

Ganga Cultural Documentation

September, 2021

KANNAUJ DISTRICT



National Mission for Clean Ganga



INTACH

Indian National Trust for Art and Cultural Heritage

71, Lodhi Estate, New Delhi – 110003

Website: www.intach.org

Email: intach@intach.org

Surveyed & Authored by : Sumesh Dudani & Aditya Gopal

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

Photo Credits : Sumesh Dudani

Map Credits : Abhishek Kumar & WWF-India

Front Cover : Mehdi Ghat In Kannauj

Background : Ganga River As Seen Near Chiasar In Kannauj

Back Cover : Saccharum Sp. (Kans Grass)

Formatting And Design By : Sumesh Dudani

GANGA CULTURAL DOCUMENTATION

KANNAUJ DISTRICT

September, 2021

Sponsored by :



National Mission for Clean Ganga

Authored By :



Contents

1.0	Introduction	1
2.0	Ganga River In Kannauj.....	4
3.0	Methodology.....	6
4.0	Tributaries Of Ganga River.....	8
5.0	Land Use/Land Cover	9
6.0	Palaeochannels Of Ganga River	11
7.0	Floodplain Of River Ganga In Kannauj	13
9.0	Riparian Flora Along Ganga River In Kannauj Distt.....	35
10.0	Faunal Diversity In Kannauj Distt.	40
11.0	Ganga Riverine Islands/Diaras In Kannauj Distt.....	47
12.0	Fishing in Kannauj Distt.....	52
13.0	Groundwater In Kannauj Distt.	56
14.0	Ganga River Bank Erosion In Kannauj Distt.	58
15.0	Mining And Brick Kilns In Kannauj	61
16.0	Boatmaking and Inland Navigation.....	63
17.0	Sacred Sites And Sacred Trees In Kannauj.....	65
18.0	Key Issues and Recommendations.....	71
19.0	References	73

List of Images

Image 1	: Ganga River As Seen From Kusumkhor Bridge On 12th September, 2021	4
Image 2	: Kaali River as observed near Balidadpur on 12 th September, 2021	8
Image 3	: Bajra Cultivation In Floodplain Fields Near Chiasar Village	14
Image 4	: Maize Cultivation In Floodplain Agriculture Fields Near Sangermaukak.....	15

Image 5 : Barbed Wires Used For Fencing Floodplain Agriculture Fields As Observed Near Dariapurpatt.....	15
Image 6 : Luxuriant Growth Of <i>Saccharum spontaneum</i> (Kans) In The Study Region	16
Image 7 : <i>Saccharum bengalense</i> (Munj)	17
Image 8 : Kans Being Collected For Making Brooms	17
Image 9 : Location Of Hara Taal.....	27
Image 10 : Hara Taal As Seen On 12 th September, 2021	28
Image 11 : <i>Nymphoides hydrophilla</i> (Crested Floatingheart)	28
Image 12 : <i>Chrysopogon zizanioides</i> (Khus Grass).....	29
Image 13 : <i>Dactyloctenium aegypticum</i>	29
Image 14 : Black-Headed Ibis And Red-Naped Ibis As Seen During Field Survey At Hara Taal	30
Image 15 : Sarus Crane As Seen At Hara Taal	30
Image 16 : Location Of Satnapur Talab.....	31
Image 17 : Satnapur Talab As Seen On 13 th September 2021.....	32
Image 18 : Location Of Pranshi Talab	33
Image 19 : Pranshi Talab As Seen On 13 th September 2021.....	33
Image 20 : Riparian Forest Patch Near Ganga River In Gauri Banger Village	37
Image 21 : Riparian Vegetation Along Ganga River Between Mehdi Ghat And Durjanpur Ghat.	38
Image 22 : <i>Mimosa</i> sp.	38
Image 23 : <i>Dalbergia sissoo</i> (Shisham Tree)	39
Image 24 : <i>Cannabis sativa</i> (Bhaang)	39
Image 25 : A Rhesus Monkey As Seen In Chiasar	41
Image 26 : Pied Kingfisher.....	45
Image 27 : Red-Wattled Lapwing.....	45
Image 28 : Asian Openbill	46
Image 29 : River Lapwings	46
Image 30 : Location Of Biggest Riverine Island In Study Region	48
Image 31 : Riverine Island As Seen Near Alha Udal Killa On 12 th September 2021.....	48
Image 32 : Location Of The Irregularly Shaped Riverine Island.....	49

Image 33 : Riverine Island With Dense Growth Of Saccharum Grasses As Seen Near Katri Abdul Sakari Village On 13 th September 2021	50
Image 34 : Location Of The Group Of Irregularly Shaped Islands In Study Region	51
Image 35 : Riverine Island As Seen Near Chawan Rishi Ashram In Chiasar On 13 th September 2021	51
Image 36 : A Fishing Village As Observed Near Mehdipur Ghat In Kannauj	53
Image 37 : A Plastic Based Fishing Net Used For Catching Fish In Study Region.....	53
Image 38 : Dragnet Based Fishing From Ganga River As Observed Near Dariapurpatt In Kannauj	54
Image 39 : Wallago attu (Padhin) Caught From Ganga River In The Study Region	54
Image 40 : Hand pumps Used For Ground Water Extraction In Study Region.....	57
Image 41 : Bank Erosion As Observed Near Gauri Banger Village.....	58
Image 42 : Lateral Bank Erosion As Observed Near Mehdipur Ghat.....	59
Image 43 : A Brick Kiln As Seen During The Field Survey In Study Region.....	61
Image 44 : Use Of Boats For Transportation From Riverine Island To River Bank In Kannauj	63
Image 45 : Chawan Rishi Ashram In Chiasar	65
Image 46 : Old And Sacred Neem Tree	66
Image 47 : Sacred Peepal Tree.....	66
Image 48 : Fahrari Baba Ashram In Chiasar	67
Image 49 : Sacred Ashok Tree.....	67
Image 50 : Sacred Peepal Tree.....	67
Image 51 : An Old And Sacred Banyan Tree In Katri Jaleshar Alipur Village	68
Image 52 : Sacred Peepal Tree Associated With Kharagpur Temple.....	69
Image 53 : Old And Sacred Banyan Tree Associated With Dev Darbar Krishna Dham.....	69
Image 54 : Old And Sacred Banyan Tree Associated With Lord Shiva Temple At Mehdipur Ghat	70
Image 55 : Old And Sacred Peepal Tree At Durjanpur Ghat In Kannauj.....	70
Image 56 : Burning Of Dead Bodies Along Ganga River Near Mehdi Ghat	71

List of Tables

Table 1 : Land Use And Land Cover Details Of Kannauj Distt.	9
Table 2 : Some Floodplain Villages Along With Their Agricultural Produce In Kannauj Distt	14
Table 3 : List Of Wetlands In Study Region	18
Table 4 : List Of Birds Recorded From Hara Taal	26
Table 5 : Riparian Flora In The Study Region	36
Table 6 : Other Important Fauna Recorded In Study Region.....	42
Table 7 : List Of Birds Recorded In Study Region.....	43
Table 8 : Riverine Fish Recorded In The Study Region.....	55
Table 9 : Groundwater Levels In Different Villages As Recorded During The Survey	57

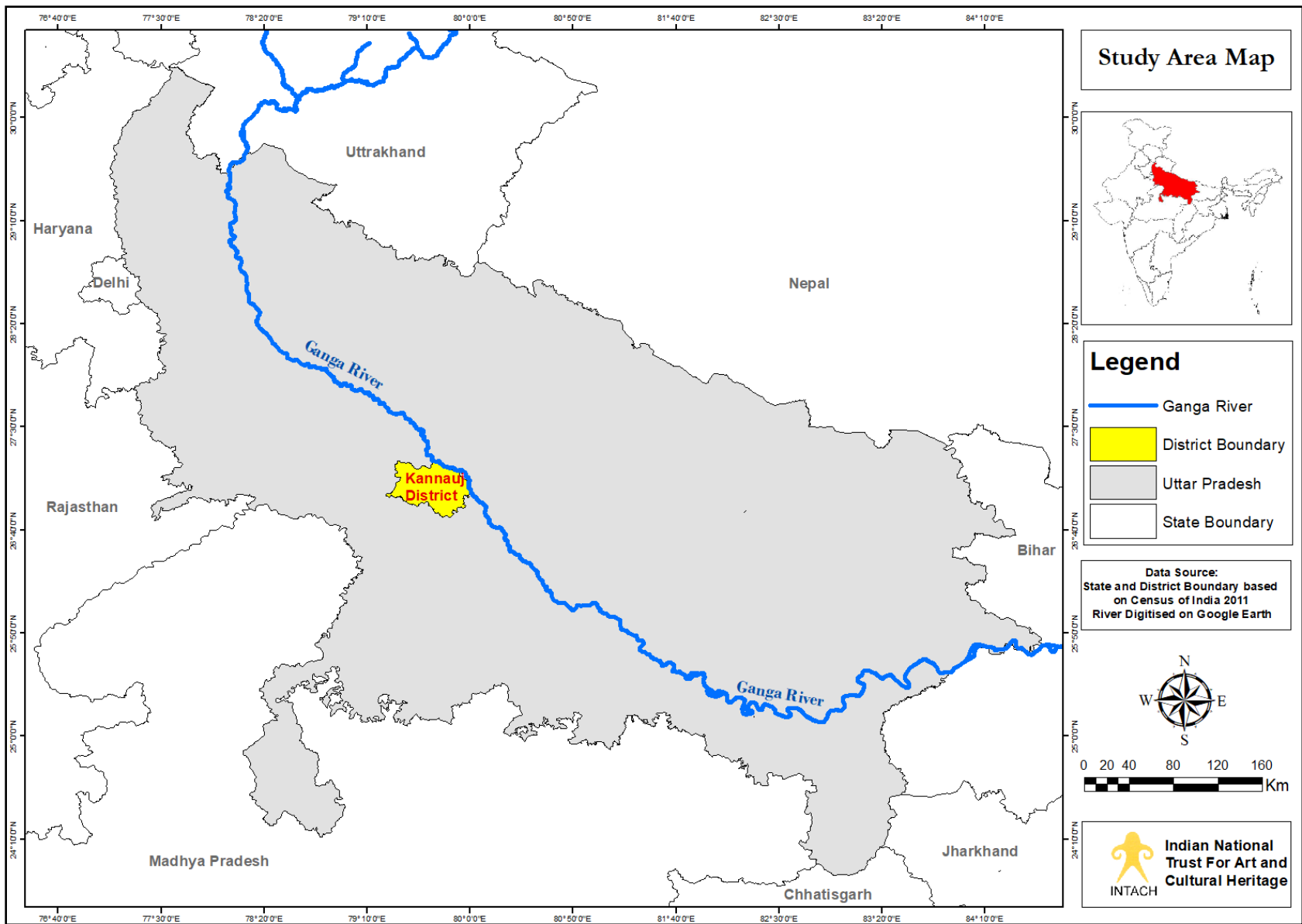
List of Maps

Map 1 : Location Of Kannauj Distt.	3
Map 2 : Spatio-Temporal Variation Of Ganga River Course In Kannauj Distt.	5
Map 3 : Study Area In Kannauj Distt.	7
Map 4 : Land Use/Land Cover Map Of Kannauj Distt.	10
Map 5 : Palaeochannels In Kannauj Distt	12
Map 6 : Spatial Distribution Of Water Bodies Within The Study Area	34
Map 7 : Erosion And Flood Prone Sites In The Study Area	60
Map 8 : Mining And Brick Kiln Sites In The Study Region	62

1.0 Introduction

- 1.1 Kannauj Distt. was carved out from the erstwhile Farrukhabad Distt. on 18 September, 1997. The Distt. is situated in Kanpur Division with its northern boundary touching Farrukhabad Distt., Hardoi Distt. on its east, Kanpur dehat at its south-east, Mainpuri touching its western border and Etawah touching its southern border. With a roughly rectangular shape [Refer Map 1] and covering a total geographical area of about 3129.2 sq. km., the Distt. is divided into three tehsils viz., Kannauj, Chibramau and Tirwa which are further subdivided into eight development blocks (Ref: <https://kannauj.nic.in/about-district/>).
- 1.2 This Distt. forms a central part of the North Indian River Plain. The cis-Ganga area exhibits a flat landscape with a few gentle undulation and slopes. The gradient of the plain is very gentle with a south-easterly gradient. The soils in the Distt. are similar to those found in Ganga alluvial plain and depending on their compositional characteristics, they can be divided into three main classes – Loam (Dumat), Clay (Matiyar) and Sand (Bhur). Overall climate of the Distt. is sub-humid with the average annual temperature of 25.5 °C and is characterized by a hot summer and general dryness except in the south-west monsoon. The average annual rainfall recorded here is 799.11 mm.
- 1.3 Kannauj is one of the most ancient places of India with a rich archaeological and cultural heritage. The ancient name of this place was ‘Kanyakubja’ or ‘Mahodaya’ as mentioned in Ramayana, Mahabharat and Puranas. According to the District Gazetteer (Neave, 1911), this place was founded by King Kushinabha who had a hundred daughters. The Hindu God of Wind – Vayu was enamored by the beauty of these ladies but when he was stopped in his advances, he cursed them to be humpbacked. Hence, this place came to be known as Kanyakubja or City of Humpback Maidens. Afterwards, this place was also known by different names such as Kushasthala, Kushika, Kusumpur, Kanogia and Kanoj but finally came to be known as Kannauj by the year 1296.

- ❖ *The Distt. prides itself as the 'city of perfumes' (attar), rose water and in tobacco which is largely sent to Kanpur and then exported to the various parts of the country and the world. The roots of the Indian perfumery lie in the past several thousand years. Vedas mention the use of juices of several herbs and flowers as offerings to God. The traditional Indian perfumery is the production of floral distillates. The Rajpur kings who ruled over these lands patronized perfumery. Later, with Mughal domination, the industry got a further boost. Kannauj today with more than 200 perfume distilleries is the largest centre of perfumery in the country. (Neave, 1911; Census of India, 2011)*
- ❖ *Over the course of years, many Ekmukhi (with one face) and Chaturmukhi (four-faced) faced shiva lingas have been found in and around Kannauj. Gauri Shankar temple is the most famous temple of Kannauj where one such Ekmukhi lingam is worshipped. The temple gets the name from the linga which bears the head of Shiva's wife Gauri. During the time of the Vardhana King Harshavardhan, one thousand priests were employed in the worship of this temple as has been recorded by Xuanzang during his travels between AD 627-643 (<https://kannauj.nic.in/>)*



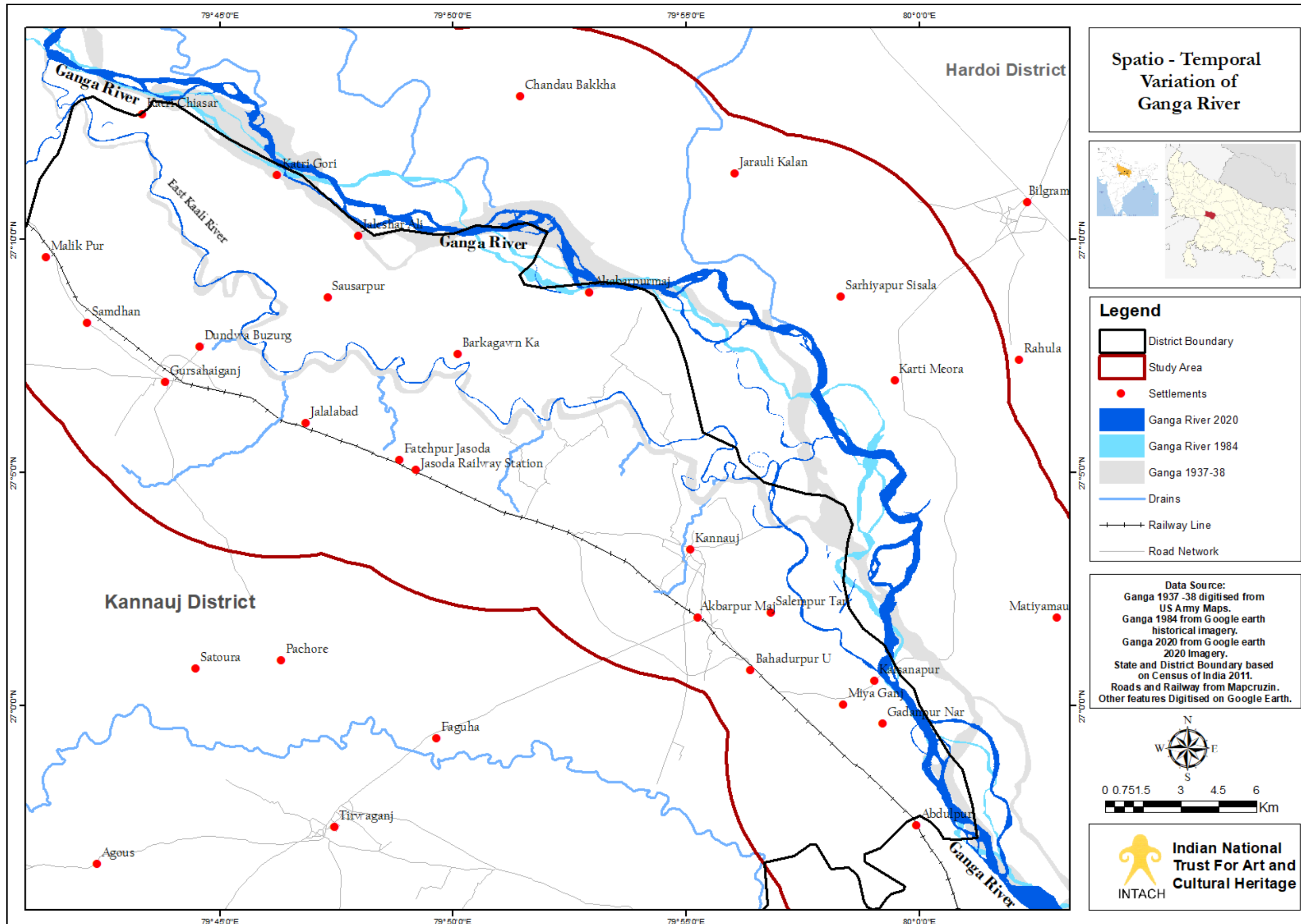
Map 1 : Location Of Kannauj Distt.

2.0 Ganga River In Kannauj

2.1 Ganga River enters Kannauj Distt. near Chiasar after exiting Farrukhabad Distt. Thereafter, it flows southwards and has a constantly changing course from side to side in this stretch. After flowing for a distance of about 49 km, it exits the Distt. near Daipur to enter Kanpur Distt. Throughout its course 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 viz. Mehdiipur Ghat bridge and a recent bridge near Kusumkhor village in Kannauj Distt. which connects Kannauj and Hardoi Distt.s. Image 1 depicts Ganga River in Kannauj as seen during field survey while Map 2 depicts the spatio-temporal variation of Ganga River in the study region.



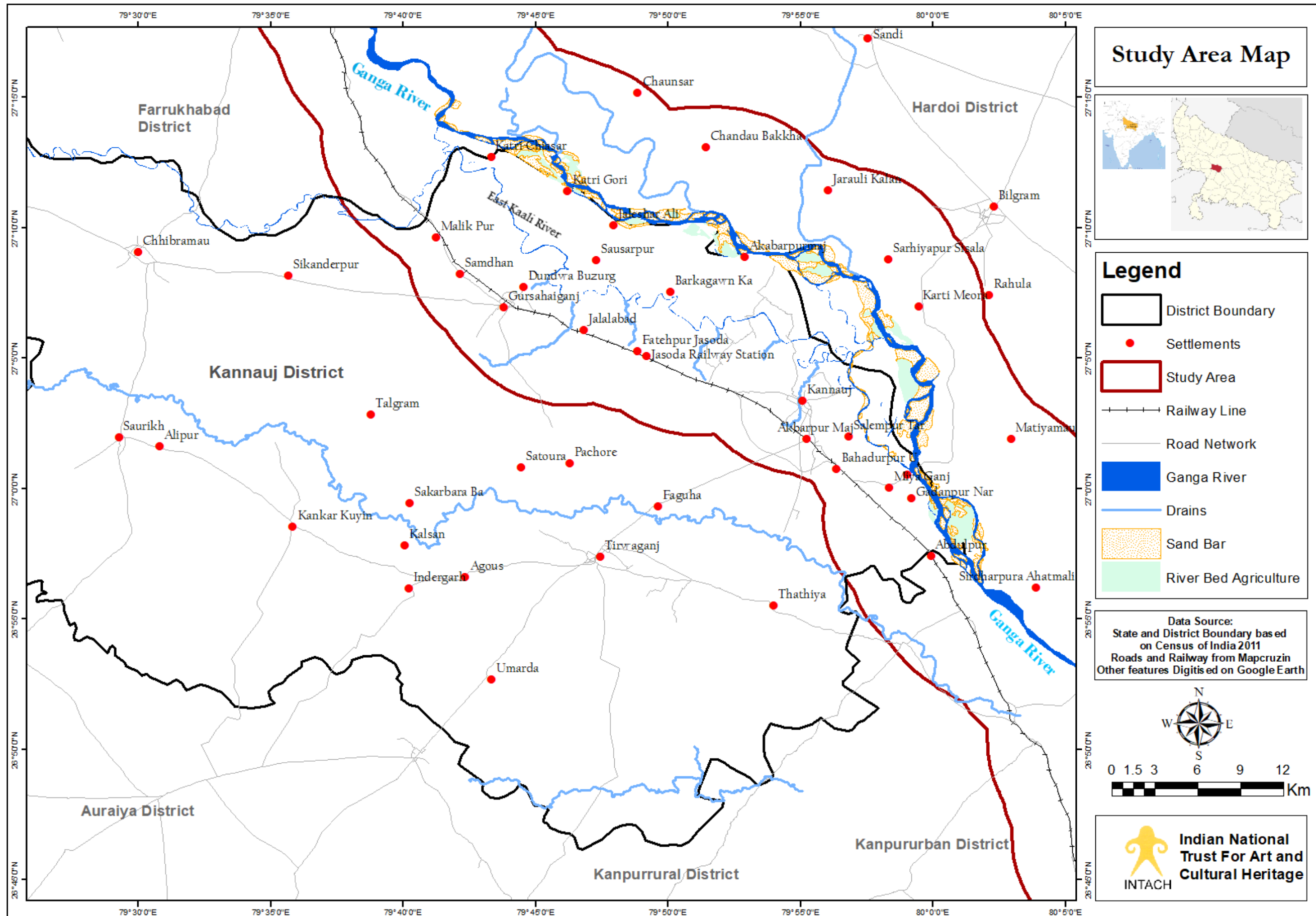
Image 1 : Ganga River As Seen From Kusumkhor Bridge On 12th September, 2021



Map 2 : Spatio-Temporal Variation Of Ganga River Course In Kannauj Distt.

3.0 Methodology

- 3.1 Ganga river flows in Kannauj Distt. for about 49 km adjoining it mostly on the right bank. Hence, for carrying out the ground survey a 7 km of buffer zone on the right bank of Ganga River was selected encompassing a total area of 460 sq.km.[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 Kannauj Distt. was carried out from 11-14 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 Kannauj Distt.

4.0 Tributaries Of Ganga River

- 4.1 **East Kaali River:** This is a major and an important tributary of Ganga River in the study region. It originates in Muzzafarnagar Distt. and traverses a distance of about 550 km passing through different Distt.s. of Uttar Pradesh state such as Meerut, Hapur, Khurja, Bulandshahar, Aligarh, Farrukhabad before entering Kannauj. It then flows in the study region almost parallel to Ganga River [Refer Map 2] making various loops and turns in its course before its confluence with Ganga near Kannauj town. The river was observed during the field survey near Balidadpur village in Kannauj Distt. [Image 2]. The river was filled up with water owing to the monsoon season which was beneficial for irrigating the agricultural fields adjoining in its course. During non-monsoon season, this river carries most of domestic sewage and industrial effluents from major settlements such as Meerut, Hapur and Bulandshahar in its upstream (Seth, 2012). Fishing activities in this river were not observed from the sites surveyed in study region.



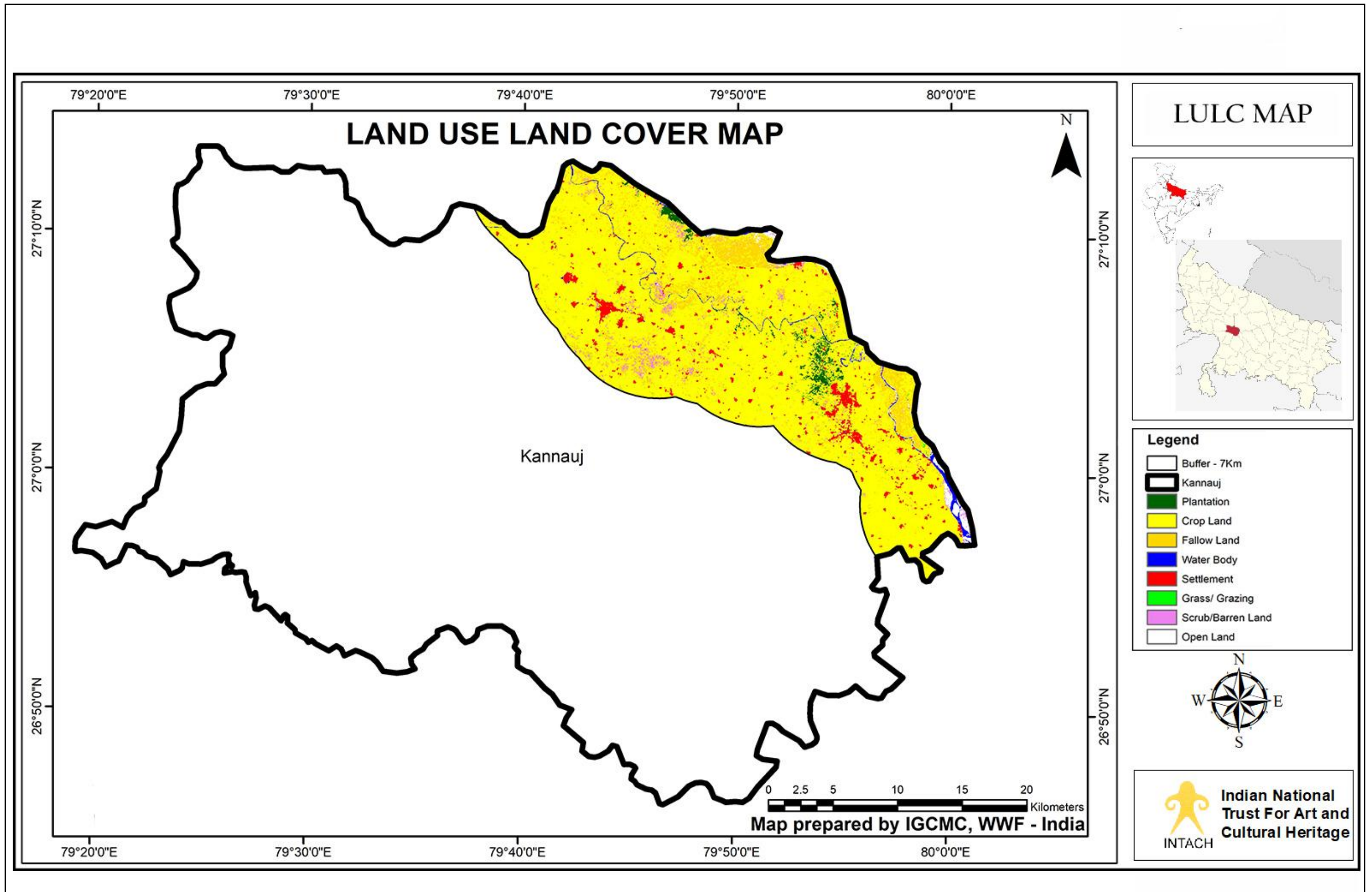
Image 2 : East Kaali River as observed near Balidadpur on 12th September, 2021

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 – plantation, crop land, fallow land, water body, settlement, grass/grazing, scrub/barren land and open land. Agriculture being a principal source of income for residents of Kannauj Distt., the crop land & fallow land categories together dominated landscape of study region. The details of these classes in terms of area are presented in Table 1 and the land use of the Distt. is depicted in Map 4.

Table 1 : Land Use And Land Cover Details Of Kannauj Distt.

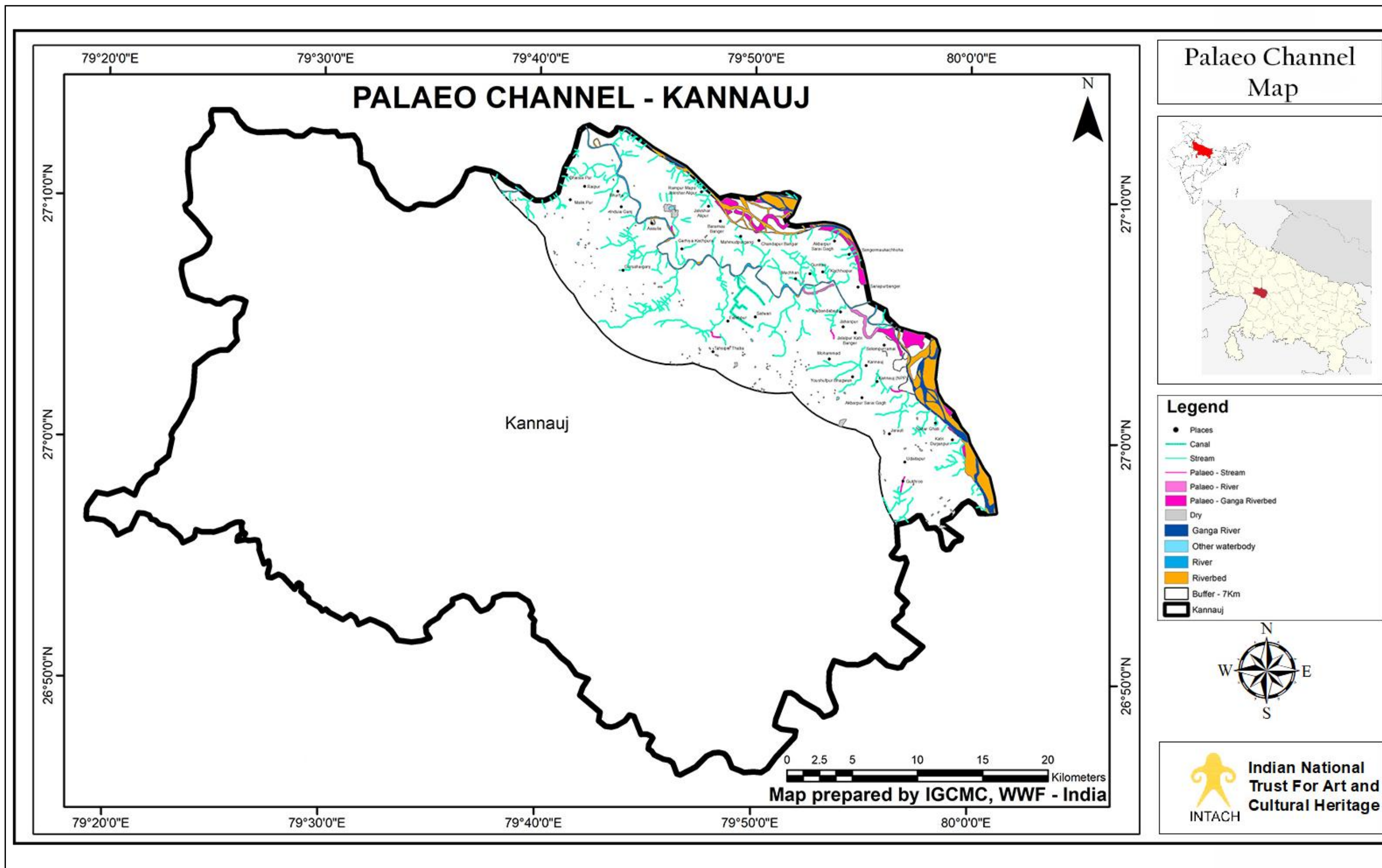
KANNAUJ			
Class Name	Area (Ha)	Area (Sq. Km)	Area (%)
Plantation	659.700	6.597	1.436
Crop Land	35756.600	357.566	77.822
Fallow land	5490.900	54.909	11.951
Water body	582.120	5.821	1.267
Settlement	1722.690	17.227	3.749
Grass/Grazing	116.550	1.166	0.254
Scrub/Barren land	800.370	8.004	1.742
Open land	818.010	8.180	1.780
Total	45946.940	459.469	100



Map 4 : Land Use/Land Cover Map Of Kannauj 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 5 was prepared which depicts the various paleochannels in the study region of Kannauj Distt.



Map 5 : Palaeochannels In Kannauj Distt

7.0 Floodplain Of River Ganga In Kannauj

- 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 Kannauj Distt. falls in the UP-4 Central Plain Zone with the major soils being deep loamy soil and deep silty soil (NICRA-ICAR, 2014). Agriculture, the chief source of income for majority of the residents of this Distt., is benefitted by the fertile alluvium brought by Ganga River. The Ganga floodplain in study region of Kannauj Distt. is 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, *bajra*, mustard, *arhar* and *chana*. Along with this, the fertile floodplains were also utilized for cultivation of vegetables such as potato and *parwal*. Table 2 provides details about floodplain crops as recorded in different villages of study region while Images 3-4 depict some floodplain agricultural plantations.
- 7.3 Most of the interlocutors during the survey stressed on 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 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 such as barbed wires [Image 5] 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 Kannauj Distt

Sr. No.	Village Name	Agricultural Produce
1.	Chiasar	Wheat, Maize, Bajra, Mustard
2.	Ambarpur	Wheat, Maize, Peanuts, Potato
3.	Khargapur	Wheat, Maize, Potato, Moong
4.	Sangermaukak	Wheat, Maize, Bajra, potato
5.	Dariapurpatt	Wheat, Bajra, Potato, Mustard
6.	Daipur	Wheat, Maize, Parwal, Potato



Image 3 : Bajra Cultivation In Floodplain Fields Near Chiasar Village



Image 4 : Maize Cultivation In Floodplain Agriculture Fields Near Sangermaukak



Image 5 : Barbed Wires Used For Fencing Floodplain Agriculture Fields As Observed Near Dariapurpatt

7.4 **Floodplain Grasses:** The floodplain of Ganga River 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 6-7]. 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. Apart from this, the dried *Saccharum* grasses were also used for making brooms [Image 8] 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 6 : Luxuriant Growth Of *Saccharum spontaneum* (Kans) In The Study Region



Image 7 : *Saccharum bengalense* (Munj)



Image 8 : *Kans* Being Collected For Making Brooms

8.0 Wetlands In Kannauj 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 6. Some important wetlands as observed during the field survey are discussed in this section.

Table 3 : List Of Wetlands In Study Region

Sr. No.	Wetland	Coordinates		Area [Hectares]
		Latitude	Longitude	
01	01	26°58'28.33"N	79°56'8.55"E	1.67
02	02	26°57'49.55"N	79°57'26.69"E	2.10
03	03	27° 4'36.82"N	79°51'26.86"E	0.32
04	04	27° 3'15.80"N	79°49'54.54"E	0.20
05	05	26°57'14.32"N	79°57'49.27"E	0.31
06	06	26°57'23.08"N	79°57'57.26"E	0.48
07	07	26°57'2.54"N	79°58'20.57"E	2.67
08	08	27° 3'13.71"N	79°49'57.80"E	0.24
09	09	26°57'10.20"N	79°58'38.63"E	0.97
10	10	26°57'45.60"N	79°58'2.63"E	0.27
11	11	27° 3'6.94"N	79°50'3.82"E	0.74
12	12	26°57'46.31"N	79°58'46.07"E	0.96
13	13	26°58'13.38"N	79°58'54.47"E	0.58
14	14	26°58'12.52"N	79°58'58.69"E	0.23
15	15	26°58'10.52"N	79°57'38.13"E	0.37
16	16	26°58'17.67"N	79°57'26.84"E	0.63

17	17	26°58'37.97"N	79°56'57.04"E	0.24
18	18	26°58'41.90"N	79°57'0.81"E	0.33
19	19	26°58'38.67"N	79°57'4.27"E	0.22
20	20	26°58'49.18"N	79°56'50.44"E	0.30
21	21	26°59'22.07"N	79°57'2.79"E	0.32
22	22	26°59'13.28"N	79°57'5.98"E	0.23
23	23	26°58'58.04"N	79°57'47.74"E	0.72
24	24	26°59'6.09"N	79°57'58.19"E	0.33
25	Satnapur Talab	26°59'43.23"N	79°57'47.61"E	1.18
26	26	26°59'52.53"N	79°57'38.71"E	0.88
27	27	26°59'55.16"N	79°58'30.34"E	0.78
28	28	27° 0'4.21"N	79°58'15.21"E	0.20
29	29	27° 0'0.36"N	79°58'36.02"E	0.23
30	30	27° 0'1.72"N	79°58'27.01"E	0.28
31	Pranshi Talab	26°59'37.25"N	79°59'6.94"E	0.78
32	32	27° 1'1.63"N	79°57'35.66"E	1.46
33	33	27° 0'25.76"N	79°56'5.32"E	0.40
34	34	27° 0'32.40"N	79°55'59.31"E	0.40
35	35	27° 0'11.10"N	79°55'42.57"E	0.61
36	36	26°59'58.32"N	79°55'58.75"E	0.58
37	37	26°59'49.63"N	79°55'56.10"E	0.49
38	38	27° 0'43.25"N	79°55'34.74"E	0.64
39	39	27° 0'38.70"N	79°55'34.40"E	0.53
40	40	27° 1'36.36"N	79°56'1.80"E	0.86

41	41	27° 1'42.10"N	79°55'44.31"E	0.47
42	42	27° 1'39.13"N	79°55'27.30"E	0.67
43	43	27° 1'49.38"N	79°55'14.27"E	0.57
44	44	27° 1'51.48"N	79°55'7.43"E	1.50
45	45	27° 2'13.59"N	79°54'57.44"E	0.96
46	46	27° 3'23.77"N	79°55'22.29"E	0.35
47	47	27° 4'28.22"N	79°55'32.07"E	0.41
48	48	27° 1'41.65"N	79°53'0.52"E	0.88
49	49	27° 1'3.56"N	79°53'25.83"E	0.57
50	50	27° 1'30.88"N	79°52'56.48"E	1.34
51	51	27° 1'30.53"N	79°52'46.83"E	1.00
52	52	27° 2'31.47"N	79°52'15.78"E	0.85
53	53	27° 2'25.79"N	79°51'56.06"E	0.99
54	54	27° 2'35.96"N	79°51'42.17"E	1.26
55	55	27° 2'31.17"N	79°51'37.37"E	0.19
56	56	27° 3'14.13"N	79°52'30.91"E	0.74
57	57	27° 3'15.33"N	79°52'11.36"E	0.46
58	58	27° 3'27.12"N	79°52'9.31"E	0.33
59	59	27° 3'22.26"N	79°51'54.08"E	0.74
60	60	27° 3'22.26"N	27° 3'22.26"N	0.24
61	61	27° 2'59.73"N	79°51'43.41"E	1.45
62	62	27° 2'53.64"N	79°51'38.65"E	0.47
63	63	27° 2'52.04"N	79°51'44.51"E	0.24
64	64	27° 2'51.21"N	79°51'40.15"E	0.10
65	65	27° 2'50.78"N	79°51'9.77"E	0.13

66	66	27° 2'56.53"N	79°51'9.10"E	0.10
67	67	27° 2'56.46"N	79°51'4.59"E	0.40
68	68	27° 2'57.92"N	79°51'4.80"E	0.10
69	69	27° 2'44.62"N	79°51'10.95"E	0.10
70	70	27° 3'6.12"N	79°50'35.77"E	1.44
71	71	27° 3'2.38"N	79°50'36.50"E	0.10
72	72	27° 3'1.55"N	79°50'38.82"E	0.25
73	73	27° 3'3.59"N	79°50'43.69"E	0.23
74	74	27° 3'9.49"N	79°50'43.86"E	0.36
75	75	27° 2'54.72"N	79°50'43.33"E	0.23
76	76	27° 3'37.09"N	79°50'54.44"E	0.61
77	77	27° 4'1.26"N	79°50'6.18"E	0.75
78	78	27° 4'3.89"N	79°50'4.12"E	0.10
79	79	27° 4'12.15"N	79°49'56.54"E	1.80
80	80	27° 3'55.97"N	79°49'46.66"E	0.44
81	81	27° 4'0.71"N	79°49'53.33"E	0.13
82	82	27° 3'35.33"N	79°49'29.20"E	0.83
83	83	79°49'32.70"E	79°49'32.70"E	0.31
84	84	27° 3'9.50"N	79°49'12.52"E	1.18
85	85	27° 3'5.00"N	79°49'3.78"E	0.45
86	86	27° 2'41.47"N	79°48'43.07"E	0.14
87	87	27° 2'33.56"N	79°49'8.36"E	0.22
88	88	79°49'16.57"E	27° 2'33.64"N	0.22
89	89	27° 2'14.66"N	79°49'50.04"E	0.70
90	90	27° 2'7.30"N	79°50'10.65"E	0.54

91	91	27° 2'6.57"N	79°50'23.82"E	5.56
92	92	27° 2'16.68"N	79°51'13.83"E	0.10
93	93	27° 2'14.36"N	79°51'16.95"E	0.13
94	94	27° 3'5.11"N	79°52'26.80"E	0.36
95	95	27° 3'10.37"N	79°52'23.99"E	0.43
96	96	27° 3'47.10"N	79°52'27.95"E	0.43
97	97	27° 3'52.20"N	79°52'25.46"E	0.1
98	98	27° 3'51.29"N	79°52'37.73"E	0.88
99	99	27° 3'43.52"N	79°52'39.14"E	0.11
100	100	27° 4'4.06"N	79°52'33.58"E	0.33
101	101	27° 4'10.51"N	79°52'34.19"E	0.17
102	102	27° 4'36.25"N	79°53'57.39"E	0.37
103	103	27° 5'56.44"N	79°51'38.31"E	0.57
104	104	27° 5'17.38"N	79°50'17.99"E	1.12
105	105	27° 5'4.38"N	79°48'48.28"E	1.10
106	106	27° 4'23.82"N	79°49'6.40"E	1.46
107	107	27° 4'4.38"N	79°48'37.42"E	0.19
108	108	27° 3'29.19"N	79°46'55.64"E	1.34
109	109	27° 3'33.56"N	79°47'0.60"E	0.62
110	110	27° 3'55.57"N	79°45'18.62"E	0.62
111	111	27° 4'24.80"N	79°44'32.26"E	0.34
112	112	27° 5'56.64"N	79°43'24.93"E	0.67
113	113	27° 6'7.27"N	79°44'50.83"E	1.10
114	114	27° 6'27.86"N	79°44'52.48"E	0.56
115	115	27° 6'31.91"N	79°45'23.76"E	1.41

116	116	27° 6'23.97"N	79°45'35.52"E	3.00
117	117	27° 6'33.64"N	79°45'33.89"E	0.36
118	118	27° 6'31.22"N	79°45'37.21"E	0.24
119	119	27° 7'33.43"N	79°43'19.23"E	0.71
120	120	27° 7'31.50"N	79°43'27.11"E	0.34
121	121	27° 7'10.34"N	79°42'34.45"E	1.12
122	122	27° 7'1.66"N	79°42'24.08"E	0.61
123	123	27° 6'59.19"N	79°42'32.56"E	0.40
124	124	27° 7'5.90"N	79°42'5.99"E	0.35
125	125	27° 7'0.29"N	79°42'9.44"E	0.44
126	126	27° 7'9.75"N	79°42'26.29"E	0.53
127	127	27° 7'12.06"N	79°42'18.53"E	0.32
128	128	27° 7'22.82"N	79°42'26.25"E	0.19
129	129	27° 8'1.00"N	79°42'6.81"E	1.91
130	130	27° 8'9.84"N	79°41'49.88"E	3.32
131	131	27° 8'21.21"N	79°41'58.84"E	0.32
132	132	27° 8'23.18"N	79°42'2.31"E	0.29
133	133	27° 8'10.55"N	79°42'18.61"E	0.99
134	134	27° 8'46.33"N	79°42'14.29"E	0.45
135	135	27° 8'38.54"N	79°43'15.92"E	0.18
136	136	27° 9'17.73"N	79°40'17.95"E	0.33
137	137	27° 9'23.26"N	79°40'20.57"E	0.46
138	138	27° 9'58.84"N	79°38'51.00"E	0.21
139	139	27° 10'45.92"N	79°43'25.47"E	0.42
140	140	79°45'29.79"E	79°45'29.79"E	0.82

141	141	26°56'39.71"N	79°58'5.56"E	2.55
141	141	26°56'45.38"N	79°58'5.96"E	1.00
142	142	79°41'28.93"E	79°41'28.93"E	0.55
143	143	27° 6'46.58"N	79°41'33.58"E	0.67
144	144	27° 6'37.64"N	79°42'5.13"E	0.28
145	145	27° 5'32.81"N	79°43'25.65"E	0.97
146	146	27° 5'25.66"N	79°43'32.85"E	0.77
147	147	27° 5'22.21"N	79°43'22.62"E	0.94
148	148	27° 4'34.66"N	79°43'14.66"E	0.57
149	149	27° 2'26.61"N	79°52'58.28"E	1.48
150	150	27° 2'34.00"N	79°52'49.09"E	0.40
151	151	27° 6'5.85"N	79°49'59.06"E	1.93
152	152	27° 6'22.03"N	79°49'32.49"E	0.57
153	153	27°11'24.45"N	79°42'51.89"E	2.15
154	154	27°11'38.33"N	79°43'20.61"E	0.45
155	155	27°11'34.84"N	79°43'21.64"E	0.39
156	156	27° 4'15.57"N	79°52'0.09"E	0.79
157	157	79°52'5.81"E	79°52'5.81"E	0.24
158	158	27° 4'13.74"N	79°51'55.14"E	0.28
159	159	27° 6'19.93"N	79°52'34.59"E	1.24
160	160	27° 6'39.87"N	79°52'32.00"E	0.66
161	161	27° 7'47.58"N	79°40'42.79"E	2.66
162	162	27°10'51.52"N	79°45'34.25"E	0.55
163	163	27° 8'45.97"N	79°47'26.89"E	0.58
164	164	27° 8'42.42"N	79°47'22.39"E	0.34

165	165	27° 8'31.28"N	79°47'42.41"E	3.64
166	166	27° 6'42.41"N	79°53'9.11"E	0.55
167	167	27° 7'4.45"N	79°56'1.58"E	1.10
168	168	27° 6'57.95"N	79°56'55.39"E	1.73
169	169	27° 3'39.26"N	79° 6'57.95"E	0.67
170	170	27° 3'12.53"N	79°56'17.28"E	2.21
171	171	27° 0'57.96"N	79°54'12.79"E	0.58
172	172	27° 0'51.55"N	79°54'2.65"E	0.50
173	173	26°56'36.32"N	79°58'44.20"E	1.00
174	174	79°53'54.12"E	79°53'54.12"E	1.24
175	175	27° 2'5.92"N	79°54'12.37"E	2.1
176	176	27° 1'42.63"N	79°54'37.19"E	0.58
177	177	27° 0'1.33"N	79°58'1.26"E	0.88
178	178	27° 0'13.46"N	79°56'55.89"E	0.46
179	179	27° 0'28.74"N	79°56'2.94"E	1.31
180	180	27° 1'2.43"N	79°56'22.99"E	0.51
181	181	26°59'50.25"N	79°56'4.28"E	0.41
182	182	27° 9'28.48"N	79°43'12.44"E	0.83
183	Hara Taal	27° 9'39.22"N	79°46'3.45"E	24.6
Total Area [Hectares]				160.66

- 8.2 **Hara Taal:** Based on the information from interlocutors during field survey in Kannauj Distt., a freshwater marshy wetland known locally as ‘Hara Taal’ (meaning green wetland) was located near Ismailpur Digan village [Images 9-10]. This wetland was spread in an area of about 24.6 ha and was covered with different species of grasses such as *Chrysopogon zizanioides*, *Saccharum spontaneum* and *Cyperus* sps. along with plants such as *Nymphoides hydrophilla*, *Hydrilla* sp., *Zizyphus* sp. and *Croton bonplandianus*. Among these plants, *Chrysopogon zizanioides* (popularly known as ‘*Khus*’ grass) is a densely tufted grass that was found luxuriant in this marshy wetland. This species is well known for its medicinal purposes as well as in perfumery industry. Some plant species recorded from this wetland are depicted in Images 11-13. The rich grass resource in and around this wetland serves as an important source of fodder for cattle reared by the villagers.
- 8.3 Besides harboring rich plant diversity, this wetland was found to be an important habitat of birds which was evident from the 18 different species recorded during the survey. Among these, four species – *Sterna aurantia* (River tern), *Grus Antigone* (Sarus crane), *Threskiornis melanocephalus* (Black-headed Ibis) and *Vanellus duvaucelii* (River lapwing) feature in the RET category of IUCN Red List. The complete list of birds recorded from Hara Taal is presented in Table 4 while Images 14-15 depict some important birds as sighted during the survey. This *Taal* is connected with Kaali River which flows close by and receives water mainly during the monsoon season. Interlocutors claimed that the residents here do not disturb or harm the birds visiting this wetland.

Table 4 : List Of Birds Recorded From Hara Taal

Sr. No.	Common Name	Scientific Name	IUCN Status
1.	Little Egret	<i>Egretta garzetta</i>	Least Concern
2.	Cattle Egret	<i>Bubulcus ibis</i>	Least Concern
3.	Great Egret	<i>Ardea alba</i>	Least Concern
4.	Grey Heron	<i>Ardea cinerea</i>	Least Concern
5.	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Least Concern
6.	Common Sandpiper	<i>Actitis hypoleucos</i>	Least Concern
7.	Asian Openbill	<i>Anastomus oscitans</i>	Least Concern
8.	Little Cormorant	<i>Microcarbo niger</i>	Least Concern

9.	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	Least Concern
10.	Little Ringed Plover	<i>Charadrius dubius</i>	Least Concern
11.	Eurasian Coot	<i>Fulica atra</i>	Least Concern
12.	Bronze Winged Jacana	<i>Metopidius indicus</i>	Least Concern
13.	River Tern	<i>Sterna aurantia</i>	Vulnerable
14.	Sarus Crane	<i>Grus antigone</i>	Vulnerable
15.	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	Near Threatened
16.	Red-naped Ibis	<i>Pseudibis papillosa</i>	Least Concern
17.	Black-winged Stilt	<i>Himantopus himantopus</i>	Least Concern
18.	River Lapwing	<i>Vanellus duvaucelii</i>	Near Threatened



Image 9 : Location Of Hara Taal [27° 9'39.22"N , 79°46'3.45"E]



Image 10 : Hara Taal As Seen On 12th September, 2021



Image 11 : *Nymphoides hydrophilla* (Crested Floatingheart)



Image 12 : *Chrysopogon zizanioides* (Khus Grass)



Image 13 : *Dactyloctenium aegypticum*



Image 14 : Black-Headed Ibis And Red-Naped Ibis As Seen During Field Survey At Hara Taal



Image 15 : Sarus Crane As Seen At Hara Taal

8.3 **Satnapur Talab:** A freshwater pond was observed near Manimau-Mehdi Ghat Road during the field survey [Image 16] which was referred by local residents as ‘Satnapur Talab’. With a roughly elongated shape covering an area of about 1.18 ha, this water body was believed to be larger than its present size but had gradually fallen prey to agriculture and residential expansions around it [Image 17]. The interlocutors reiterated that this pond remains filled with water throughout the year and is mainly used for fish rearing and sometimes growing water chestnuts. Major fish caught from this pond include – Rohu, China and Sidhari. Apart from this, the water here is also employed for bathing cattle, washing clothes and other domestic purposes. The interlocutors emphasized on the need for better management for this and other such water bodies in the region.



Image 16 : Location Of Satnapur Talab [26°59'43.23"N , 79°57'47.61"E]



Image 17 : Satnapur Talab As Seen On 13thSeptember 2021

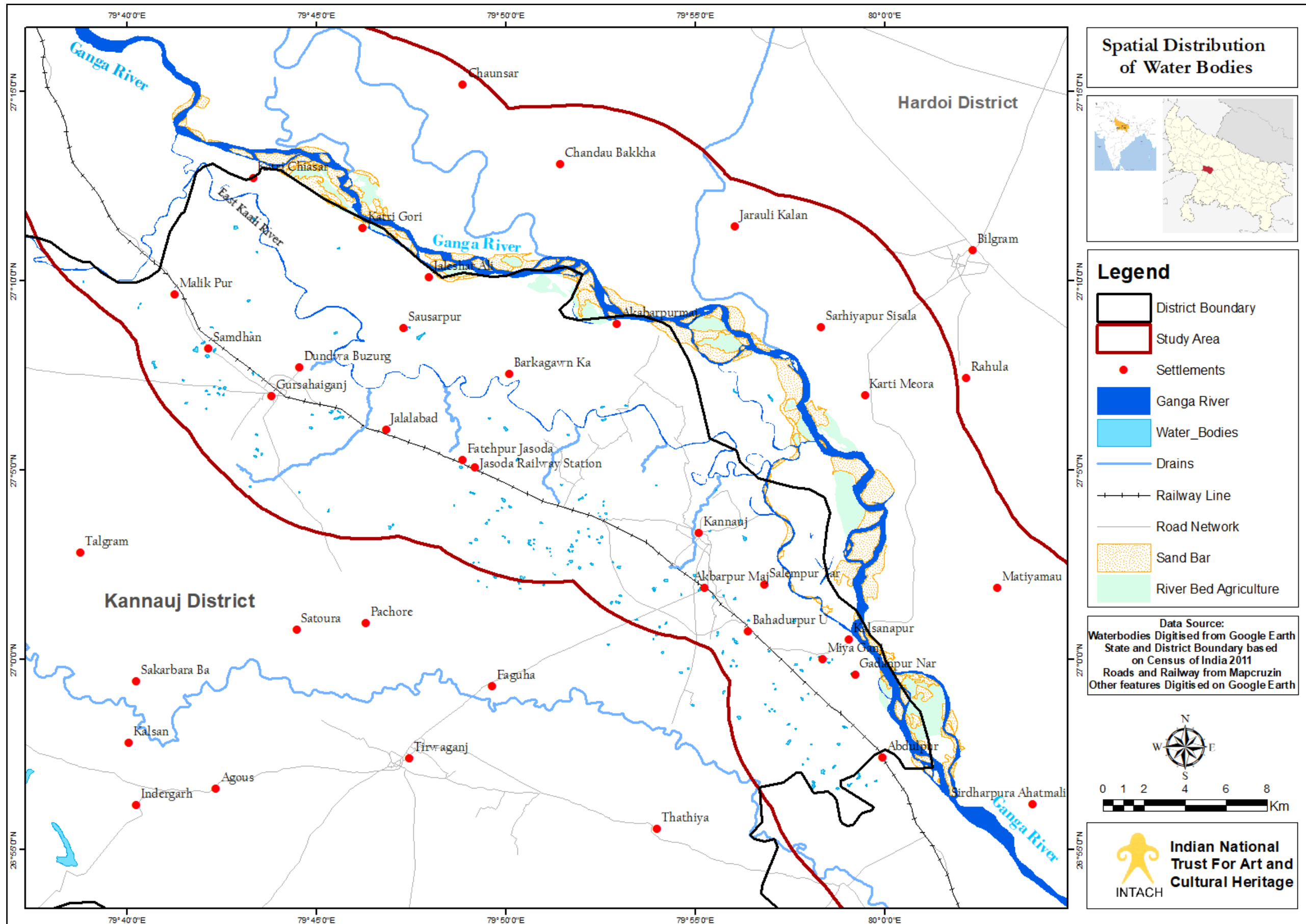
- 8.3 **Pranshi Talab:** Another freshwater pond covering an area of about 0.78 ha was observed in Sayyadpur Sakri village during the field survey [Image 18] which was referred by local residents as ‘Pranshi Talab’. Once an important source of water for the local residents, this pond has fallen prey to encroachments and waste dumping including sewage and solid waste [Image 19]. The interlocutors cited lack of attention and mismanagement as the key reasons for the current condition of this water body. The fish rearing in this pond had stopped since last two decades as reiterated during the interactions.



Image 18 : Location Of Pranshi Talab [26°59'37.25"N , 79°59'6.94"E]



Image 19 : Pranshi Talab As Seen On 13th September 2021



Map 6 : Spatial Distribution Of Water Bodies Within The Study Area

9.0 Riparian Flora Along Ganga River In Kannauj 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], Krishnamurti [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. An important study by 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 study area in Kannauj Distt. has rich riparian vegetation as seen during the field survey with some forest like patches occurring near the river [Images 20-21]. A total of 32 different plant species were recorded which included 12 tree species, 7 shrub species, 8 species of herbaceous plants and 5 species of grasses. The canopy in this vegetation was formed by trees such as Peepal, Bargad, Neem, Shisham and Jamun while the shrubs were mainly dominated by *Lantana* sp., *Ipomoea* sp. and *Zizyphus* sp. The ground flora in riparian vegetation had luxuriant growth of grasses with *Saccharum* sps. dominating the landscape in most parts. The riparian flora diversity recorded from study region is presented in Table 5 while Images 22-24 depict some representative plant species.

Table 5 : Riparian Flora In The Study Region

Sr. No.	Botanical Name	Common Name	Family	Habit
1.	<i>Acacia nilotica</i> (L.) Delile	Babool	Fabaceae	Tree
2.	<i>Azadirachta indica</i> A. Juss.	Neem	Meliaceae	Tree
3.	<i>Bombax ceiba</i> L.	Semal	Bombacaceae	Tree
4.	<i>Borassus flabellifer</i> L.	Taad	Arecaceae	Tree
5.	<i>Dalbergia sissoo</i> Roxb. ex DC.	Shisham	Fabaceae	Tree
6.	<i>Eucalyptus</i> sp.	Nilgiri		Tree
7.	<i>Ficus benghalensis</i> L.	Banyan tree/Bargad	Moraceae	Tree
8.	<i>Ficus religiosa</i> L.	Peepal	Moraceae	Tree
9.	<i>Mangifera indica</i> L.	Aam	Anacardiaceae	Tree
10.	<i>Phoenix dactylifera</i> L.	Khajur	Arecaceae	Tree
11.	<i>Syzygium cumini</i> (L.) Skeels	Jamun	Myrtaceae	Tree
12.	<i>Tectona grandis</i> L.f.	Teak/Saagwan	Lamiaceae	Tree
13.	<i>Calotropis procera</i> (L.) Dryand.	Aak	Apocynaceae	Shrub
14.	<i>Ipomoea carnea</i> Jacq.	Bush Morning Glory	Convolvulaceae	Shrub
15.	<i>Lantana camara</i> L.	Lantana	Verbenaceae	Shrub
16.	<i>Mimosa</i> sp.		Fabaceae	Shrub
17.	<i>Pedaliium murex</i> L.	Gokharu	Pedaliaceae	Shrub
18.	<i>Polygonum glabrum</i> Willd.		Polygonaceae	Shrub
19.	<i>Zizyphus</i> sp.	Wild ber	Rhamnaceae	Shrub
20.	<i>Cannabis sativa</i> L.	Bhaang/Ganja	Cannabaceae	Herb
21.	<i>Commelina benghalensis</i> L.		Commelinaceae	Herb
22.	<i>Croton bonplandianus</i> Baill.	Ban Tulsi	Euphorbiaceae	Herb
23.	<i>Euphorbia hirta</i> L.	Asthma weed	Euphorbiaceae	Herb
24.	<i>Ocimum</i> sp.	Wild Tulsi	Lamiaceae	Herb
25.	<i>Parthenium hysterophorus</i> L.	Congress grass	Asteraceae	Herb
26.	<i>Persicaria</i> sp.	Smartweed	Polygonaceae	Herb

27.	<i>Xanthium strumarium</i> L.		Asteraceae	Herb
28.	<i>Cynodon dactylon</i> (L.) Pers.	Dhoob/Durva grass	Poaceae	Grass
29.	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Crowfoot grass	Poaceae	Grass
30.	<i>Saccharum spontaneum</i> L.	Kans/Katha	Poaceae	Grass
31.	<i>Saccharum bengalense</i> Retz.	Munj	Poaceae	Grass
32.	<i>Bambusa bambos</i> (L.) Voss	Indian thorny bamboo	Poaceae	Bamboo Grass



Image 20 : Riparian Forest Patch Near Ganga River In Gauri Banger Village



Image 21 : Riparian Vegetation Along Ganga River Between Mehdi Ghat And Durjanpur Ghat



Image 22 : *Mimosa* sp.



Image 23 : *Dalbergia sissoo* (Shisham Tree)



Image 24 : *Cannabis sativa* (Bhaang)

10.0 Faunal Diversity In Kannauj Distt.

- 10.1 **Gangetic Dolphins:** The Gangetic River Dolphin is exclusively aquatic and piscivorous, 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 (*Nilssonina 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.
- 10.5 **Rhesus Monkey:** The rhesus monkey (*Macaca mulatta*)[Image 25] was found widely distributed in the study area. Their population has increased in the last couple of years as reiterated by the interlocutors and so have the cases of human-monkey conflicts in the region. These monkeys have attacked local residents in the villages surveyed along Ganga River numerous times due to which there is a growing concern among them.



Image 25 : A Rhesus Monkey As Seen In Chiasar

10.6 **Other fauna:** Based on visual observations during field survey and interactions with the interlocutors some major fauna species recorded from study region in Kannauj Distt. is presented in Table 6.

Table 6 : Other Important Fauna Recorded In Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	Indian Roofed Turtle	<i>Pangshura tecta</i>	Vulnerable
2.	Golden Jackal	<i>Canis aureus</i>	Least Concern
3.	Bengal Monitor Lizard	<i>Varanus bengalensis</i>	Near Threatened
4.	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	Least Concern
5.	Danaid Eggfly (Butterfly)	<i>Hypolimnas misippus</i>	Least Concern
6.	Grey Pansy (Butterfly)	<i>Junonia atlites</i>	Least Concern
7.	Peacock Pansy (Butterfly)	<i>Junonia almana</i>	Least Concern
8.	Blue Jay (Butterfly)	<i>Graphium doson</i>	Least Concern
9.	Common Mime (Butterfly)	<i>Papilio clytia</i>	Least Concern

10.7 **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 riverlapwing (*Vanellus duvaucelii*) also breed on the islands, sandbars and banks of the Ganga River. The literature suggests that 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 Kannauj Distt., a total of 72 different bird species have been recorded which include 24 wetland birds and 48 forest and grassland birds. Among these, 6 birds feature in the IUCN Red List – Alexandrine Parakeet, Black-Headed Ibis & River Lapwing (Near Threatened), River Tern & Sarus Crane (Vulnerable) and Pallas's Fish Eagle (Endangered). The details of these bird species are presented in Table 7 while some important birds as seen during the survey are depicted in Images 26-29.

Table 7 : List Of Birds Recorded In Study Region

Sr. No.	Common Name	Scientific Name	Conservation Status
1.	White throated Kingfisher	<i>Halcyon smyrnensis</i>	Least Concern
2.	Pied Kingfisher	<i>Ceryle rudis</i>	Least Concern
3.	Cattle Egret	<i>Bubulcus ibis</i>	Least Concern
4.	Little Egret	<i>Egretta garzetta</i>	Least Concern
5.	Intermediate Egret	<i>Ardea intermedia</i>	Least Concern
6.	Great Egret	<i>Ardea alba</i>	Least Concern
7.	Indian Pond Heron	<i>Ardeola grayii</i>	Least Concern
8.	Grey Heron	<i>Ardea cinerea</i>	Least Concern
9.	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Least Concern
10.	Common Sandpiper	<i>Actitishypoleucos</i>	Least Concern
11.	Asian Openbill	<i>Anastomus oscitans</i>	Least Concern
12.	Little Cormorant	<i>Microcarbo niger</i>	Least Concern
13.	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	Least Concern
14.	Little Ringed Plover	<i>Charadrius dubius</i>	Least Concern
15.	White breasted - Waterhen	<i>Amaurornis phoenicurus</i>	Least Concern
16.	Common Moorhen	<i>Gallinula chloropus</i>	Least Concern
17.	Eurasian Coot	<i>Fulica atra</i>	Least Concern
18.	Bronze Winged Jacana	<i>Metopidius indicus</i>	Least Concern
19.	River Tern	<i>Sterna aurantia</i>	Vulnerable
20.	Sarus Crane	<i>Grus antigone</i>	Vulnerable
21.	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	Near Threatened
22.	Red-naped Ibis	<i>Pseudibis papillosa</i>	Least Concern
23.	Black-winged Stilt	<i>Himantopus himantopus</i>	Least Concern
24.	River Lapwing	<i>Vanellus duvaucelii</i>	Near Threatened
25.	Red-wattled Lapwing	<i>Vanellus indicus</i>	Least Concern
26.	Black Drongo	<i>Dicrurus macrocercus</i>	Least Concern
27.	Ashy Drongo	<i>Dicrurus leucophaeus</i>	Least Concern
28.	Common Myna	<i>Acridotheres tristis</i>	Least Concern
29.	Bank Myna	<i>Acridotheres ginginianus</i>	Least Concern
30.	Paddyfield Pipit	<i>Anthus rufulus</i>	Least Concern
31.	Common Stonechat	<i>Saxicola torquatus</i>	Least Concern
32.	Jungle Babbler	<i>Turdoides striata</i>	Least Concern
33.	Indian Bushlark	<i>Mirafra erythroptera</i>	Least Concern
34.	Common Babbler	<i>Argya caudata</i>	Least Concern
35.	White Wagtail	<i>Motacilla alba</i>	Least Concern
36.	Asian Plain Martin	<i>Riparia chinensis</i>	Least Concern
37.	Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	Least Concern

38.	Barn Swallow	<i>Hirundo rustica</i>	Least Concern
39.	Common Tailorbird	<i>Orthotomus sutorius</i>	Least Concern
40.	Alexandrine Parakeet	<i>Palaeornis eupatria</i>	Near Threatened
41.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	Least Concern
42.	House Sparrow	<i>Passer domesticus</i>	Least Concern
43.	Indian Jungle Crow	<i>Corvus culminatus</i>	Least Concern
44.	House Crow	<i>Corvus splendens</i>	Least Concern
45.	Oriental Magpie Robin	<i>Copsychus saularis</i>	Least Concern
46.	Common Pigeon	<i>Columba livia</i>	Least Concern
47.	Ashy Prinia	<i>Prinia socialis</i>	Least Concern
48.	Plain Prinia	<i>Prinia inornata</i>	Least Concern
49.	Asian Koel	<i>Eudynamys scolopaceus</i>	Least Concern
50.	Greater Coucal	<i>Centropus sinensis</i>	Least Concern
51.	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	Least Concern
52.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Least Concern
53.	Shikra	<i>Accipiter badius</i>	Least Concern
54.	Common Kaestral	<i>Falco tinnunculus</i>	Least Concern
55.	Black-winged kite	<i>Elanus caeruleus</i>	Least Concern
56.	Black Kite	<i>Milvus migrans</i>	Least Concern
57.	Osprey	<i>Pandion haliaetus</i>	Least Concern
58.	Pallas's Fish Eagle	<i>Haliaeetus leucoryphus</i>	Endangered
59.	Spotted Dove	<i>Spilopelia chinesis</i>	Least Concern
60.	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	Least Concern
61.	Laughing Dove	<i>Spilopelia senegalensis</i>	Least concern
62.	Red Turtle Dove	<i>Streptopelia tranquebarica</i>	Least concern
63.	Baya Weaver	<i>Ploceus philippinus</i>	Least Concern
64.	Pied Bushchat	<i>Saxicola caprata</i>	Least Concern
65.	Purple Sunbird	<i>Cinnyris asiaticus</i>	Least Concern
66.	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	Least Concern
67.	Common Hoopoe	<i>Upupa epops</i>	Least Concern
68.	Black Redstart	<i>Phoenicurus ochruros</i>	Least Concern
69.	Eurasian Thick-knee	<i>Burhinus oedicephalus</i>	Least Concern
70.	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	Least Concern
71.	Indian Peafowl	<i>Pavo cristatus</i>	Least Concern
72.	Indian Roller	<i>Coracias benghalensis</i>	Least Concern



Image 26 : Pied Kingfisher



Image 27 : Red-Wattled Lapwing



Image 28 : Asian Openbill



Image 29 : River Lapwings

11.0 Ganga Riverine Islands/Diaras In Kannauj 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 small and big sized irregularly shaped riverine islands are found throughout the Ganga river stretch in Kannauj Distt. Many of these islands are used by the local people for agricultural purposes owing to the fertile lands.
- 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 [Image 30]. Parts of this island were observed during the survey near Dariapurputt village and near Alha Udal Kila in Kannauj town [Image 31]. 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.

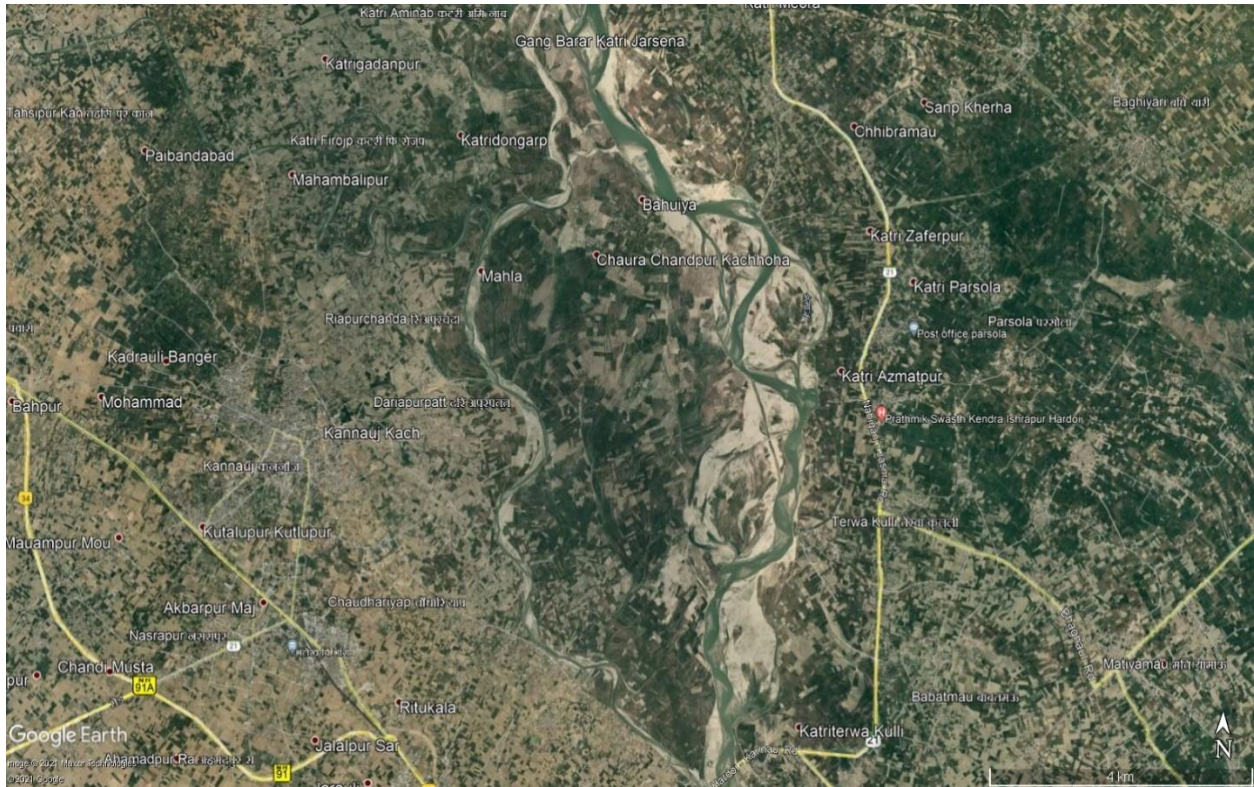


Image 30 : Location Of Biggest Riverine Island In Study Region



Image 31 : Riverine Island As Seen Near Alha Udai Killa On 12th September 2021

11.3 Another irregularly shaped island was observed in the southern part of Kannauj Distt. which measured about 6 kms long and 0.5-2 kms wide [Image 32]. It was observed near Katri Abdul Sakari village during the survey [Image 33]. 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.

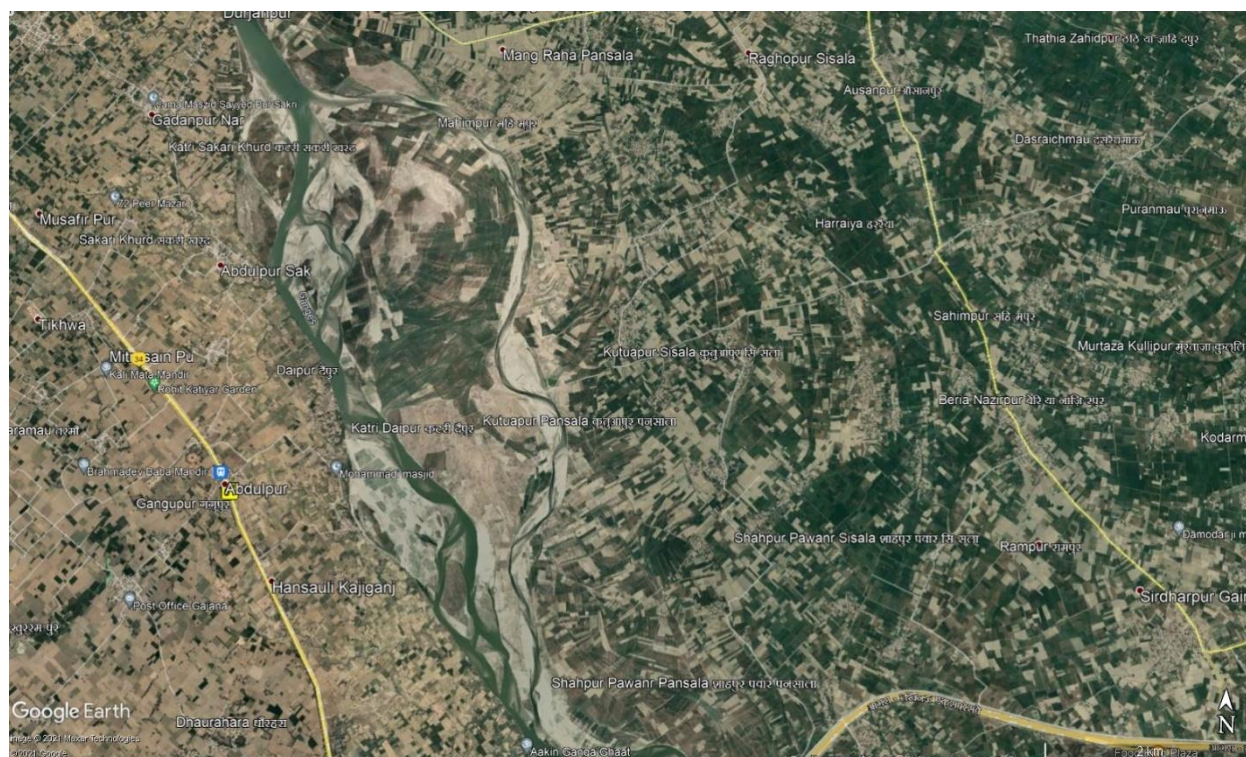


Image 32 : Location Of The Irregularly Shaped Riverine Island



Image 33 : Riverine Island With Dense Growth Of *Saccharum* Grasses As Seen Near Katri Abdul Sakari Village On 13th September 2021

- 11.4 A group of irregularly shaped riverine islands is present in the northern part of this Distt. [Image 34] which were observed near Chawan Rishi Ashram & Fahrari Baba Ashram in Chiasar and near Kharagpur temple in Pharhan. These islands are mainly covered with dense riparian vegetation [Images35] 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 34 : Location Of The Group Of Irregularly Shaped Islands In Study Region



Image 35 : Riverine Island As Seen Near Chawan Rishi Ashram In Chiasar On 13th September 2021

12.0 Fishing In Kannauj 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). A study conducted by Sarkar et al. (2012) recorded the presence of 33 different fish species from the Ganga river stretch between Narora to Kanpur including Kannauj distt.
- 12.2 Fishing from Ganga River is an important source of livelihood and food for local residents in the study region. During the survey, a fishing village near Mehdipur Ghat [Image 36] was visited wherein interactions with the fishermen were carried out to record the fishing techniques and fish availability. The chief fishing gears employed here included – fine meshed gill nets, drag nets and locally made fishing rods [Images 37-38]. Most of the nets used here were made of plastic and 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 of study region. According to the claims of fisher folk, **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 [Image 39], 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 36 : A Fishing Village As Observed Near Mehdipur Ghat In Kannauj



Image 37 : A Plastic Based Fishing Net Used For Catching Fish In Study Region



Image 38 : Dragnet Based Fishing From Ganga River As Observed Near Dariapurpatt In Kannauj



Image 39 : *Wallago attu* (Padhin) Caught From Ganga River In The Study Region

Table 8 : Riverine Fish Recorded In The Study Region

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

13.0 Groundwater In Kannauj Distt.

- 13.1 Kannauj Distt. forms a central part of Indo-Gangetic alluvial plain. The cis-Ganga area exhibits a flat topography with a few gentle undulation and slopes. The elevation of plain, in general ranges between 138 and 155 meters also mean sea level. The gradient of the plain is very gentle and its slope is in south-east direction. Major geomorphic units in the Distt. are – Meander floodplain, New alluvial plain and Older alluvial plain. The Distt. is occupied by the Ganga alluvium of the Quaternary age consisting mainly of fine to coarse sands, gravels, silt, clay and *kankars*.
- 13.2 The granular zones consisting of different grades of sands and gravels form the multi aquifer system in the area. Shallower aquifers are generally of unconfined nature whereas the deeper aquifers are of semi-confined to confined nature. In general, the depth of groundwater level in the distt. varies from 4-17.68 m bgl during pre-monsoon season and 3.7-12.6 m bgl during post monsoon season. The study also highlights that the long term groundwater level in the Distt. for 10 years (1998-2007) has shown a declining trend in almost all the blocks with few exceptions. Overall, the groundwater level in the Distt. contains most of the trace elements in permissible limits and is considered suitable for all purposes.
- 13.2 During the field survey groundwater level was recorded from different villages surveyed in the study region. The depth of groundwater here varied from 35 – 110 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 9 while Image 40 depicts hand pump type used throughout the study region for extraction of groundwater.

Table 9 : Groundwater Levels In Different Villages As Recorded During The Survey

Place	Coordinates		Water depth (Ft.)
	Lat.	Long.	
Chyavan Rishi Ashram, Chiyasar	27°12'59.60"N	79°43'36.56"E	35 ft.
Madhwapur	27°12'36.15"N	79°43'18.61"E	45 ft.
Falhari Baba Aashram	27°12'45.13"N	79°44'38.96"E	45 ft.
Kusumkhor	27° 8'18.24"N	79°52'17.82"E	35 ft.
Jaleshar	27°10'4.06"N	79°47'31.21"E	50 ft.
Alipur	27°10'31.05"N	79°47'43.27"E	60 ft.
Saiyedpur	26°59'36.00"N	79°59'17.08"E	110 ft.
Kannauj Town	27° 3'7.90"N	79°55'26.06"E	60 ft
Mehdipur Ghat	27° 0'39.36"N	79°59'8.17"E	40 ft.



Image 40 : Hand pumps Used For Ground Water Extraction In Study Region

14.0 Ganga River Bank Erosion In Kannauj Distt.

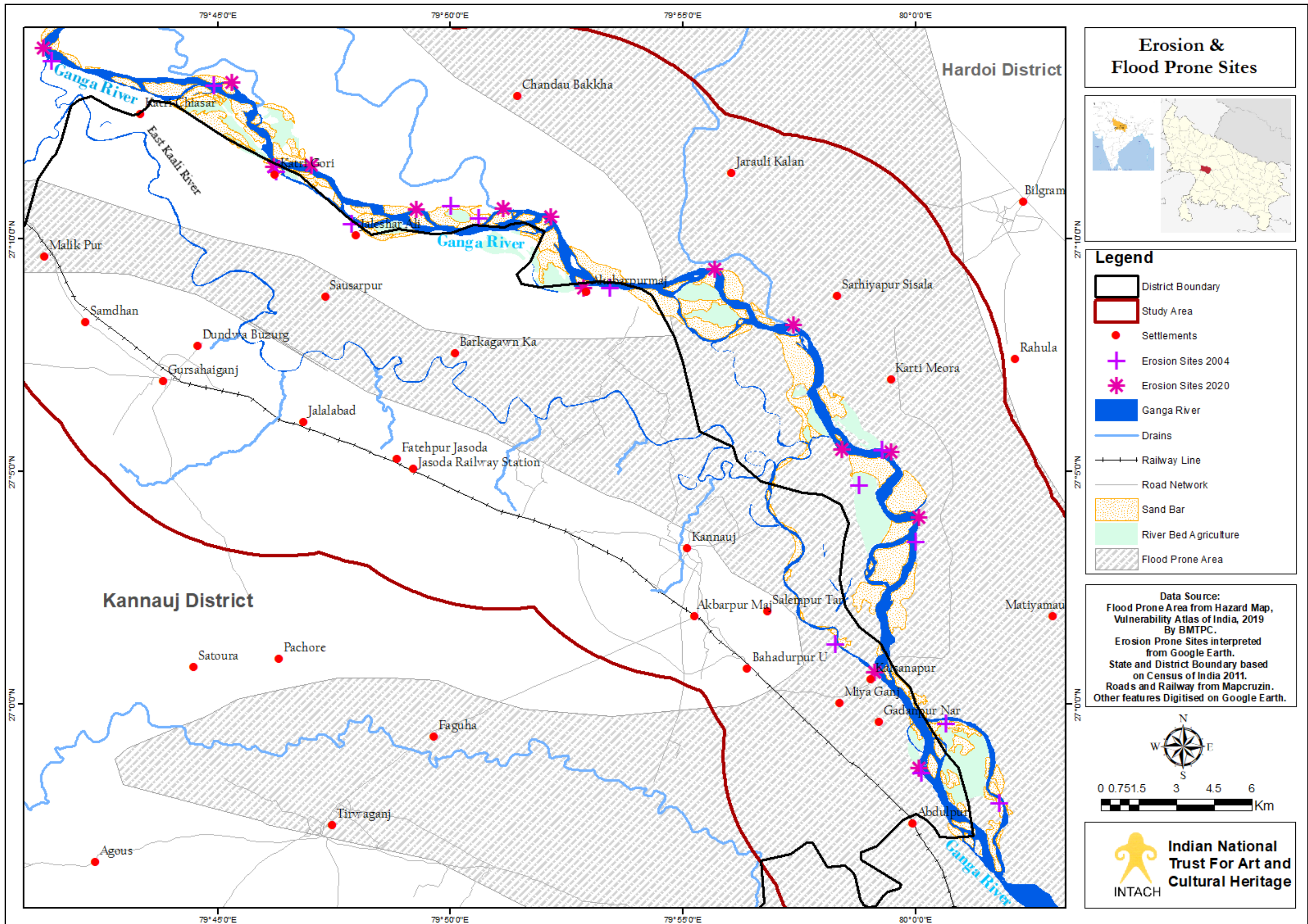
- 14.1 Weathering of soils by natural forces is both constructive and destructive. Erosion is the chief agent responsible for the natural topographic cycles as it wears down higher elevations, banks (lateral erosion) and deposits sediments in the plains. However, erosion gets aggravated due to human interventions through change in land use, excessive grazing, extensive farming and 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 surveyed in the study region of Kannauj Distt. was also prone to erosion in certain places which are marked in Map 7. However, the extent of erosion here was less as compared to Hardoi Distt. on the opposite bank. The composition of bank soil including new and old alluvium intermixed with gravels and *kankars* along with rich riparian vegetation including luxuriant growth of trees and grasses can be considered as chief reasons for this. Some erosion prone sites as observed during the survey are depicted in Images 41-42.



Image 41 : Bank Erosion As Observed Near Gauri Banger Village



Image 42 : Lateral Bank Erosion As Observed Near Mehdipur Ghat



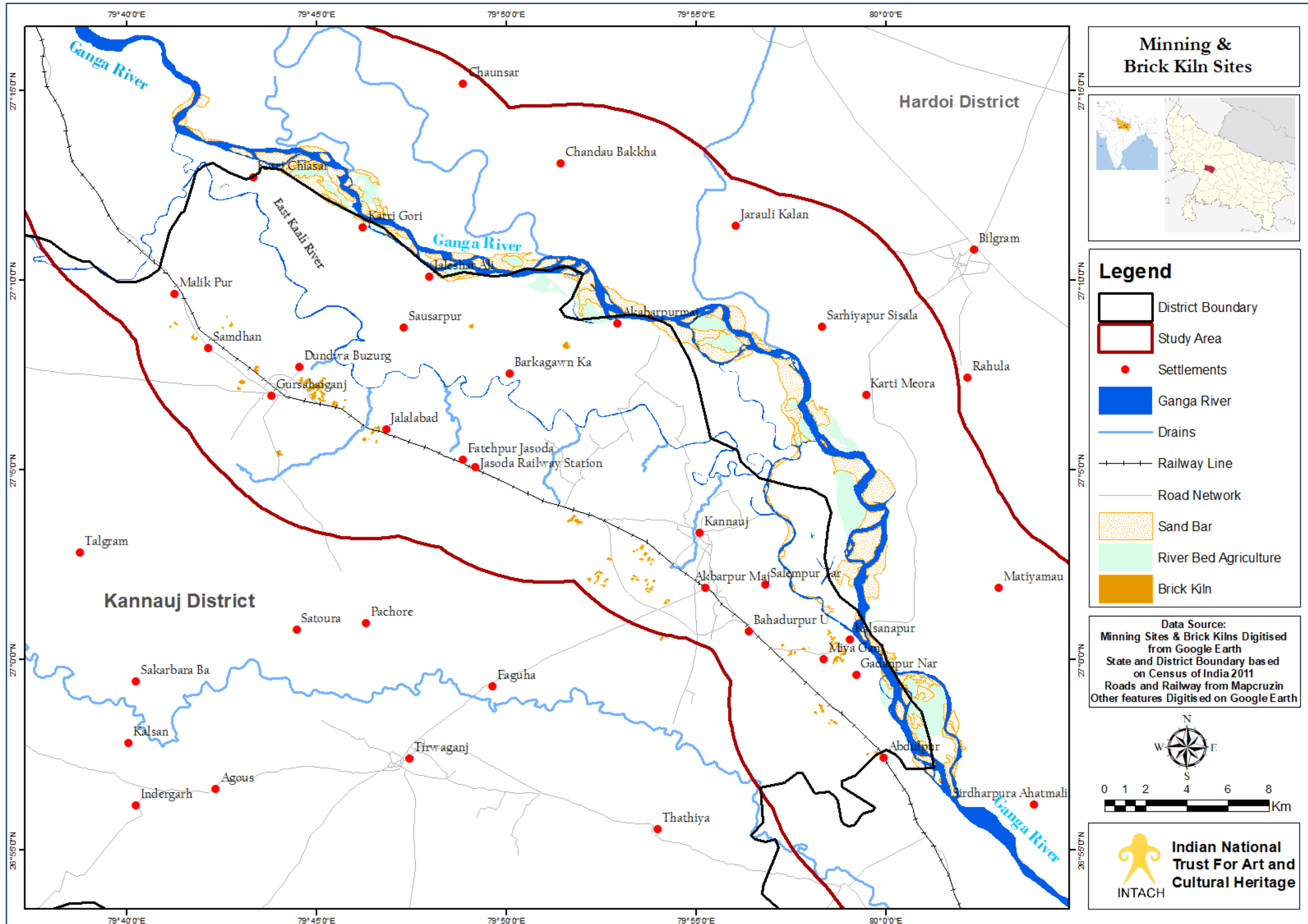
Map 7 : Erosion And Flood Prone Sites In The Study Area

15.0 Mining And Brick Kilns In Kannauj

- 15.1 Kannauj Distt. is not enriched from the minerals point of view and sand is the only main mineral available in the Ganga river basin of the Distt. (MSME-Development Institute, 2011). The sand extracted is chiefly employed in construction works. 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. Several brick kilns can be found in the study region and the spatial distribution of these is presented in Map 8. Image 43 depicts a brick kiln as seen during the survey.



Image 43 : A Brick Kiln As Seen During The Field Survey In Study Region



Map 8 : Mining And Brick Kiln Sites In The Study Region

16.0 Boatmaking And Inland Navigation

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 were used by the residents for transporting people and other materials to the riverine islands [Image 44] and back as well as transportation to opposite banks in Hardoi 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 Mehdi Ghat in Kannauj to Rajghat in Hardoi 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 : Use Of Boats For Transportation From Riverine Island To River Bank In Kannauj

17.0 Sacred Sites And Sacred Trees In Kannauj

- 17.1 **Chawan Rishi Ashram:** This ashram was located along Ganga River in Chiasar village and is believed to be around 50-60 years old [Image 45]. According to the local interlocutors, this ashram was established by Shri Ramesh Chandra Brahmachari Maharaj who was disciple of Shri Dandi Swamy Maharaj. Residents from this village and nearby villages gather at this Ashram and an adjoining temple dedicated to Goddess Durga during auspicious occasions such as Kartik Poornima, Buddha Poornima and Ganga Dushera. Two sacred trees – Neem and Peepal are also found associated with this site [Images 46-47].



Image 45 : Chawan Rishi Ashram In Chiasar



Image 46 : Old And Sacred Neem Tree

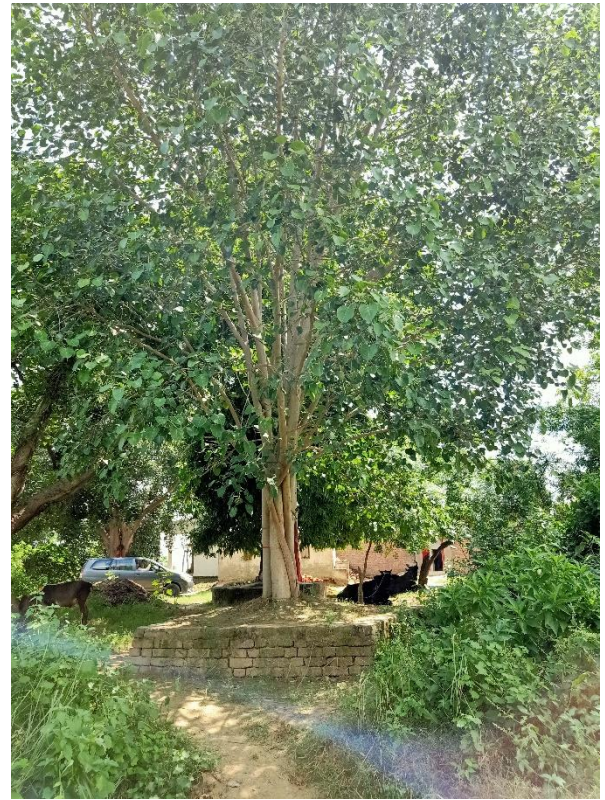


Image 47 : Sacred Peepal Tree

17.2 Fahrari Baba Ashram: Another ashram was present in Chiasar which was dedicated to a saint who only ate fruits and raw vegetables throughout his life while doing penance. Hence, the name of this place came to be known as ‘Fahrari Baba Ashram’ [Image 48]. Two sacred trees – Peepal and Ashok [Images 49-50] were found to be associated with this ashram which were worshipped during auspicious occasions especially by the female residents.



Image 48 : Fahrari Baba Ashram In Chiasar



Image 49 : Sacred Ashok Tree



Image 50 : Sacred Peepal Tree

17.3 Sacred & Old Banyan Tree: A sacred Banyan tree (*Ficus benghalensis*) believed to be hundreds of years old [Image 51] was found associated with a group of temples along Ganga River in Katri Jaleshar Alipur village of Kannauj Distt. These temples house various deities which are worshipped by local residents throughout the year.



Image 51 : An Old And Sacred Banyan Tree In Katri Jaleshar Alipur Village

17.4 Other sacred trees: Apart from these sacred sites, trees such as Peepal, Bargad and Neem are considered as sacred in various parts of the study region were generally worshipped by women residents by tying threads and offering water on auspicious occasions throughout the year. Some such examples are depicted in Images 52-55.



Image 52 : Sacred Peepal Tree Associated With Kharagpur Temple



Image 53 : Old And Sacred Banyan Tree Associated With Dev Darbar Krishna Dham



Image 54 : Old And Sacred Banyan Tree Associated With Lord Shiva Temple At Mehdipur Ghat



Image 55 : Old And Sacred Peepal Tree At Durjanpur Ghat In Kannauj

18.0 Key Issues And Recommendations

- 18.1 One important Hindu ritual associated with Ganga River throughout India is cremation of dead bodies as it is widely believed that by immersing your burnt remains in the holy Ganga water, the person will attain ‘Moksha’. This practice was also observed along Ganga River bank in the study region especially below Mehdiपुर Ghat Bridge [Image 56]. 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 56 : Burning Of Dead Bodies Along Ganga River Near Mehdi Ghat

- 18.2 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.

- 18.3 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.
- 18.4 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.

19.0 References

1. Agriculture Contingency Plan for District: Kannauj. <http://upagripardarshi.gov.in/MediaGallery/UP47-Kannauj.pdf>
2. Bhattacharyya, U.C. and Goel, A.K. (1982). *Studies on the vegetation of Tehri dam and some rare plants in Garhwal Himalayas*. B.S.I., Howrah. pp. 1-38.
3. Castelle, A.J., Johnson A.W. and Conolly, C. (1994). Wetland and stream buffer size requirements: A review. *Journal of Environmental Quality*, 23:878-882.
4. Gangwar, R.S. and Gangwar, K.K. (2011). Taxonomic and economic classification of riparian floral diversity along river Ganga in Garhwal Himalayan region of India. *Researcher*, 3(4):5-14.
5. Gangwar, R.S. and Joshi, B.D. (2006). Some Medicinal flora in the riparian zone of river Ganga at Saptrishi, Haridwar, Uttaranchal. *Himalayan Journal of Environment and Zoology*, 20(2): 237-241.
6. Groffman, P.M., Gold, A.J., Husband, T.P., Simmons R.C. and Eddleman W.R. (1990). *An investigation into multiple uses of vegetated buffer strips*. RI: University of Rhode Island, Kingston.
7. Gupta R.K. (1960), On a botanical trip to the source of the rive Ganga in Tehri Garhwal Himalayas. *Indian Forester*, 86: 547-552.
8. Islam Md.S., Rahman M.M., Halder C.G. and Tanaka M. (2006), Fish assemblage of a traditional fishery and seasonal variation in diet of its most abundant species *Wallago attu* (Siluriformes: Siluridae) from a tropical floodplain. *Aquatic Ecology*, 40: 263-272.
9. Joshi K.D., Jha D.N., Alam A., Srivastava S.K., Kumar V. and Sharma A.P. (2014), Environmental flow requirements of river Sone: impacts of low discharge on fisheries. *Current Science*, 107(3): 478-488.
10. Meena M. (2017), Agriculture crop damage by antelope (*Boselaphus tragocamelus*) and management strategies: Challenges in India. *International Journal of Zoology Studies*, 2(6): 157-160.
11. MSME-Development Institute (2012), Brief Industrial Profile of Kannauj District. Report prepared for Ministry of MSME, Govt. of India.
12. Neave E.R. (1911), Farrukhabad: A Gazetteer being Vol. IX of the District Gazetteers of the United Provinces of Agra and Oudh. Printed by Govt. Press, United Provinces.
13. Osterkamp W.R. (1998), Processes of fluvial island formation with examples from Plum Creek, Colorado and Snake River, Idaho. *Wetlands*, 18(4): 530-545.
14. Pallis M. (1934), Gangotri und Leo Pangal. *Himalayan Journal*, 7(6): 106-126.
15. Pandey D.S. (2013), Groundwater scenario of Kannauj District, U.P. Report published by Central groundwater Board.
16. Prasad R., Pruthi V. and Saini R.K. (2012), Riparian floral diversity of Ganga River. Report prepared by Indian Institutes of Technology.

17. Rhodin A.G.J. (2006), Turtles and humans in Florida and the world: A global perspective on diversity, threats, and economic development. In: Meylan, P.A. (Ed.), *Biology and Conservation of Florida Turtles* (pp. 19–27). Chelonian Research Monographs, Chelonian Research Foundation.
18. Sarkar U.K., Pathak A.K., Sinha R.K., Sivakumar K., Pandian A.K., Pandey A., Dubey V.K. and Iakra W.S. (2012), Freshwater fish biodiversity in the River Ganga (India): changing pattern, threats and conservation perspectives. *Rev. Fish Biol. Fisheries*, 22: 251-272.
19. Seth B.L. (2012), Black curse of the Kali river.
<https://www.downtoearth.org.in/news/black-curse-of-the-kali-river-39382>
20. Shyam R. (2008), A study on riparian floral biodiversity of river Ganga between Haridwar and Gangotri. Thesis submitted to Gurukul Kangri University, Haridwar, India.
21. Sinha M. and Khan M.A. (2001) Impact of environmental aberrations on fisheries of the Ganga (Ganges) River. *Aquatic Ecosystem Health and Management Society*, 4: 493-504.
22. Siddiqui (1991), Integrated study of Ganga ecosystem between Narora and Kannauj (U.P.). (Eds. C.R. Krishnamurti). pp. 117-124.
23. Sinha R.K. and Kannan K. (2014), Ganges River Dolphin: An overview of Biology, Ecology and Conservation status in India. *Ambio*, DOI 10.1007/s13280-014-0534-7.
24. Schaller G.B. (1967), The deer and tiger. Chicago University Press.
25. Stuart B.L. and Thorbiarnarson J. (2003), Biological prioritization of Asian countries for turtle conservation. *Chelonian Conservation and Biology*, 4(3): 642–647.
26. Tripathi S., Gopesh A. and Swivedi A.C. (2017), Fish and fisheries in the Ganga River: Current assessment of the fish community, threats and restoration. *Journal of Experimental Zoology India*, 20(2): 907-912.
27. Vasudevan K. and Sondhi S. (2010), Amphibians and Reptiles of Uttarakhand, India. Wildlife Institute of India, Dehradun, Uttarakhand, India.
28. WII-GACMC (2017), Aquatic Fauna of Ganga River: Status and Conservation. Ganga Aqualife Conservation Monitoring Centre, Wildlife Institute of India, Dehradun.
29. Wyrick J.R. and Klingeman P.C. (2011), Proposed fluvial island classification scheme and its use for river restoration. *River Resources and Applications*, 27: 814-825.
30. ZSI (1991), Faunal Resources of Ganga, Part-I. Zoological Survey of India, Calcutta.

