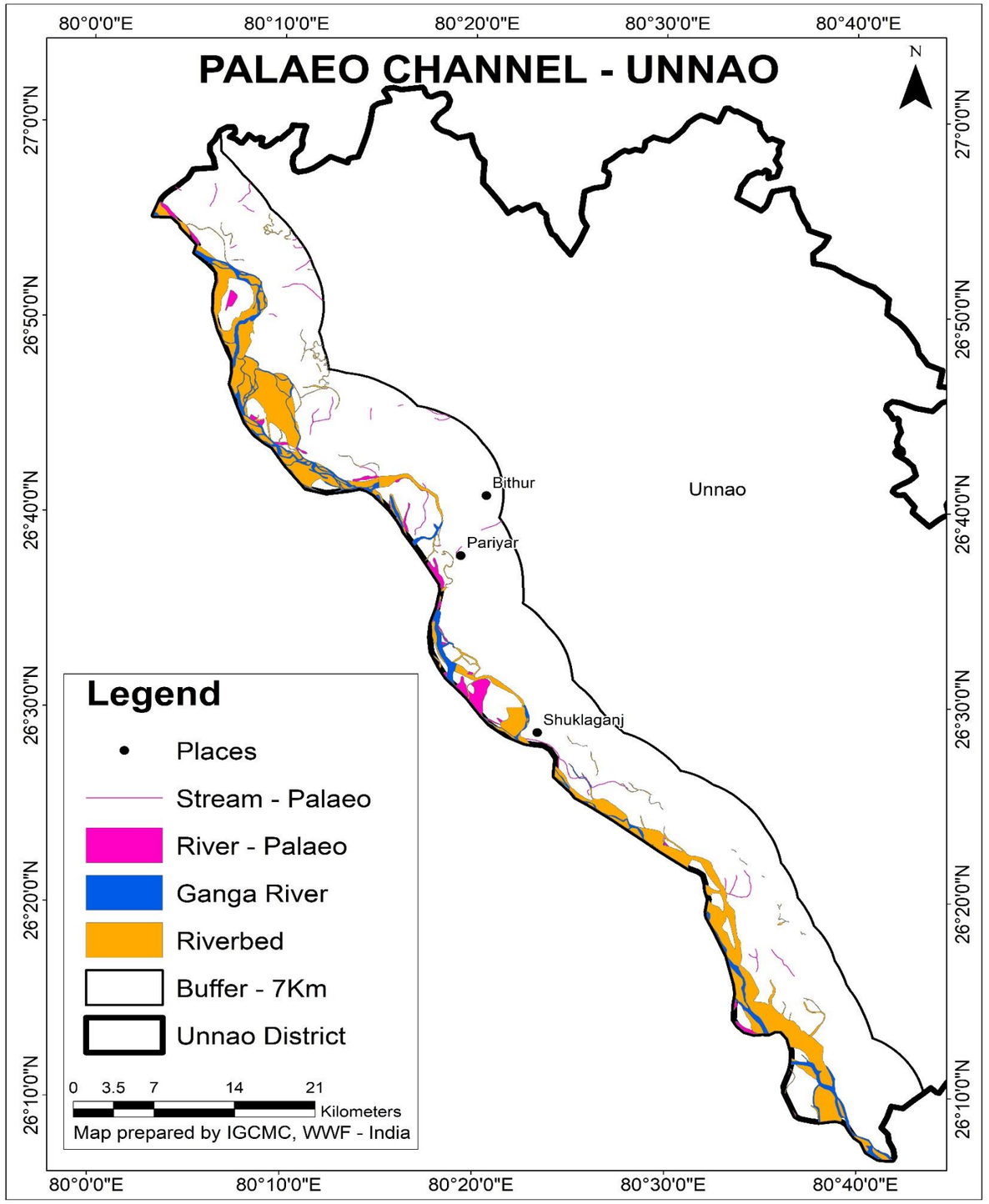


Image 5 : Palaeochannel (Marked Red) Near Jamalnagar Ahatmal Village In Unnao Distt.

Image 6 : Part Of This Palaeochannel As Observed On 9th April, 2022



Map 6 : Paleochannels In The Study Region

7.0 Floodplain Of River Ganga In Unnao

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 Unnao Distt. falls in the Central Plain Zone/Upper Gangetic Plain Region with the major soils being deep sandy soils, deep stratified loamy soils and deep fine soils. The net sown area in the district is 309 hectares in which 184.6 hectares of area is sown more than once (NICRA-ICAR, 2014). Agriculture is one of the major sources of income for the residents of the Distt. and it is benefitted by the fertile alluvium brought by Ganga river and its tributaries. Vast floodplain lands along Ganga and other minor streams in the study region were observed to be under extensive crop cultivation during the field survey. Wheat is the chief crop in this region followed by other crops such as maize, chana, bajra, sugarcane along with various pulses and vegetables such as potato, onion, chillies, green peas and tomato. The details of some villages surveyed along with their floodplain agriculture produce is provided in Table 2 while Images 7-8 depict floodplain agriculture fields as recorded during the survey.

Table 2 : Some Floodplain Villages And Their Agriculture Produce In Kasganj Distt.

Sr. No.	Village Name	Agricultural Produce
1.	Achalganj	Wheat, mustard, chana, brinjal, potato
2.	Banthar	Rice, wheat, mustard, onion, chilies
3.	Sarsoi	Rice, wheat, mustard, potato, tomato
4.	Patari	Wheat, rice, mustard, maize, chana, potato
5.	Pawa	Bajra, maize, rice, chilies, radish, water melon
6.	Lakhan Pur	Wheat, maize, pumpkin, chana, arhar, potato
7.	Pariyar	Wheat, chana, mustard, arhar, tomato, chilies

Image 7 : Cultivation Of Vegetables On Ganga River Bank In Shuklaganj

Image 8 : Floodplain Wheat Cultivation Near Pariyar In Unnao Distt.

7.3 Floodplain grasses : The Ganga floodplain region and riverine islands in Unnao Distt. were dominated by riparian grasses including species such as *S. spontaneum* (commonly known as *Kans*) and *S. bengalense* (commonly known as *Munj/ Sarkanda*) [Images 9-10] along with other grasses such as *Cynodon dactylon* (L.) Pers. (commonly known as Doob or Durva grass). *Saccharum* species 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 Distt. for roof thatching in villages. Along with this some local residents also utilize these grasses in construction of temporary huts to monitor their agricultural fields as well as for constructing temporary boundaries to distinguish their fields. These grasses are also used in making mats/ *chatai*. The abundance of this grass and availability throughout the year makes it an excellent bio resource for the residents in this region.

Image 9 : Lush Growth Of *Saccharum* Grasses Along Ganga River Near Nanamau Ghat In Unnao Distt.
[Note: The Dried Grasses Act As Boundaries For Agricultural Fields]

Image 10 : Luxuriant Growth Of *Saccharum* Grasses Near Baksar Ghat In Unnao Distt.

8.0 Wetlands In Unnao 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. During the current study about 94 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 significant wetlands are discussed in detail under this section.

Table 3 : List Of Wetlands In The Study Region

Sr. No.	Wetland ID	Lat	Long	Area (Ha)
1.	1	26° 30' 25.56" N	80° 21' 5.4" E	219.65
2.	2	26° 15' 5.4" N	80° 35' 51.36" E	1.23
3.	3	26° 15' 11.52" N	80° 35' 39.84" E	1.34
4.	4	26° 15' 15.12" N	80° 35' 42.36" E	0.37
5.	5	26° 15' 34.2" N	80° 35' 44.88" E	4.11
6.	6	26° 15' 54.36" N	80° 35' 36.6" E	1.76
7.	7	26° 26' 34.8" N	80° 24' 38.88" E	14.80
8.	8	26° 56' 36.6" N	80° 5' 36.6" E	1.43
9.	9	26° 36' 30.6" N	80° 20' 2.76" E	23.44
10.	Wetland-3	26° 37' 17.76" N	80° 20' 23.64" E	28.29
11.	10	26° 36' 15.48" N	80° 19' 50.16" E	0.37
12.	11	26° 32' 16.44" N	80° 20' 0.6" E	59.97
13.	12	26° 31' 2.64" N	80° 19' 49.08" E	13.33
14.	Wetland-4	26° 29' 38.76" N	80° 23' 5.28" E	21.06
15.	13	26° 29' 28.68" N	80° 23' 37.32" E	7.63
16.	14	26° 28' 41.16" N	80° 24' 7.92" E	1.52
17.	15	26° 28' 24.24" N	80° 24' 53.28" E	1.17
18.	16	26° 29' 18.96" N	80° 23' 49.56" E	1.67
19.	17	26° 29' 29.4" N	80° 23' 53.52" E	0.61
20.	18	26° 29' 40.56" N	80° 23' 43.8" E	0.83
21.	19	26° 29' 40.2" N	80° 23' 47.04" E	0.33
22.	20	26° 29' 40.2" N	80° 23' 59.64" E	0.28
23.	21	26° 29' 43.08" N	80° 24' 0.72" E	0.20
24.	22	26° 14' 36.24" N	80° 35' 55.68" E	4.03

25.	23	26° 13' 27.48" N	80° 37' 33.96" E	4.71
26.	24	26° 12' 56.88" N	80° 38' 0.24" E	11.66
27.	25	26° 10' 32.16" N	80° 41' 54.24" E	2.54
28.	26	26° 10' 38.28" N	80° 41' 39.48" E	0.25
29.	27	26° 11' 8.88" N	80° 41' 48.84" E	1.14
30.	28	26° 11' 8.88" N	80° 41' 56.04" E	0.56
31.	29	26° 11' 3.12" N	80° 41' 54.96" E	0.76
32.	30	26° 11' 20.4" N	80° 41' 56.4" E	1.15
33.	31	26° 8' 10.68" N	80° 40' 39.36" E	0.35
34.	32	26° 8' 10.68" N	80° 40' 32.88" E	0.15
35.	33	26° 8' 14.28" N	80° 40' 28.92" E	0.30
36.	34	26° 9' 20.88" N	80° 41' 23.28" E	0.41
37.	35	26° 9' 27.36" N	80° 41' 10.68" E	1.40
38.	36	26° 9' 47.52" N	80° 41' 4.56" E	1.59
39.	37	26° 9' 57.96" N	80° 40' 58.44" E	0.51
40.	38	26° 54' 56.88" N	80° 5' 45.24" E	0.29
41.	39	26° 2' 11.76" N	80° 41' 35.52" E	0.61
42.	40	26° 38' 57.48" N	80° 17' 34.8" E	16.57
43.	41	26° 47' 2.76" N	80° 8' 45.6" E	11.79
44.	42	26° 47' 5.28" N	80° 9' 3.24" E	2.16
45.	43	26° 48' 33.84" N	80° 8' 27.24" E	65.99
46.	44	26° 13' 40.8" N	80° 35' 57.84" E	15.69
47.	45	26° 13' 9.12" N	80° 36' 21.96" E	1.28
48.	46	26° 13' 9.48" N	80° 36' 36.72" E	2.72
49.	47	26° 51' 11.88" N	80° 8' 48.84" E	3.16
50.	48	26° 51' 9.72" N	80° 8' 50.64" E	0.24
51.	49	26° 50' 55.32" N	80° 9' 11.88" E	0.45
52.	50	26° 49' 51.24" N	80° 8' 54.24" E	8.45
53.	51	26° 51' 37.44" N	80° 8' 2.04" E	3.93
54.	52	26° 51' 39.96" N	80° 7' 54.12" E	0.43
55.	53	26° 50' 41.28" N	80° 8' 5.28" E	12.79
56.	54	26° 53' 26.88" N	80° 5' 42.36" E	4.79
57.	55	26° 49' 26.04" N	80° 6' 53.28" E	7.47
58.	56	26° 49' 51.6" N	80° 6' 33.48" E	1.92
59.	57	26° 49' 39.36" N	80° 6' 33.48" E	2.88
60.	58	26° 50' 1.68" N	80° 6' 46.08" E	1.85
61.	59	26° 50' 11.76" N	80° 6' 48.96" E	0.62
62.	60	26° 46' 58.8" N	80° 7' 23.88" E	6.98

63.	61	26° 43' 53.76" N	80° 8' 33.72" E	24.33
64.	62	26° 42' 44.64" N	80° 11' 38.04" E	5.22
65.	63	26° 42' 14.4" N	80° 11' 56.4" E	1.50
66.	64	26° 42' 3.6" N	80° 12' 31.68" E	3.20
67.	65	26° 41' 40.56" N	80° 12' 59.4" E	1.41
68.	66	26° 41' 32.28" N	80° 13' 17.76" E	0.76
69.	67	26° 42' 48.6" N	80° 10' 40.08" E	2.22
70.	68	26° 42' 30.24" N	80° 10' 40.08" E	0.55
71.	69	26° 53' 50.64" N	80° 9' 8.28" E	4.01
72.	70	26° 53' 60" N	80° 9' 15.48" E	0.73
73.	71	26° 57' 52.2" N	80° 5' 33" E	0.28
74.	72	26° 57' 47.52" N	80° 5' 38.04" E	0.15
75.	73	26° 54' 10.8" N	80° 7' 0.12" E	3.32
76.	74	26° 53' 54.24" N	80° 7' 4.8" E	1.13
77.	75	26° 53' 8.88" N	80° 7' 21.36" E	0.31
78.	76	26° 53' 6" N	80° 7' 24.24" E	1.03
79.	77	26° 48' 20.88" N	80° 11' 10.32" E	0.64
80.	78	26° 48' 0" N	80° 12' 0.72" E	0.83
81.	79	26° 36' 4.32" N	80° 21' 9" E	1.78
82.	80	26° 39' 56.52" N	80° 18' 8.64" E	11.28
83.	81	26° 39' 46.8" N	80° 18' 16.92" E	3.27
84.	Wetland-2	26° 40' 29.28" N	80° 17' 52.44" E	10.90
85.	Wetland-1	26° 41' 2.04" N	80° 17' 52.08" E	8.41
86.	82	26° 41' 31.56" N	80° 17' 13.2" E	4.22
87.	83	26° 38' 45.96" N	80° 17' 51.36" E	18.82
88.	84	26° 29' 57.48" N	80° 23' 55.68" E	4.05
89.	85	26° 29' 52.08" N	80° 24' 9.72" E	2.65
90.	86	26° 16' 20.64" N	80° 36' 58.68" E	3.65
91.	87	26° 16' 59.16" N	80° 36' 48.6" E	8.92
92.	88	26° 16' 39.36" N	80° 36' 7.92" E	2.09
93.	89	26° 16' 4.44" N	80° 36' 32.4" E	0.33
94.	90	26° 15' 55.44" N	80° 36' 30.96" E	0.53

8.2 **Pair of Unnamed Wetlands :** Two narrow and elongated wetlands were observed near Maraunda Majhwara (Wetland-1) and Katri Bajidpur (Wetland-2) villages of study region during the field survey [Image 11]. Wetland-1 covered an area of about 8.41 ha while Wetland-2 covered an area of about 10.90 ha. Located closer to each other, both these wetlands are referred locally as 'Jheel' by the residents in this region. Both these wetlands receive water chiefly during monsoon from Ganga River overflow that becomes an important source of irrigation for residents of surrounding villages. While the water starts drying up as summer approaches specially in the fringes of these wetlands, some amount of water remains in their central part which serves as important habitat for birds and other fauna in this region. During the survey, the wetlands were found to be brimming with water with birds such as Asian openbill and other species were found inhabiting here [Images 12-13]. Fishing was also observed to be a prominent activity in these wetlands which was mainly for local consumption by the village residents.

Image 11 : Location Of The Two Unnamed Wetlands In Unnao Distt.
[26° 41' 2.04" N; 80° 17' 52.08" E & 26° 40' 29.28"; N 80° 17' 52.44" E]

Image 12 : Wetland-1 As Observed On 10th April, 2022

Image 13 : Wetland-2 As Observed On 10th April, 2022

8.3 Another unnamed wetland (Wetland-3) roughly semi-circle shaped was observed near Bhadevna village in Unnao Distt. [Image 14]. This wetland is spread in an area of about 28.29 ha and receives rainwater during monsoon along with water from streams flowing close by that are associated with Ganga River. Extensive agriculture surrounding this wetland puts tremendous pressure on its resources and also poses threat to its sustenance in this region. During the field survey, this wetland was found to be reduced to a marshy land with agriculture slowly expanding in its watershed area [Image 15]. Water, wherever present, was mainly covered with water hyacinth, algae and other submerged aquatic plant species [Image 16]. If appropriate conservation measures are not employed soon, this wetland might ultimately vanish from this region in coming years.

Image 14 : Location Of Unnamed Wetland Near Bhadevna Village [26° 37' 17.76" N; 80° 20' 23.64" E]

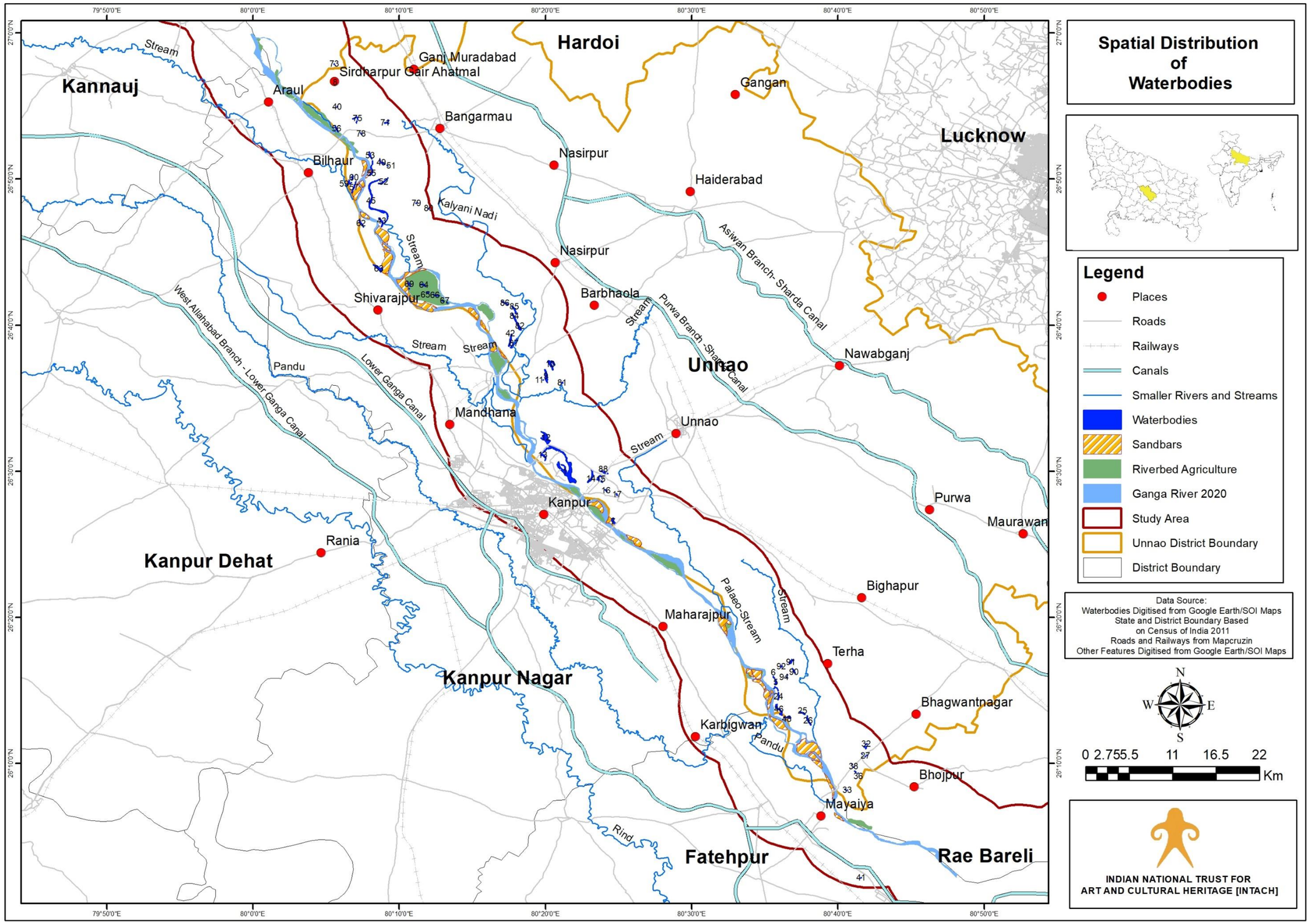
Image 15 : Part Of Wetland-3 As Observed During The Field Survey On 10th April, 2022

Image 16 : Water Of This Wetland Covered With Water Hyacinth And Other Vegetation

8.4 Another unnamed elongated oxbow lake measuring about 1.6 km long and covering an area of about 21.06 ha is located close to Shuklaganj town in Unnao Distt. [Image 17]. This wetland is in a neglected condition with water being covered by water hyacinth and other aquatic vegetation [Image 18]. Solid and liquid waste was also found to being dumped in this wetland at different sites further deteriorating its ecology. The interlocutors reiterated that this wetland was formed due to shift in the Ganga river course in this region and has not been paid attention to in the recent years resulting in its current situation.

Image 17 : Location Of The Oxbow Lake Near Shuklaganj Town [26° 29' 38.76" N; 80° 23' 5.28" E]

Image 18 : Oxbow Lake As Observed During Field Survey On 10th April, 2022



Map 7 : Spatial Distribution Of Water Bodies Within Study Area

9.0 Riparian Flora Along Ganga River In Unnao 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 During the field survey the riparian vegetation was found to have patchy distribution with it being sparse in most sites and dense in some sites [Images 19-20]. This could be attributed to the fact that agriculture is dominant in the landscape of study region especially along Ganga River and its tributaries. Shrubs and herbs were dominant in terms of growth and extent of distribution as compared to the trees. The common tree species in study region included – Babool, Neem, peepal and Banyan among which Peepal and Banyan were also found associated with various religious sites. The common shrubs and herbs in the study region included – *Croton bonplandianus, Parthenium hysterophorus, Polygonum sp.* and *Zizyphus* sp. The floodplain grasses – *Saccharum* sps. were a major component of riparian vegetation throughout with its luxuriance dominating the other flora at some sites. 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.	*Blumea lacera* (Burm.f.) DC.	Asteraceae	Herb	Kakronda
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
24.	*Saccharum spontaneum* L.	Poaceae	Grass	Kans/Katha

Image 19 : A Riparian Vegetation Patch Near Kalyanpur Village In Unnao Distt.

Image 20 : A Riparian Vegetation Patch Near Katri Rampur Village In Unnao Distt.

10.0 Faunal Diversity In Unnao 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 dolphins occurred in the study region. However, according to interlocutors, occasional dolphin sightings occur during the monsoon season when water level rises in the river.

10.2 **Turtles :** Turtles form an important component of Ganga riverine biodiversity and play a critical ecological role by controlling aquatic vegetation, serve as scavengers and help maintain rivers (WII-GACMC, 2017). Total 24 species of fresh water turtles are found in India out of which 13 are found in the River Ganga. Poaching, habitat loss, pollution and over fishing are major threats to the species. Turtles are also often caught in the fishing net by fishermen which make them more vulnerable to poaching (Stuart & Thorbiarnarson, 2003). While no direct turtle sightings could be made in the study region, their presence was confirmed by interlocutors who reiterated that these turtles were occasionally found basking along sandy banks and on sand bars.

10.3 **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. According to the interlocutors there is a small population of Nilgai in the study region which can be seen near Achalganj, Banthar, Sarsoi, Patari and Pariyar villages.

10.4 **Wild boar:** The Indian wild boar (*Sus scrofa* L.) also known as the wild pig is one of the most 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). During the survey, the locals stated that the boars are responsible for destroying the crops, potatoes and other vegetables. The problem persists specially in Patari, Sarsoi, Pawa, Lakhan Pur, Hajipur, Dudhora and

other flood plain agricultural areas. In the study region, wild boars inhabit the tall iparian grasses dominated sites along the river and on the riverine islands.

10.5 Based on visual observations during field survey and interactions with the interlocutors some other major faunal species recorded from study region in Unnao Distt. is presented in Table 5.

Table 5 : Other Important Fauna Recorded In The Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Blackbuck	*Antilope cervicapara*	Least Concern
2.	**Red Sand Boa**	***Eryx johnii***	**Near Threatened**
3.	Northern Plains Grey Langur	*Semnopithecus entellus*	Least Concern
4.	Golden Jackal	*Canis aureus*	Least Concern
5.	Rhesus Monkey	*Macaca mulatta*	Least Concern
6.	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern
7.	**Bengal Monitor**	***Varanus bengalensis***	**Near Threatened**
8.	Danaid Eggfly (Butterfly)	*Hypolimnas misippus*	Least Concern
9.	Grey Pansy (Butterfly)	*Junonia atlites*	Least Concern
10.	Peacock Pansy (Butterfly)	*Junonia almana*	Least Concern
11.	Blue Jay (Butterfly)	*Graphium doson*	Least Concern
12.	Common Mime (Butterfly)	*Papilio clytia*	Least Concern
13.	Common Grass Yellow (Butterfly)	*Eurema brigitta*	Least Concern

Image 21 : Golden Jackal Sighted During The Survey

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 (*Grus antigone*) and River lapwing (*Vanellus duvaucelii*) also breed on the islands, sandbars and banks of the Ganga River. Unnao Distt. has rich and highly diverse avian fauna which is still relatively understudied. During the field survey in study region of Unnao Distt., the diversity of avian species was recorded using binoculars and identified using field guides (Salim Ali, 2012; Grimmett *et al.*, 2016). The conservation status of these recorded species was listed by following IUCN Red Data List and is presented along with other details in Table 6. Important observations from the study are presented below:

- A total of 74 different bird species were sighted, out of which 28 were wetland birds' species while remaining 46 species were of forest and grassland.
- White throated kingfisher, Little Egret, Cattle Egret, Indian Pond Heron, House Sparrow, Jungle Crow, Common Myna, Bank Myna, Common Pigeon, Common Babbler, Spotted Dove, Eurasian Collared Dove and White Wagtail were the most frequently sighted species.

- Among the recorded avian species; **Black-headed Ibis, Asian Woolyneck, Painted Stork** and **River Lapwing** comes under **"Near Threatened"** category of IUCN's Red List of Threatened Species whereas **River Tern** and **Sarus Crane** have **"Vulnerable"** status (IUCN red Data List).
- A total of 5 Migratory and 4 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 7.

Table 6 : 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.	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.	Common Sandpiper	*Actitis hypoleucos*	Least Concern
10.	**Sarus Crane**	***Grus Antigone***	**Vulnerable**
11.	Green Sandpiper	*Tringa ochropus*	Least Concern
12.	Asian Openbill	*Anastomus oscitans*	Least Concern
13.	**Asian Woollyneck**	***Ciconia episcopus***	**Near Threatened**
14.	**Painted Stork**	***Mycteria leucocephala***	**Near Threatened**
15.	Little Cormorant	*Microcarbo niger*	Least Concern
16.	Great Cormorant	*Phalacrocorax carbo*	Least Concern
17.	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
18.	**Black-headed Ibis**	***Threskiornis melancephalus***	**Near Threatened**
19.	White breasted -Waterhen	*Amaurornis phoenicurus*	Least Concern
20.	Common Moorhen	*Gallinula chloropus*	Least Concern
21.	Little Grebe	*Tachybaptus ruficollis*	Least Concern
22.	Purple Swamphen	*Porphyrio porphyrio*	Least Concern
23.	Eurasian Coot	*Fulica atra*	Least Concern
24.	Common Greenshank	*Tringa nebularia*	Least Concern
25.	Black-winged Stilt	*Himantopus himantopus*	Least Concern
26.	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
27.	Caspian Gull	*Larus cachinnas*	Least Concern
28.	**River Tern**	***Sterna aurantia***	**Vulnerable**
29.	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
30.	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
31.	Black Drongo	*Dicrurus macrocercus*	Least Concern
32.	Common Myna	*Acridotheres tristis*	Least Concern

33.	Bank Myna	*Acridotheres ginginianus*	Least Concern
34.	Asian Pied Starling	*Gracupica contra*	Least Concern
35.	Common Stonechat	*Saxicola torquatus*	Least Concern
36.	Pied Bushchat	*Saxicola caprata*	Least Concern
37.	Common Babbler	*Argya caudata*	Least Concern
38.	Jungle Babbler	*Argya striata*	Least Concern
39.	White Wagtail	*Motacilla alba*	Least Concern
40.	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
41.	Indian Silverbill	*Euodice malabarica*	Least Concern
42.	Common Hoopoe	*Upupa epops*	Least Concern
43.	Common Tailorbird	*Orthotomus sutorius*	Least Concern
44.	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
45.	House Sparrow	*Passer domesticus*	Least Concern
46.	Indian Jungle Crow	*Corvus culminatus*	Least Concern
47.	House Crow	*Corvus splendens*	Least Concern
48.	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
49.	Indian Robin	*Saxicoloides fulicatus*	Least Concern
50.	Streak throated Swallow	*Petrochelidon fluvicola*	Least Concern
51.	Barn Swallow	*Hurindo rustica*	Least Concern
52.	Coppersmith Barbet	*Psilopogon haemacephalus*	Least Concern
53.	Ashy Prina	*Prinia socialis*	Least Concern
54.	Greater Coucal	*Centropus sinensis*	Least Concern
55.	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
56.	Red-vented Bulul	*Pycnonotus cafer*	Least Concern
57.	Black-winged kite	*Elanus caeruleus*	Least Concern
58.	Green Bee-eater	*Merops orientalis*	Least Concern
59.	Blue-tailed Bee eater	*Merops philippinus*	Least Concern
60.	Scaly-breasted Munia	*Lonchura punctulata*	Least Concern
61.	Indian Peafowl	*Pavo cristatus*	Least Concern
62.	Jungle Owlet	*Glaucidium radiatum*	Least Concern
63.	Crested Lark	*Galerida cristata*	Least Concern
64.	Paddyfield Pipit	*Anthus rufulus*	Least Concern
65.	Common Pigeon	*Columba livia*	Least Concern
66.	Spotted Dove	*Spilopelia* chinesis	Least Concern
67.	Eurasian Collared Dove	*Streptopelia decaocto*	Least Concern
68.	Laughing Dove	*Spilopelia senegalensis*	Least concern
69.	Rufous Treepie	*Dendrocitta vagabunda*	Least concern
70.	Purple Sunbird	*Cinnyris asiaticus*	Least concern
71.	Indian Roller	*Coracias benghalensis*	Least concern
72.	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern
73.	Brown Rockchat	*Oenanthe fusca*	Least Concern
74.	Grey Francolin	*Francolinus pondicerianus*	Least Concern

Image 22 : Painted Stork

Image 23 : A pair of Sarus Crane

Image 24 : A Flock Of Asian Openbill Storks

Table 7 : List Of Migratory Birds Recorded 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.	White Wagtail	*Motacilla alba*	Least Concern	M
4.	Common Greenshank	*Tringa nebularia*	Least Concern	M
5.	Caspian Gull	*Larus cachinnas*	Least Concern	M
6.	Great Cormorant	*Phalacrocorax carbo*	Least Concern	LM
7.	Black-winged Stilt	*Himantopus himantopus*	Least Concern	LM
8.	Barn Swallow	*Hurindo rustica*	Least Concern	LM
9.	**Painted Stork**	***Mycteria leucocephala***	**Near Threatened**	**LM**

11.0 Ganga Riverine Islands/*Diaras* In Kasganj 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 irregularly shaped sand bars and few riverine islands are present in the Ganga river stretch of study region.

11.2 Throughout the Ganga River stretch between Kanpur and Unnao Distt.s., several irregularly shaped riverine island and sandbars can be observed. While only some of them had natural vegetation chiefly dominated by Saccharum grasses, most of them were totally exploited for agriculture in the region. Upon interactions, several interlocutors had different versions about how and when did local residents initiated cultivation on these lands. Some major islands and sand bars as observed during the field survey are discussed in this section.

11.3 Among the significant islands of study region, one roughly spear-head shaped island was observed between Bithoor in Kanpur Distt. and Katri Pariyar in Unnao Distt. [Image 25]. It measured about 2.8 km long and 0.5-1.5 km wide covering an area of about 260 ha. Entire island was enveloped with extensive agriculture [Image 26] with crops such as cucumber, melons and pumpkin being grown by the residents of nearby villages. Dried *Saccharum* grasses were used for setting up boundaries on these fields as well as for construction of temporary shelters on this island. Mostly small wooden hand-rowed boats were employed by the residents for accessing to this island from both Kanpur and Unnao sides.

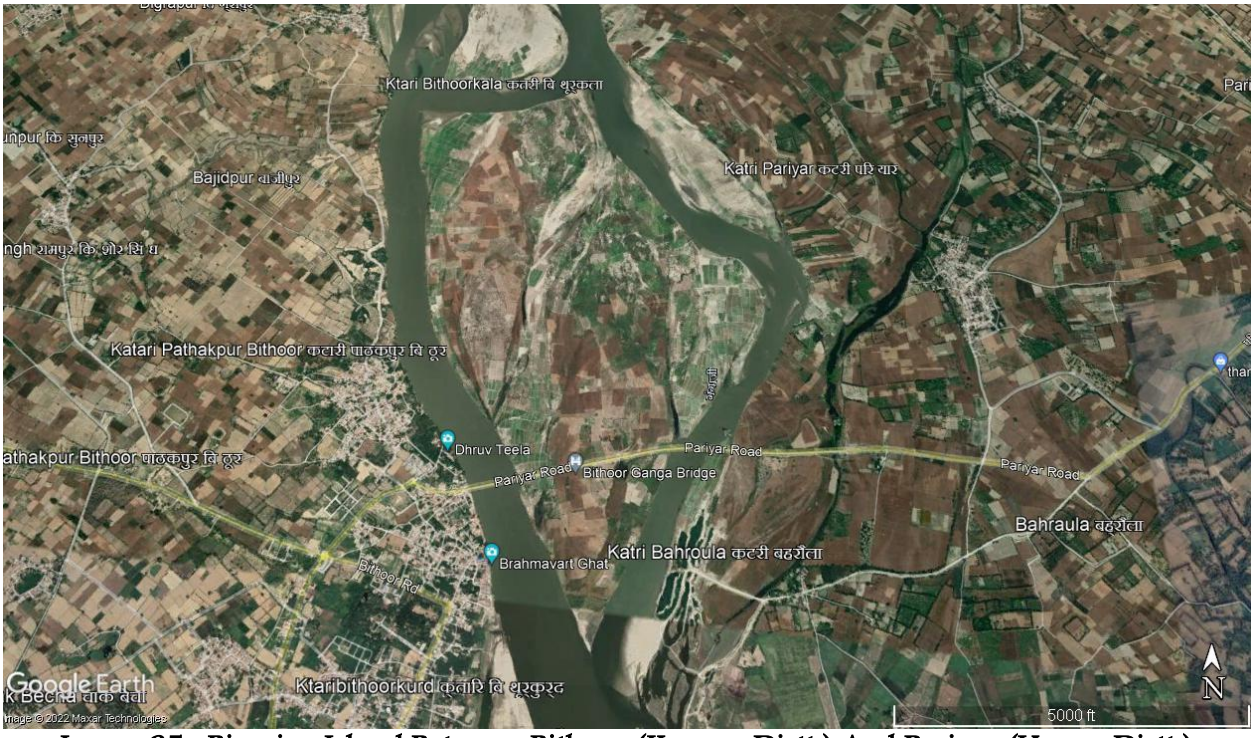


Image 25 : Riverine Island Between Bithoor (Kanpur Distt.) And Pariyar (Unnao Distt.)

Image 26 : Part Of This Riverine Island As Seen Near Bithoor On 8th April, 2022

11.4 A group of irregularly shaped riverine islands and sandbars was observed near Keola Khera village of Unnao Distt. [Image 27]. Major part of these islands and sandbars were covered by Saccharum grasses along with some emergent vegetation on its fringe parts. However, agriculture had started creeping in even here with some residents already clearing this natural vegetation for cultivating wheat and other crops as observed during the survey [Image 28]. If appropriate steps are not undertaken, these islands might meet the same fate as others in the study region very soon.

Image 27 : Location Of Riverine Island Near Keola Khera Village In Unnao Distt.
[Note: The Patch Marked With Red Boundary Shows Clearing Of Natural Vegetation For Agriculture On This Island]

Image 28 : Field Image Of The Riverine Island Near Keola Khera Village With Natural Vegetation That Is Being Punctuated With Agriculture As Observed On 11th April, 2022

11.5 Another group of small irregularly shaped sandbars & riverine islands were observed near Nanamau Ghat in Unnao Distt. [Image 29]. Upon interactions, the interlocutors reiterated that the residents of surrounding villages were involved in cultivation of crops mainly watermelon, cucumber, pumpkin and other vegetables on these islands. *Saccharum* grass which was found on some peripheral parts here was used in dried form for demarcating different fields for different people involved in agricultural activities [Image 30]. Small wooden boats were used for crossing water to access these islands along with transportation of required goods to and from these sites. The interlocutors highlighted that most of these islands and bars are submerged completely during monsoon season and are exploited for agriculture as soon as water recedes sufficiently enough. They also claimed that mostly those residents who have agricultural fields closer to Ganga river in the floodplain villages of this region are involved in cultivation of crops on these islands.

Image 29 : Location Of Riverine Islands And Sandbars In Ganga River Near Nanamau Ghat

Image 30 : One Of The Riverine Island As Observed On 10th April, 2022

12.0 Fishing In Unnao 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 According to the interlocutors, fishing from Ganga River is a prominent activity in this region and an important source of livelihood for local residents. Various fishing gears such as cast nets, drag nets, fine-meshed nets of various sizes and materials and locally made fishing rods are employed for catching fish in the study region. The nets and other important fishing gear are generally purchased from neighboring towns. Small wooden hand rowed boats are sometimes employed for fishing while most of the time people catch fish without the use of boats as water depth is lower in this stretch of the river. An important fish market is set up in Pariyar town of Unnao Distt. [Image 31] where the fish caught are being sold commercially. However, during the field survey in this region, fishing activity was not observed much and fish market was also found to be inoperative owing to temporary ban on selling non-veg food due to ongoing Navratri festivities. Image 32 depicts fishing activity as observed near Baksar Ghat in Unnao Distt. Based on the feedback from interlocutors, the fish species recorded from Ganga river stretch of study region is presented in Table 8.

Image 31 : Inoperative Fish Market Site In Pariyar Town Of Unnao Distt.

Image 32 : Fishing Activity As Observed Near Baksar Ghat During Field Survey In Unnao Distt.

Table 8 : Major Fish Caught From Rivers In The Study Region

Sr. No.	Scientific Name	Common Name
1.	*Labeo rohita*	Rohu
2.	*Labeo catla*	Catla/Bhakur
3.	*Wallago attu*	Buari/Barari
4.	*Mystus tengara*	Tengara
5.	*Puntius sp.*	Sidhari
6.	*Cyprinus carpio*	Common/Chinese carp
7.	*Channa punctata*	Garai
8.	*Eutropiichthys vacha*	Bachwa
9.	*Anguilla bengalensis*	Baam
10.	*Cirrhinus mrigala*	Naini
11.	*Oreochromis* sp.	Tilapia

13.0 Groundwater In Unnao Distt.

13.1 Ground water characteristics of a particular area are subject to several natural factors like precipitation, drainage, topography, lithology and hydrogeological conditions of the region. Geomorphologically, Unnao Distt. is an alluvial plain of almost flat topography with the master slope in the direction NW to SE. It has two distinct topographical features viz. Lowland and Up-land. Low-land or the younger alluvial plain lies along the Ganga river in the west and along the Sai river in the extreme north and east. The upland or the older alluvial plains extends NW to SE between the two high banks of the above rivers (Singh, 2013).

13.2 The alluvial plain of Unnao Distt. constitutes of clay, silt, gravel and kankar sediments of Quaternary age. These alluvial deposits of the area may be broadly classified into newer and older litho-units on the basis of sedimentary constitution, depositional and developmental geological history. The Distt. has in general three prominent sub-surface granular zones: upper most sub-surface granular zone extends upto the depth of 90 m.b.g.l., second from 100 to 250 m.b.g.l. and the third one extending from 250 to the drilled depth of 455 m.b.g.l. The aquifers in the district are constituted of mainly by the different grades of alluvial sands, gravel and kankar sediments. These porous and permeable sediments generally occurring in the form of granular-zones are fully saturated by the ground water. Three different aquifer systems can be categorized in this Distt.: Upper or Phreatic Aquifer system, Middle Aquifer system and Lower Aquifer system (Singh, 2013).

13.3 During the field survey, ground water levels as recorded from different villages based on information from the interlocutors is presented in Table 9. The water depth varied from 10 ft. below ground level (Lakha Pur) to 45 ft. below ground level (Haibatpur) in the study region which kept on increasing as the distance from Ganga River increased. The use of wells in earlier years was quite common in this region which has declined significantly giving way to handpumps and motor based systems.

Table 9 : Grounwater Levels Recorded From Different Villages In Study Region

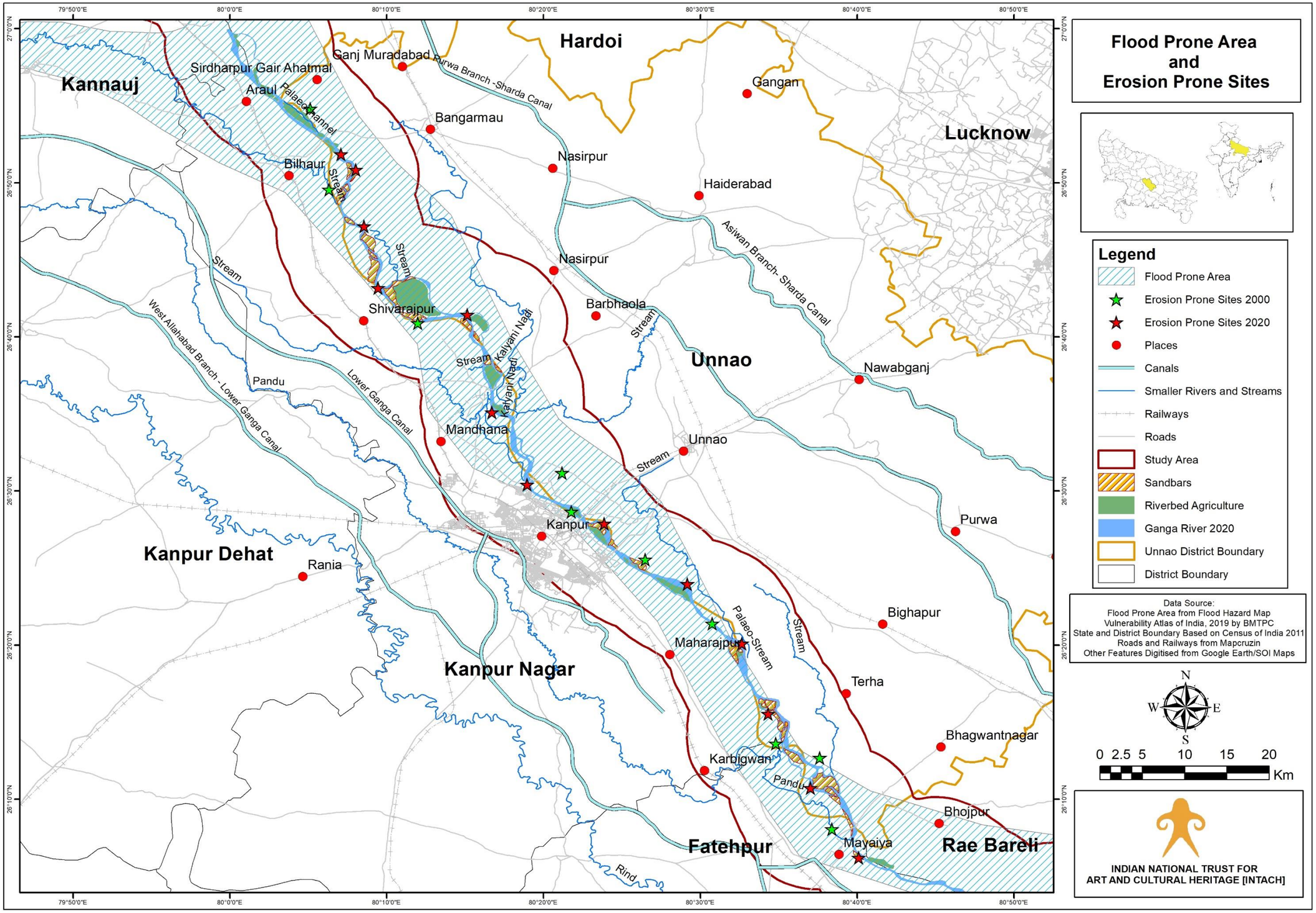
Place	Coordinates		Ground Water Table in Feet
	Lat.	Long.	
Rajwa Khera	26°27'13.61"N	80°25'2.83"E	35
Haibatpur	26°30'14.99"N	80°24'13.03"E	45
Pariyar	26°38'12.21"N	80°18'54.99"E	25
Marunda Majhwara	26°41'0.25"N	80°17'51.16"E	10
Katari Gadanpur	26°49'56.34"N	80° 8'11.36"E	15
Umariya Bhagwantpur	26°51'24.36"N	80° 8'47.87"E	15
Lakha Pur	26°27'0.85"N	80°25'30.72"E	10
Banthar	26°29'3.95"N	80°26'31.93"E	30

14.0 Ganga River Bank Erosion In Unnao 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. The Ganga River bank of study region is prone to erosion at several sites as observed from Map 8. Some erosion prone sites as observed during the field survey include near Nanamau Ghat, Baksar Ghat and Keola Khera among others [Images 33-34]. The interlocutors reiterated that severe erosion led to losses in agricultural lands and even village settlements at some places which in turn affected their livelihoods. Intensive agricultural expansion in this region leading to diminished riparian vegetation can be a chief region attributed to bald banks which are prone to erosion. Steps to control erosion were not observed much during the field survey.

Image 33 : Severe Ganga River Bank Erosion As Observed Near Keola Khera Village In Unnao Distt.

Image 34 : Ganga River Bank Erosion Near Nanamau Ghat In Unnao Distt.



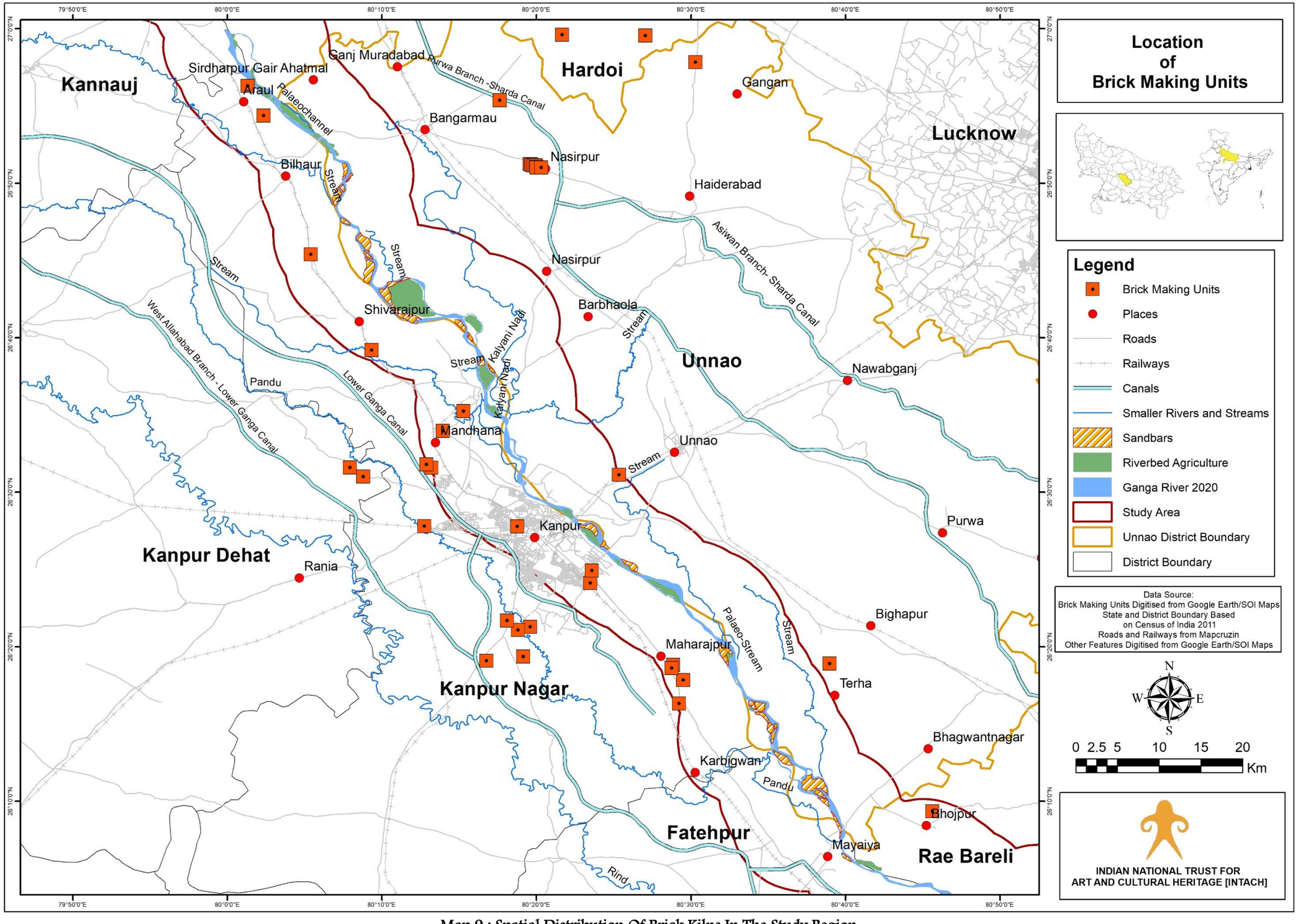
Map 8 : Spatial Distribution Of Erosion Prone Sites In Unnao Distt.

15.0 Mining And Brick Kilns In Unnao Distt.

15.1 Sand is one of the major minerals extracted from the Ganga River, especially in its middle and lower stretch. The demand is ever increasing due to rapid expansion of settlements and their upgradation across the country. According to the District Survey Report (D.S.R, 2017), mining of sand/ordinary sand from Ganga River and its tributaries is an important activity in Unnao Distt. Mining permits have been issued by concerned department at some designated sites among which one such site near Pariyar town was observed during the field survey [Image 35].

Image 35 : Sand Mining From Ganga River Near Pariyar Town In Unnao Distt.

15.2 **Brick Kilns:** An important economic activity in the Distt. is production of bricks in the brick kilns. With rapid urbanization, bricks have become an important building material for construction activities. Brick kilns in the study area provide livelihood opportunity to the local community. However, this industry has posed current and potential future threats to the soil, air, biota and water system of the region. During the field survey, very few brick kilns were observed as compared to Kanpur Distt. which is also evident from Map 9 that depicts spatial distribution of brick kilns in the study region of Unnao Distt.



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

16.0 Boatmaking And Inland Navigation In Unnao Distt.

16.1 Boats play a crucial role in the livelihood and day-to-day activities of riparian communities in the study region. Different types of boats ply on the Ganga River and its tributaries depending upon its purpose. Two major types of boats were observed in the study region – smaller hand rowed wooden boats [image 36] (with or without the use of metal) which were principally used for fishing and transporting goods/people from banks to diaras and vice-versa; & motorized boats made up of wood and metal principally used at sites such as Nanamau Ghat and Baksar Ghat especially during auspicious occasions for tourists and pilgrims. Most interlocutors reiterated that these boats were constructed with the help of 'Mistry' (carpenters) from nearby towns and cities specializing in this aspect. While Sakhua (*Shorea robusta*) is the chief wood choice in these boats, other options such as babool and mango are also explored depending upon prices and availability. The average cost of boatmaking ranges between Rs. 50,000 – Rs. 1 lakh depending upon various factors.

Image 36 : A Wooden Boat Combined With Metal Used For Fishing & Navigation To Riverine Islands

17.0 Sacred Sites In Unnao Distt.

17.1 **Baksar Ghat :** Perhaps the most important sacred site along Ganga River in Unnao Distt. is Baksar Ghat [Image 37] located close to its border with Rae Bareily and Fatehpur Distt.s. Close to this Ghat is the temple of Siddha Peet Mata Chandrika Devi which is a very popular Dham in this region. According to Jagran (2015), two deities are established in Chandrika Dham which are known as Chandika and Ambica who face towards Ganga River. This Dham has also been described in the Puranas according to which it is at this site that Medha Rishi described the greatness of Goddess Durga to King Surath and Samadhi Vaishya which became popular as 'Durga Saptapati'. Owing to its high religious significance, scores of devotees throng this site during auspicious occasions such as Navratri and Karthik Purnima among others to worship in this temple and take bath in Holy River Ganga.

Image 37 : Baksar Ghat In Unnao Distt.

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. Such activity was observed during the survey along Ganga River near Nanamau Ghat & Baksar Ghat in the study region [Image 38]. 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 38 : Cremation Activities Near Baksar Ghat In Unnao Distt.

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.

18.2 The popularity of places such as Baksar Ghat often leads to a high footfall of tourists and pilgrims which also leads to generation of solid and liquid waste. If appropriate measures are not ensured such waste may enter directly into the water of Ganga River and turn out be extremely hazardous by degrading the water quality and negatively impacting the aquatic biodiversity. Hence, it is suggested in this study to develop appropriate waste management strategies for the local communities directly linked to Ganga River.

18.3 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 Distt. to identify erosion prone and impacted sites along with developing suitable remedies for its control such as extensive plantation of trees, shrubs and grasses having strong root system to bind the soil.

18.4 The wetlands observed in the study serve as crucial resources for livelihoods and day to day needs of local residents associated with them. However, no effort has been made to ensure conservation and maintenance of these resources which has resulted in issues like sewage influx and dominance of invasive species. These wetlands if conserved properly have the potential to not only provide good fish resources, but also harbor other flora and fauna diversity, provide aesthetic benefits and clean water for various uses. Hence, it is strongly recommended to pay immediate attention for maintenance of these water bodies especially in conjunction with local stakeholders.

18.5 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 Distt. 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.

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