Ganga Cultural Documentation

2021

BIJNOR DISTRICT
Natural Heritage

NAMAMI GANGE

National Mission for Clean Ganga

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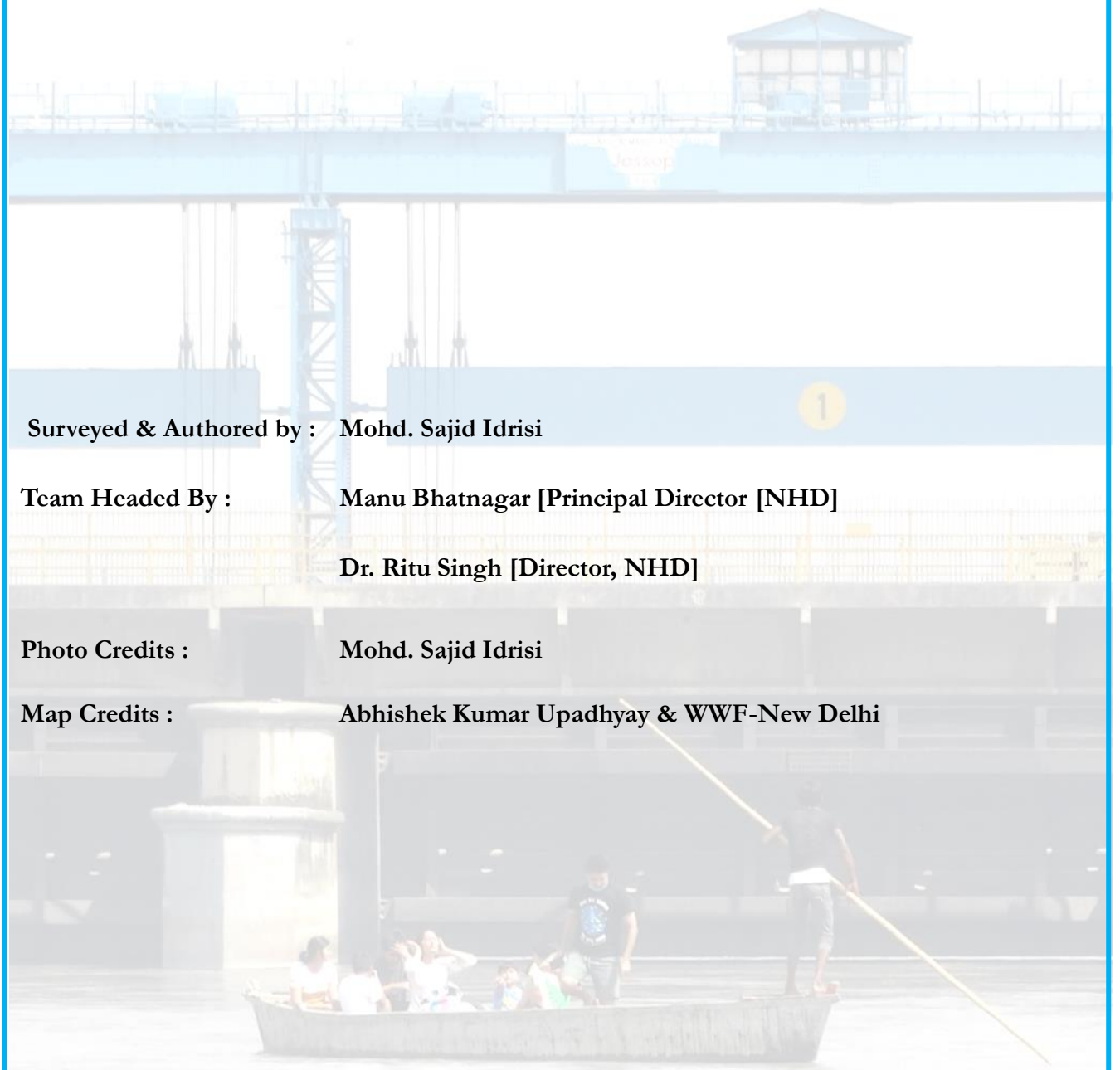

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Front Cover : **Boats Parked at Ganga Ghat, Bijnor Barrage**

Background : **Local tourists taking boat ride at Bijnor Barrage**

Back cover : **A huge Banyan tree inside a muslim graveyard, Dhinvarpura**

Formatting & Design by : **Mohd. Sajid Idrisi**

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1.0 Introduction

1.1 Distt. Bijnor, situated on the left bank of Ganga River [Approx. 85 km reach in the Distt.] occupies the north-west corner of the Moradabad division and borders with the State of Uttarakhand. Historically, Bijnor is associated with the antiquity of the Mahabharata, when Pandavas and Kaurvas sought refuge for their families at Vidur Kuti, Daranagar Ganj. The place is now a temple complex named after Vidur – the Mahamantri of Hastinapur, who prayed at this place for peace and to avert the war. During later days, it has been under the rule of different kingdoms and formed as a district in 1871 with its headquarters at Nagina town.

1.2 The geographical area of the Distt. is 4561 Sq. km which is about 1.89 percent of the total Uttar Pradesh area. The urban area of the Distt. is 109.7 Sq. km and rural area as 4451.3 Sq.km[1]. The Distt. shares boundary with Meerut and Muzaffarnagar Distt.s on the West, Haridwar and Pauri Garhwal on North, and Amroha in South. The Distt. has five tehsils namely Bijnor, Najibabad, Nagina, Dhampur, and Chandpur with 11 development blocks.

1.3 The Distt. forms the Northern part of Gangetic plains sloping towards South. The northern boundary makes clear distinction between lower Himalayan foothills of Shivalik Range running South-east and the plains of the Distt. Here, it borders with Kalagarh range of the Corbett National Park. The Distt. plains are dissected by a number of smaller rivers and streams – most of which are flowing in easterly direction. They are Ban Nala, Gangan Nadi, Khoh River, Ram Ganga and Banaili Nadi. Malin river which rises in the hills above Kotdwar is the major tributary of Ganga River in the Distt.. Another is Chhoiya Nala which rises near Najibabad and joins Ganga near Sujatpur Khadar in Chandpur Tehsil. Few other smaller streams such as Sukha Nadi, Lakharhan Nadi, and Ratnal Nadi join Malin River which drains into Ganga near village Shahjadpur Ahatmali in Tehsil Bijnor.

1.4 Geomorphologically[2], the Distt. is almost flat alluvial plain which can be divided into five major units: floodplain alluvium, sand bars, younger alluvial plain, older alluvial plain, and piedmont plain. Soils of the Distt. are of 4 types – (i) Bhur or sandy soil (ii) Bur sewai or Sandy loam soil (iii) Sawai or loam soil (iv) Matiyar or clayey soil. Upland areas have sandy loam while khadar and depressions are formed of silty loam to silty clay.

[1] District Census Handbook, Bijnor, Census of India, 2011
[2] Groundwater Brochure of Bijnor District, UP [2012-2013], CGWB

1.5 The primary occupation in the Distt. is agriculture employing most of its population. Sugarcane farming dominates the agriculture fields. Other major crops grown are wheat, rice, maize, pea, lentil, gram, mustard and groundnut. Other agrarian activities include dairy and milk production, fish farms, poultry farms, mango orchards, eucalyptus and poplar cultivation. Sugarcane mills are major industrial units in the Distt. located at Dhampur, Bijnor, Chandpur, Najibabad, Bilai and Seohara. Other industries are pipe, rubber, steel manufacturing factory, automobile industry, IT and advertising, brick and tiles making industry. There are few places of religious and cultural importance along the Ganga River such as Ganga River Ghat at Bijnor Barrage, Vidur Kuti at Dara Nagar Ganj and old graveyard and shrine at Mandawar.

Image 1 : Ganga River View Downstream of Bijnor Barrage
[Note floating patches of Water Lettuce - *Pistia stratiotes*]

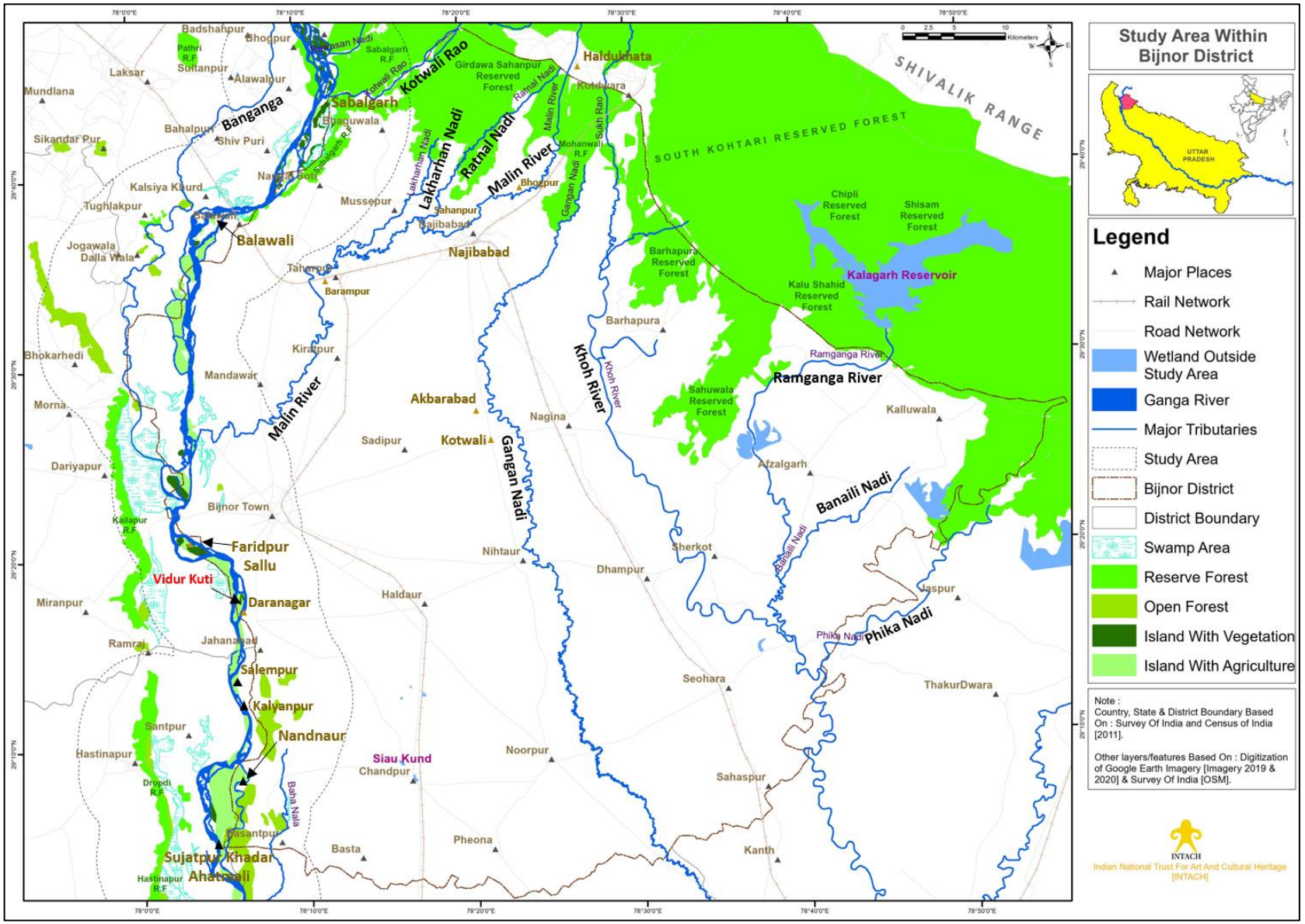
Map 1 : Location Of Bijnor Distt. on Left Bank of Ganga River

2.0 Ganga River in Bijnor Distt.

2.1 Ganga River enters Bijnor Distt. at Sabalgarh village, Najibabad tehsil, in Uttar Pradesh after crossing Haridwar Distt in Uttarakhand. [See Map No.2]. The river channel is around 1 km in width here. The length of Ganga River in Bijnor Distt. is around 85 km coursing along Distt. Boundary and on its left bank. The upper immediate catchment area includes Sabalgarh Reserve Forest, Chidiyapur Forest Range, and Rajaji National Park in Uttarakhand. At Sabalgarh, the Ganga takes southwesterly direction till Balawali. The river channel, in this reach, is up to 2-4 km wide, dotted with river islands, most of which are under cultivation.

2.2 At Balawali, there is an old iron road bridge and a railway bridge on Ganga River connecting the Distt. with Laksar, Roorkee and Haridwar in Uttarakhand. Around 200 m downstream there is new road bridge under construction. Here, the river flows southwards till Ganga Barrage in Bijnor. In this stretch, the river flows throw narrow channels in non-monsoon season and there are very large islands and sand bars covering maximum area. The barrage in Bijnor is known as Madhya Ganga Barrage or Chaudhary Charan Singh Ganga Barrage. The barrage diverts water to Madhya Ganga Canal but only during monsoon months. Towards the west, the shallow depression area is rich in aquatic vegetation and bird diversity and is known as Haiderpur Wetland [falls in Muzaffarnagar Distt.], gaining popularity among bird watchers and nature lovers. The road bridge at Ganga Barrage is the only major viewpoint for a visual experience of the Ganga River in the Distt..

2.3 Around 4 km downstream till village Faridpur Sallu, Ganga again takes an easterly direction with channel width of around 2.5 km. From this point Ganga flows south till Nandnaur-Hastinapur Bridge, connecting Chandpur in Bijnor with Hastinapur in Meerut. The channel is comparatively narrow bifurcating with large islands at some places. The Ganga exits Bijnor Distt. near Sujatpur Khadar Ahatmali in Chandpur, Tehsil.



Map 2 : Study Area In Bijnor Distt

3.0 Methodology

3.1 For carrying out surveys, a 7 km buffer zone of Ganga River in the Distt. was considered. Before carrying out surveys, various access points and routes to the river were located with the help of Google Earth. Special emphasis was given to the sites and features of interest such as river channel, river bed, floodplain conditions, farming and fishing activities, sites of religious interest. Some known local residents living in villages near Ganga were contacted for field assistance.

3.2 The survey was undertaken from 10-17th April, 2021 with the help of taxi, boat, bike and on foot. Sites were visited from upstream floodplain areas in Distt. such as Sabalgarh, Bhaguwala, Nangal to Balawali, Mandawar, Bijnor Barrage area in mid-section and then proceeding to Daranagar Ganj, Salempur, Kalyanpur and Nandnaur downstream. Sony Digital Camera Cyber-shot DSC-HX300 with 50X optical zoom and OnePlus 5 mobile phone were used for photography. Garmin handheld GPS eTrex30 was used for marking locations and understanding elevation difference. Pre-marked Google Earth's Kml files and Google Maps were used for navigation. Field guides were used for flora and fauna identification. Information was obtained through informal interviews and discussion with farmers, fishermen, boatmen and local people.

4.0 Tributaries of Ganga River

4.1 There are a number of smaller rivers and seasonal streams and a few tributaries dissecting the plains of the Distt. [See Map No. 2]. The tributaries have their origin in the hilly reserve forest areas of Haridwar and Pauri Garhwal Distt.s and flow in Southwest direction in the Bijnor Distt. to join Ganga flowing along its western boundary. They are described below:

i) **Kotwali Rao** – As described in the Bijnor Distt. Gazetteer[3] of 1908, Kotwali Rao was also known sometimes by the generic term 'Rao'. It passed through the forest tract, past the old fort of Saiyid Bhura and joins the Ganga at Asafgarh, though that castle has long been swept away by the action of stream. Today the stream serves as a part of the northern boundary of the Distt. and is around 25 km long. The stream is dry during most of the year with meagre flow except monsoon season. The exposed river bed area is used for cucurbits cultivation. During the field visit, river bed mining through trucks was observed here from the bridge of Eastern Ganga Canal Road and Haridwar Road bridge [NH-34] near Mirzapur village.

ii) **Malin River** – Bijnor Gazetteer (1908) describes Malin as an important perennial tributary of some magnitude and gives a detailed description of the stream as follows: It rises in the hills of Garhwal entering the Distt. in the north of Pargana Najibabad – a short distance to the east of Haldukhata on the submontane road. At this point the stream flows in three distinct channels, that on the west being known as the Ratnal and on the east as the Riwari. These re-join the main stream after a course of several miles through the forest tract, the former affecting the junction near Sahanpur, and the latter near Bhogpur above Najibabad. About three miles beyond the confluence, the Malin enters Pargana Kiratpur, flowing parallel to the railway on its northern side. Just as it approaches the boundary of Mandawar, it bends south to cross the railway, after having received on its right bank the water of Lakharhan, a small stream which rises in the forests of Najibabad. The Lakharhan itself is fed by several tributary drainage channels, of which the chief is the Sukha Nala. Close to the railway crossing, about two miles below the junction with Lakharhan, another small stream falls in the Malin near the village of Barampur. This is known as Katra Nala which rises near Kashirampur in pargana Najibabad which further fed by an insignificant channel known as Bhera. In the remaining portion of its course in the parganas of Kiratpur and Bijnor, the Malin receives no other tributaries, except a large ravine which joins it on the left bank two miles northwest to the Kiratpur. It joins Ganga at Raoli on the borders of Bijnor and Mandawar parganas.

[3] Bijnor : A Gazetteer being volume XIV of the district gazetteers of the United Provinces of Agra and Oudh by H.R. Nevill, Allahabad (1908)

4.2 Throughout its course the river flows in a broad and shallow valley, and except on the northern borders of the Distt., where action of the river is often destructive, the cultivation on its banks is perhaps the finest in the Distt. The actual river bed is well defined, and within its limits, the channel shifts frequently under the action of the annual floods. Except with few ravines, banks with deep riverbed are no longer affected by action of the river, and the whole valley is a continuous stretch of stable cultivation.

4.3 Malin has been the river of historical interest. It has been tentatively identified with the Erineses mentioned by the Greek Ambassador Megasthenes around 300 B.C.; while some 250 years later the poet Kalidasa immortalised the stream in his famous drama 'Sakuntala'. It was here that the King Dushyanta pursued an antelope to its refuge in the shrine of a hermit, and in the forests on the river bank, the monarch first beheld his future queen.

iii) **Chhoiya** – Just below the confluence with Malin, the Ganga River receives another smaller tributary – the Chhoiya, a drainage channel of considerable length, which remains dry for most part of the year. The Bijnor Gazetteer (1908) describes it as : 'It rises in the village of Samipur, three miles west of Tehsil headquarters. It further flows in south-westerly direction, skirting the southern boundary of the pargana and afterwards separating Kiratpur from Akbarabad. It then crosses the centre of pargana Bijnor, afterwards forming the boundary of Daranagar for some miles, and subsequently traversing through its western portion before joining Ganga River some two miles below Jahanabad. For the larger part of its course, the land on the banks of the Chhoiya possesses fertile clay, but in pargana Kiratpur and elsewhere ravines appear and the soil is dry and sandy. The only affluent of the Chhoiya is an insignificant stream known variously as the Paodhoi or Khalia, which drains a few villages in the west of Akbarabad and joins the main stream at Padla. There is another Paodhoi on the opposite bank, which has a course of some two miles and flows in to the Chhoiya near Memon in pargana Kiratpur.'

iv) All other remaining rivers of the Distt. are ultimately tributaries of the Ramganga. Several of them effect their junction with that river within the limits of this Distt., but those draining the central upland tract pass southwards into Moradabad and form a subsidiary system of their own. Notable ones are Ban Nala, Gangan Nadi, Pelkhala Nala, Karula Nala, Khoh River, Ram Ganga, Banaili Nadi and Phika Nadi.

Image 2 : Kotwali Rao [Upstream Area Seen From Eastern Ganga Canal Road]

Image 3 : Malin River [Upstream] Seen From Eastern Ganga Canal Road

Image 4 : Dry Malin River Seen From Chandak-Bhojpur Marg

Image 5 : Chhoiya Nala/Nadi At Ganj-Chandpur Road

5.0 Land Use Land Cover [LULC]

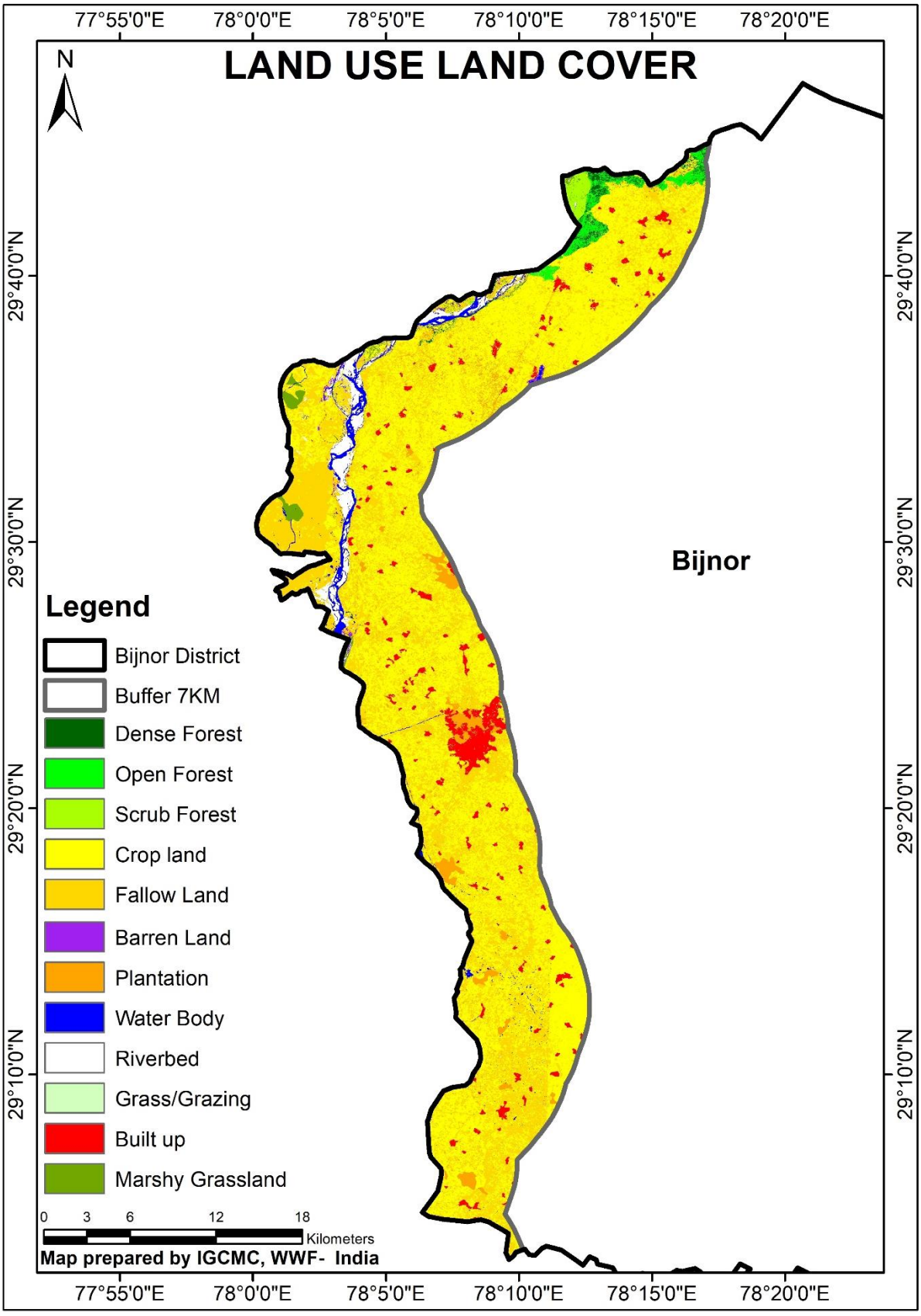
5.1 Land Use Land Cover [LULC] map of the study area has been prepared from Landsat imagery for the year 2020. [Table No.1] Using supervised classification system, 13 different classes were generated – dense forest, open forest, scrub forest, cropland, fallow land, barren land, plantation, waterbody, open land, grazing land, built-up, and marshy grassland [Map 3]. Since agriculture is the primary occupation in the Distt., cropland and fallow land area dominate other classes.

5.2 Major insights are the following :

i. Cropland is the dominant land use with 52% of the total area [333.64 Sq.Km]
ii. Together with fallow land, total area under agriculture is around 85 % [533 Sq. km]
iii. Total forest area is only 2.87 % [i.e. 18.12 Sq.km] with dense forest being <1%
iv. Built-up area is third largest with 3.64% [22.97 Sq.km]
v. Plantation – which includes mainly mango orchards, eucalyptus, poplars covers around 4% [i.e. 24.70 Sq.km]
vi. Waterbody which also includes river area is around 1.66 % [i.e.10.46 Sq. km]
vii. Open land occupies 2.30 % with 14.52 Sq. km

Table 1 : Land Use Land Cover of Study Area in Bijnor Distt. [2020]

Classes	Area (Ha)	Area (Sq.Km)	Area (%)
Dense Forest	479.21	4.79	0.76
Open Forest	860.14	8.60	1.36
Scrub Forest	473.27	4.73	0.75
Crop Land	33364.60	333.64	52.85
Fallow Land	19946.70	199.46	31.59
Barren Land	179.95	1.79	0.29
Plantation	2470.57	24.70	3.91
Water Body	1046.20	10.46	1.66
Open Land	1452.32	14.52	2.30
Grass/Grazing Land	17.30	0.17	0.03
Built-up	2297.38	22.97	3.64
Marshy Grassland	548.40	5.48	0.87
Total	**63136.03**	**631.36**	**100**



Map 3 : Land Use Land Cover In Study Area Of Bijnor Distt.

6.0 Palaeochannels Of Ganga River In Bijnor Distt.

6.1 Palaeochannels are the remnants or old channels of once active rivers or streams, some of which are lie buried under the cover of younger sediments. They are formed when the rivers or streams migrate their courses and form new ones. Paleochannels are important to understand area geology, old river routes, sediment deposition and are considered suitable areas for ground water recharge. Factors such as change in land use pattern, sand mining, agricultural practices, and industrial activities lead to disappearance of such channels along rivers. Generally, such old channels do not carry water during most of the year but may flow during flood events. Such abandoned and silted palaeochannels can be mapped using old maps and remote sensing techniques. Based on the available satellite data and remote sensing technique, Map No.4 was prepared, which depicts the various palaeochannels in the study area of Bijnor Distt. During field visits, it was observed that these palaeochannels serve as waterbodies for irrigating surrounding agricultural fields thus reducing pressure on groundwater; for fodder – since they are rich in riparian vegetation; supporting fish diversity due to rich aquatic vegetation and adding visual appeal to monotonous agriculture landscapes. [Refer Map No. 4].

Image 6 : Palaeochannel Near Bijnor Barrage [29°22'38.76"N, 78° 4'38.25"E]

Image 7 : Palaeochannels Support Riparian Habitats and Aquatic Vegetation

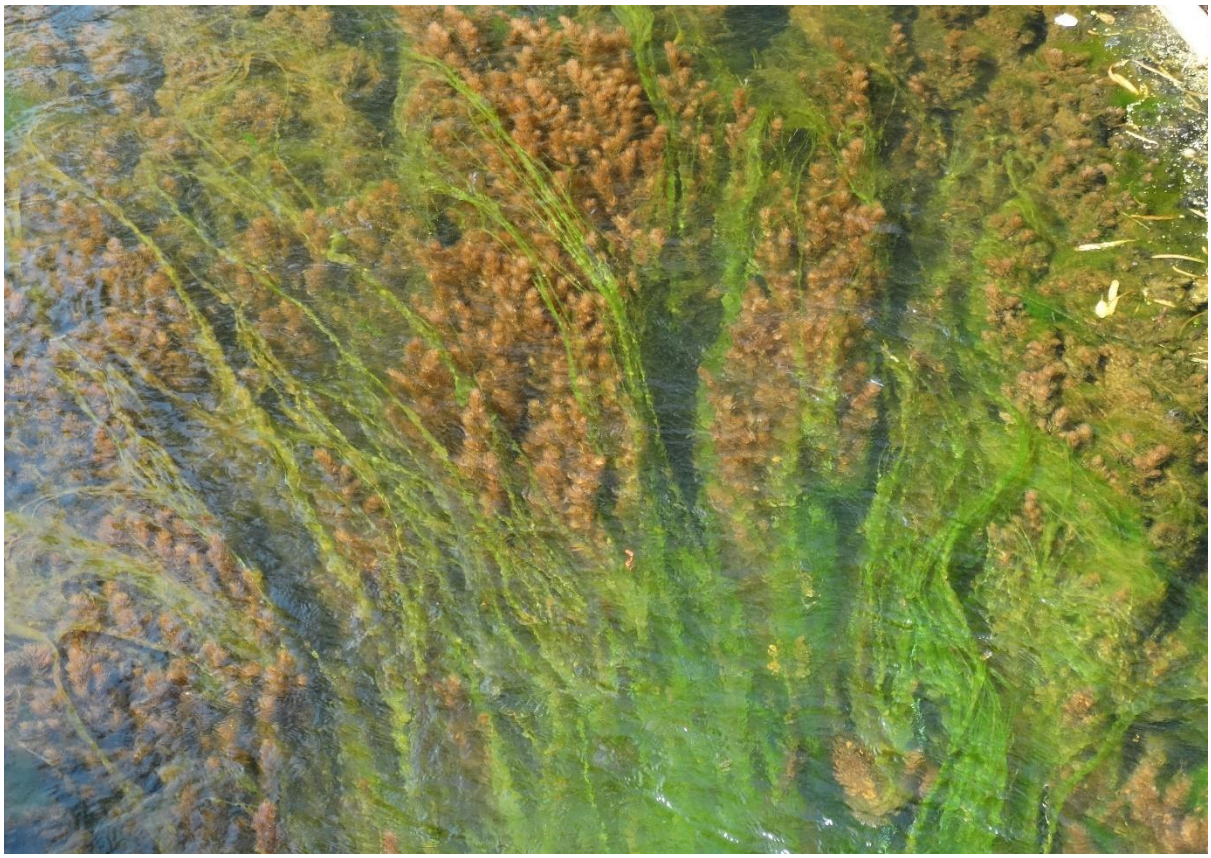
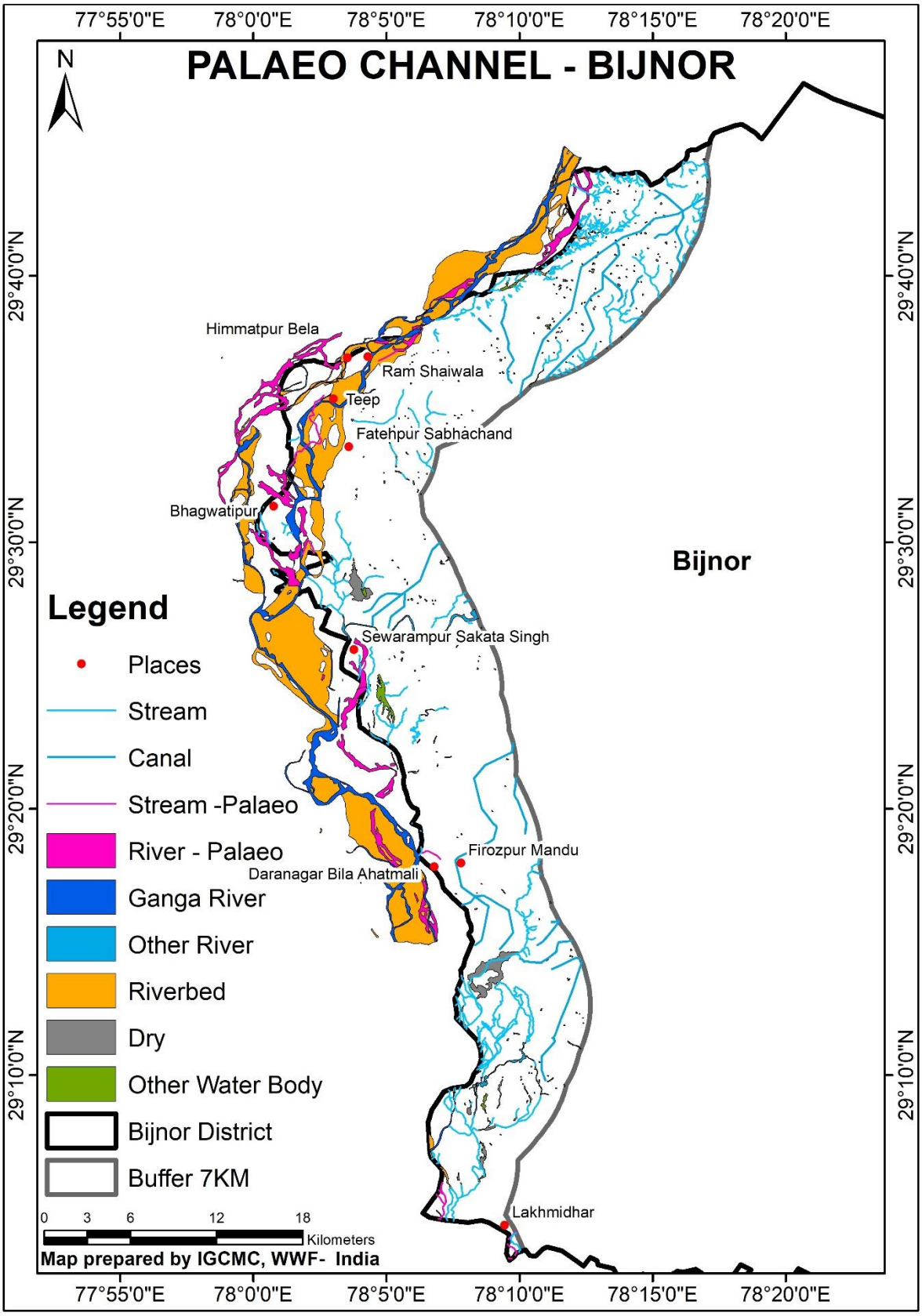


Image 8 : Submerged Vegetation [*Hydrilla*] Visible In A Palaeochannel at Hemraj Colony, Bijnor



Map 4 : Palaeochannels In The Study Region

7.0 Floodplain Of Ganga River In Bijnor Distt.

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 Distt.s, where it passes through, for agricultural purposes.

7.2 Ganga River floodplains in Bijnor Distt. are cultivated for major crops such as wheat, rice, maize, sugarcane and seasonal vegetables. The agriculture fields could be observed extended up to the edge of the active channel of the river. Agriculture is one of the major sources of income in the Distt. and farmers of floodplain areas are benefitted by the fertile alluvium brought in by the river. Cucurbit and vegetable cultivation is mostly done in dry river bed areas and on river islands. According to riparian communities, the river reclaims its original channel every monsoon season, washing away these agriculture fields and changing their structure as it meanders downstream. Upland areas in the northern part of the Distt. from Sabalgarh to Nangal have characteristic forest mounds. Many such mounds have been washed away from the action of the river while some have been flattened for agriculture. The remaining come under forest management with visible young teak and eucalyptus plantation [Image-10]. The river floodplain areas are accessible from almost everywhere – mostly via smaller roads leading to villages which are situated right on the river bank. A few such villages are Manwala, Sukhapur, Khan Kulipur, Inderpur Rajroop, Sadullapur, Kajiwala, Navalpur, Daranagar and Kheri Kalan [Image-9]. These villages experience some level of floods every monsoon season when the flow in the river is high. Local community treat floodplain areas as open waste lands and use them for multiple rural and agrarian activities such as making cow dung cakes, mining clay for household and religious use, and cattle grazing. Other major land-use and

activities on floodplain areas include mango orchards, poplar and eucalyptus tree hedges and apiculture on smaller scale.

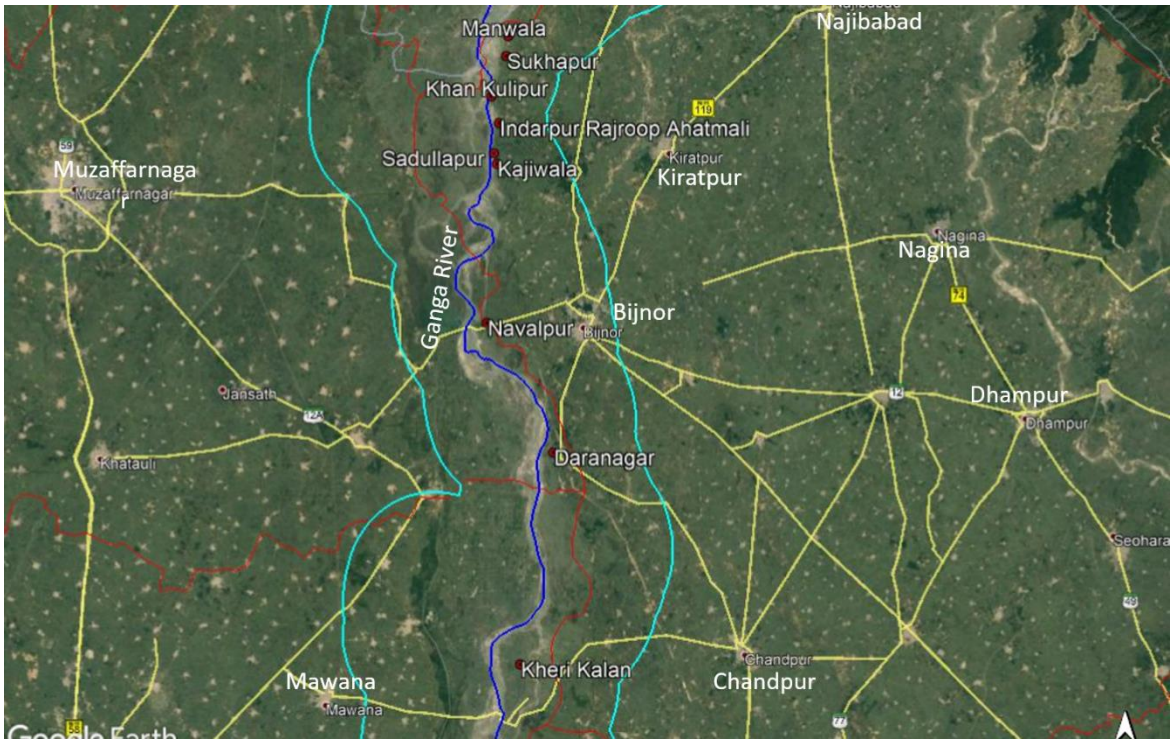


Image 9 : Location Of Some Floodplain Villages Along Ganga In Bijnor

Image 10 : Natural Mounds With Eucalyptus Plantation At Nangal

Image 11 : Dung Cake Mounds And Visible Excavated Soil Pit At Saifpur Khadar

7.3 **Riparian Vegetation:** The floodplains are devoid of significant riparian vegetation as most of them are being cultivated till the edge of active river channel. Some extent of protected forest and grasses [mainly *Sachharum*] are present in the northern part of the Distt. between Sabalgarh to Nangal. Some riparian species of Genus Typha, Tamarix, Phragmites, Alternanthera were observed in depressions, palaeochannels, waterbodies and in dry canals. Refer to Riparian Flora Section [9.0] for a detailed account.

Image 12 : Fresh Wheat Crop Harvest On Ganga Floodplains at Kalyanpur

Image 13 : Apiculture On Floodplain Area Near Nandnaur-Hastinapur Ganga Bridge

Image 14 : Floodplain Vegetation And Forest At Nangal

8.0 Wetlands In Bijnor Distt.

8.1 Wetlands are highly productive ecosystems and help in maintaining ecological balance by providing food and habitat to large number of living organisms. They also help in controlling floods, recharging groundwater, nutrient recycling, climate stabilization and carbon sequestration. A report 'Wetland Report for Ganga River Basin Management Plan' published in 2012 by consortium of IITs mentions that 57% of the wetlands in Uttar Pradesh are related to river/streams with 181935 ha area approximately followed by 13.6% water logged areas and other wetlands (<2.25 ha). In Distt. Bijnor, the total no. of wetlands mentioned are 1708 with 1359 wetlands (<2.25 ha) with total area of 17879 ha. River/Stream category constitutes around 71.74% [12826 ha] of the total wetland area in the Distt.. Area estimates of Wetlands in Bijnor Distt. mentioned in the report is given below in Table No.2 :

Table 2 : Area Estimates Of Wetlands In Distt. Bijnor

S. No.	No. of Wetlands	No. of Wetlands	Total Area [Ha]	% of Wetland Area
1.	Lakes/Wetlands	21	118	0.66
2.	Ox-bow lakes/cut off meanders	16	243	1.36
3.	Riverine wetlands	16	962	5.38
4.	Waterlogged	40	654	3.66
5.	River/Stream	64	12826	71.74
6.	Reservoirs/Barrages	6	931	5.21
7.	Tank/Ponds	186	786	4.40
8.	Wetland (<2.25 ha)	1359	1359	7.60
	Total	**1708**	**17879**	**100.0**

Source: Wetland Report for Ganga River Basin Management Plan' GRBMP by IITs (2012)

8.2 In the subject study area, a total of 79 wetlands have been mapped with the help of Google Earth satellite imagery and available maps in the study area. The list of mapped wetlands is given in Table No. 3 and their spatial distribution is shown in Map No. 5.

Table 3 : List Of Wetlands In The Study Area

Sr. No.	Wetland Name	Coordinates		Area [in hectares]
		Latitude	Longitude	
01	01	29°42'29.67"N	78°12'54.68"E	0.62
02	02	29°42'28.99"N	78°13'3.42"E	0.60
03	03	29°42'42.67"N	78°13'12.62"E	0.14
04	04	29°42'39.85"N	78°13'16.44"E	0.14
05	05	29°42'43.22"N	78°13'19.61"E	0.48
06	06	29°42'47.22"N	78°13'23.77"E	1.72
07	07	29°42'25.94"N	78°15'15.71"E	1.11
08	Kalal Wala Talab	29°42'11.96"N	78°15'24.95"E	0.20
09	09	29°42'22.49"N	78°13'34.43"E	0.29
10	10	29°42'21.68"N	78°13'28.50"E	0.21
11	11	29°41'35.30"N	78°14'43.36"E	3.0
12	12	29°41'34.99"N	78°14'32.94"E	0.99
13	13	29°41'56.75"N	78°15'20.80"E	1.40
14	14	29°41'40.39"N	78°15'20.22"E	0.14

15	15	29°41'10.42"N	78°13'54.14"E	1.0
16	16	29°41'1.16"N	78°14'49.29"E	0.58
17	17	29°40'53.20"N	78°15'26.55"E	2.83
18	18	29°40'56.85"N	78°15'45.44"E	0.59
19	19	29°40'44.51"N	78°15'45.84"E	0.79
20	20	29°40'45.83"N	78°13'36.81"E	1.00
21	21	29°40'26.22"N	78°12'48.35"E	1.93
22	22	29°40'7.23"N	78°12'44.23"E	5.75
23	23	29°40'22.54"N	78°13'39.92"E	0.79
24	24	29°40'10.48"N	78°14'17.80"E	0.44
25	25	29°39'47.19"N	78°15'32.70"E	1.36
26	26	29°39'48.72"N	78°15'38.39"E	0.40
27	27	29°39'38.83"N	78°13'43.55"E	1.96
28	28	29°39'54.22"N	78°13'44.62"E	1.29
29	29	29°39'49.04"N	78°11'42.12"E	4.29
30	30	29°39'18.63"N	78°11'23.91"E	1.30
31	31	29°39'25.45"N	78°11'50.72"E	3.57
32	32	29°38'57.92"N	78°12'20.47"E	3.52
33	33	29°38'45.26"N	78°12'46.07"E	1.37
34	34	29°38'6.49"N	78°11'4.17"E	5.88
35	35	29°38'21.78"N	78°11'15.02"E	1.10
36	36	29°37'37.69"N	78° 9'9.68"E	1.30
37	37	29°37'23.16"N	78° 8'55.74"E	0.76
38	38	29°35'37.39"N	78° 9'25.43"E	0.50
39	39	29°35'17.76"N	78° 4'39.78"E	13.0
40	40	29°33'39.63"N	78° 5'44.44"E	0.30
41	41	29°32'11.67"N	78° 6'2.58"E	1.10
42	42	29°32'38.48"N	78° 5'29.23"E	3.40
43	43	29°32'51.35"N	78° 5'21.74"E	1.66
44	44	29°29'25.24"N	78° 7'16.90"E	1.56
45	45	29°28'54.64"N	78° 7'3.23"E	1.72
46	46	29°30'26.88"N	78° 4'9.36"E	21.3
47	47	29°29'58.28"N	78° 3'50.32"E	5.72

48	48	29°29'40.93"N	78° 3'48.63"E	10.5
49	49	29°29'18.72"N	78° 5'11.80"E	0.74
50	50	29°29'1.03"N	78° 5'24.27"E	0.81
51	51	29°25'13.62"N	78° 9'3.33"E	0.88
52	52	29°24'59.40"N	78° 6'38.90"E	1.21
53	53	29°25'9.50"N	78° 6'3.24"E	0.63
54	54	29°25'18.36"N	78° 6'20.51"E	2.00
55	55	29°25'51.69"N	78° 5'33.55"E	1.76
56	56	29°25'34.69"N	78° 5'31.90"E	2.35
57	57	29°27'10.65"N	78° 3'43.12"E	17.8
58	58	29°28'1.36"N	78° 4'28.45"E	5.71
59	59	29°27'12.65"N	78° 4'34.62"E	1.73
60	60	29°27'26.59"N	78° 4'49.48"E	0.57
61	61	29°24'35.03"N	78° 6'39.00"E	1.49
62	62	29°24'23.64"N	78° 6'39.58"E	0.27
63	63	29°23'28.12"N	78° 6'28.64"E	2.86
64	64	29°23'37.32"N	78° 6'28.68"E	1.47
65	65	29°23'41.84"N	78° 6'37.17"E	0.94
66	66	29°23'38.34"N	78° 6'48.56"E	0.50
67	67	29°22'26.58"N	78° 8'53.18"E	0.94
68	68	29°18'30.15"N	78° 9'59.90"E	0.16
69	69	29°18'45.30"N	78°10'3.11"E	0.21
70	70	29°16'34.61"N	78° 7'0.40"E	0.67
71	71	29°16'50.00"N	78° 6'39.10"E	0.27
72	72	29°17'11.78"N	78° 8'22.07"E	0.49
73	73	29°13'40.30"N	78°11'40.66"E	0.46
74	74	29° 8'21.19"N	78° 9'50.49"E	2.98
75	75	29° 8'46.48"N	78° 8'40.85"E	17.6
76	76	29° 8'50.70"N	78° 9'12.87"E	3.17
77	77	29° 7'27.52"N	78° 7'19.16"E	3.00
78	78	29° 5'53.44"N	78° 8'38.97"E	18.8
79	79	29°18'55.92"N	78° 5'34.68"E	1.10

8.3 **Pond At Bhaguwala :** This pond is located North of Bhaguwala, outside the village – west of Haridwar road [NH-34] and can be approached via a short village pathway. The area of pond is around 1.11 Ha. [Lake No. 7]. There is a Muslim graveyard towards its south and rest is surrounded by agriculture fields. There are few Sheesham and Mango trees on its southwestern edge. The pond comes under the jurisdiction of Gram panchayat and is used for fish breeding. During field visit it was found to be completely covered with dense mats of Water Lettuce [*Pistia stratiotes*]. It does not receive any sewage effluent from the village. The pond is apparently is 6-7 feet deep and is cleaned before the fingerlings are introduced for breeding. As reported by local community, the pond was comparatively larger in size in the past and has been encroached gradually by surrounding agricultural fields.

Image 15 : Location Of Pond At Bhaguwala [29°42'23.04"N, 78°15'15.20"E]

Image 16 : Panaromic View Of Pond at Bhaguwala
[Note the dense mats of Water Lettuce – *Pistia stratiotes*]

8.4 **Pond at Nangal Soti:** It is a large waterbody [Around 4.29 Ha] towards east of the Nangal on the main road at the entry of the village [Lake No. 29]. It is surrounded by agricultural fields on the eastern side and by settlements on the western side slowly encroaching in to the waterbody. During field visit, earth filling from the northern side [Nangal Link Road] was observed. It was learnt from local community that a private real estate contractor is encroaching upon the waterbody who has diverted the sewage channel away from the pond across the main road into the village. The unmanaged sewage emits foul smell and drain back into the village during rainy season. The southern part of the pond has also been encroached – where a warehouse kind of structure is clearly visible from Google Earth satellite imagery. Remaining area of the pond is used for fish breeding which are sold locally. Earlier the original size of the pond was large and migratory birds used to visit the waterbody during the winter season. Now the fishermen (or fish contractors) hang thin threads across the pond in order to keep away the fish feeding birds such as Kingfisher, Egrets, and Pond Herons. The same technique has been observed in many other smaller waterbodies in the Distt.. With time, the waterbody area reduced due to encroachment and complete negligence. Several resident birds such as Black-winged Stilt (*Himantopus himantopus*), Common Moorehen (*Gallinula chloropus*), Little

Grebe (*Tachybaptus ruficollis*), White-breasted Waterhen (*Amaurornis phoenicurus*) were sighted during the field visit.

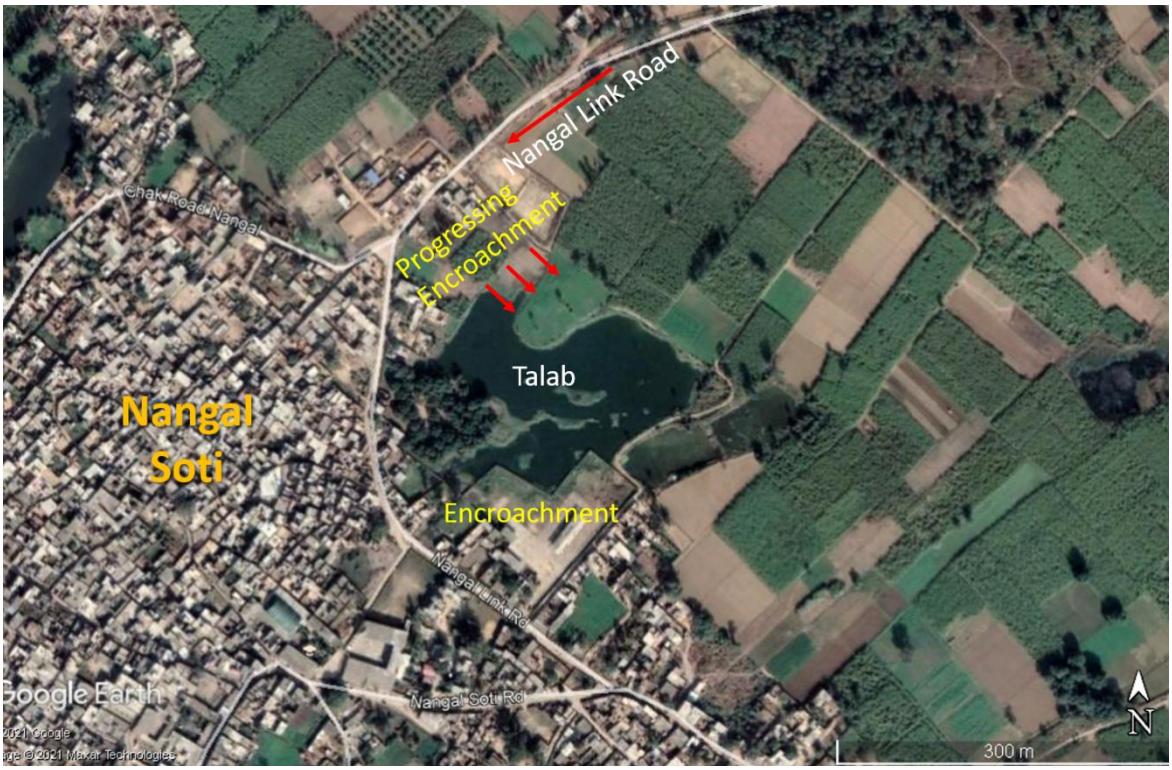


Image 17 : Location Of Pond At Nangal Soti [29°39'49.04"N, 78°11'42.12"E]

Image 18 : Earth Filling at Pond In Nangal [Looking Southeast]

Image 19 : Southwestern Edge Of The Pond

8.5 **Lake Near Sadullapur :** A large lake of area around 21.3 Ha is located between village Mohinuddinpur and Sadullapur, around 200 metre east of Ganga River [Lake No.46]. Historical imagery of 2004 on Google Earth reveals that the lake was originally an old meander [palaeochannel] of the Ganga River [around 5 km in length] extending till Husainpur village [Image-21] now gradually reduced to a lake disconnected from the river. The lake is rich in aquatic vegetation and thus a suitable habitat for resident and migratory bird diversity. Bird species sighted at the lake are Black-winged Stilt (*Himantopus himantopus*), Common Moorehen (*Gallinula chloropus*), White-breasted Waterhen (*Amaurornis phoenicurus*), White-throated Kingfisher (*Halcyon smyrnensis*), Grey Heron (*Ardea cinerea*) and Cattle Egret (*Bubulcus ibis*). The lake is currently used for irrigation by surrounding agricultural fields but the same farmers are encroaching upon it extending their fields by filling its edges.

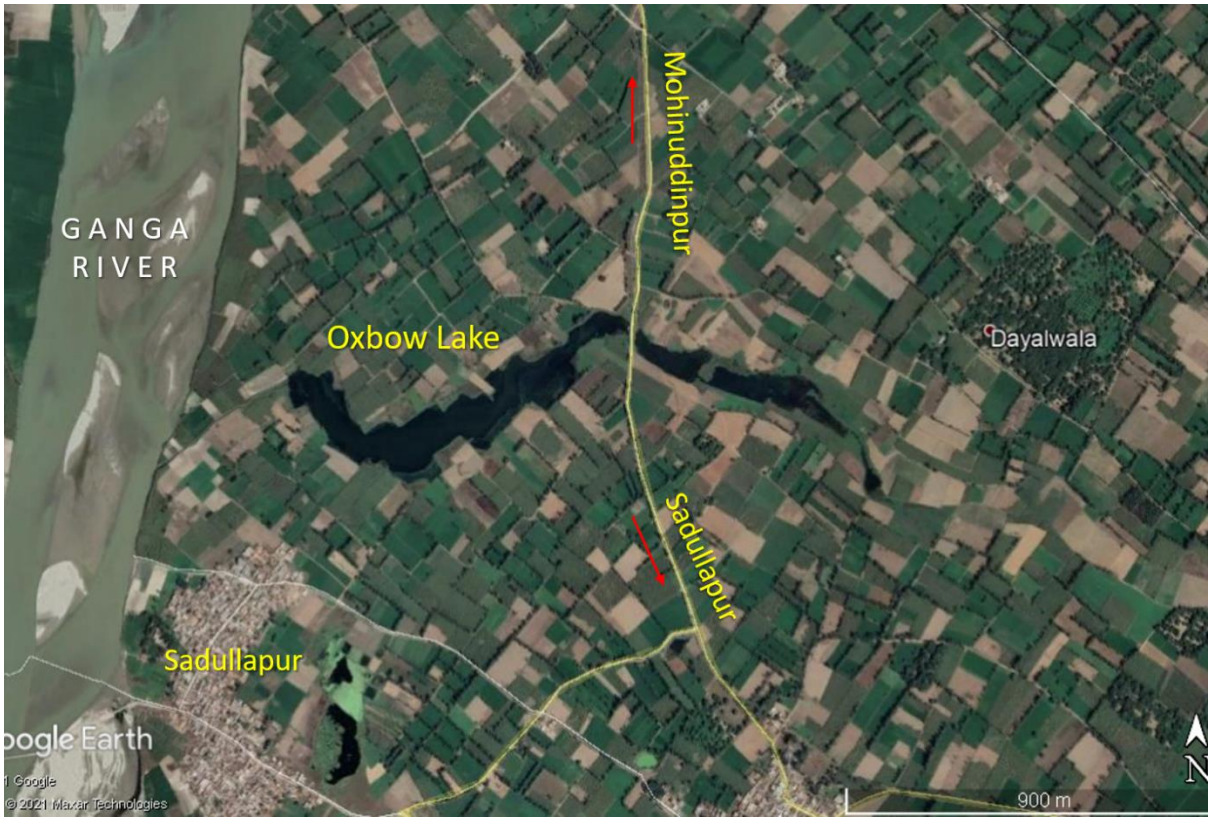


Image 20 : A Large Lake Near Sadullapur [29°30'26.88"N, 78° 4'9.36"E]

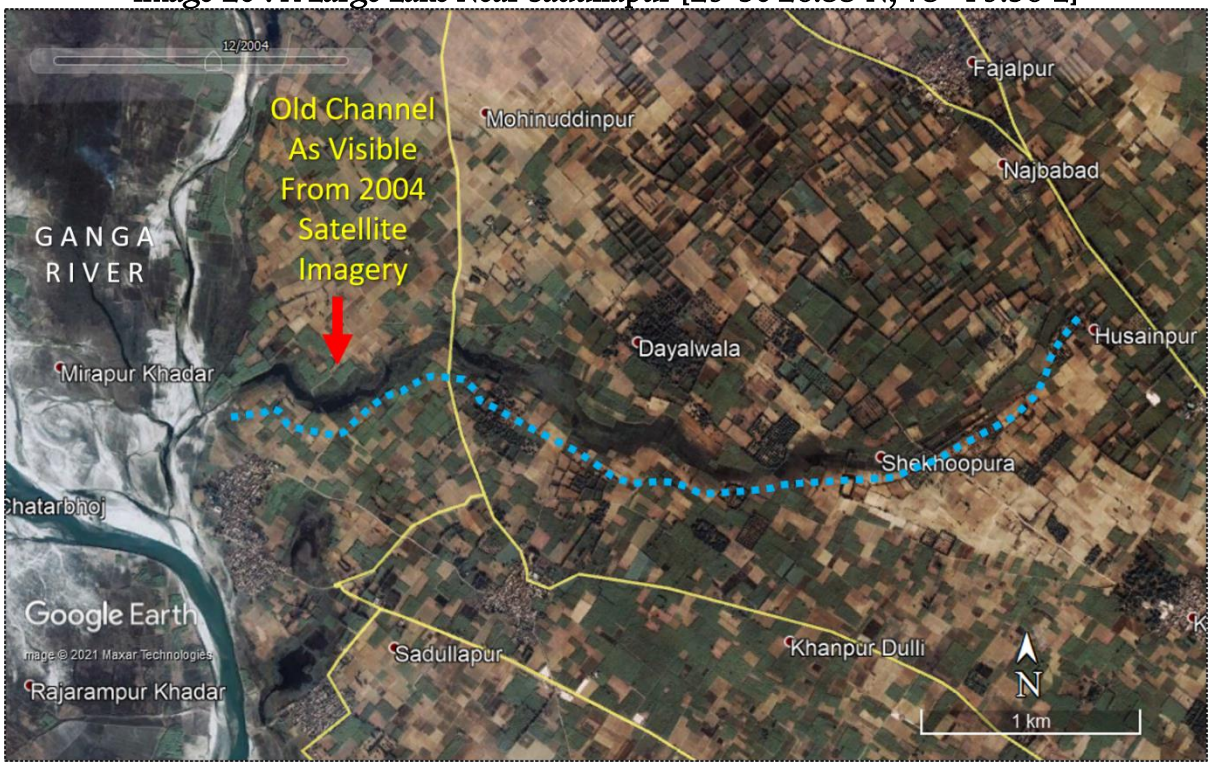


Image 21 : The Lake Was Once Part Of The Palaeochannel [2004]

Image 22 : Lake Near Sadullapur [part of disappearing meander channel]

8.6 **Peer Wali :** Although the lake falls outside the study area buffer, it is the largest waterbody located east of Mandawar town [around 7 km from Ganga River]. It is known as Peer Wali named after a local saint 'Dada Nooruddin' whose tomb is located few metres southwest from the waterbody in the old graveyard across the main road which leads to Mandawar town. The graveyard houses many old grave structures of more than 100 years old. During field visit, it was known from local community that original area of the waterbody was much larger and the saint used to live on its bank and hence it got the name. Now, the main road cuts this connection and waterbody falls on the right [east] of the road. Currently, the waterbody does not hold any spiritual or cultural significance and is used for fish culture. Species such as Manghur (*Clarias batrachus*), Tilapia (*Oreochromis niloticus*), Kari or Pangas (*Pangasianodon hypophthalmus*) are cultured and sold locally in the Distt.. It receives sewage discharge from the town and the water quality remains poor throughout year except monsoon season. As visible in the satellite imagery [Image-23], the waterbody has been severely encroached throughout its western edge and is under pressure from other sides.

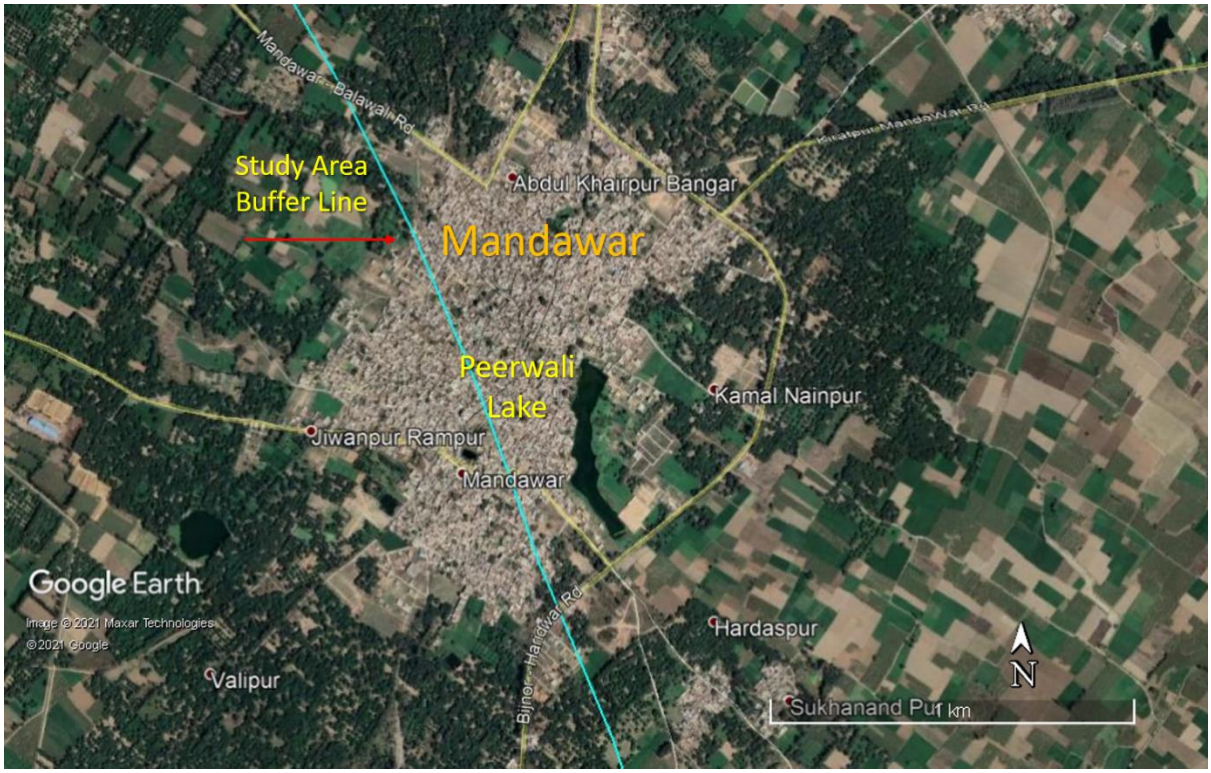


Image 23 : Peer Wali Lake at Mandawar

Image 24 : Peer Wali Lake at Mandawar [Looking North]

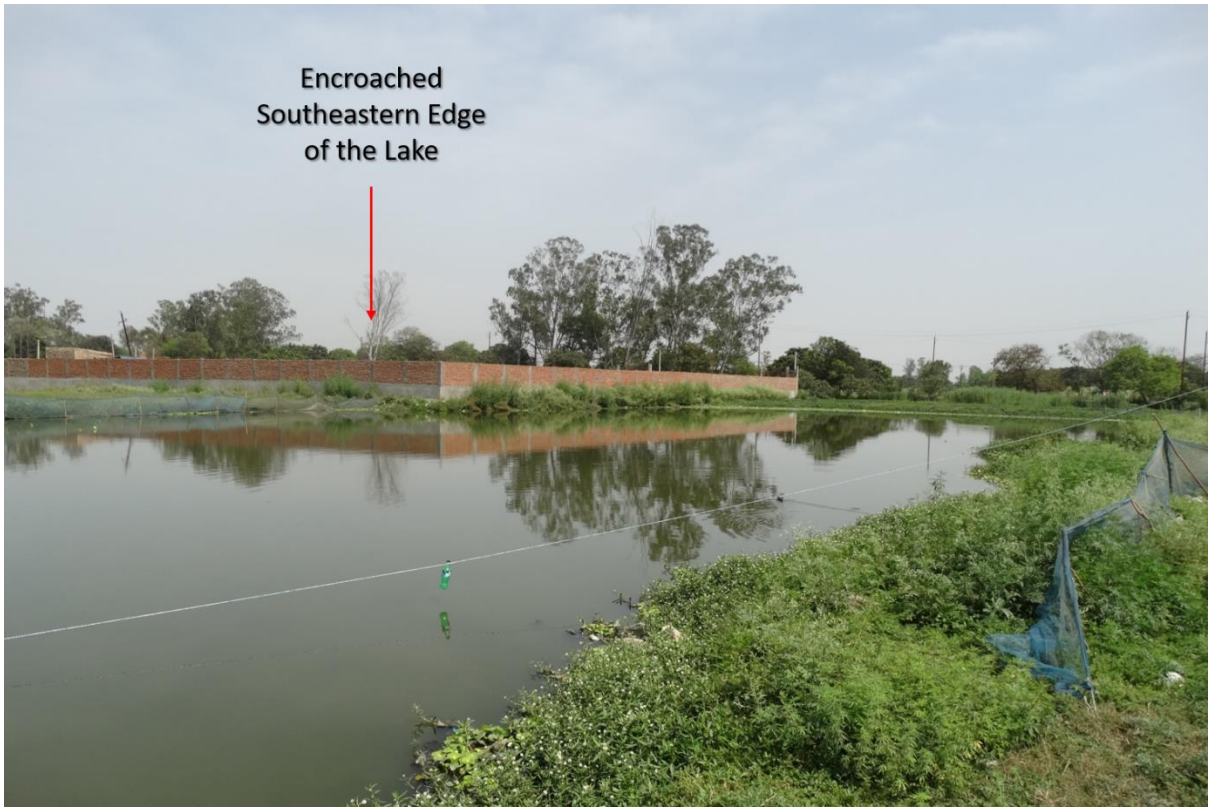
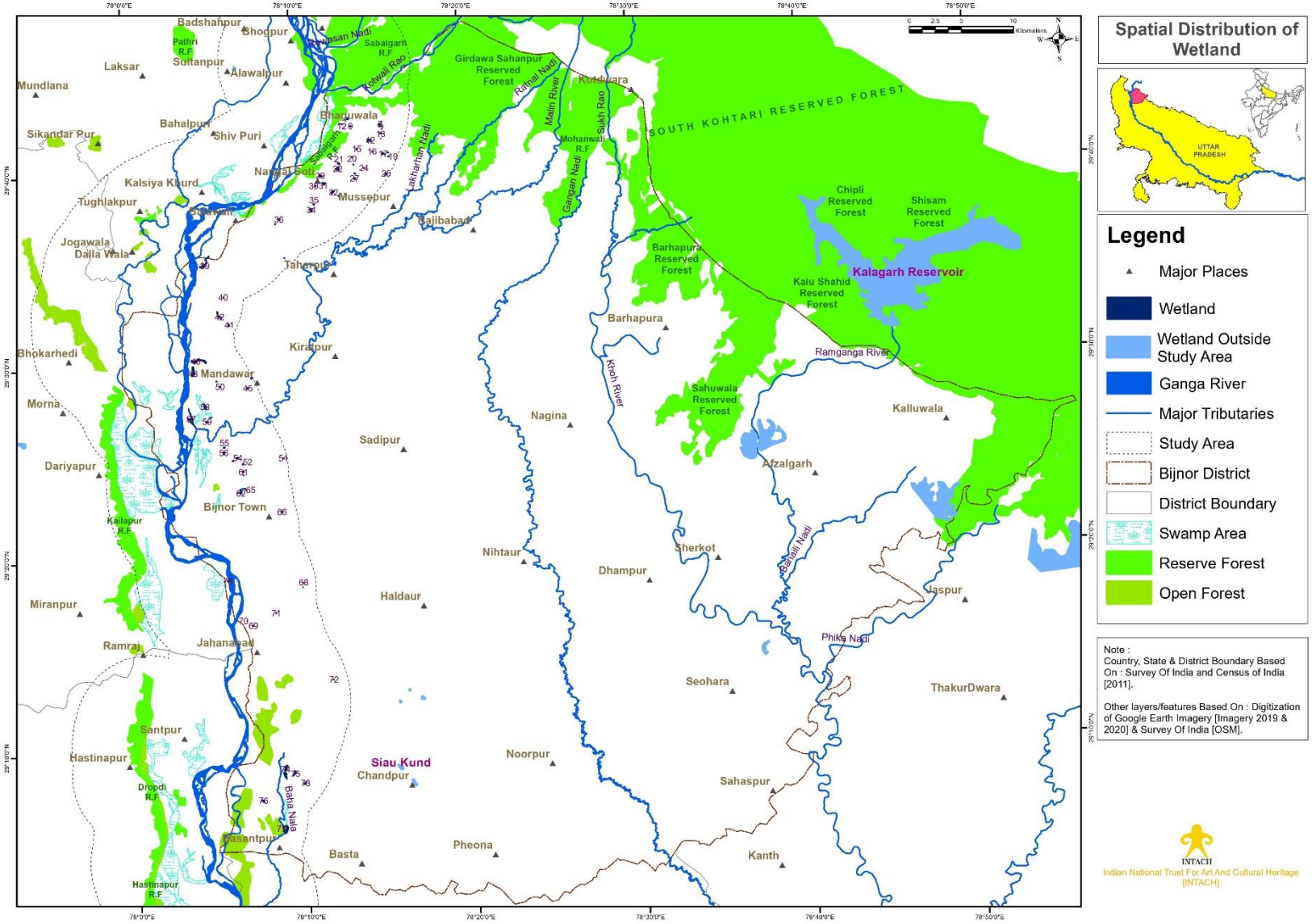


Image 25 : The Lake Is Under Severe Encroachment Pressure From All Sides

Image 26 : Tomb of Dada Nooruddin And Old Graveyard At Mandawar



Map 5 : Spatial Distribution Of Waterbodies In The Study Area

9.0 Riparian Flora Along Ganga River In Bijnor 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 harbour 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, harbouring faunal diversity and providing livelihood resources [Groffmanet al., 1990; Castelle 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], Groffmanet al. [1990], Krishanmurti [1991], Castelle 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.

9.3 In Bijnor Distt., as mentioned in floodplain section (7.0) of the report above, most of the floodplain area is under agriculture rarely leaving little trace of riparian vegetation. Most of the agriculture fields extend up to the active channel of the river. There are several protected forest patches in the north from Sabalgarh to Nangal [forest mounds], at Daranagar [near Vidur Kuti], Jahanabad, Kalyanpur [has the largest patch] and Rampur Khadar. Both Jahanabad and Kalyanpur forest patches show poor growth with rich understorey of grasses and weeds, though plantation with trees of 5-7 ft. approx. was observed during the field visit. Several solitary trees were observed along the bank and on floodplains mentioned in Table No. 4. Eucalyptus and Poplar plantation was observed around agriculture fields as a common practice for windbreaking. Palaeochannels, depressions, and lakes were found to be rich in riparian and aquatic vegetation. Species of *Typha, Phragmites, Saccharum, Tamarix, Calotropis, Alternanthera* were observed. *Sachharum* grass holds great economic value. Apart from its use for making hedges and thatch roof, it is used for making cane furniture. Few members of local community were observed making cane furniture using Saccharum grass on Balawali-Mandawar road

[Image-28]. This local enterprise is completely dependent upon the Saccharum grass harvested from Ganga River floodplain.

Table 4 : Main Tree Species Recorded In The Study Area

S. No.	Botanical Name	Common Name	Family
1.	*Albizia lebbeck*	Siris	Fabaceae
2.	*Azadirachta indica* A. Juss.	Neem	Meliaceae
3.	*Acacia nilotica* L.	Babool/Kikar	Fabaceae
4.	*Dalbergia sissoo DC.*	Sheesham	Fabaceae
5.	*Ficus religiosa* L.	Peepal	Moraceae
6.	*Ficus benghalensis* L.	Banyan	Moraceae
7.	*Ficus virens*	Pilkhan	Moraceae
8.	*Ficus racemosa*	Gular	Moraceae
9.	*Bombax ceiba L.*	Semal	Bombacaceae
10.	*Mangifera indica*	Aam	Anacardiaceae
11.	*Populus spp.*	Poplar	Salicaceae
12.	*Eucalyptus spp.*	Liptis	Myrtaceae
13.	*Phoenix dactylifera L.*	Khajur	Arecaceae
14.	*Tectona grandis* L.f.	Teak/Saagwan	Lamiaceae
15.	*Ziziphus mauritiana*	Indian Jujube	Rhamnaceae
16.	*Delonix regia*	Gulmohar	Fabaceae
17.	*Melia azedarach*	Bakain	Meliaceae
18.	*Leucaena leucocephala*	Subabool	Fabaceae
19.	*Syzygium cumini*	Jamun	Myrtaceae
20.	*Aegle marmelos*	Bel	Rutaceae
21.	*Butea monosperma*	Dhak	Fabaceae
22.	*Morus alba*	Shahtoot	Moraceae
24.	*Saraca ashoka*	Ashok	Fabaceae
25.	*Terminalia arjuna*	Arjun	Combretaceae

Image 27 : Partially Harvested Saccharum Patch On Dry Ganga Riverbed At Balawali

Image 28 : Making Cane Furniture From Saccharum Grass, Balawali-Mandawar Road

Image 29 : A Banyan Tree [*Ficus benghalensis*] With Multiple Prop Roots [Dhinvarpura*]

[*Dhinvarpura is around 5 km east of Ganga and this huge tree with more than 50 prop roots covers major part of the Muslim graveyard]

Image 30 : Sacred Peepal Tree [*Ficus religiosa*] At Ganga Floodplain, Balawali

10.0 Faunal Diversity Along Ganga River In Bijnor Distt.

10.1 Due to very few and scattered forest in the study area, the mammal diversity is poor and includes common terrestrial mammals which are sighted occasionally on floodplain areas along the Ganga. Although the part of Hastinapur Wildlife Sanctuary covers Ganga floodplains in the Distt., but most of it is agriculture landscape with little forest cover. Common mammals include Indian Jackal (*Canis aureus indicus*), Bengal Fox (*Vulpes bengalensis*), Langur (*Semnopithecus spp.*), Indian Hare (*Lepus nigricollis*), Sambar Deer (*Rusa unicolor*), Chital (*Axis axis*). Bijnor Gazetteer of 1908 mentions about other mammals which were part of the landscape in earlier days. They were Tiger, Hyaena, Wolf and Wild Dogs. The most common antelopes were Chital or Spotted Deer (*Axis maculatus*), Parha or Hog Deer (*Axis porcinus*), and Black Buck (*Antelope cervicapra*). Gond or Swamp Deer (*Rucervus duvaucelii*) and Four-horned Antelope (*Tetracerus quadricornis*) were part of the Distt. but noted to be extinct during those days. Nilgai were unexpectedly rare and occurred in woodlands. Wild pigs were very common both in the northern jungles and in open plains and wherever ravines, tall grass and sugarcane were plentiful. Wild elephants which used to wander till swamps of Bashta [10 km southwest of Chandpur] were noted to be limited to northern woodlands where they came in large herds during rainy season.

10.2 Presently, there are occasional sightings of Indian Leopard (*Panthera pardus fusca*) or their cubs in the Distt. which apparently stray from their habitat in hilly forests of Uttarakhand [north of Distt.] – mainly Pathari and Chidiyapur Forest Range and Corbett National Park. Nilgai (*Boselaphus tragocamelus*) are found in abundance and destroy crops frequently. Wild Boar (*Sus scrofa*) also creates the same menace but are lesser visible in open fields. Monkey (*Rhesus macaque*) are present in large numbers and mostly found in northern belt from Sabalgarh to Nangal area due to close proximity to forests.

10.3 Some major aquatic fauna found in this stretch of Ganga River stretch have been described briefly below:

10.4 **Gangetic Dolphin** : The Gangetic River Dolphin (*Platanista gangetica gangetica*) 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 Ganga–Brahmaputra–Meghna and Sangu–Karnaphuli River systems in India, Nepal, and Bangladesh (Sinha & Kannan, 2014). It has been declared as the National Aquatic Animal by Govt. of India (Sinha & Kannan, 2014) and is classified as 'Endangered' in the IUCN

Red List owing to the decrease in its population in the last 3-4 decades. A joint census[4] carried out in October, 2019 by Uttar Pradesh Forest Department's divisions of 5 Distt.s namely Bijnor, Meerut, Hapur, Amroha and Bulandshahr and WWF-India recorded 36 dolphins which also included 3 calves. Most of them (31) were recorded in Hastinapur Wildlife Sanctuary which stretches from Bijnor Ganga Barrage to Garhmukteshwar. Based on the interactions with local people, it was found that most of the dolphins are sighted upstream of Bijnor Ganga barrage. They are mostly sighted during monsoon season when the water level is high. Interactions with local community and island farmers at Nangal, Balawali, Devalgarh, Daranagar Ganj reveal that dolphin sightings were common around a decade back when the flow in the river was high for days during and after the monsoon. Now the water recedes more quickly. Many local people have not even heard about the fish.

10.5 **Gharial** : Indian Gharial (scientifically known as *Gavialis gangeticus*) is the only surviving member of an ancient family of crocodiles found to reside mainly in Indian sub-continent. It derives its popular name – gharial or gavial from the bulbous knob like protuberance on a breeding male's snout which resembles a 'Ghara' meaning an earthen pitcher (Saikia, 2012). This species is endemic to the Indian sub-continent and is considered to be 'Critically Endangered' in the IUCN Red List. Once distributed across several major river systems in India and neighbouring countries, this species has seen an estimated 96-98% decline in its population owing and is now restricted to only few scattered locations in India and Nepal (Sinha, 2018).

10.6 Earlier records of Gharial in Bijnor Distt. come from the time when 225 captive reared Gharial released by the Uttar Forest Department in the Ganga river upstream of Bijnor in the Hastinapur Wildlife Sanctuary in the year 1991-92[5]. Later on, another batch of 678 Gharials was released in 2015 near Makhdoompur village in Hastinapur Wildlife Sanctuary – out of which only 16 Gharials survived[6]. During current study, no gharial or crocodile was sighted, however fishermen at a small fish market located at village Navalpur near Ganga Barrage shared the pictures of a batch of Gharials released by the Forest Dept. on 24th Nov. 2020. [Image-31 & 32]. Some local people revealed that fishermen do not like their presence as they feed on the fish and decrease fish productivity while some are familiar with the fact that they clean the river by feeding on the detritus other than the fish.

[4] With three calves, Ganges dolphin population up to 36 in UP, Times of India, Oct.16, 2019
[5] Status of Higher vertebrates in the Ganga River : Ganga River Basin Environment Management Plan by IITs, June 2012
[6] WWF rescues Gharial trapped in Ganga canal after gates shut monsoon. Oct.28, 2017

Image 31 : Batch Of Gharial Being Released Downstream Of Bijnor Barrage

Image 32 : Gharials On Their Way Into The Ganga River

10.7 Locals at Nangal Soti village informed that there have been many incidents of Gharial or Crocodile straying into the village or agriculture fields and the village is known in the Distt. for such incidents, however any loss to life or injury have not been reported. One such incident was reported recently on 26th May, 2021, when a 'Magarmuchh' [Not confirmed whether it was a Gharial or Crocodile] strayed in Valmiki Basti of Nangal Soti village. It was rescued and later released in Ganga River next day. [See Image-33] Boatmen at Ganga ghat at Bijnor informed that Gharials are seen in 5 to 10 km stretch downstream of Ganga barrage and it's easy to sight such aquatic diversity during or immediately after monsoon season.

मेरठ | बुधवार, 26 मई 2021 5

बस्ती में घुसा मगरमच्छ गंगा नदी में छोड़ा गया

संवाद न्यूज एजेंसी

नागलसोती के मोहल्ले में मगरमच्छ पहुंचने से मचा हड़कंप, पुलिस ने पकड़ा

नांगलसोती। नांगलसोती की बाल्मीकि बस्ती में घुसे मगरमच्छ को देखकर ग्रामीणों में हड़कंप मच गया। सूचना पर वन विभाग के अधिकारी मौके पर नहीं पहुंचे। बाद में नांगलसोती पुलिस ने मगरमच्छ को पकड़कर गंगा में छोड़ा।

नांगलसोती के मोहल्ला वाल्मीकि बस्ती के समीप एक तालाब है। सोमवार की देर रात बस्ती में घुसे मगरमच्छ ने विशु के घर में घुसने का प्रयास किया। अचानक करीब पांच फीट लंबे मगरमच्छ को देखकर परिवार सहित बस्ती के लोगों में हड़कंप मच गया।

बस्ती के लोगों ने मगरमच्छ के बस्ती में घुसने की सूचना वन विभाग को दी, लेकिन कोई भी अधिकारी मौके पर नहीं पहुंचा। सूचना पर नांगलसोती थाने से पहुंचे एसआई विनोद कुमार ने अपनी टीम के साथ मगरमच्छ को जाल के सहारे कैद करने का प्रयास किया। घंटों की मशक्कत के बाद मगरमच्छ को पकड़ने में कामयाबी मिली। जिस पर लोगों ने राहत की सांस ली।

बस्ती के लोगों के लिए खौफ बने मगरमच्छ पुलिस थाने ले गई। पूरी रात मगरमच्छ को थाने में बंधक बनाकर रखा गया। सुबह होते ही नांगलसोती पुलिस ने मगरमच्छ को गंगा में छुड़वा दिया।

Image 33 : Newspaper Report Of Crocodile Sighting [Source : Amar Ujala]

10.8 **Turtles :** India is one of the world's hotspots for turtle diversity representing 29 species of tortoises and freshwater turtles among which 13 different species find their abode in the Ganga river system. These turtles play a significant role in the river by scavenging dead organic material and diseases fish, controlling fish population as predators and controlling aquatic plants and weeds (WII, 2017). Variety of habitats such as muddy and sand banks, islands, varying depth of water in Ganga, and floodplain lakes supports chelonian diversity but major threats such as floodplain agriculture, increasing pollution, irregular flow of water and sandmining activities are altering their habitats and thus their population is continuing to decline.

10.9 A report published by WWF-India[7] in 2011 mentioned the presence of 12 species of turtles between Bijnor and Kanpur stretch of Ganga River [Table-5]. Based on collections of shell and live specimens, eight species belonging to four genera and one family of hard-shell turtles, and four species belonging to three genera and one family of soft-shell turtles

[7] Behera, S., G. Areendran, P. Gautam and V. Sagar (2011), For A Living Ganga–Working with People and Aquatic Species, New Delhi: WWF-India, 84 pp.

were identified by them. During the current field visit, a large group of Brown-roofed Turtles [Image-34] was sighted at a smaller island in Ganga River at Daranagar Ganj which was accessed with the help of a small wooden boat owned by an island farmer. There were around more than 30 turtles basking in the sun. Some were sighted carrying their offspring on their carapace. Another sighting [Image-35] came from the Ganga River visible from Nandnaur-Hastinapur bridge [on the road leading to Hastinapur in Meerut]. The Ganga channel is around 500 m wide here with an island (completely under cultivation) underneath the bridge. The turtles were sighted away from the island on smaller sand beds, claiming what is left for them to survive.

Table 5 : Freshwater Turtles In Ganga River Between Bijnor and Kanpur

S.No.	Family	Genus	Species	Common Name
1.	Emydidae	*Hardella*	*thurjii*	Crown River Turtle
2.		*Geoclemys*	*hamiltonii*	Spotted Pond Turtle
3.		*Melanochelys*	*trijuga*	Indian Black Turtle
4.		*Batagur*	*kachuga*	Red-crowned Turtle
5.		*Pangshura*	*smithii*	Brown-roofed Turtle
6.		*Pangshura*	*tecta*	Indian-roofed Turtle
7.		*Pangshura*	*tentoria*	Indian Tent Turtle
8.		*Batagur*	*dhongoka*	Striped Roof Turtle
9.	Trionychidae	*Lissemys*	*punctata*	Indian Flapshell Turtle
10.		*Chitra*	*indica*	Narrow-headed soft-shell Turtle
11.		*Nilssonia*	*gangeticus*	Indian soft-shell Turtle
12.		*Nilssonia*	*hurum*	Indian Peacock Soft-shelled Turtle

Source : WWF-India, 2011

Image 34 : A Bale Of Brown-roofed Turtles In Ganga River At Daranagar Ganj [note vertical erosion of river bank in the background]

Image 35 : Brown-roofed Turtles Sighted From Nandnaur-Hastinapur Bridge

Image 36 : Smaller Sand Beds Are The Last Refuge For Turtles

10.10 **Avian Diversity :** During field survey, the diversity of avian species was recorded using binoculars and identified using field guides (Grimmett et al., 2016 and others). During the field visit, a total of 59 bird species were sighted. Out of which 22 are aquatic species and remaining 37 are terrestrial birds [Table-6].

10.11 Important observations are:

- On the basis of field experience, it can be said, the Distt. harbours rich bird diversity due various kind of habitats – rivers, swamps, depressions, lakes, riparian buffer of channels, open lands, and agriculture fields.
- Aquatic vegetation and riparian grasses of palaeochannels, waterbodies and depressions are serving as important habitats for birds in the river basin.
- In absence of main river islands – where every inch is under farming, the smaller islands and exposed sand beds are proving as last refuge for aquatic biodiversity especially migratory birds, turtles, gharials and crocodiles. Ruddy Shelduck [*Tadorna ferruginea*] were also sighted seeking refuge at such islands.
- White throated kingfisher was sighted frequently in dry canals and streams with few water pools indicating importance of baseflow and connection with habitats.

- Green-bee Eater birds were sighted more frequently near floodplain lakes and depressions preying upon dragon and damselflies.
- Bronze-winged Jacana was sighted in almost every waterbody, depression or swamp in the study area.
- Common birds sighted more often in and around the river are River Tern, White-throated Kingfisher, Grey Heron, Indian Pond Heron, Cattle Egret, Cormorants, and River Lapwing.
- Birds sighted more frequently in and around waterbodies are Indian Pond Heron, Bronze-winged Jacana, Asian Open Bill, White Breasted Waterhen, Cattle Egret, Little Egret, White-throated Kingfisher.
- Two bird species – Painted Stork and River Lapwing fall under IUCN's 'Near Threatened' category and River Tern fall under ' Vulnerable Category'.

Table 6 : List Of Birds Sighted During Field Visit

S. No.	Common Name	Scientific Name	Conservation Status
1.	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern
2.	White throated Kingfisher	*Halcyon smyrnensis*	Least Concern
3.	Asian Openbill	*Anastomus oscitans*	Least Concern
4.	Little Cormorant	*Microcarbo niger*	Least Concern
5.	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
6.	White breasted -Waterhen	*Amaurornis phoenicurus*	Least Concern
7.	Indian Pond Heron	*Ardeola grayii*	Least Concern
8.	Cattle Egret	*Bubulcus ibis*	Least Concern
9.	Little Egret	*Egretta garzetta*	Least Concern
10.	Great Egret	*Ardea alba*	Least Concern
11.	Little Grebe	*Tachybaptus ruficollis*	Least Concern
12.	**Painted Stork**	***Mycteria leucocephala***	**Near Threatened**
13.	**River Lapwing**	***Vanellus duvaucelii***	**Near Threatened**
14.	**River Tern**	***Sterna acuticauda***	**Vulnerable**
15.	Yellow-wattled Lapwing	*Vanellus malabaricus*	Least Concern
16.	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
17.	Grey Heron	*Ardea cinerea*	Least Concern
18.	Purple Swamphen	*Porphyrio porphyrio*	Least Concern
19.	Common Moorehen	*Gallinula chloropus*	Least Concern
20.	Common Coot	*Fulica atra*	Least Concern

21.	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
22.	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
23.	Black Drongo	*Dicrurus macrocercus*	Least Concern
24.	Bank Myna	*Acridotheres ginginianus*	Least Concern
25.	Common Myna	*Acridotheres tristis*	Least Concern
26.	Oriental Dove	*Streptopelia orientalis*	Least Concern
27.	Spotted Dove	*Spilopelia chinesis*	Least Concern
28.	Black-winged Kite	Elanus caeruleus	Least Concern
29.	Shikra	*Accipiter badius*	Least Concern
30.	Asian Koel	*Eudynamys scolopaceus*	Least Concern
31.	Greater Coucal	*Centropus sinensis*	Least Concern
32.	Red-vented Bulbul	*Pycnonotus cafer*	Least Concern
33.	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concern
34.	Oriental Magpie Robin	*Copsychus saularis*	Least Concern
35.	Indian Robin	*Saxicoloides fulicatus*	Least Concern
36.	Common Pigeon	*Columba livia*	Least Concern
37.	Common Koel	*Eudynamys scolopaceus*	Least Concern
38.	House Sparrow	*Passer domesticus*	Least Concern
39.	Indian Jungle Crow	*Corvus culminatus*	Least Concern
40.	House Crow	*Corvus splendens*	Least Concern
41.	Plain Prinia	*Prinia inornata*	Least Concern
42.	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
43.	Common Tailorbird	*Orthotomus sutorius*	Least Concern
44.	Indian Silverbill	*Euodice malabarica*	Least Concern
45.	Yellow Wagtail	*Motacilla flava*	Least Concern
46.	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
47.	White Wagtail	*Motacilla alba*	Least Concern
48.	Indian Bushlark	*Mirafra erythroptera*	Least Concern
49.	Common Babbler	*Turdoides caudatus*	Least Concern
50.	Jungle Babbler	*Turdoides striata*	Least Concern
51.	Asian Pied Starling	*Gracupica contra*	Least Concern
52.	Common Stonechat	*Saxicola torquatus*	Least Concern
53.	Black Drongo	*Dicrurus macrocercus*	Least Concern
54.	Grey-throated Martin	*Riparia chinensis*	Least Concern
55.	Rufous-backed Shrike	*Lanius schach*	Least Concern

56.	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
57.	Ashy prinia	*Prinia socialis*	Least Concern
58.	Green bee-eater	*Merops-orientalis*	Least Concern
59.	Baya Weaver	*Ploceus philippinus*	Least Concern

Image 37 : Ruddy Shelducks (*Tadorna ferruginea*) Sighted From Nandnaur-Hastinapur Bridge

Image 38 : River Lapwing (*Vanellus duvaucelii*) Sighted At Devalpur

Image 39 : Bronze-winged Jacana [*Metopidius indicus*] Sighted At Balawali

Image 40 : Green bee-eater (*Merops orientalis*) Sighted Near Palaeochannel, Bijnor Barrage

Image 41 : Brown Darner (*Gynacantha dravida*) Sighted At Balawali

Image 42 : Blue-Grass Dartlet (*Pseudagrion microcephalum*) In Flight Over Ganga At Nangal

11.0 Ganga Riverine Islands In Bijnor 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]. Islands are generally formed by sand or sediments mass by currents during higher level of river flow and are exposed during dry season. River islands provide habitat to a large variety of living organisms such as birds, butterflies, insects and smaller mammals.

11.2 During the field visit it was observed that in Bijnor stretch of Ganga River, there are many exposed and partially exposed river islands of varying shape and size. As per the fluvial island classification proposed by Wyrick & Klingeman (2011), the islands here would be fall under 'Braided' category – which means many channels divided by islands and bars, which may be washed out in high flows. These islands and sandbars get immersed with the increased water flow in river – especially during monsoon season

along with the river channels in between them. Such sand bars make it difficult for motor boats to navigate through as their outboard motor with propellor fan gets stuck in the sand. In Bijnor – downstream of barrage, it got very difficult even to move 500 metres onboard the *Ganga Dolphin Safari* motorboat. It had to be pulled out of the river manually. Local boatmen and fishermen identify these channels with the help of long bamboo or wooden poles which they use to propel their boats.

11.3 Apart from naturally formed islands in the river, a significant amount of island area is building up due to increasing sedimentation load upstream of Bijnor barrage – shrinking the water channel towards left bank [here the river bank is protected by embankment in order to avoid spillage and loss during high flow]. The similar sedimentation build up is visible downstream of barrage but here due to concave bank formed due to easterly course of the river. The island thus formed is cultivated for cucurbit crops every year. [Image-44]

11.4 In Bijnor, most of the river islands are used for agriculture by local farmers except smaller or less stable ones. Cucurbits such as cucumber, melons, bitter and bottle gourds, tomatoes, pumpkins are grown and known as '*Palez*'. Smaller wooden boats are used for to and fro movement from the main land. As mentioned in faunal diversity section, all the main river islands are under cultivation, the smaller islands and exposed sand beds are proving as last refuge for aquatic biodiversity especially migratory birds, turtles, gharials and crocodiles. The width of the islands varies between 500 m- 1 km and length 1 km to 4 km as observed via Google Earth's satellite imagery. [Image-43]

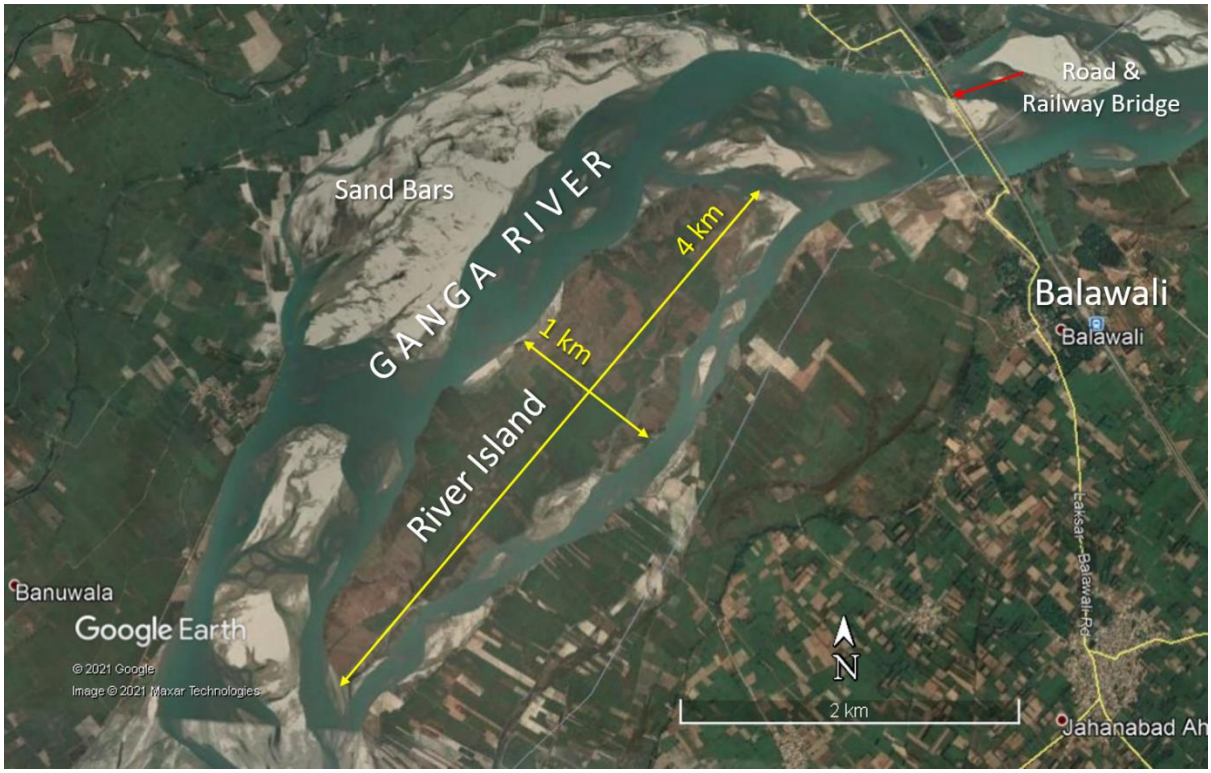


Image 43 : River Island At Balawali As Seen Through Google Earth Imagery

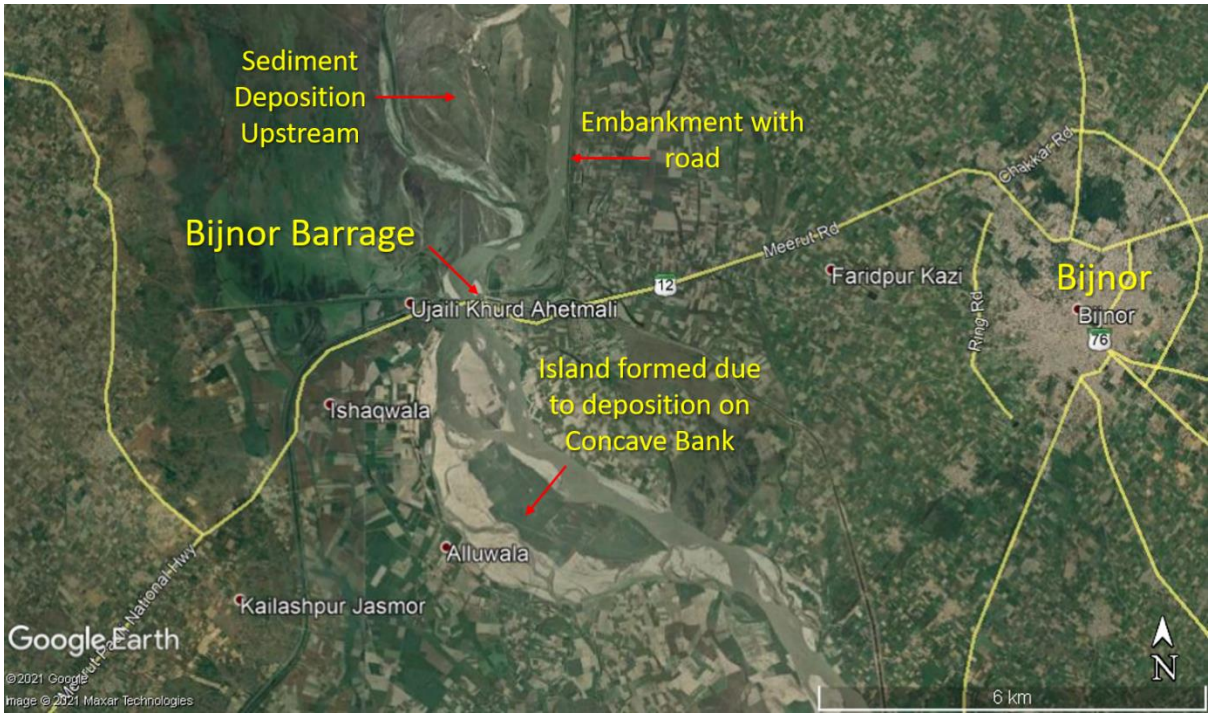


Image 44 : Sediment Deposition Upstream and Downstream Of Bijnor Barrage

Image 45 : Cucurbits Cultivation On A Large River Island At Nangal

Image 46 : Island Under Cultivation At Nandnaur~Hastinapur Bridge

Image 47 : Boats Being Pulled Out Of River Downstream Of Bijnor Barrage Owing to Shallow Waters

Image 48 : A Boatman Propelling Small Wooden Boat By Bamboo Pole Downstream Barrage

12.0 Fishing In Bijnor Distt.

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

12.2 Fishing is an important source of income for fishermen and daily wagers in Bijnor Distt. Fishing is carried out by various means – nylon & rope nets, rods and nylon fishing lines (threads). Fish captured by fishermen are sold in the local markets and occasionally out of the Distt. One such market (fish mandi) was visited during field visit at Navalpur village near Bijnor Ganga barrage [Image-51]. The village is inhabited by Bengali community who migrated from parts of Bengal after India's independence. Most of the members of community are involved in fishing and agriculture for their subsistence.

12.3 Upon interaction with local fishermen, it was found that most of the fish species are found in this stretch of Ganga River. The fish species diversity increases during monsoon season and decreases as water level goes down post monsoon every year. There are no specific techniques to identify the spots for fishing in river. It entirely depends on accessibility and area divided between fishermen.

12.4 The most common fish species are Rohu (*Labeo rohita*), Catla (*Labeo catla*), Carp (*Cyprinus carpio*), Singhi (*Heteroneustes fossilis*), *Naini* (*Cirrhinus mrigala*), Singhara (*S. seenghala*), Gonch (*Bagarius bagarius*), Chilwa (*Oxygaster bacaila*), Chaal (*Chela bacaila*) Sauli or Sawli (*Channa striatus*) and (*Channa punctata*) [Table No.7]. Mahasher or Golden Mahaseer (*Tor tor*) is a rare occurrence in the Distt. stretch of Ganga River.

Table 7 : Riverine Fish Common in Bijnor Distt.

S. No.	Common Name	Scientific Name
1.	Rohu	*Labeo rohita*
2.	Catla	*Labeo catla*
3.	Common Carp	*Cyprinus carpio*
4.	Grass Carp	*Ctenopharyngodon idella*
5.	Silver Carp	*Hypophthalmichthys molitrix*

6.	Sauli or Sawli	*Channa punctata*
7.	Sauli or Sawli	*Channa striatus*
8.	Naini	*Cirrhinus mrigala*
9.	Gonch	*Bagarius bagarius*
10.	Singhi	*Heteroneustes fossilis*
11.	Singhara	*Sperata seenghala*
12.	Chilwa	*Oxygaster bacaila*
13.	Chaal	*Chela bacaila*
14.	Puthi	*Puntius sarana (Ham.)*
15.	Bata	*Labeo bata*
16.	Kalmouch	*Labeo calbasu*
17.	Laanchi	*Wallagu attu*
18.	Teenghara	*Mystus vittatus*
19.	Manghur	*Clarias batrachus*
20.	Manghur	*Clarias gariepinus*
21.	Chapra	*Gudusia chapra*
22.	Cheetal or Mau	*Chitala chitala*

Image 49 : Freshly Caught Cheetal or Mau [*Chitala Chitala*] at Navalpur Village Fish Market

Image 50 : Sawli (*Channa punctata*) Caught From Ganga River, Bijnor

Image 51 : Small Fish Market At Navalpur Village, Near Bijnor Ganga Barrage

13.0 Groundwater Condition In Bijnor Distt.

13.1 As per Distt. Groundwater Brochure, CGWB [2012-2013], the major part of the Distt. is underlain by alluvial sediments of quaternary period deposited by drainage system of river Ramganga and Ganga. The Siwalik system of formation belonging to tertiary period are exposed in the extreme north-western part of the Distt. in the Najibabad block. The sub-surface geology and aquifers layout as studied with the help of lithological logs reveal the aquifer geometry down to 450 m depth. The fence diagram reveals two major clay layers, one occurring at a depth of 80-90 m and the other at 250 m. Thickness of first clay layer is 8-10 m while the second clay layer is 25 metres. Three tier aquifer system exists in the area. The formation encountered are sands of various grades of clay and kankar. The aquifer material is sand, fine to coarse grained with occasional gravels. The aquifer groups are as follows:

Table 8 : Aquifer Group And Its Depth Range

S.No.	Aquifer Group	Depth Range (m)
1.	First Aquifer (Top)	00.00 – 110.00
2.	Second Aquifer (Middle)	120.00 – 250.00
3.	Third Aquifer (Bottom)	270.00 – 450.00

Source : Distt. Groundwater Brochure, CGWB [2012-2013]

13.2 The brochure further states that the first and second aquifers are most productive and most of the state government tube wells have been constructed in the first aquifer which are yielding 1500-2000 lpm [litres per minute] at a reasonable drawdown. The second and third aquifer are also productive and discharge of up to 3000 lpm can be obtained at moderate drawdown from these aquifers. Occurrence of thin clay lenses is quite common within the aquifers. In the central part of the Distt. frequent occurrence of clay within the second and third aquifer has been observed. This may be due to the migration of two important drainage system, the Ganga and Ramganga, which are responsible for deposition of alluvium sediments. The Ganga system has deposited coarser sediments in the western part of the Distt..

13.3 The groundwater in the Distt. occurs under unconfined state in shallow aquifers while in semiconfined to confined state in deeper ones. Water table contour map indicates flow to the south and the scope of water table is steeper in the northern part of the Distt. (4.5m/km) while further south it is much flatter (0.62 m/km). The highest elevation of the water table is over 300 mamsl in the northern part while around 210 mamsl in the southern part.

13.4 Perusal of depth to water level map of the Distt. indicates that the water level varies between 3.33 to 17.92 mbgl during premonsoon period. Deepest water level (more than 15 mbgl) occurs in the eastern part of Ganga river and in Muhammadpur block. The water level between 10 to 15 mbgl occurs in parts of Jalilpur, Haldaur, Mohammadpur Deomal, Kiratpur and Najibabad blocks. Water level varies between 5 to 10 mbgl in parts of Noorpur, Nehtaur and Kotwali blocks. Shallow water level less than 5 metres has been observed in parts of Seohara, Dhampur, Afzalgarh and Kotwali blocks.

13.5 The Distt. groundwater brochure further indicates that the groundwater is declining very fast in Distt. with one 'Critical' block i.e. Noorpur and two 'Semi-critical' blocks i.e. Jalilpur and Seohara. This is due to massive groundwater extraction in these blocks for irrigation as well as for industries. Lowered water table has resulted in drying up of many minor drainage channels and dug wells have almost become defunct. Groundwater levels recorded during the survey in some of the villages are given below:

Table 9 : Groundwater Levels Of Some Villages Along Ganga In Bijnor Distt.

S. No.	Village	Coordinates		Depth to Water Table in Feet
		Lat.	Long.	
1.	Bhaguwala	29°42'16.94"N	78°15'24.42"E	140
2.	Nangal Soti	29°39'39.46"N	78°11'29.80"E	100
3.	Chandok	29°35'45.18"N	78° 9'27.04"E	80
4.	Daulatpur	29°34'16.17"N	78° 8'37.90"E	160
5.	Balawali	29°37'38.97"N	78° 6'28.16"E	60
6.	Mandawar	29°29'0.53"N	78° 7'30.61"E	150
7.	Jahangirpur	29°31'34.86"N	78° 4'16.84"E	70
8.	Hemraj Colony	29°22'28.03"N	78° 5'8.80"E	35

Image 52 : Old Defunct Well On Ganga River Floodplain At Nangal

Image 53 : Private Tube Wells Are Major Source of Irrigation In The Distt.

14.0 Ganga Bank Erosion In Bijnor Distt.

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

14.2 In a recent attempt to make river banks greener, the Uttar Pradesh State govt. claims to have planted more than 2.2 Crore trees along river banks as a part of annual plantation drive. The Ganga River has got the maximum – around 67 lakh trees and the plantation has been done in all the 27 Distt.s along Ganga in the State as noted by Times of India [August 20, 2020][8]. ***However, this exercise cannot prevent bank erosion which is preventable only through the binding of an extensive root system as available in native riparian grasses.***

14.3 As assessed from the Google Earth imagery [2020], the major erosion prone sites on Ganga River in Bijnor Distt. are located upstream of Balawali where Ganga, while flowing southwest, takes a sharp left turn [See Map No.6]. Other erosion prone sites are located at many places till Bijnor Barrage due zig-zag meandering of the river. Further downstream there are considerable erosion prone sites at Daranagar Ganj due to southeast meandering of the river. During boat survey at Daranagar Ganj, few such erosion sites were observed with low to moderate erosion. Absence of riparian vegetation is a major driver for such erosion. The locals informed about the annual inundation of river bank area which erodes enormous parts of their agriculture land. They call it *'Kat or Kataav'* which means bank erosion. Further downstream, from Jahanabad to Basantpur, such sites have been marked as 'Erosion Prone Sites Outside Study Area' due to unclear Distt. boundaries which often change due to meandering of the river.

14.4 During field visit, nesting holes of birds were observed on the eroded banks (left) of the Ganga River across village Devalgarh. River Bank Myna (*Acridotheres ginginianus*) were sighted in and around the nesting holes. They are smaller birds commonly found near rivers banks, streams, and farmlands and often find in flocks. They make their nests in mud walls, river banks, embankments and in open wells and hence the name. There is a

[8] River banks made greener in Uttar Pradesh. Aug.20, 2020. Times of India

pontoon bridge at this site, built in 2019-2020 connecting the area with Distt. Muzaffarnagar.

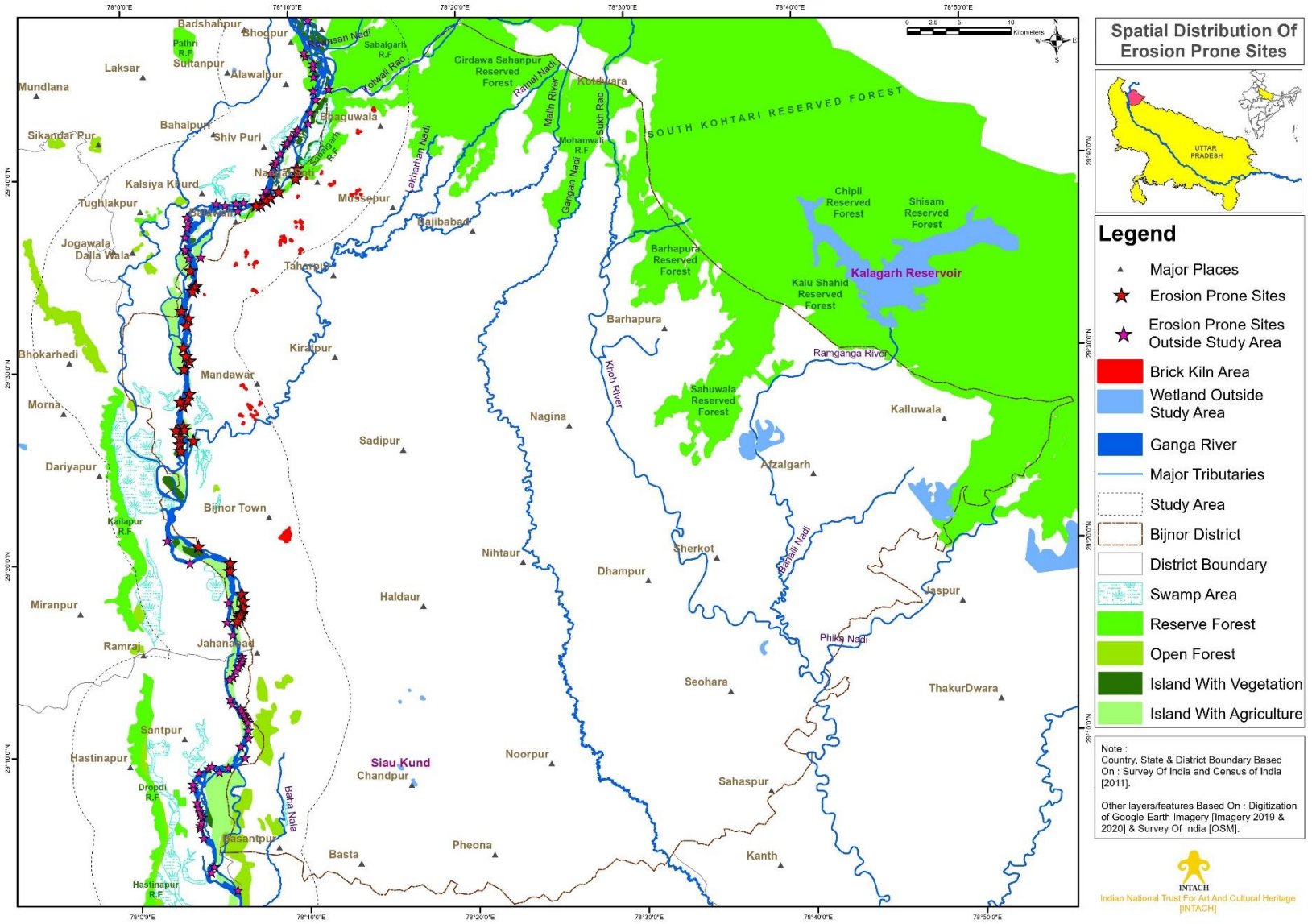
Image 54 : Lateral Bank Erosion At Daranagar Ganj

Image 55 : Bank Erosion At Balawali

[Note the wheat cropping till edge of the main channel with no riparian vegetation and thus no terrestrial habitats]

Image 56 : Nesting Holes By River Bank Myna In Eroded River Bank

Image 57 : Temporary Pontoon Bridge Connecting Eroded River Bank



Map 6 : Spatial Distribution Of Erosion Prone Sites In The Study Region

15.0 Mining And Brick Kilns In Bijnor Distt.

15.1 **Sand Mining** : Sand is one of the major minerals resource extracted from the Ganga River, especially in its mid and lower stretch. The demand is ever increasing due to rapid expansion of settlements and their upgradation across the country. Often carried out illegally and excessively to earn large profits, sand mining is altering rivers' overall health. Excessive sand mining results in the destruction of aquatic and riparian habitats and also poses threat to bridges, river banks and nearby structures[9]. Distt. Bijnor has been an important Distt. for sand and gravel mining due to its location in the Himalayan foothills. The Ganga and its tributaries such as Kotwali Rao, Malin, and Chhoiya and other important streams flowing eastwards in the Distt. bring huge amount of sediment and gravel material from upstream areas in the hills. This has made the Distt. a hotspot for sand and river bed mining.

15.2 The Distt. has always been in news for continued sand mafia operations and failure of administration to curb the menace. Areas of major operations are Najibabad, Afzalgarh, Badhapur, Raipur and Nagina Sadat. According to local sources, large scale illegal mining takes place during two shifts : early morning hours [3:00 AM to 8:00 AM] and evening to late night [7:00 PM to 12:00 – 1:00 AM] in order to avoid visibility of the activity. Distt. Survey Report for Sand Mining/River Bed Mining [RBM] dated 6th August, 2020 states that the whole Distt. is composed of recent deposits known collectively as the Indo-Gangetic Alluvium which consists of River Bed Material [RBM], alluvial sand and clay. Sand mining was not regulated until Uttar Pradesh Minerals Rules, 1963 and amended rules in 2017 [42nd Amendment] came into being. The potential of the Distt. for minor minerals mentioned in the report is given below :

Table 10 : Minor Minerals Potential Of Distt. Bijnor

Boulder [MT]	Bajari [MT]	Sand	Total Mineable Mineral Potential
58376	Not Available	2576281	4637305

Source : Distt. Survey Report, 2020

15.3 During the field visit, mining operations were not observed in the Ganga River stretch in the Distt.. However, river bed mining for gravel was observed in Kotwali Rao tributary of Ganga River. Many trucks were seen loading river bed material from the tributary – as observed from the bridge of Eastern Ganga Canal Road and Haridwar Road bridge [NH-34] near Mirzapur village (looking downstream).

[9] Impacts of Sand Mining. ENVIS Centre on Environmental Problems of Mining, IIT Dhanbad, Jharkhand

Image 58 : River Bed Mining At Kotwali Rao As Seen From Eastern Ganga Canal Road

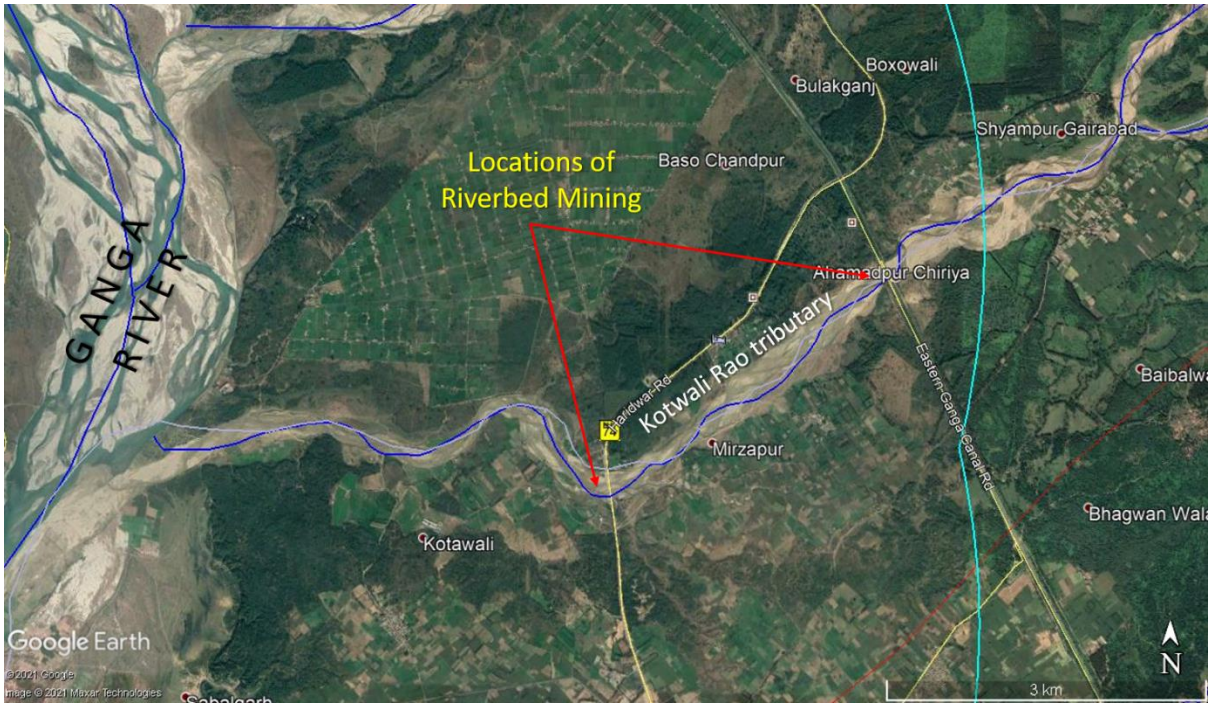


Image 59 : River Bed Mining Locations At Kotwali Rao Tributary

15.4 **Brick Kilns:** Brick making is one of the major economic activities in the Distt., providing employment to many daily wage workers. With rapid urbanisation, bricks have become important building material with ever increasing demand. However, the industry has current and future implications for the soil, agriculture land and air quality of the region. Most of these units are located upstream from Bijnor Ganga Barrage. Few others are located southeast of Bijnor City on Bijnor-Moradabad Road. Except few, most of the brick kilns (within study area) were found situated away from the Ganga River – often in a cluster of 2 to 4 units. This is apparently to maintain the distance obligations from roads, railways, villages, mango orchards etc. set in 'The Uttar Pradesh Brick Kilns (Siting Criteria from Establishment) Rules 2011'. However, there is no mention of distance from river, floodplains or a waterbody in these rules.

Image 60 : Brick-Kiln At Chandok-Balawali Road

16.0 Boatmaking In Bijnor Distt.

16.1 Boatmaking is not a popular profession or income source in the Distt. Several fishermen or farmers whose livelihoods depend on the fishing or floodplain farming keep the smaller wooden boats. These are made by local carpenters (wooden boat) and blacksmith (iron boat – thick gauge GI sheet) who get such work occasionally.

16.2 Upon interaction with a local boatman from Navalpur village it was found that most of the boats in the Distt. are brought from Sukratal area in Muzaffarnagar, although there are carpenters in the Bijnor Distt. too. The price of small wooden boats ranges from between Rs.17,000/- to Rs.20,000/-. If carpenters are provided with the materials needed, the cost of the job comes down between Rs. 5000/- to Rs.7000/-. Comparatively, motorboats are expensive and are priced somewhere around Rs. 1.75 Lakhs per unit.

16.3 There are around 20 small wooden boats plying at Bijnor Ganga Barrage mostly owned by local community from Navalpur village located left bank of Ganga River near Bijnor Barrage. They are mostly in business post monsoon season from October to December, when the water level is sufficient for the boats to float.

16.4 One interesting observation comes from Nangal Soti village situated in the north-western part of the Distt. where river island farmers sometimes make smaller floating aids with the dried bottle gourds. To do this, few bottle gourds are left to attain their maximum size in the farmlands. They are then harvested, hollowed and tied together with the help of ropes. They have been used traditionally by riparian farmers as a cheap alternative to boats. Over time, their place has been taken by rubber tyre tubes which are efficiently used by fishermen and farmers for fishing and to cross the river sometimes.

Image 61 : Motorboat Used For Ganga Dolphin Safari, Ganga Ghat, Bijnor Barrage

Image 62 : Wooden Boats Wating For Passengers At Ganga Ghat, Bijnor Barrage

Image 63 : A Fisherman Using Rubber Tube To Keep Afloat In Ganga At Daranagar Ganj

17.0 Inland Navigation In Bijnor Distt.

17.1 The Ganga River in Bijnor Distt. is navigable other than in except in spring and summer when it becomes shallow at some places with emergent sand bars making navigation difficult. River route is hardly used by people to travel downstream villages. Island farmers use small wooden boats to cross the rivers from villages situated on left bank in the Distt. to reach Ganga River islands. The Bijnor Gazetteer of 1908[10] mentions about navigation and flow : 'The Ganges touches Bijnor in the extreme north, close to its exit from the hills above Haridwar. Then it flows southwards in a wide bed of boulders, the volume of the stream being greatly diminished by Ganges canal, which takes off at Mayapur on the right bank. A short distance from this place the bed becomes sandy, and the alluvial deposit left by the annual floods makes its appearance on its banks; *but the channel is comparatively shallow and the river is not navigable till it teaches Nangal in pargana Najibabad*.' It further describes the changing course directions of Ganga till Bijnor Khadirs – '*The river is but little used as a highway, though it serves a useful purpose in carrying down the produce of the forests*. There are no places of importance on its banks, with perhaps the exception of Daranagar, which stands on the raised cliff of the upland tract.'

Image 64 : Island Farmer Crossing Ganga On A Small Wooden Boat, Daranagar Ganj

[10] Bijnor : A Gazetteer being volume XIV of the district gazetteers of the United Provinces of Agra and Oudh by H.R. Nevill, Allahabad (1908)]

18.0 Key Observations and Recommendations

18.1 **Palaeochannels and Floodplain Lakes :** The Distt. authorities as well as farmers must acknowledge the role of palaeochannels, floodplain lakes and depressions along the Ganga River in the Distt. From acting as groundwater recharge zones to maintaining river biota especially aquatic plant species and fish diversity, their role along rivers have been undervalued. Their edges provide space for riparian grasses and trees and thus help in maintaining food chains by providing habitat to various birds, reptiles and insects. They provide invaluable service to farmers as water retention ponds for irrigation. They also add visual appeal to large and monotonous agricultural landscapes – especially in a state like Uttar Pradesh.

18.2 **Waterbodies Encroachment :** Waterbodies in the Distt. are highly threatened by encroachment, pollution and increasing eutrophication. During the field visit, it was observed that not even a single waterbody has been spared from illegal encroachment. There are settlements coming on their edges and thus decreasing their area and water spread. Healthy water bodies in villages and towns of the Distt. would ensure income generation options for the local people through fisheries and water chest nut production. They would also help in groundwater recharge as the current rate of withdrawal is high across villages due to installation of private submersible pumps.

18.3 **Riparian Flora :** All along the Ganga River in Bijnor, the river banks are devoid of riparian vegetation. Most of the floodplain area is under agriculture rarely leaving any trace of riparian flora except floodplain *Saccharum spontaneum* L. which is retained for its multiple uses. Most of the agriculture fields extend up to the active channel of the river. Absence of riparian vegetation promote biodiversity loss, bank erosion and sand mining. It is recommended that Distt. and state authorities should take a note of it and take measures to regulate use of river banks. Floodplain farmers may be persuaded to adopt agroforestry practices and maintain a wide strip [10m wide] of riparian grasses to provide habitats and bank stability.

18.4 **Aquatic Fauna:** The Bijnor stretch of Ganga is an important habitat of major aquatic fauna such as Gangetic Dolphin, Gharial, Crocodile and at least 12 species of turtles – many of which are threatened by multiple factors. And there are many other associated species such as frogs, toads, butterflies, insects, aquatic invertebrates that are poorly documented but form important part of the food web. Forest dept. should carry out annual faunal surveys in collaboration with expert institutions besides bird census. Such annual exercise would supplement the existing data on Ganga River biodiversity.

18.5 **Protection for River Islands :** As mentioned in the Faunal Diversity section [10.0], river islands were observed to have better diversity of birds and as safe habitats for turtles, gharials, and crocodiles. Such islands and exposed sand-beds should be seen as refuges for biodiversity. River islands must be protected. Agriculture practices on such islands and sand-beds should be curbed and a central 'River Island Policy' must be drafted. Any conservation planning or initiative for rivers in the state should consider protection of islands an important priority.

18.6 **Sand and River Bed Mining** has been a major issue in the Distt. It should be checked and curbed completely. Excessive mining alters the natural river bed forcing the river to change course and thus promotes banks erosion. It has also been noted that deep excavations due to mining transforms into deeper pools after the high flow in the river and thus endanger lives of people who come for bathing during religious ceremonies. To keep a regular track, distt. authorities may utilise Google Earth and drones to keep themselves updated. Excessive sand mined areas could be easily spotted from the Google Earth or other high resolution satellite imageries.

18.7 **Cremation :** Cremation of dead bodies and immersion of their remains is quite common along the Ganga River and its tributaries. There is large crematorium space at Ganga River Ghat at Bijnor Ganga Barrage, but local communities living near to river carry out cremation at their nearest river banks. This, on a daily basis is contributing to the pollution levels in the river. Distt. authorities should encourage them to cremate at the designated crematorium facilities.

Image 65 : Locals Returning From Cremation At Nandnaur-Hastinapur Bridge

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